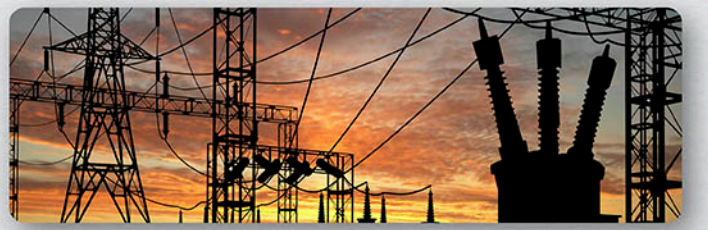

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Electric Industry Perspective: Policy and Market Forces Transforming Electric Power

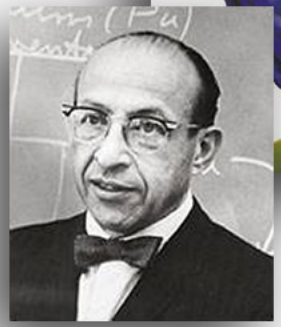
Victor Niemeyer
Technical Executive

NYSERDA 2011 EMEP Conference
November 15, 2011

Albany, New York

Introducing EPRI…

- Founded in 1972
- Independent, nonprofit center for public interest energy and environmental research
- **Collaborative** resource for the electricity sector
- Major offices in Palo Alto, CA; Charlotte, NC; Knoxville, TN
  - Laboratories in Knoxville, Charlotte and Lenox, MA



Chauncey Starr
EPRI Founder

Our Mission…

To conduct research on key issues facing the electricity sector…on behalf of its members, energy stakeholders, and society.

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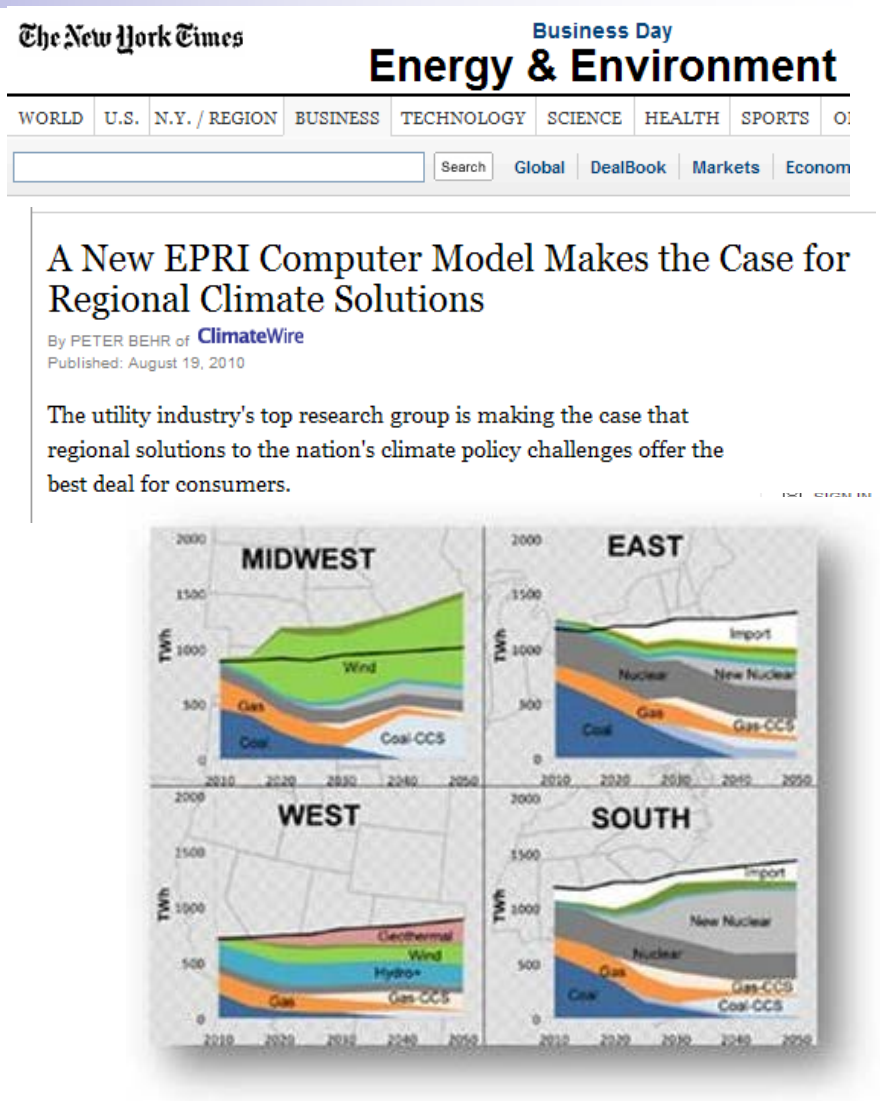
Looking Forward … Prism 2.0

Building upon previous EPRI Prism…

- **US economy-wide model incorporating regional detail**
- **Improved treatment of renewables**
  - *High-resolution wind and solar resource data*
  - *Full treatment of integration costs of variable generation*
  - *Integrated biomass model with resource competition*
- **Full complement of environmental regulations**
- **Expanded demand-side detail by region**
  - *Energy efficiency, demand response, and distributed resources*



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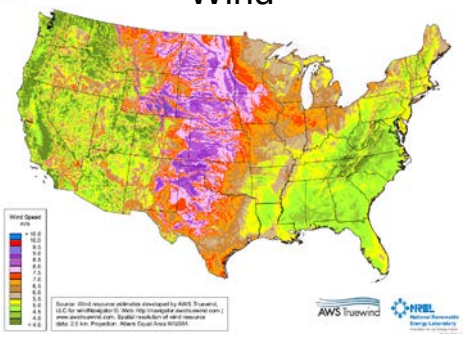
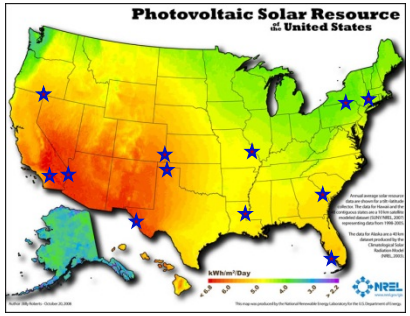
Prism 2.0 Project Funders

