Understanding Fuel Diversity:

Market and Regulatory Trends

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Overview

- Diversity?
- Recent industry trends
- Gas price and supply
- Environmental regulation
  - Conventional
  - Greenhouse gases

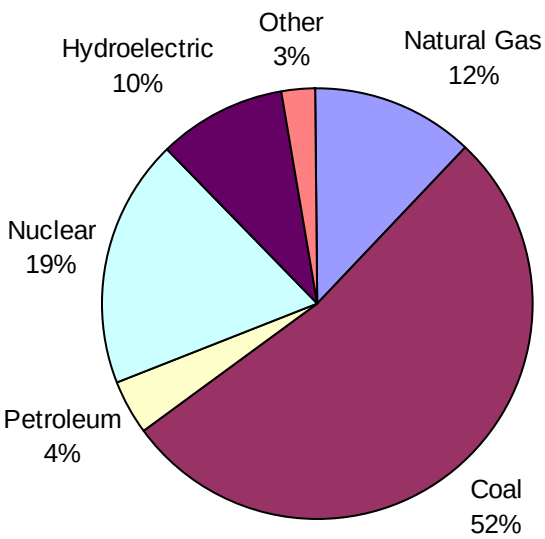
Diversity?

- What is it?
- Do we want it?
- Is there a better goal?

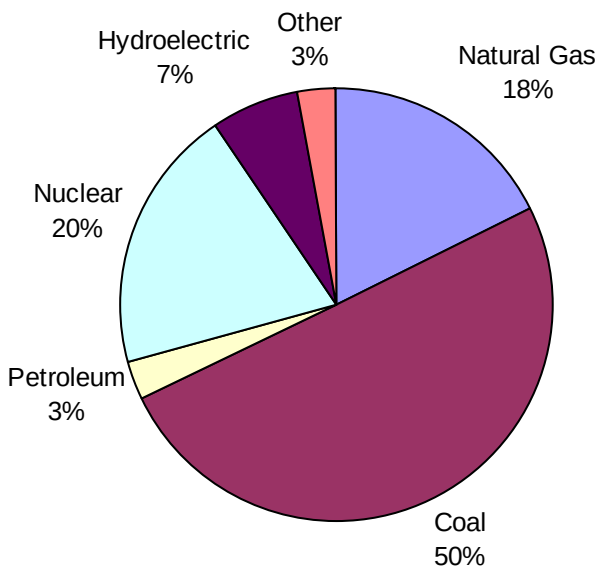
What mix is most achievable, economic and sustainable?

