EDISON ELECTRIC INSTITUTE

Critical Issues Facing Federal Customers and the Electric Industry: *A Call to Partnering*

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FUPWG
November 28, 2007

Overview

- State of the industry
- Review recent Energy Infrastructure Picture

State of the Industry
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 baseload plants and transmission

Climate Change

Dozen bills pending in Congress
States becoming aggressive
Role of Renewables

Energy Efficiency

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

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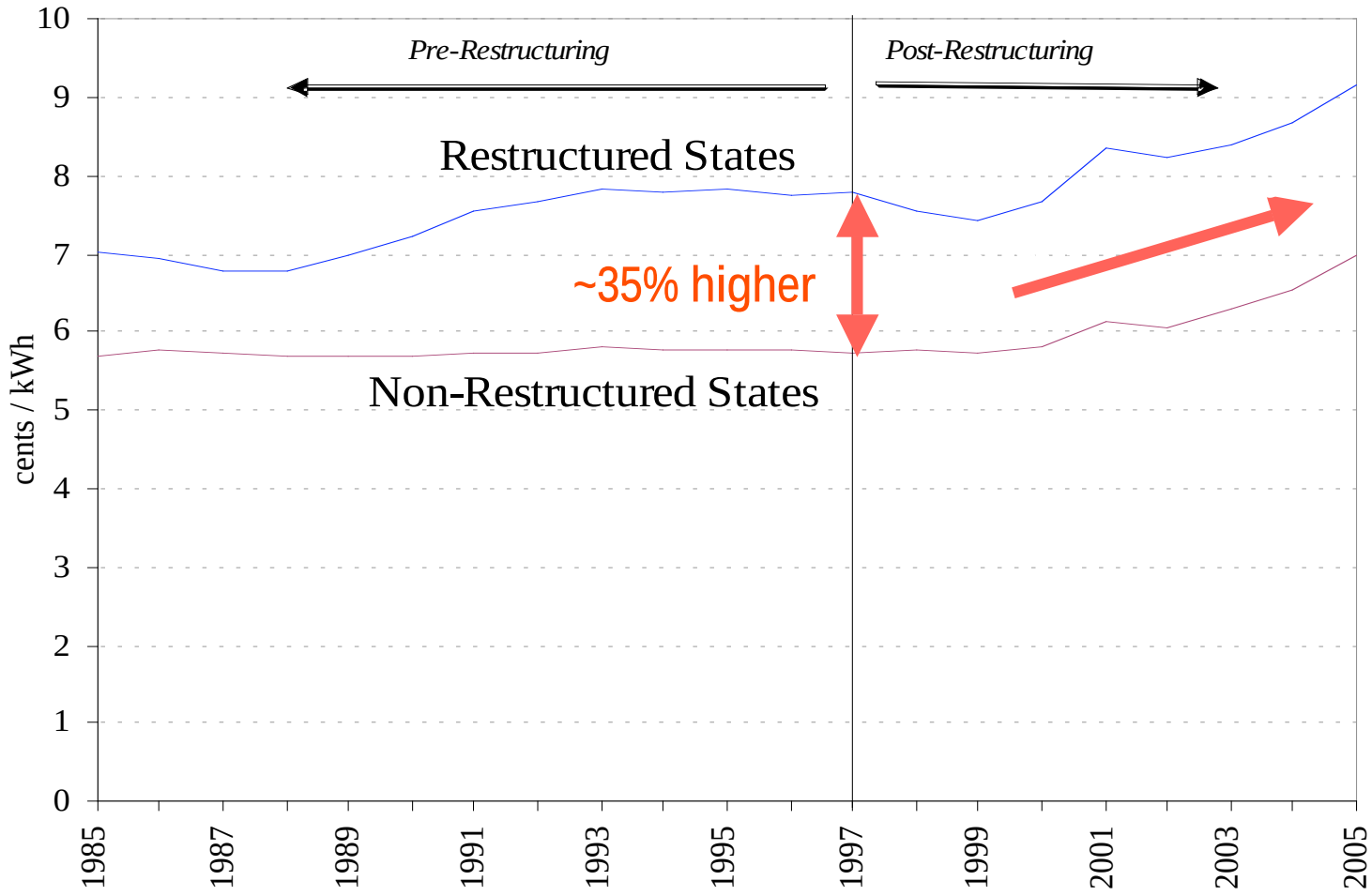
Rates Rising In Many States

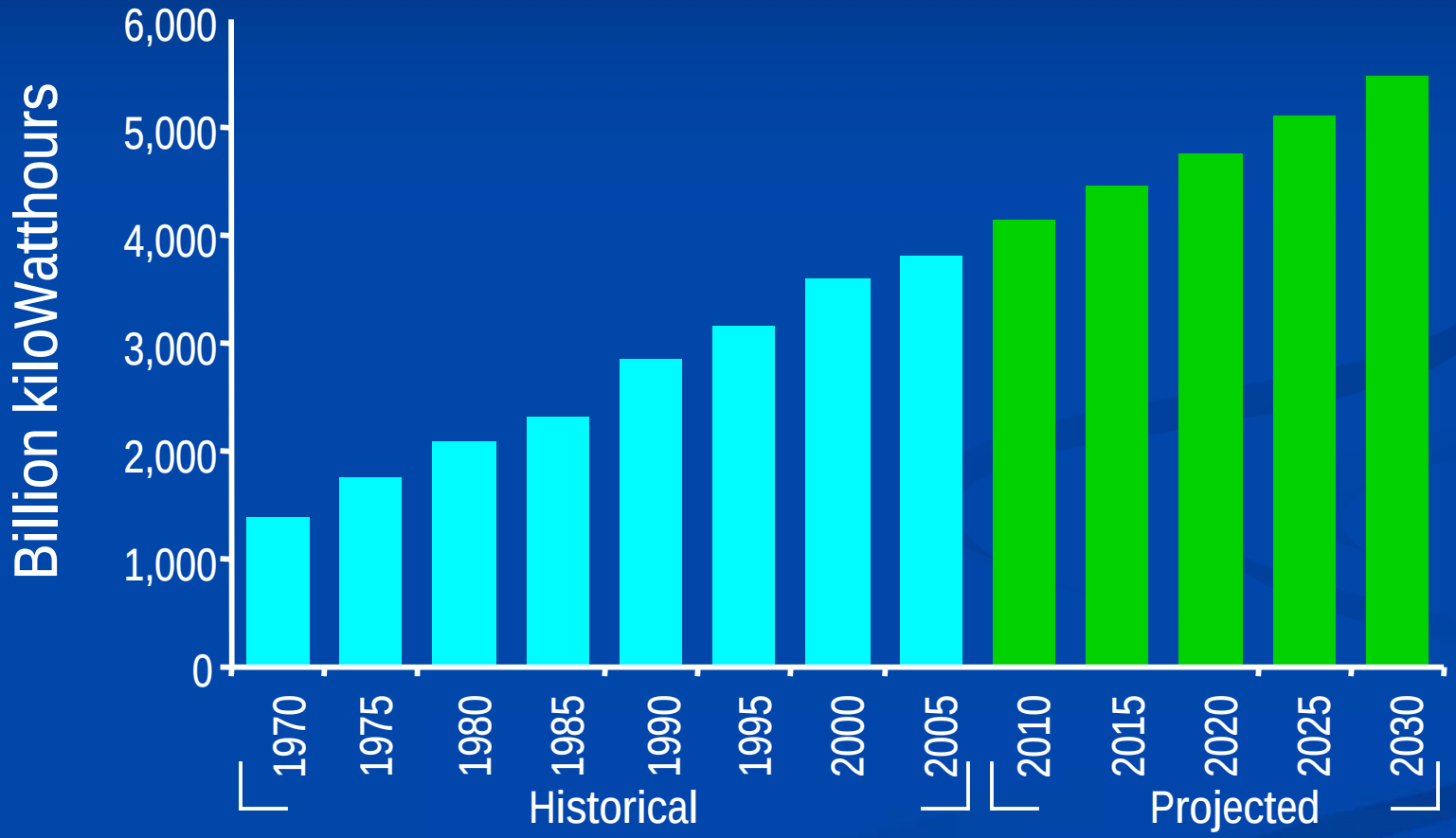


Source: EIA Form 861, EIA Monthly Energy Review March 2006.

