The Outlook for Natural Gas Use in Electricity Generation: Climate Policy and Other Drivers

for
LDC Gas Forum
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Energy Information Administration
Official Energy Statistics from the U.S. Government

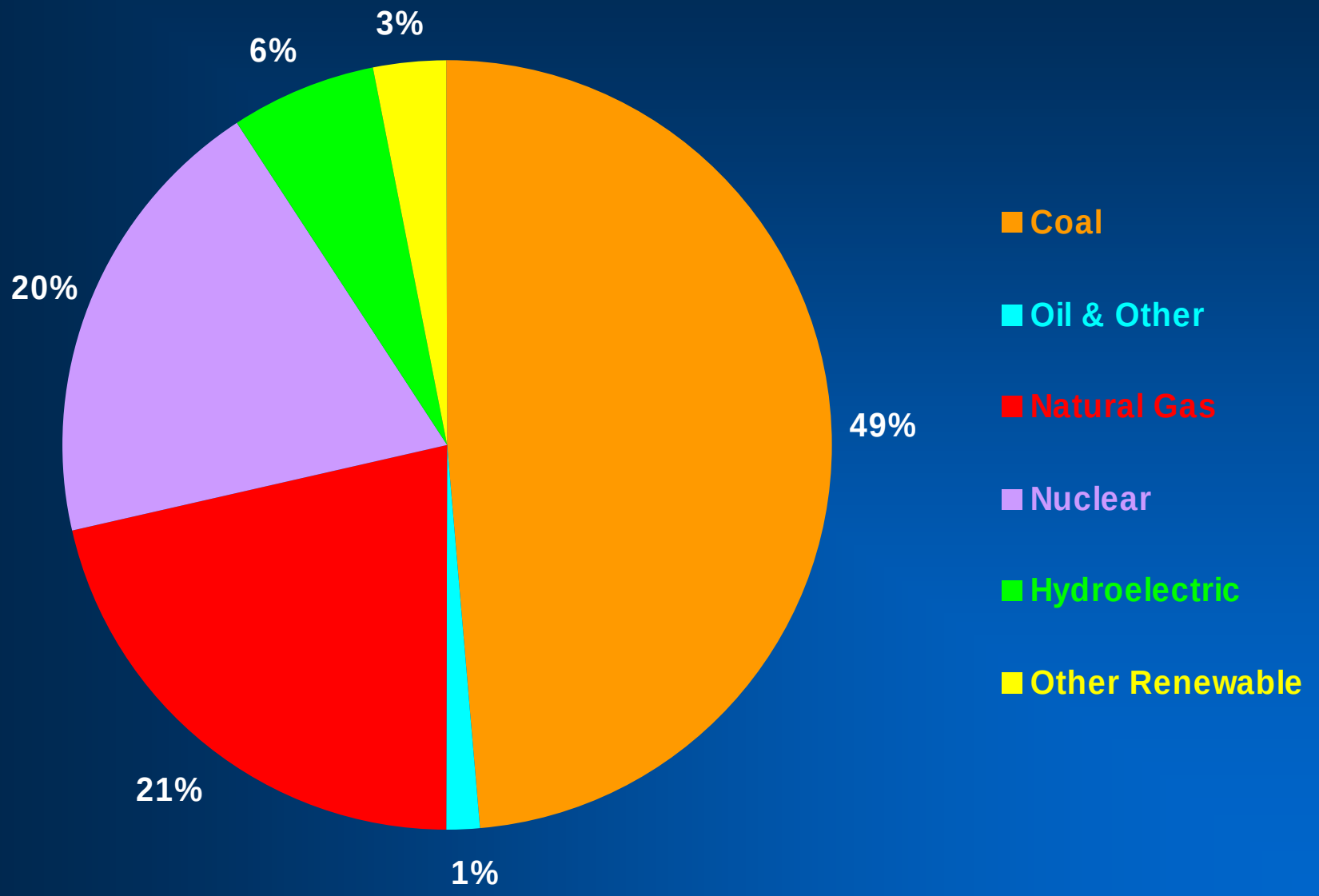
Roadmap for Discussion

1. PAST SUPPLY MIX AND PROJECTED DEMAND AND SUPPLY TRENDS WITHOUT CLIMATE POLICY

2. KEY FACTORS AFFECTING CAPACITY CHOICES
- Capital Costs and Fuel Costs
- Climate Policy (and/or expectations thereof)

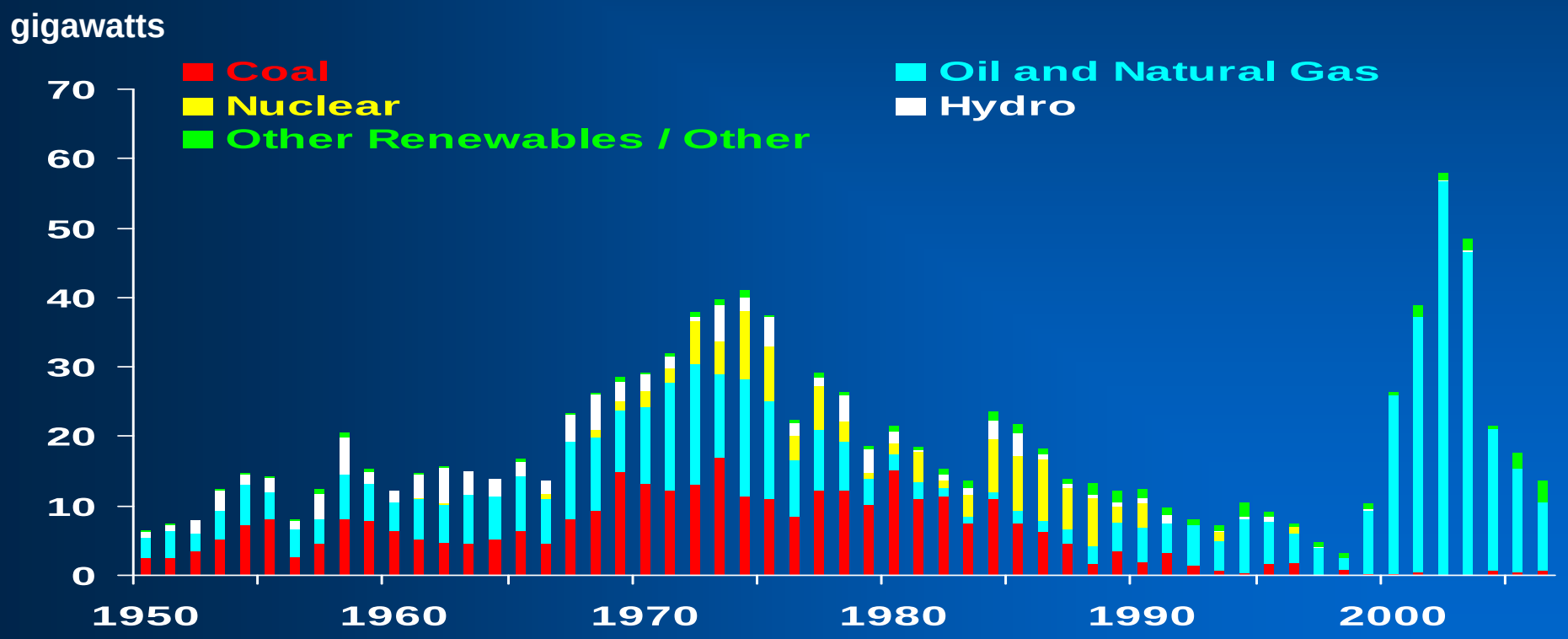
3. CLIMATE POLICY: The Details Matter

Coal continued to dominate the U.S. generation mix in 2008

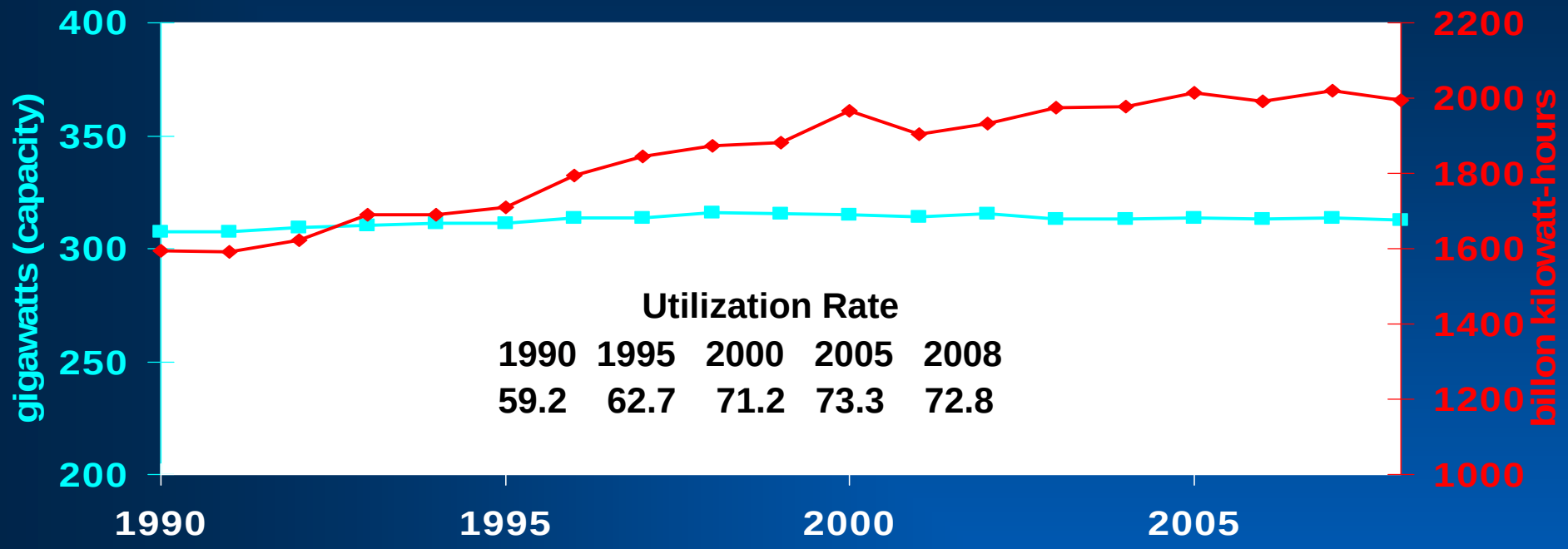


Historically, U.S. generating capacity additions were dominated by coal and nuclear, then natural gas

- **Significant amounts of coal and nuclear capacity, which have relatively low operating costs, were added in the 1980s.**