U.S. Electricity Generation Mix

1990



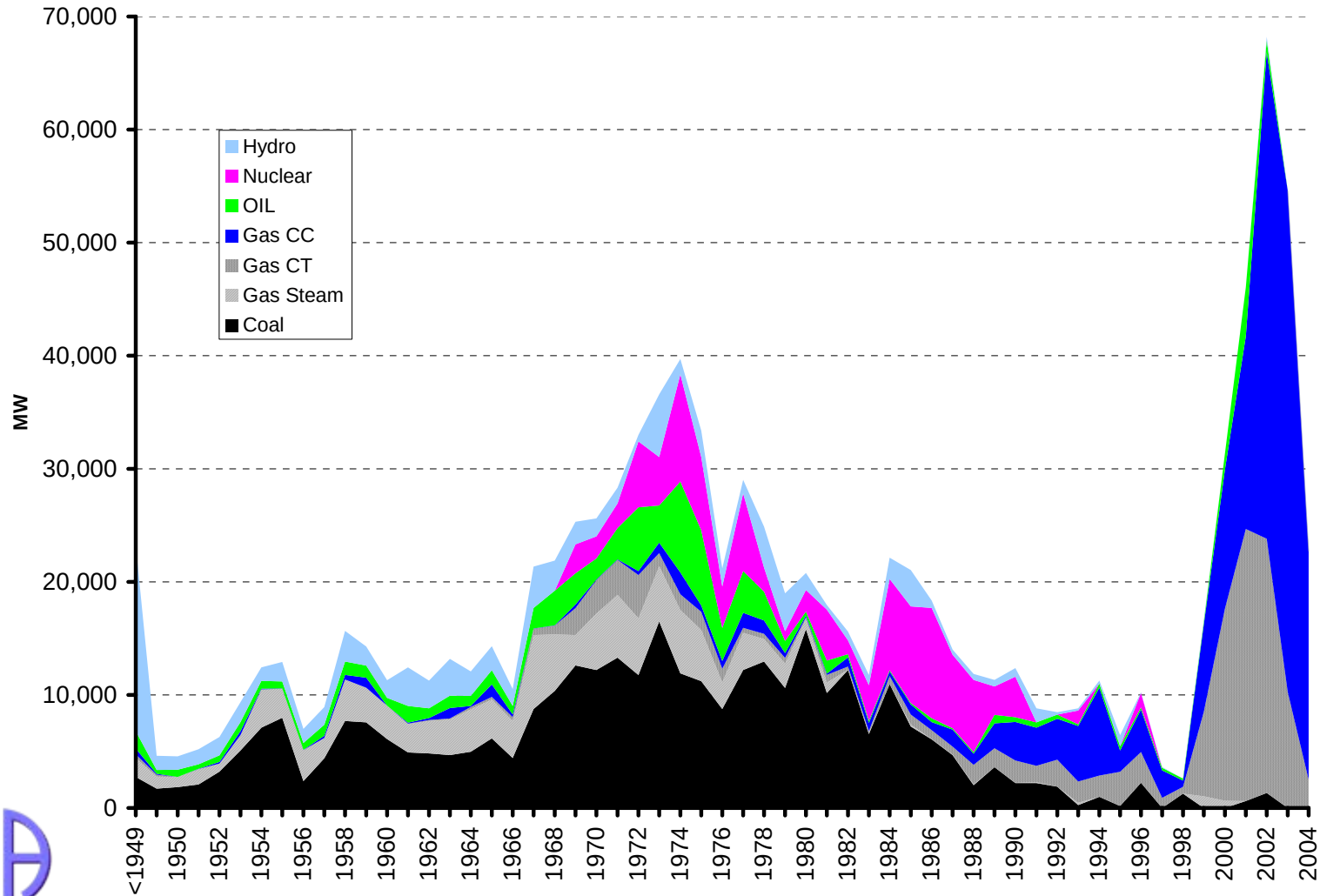
2004



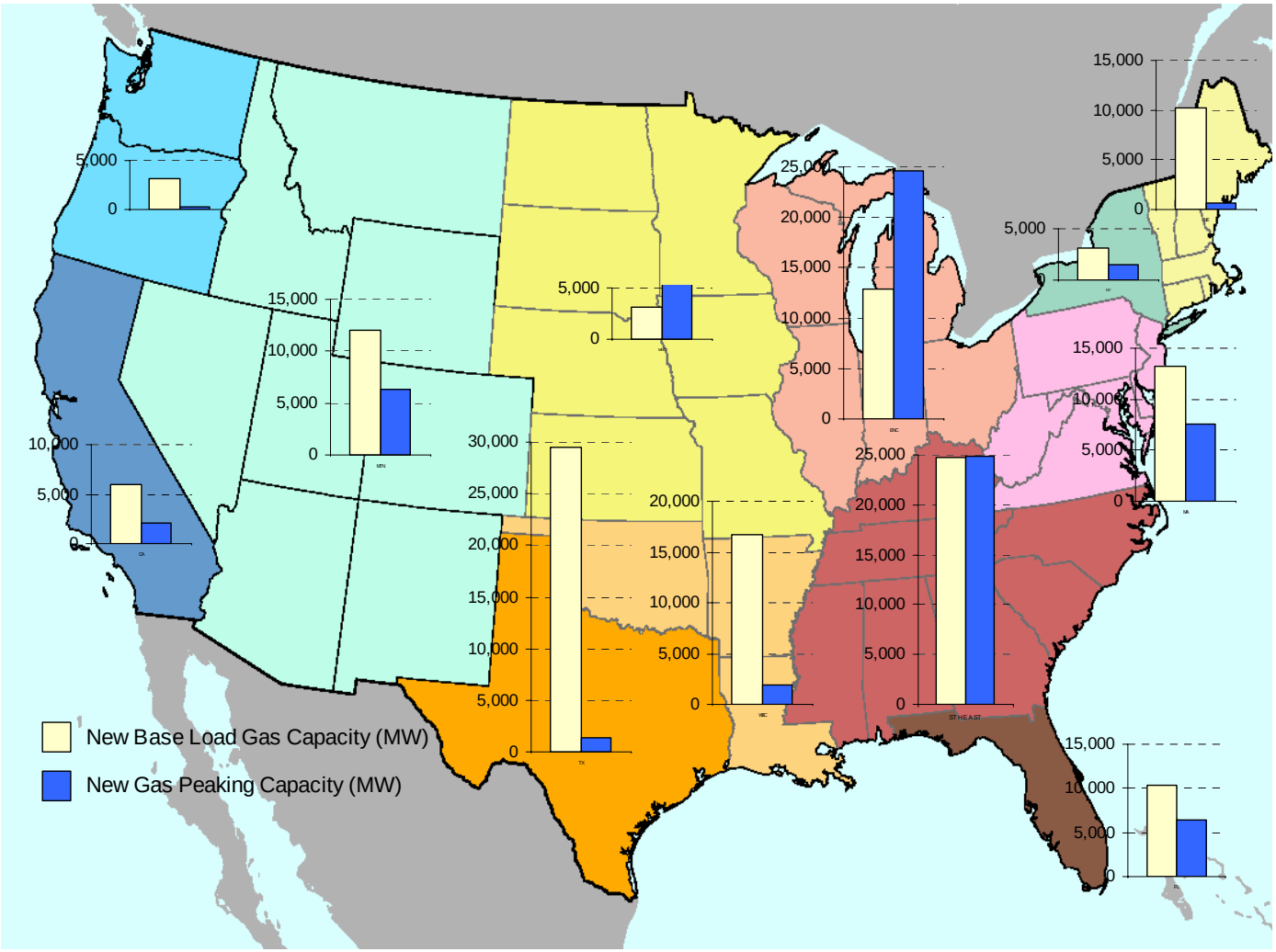
The Boom in Gas Generation

- Over 200 GW of new gas generation has been built since 1999 - about 1/3 peakers.
- Power gen is the fastest growing sector of gas consumption - but not due to new plants.
  - New plants have reduced the rate of gas demand growth.
- The role and fate of the new plants differs by region.