Understanding the Core Drivers

Demand for Electricity Is Increasing

EIA projects U.S. energy demand will grow 40% by 2030

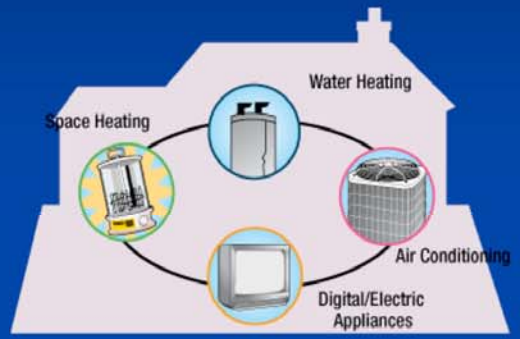


Sources: U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2005* and *Annual Energy Outlook 2007 Early Release*

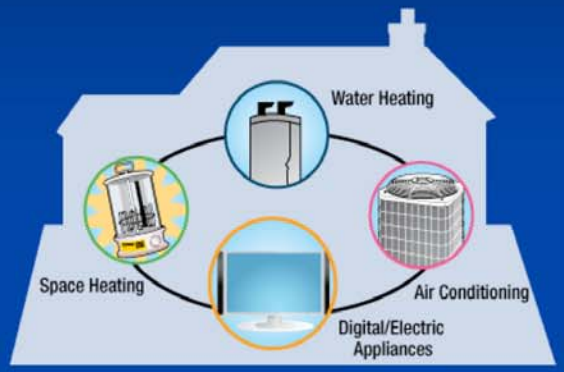
Causes for Rising Demand

- 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 way up
- MP3 players up >17 million in one year
- Average US household owns 26 consumer electronics products
- Many of your facilities are much bigger and are more energy intensive

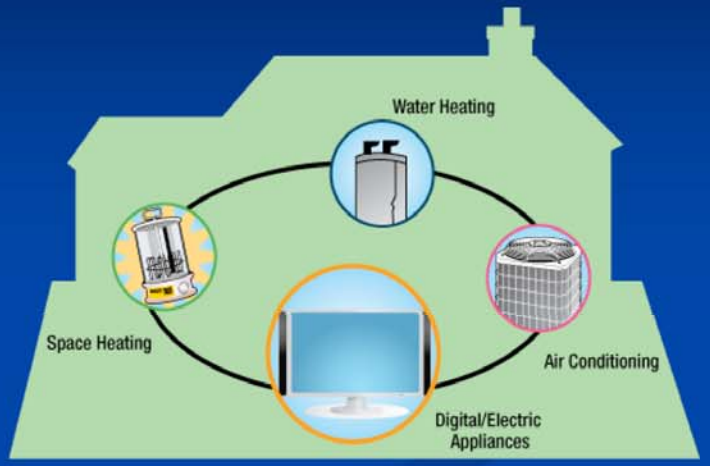
Typical U.S. Home Electric Use Dramatically Increasing



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



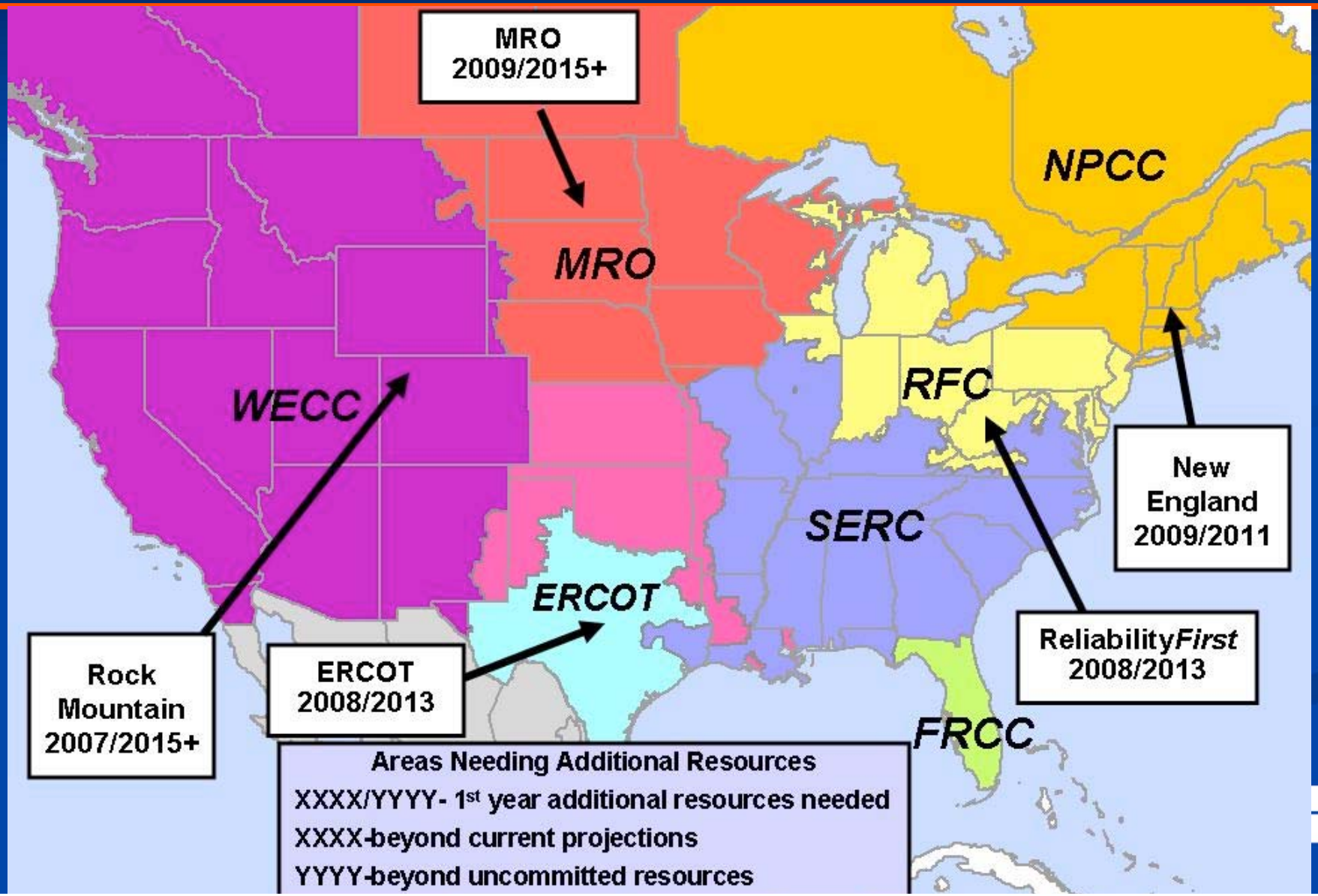
Future (2030)
Average Total Use:
1.45 kW/Hour/Household

Increased number of homes 47.85% in 8 years

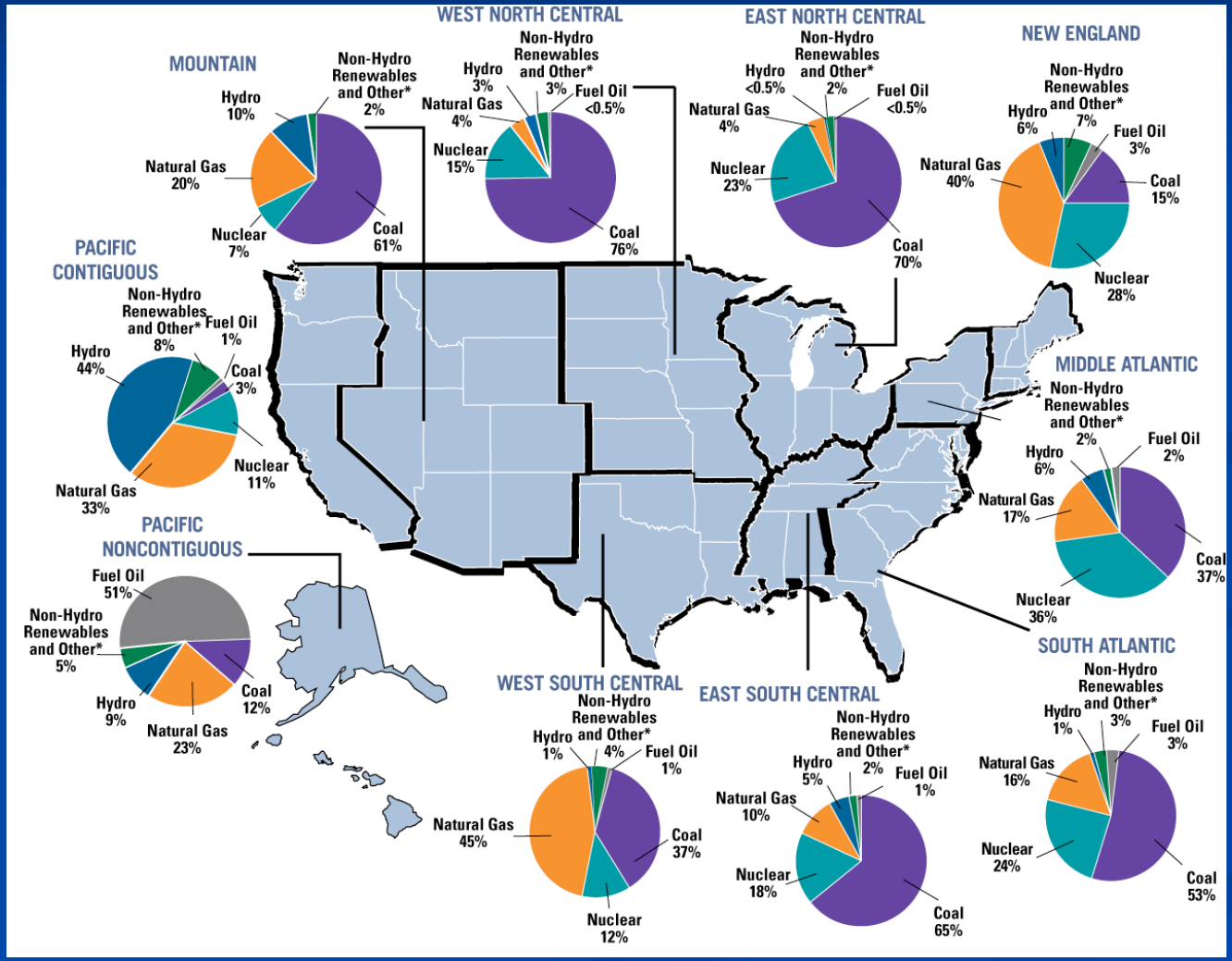
Increased number of larger homes 72% in 9 years (over 2400 sq. ft.)