- **Large amounts of natural-gas-fired generating capacity have been added since 1999. The rise in natural gas prices from 2000 through mid-2008 made it more expensive to operate these plants.**



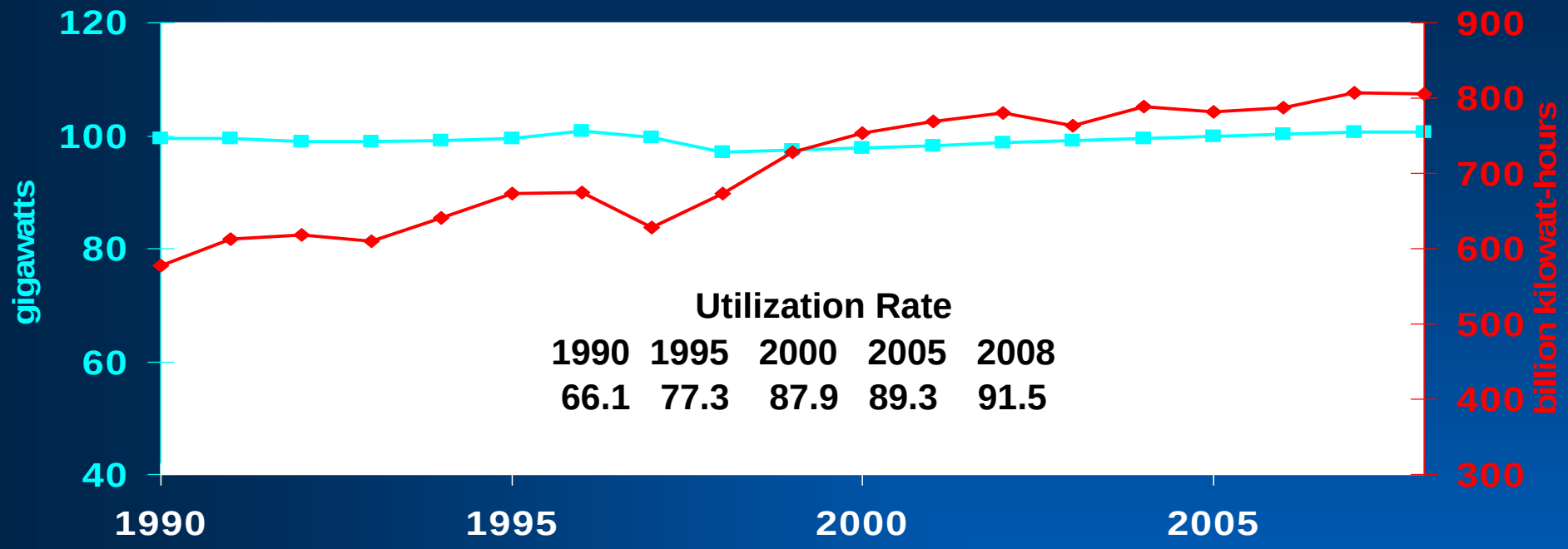
Coal Capacity and Generation



- Although coal-fired generation capacity hasn't grown significantly since 1990, coal-fired generation has increased by 400 billion kilowatt-hours due to higher utilization rates.

- There is some opportunity for further increases in utilization <u>if</u> baseload demand grows AND relative fuel prices favor coal.

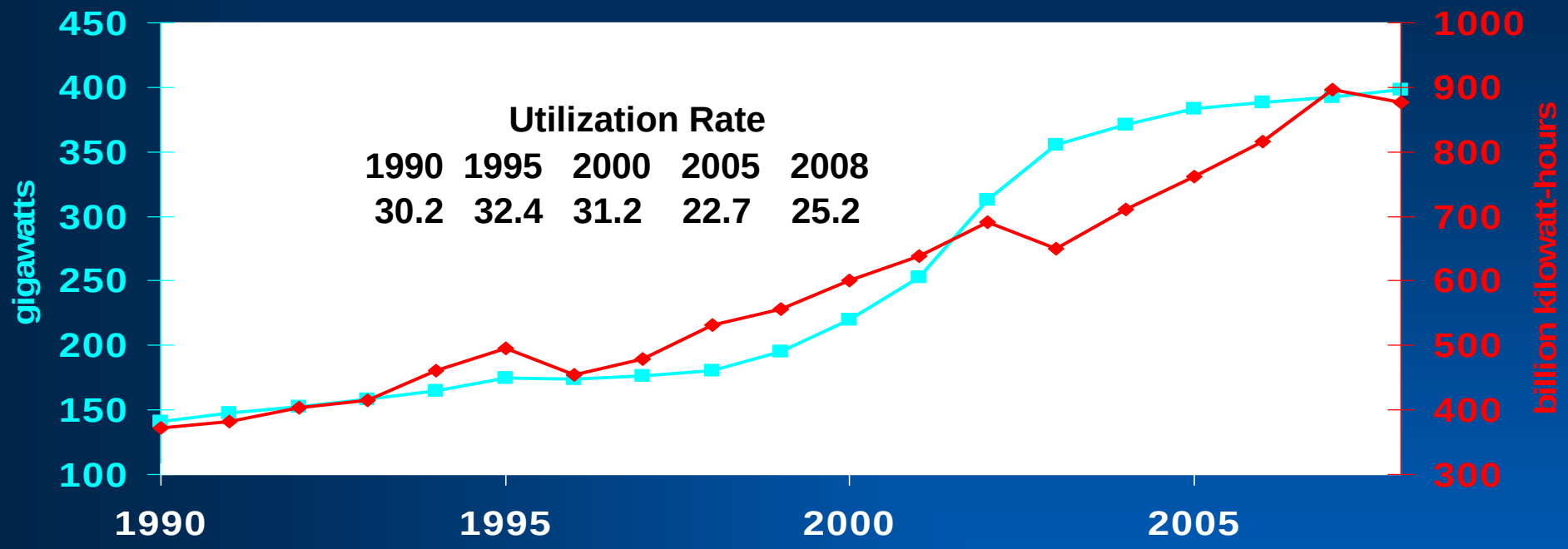
Nuclear Capacity and Generation



- Increases in nuclear generation since 1990, roughly 230 billion kilowatt-hours, have also been driven by higher utilization rates rather than capacity additions.