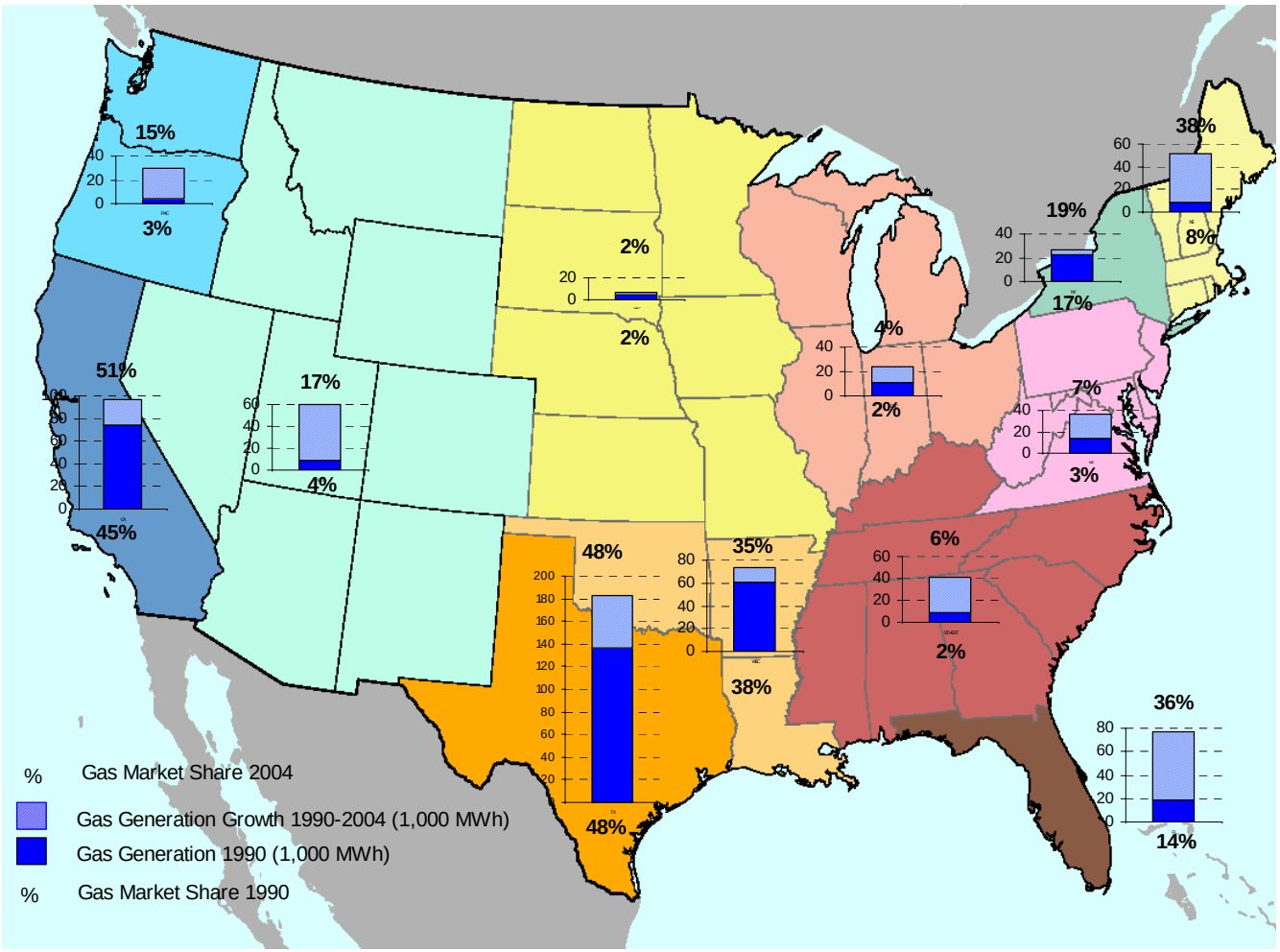
Power Plant Construction by Year



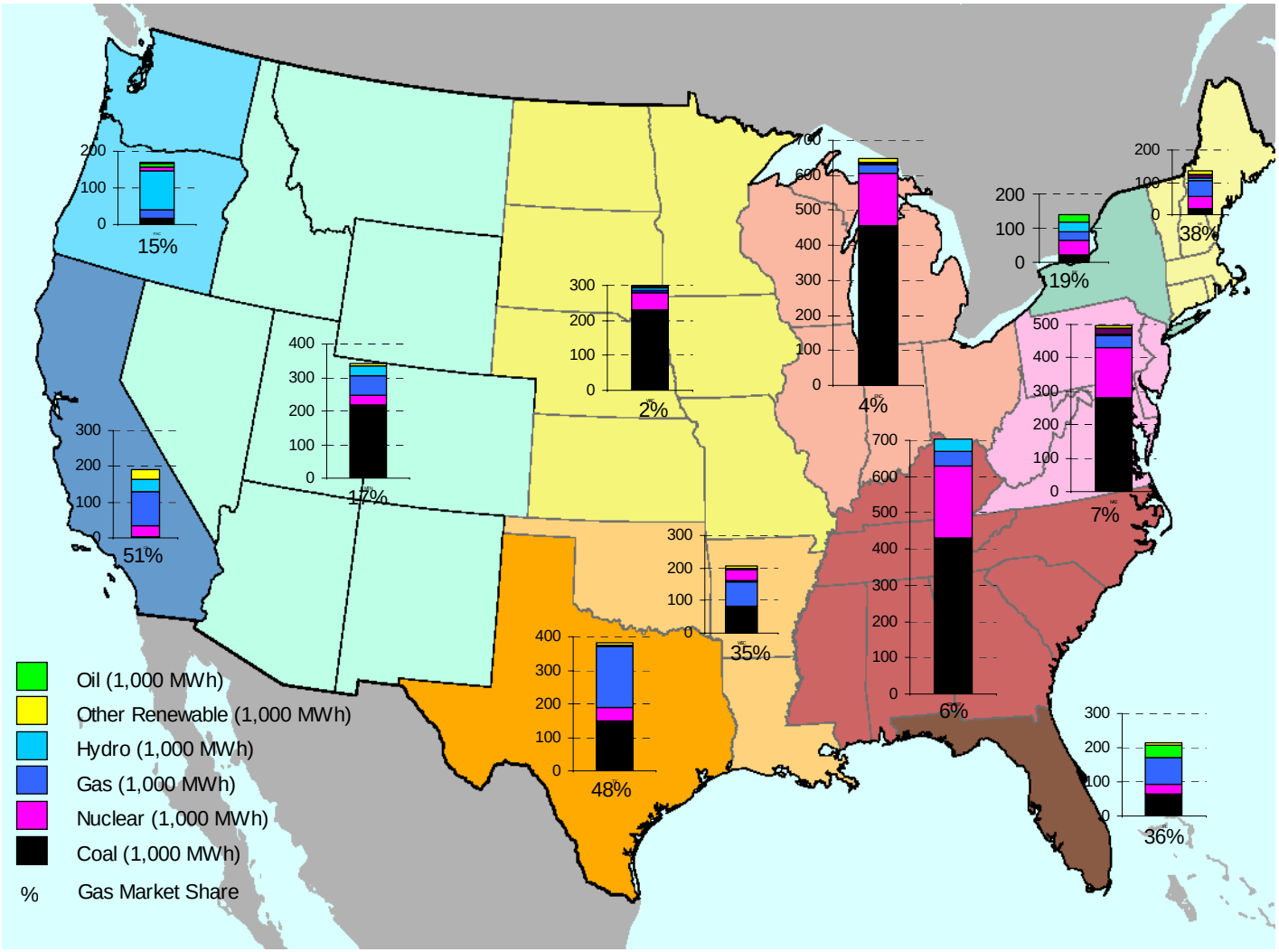
New Gas Power Plants - 1999-2004



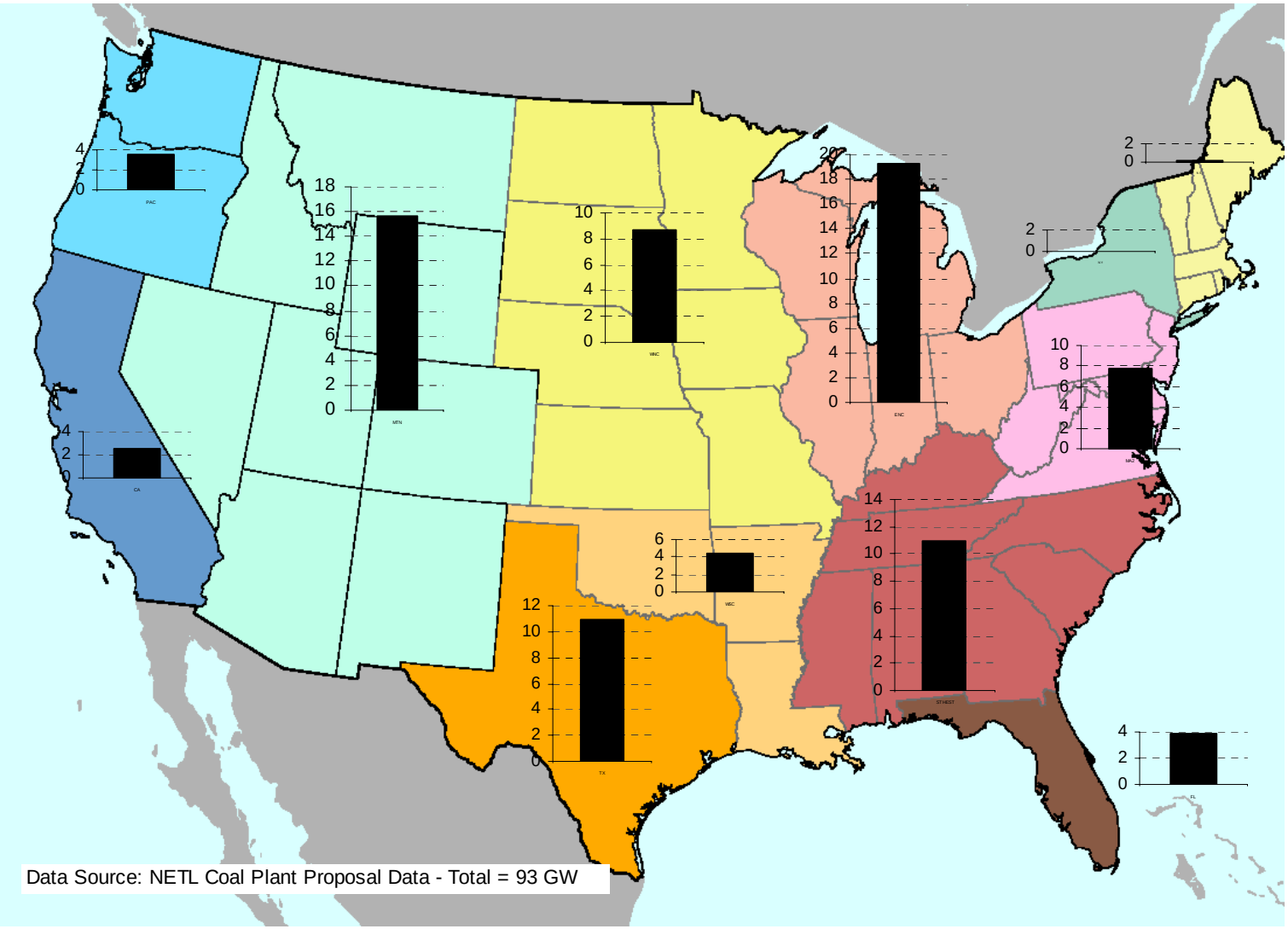
Growth in Gas Generation 1990-2004



Generation Fuel Shares by Region 2004



Proposed Coal Plants - 2006



Drivers for Gas Generation

- Restructuring.
- Lower capital cost.
- Low fuel cost (in late 1990s).
- Shorter construction time.
- Lower water, land requirements, lower profile, less infrastructure requirement.

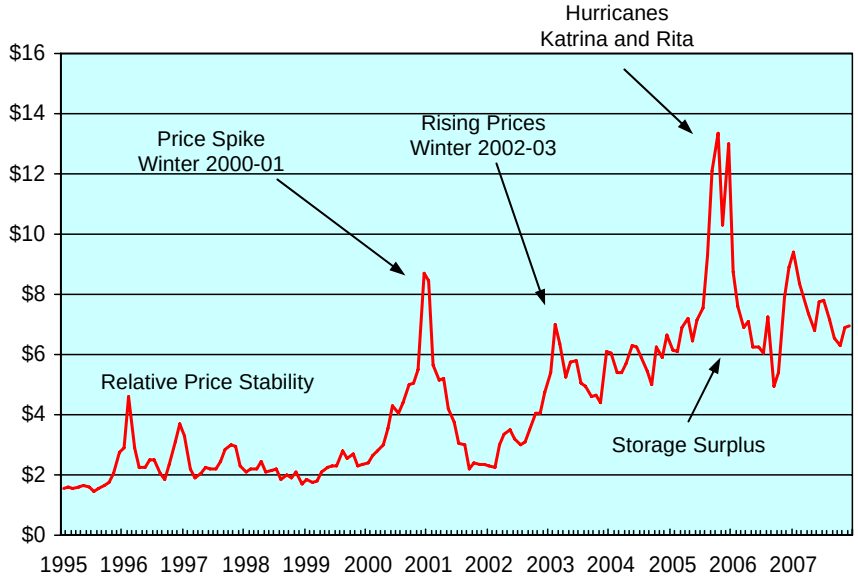
  …. And cleaner.

What Has Changed?