Sources: The Brattle Group, National Association of Home Builders

Generation Reserve Margins Shrinking



Different Regions Of The Country Rely on Different Fuel Mixes

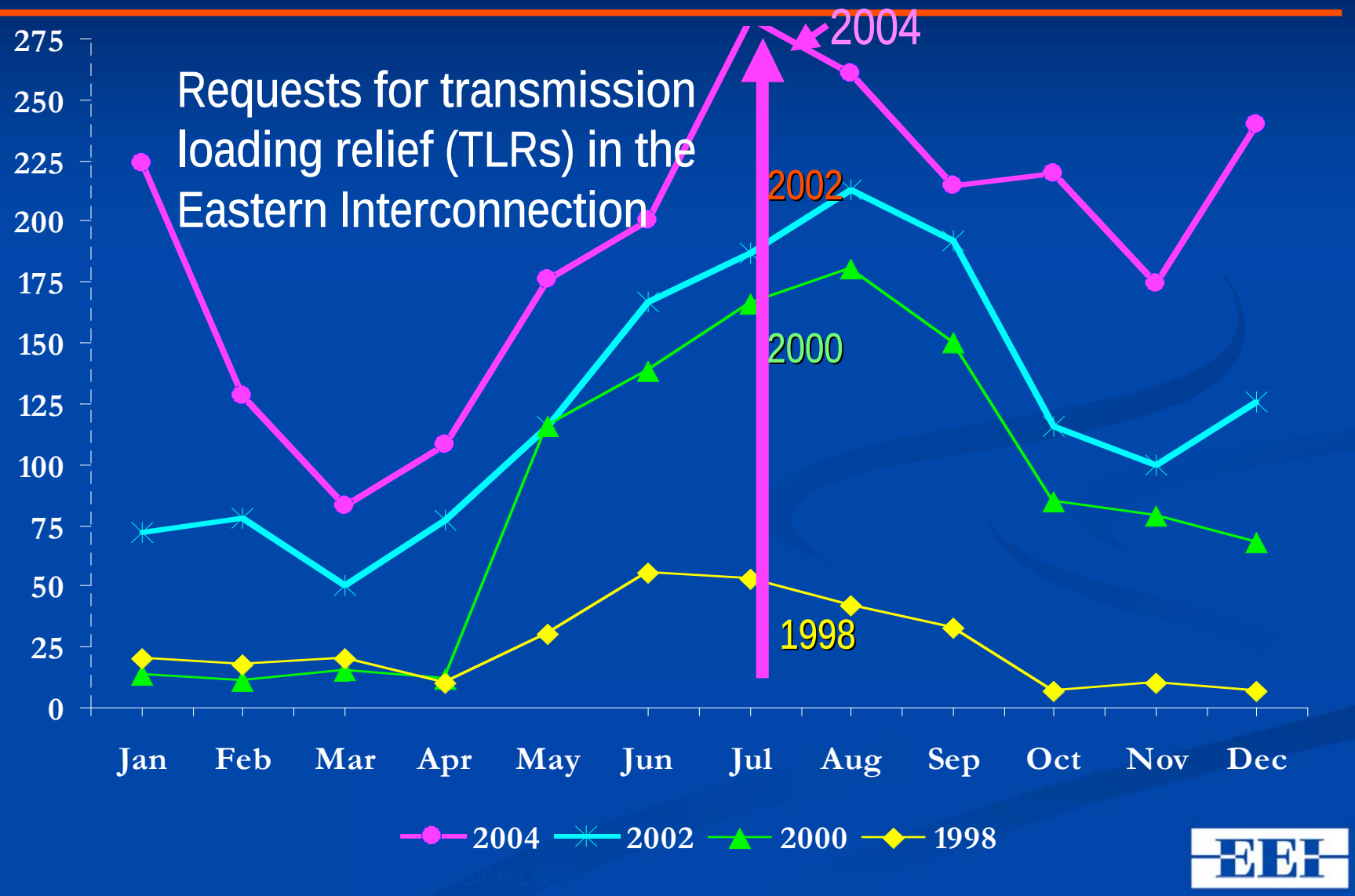


* Non-Hydro Renewables and Other includes generation from solar, wind, geothermal, biomass (agricultural waste, municipal solid waste, landfill gas recovery, wood, pitch), hydrogen, batteries, chemicals, non-wood waste, purchased steam, sulfur and miscellaneous technologies.

Sum of components may not add to 100% due to independent rounding.

Source: U.S. Department of Energy, Energy Information Administration, Power Plant Report (EIA-920), Combined Heat and Power Plant Report (EIA-920), and Electric Power Monthly (2006 Preliminary).

Transmission Congestion Dramatically Increasing



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 car disaster recovery, end of rate freezes, RPS, fuel

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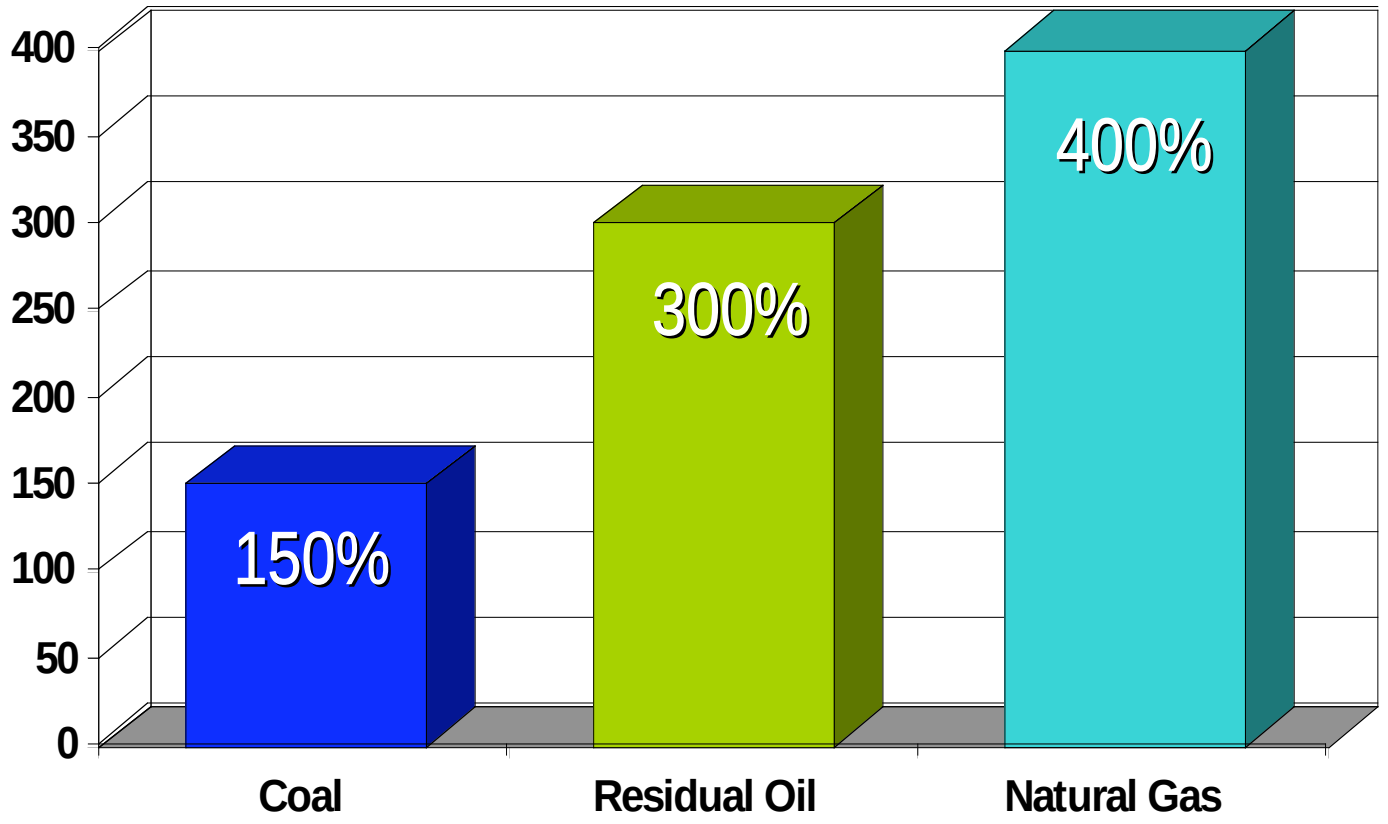
Fuel Costs Increasing Dramatically

Natural Gas percentage increase 1999 – 2005



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

Fuel Costs – Coal Prices Have Risen

- From 2004 to 2007, the delivered price has increased by 24% across the US.
- Exports, environmental issues are drivers