- Current utilization rates are very high, limiting prospects for further improvements.

Gas-fired Capacity and Generation

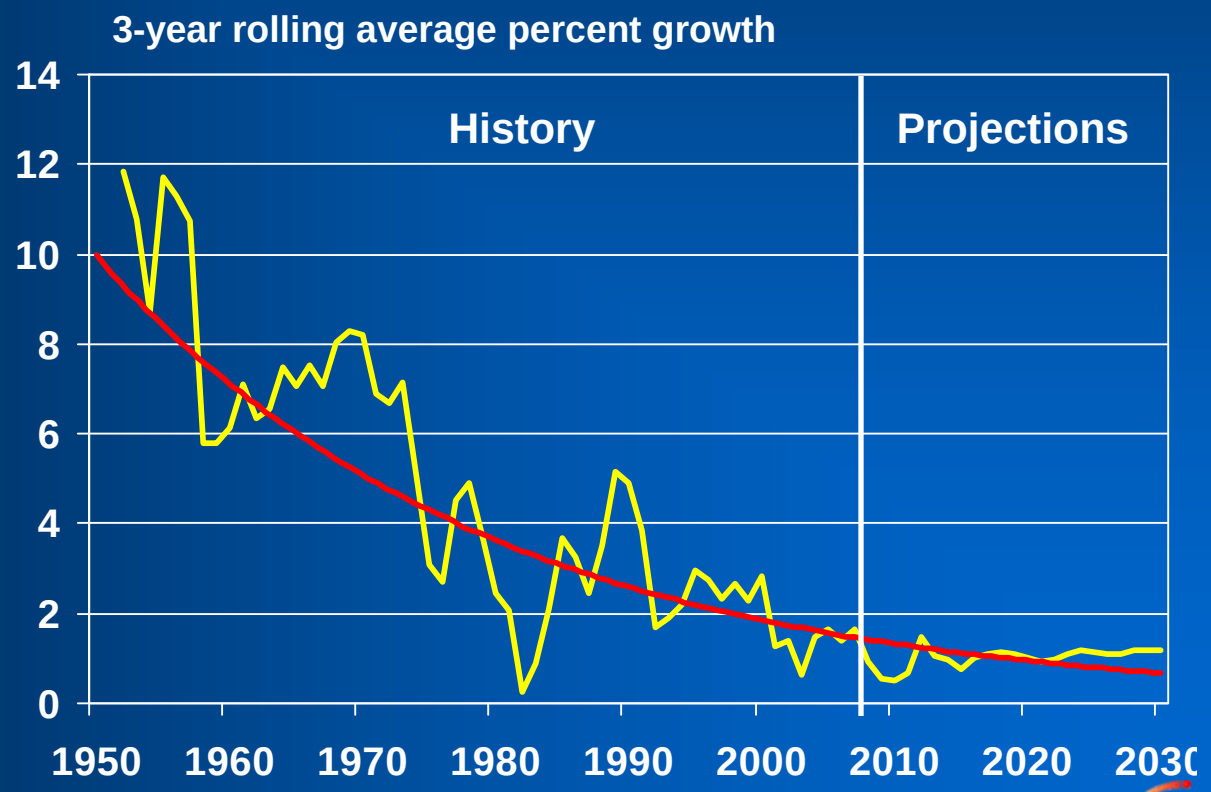


- Increases in gas-fired generation since 1990 have reflected capacity additions. Utilization rates remain relatively low.
- Total growth in gas generation 1990-2008 is less than the growth in nuclear plus coal generation, where minimal capacity was added.

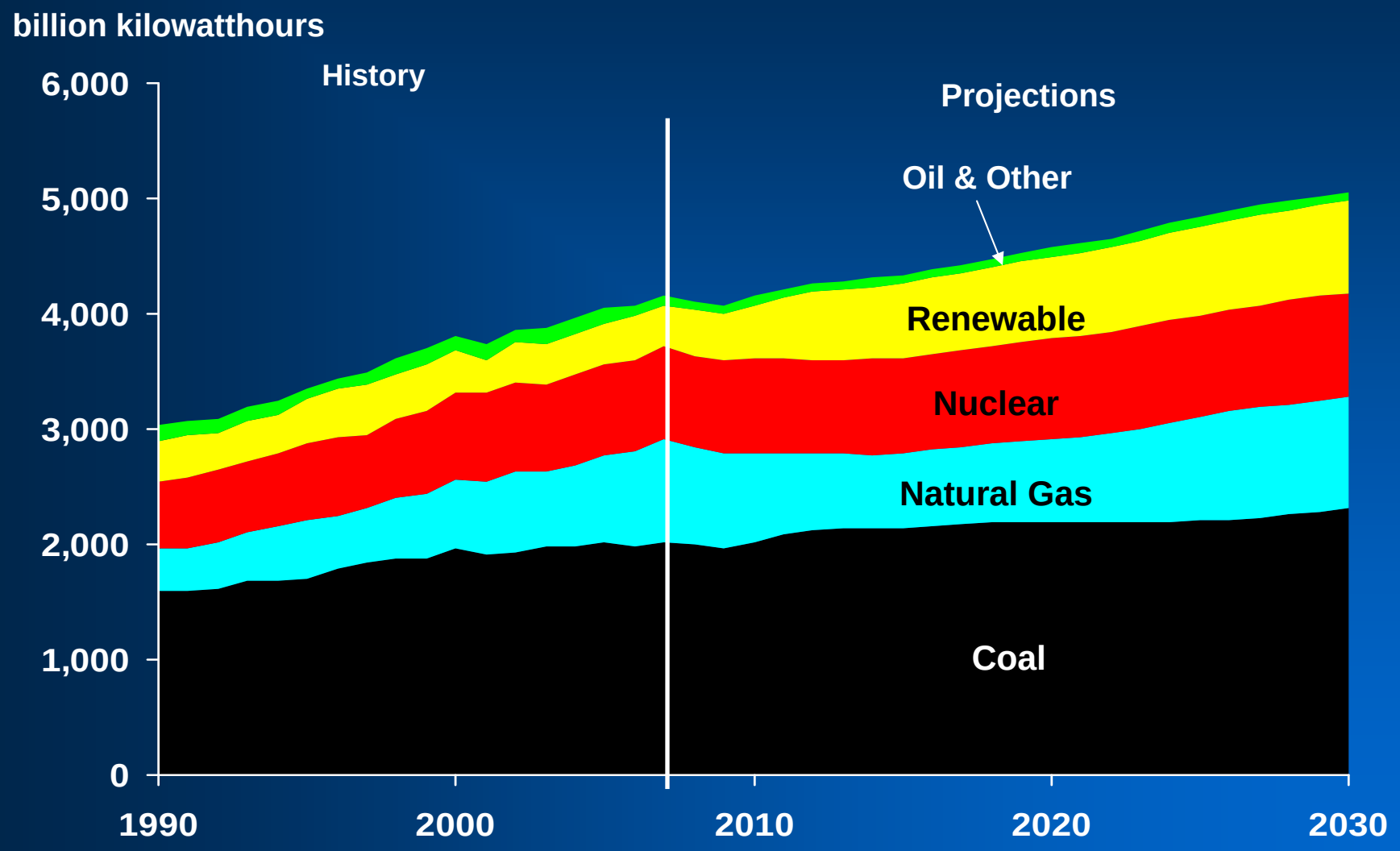
Electricity demand growth continues to slow

