

Combustion Technology University Alliance and the Clean Coal Power Initiative (CCPI)

***University Applied R&D
Supports
Demonstration Projects***

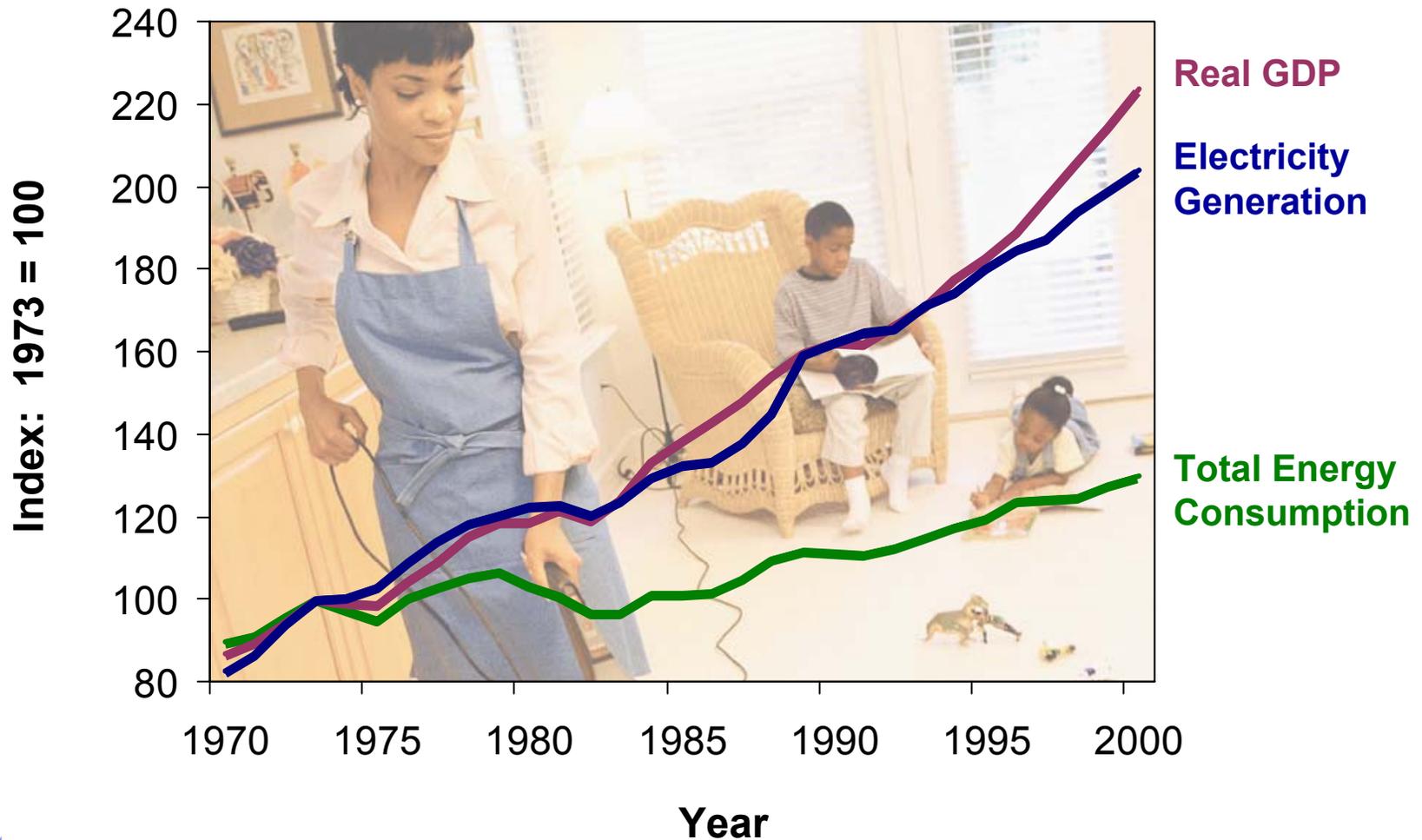
***Presented at the
Combustion Technologies
University Alliance Workshop***