Fuel Costs – Uranium Skyrockets

Higher worldwide demand and a fear of future shortages have driven the price of processed uranium ore (yellow cake)

- $7 lb at the beginning of 2001
- $10 lb in 2003
- $36.25 at the beginning of 2006
- $72 at the beginning of this year.
- Weekly spot price $138 lb this month
- China and India drivers

Nuclear Power Worldwide

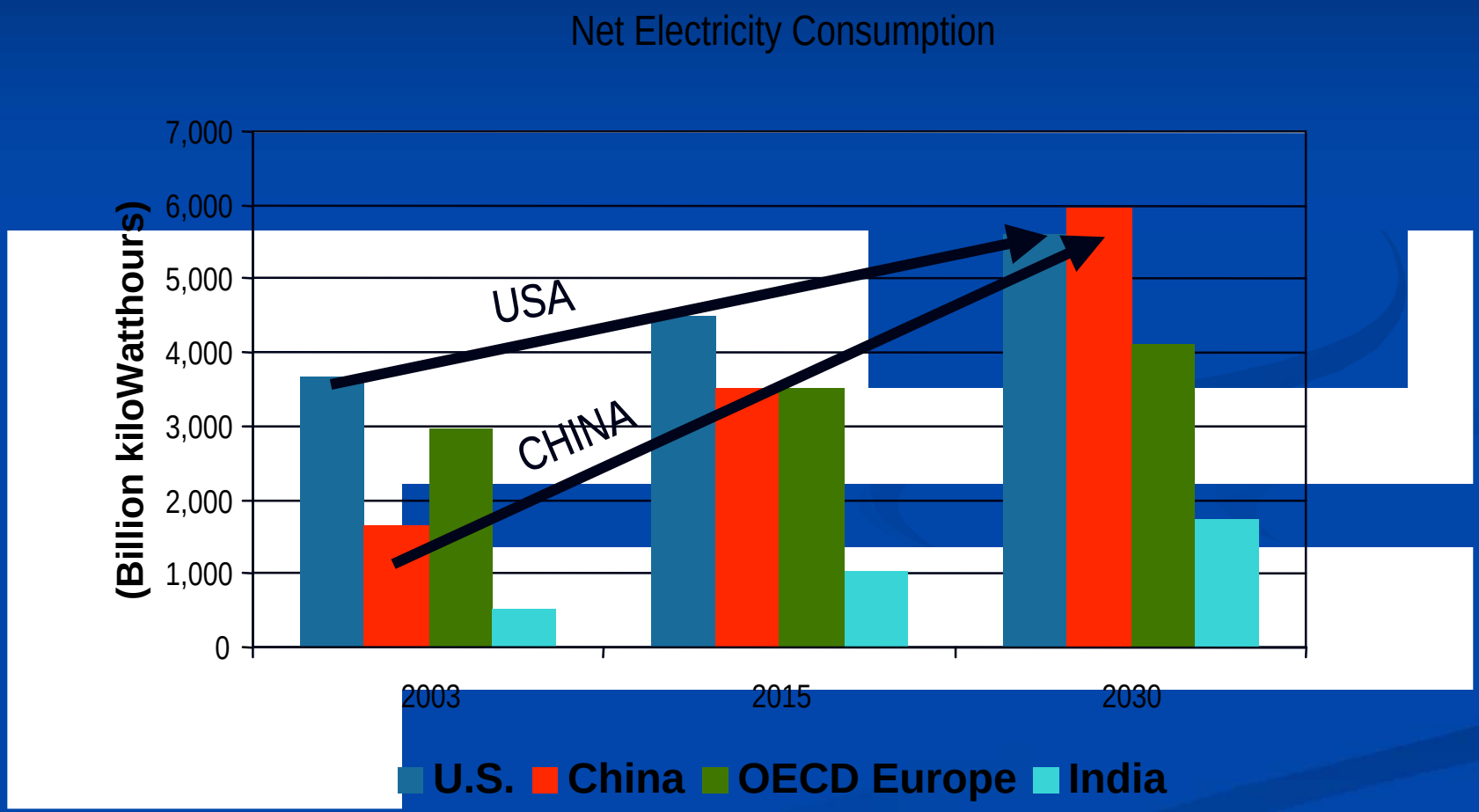
- *20% in the United States*
  - *104 commercial reactors*
  - *33 applications for new permits*
- *80% in France.*
- *Nine countries get 40% or more of their electricity from nuclear power*
- *But worldwide, it supplies only 17% of the total.*
- *China 2.3 % nuclear, but it intends to spend $50 billion to build 32 nuclear plants by 2020.*

Massive Inflation in Commodity Costs

- **Copper:**
  - **$1.25 / pound in early 2004**
  - **$3.45 / pound in July 2007 (peak of $3.70), 59% increase in 2007**
- **Rolled steel**
- **Aluminum**
- **Nickel**
- **Concrete**

Raised the price of baseload plants alone by an estimated 25-30% in the last 18 months

Worldwide Electricity Demand Growth



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

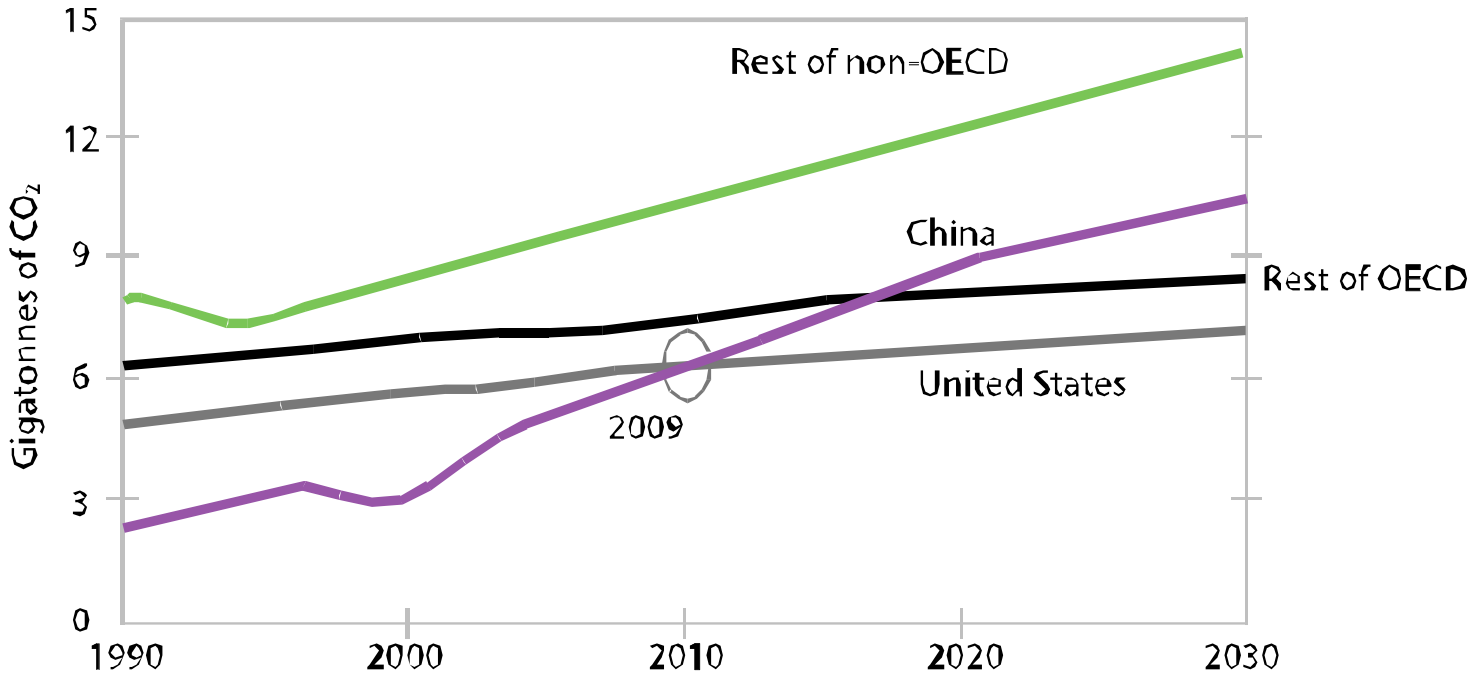
Global Economy – Electric Facts

- China Electric Usage: 2.09 Trillion kWh
- India Electric Usage: 0.63 Trillion kWh
- Combined: 2.72 Trillion kWh

- US: 3.9 Trillion kWh
- 1,050 GW nameplate capacity in 2005 (800 GW in 1993). 1-1.5% growth/year.