- **Electricity demand growth has slowed over time.**
- **However, electricity demand is still expected to grow more than 22 percent above the 2007 level by 2030.**

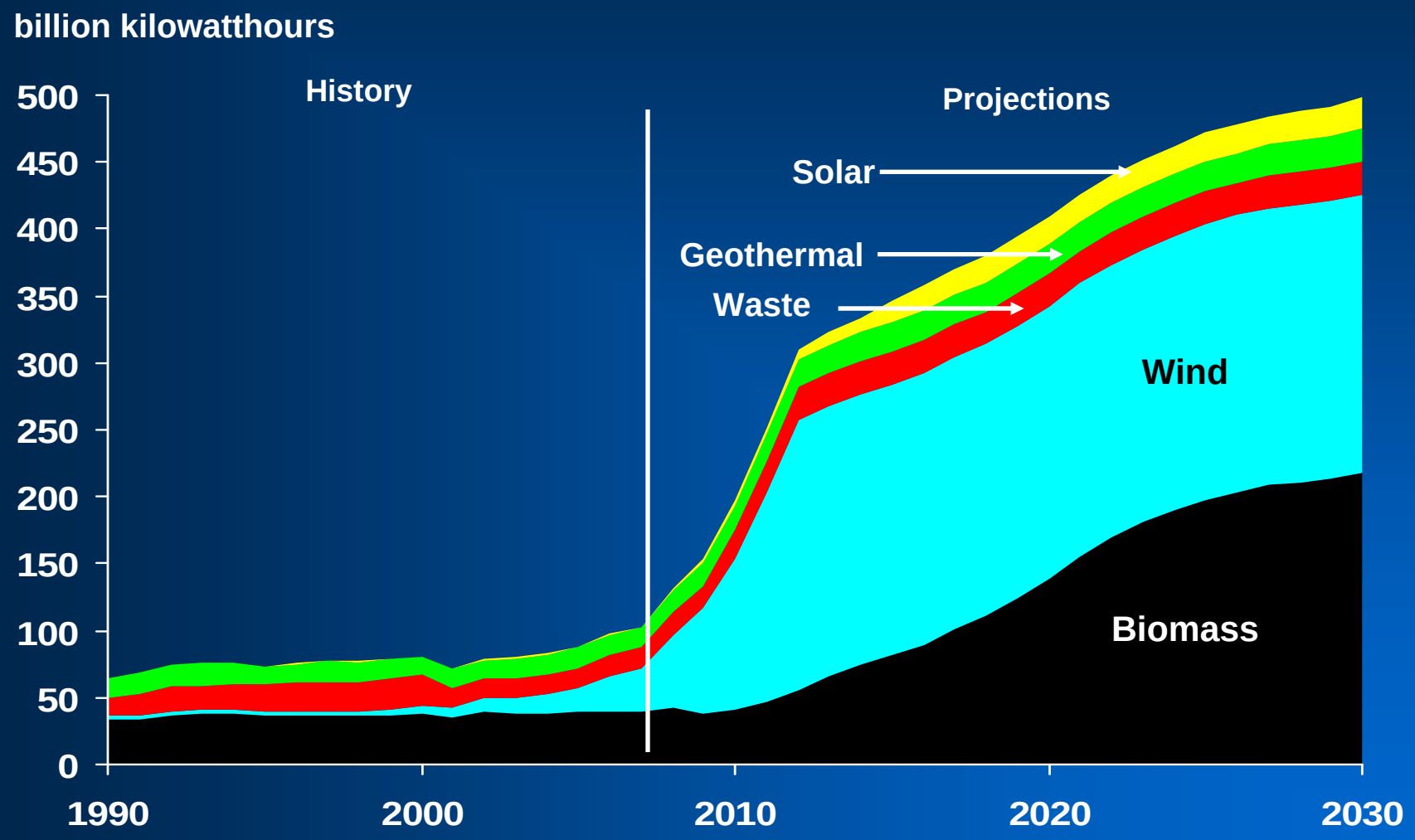
Period	Annual Average Growth
1950s	9.0
1960s	7.3
1970s	4.2
1980s	3.1
1990s	2.4
2000-2006	1.2
2006-2030	0.9



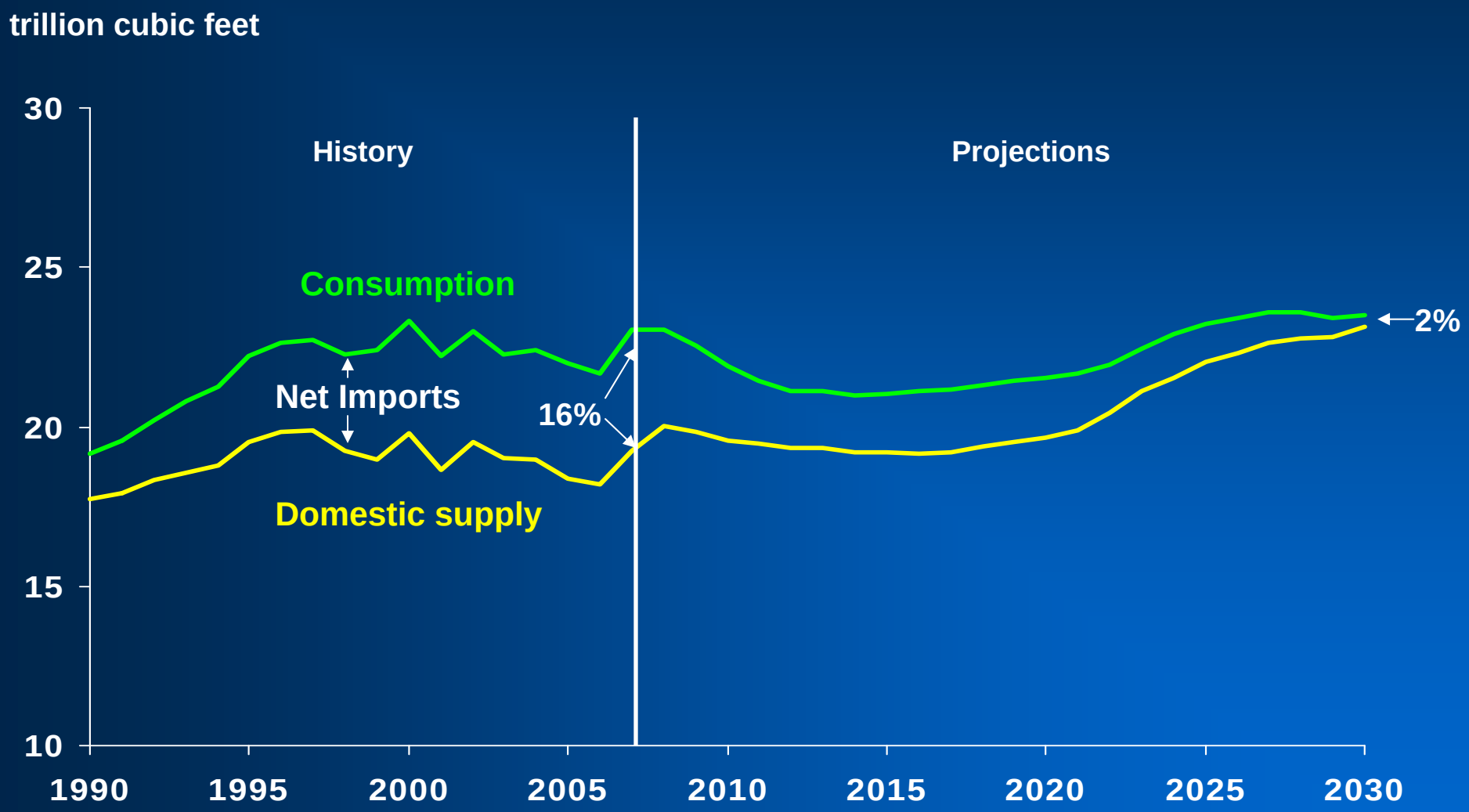
EIA's AEO2009 Outlook: Even without a new climate policy, the generation fuel mix shifts towards lower carbon options