**Columbus, Ohio
August 5, 2003**

**National Energy Technology Laboratory
Carl Bauer Associate Laboratory Director**

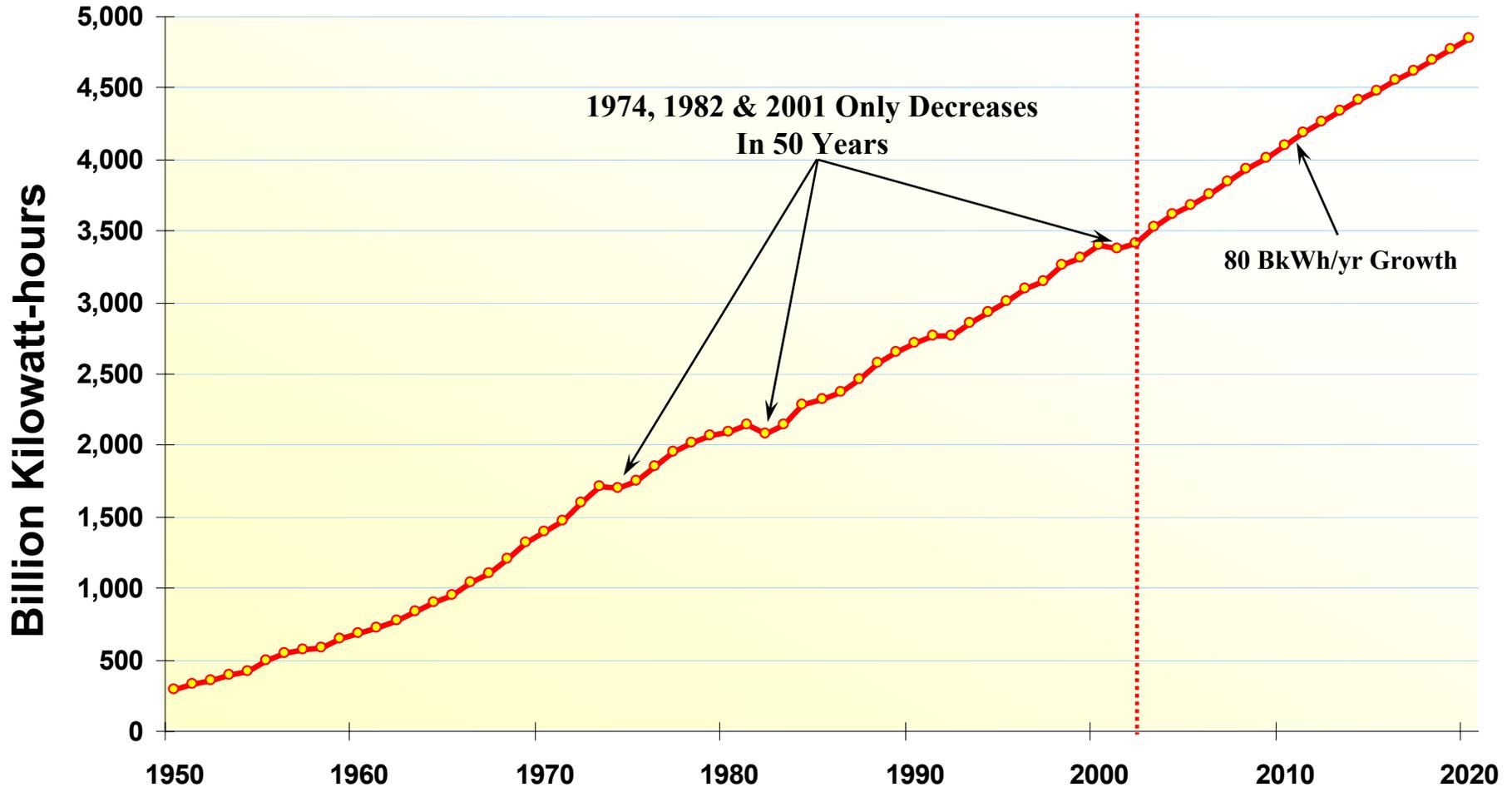


Economic Growth Linked to Electricity



GDP: U.S. DOC, Bureau of Economic Analysis
Energy & Electricity: EIA, AER Interactive Data Query System

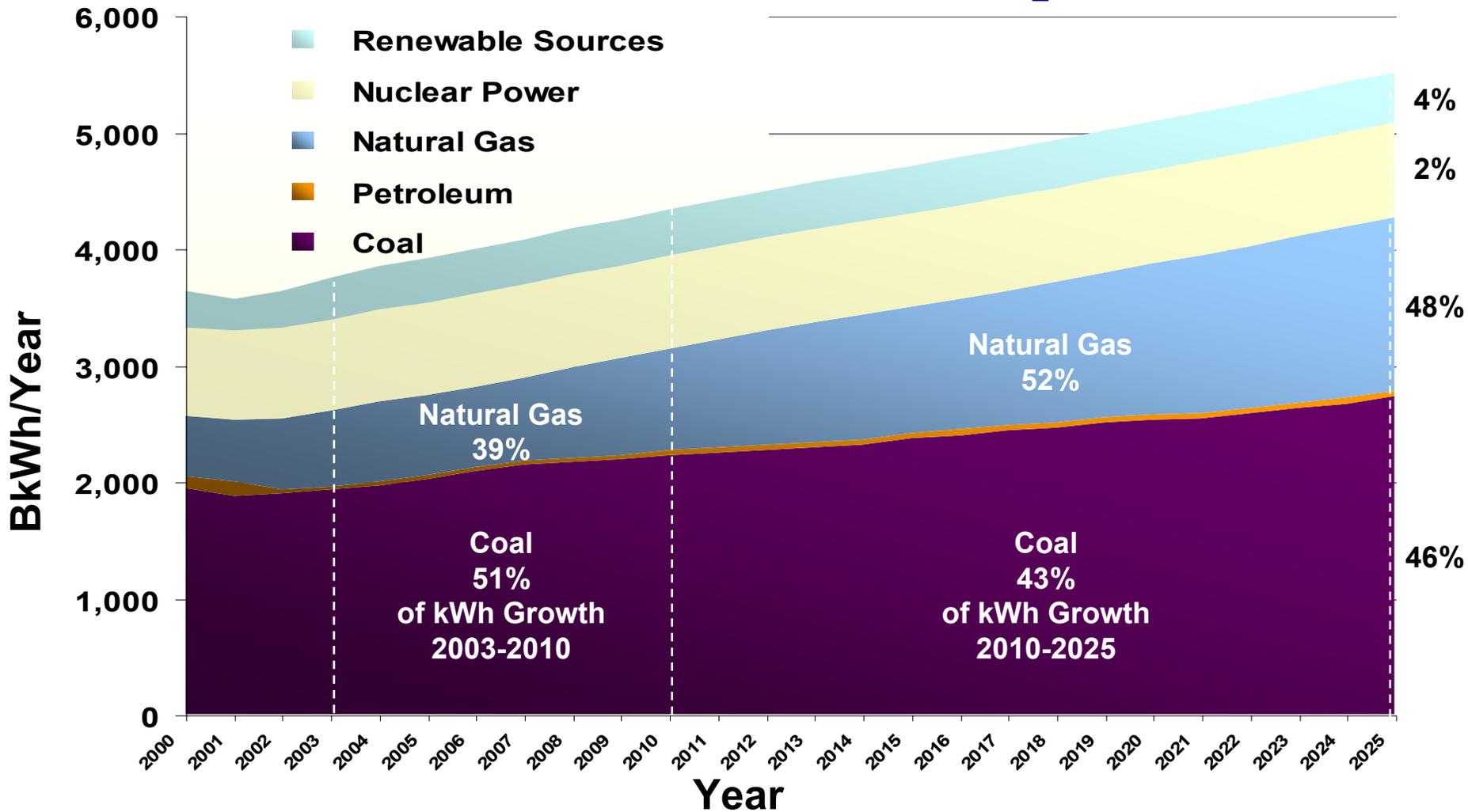
Growth of U.S. Electricity Market



Relentless Electricity Growth; Significant to Economic Growth



AEO'03 kWh Growth Assumptions



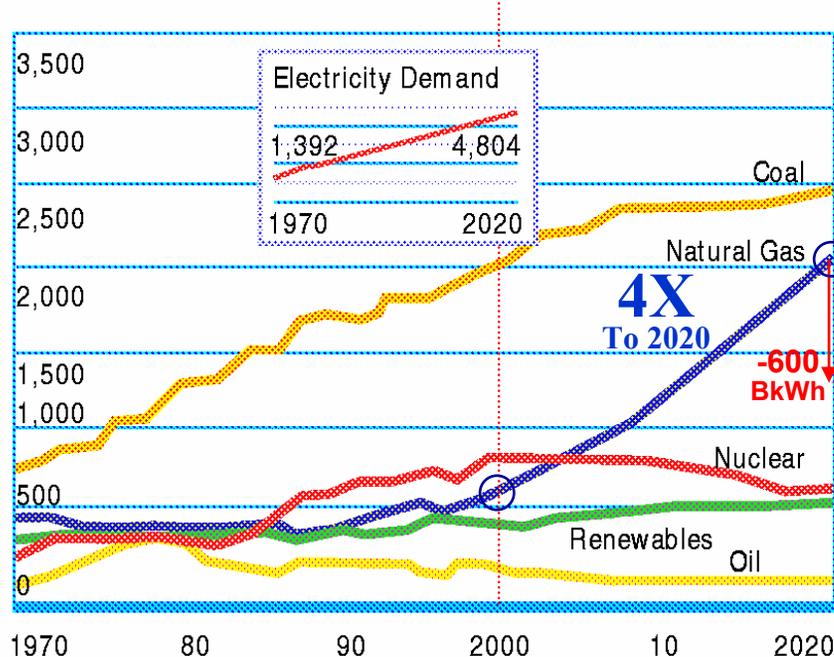
Coal Already Assumed to Provide 30% More Incremental kWhs Than Gas, 2003 to 2010, Despite Few Additions



