

The Brattle Group

A New Electricity Business Model for a Low-Carbon World

Presented to
The Global Energy and Environment Initiative (GEEI) at
The Paul H. Nitze School of Advanced International Studies (SAIS)
Johns Hopkins University

February 18, 2009

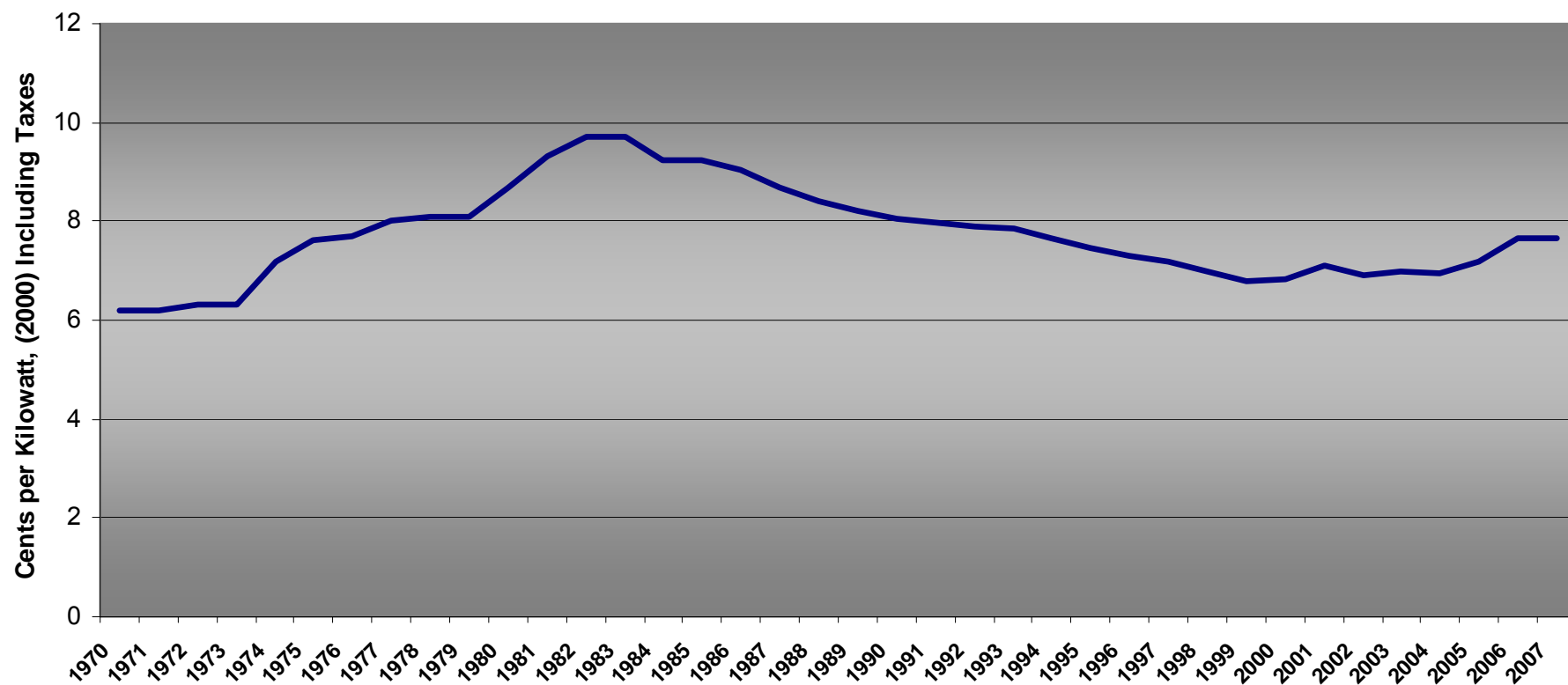
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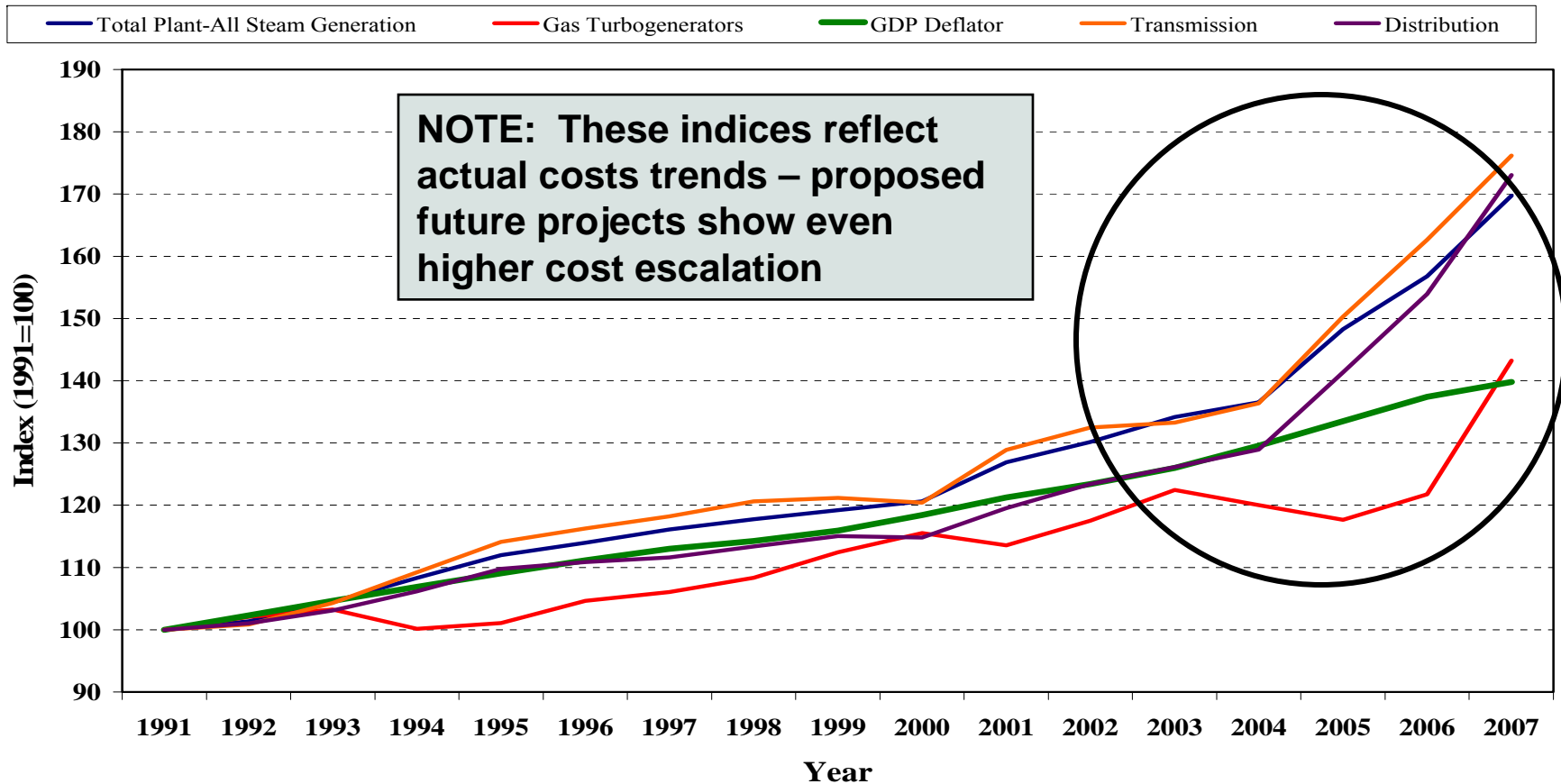
Real Average U.S. Electric Rates (1970-2007)