- China is installing 60-80 GW every year (600-800 GW in 10 years). Installed 51 GW in 2005; 102 GW in '06 – *mostly coal*
- India: 130 GW now, plans for 780 GW by 2030 (about 30 GW every year)
- *Both: Electric use growth rates > 8-10%+ / yr*

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

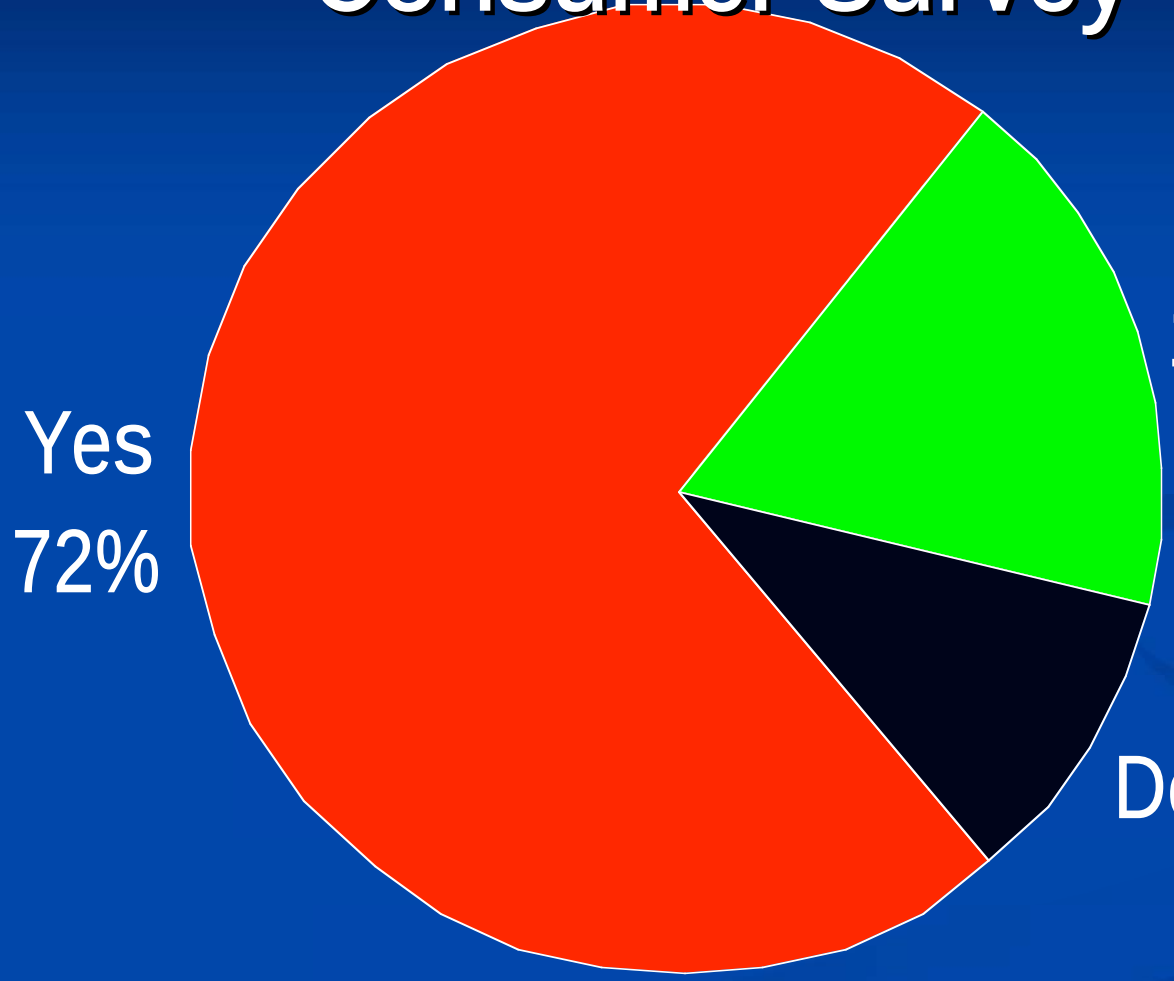


Source: International Energy Agency, *World Energy Outlook 2006*

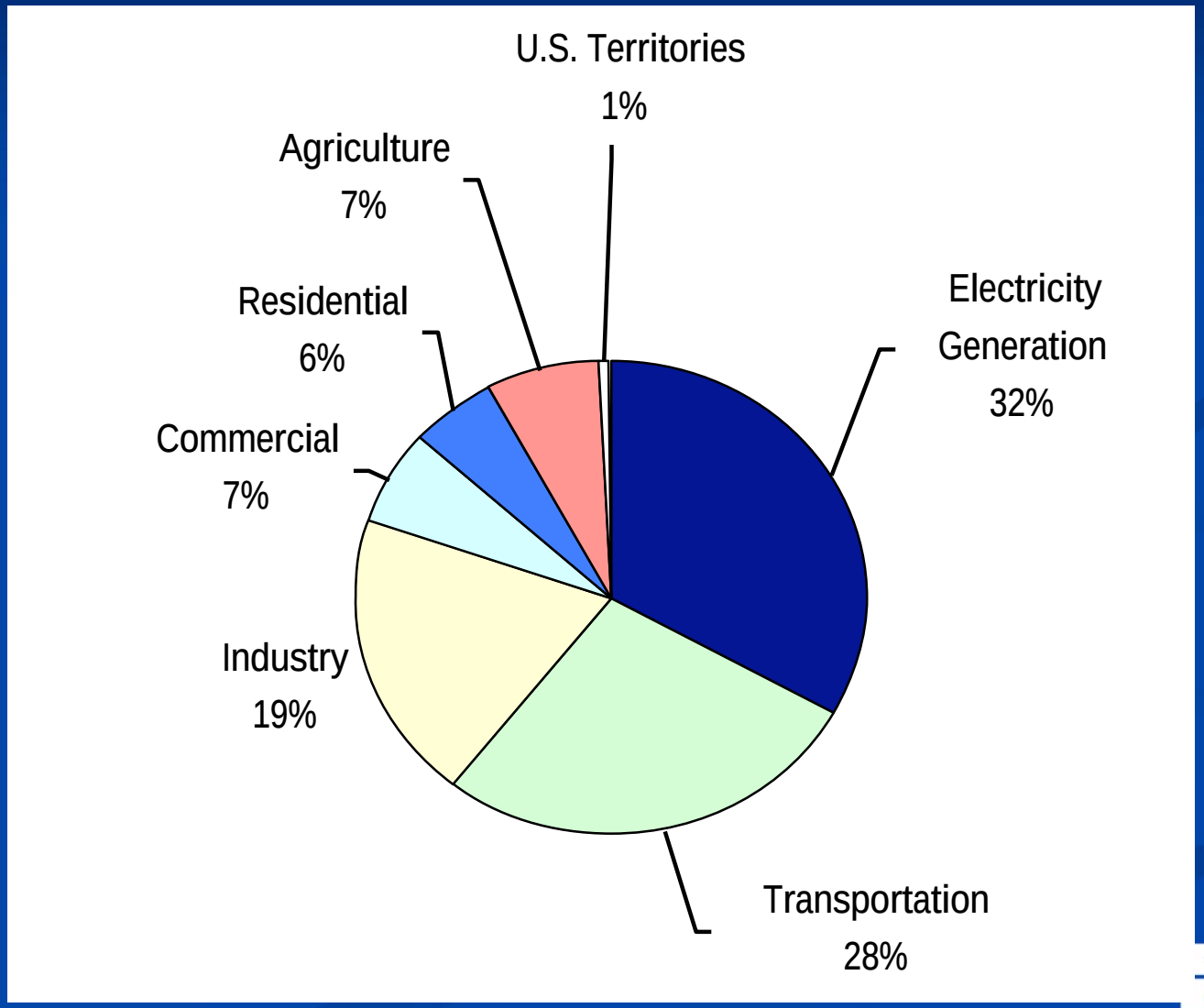
Climate Change

"Is Global Warming Really Happening?"

Consumer Survey



U.S. Green House Gas Emissions By Sector



Controlling Greenhouse Gas (GHG) Emissions – Current Status

- Congress seriously considering legislation aimed at reducing GHG emissions
  - Goals in CO2 emissions cuts range from 50% - 80% by 2050
- 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?
- Include all sectors of the economy and all sources of GHG?
- Will the development and deployment of needed technologies be ready to address compliance timetables?
- Mechanisms to achieve cost-effective GHG reductions?
  - Cap and trade (w/ or w/o safety valve), tax, hybrid?

Climate Change: Cap and Trade

- The mechanism most bandied about is a cap-and-trade system whereby the government would set limits on emissions and then auction credits to companies.
  - If companies are unable to meet the limitations, they could use their credits so that they could emit more.
  - If they are able to get there, they could bank or sell those credits to others unable to do so.
  - The price of those credits would subsequently be factored into the price of power

Carbon Tax Also Being Discussed

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!