- Gas prices.
- Movement towards restructuring.
- Who is building the plants.

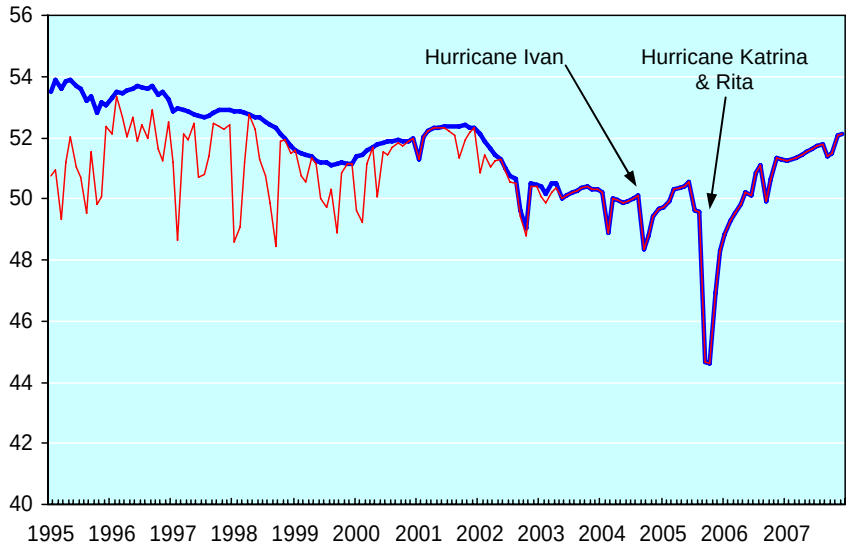
The Changing Gas Balance

Historical Gas Price at Henry Hub ($ per MMBtu)



Source: Platts Gas Daily & Energy and Environmental Analysis, Inc.

Lower-48 Dry Gas Production Vs. Dry Gas Capacity (BCFD)



Source: Energy and Environmental Analysis, Inc.

A tight balance between supply and demand has led to higher gas prices, and increased price volatility.

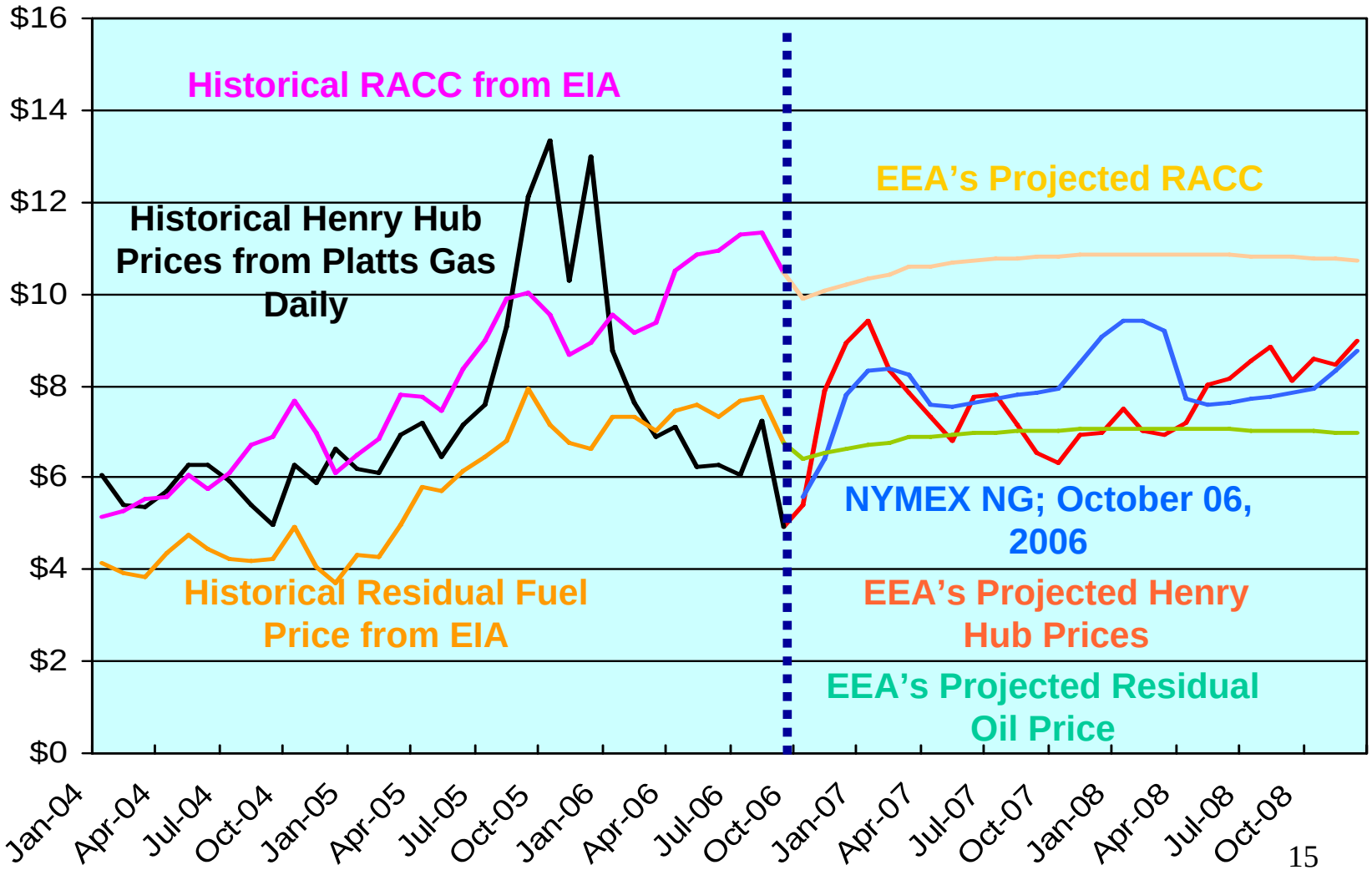
TIGHT BALANCE EXPECTED TO CONTINUE

Heat, Hurricanes and Oil Prices

- Summer ‘05 was more than 15 percent hotter than normal in the U.S.
  - Gas use for power generation up by almost 35%.
- Oil prices above $60/barrel pulled all hydrocarbon prices up.
- The hurricane season removed more than 700 Bcf of gas production from the market.
- Warm winter weather relieved pressure on market.
  - Gas prices have come down even before crude oil prices.

This effect will not last.

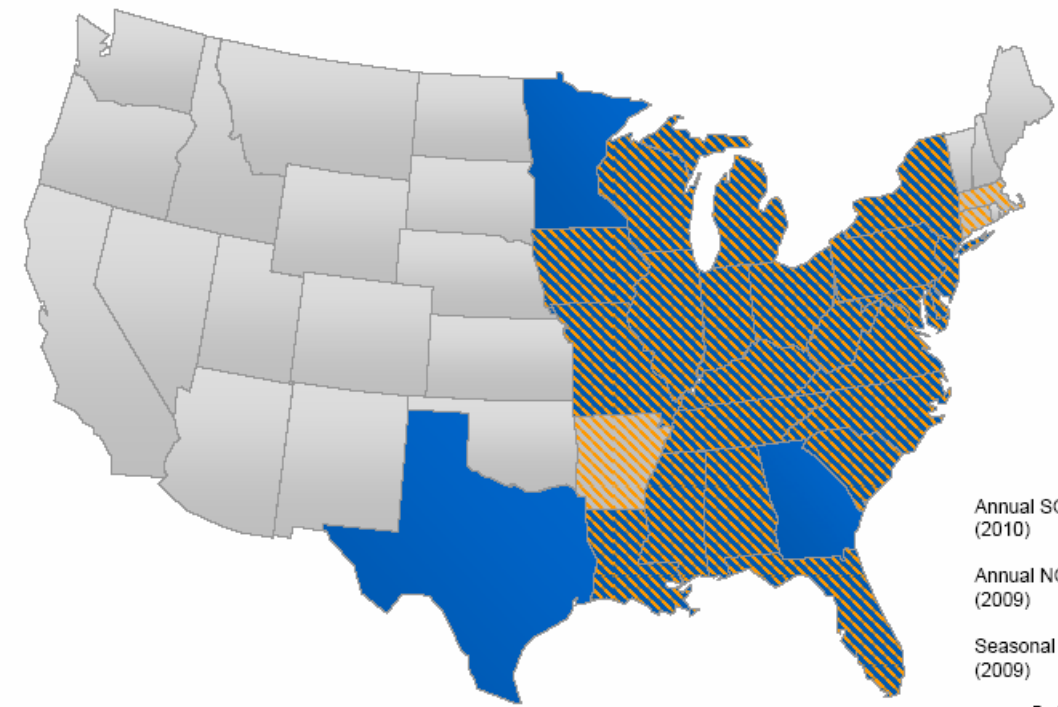
Near-Term Gas and Oil Prices ($ per MMBtu)