Prism Model Designed to Appreciate Nuances of Carbon and Clean Energy Policy

Wind

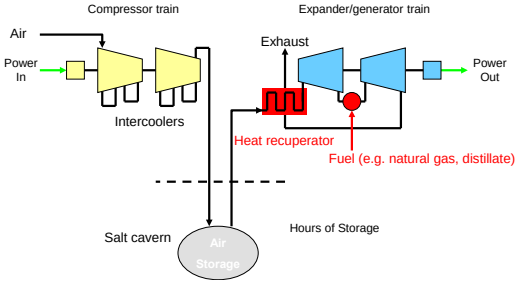


Solar



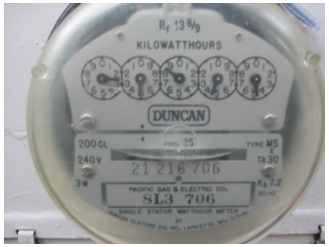
Bioenergy

CAES Storage

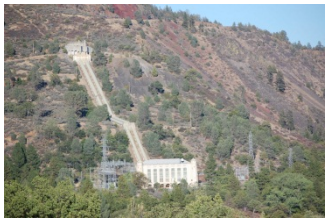


New Interregional Transmission

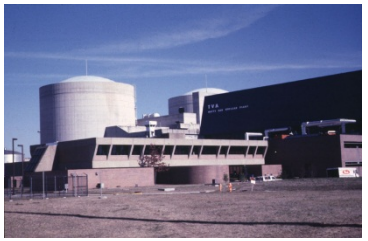
8,760 Hourly Loads



Hydro



Nuclear



Gas CTs & CCs

Coal

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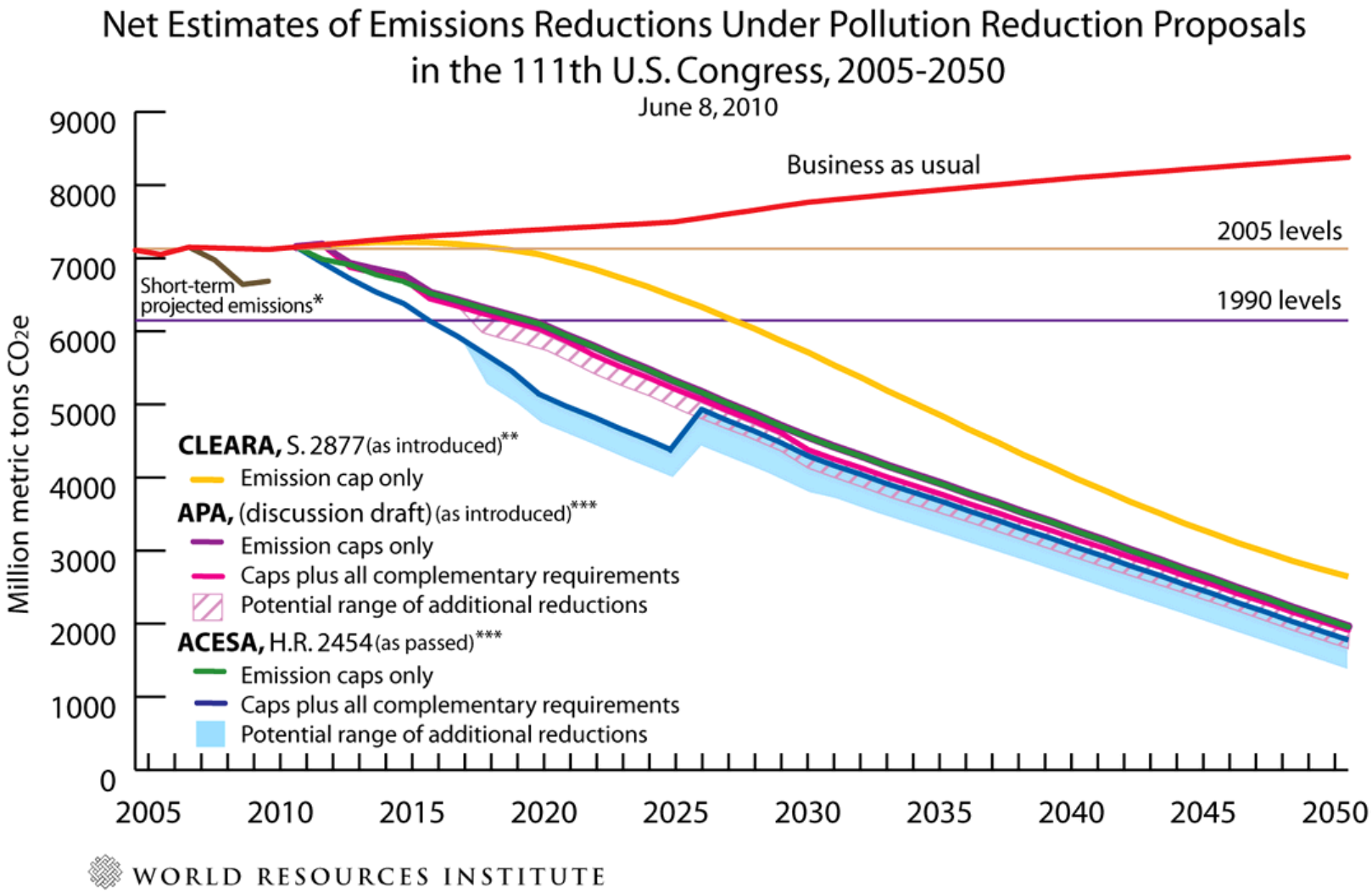
Four Key Issues Driving Electric Power's Future

- Climate policy
- Converging environmental initiatives
- Renewables and clean energy policy
- Natural gas prices

Climate Legislation Unlikely Soon but Potential for a National Cap-and-trade Program Remains



Cutting National Emissions Likely to Mean Cutting CO_2 From Existing Coal

Electric sector's share of national total (2006)