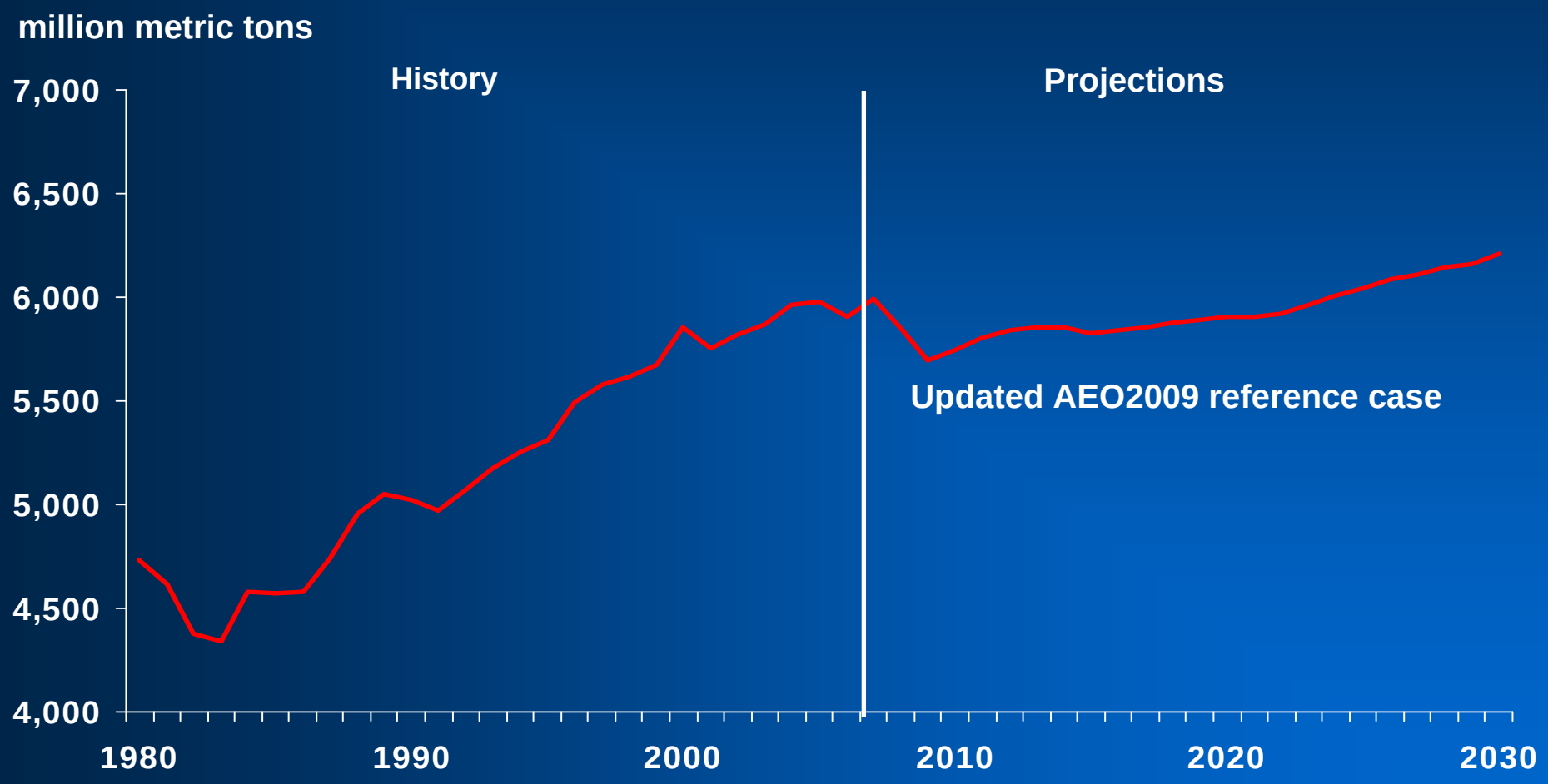
Nonhydropower renewable sources meet 44 percent of total generation growth between 2007 and 2030



The import share of natural gas supply is projected to decline sharply as domestic supply grows

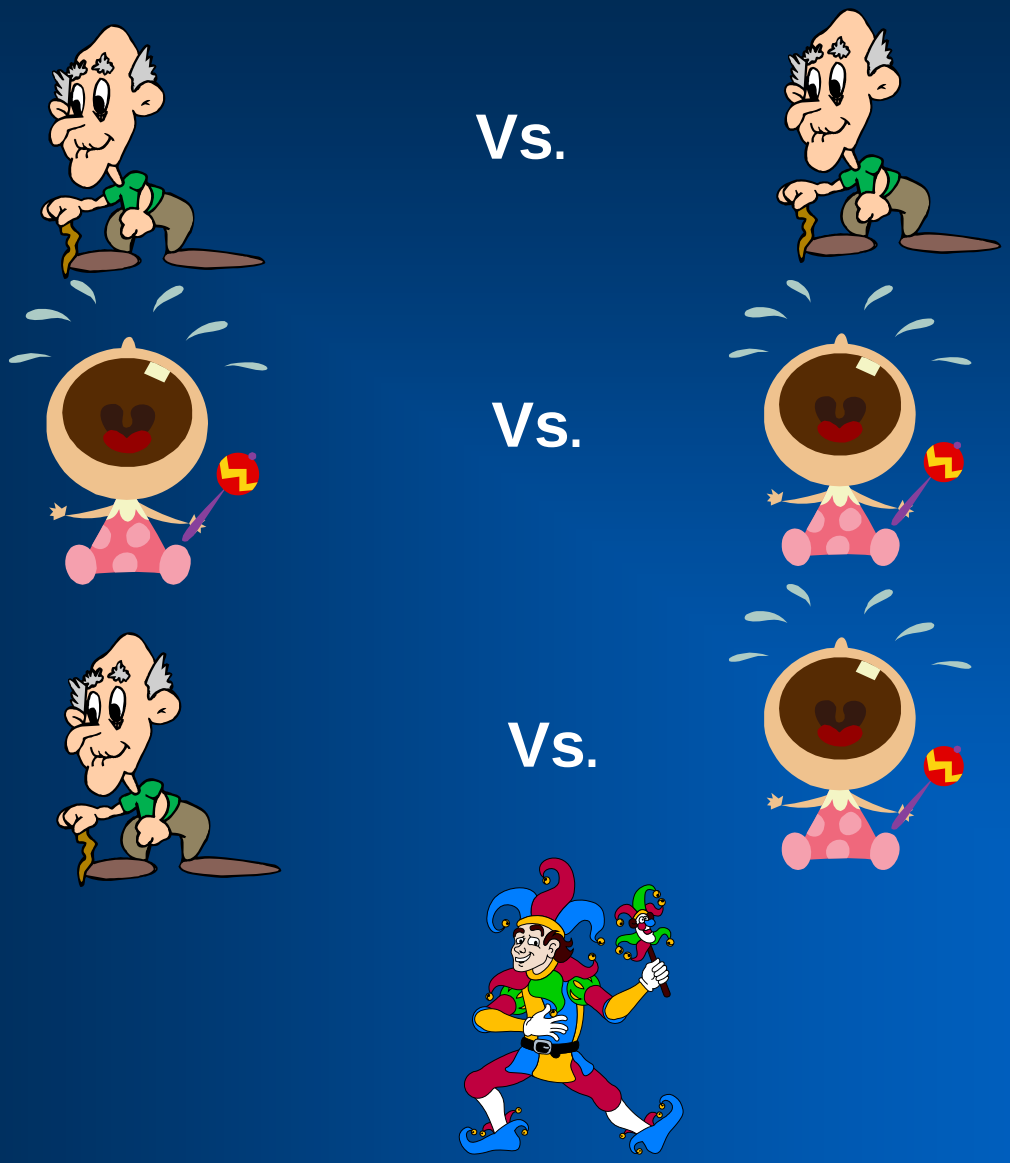


Growth in energy-related CO_2 emissions slows with slowing growth in energy use and a shift to less carbon-intensive fuels