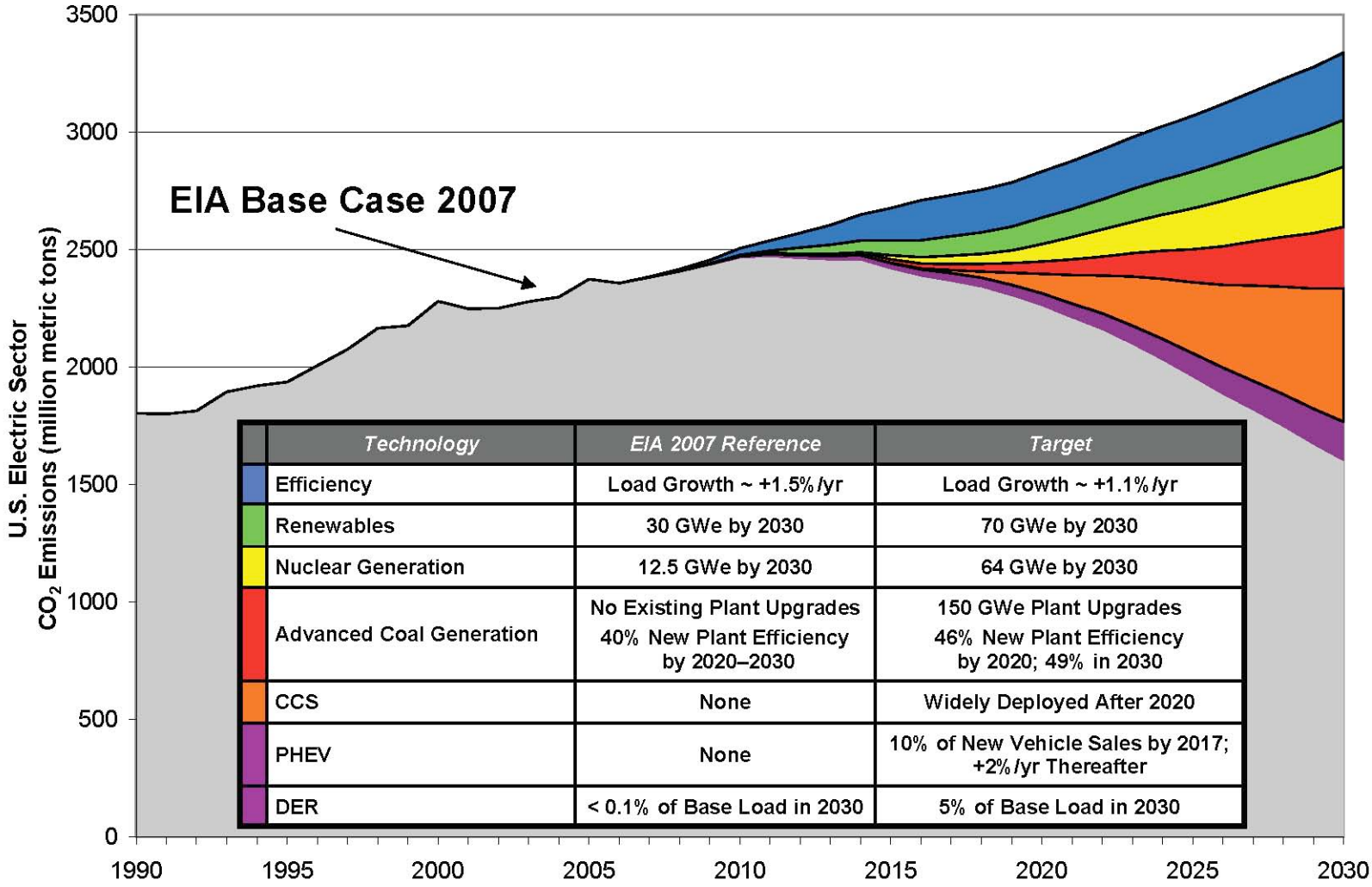
Key Technology Challenges

According to EPRI, the U.S. electricity sector will need ALL of the following technology advancements to significantly reduce CO_2 emissions over the coming decades:

1. Smart grids and communications infrastructures to enable end-use efficiency and demand response, distributed generation, and PHEVs .
2. A grid infrastructure with the capacity and reliability to operate with up to 30% intermittent renewable generation.
3. Significant expansion of nuclear energy and a viable strategy for managing spent fuel.
4. New commercial-scale coal-based generation units operating with 90+% CO_2 capture and storage in a variety of geologies.

Source: Electric Power Research Institute

CO_2 Reductions … What's Technically Feasible



	Technology	EIA 2007 Reference	Target
	Efficiency	Load Growth ~ +1.5%/yr	Load Growth ~ +1.1%/yr
	Renewables	30 GWe by 2030	70 GWe by 2030
	Nuclear Generation	12.5 GWe by 2030	64 GWe by 2030
	Advanced Coal Generation	No Existing Plant Upgrades 40% New Plant Efficiency by 2020–2030	150 GWe Plant Upgrades 46% New Plant Efficiency by 2020; 49% in 2030
	CCS	None	Widely Deployed After 2020
	PHEV	None	10% of New Vehicle Sales by 2017; +2%/yr Thereafter
	DER	< 0.1% of Base Load in 2030	5% of Base Load in 2030

* Achieving all targets is very aggressive, but potentially feasible

EPRI ELECTRIC POWER RESEARCH INSTITUTE

Challenge: Technologies and Timeframes

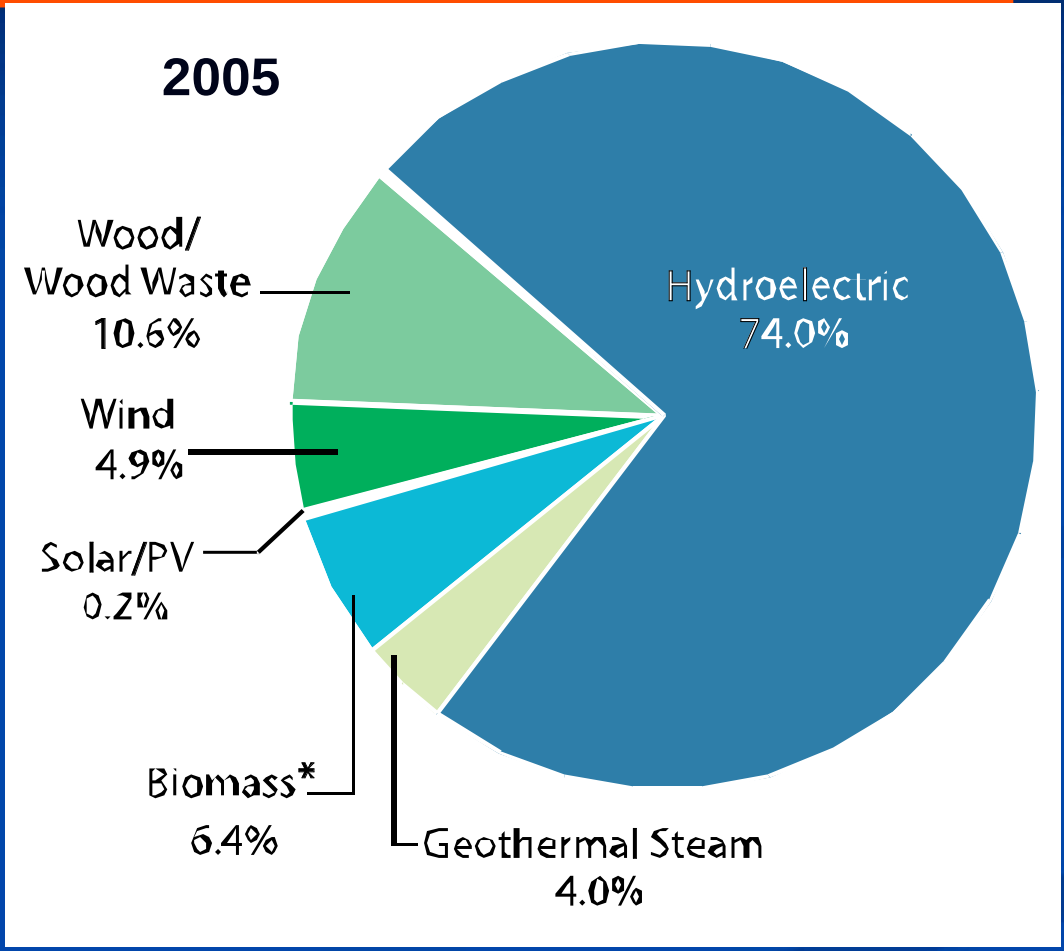
- Clean coal technologies
  - Not commercially available until 2015
- Carbon capture and storage (CCS) technologies
  - Not commercially available until 2020-2025
- Deployment of nuclear plants
  - Not possible until 2015 at earliest

Renewables

What Will It Take?