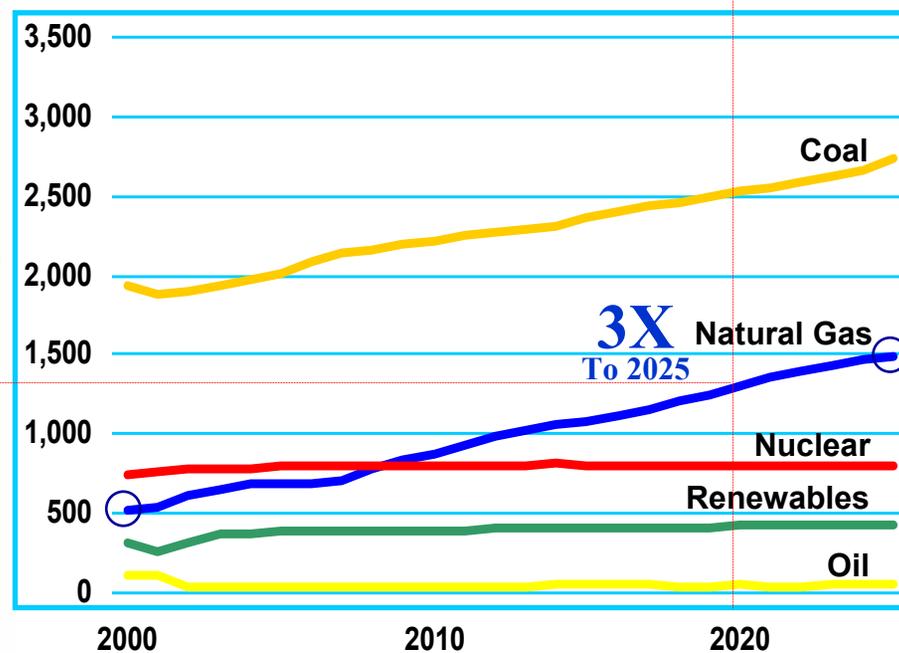
kWh Growth Forecasts

Electricity Generation by Fuel: Current Trends

(Billions of Kilowatt-Hours)



National Energy Policy Report
May (2001)

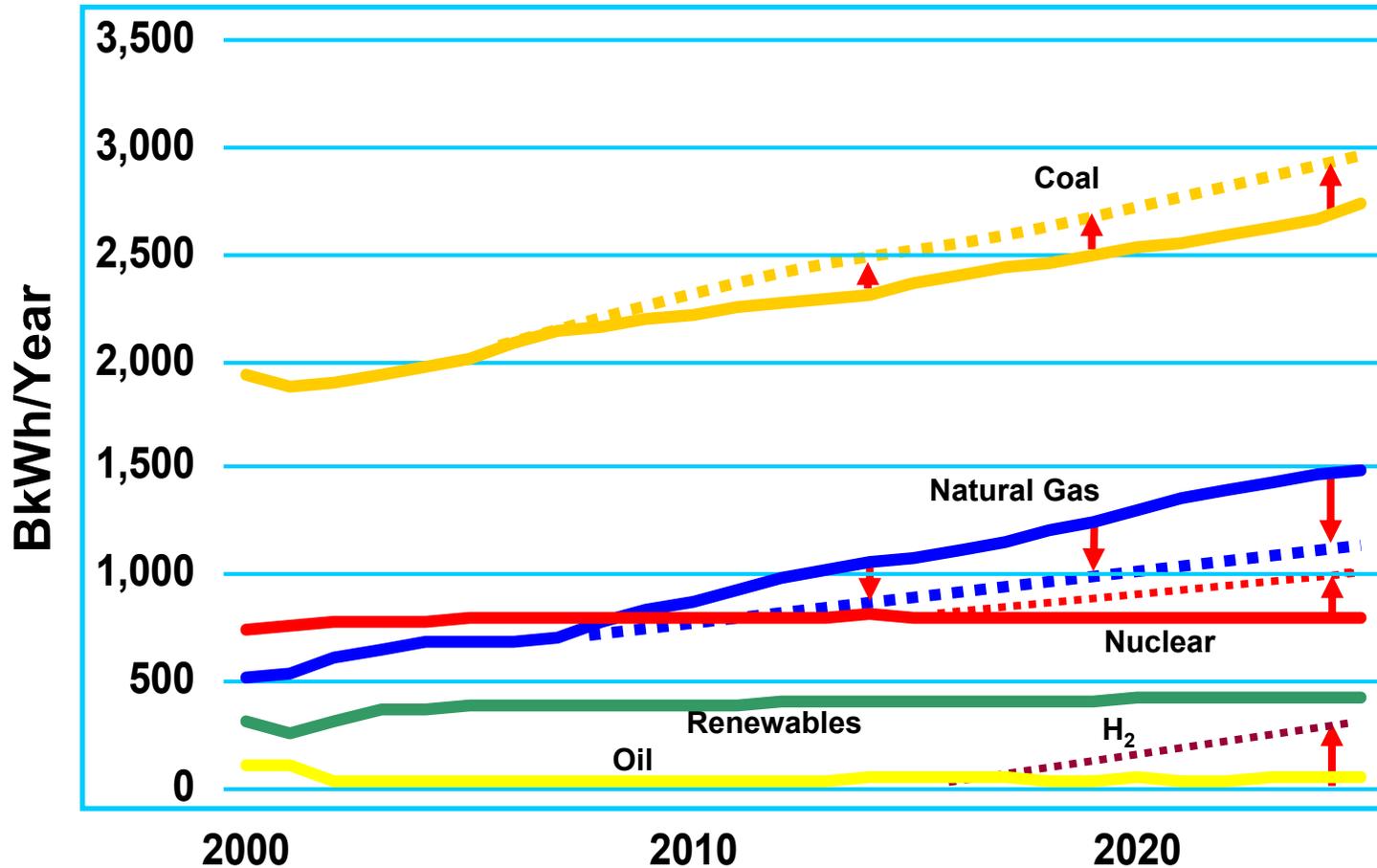


Annual Energy Outlook 2003
December (2002)