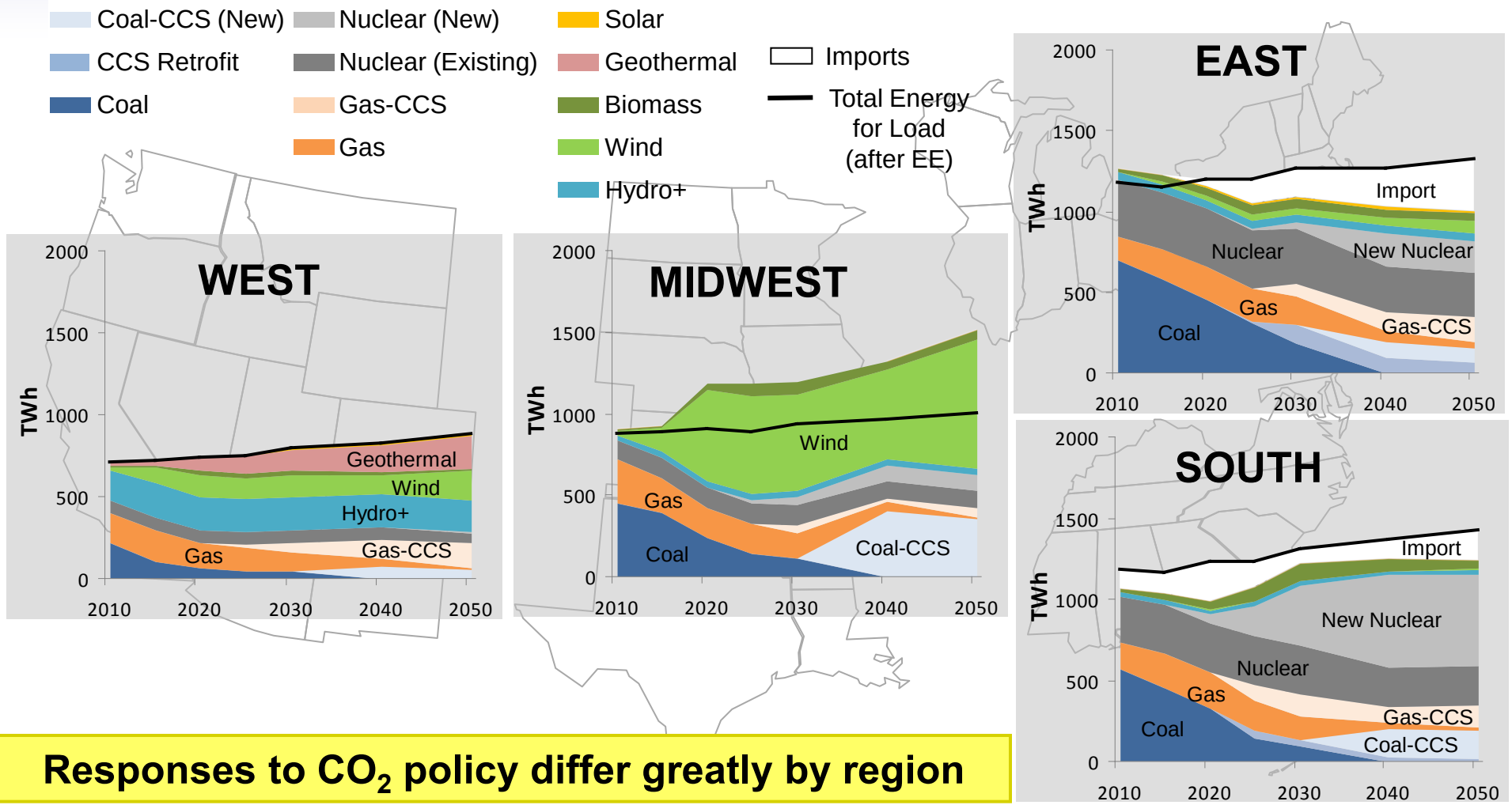
- 33% of total GHGs
- 39% of total CO_2

Shares within the electric sector CO_2

- 15% from natural gas ($5/MMBtu)
- **83% from coal ($2/MMBtu)**

Policy cost will be driven by economics of coal substitution (renewables, nuclear, CCS, EE)

Regional Generation Mix: CO2 Policy



Responses to CO_2 policy differ greatly by region

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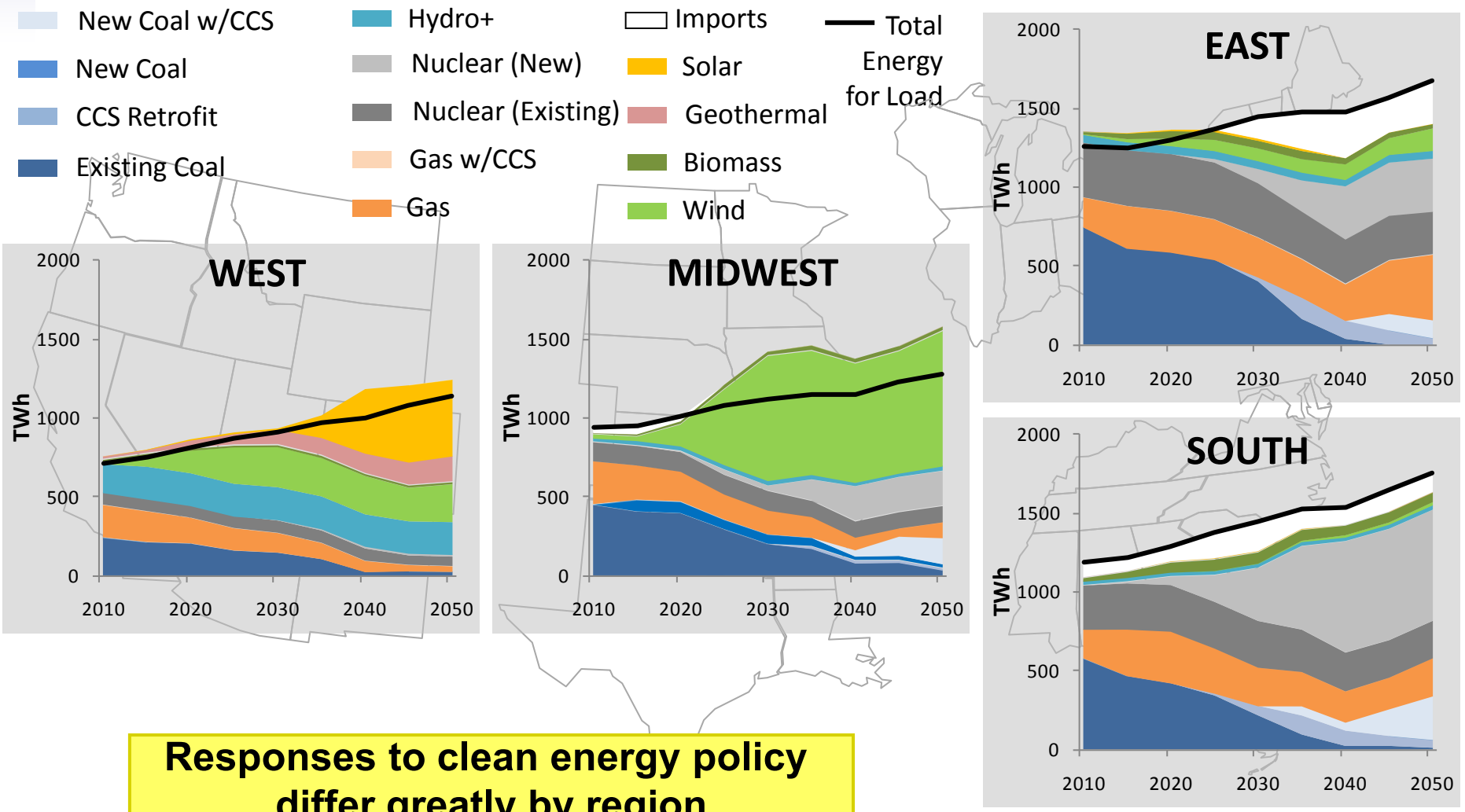
Regional Generation Mix: Clean Energy Standard



Responses to clean energy policy differ greatly by region

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Key Question for Power Companies: How Much to Keep Existing Coal Units Running?