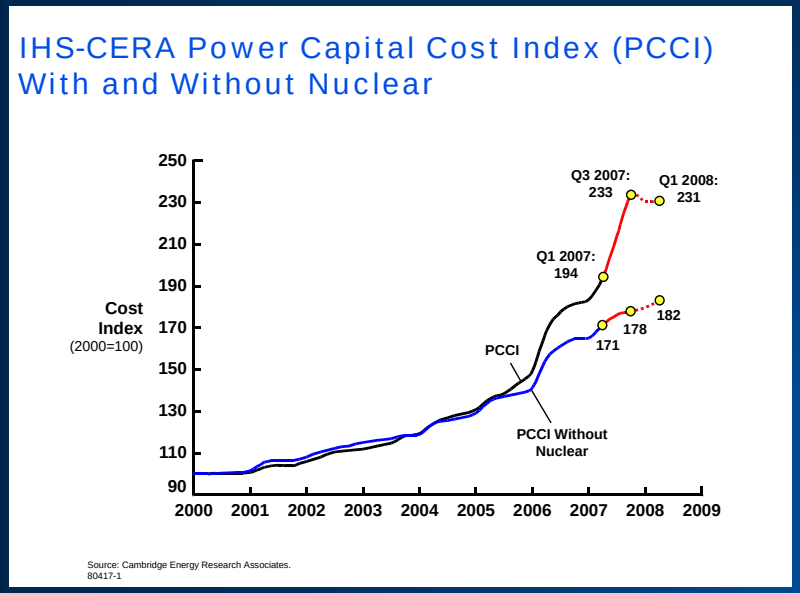


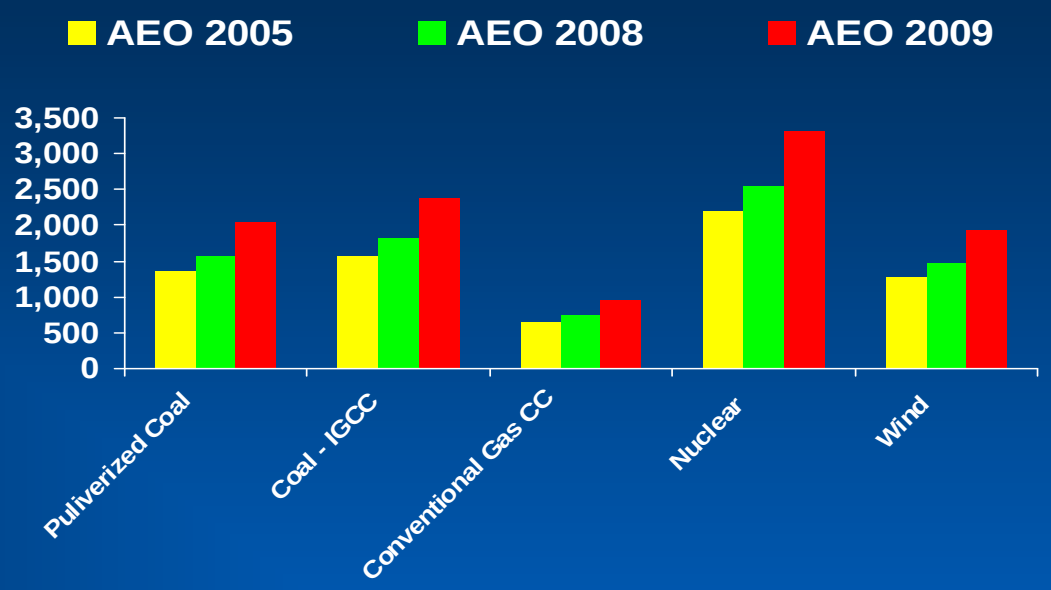
3 Competitive Arenas and
4 Key Factors Driving Capacity Choices

Three Competitive Arenas



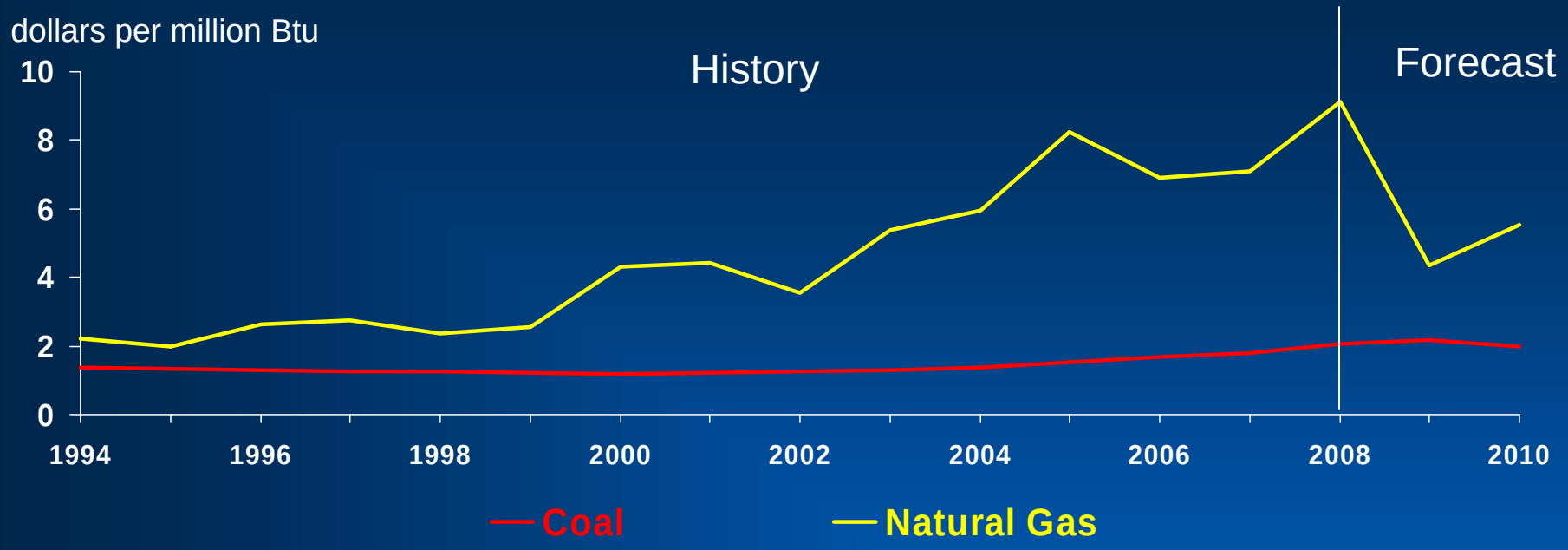
Capital Costs of New Plants: New vs. Old/New





- The "overnight" capital cost of major energy projects has risen dramatically in recent years
- New coal plant and nuclear plant costs which have the biggest proportion of capital costs "on-site" have risen especially fast
- KEY QUESTION: Is it a bubble or permanent shift?
- HIGHER NEW PLANT CAPITAL COSTS FAVOR
  - Existing Plants
  - Less capital-intensive technologies