Reduced kWh Expectations From Natural Gas



Changing kWh Growth Expectations



Coal-fired Generation Only Significant Near-term Incremental Growth



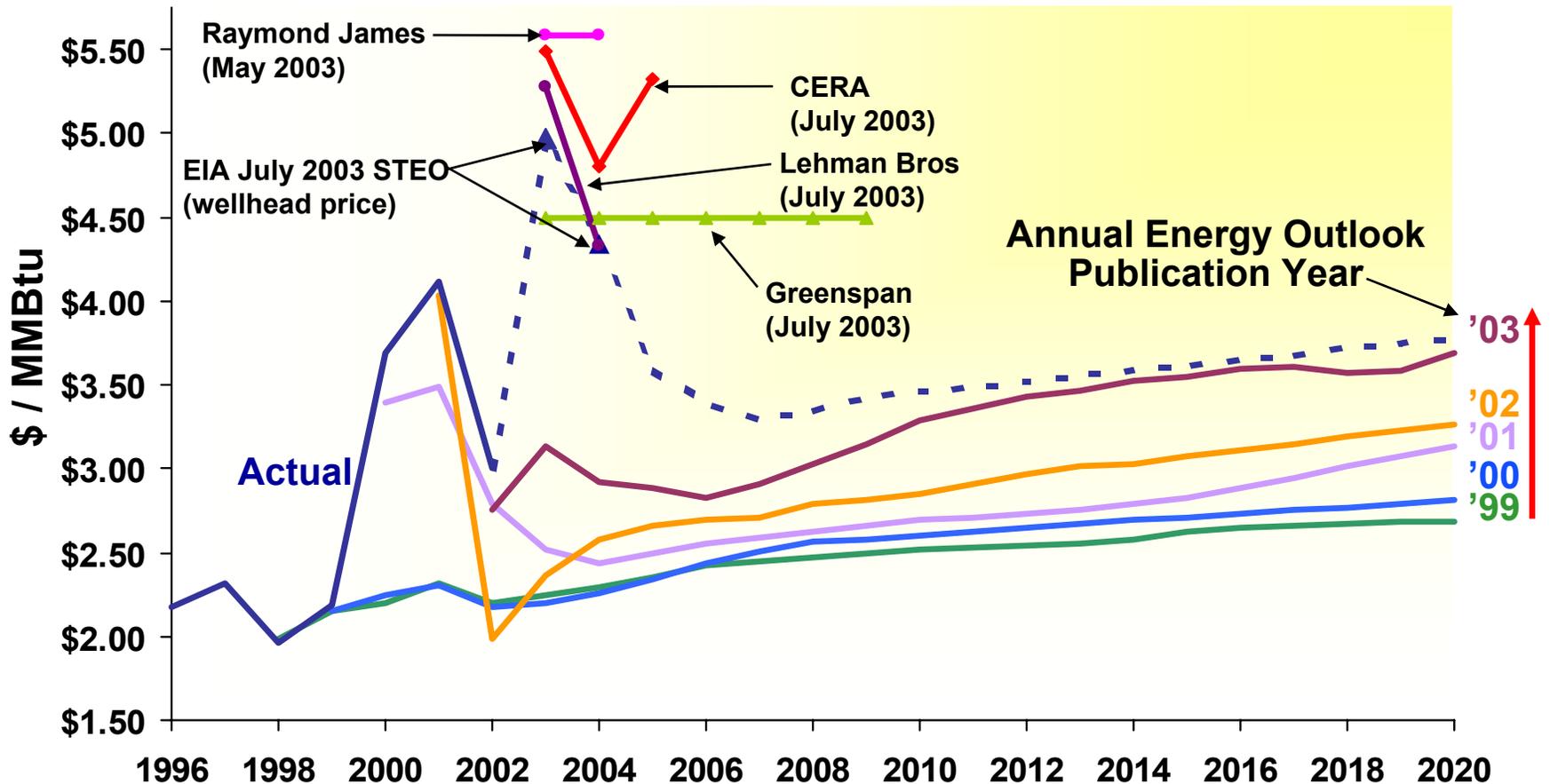
Price Is Almost Everything

True— GDP does follow electrical generation, but not at any price. GDP and economic growth follows affordable electricity and coal is key in keeping it affordable.



Changing Forecasts After 4 Years of High Price

Paradigm Shift in a Fuel Price for Electricity?