Source: "Annual Energy Review 2007," *Energy Information Administration Report*, U.S. Department of Energy, June 23, 2008.

Utility Construction Costs Also Rising

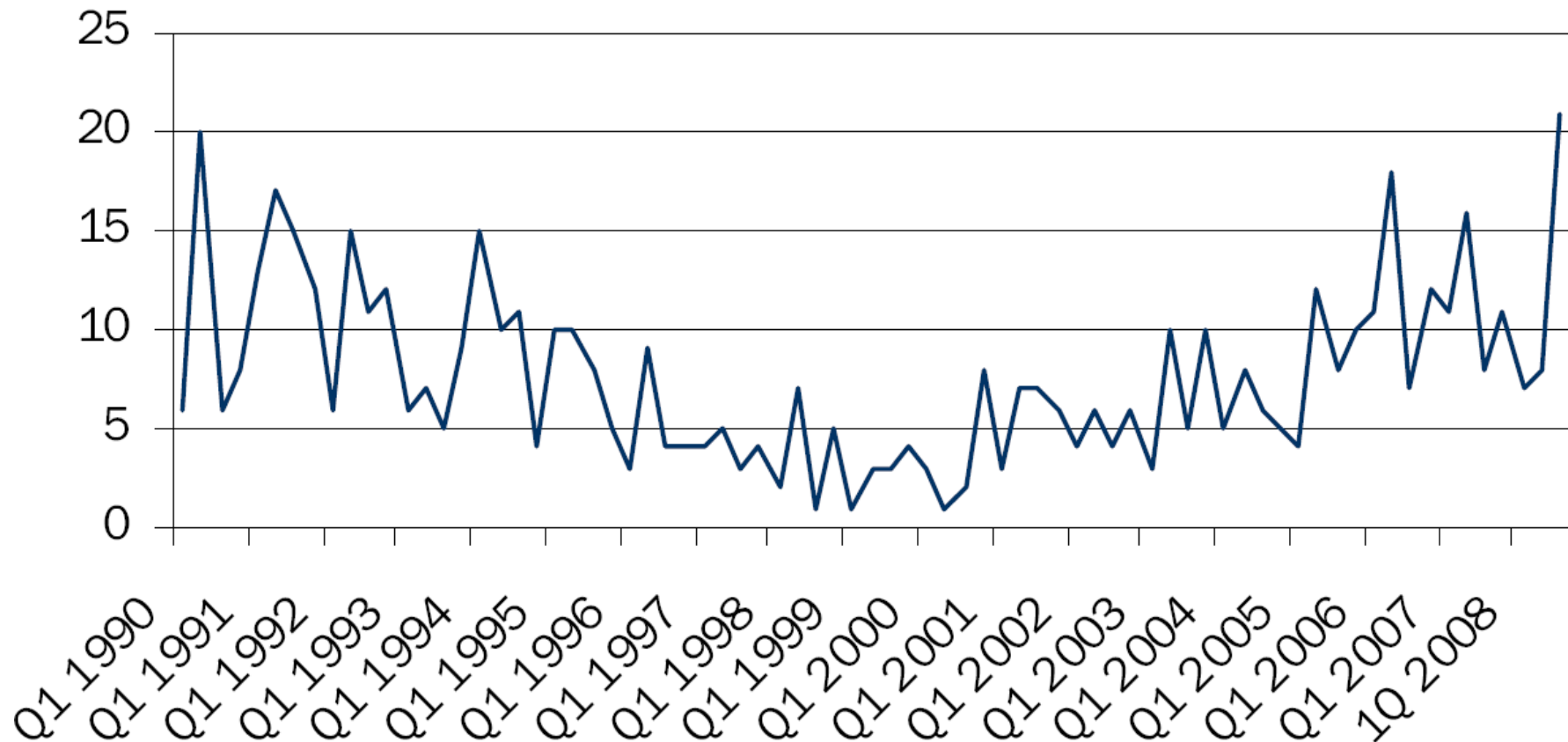
National Average Utility Infrastructure Cost Indices



Source: "Transforming America's Power Industry: The Investment Challenge", *The Brattle Group*, presented to the Edison Foundation, April 21, 2008.