Estimates of 50-100 GW of capacity "at risk"

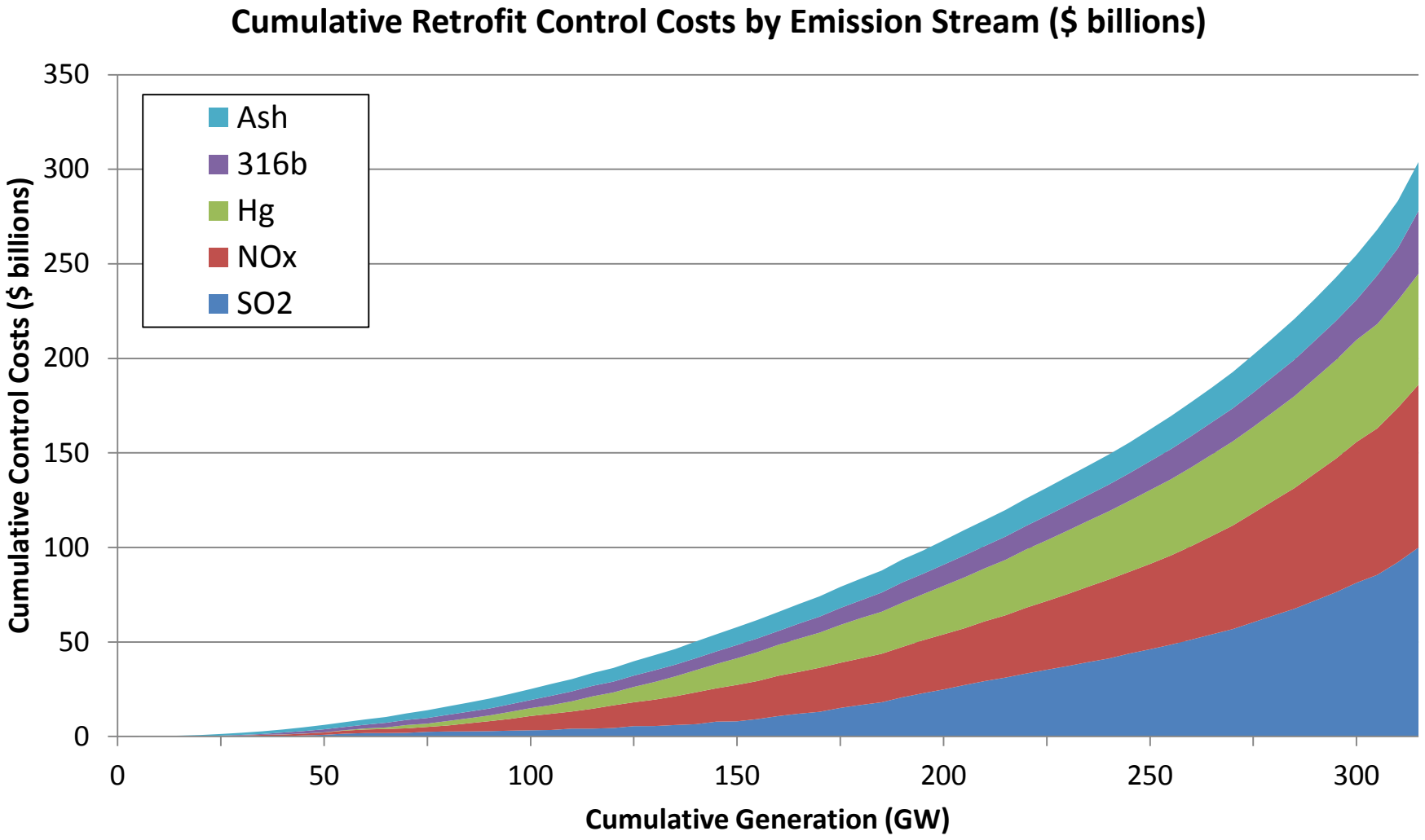
Pending Environmental Control Initiatives

Pollutant	Perspective
SO_2; NO_x	• Cross State Air Pollution Rule in 2012 • Limited trading between states and regions

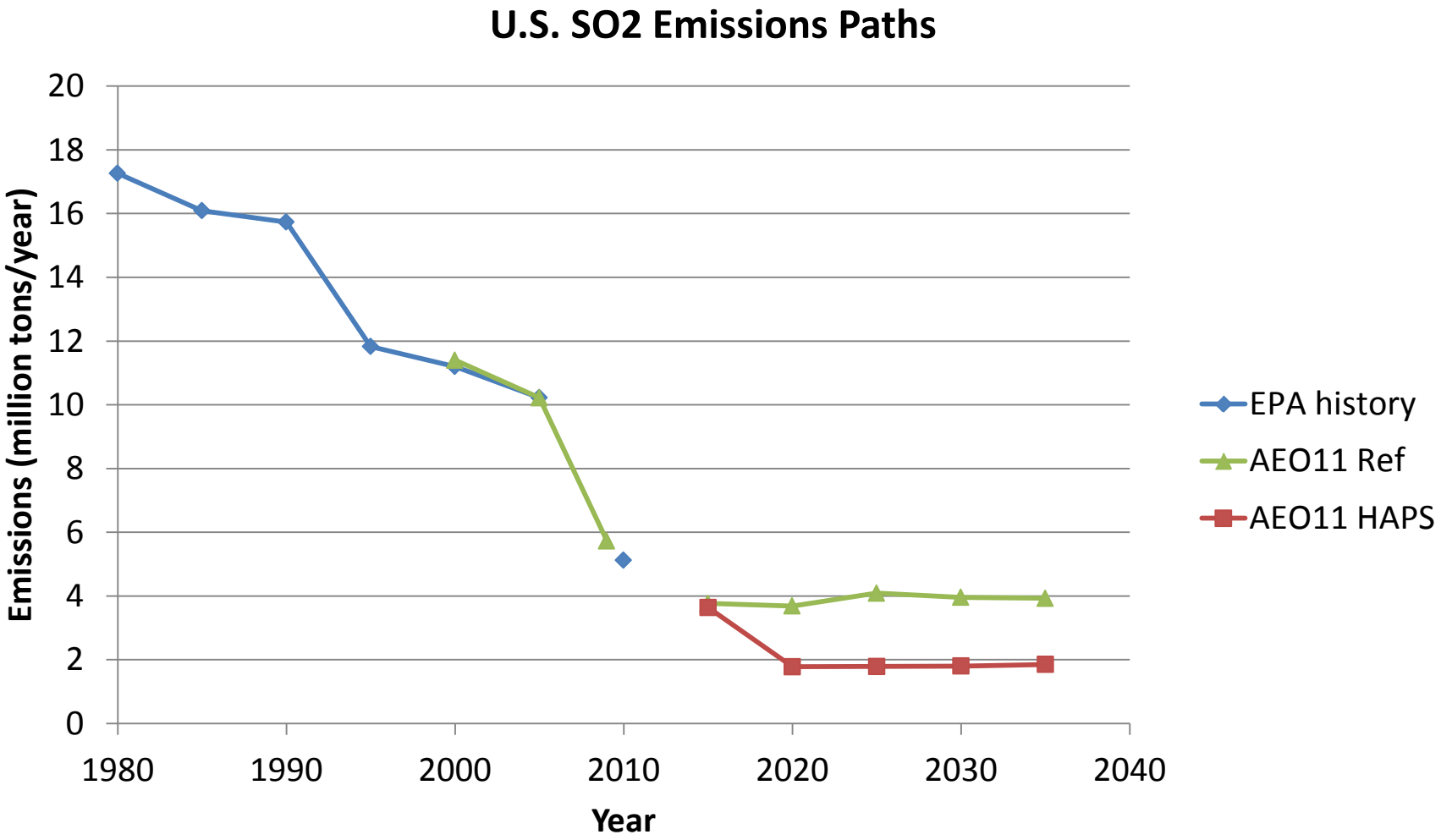
Hg; HAPs	• Technology-forcing regulations by 2015
	  • Scrubbing, SCRs
	  • Particulate control + ACI or Toxecon