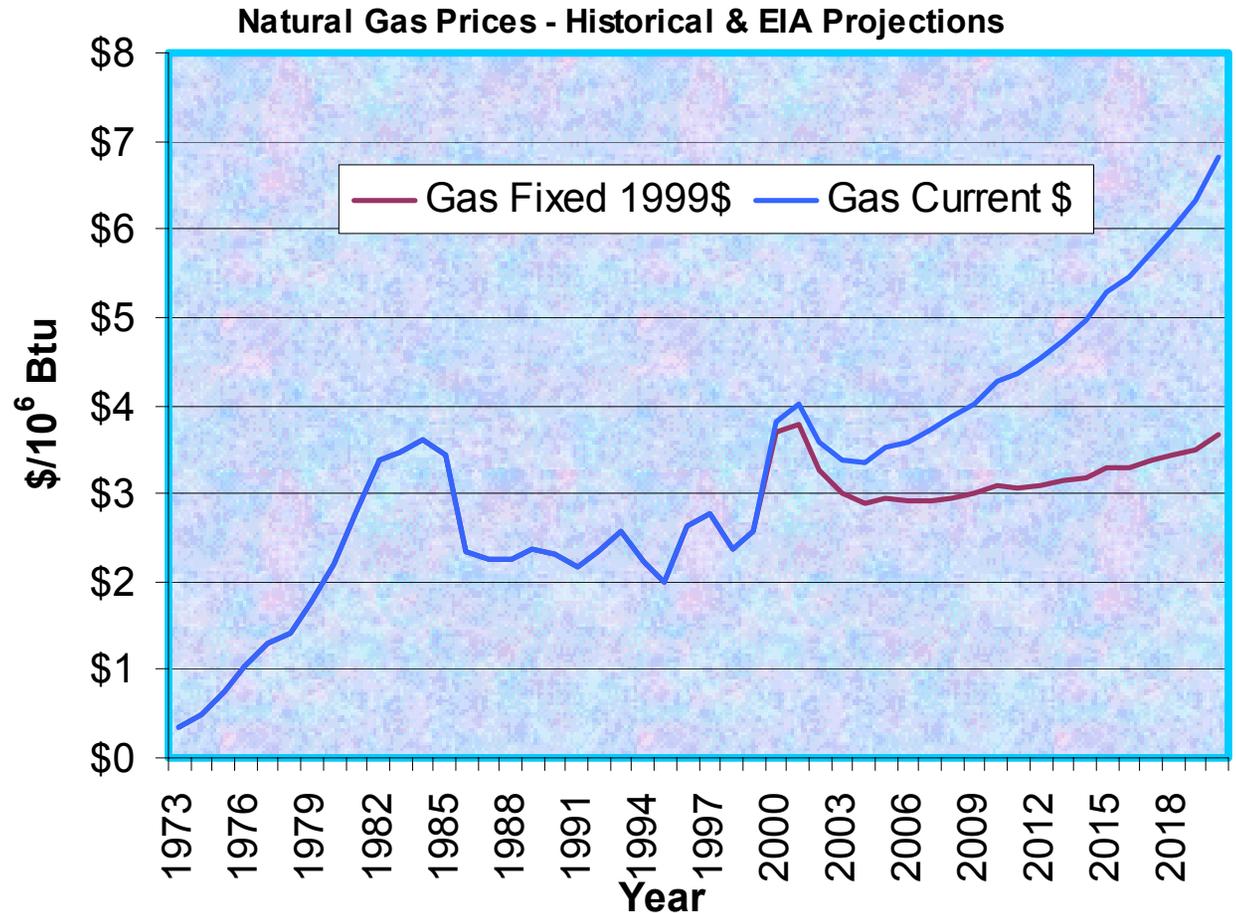


Growing Belief in New Price Plateau at Least \$4–5 / MMBtu
Where Will AEO 2004 Peg Prices?



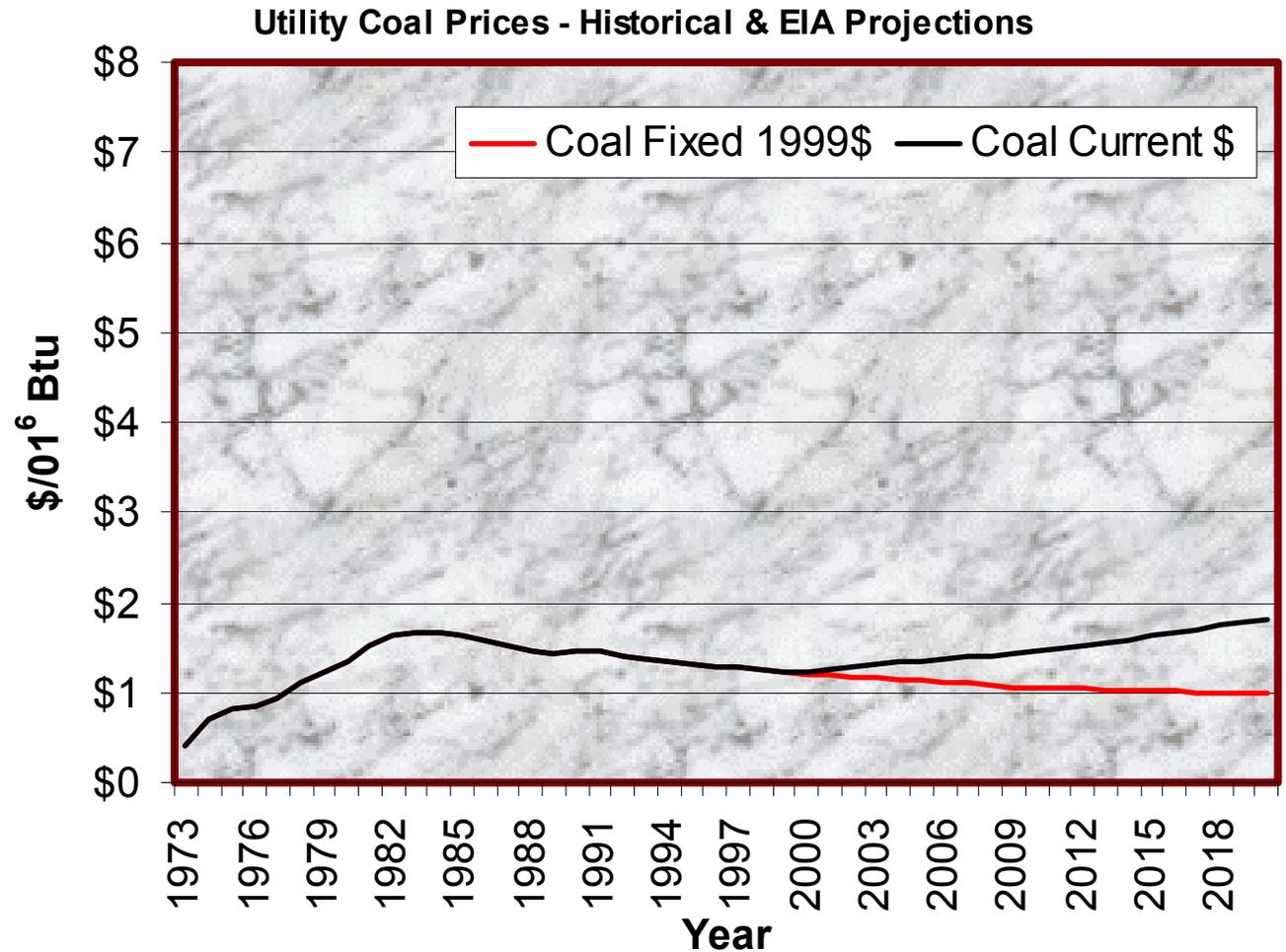
EIA National Natural Gas Prices

- Gas Prices unstable at present
- Gas prices are also a function of transportation infrastructure
- Gas will track oil prices



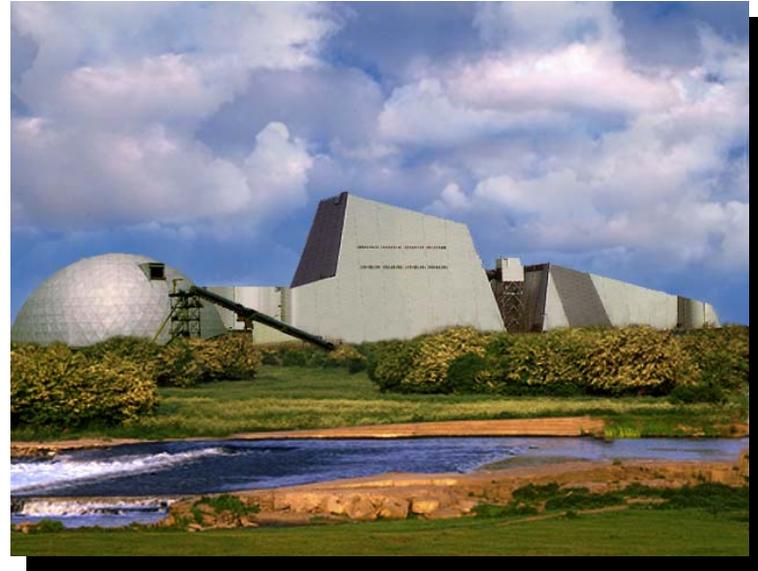
EIA National Coal Prices

- Coal Prices are relatively stable
- Coal prices based on production costs and cost of coal-fired generation.