Number of Rate Cases Filed: 1990- Q3 2008

U.S. Shareholder-Owned Electric Utilities



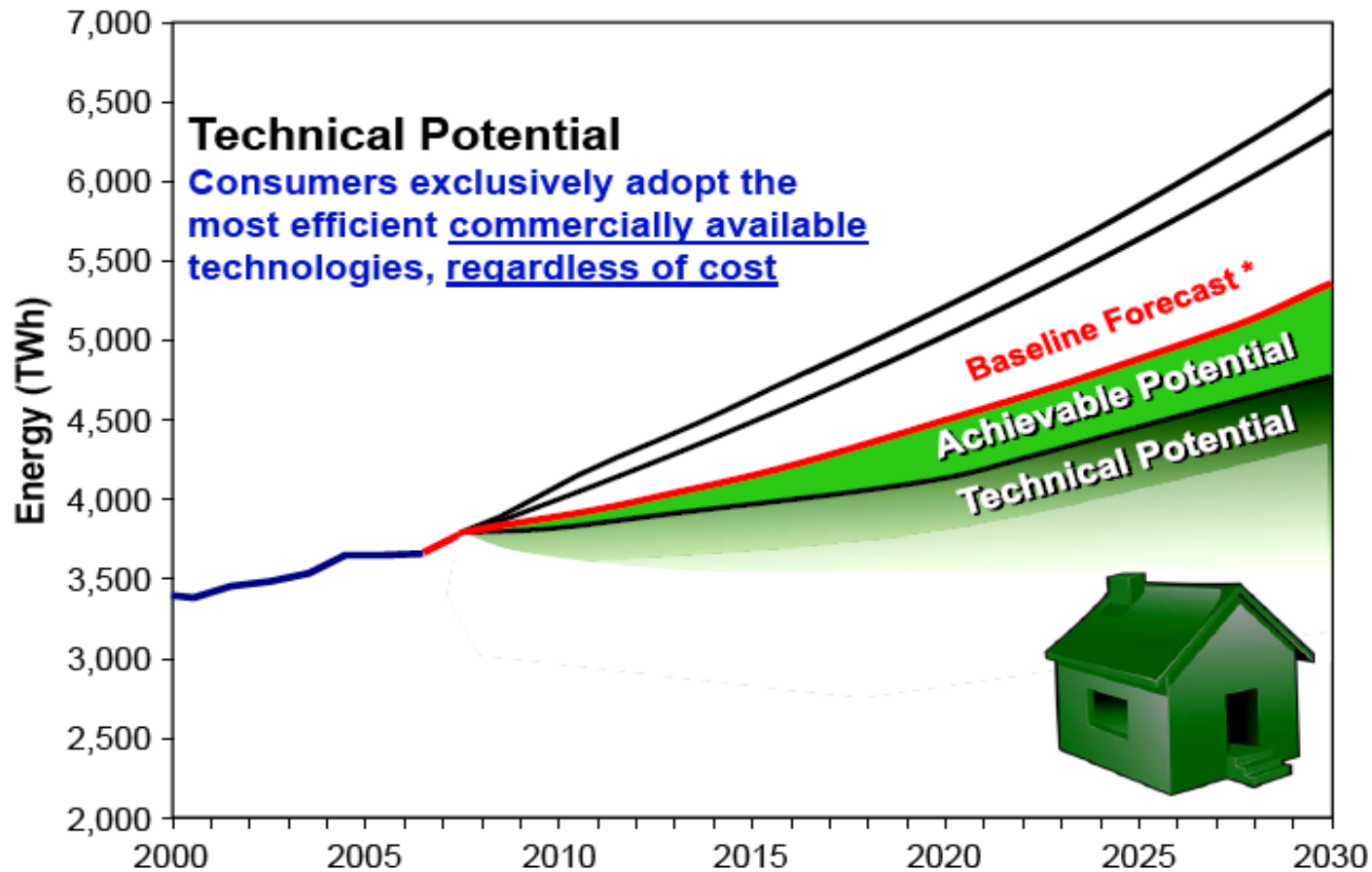
Source: "Rate Case Summary," *Quarter Three Financial Update*, Edison Electric Institute, December, 2008.

Price Elasticity Impacts

- ◆ For every 10% increase in real price long-term demand drops 6% to 10%
- ◆ The full impact is spread over about 7 years so is often missed in analyses and forecasts models
- ◆ During periods of rapid and sustained price increases lost sales are often larger
- ◆ Nationwide simulation by *The Brattle Group* shows conservative reduction in sales of about -6%
- ◆ Careful work needed in utility resource plans

Source: Gregory Basheda *et al.* "Why Are Electricity Prices Increasing?" prepared for the Edison Foundation, June, 2006.