316(b)	• Impingement/entrainment retrofits by 2020
Ash	• RCRA C or D designation by 2020
CO_2	• Cap, tax and/or performance standards

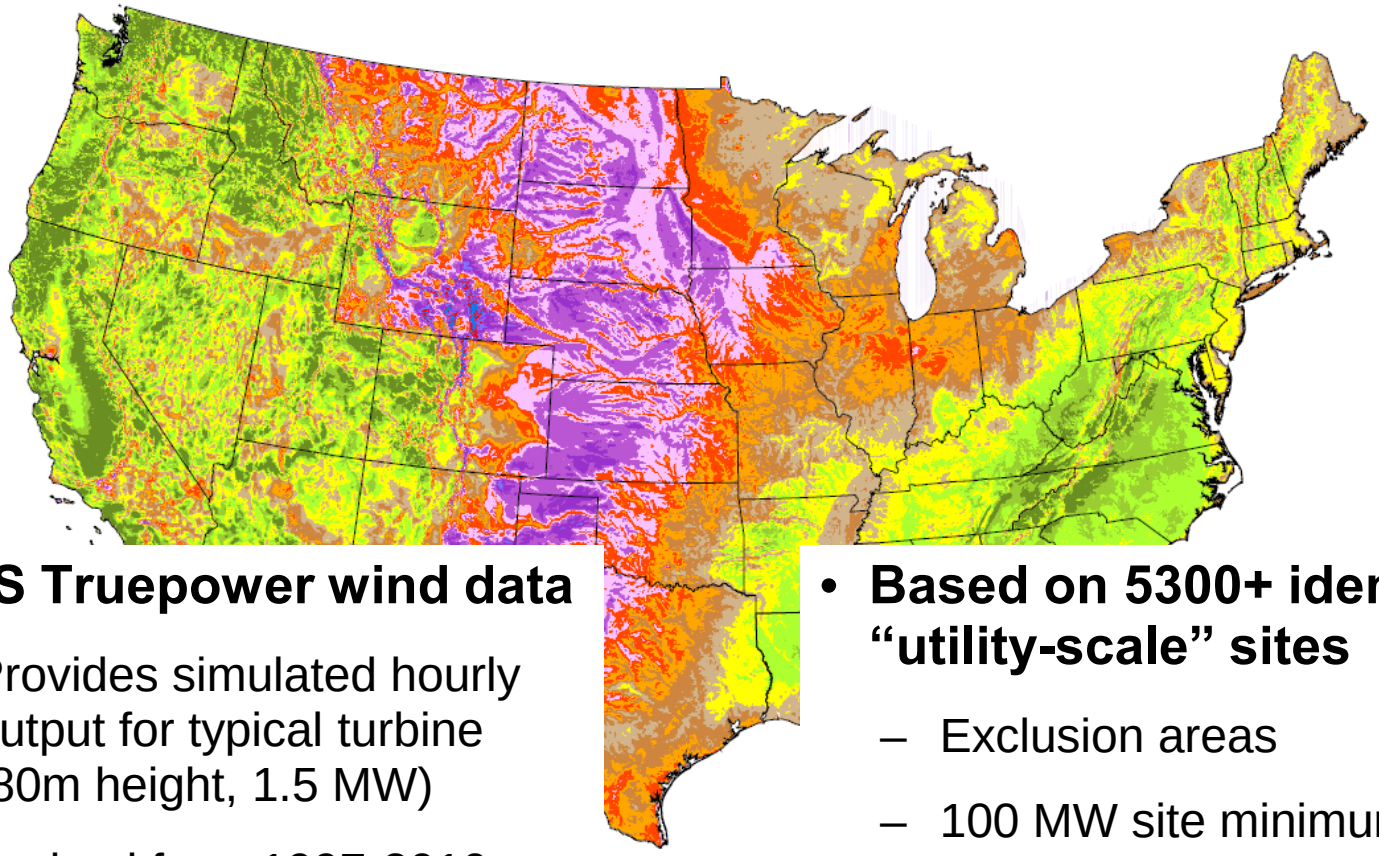
Total Cumulative Compliance Cost Potentially $300 Billion



Clean Air Act: Tremendous Progress but No Stopping Rule Implies Continued Action



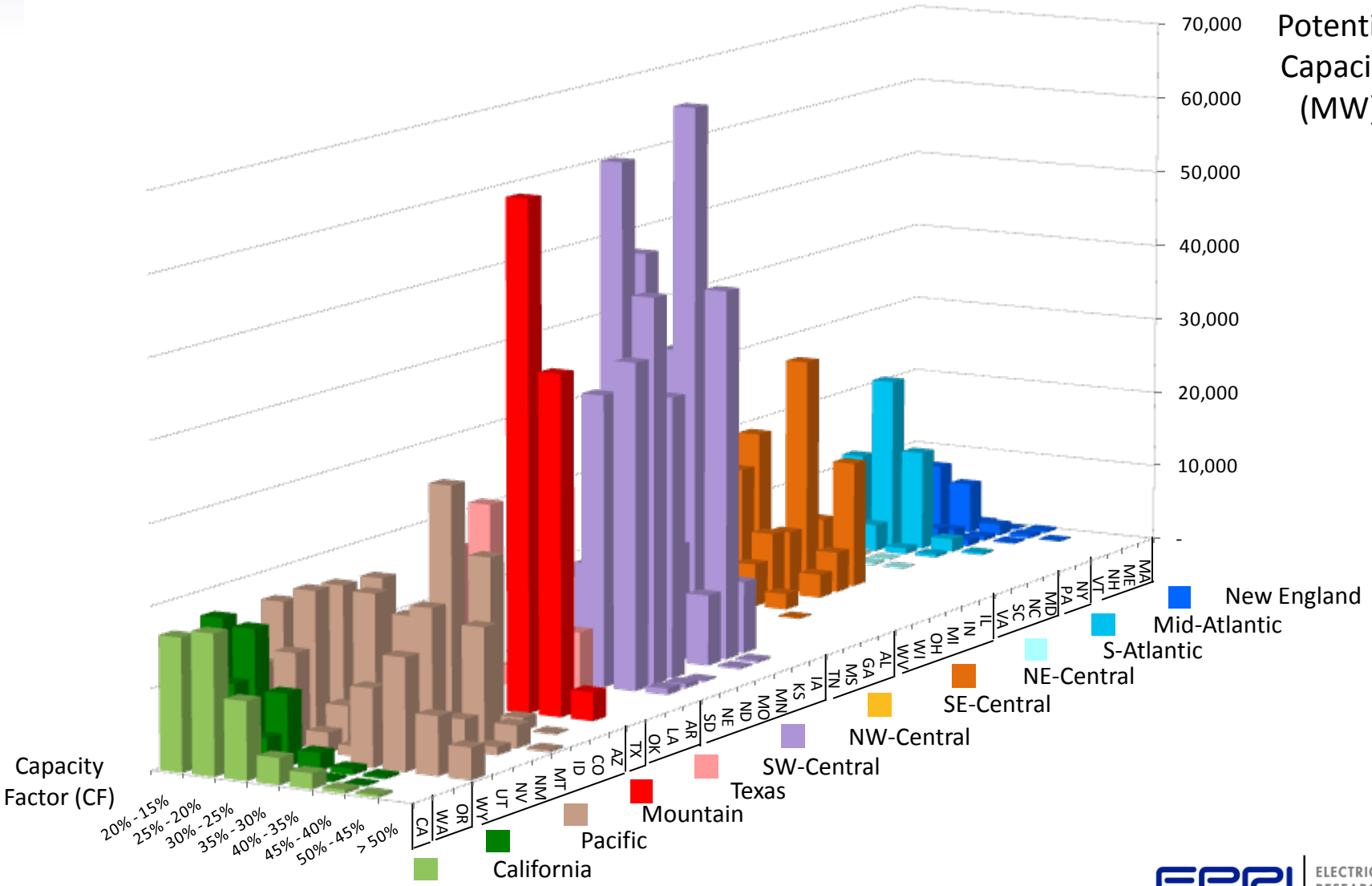
Wind: A Potentially Tremendous Resource that is Popular, Variable, and Distant