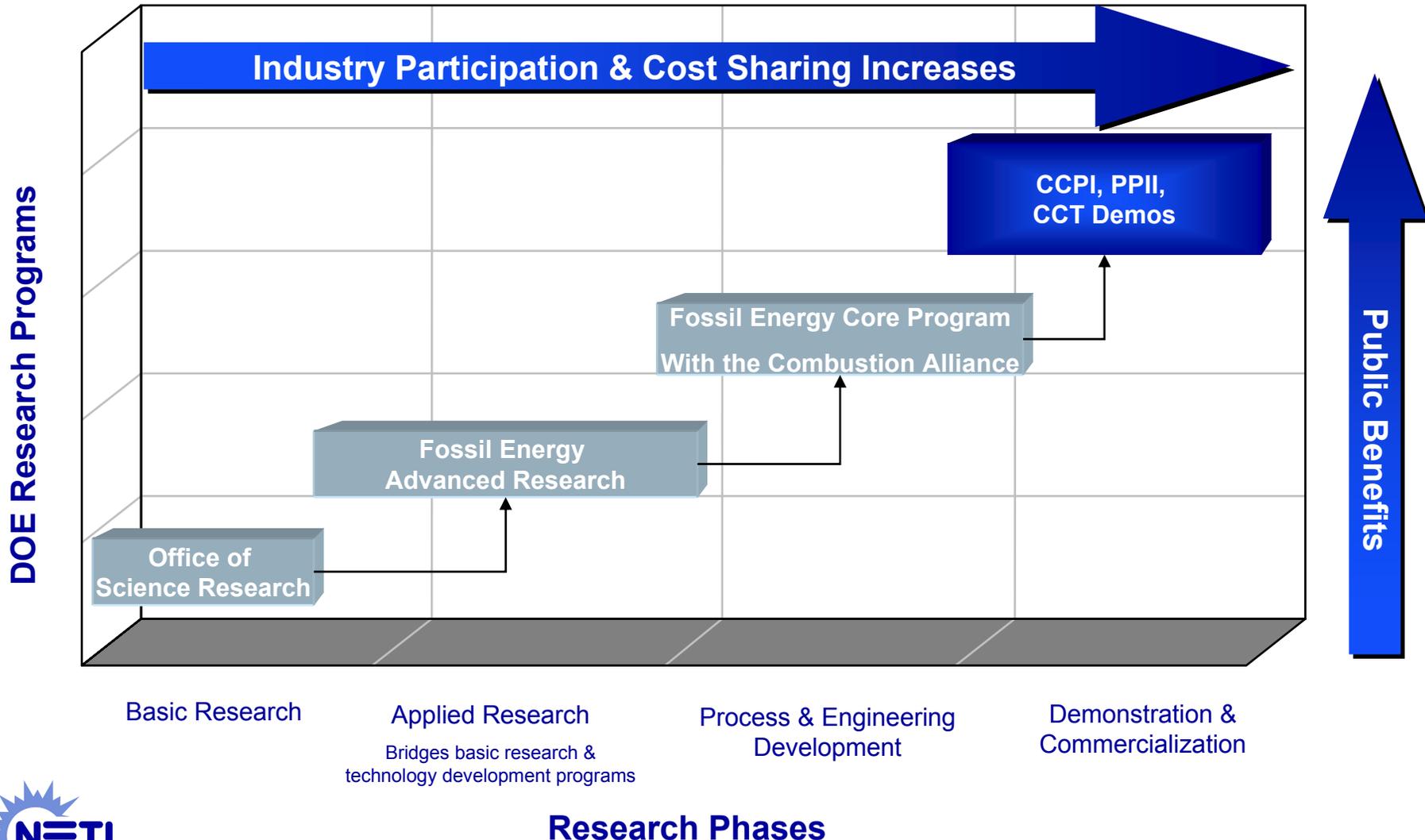
Coal Power Program Roadmap Addresses Near- and Long-range Needs

- **Short-term: existing fleet**
 - Cost-effective environmental control technologies to comply with current and emerging regulations
- **Long-term: future energy plants**
 - Near-zero emissions power and clean fuels plants with CO₂ management capability