Environmental Regulation: Conventional - CAIR/CAMR

- Clean Air Interstate Rule (CAIR) – Limits SO_2 and NO_x in the eastern U.S. Starting on 2009, fully effective in 2015.
- Clean Air Mercury Rule (CAMR) – Limits mercury emissions from coal plants throughput U.S. starting in 2010, fully effective in 2018.
- Both allow states to use allowance trading. Almost all states using trading for CAIR, not all for CAMR

CAIR Coverage and Caps



Emission Caps*
(million tons)

	2009/2010	2015
Annual SO_2 (2010)	3.7	2.6
Annual NOx (2009)	1.5	1.3
Seasonal NOx (2009)	.58	.48

*For the affected region.

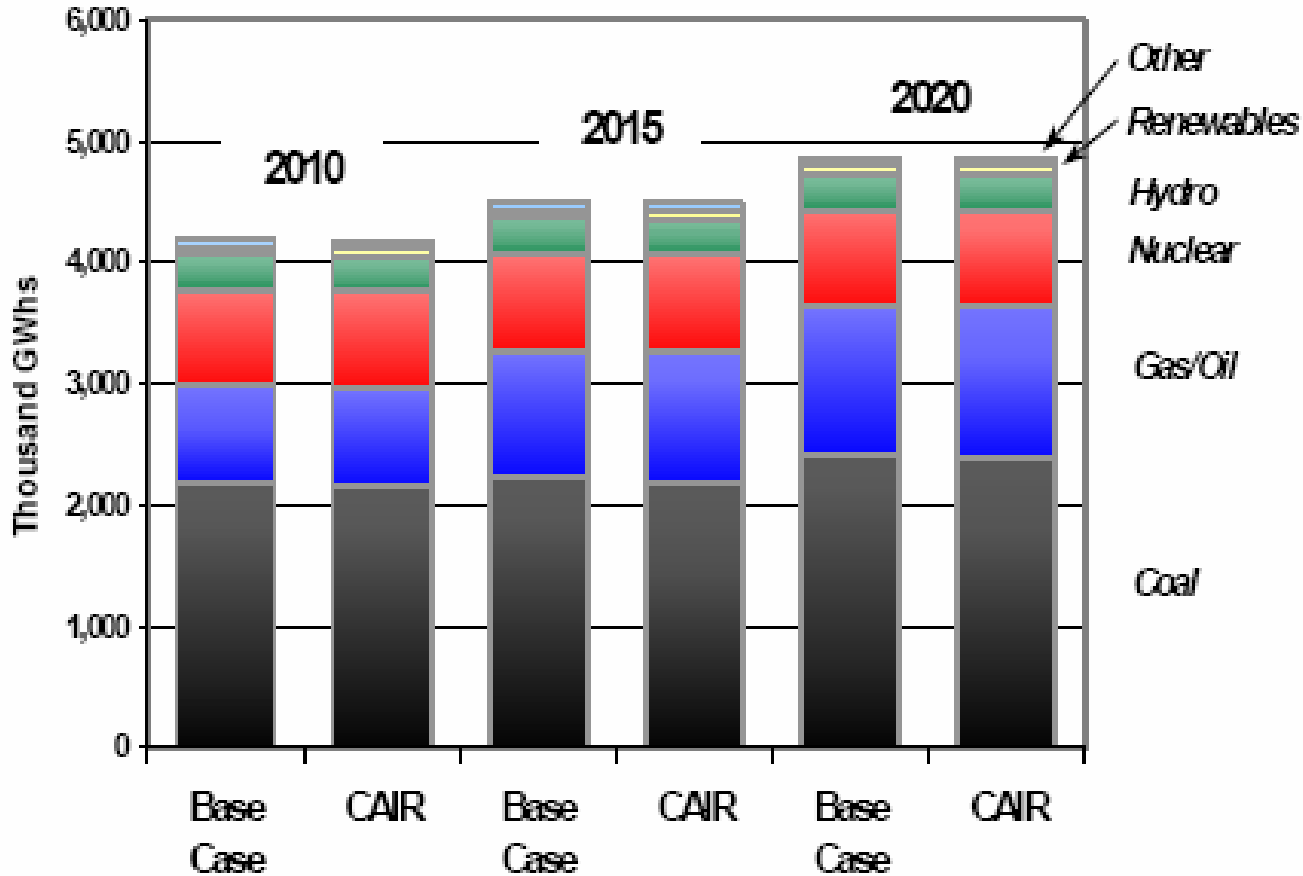
- States not covered by CAIR
- States controlled for fine particles (annual SO_2 and NOx)
- States controlled for both fine particles (annual SO_2 and NOx) and ozone (ozone season NOx)
- States controlled for ozone (ozone season NOx)

Source: U.S. EPA

CAIR/CAMR Impacts

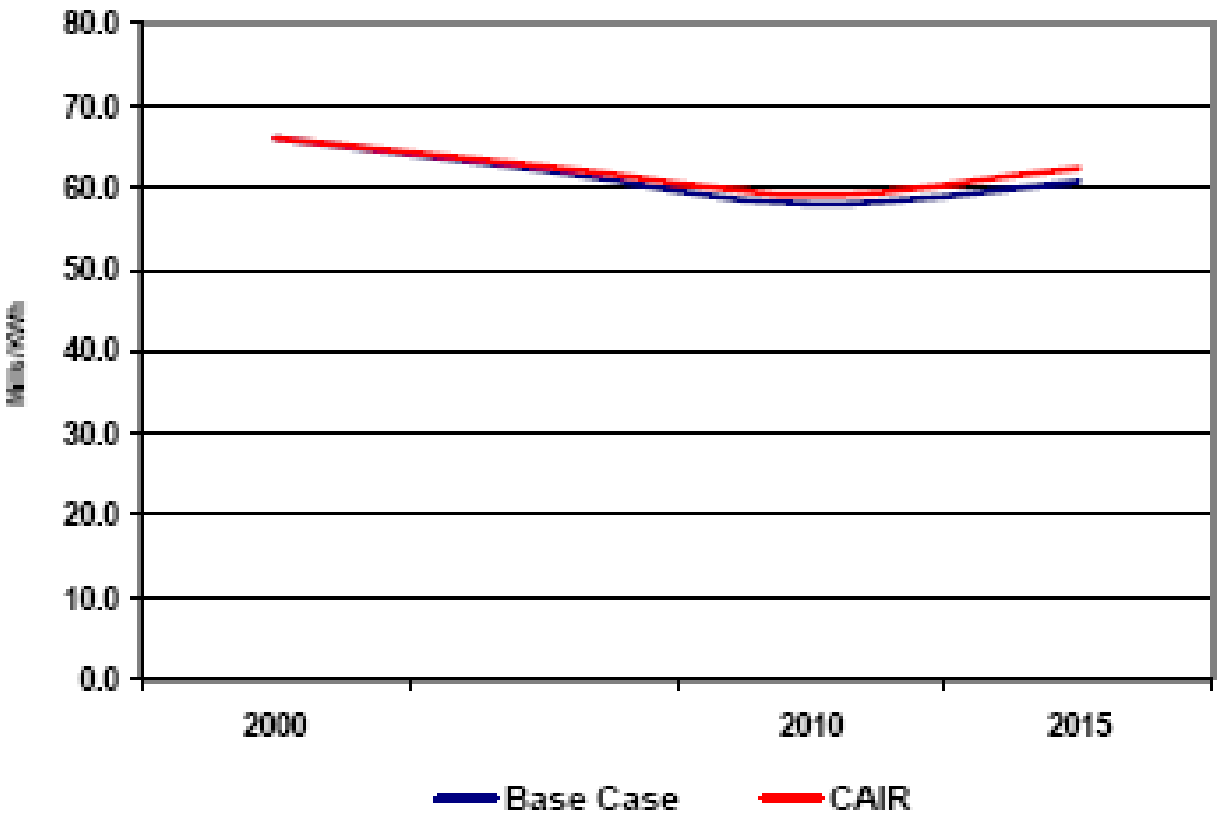
- CAIR/CAMR are primarily an issue for existing plants.
- EPA projects low cost/little effect on existing coal plants.
- Biggest unknown is performance of mercury control equipment.
  - Many states preparing “outs”.