An Intensified Commitment To Renewables

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



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:

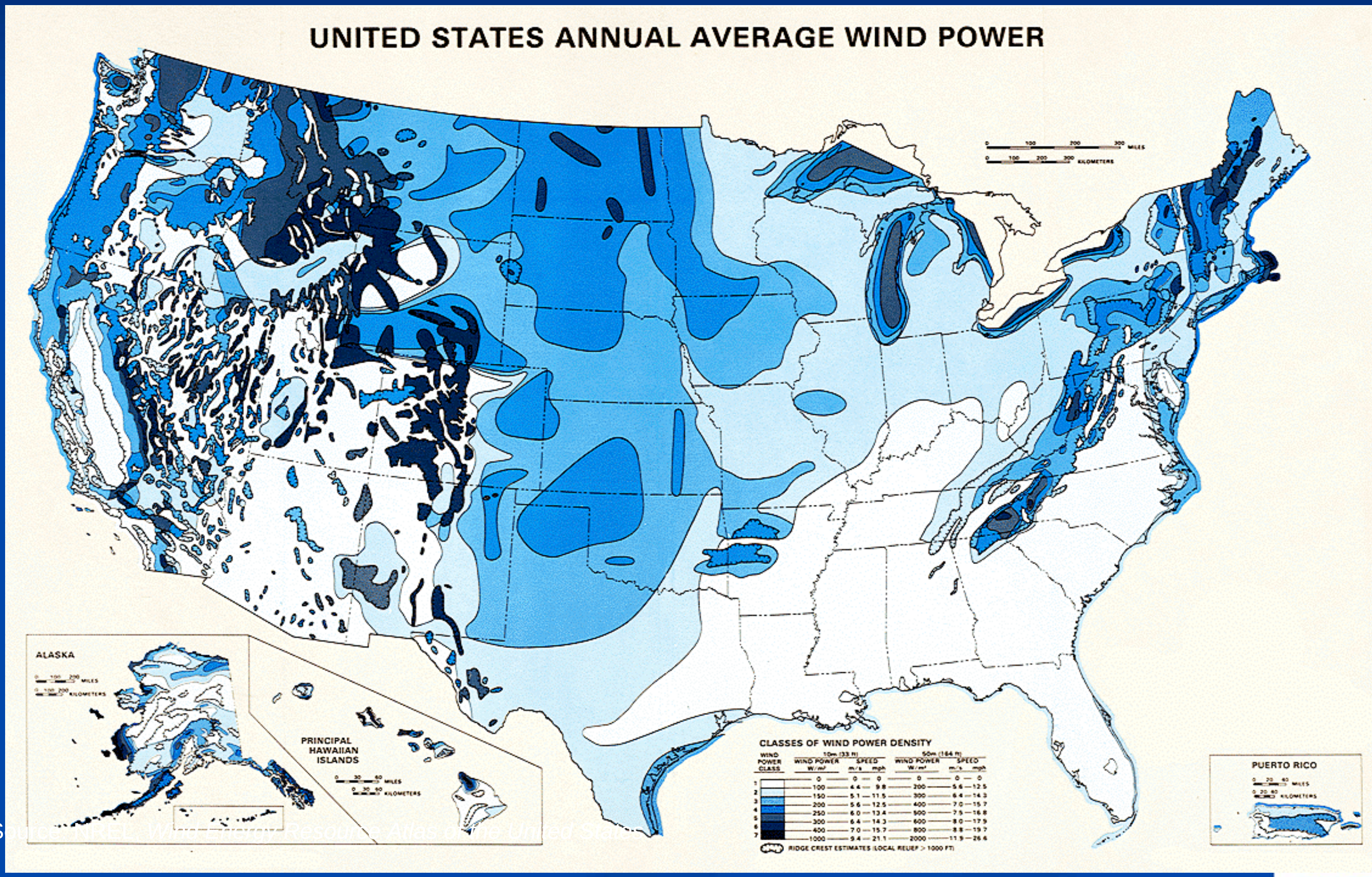
- Renewables becoming bigger part of fuel mix
  - Wind, solar, geothermal, and biomass
- Generally less environmental impact
- Non-hydro renewables: 2.4% Today → 4.4% by 2030
  - Biomass produces 1.5% of generation
  - Wind 0.4%
  - Geothermal 0.4%
  - Solar 0.01%
- Largely CO_2 emission free

Electricity Generated from Renewables

Challenges:

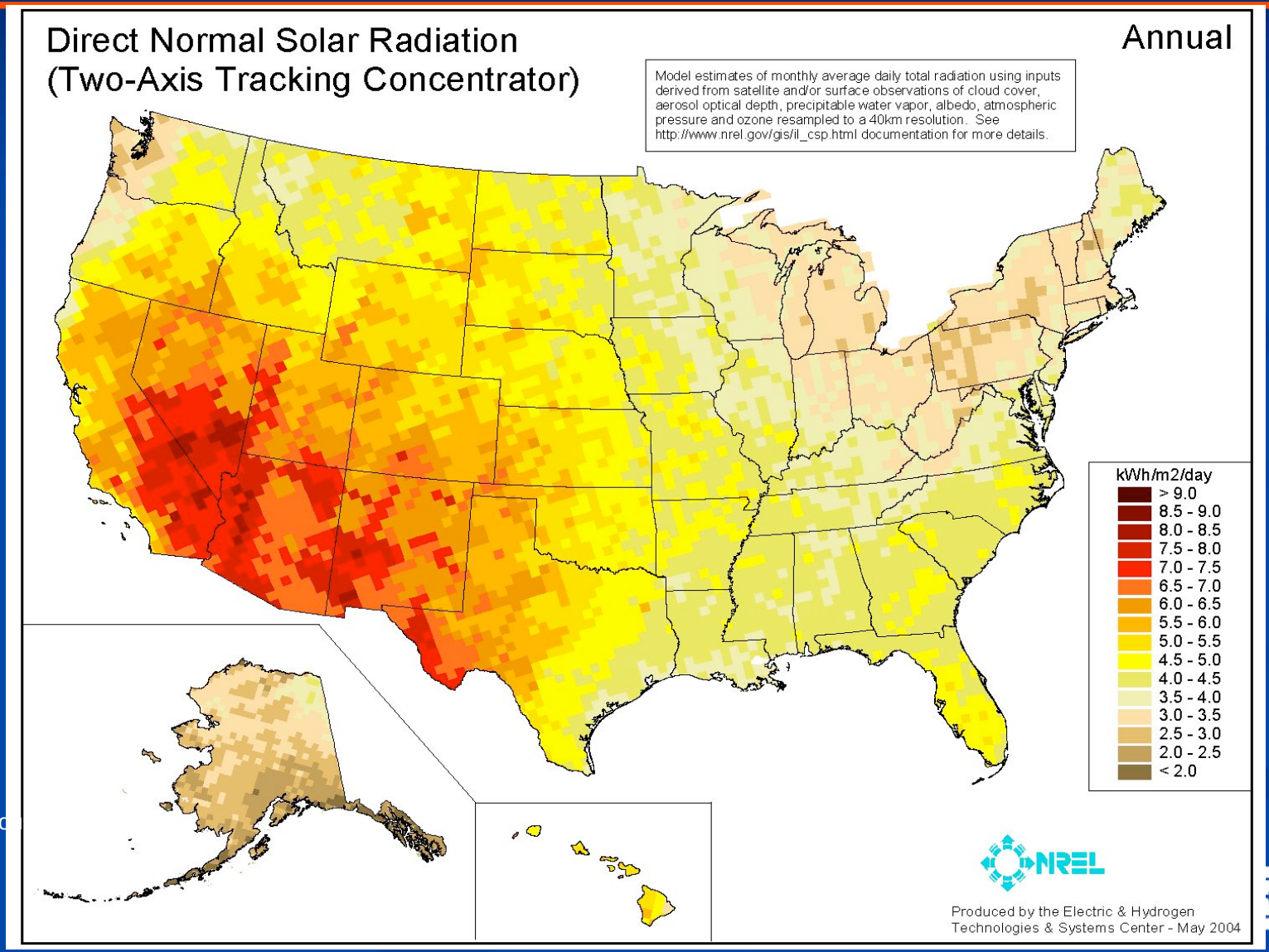
- High initial capital costs
  - Need tax credits or other incentives
  - Market is coming to the rescue
- Intermittent nature of supply (i.e., wind and solar)
- Transmission availability
- Frequent expiration of production tax credit
- Environmental and aesthetic challenges
- Geographic limitations