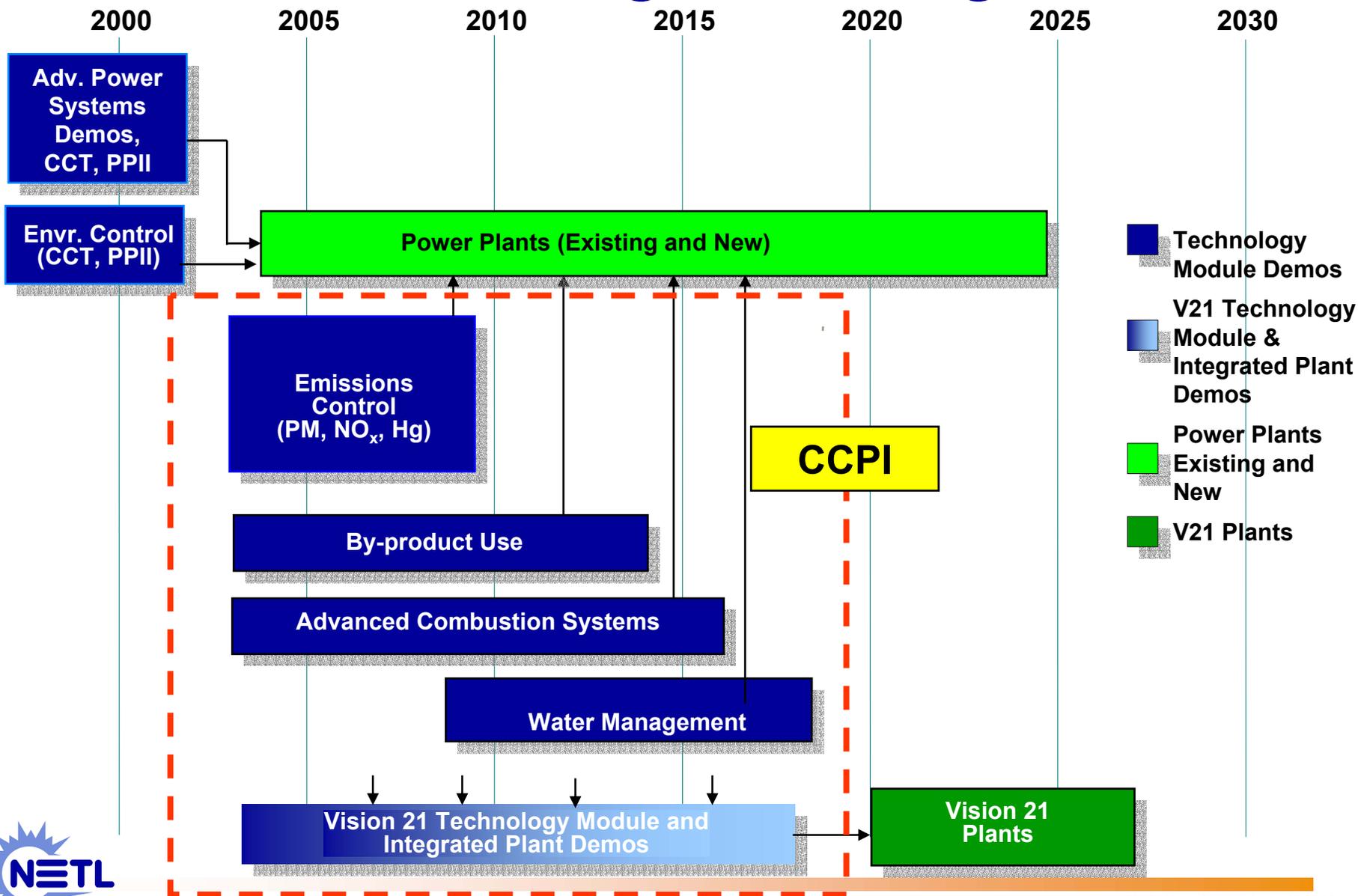


Stages of Energy RD&D

Technology demonstrations play an enabling role



Demonstration Targets – Existing Plants



Existing Plants

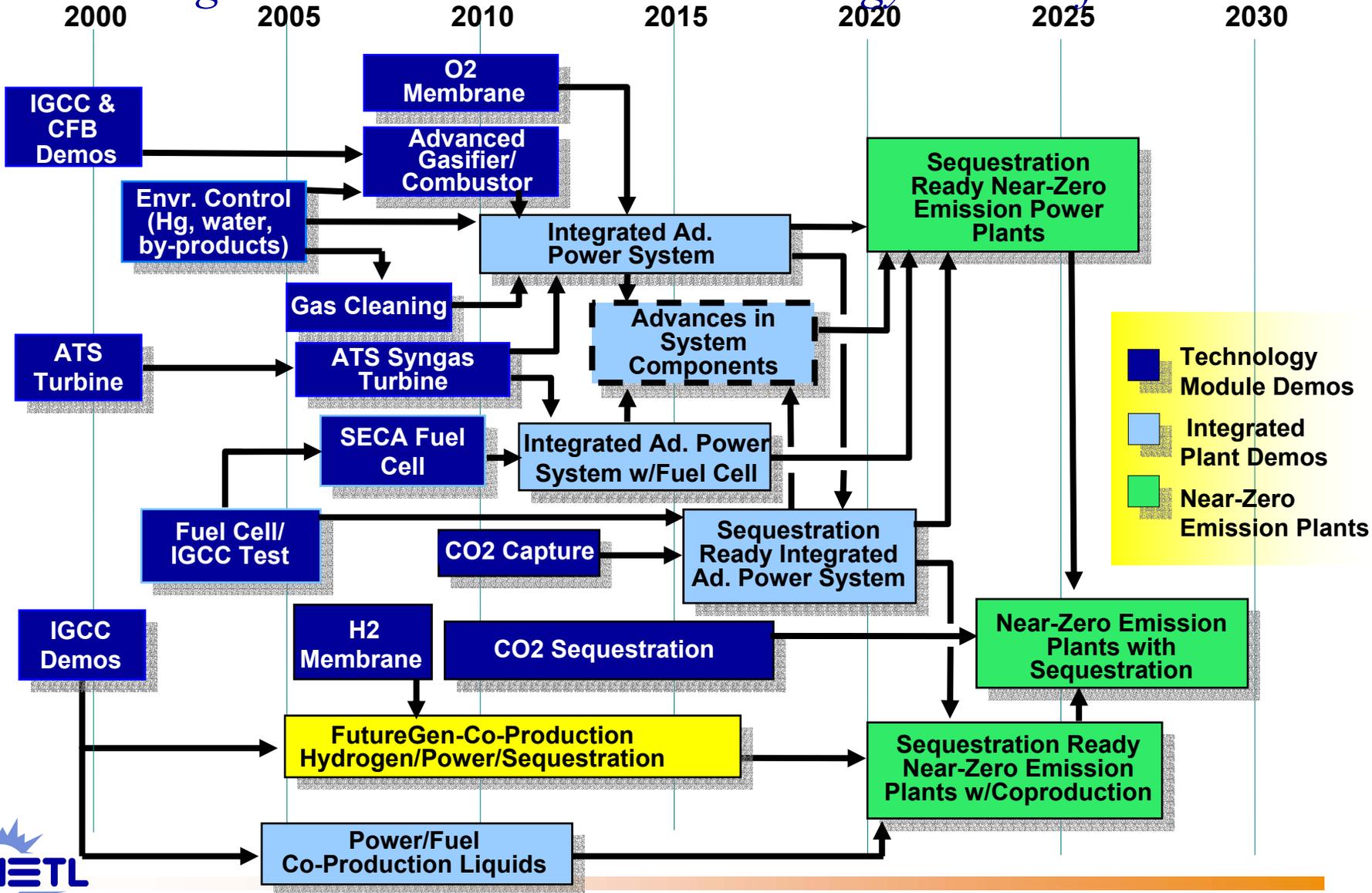
Roadmap Performance Objectives

- Reduced Cost for NO_x Control
- Reduced Cost for High-Efficiency Hg Control
- Achieve PM Targets in 2010: 99.99% capture of 0.1 – 10 μ Particles



FE RD&D –

Enabling FutureGen and Near-Zero Energy Plants of Future



Coal Power Program Roadmap

New Plant Performance Targets

(Represents best integrated plant technology capability)

	Reference Plant	2010	2020 Vision 21
Air Emissions	98% SO₂ removal	99%	>99%
	0.15 lb/10⁶ Btu NO_x	0.05 lb/10⁶ Btu	<0.01 lb/10⁶ Btu
	0.01 lb/10⁶ Btu Particulate Matter	0.005 lb/10⁶ Btu	0.002 lb/10⁶ Btu
	Mercury (Hg)	90% removal	95% removal
By-Product Utilization	30%	50%	near 100%
Plant Efficiency (HHV)	40%	45-50%	50-60%