U.S. Generating Mix With and Without CAIR



EPA Analysis Using Integrated Planning Model

Regional Electricity Prices With and Without CAIR



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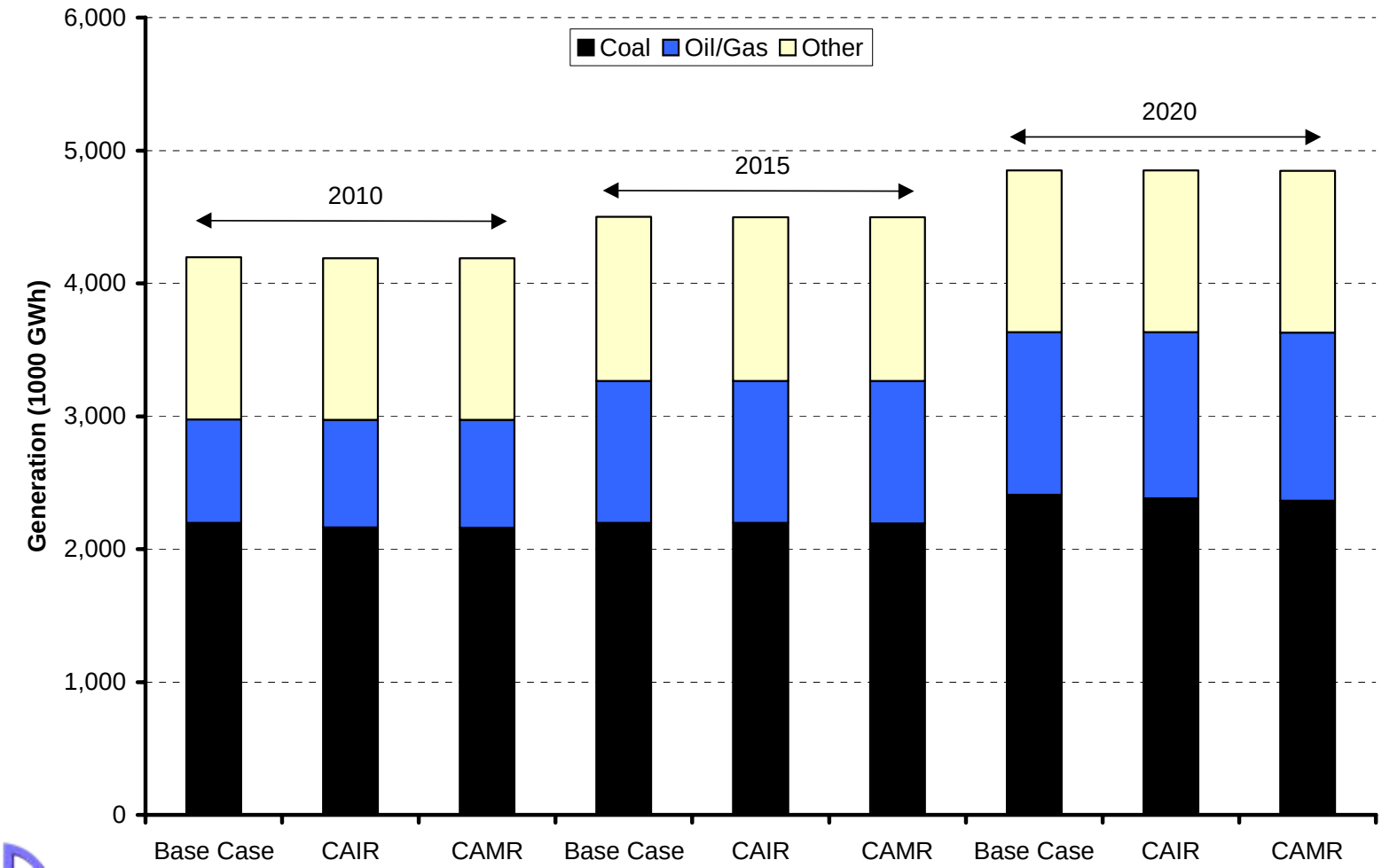
U.S. Generating Mix With and Without CAMR



EPA Analysis Using Integrated Planning Model

New Source Review

- Enforcement actions affect existing plants.
  - Florida plants settled early in the process.
- New plants can meet new source requirements for conventional pollutants.
- Biggest NSR issue for new plants is the use of IGCC.
  - Would constitute a major change in NSR policy but unlikely to happen.

GHG Regulation

- Kyoto implementation proceeding with some difficulty.
  - Volatile prices in the EU program, difficult questions in other countries.
- Bush administration continuing to focus on technology and voluntary programs.
- CO_2 reduction legislation proposed in the Senate.
  - Sense of the Senate resolution.
- States taking individual action.
  - RGGI endorsed by eight states.
  - Western states developing programs.

Where Do We Go From Here?

- Too late for Kyoto for U.S.
- But increasing acknowledgement that some mandatory program will happen.
- 2005 Sense of the Senate Resolution.
  - Man-made climate change is a problem…
  - Mandatory response is needed…
  - But it must not harm the economy.
  - Similar action by House Appropriations Committee, Senate Foreign Relations

The Focus is On

A GHG mitigation plan that is:

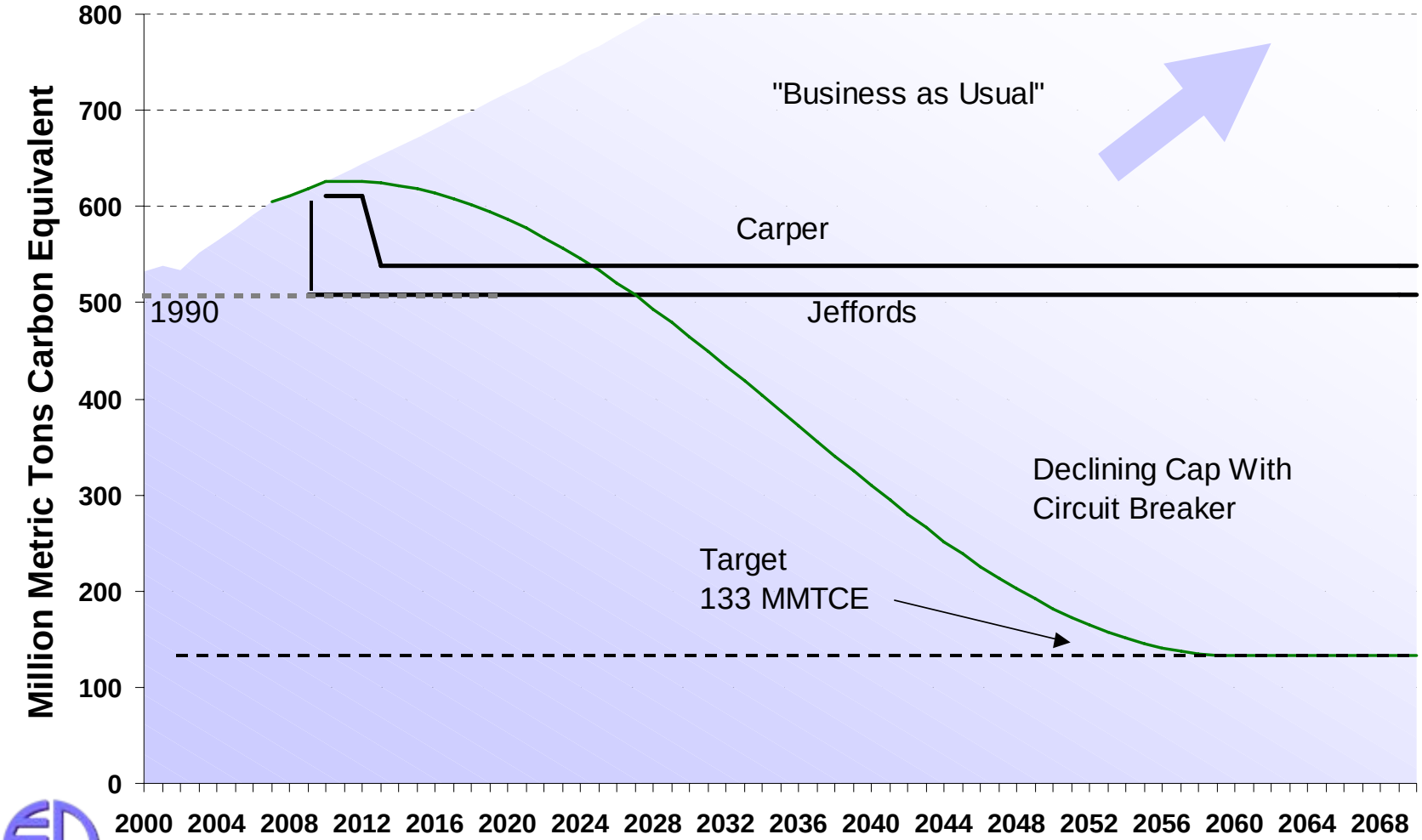
- Gradual
- Economy-wide
- Market-based
- Technology-driven
- Linked to international progress
- Non-threatening politically and economically