- **AWS Truepower wind data**
  - Provides simulated hourly output for typical turbine (80m height, 1.5 MW)
  - Derived from 1997-2010 meteorology

- **Based on 5300+ identified "utility-scale" sites**
  - Exclusion areas
  - 100 MW site minimum
  - Distance to grid
  - Terrain/wake effects

Location of Wind Resource by State and Capacity Factor



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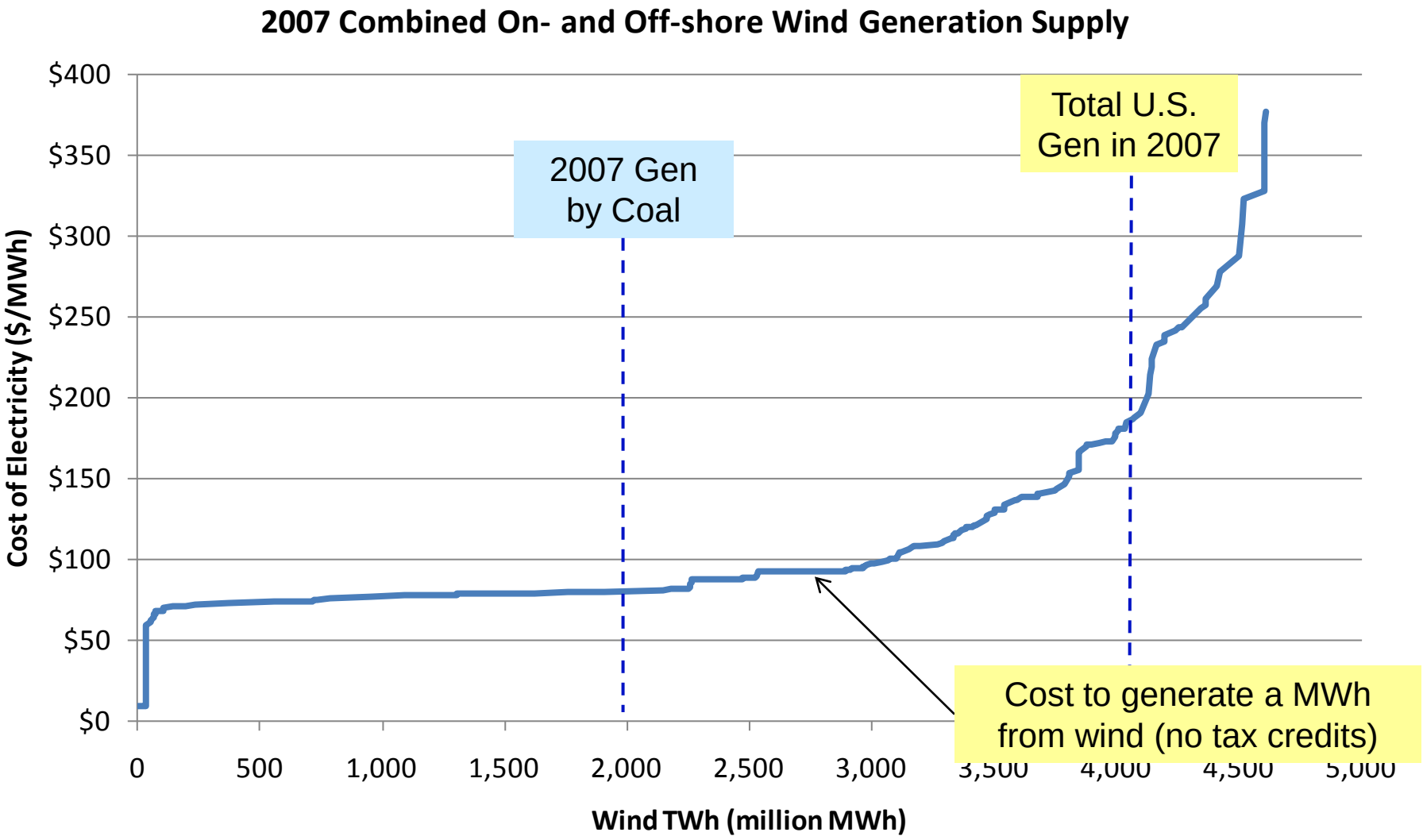
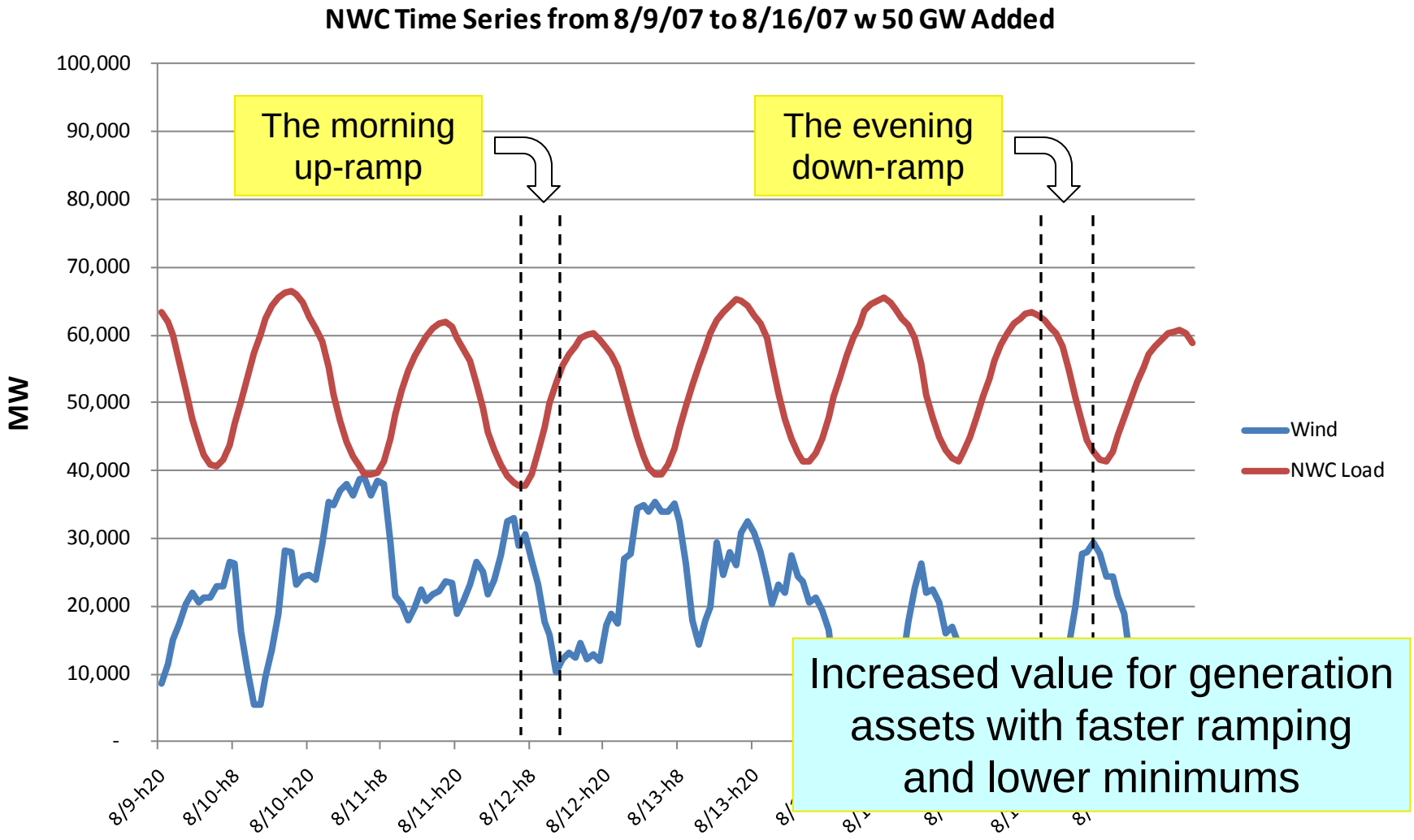
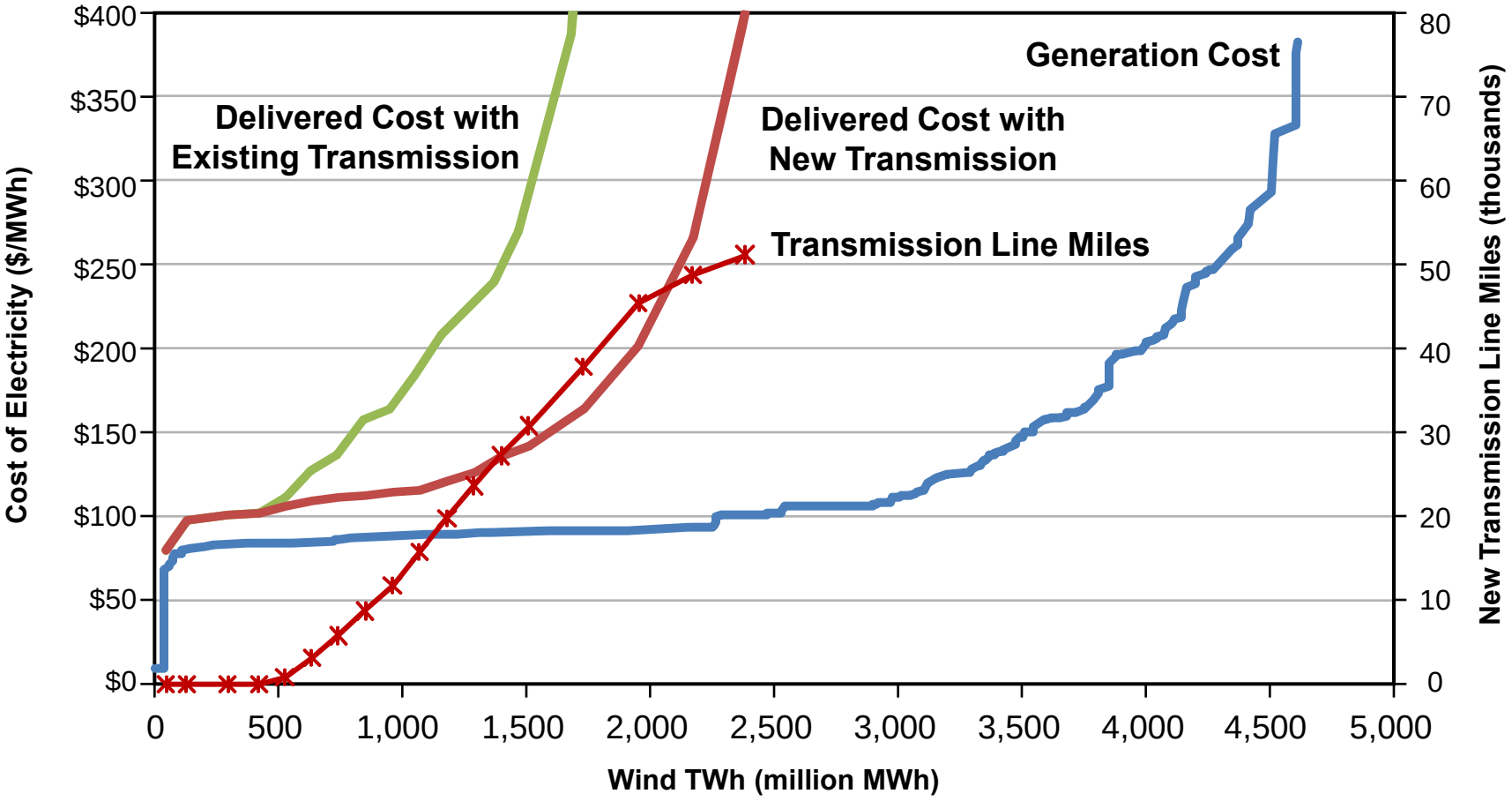
EPRI Wind Resource Assessment from Truepower Shows Vast Generation Potential