Electricity Consumption . . . Technical Potential Electricity Savings



* Based on EIA Annual Energy Outlook 2007 (Residential, Commercial, and Industrial sectors)

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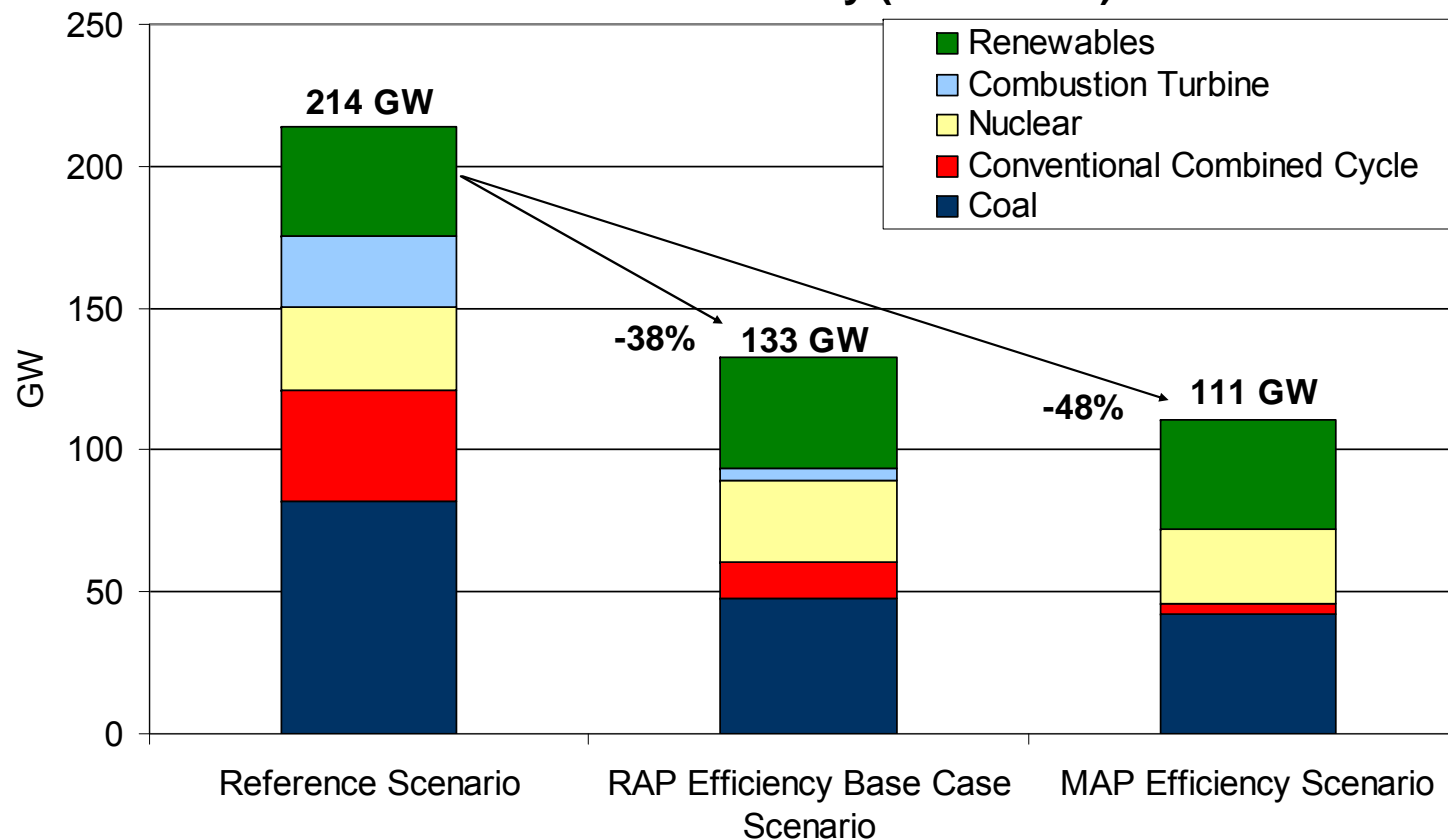
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EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Source: Howard, Michael. "Energy Efficiency: How Much Can We Count On?," presented at the Edison Foundation Conference, *Keeping the Lights on: Our National Challenge*, April 21, 2008.