- *Mandatory*

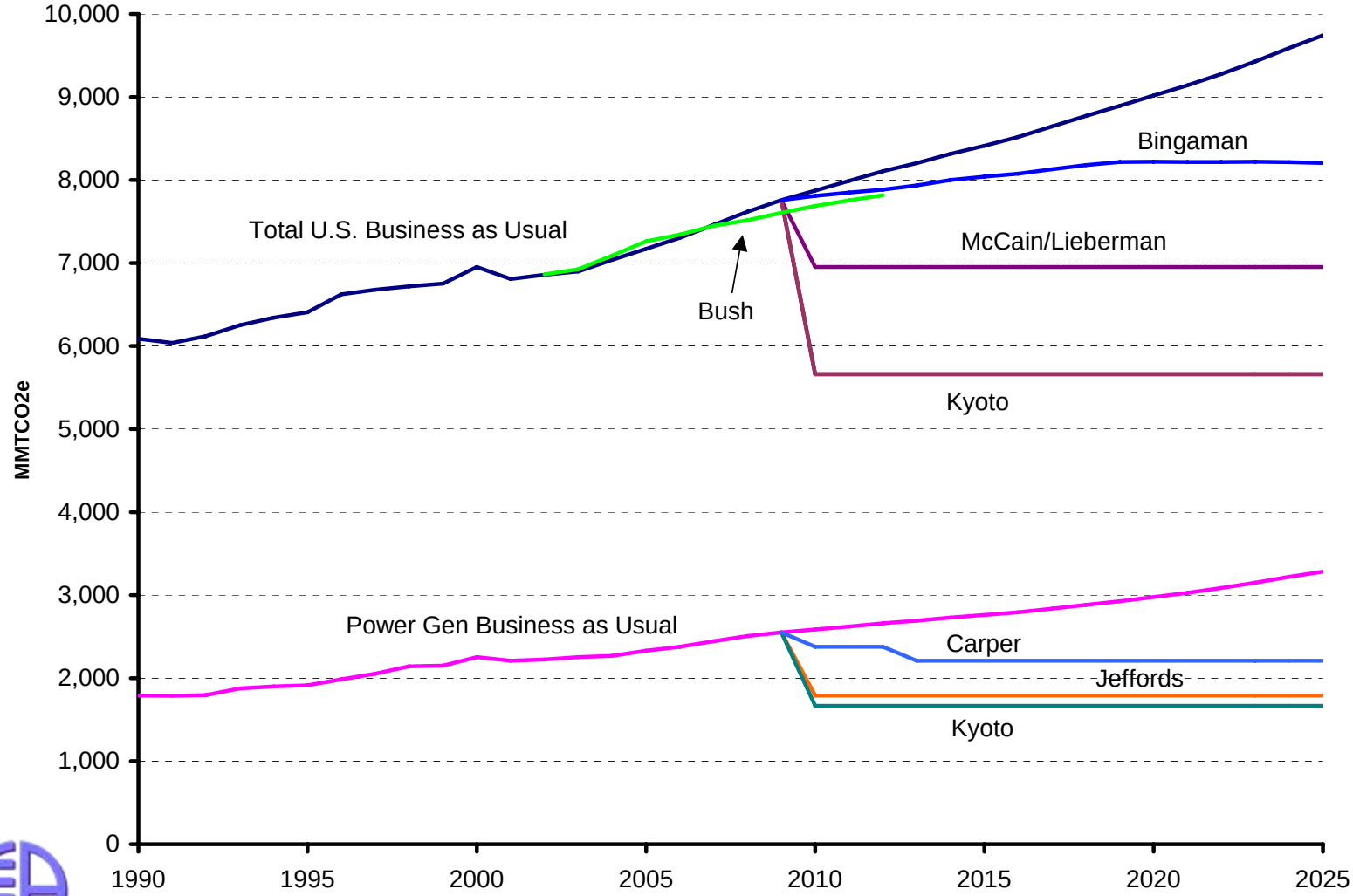
Federal GHG Legislation Summary

	McCain	Bingaman	Feinstein
Level	2000 levels in 2010	-2.4 - 2.8% intensity	7% below current in 2020
Point of Regulation	Direct emissions from large emitters, indirect from refineries	Indirect emissions at coal mines, refineries, pipelines, importers	Direct emissions from large emitters, indirect from refineries
Starting	2010	2010	2011
Allocation	TBD	Mostly Auction	TBD
Safety Valve	TBD	$7/tonne	TBD