Fuel Costs Affect All Areas of Competition



- **Natural gas prices rose dramatically between 1999 and mid-2008**
- **Coal prices have also risen, but to a much lesser extent**
- **The relative increase in natural gas prices through mid-2008 has made other generation sources, including coal, nuclear, and renewables, more economically attractive**

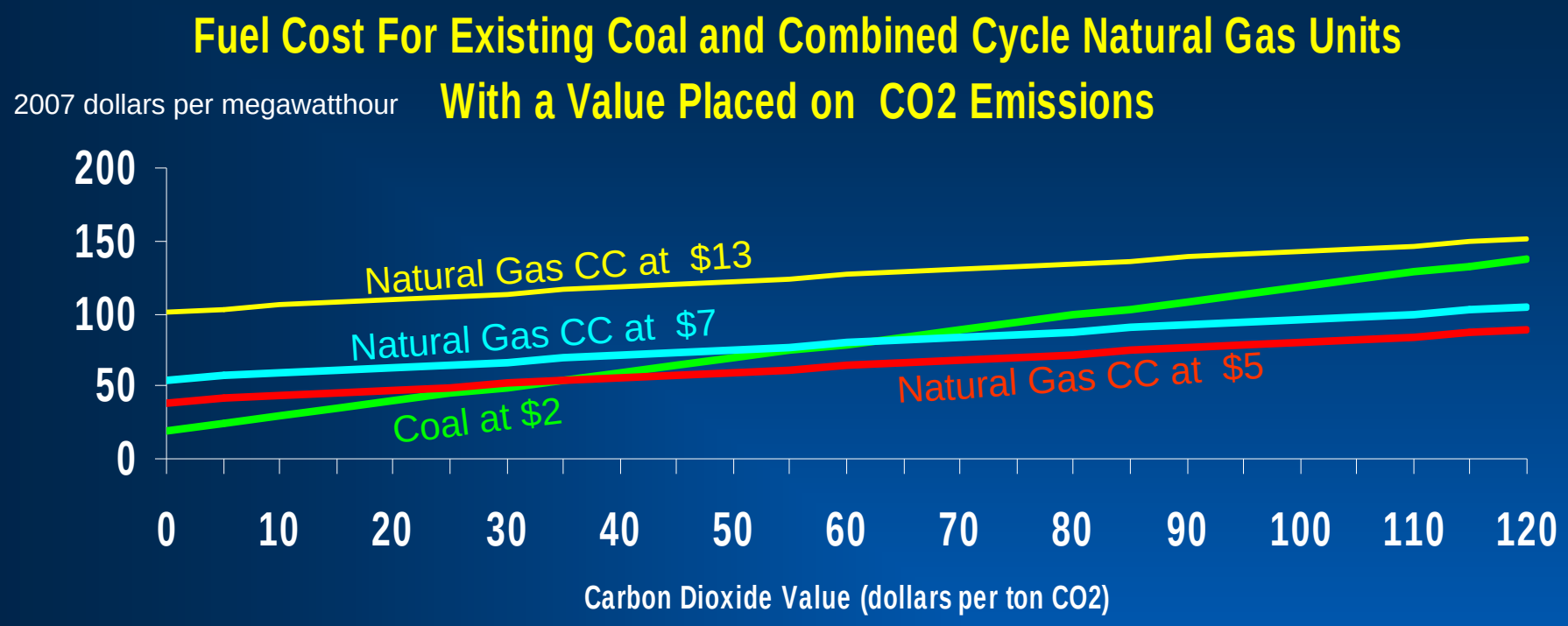
BUT …….

Placing a value on CO_2 raises the cost of using all fossil fuels, with coal most heavily affected.

Fuel	CO_2 content per million Btu	Delivered Price (2007, all sectors, per million Btu)	Impact of $10 per ton CO_2 value		Impact of $50 per ton CO_2 value	
			$	percent	$	percent
Coal	0.094	1.81	0.94	51.9	4.70	260
Oil	0.074	20.31	0.74	3.6	3.70	18.2
Nat. Gas	0.053	9.01	0.53	5.9	2.65	29.4

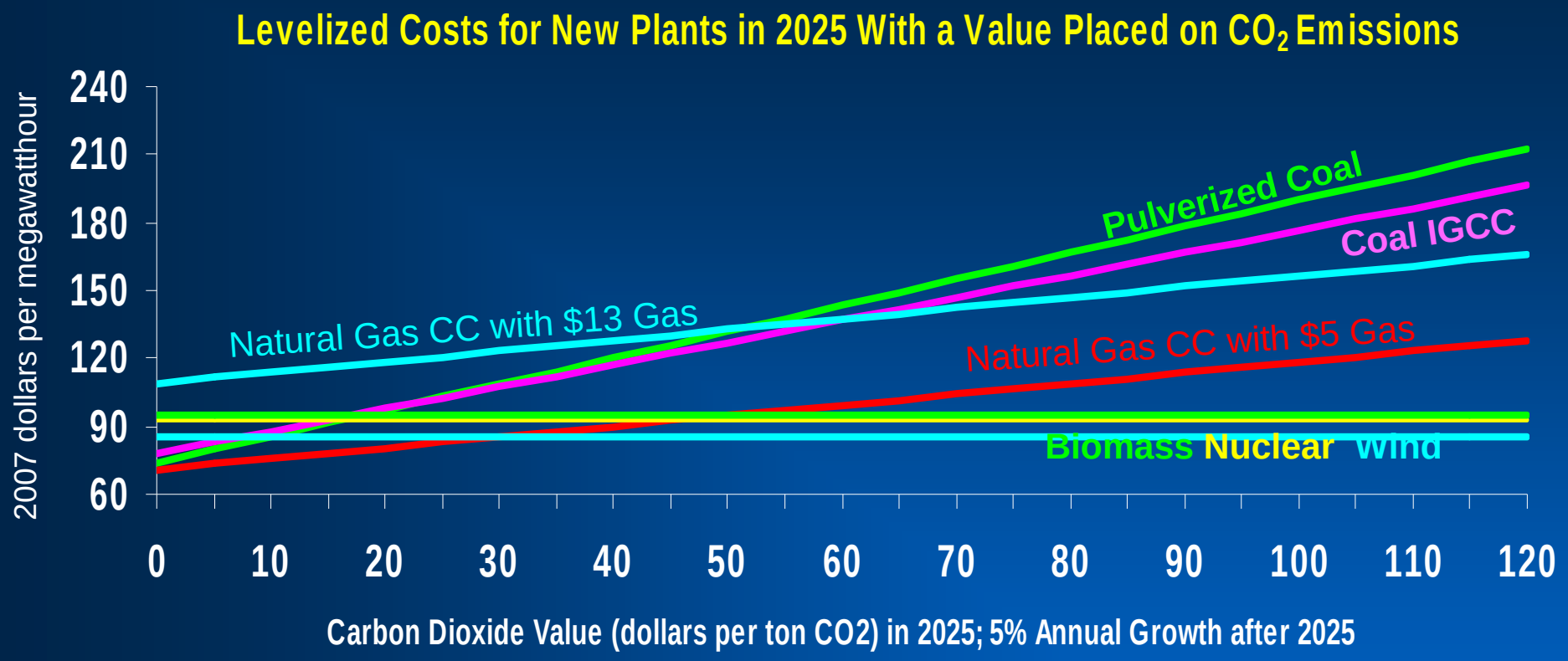
- As shown above, placing a value on GHGs through either a tax or a cap-and-trade program has a relatively large impact on the delivered price of coal.
- This reflects both the substantially lower price of coal relative to other fossil fuels under baseline conditions and its higher emission of CO_2 per unit of energy
- A $25/ton value on CO_2 raises gasoline prices by about 23 cents per gallon.