Coal Power Program Roadmap

New Plant Performance Targets¹

(Represents best integrated plant technology capability)

	Reference Plant	2010	2020 Vision 21
Availability⁽³⁾	>80%	>85%	≥90%
Plant Capital Cost⁽²⁾ \$/kW	1000 – 1300	900 – 1000	800 – 900
Cost of Electricity⁽⁴⁾ ¢/kWh	3.5	3.0 - 3.2	<3.0

- (1) Targets are w/o carbon capture and sequestration and reflect current cooling tower technology for water use
- (2) Range reflects performance projected for different plant technologies that will achieve environmental performance and energy cost targets
- (3) Percent of time capable of generating power (ref. North American Electric Reliability Council)
- (4) Bus-bar cost-of-electricity in today's dollars; Reference plant based on \$1000/kW capital cost, \$1.20/10⁶ Btu coal cost



Clean Coal Power Initiative (CCPI)

- **Drivers**

- Clear Skies Initiative
- Reduced carbon intensity
- Zero emissions technology goals
- Energy/economic security

Round 1 (Broad)

- Advanced coal-based power generation
- Efficiency, environmental & economic improvements

Round 2 (next up)

- **Technology Demonstration Opportunities**

- 3P control systems (SO₂, NO_x and Mercury)
- High-efficiency electric power generation
 - Gasification
 - Advanced combustion
 - Fuel Cells and Turbines
- Retrofit, Repowering and new Merchant Plants



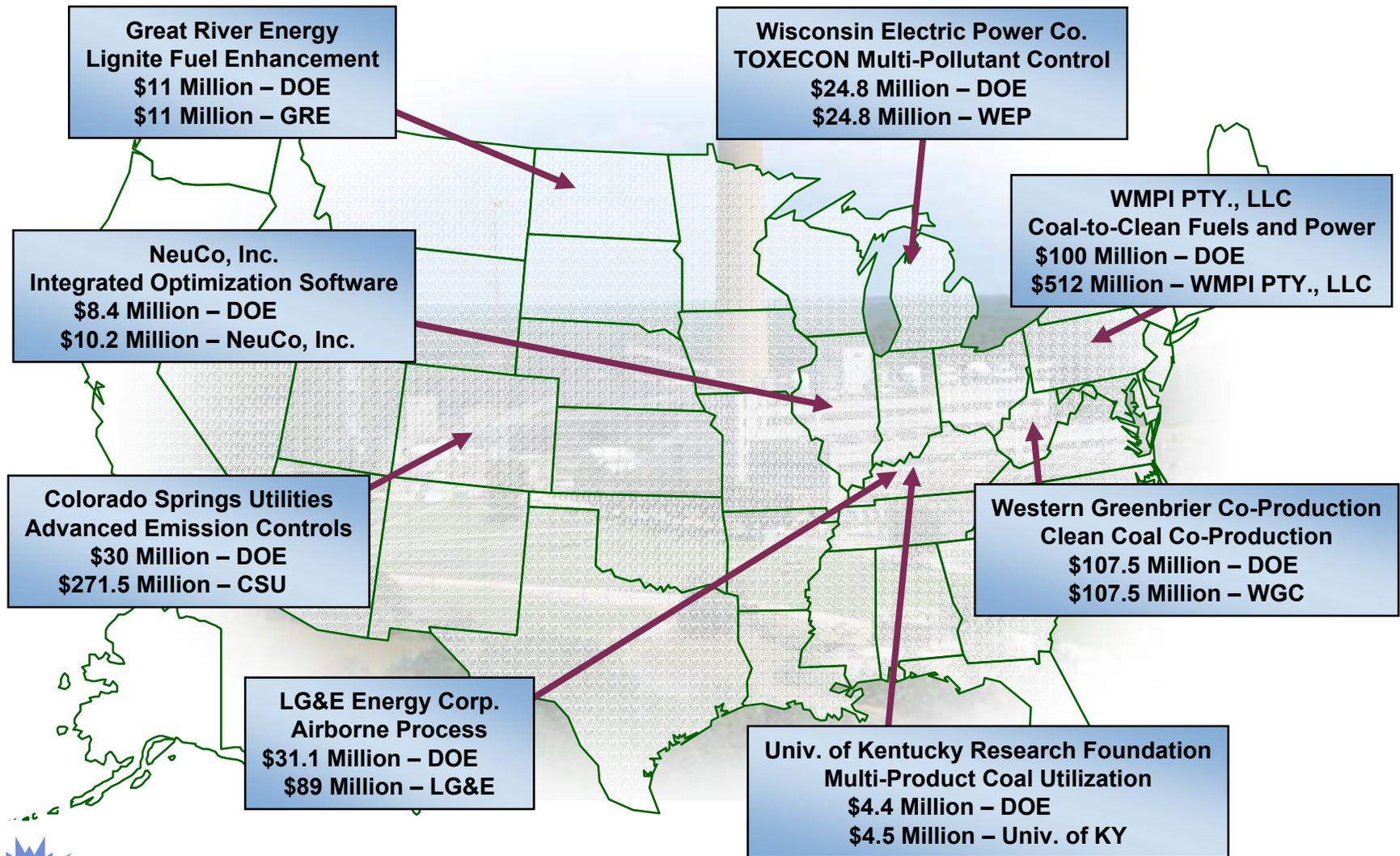
Clean Coal Power Initiative

Technical, Economic & Market Barriers/Hurdles

- Securing minimum 50% private sector cost-sharing for demonstrating first-of-a-kind technologies (high risk)
 - On high-interest technologies needed to meet coal program performance goals
- Repayment obligations dampen commercialization goals
- Achieving a fair balance of federal/private sector interest in intellectual property
- Uncertain mid- and long-range market conditions (e.g. energy prices, environmental regulations, global climate change policies)
- Deregulation inhibits risk-taking -- drives industry away from R&D and higher-risk investments



Clean Coal Power Initiative (CCPI) – Round 1



Coming CCPI Solicitation *Planning Opportunities*

- **28th International Technical Conference on Coal Utilization and Fuel Systems, Clearwater, Florida, March 10-13, 2003 (completed)**
- **CCPI Round 2 Planning Workshop, Hyatt Hotel (at airport) Pittsburgh, PA, August 26, 2003**
- **Pittsburgh Coal Conference, Pittsburgh, PA, September 15-19, 2003**
- **Clean Coal and Power Conference, Ronald Reagan Building, Washington, DC, November 17, 2003**

**Monitor
www.fe.doe.gov or
www.netl.doe.gov/coalpower/ccpi
websites for coming events**



And Finally

**Thank You All for Attending and
Participating in the Combustion
Technologies University
Alliance**