Example Long-Term Cap for CO_2



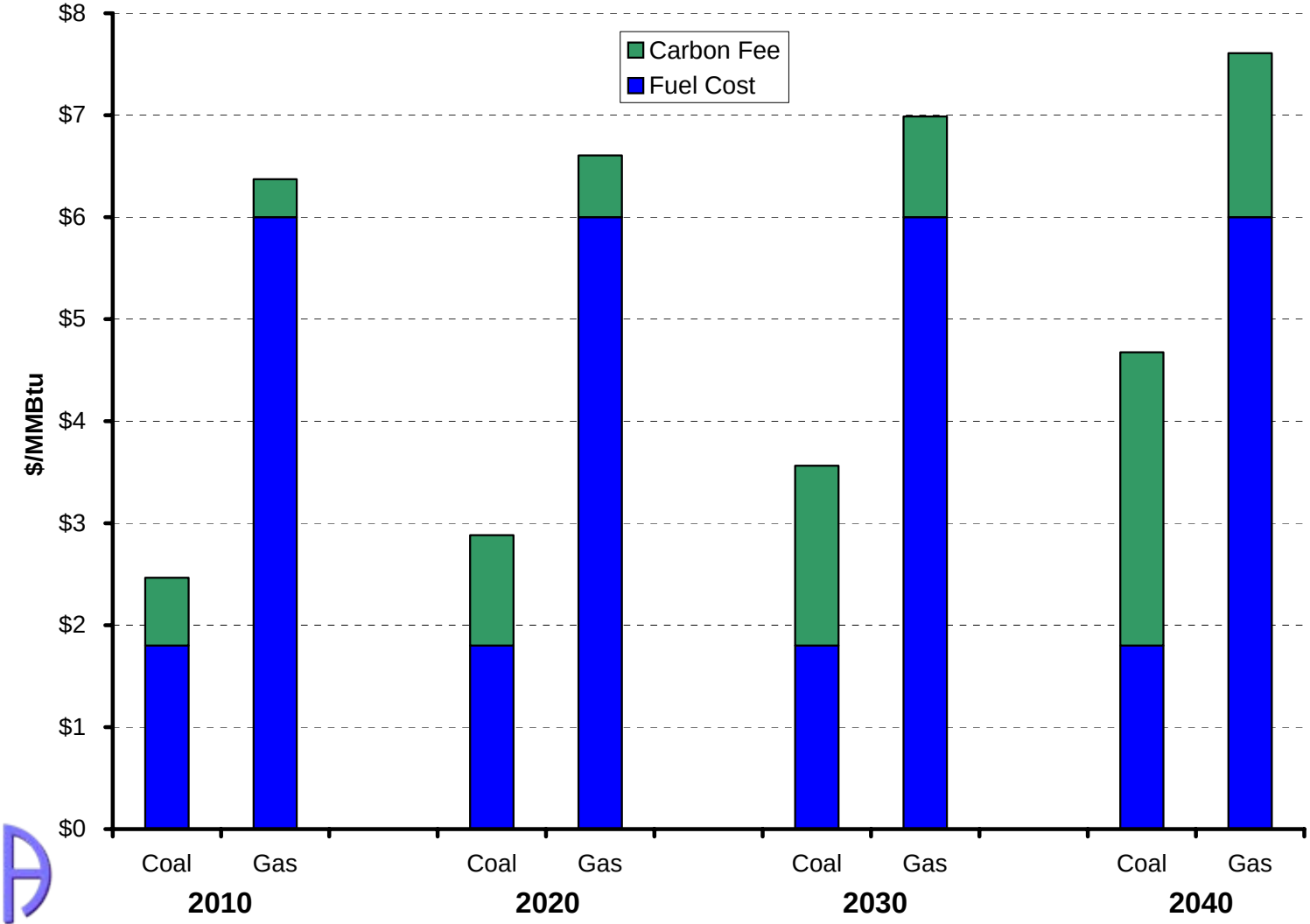
Evolution of GHG Proposals



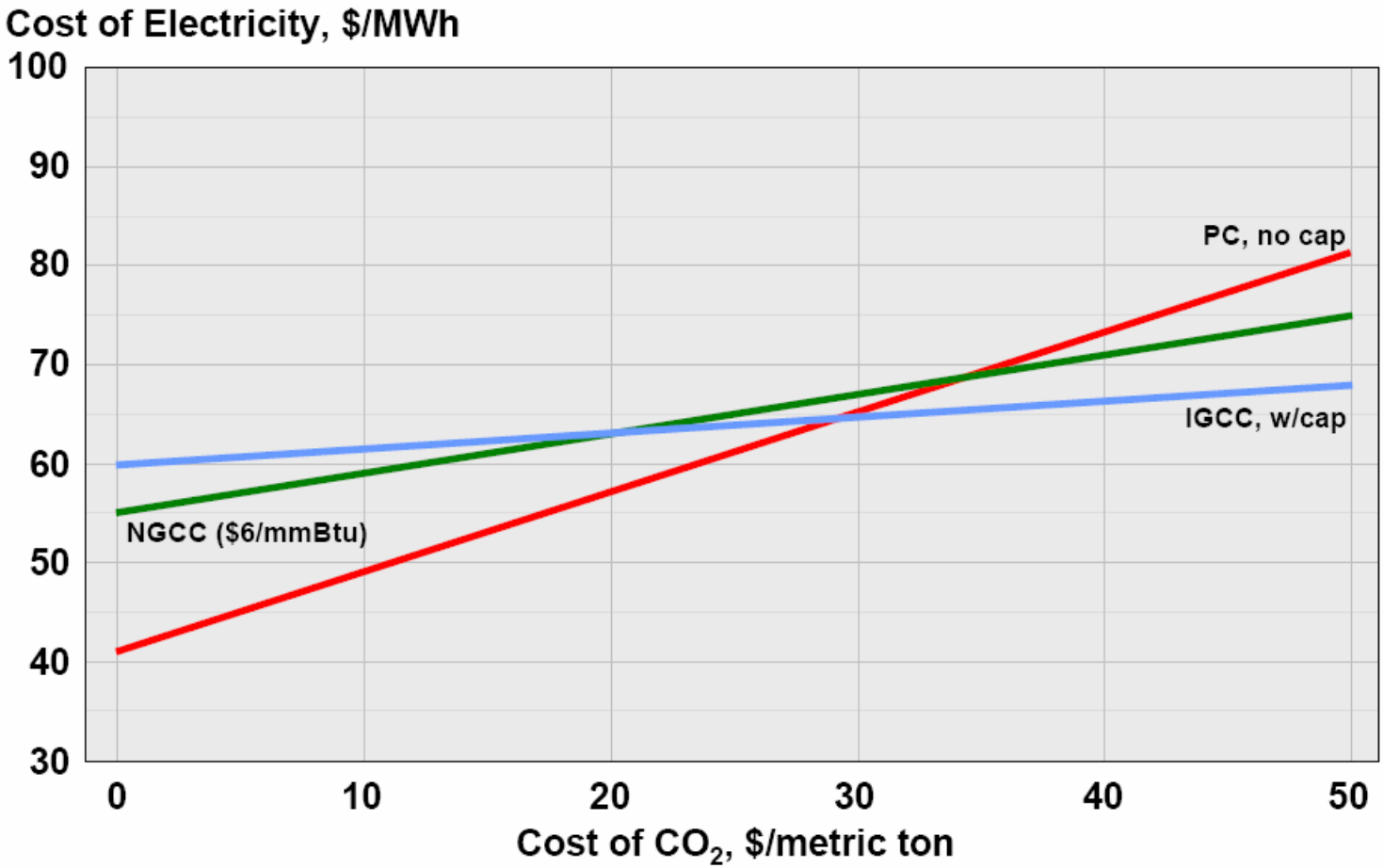
Impact of a $7/tonne CO_2 Price

	Energy Price Impact
Coal	$0.67/MMBtu
Oil	$0.51/MMBtu $0.07/gallon
Gas	$0.37/MMBtu

With Carbon Fee, Gas Still More Expensive Than Coal



Technology Comparison - 2010



Data Source: EPRI 2005

State GHG Activities

- RGGI – Eight states implementing power sector cap and trade starting in 2009.
- California – Designing economy-wide program with long-term/gradual cap.
- Oregon, Washington – Developing power sector caps.
- Other states developing GHG plans, doing studies.

RGGI Status

- Seven states have endorsed MOU limiting emissions to “current levels” in 2009.
- Cap shrinks 10% from 2015 to 2018.
- Offsets and international credits allowed at progressive price thresholds.
- 25% of allowances to be withheld to support energy efficiency, renewables, etc.

GHG Summary

- Regional limits in effect now.
- National limits likely in near term.
- Limits likely to be gradual with initial economic safety valve.
- Efficient coal plants likely to be economic in near term.
- Longer term answer yet to be determined.

The Other “Environmental Issue”

- Environmental regulations allow challenges from non-regulators
  - Citizens
  - Environmental groups
- This has been the more significant barrier to new plant construction.

Summary

- Need to identify criteria for capacity mix.
- Fuel price economics likely to favor coal.
- Coal able to meet conventional environmental requirements.
- Near-term (10-20 years) GHG costs likely to be low, even for coal.
- NIMBY issues may be larger.
- Longer-term GHG solution is not clear.

Where Are We Headed?

- Large economic incentive for new, non-gas plants in competitive electric markets.
- Can “business” drive the next phase of expansion?
- Can coal grow without certainty on CO_2?
- Will NIMBY stifle all growth?
- Without other resources, we will be forced to rely on existing gas capacity to meet growth.

Setting the Fuel Mix

- What are the criteria? What meets the criteria?
- Gas power will be more expensive, but can we build anything else?
- Will citizens allow new coal?
- Will new nuclear plants be economically and politically viable?
- If so, how quickly?