Wind Power

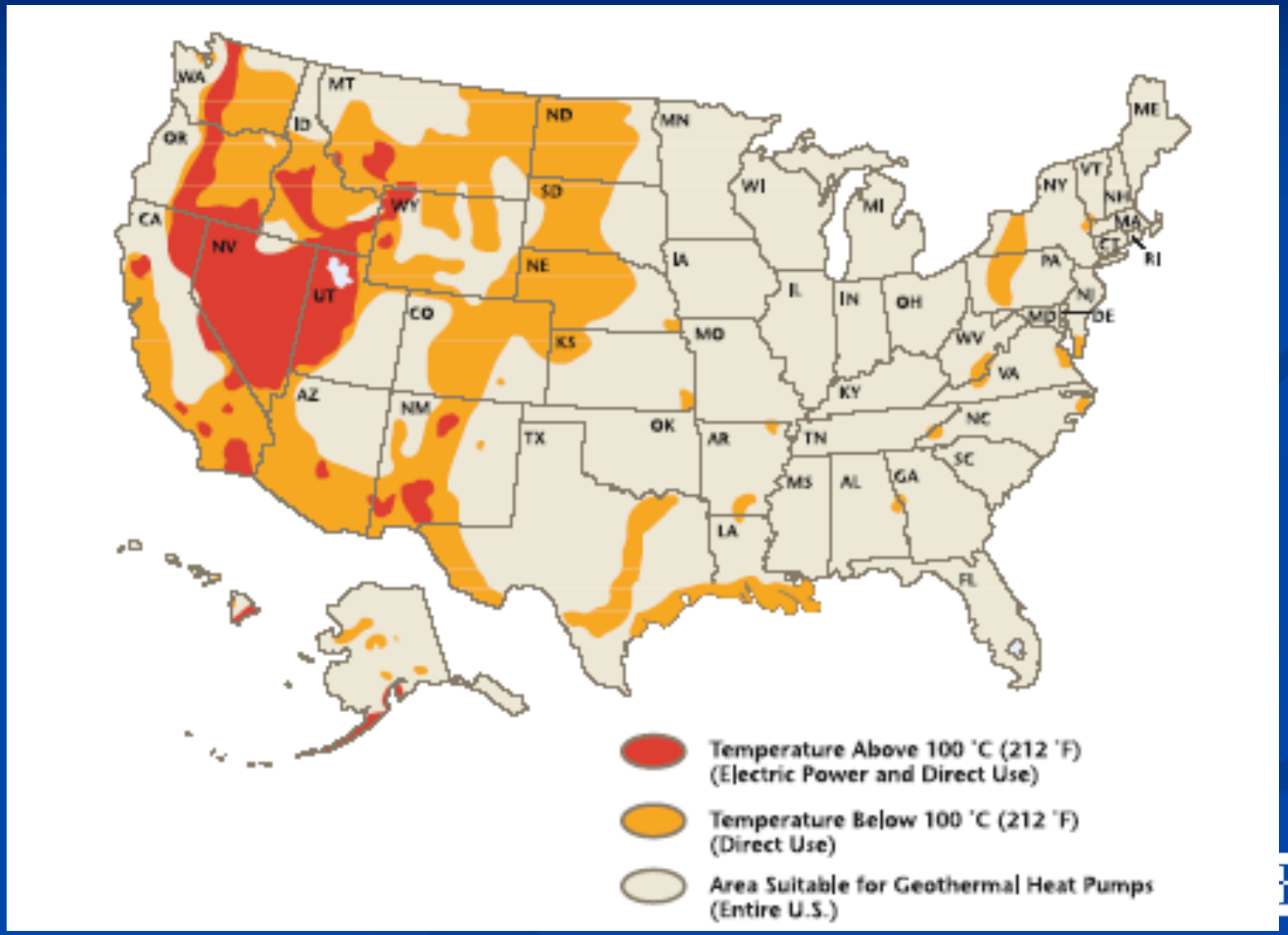


Source: NREL – *Wind Energy Resource Atlas of the United States*

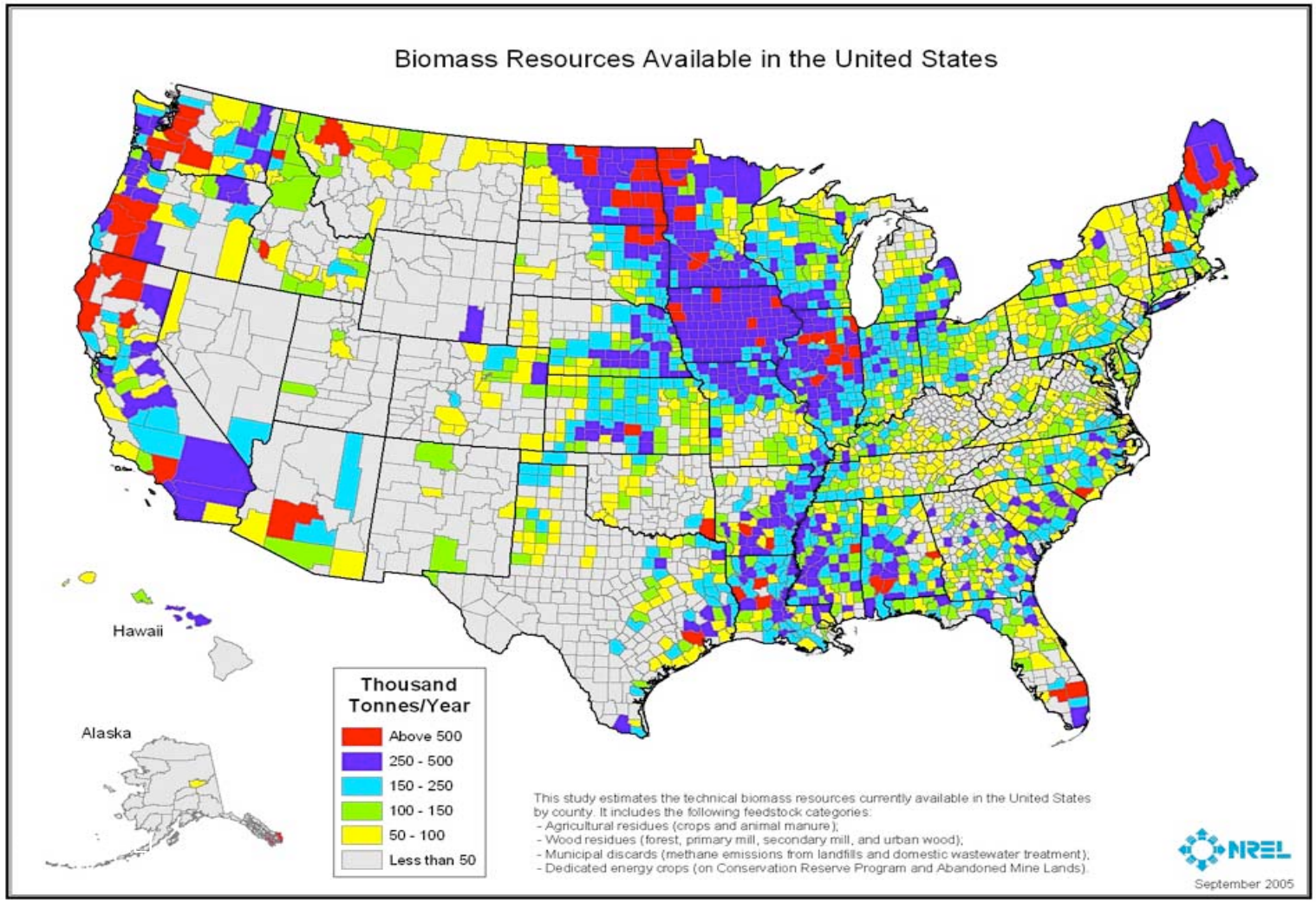
Solar Radiation – Tracking Concentrator



Geothermal Resources



Biomass Resources

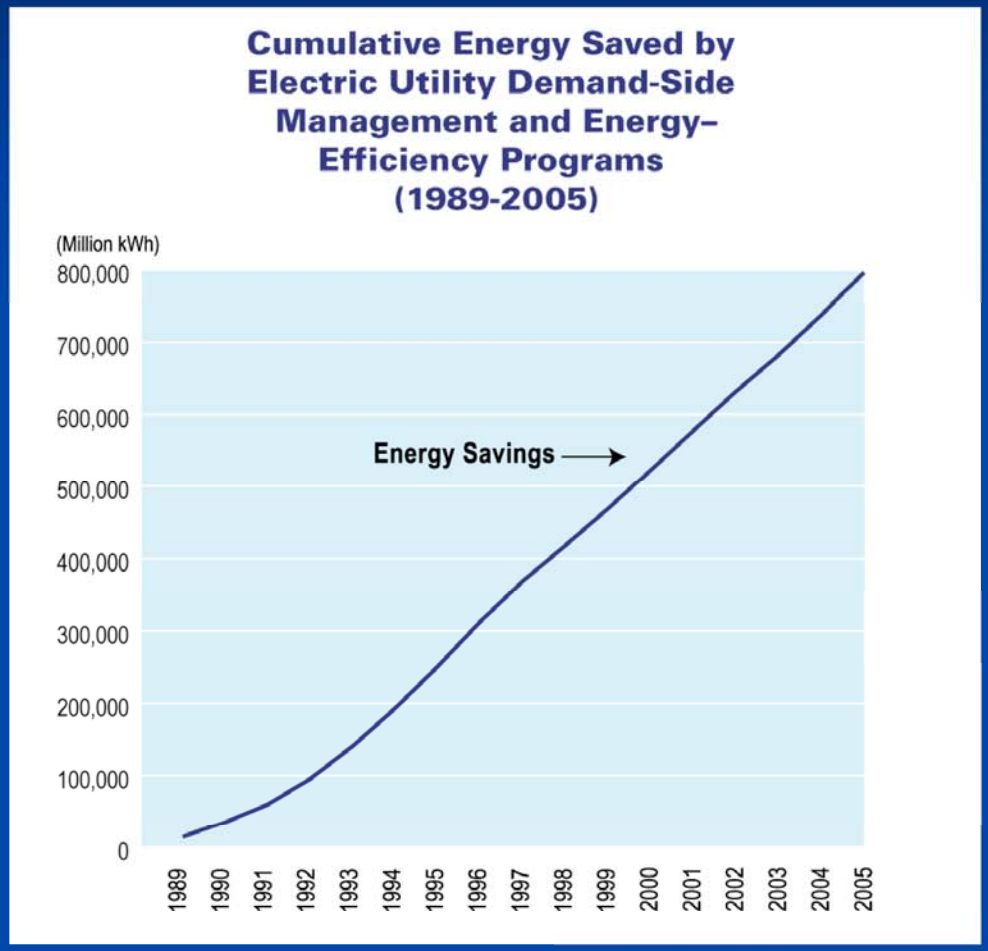


Energy Efficiency

It's Available Now!!!

What Will It Take?

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
  - Roughly 100k grocery stores
  - Annual output of ~336 baseload power plants
    - 300 MegaWatts (MW) each

Energy Efficiency Tools and Resources

- Work with utility representatives - Areawide Contracts
- If you operate in other states, check www.eei.org/na for listing of incentive and DR programs

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