Anti-correlation of Wind with Load Critical to its Economics

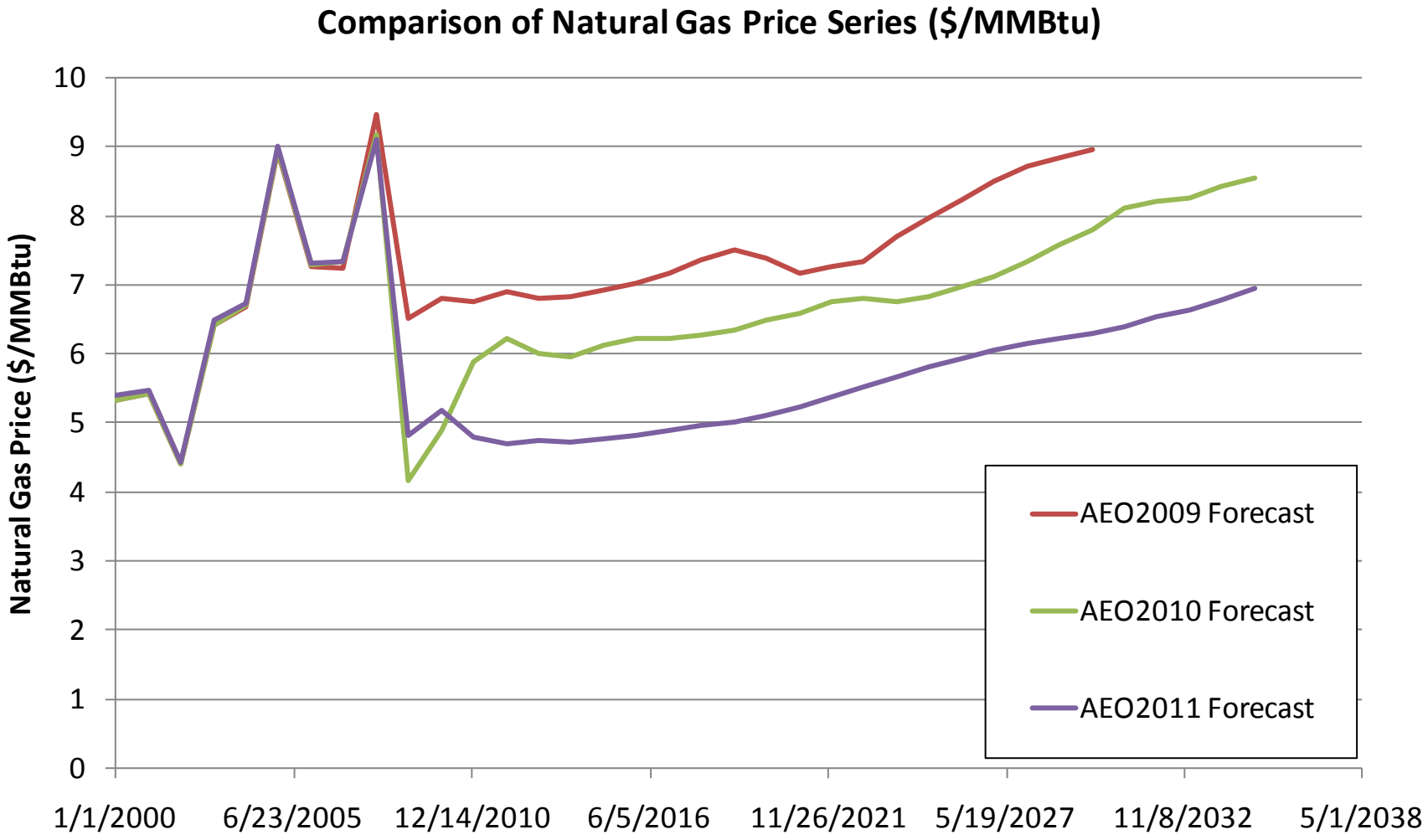


National Wind Energy Potential Supply Curves* (including delivery costs)

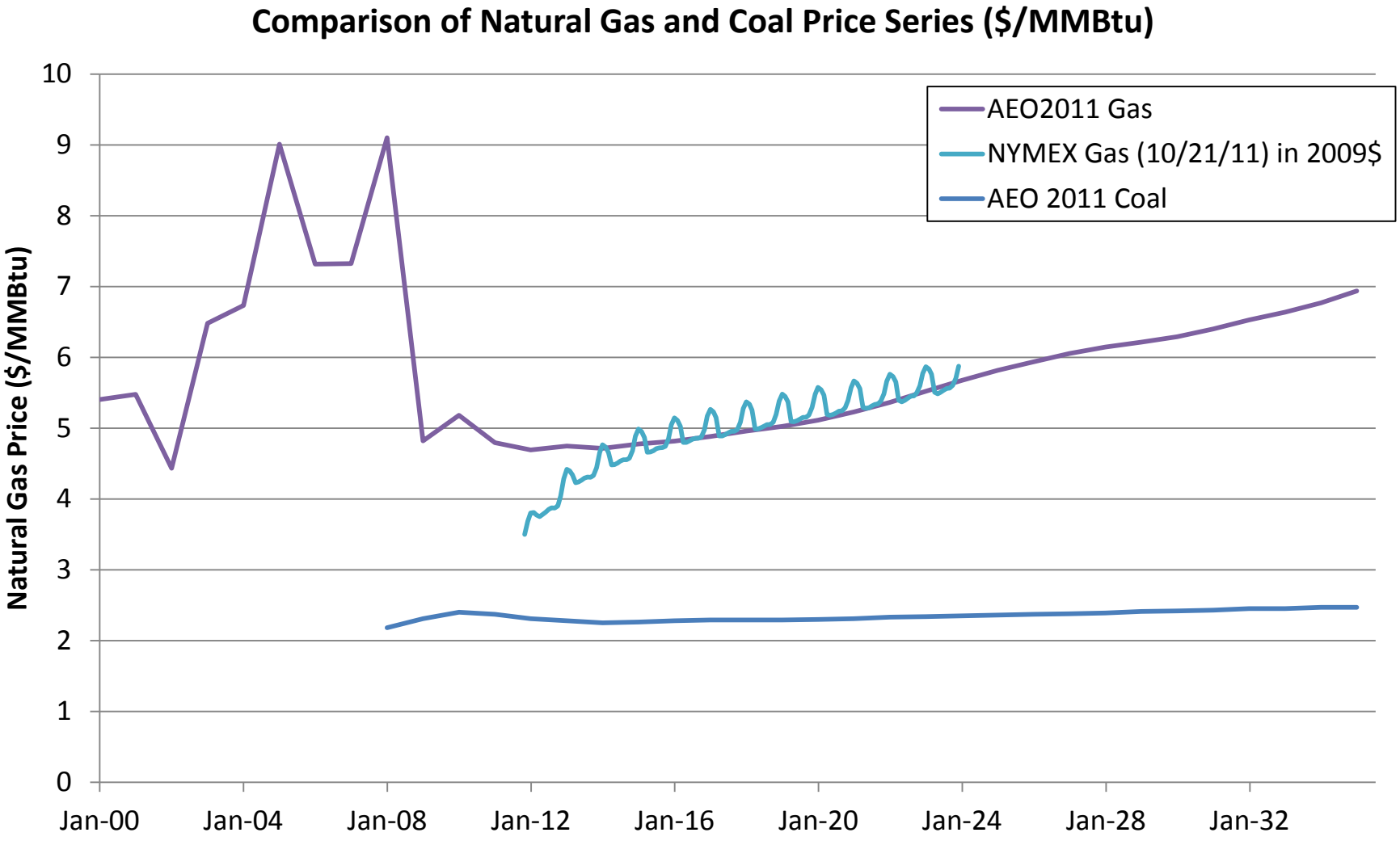


*EPRI – AWS TruePower National Wind Energy Supply Curves

DOE Annual Energy Outlook (AEO) Natural Gas Price Forecasts Have Been Coming Down



Markets and Forecasts Lining Up – What could possibly go wrong?



Some Observations on R&D Directions

- Resolving the uncertainty over climate policy
- Learning to capitalize on renewable resources, without dimming the lights or breaking the bank
- Deciding if/when enough is enough on air emission reductions
- Resolving natural gas resource development policy and environmental protection

Together…Shaping the Future of Electricity

for more information contact:
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niemeyer@epri.com