Climate Policy Impact on Operating Costs: OLD vs. OLD



- **Climate policies affect the operating costs of both coal-fired and natural-gas-fired power plants**
- **OLD vs. OLD: The "crossover point" for least-cost dispatch of coal and natural gas capacity depends on both fuel prices and the carbon value. As natural gas prices increase, the "crossover" occurs at a higher carbon value.**
- **NEW (not shown) vs. OLD: Carbon values may eventually get high enough to make the capital plus operating costs of new no-carbon generation cheaper than the operating only costs of an existing generation unit. At that point, operators will want to retire the existing unit.**

Climate Policy Impact on Levelized Cost: NEW vs.OLD/ NEW



- **Levelized cost, which considers both capital and operating costs, is a useful metric for new plants.**

- **The crossing points for tradeoffs among technologies in "NEW vs. NEW" capacity decisions generally occur at lower carbon dioxide values than the crossing points for "OLD vs. OLD" dispatch decisions.**

What is the impact of climate change policy on the use of natural gas for electricity generation?

- **What is the implicit value of carbon**
  - **What are the emissions targets?**
  - **To what extent are offsets allowed or used?**
  - **Cost, timing, and public acceptance of low/no carbon generation technologies**
- **What is the price of natural gas?**
  - **Supply/Demand balance in regional markets that become disconnected from the global LNG market**
  - **Oil price, and oil/LNG price relationships, in markets where LNG makes, rather than takes, prices**
- **How much support will renewables get from tax credits, mandates, or feed-in tariffs?**
- **How do end-use efficiency efforts, included in or parallel to climate policies, affect load growth?**
- **Which competitive margin are we looking at in each market?**

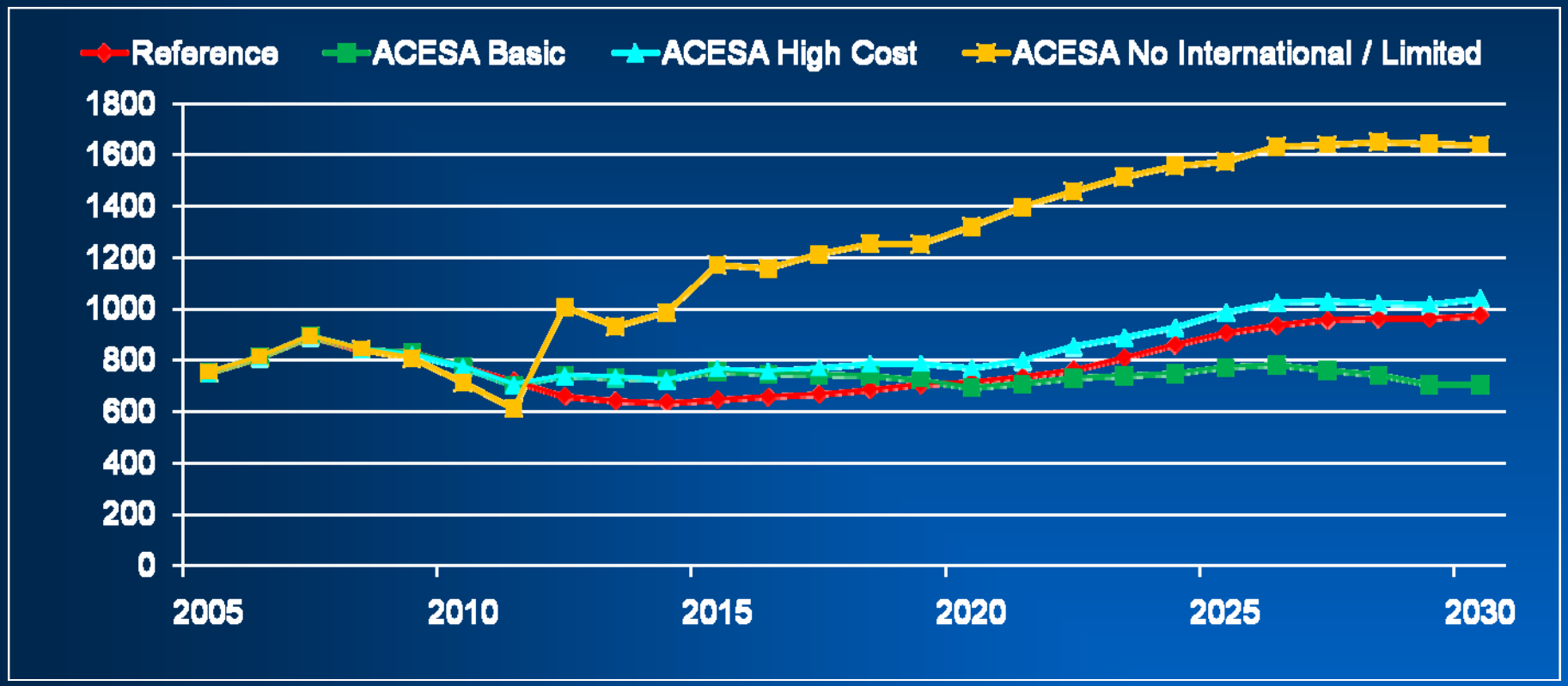
Demand is also uncertain

- **EIA's reference electricity demand projection is sensitive to:**
  - **the projected rate of economic growth and its mix: faster growth and more growth in energy-intensive sectors would raise demand**
  - **the pace of efficiency improvements, both mandated and price-induced**
  - **residential fuel switching towards electricity and the growth of "other" plug load**

- **Transportation fuel switching (i.e. plug-in hybrids) is not a major source of demand uncertainty over the next decade**
  - **One million plug-in hybrids with a 40-mile range on grid power (PHEV-40) would raise projected electricity demand in 2020 by only about 5 billion kilowatthours, or one-tenth of 1 percent.**

Impacts of the ACES Act (H.R. 2454) on Gas-fired Generation: Results from Recent EIA Analysis

billion kilowatthours



- Major emissions reductions in electricity generation require EXISTING coal capacity to be retired in favor of NEW generation capacity
- Conventional coal generation declines and renewables grow, in all climate policy cases.
- The level of natural gas generation is sensitive to the availability and costs of nuclear power, coal with CCS, biomass, and offsets.

Summing Up

- The rate of demand growth, fuel costs, capital costs, and climate change policies are key drivers of electricity mix decisions.
  - KEY FUEL COST ISSUE: The natural gas supply and demand balance, regionally and globally.
  - KEY CAPITAL COST ISSUE: The extent to which recent increases in new plant costs are permanent or a bubble, the capital costs of low/no carbon technologies, as well as the availability and public acceptance of these technologies.
  - KEY U.S. CLIMATE POLICY ISSUES:

    1) the size of required reductions in domestic energy-related emissions after considering domestic and international offsets.

    2) the rate of electricity demand growth after consideration of targeted end-use efficiency policies.

    3) the extent of emissions reductions from targeted policies outside the electricity sector that reduce the requirement for reductions driven by the cap-and-trade program.

    4) embedded subsidies and mandates for particular electricity generation technologies.

- The climate issue is affecting capacity expansion decisions even before a climate policy is implemented.

Periodic Reports from EIA

***Petroleum Status and Natural Gas Storage Reports*, weekly**

***Short-Term Energy Outlook*, monthly**

***Annual Energy Outlook 2009*, March 2009**

***International Energy Outlook 2009*, May 2009**

Examples of Special Analyses from EIA

***Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009*, August 2009**

***An Updated Annual Energy Outlook 2009 Reference Case Reflecting Provisions of the American Recovery and Reinvestment Act and Recent Changes in the Economic Outlook*, April 2009**

"Impact of Limitations on Access to Oil and Natural Gas Resources in the Federal Outer Continental Shelf"*, Annual Energy Outlook 2009*

***Analysis of Crude Oil Production in the Arctic National Wildlife Refuge*, May 2008**

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