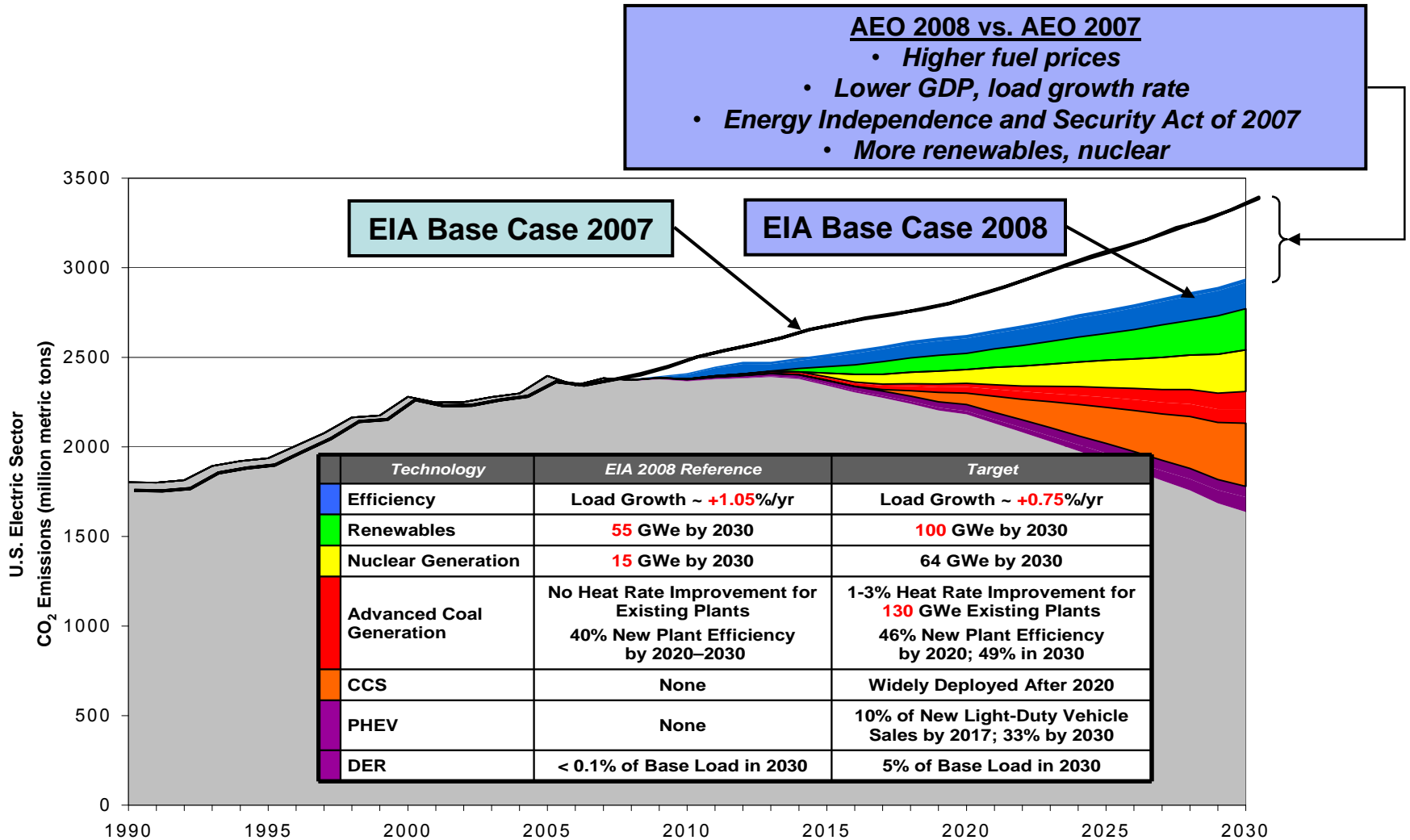
Energy Efficiency Program Can Reduce New Capacity Requirements by at Least 38- 48%

Impact of RAP and MAP EE/DR Programs on Reference Scenario Required Generation Capacity - No Carbon Policy (2010-2030)



Source: Marc Chupka *et al.* "Transforming America's Power Industry: The Investment Challenge 2010-2030." prepared for the Edison Foundation Financial Conference, November 10, 2008.

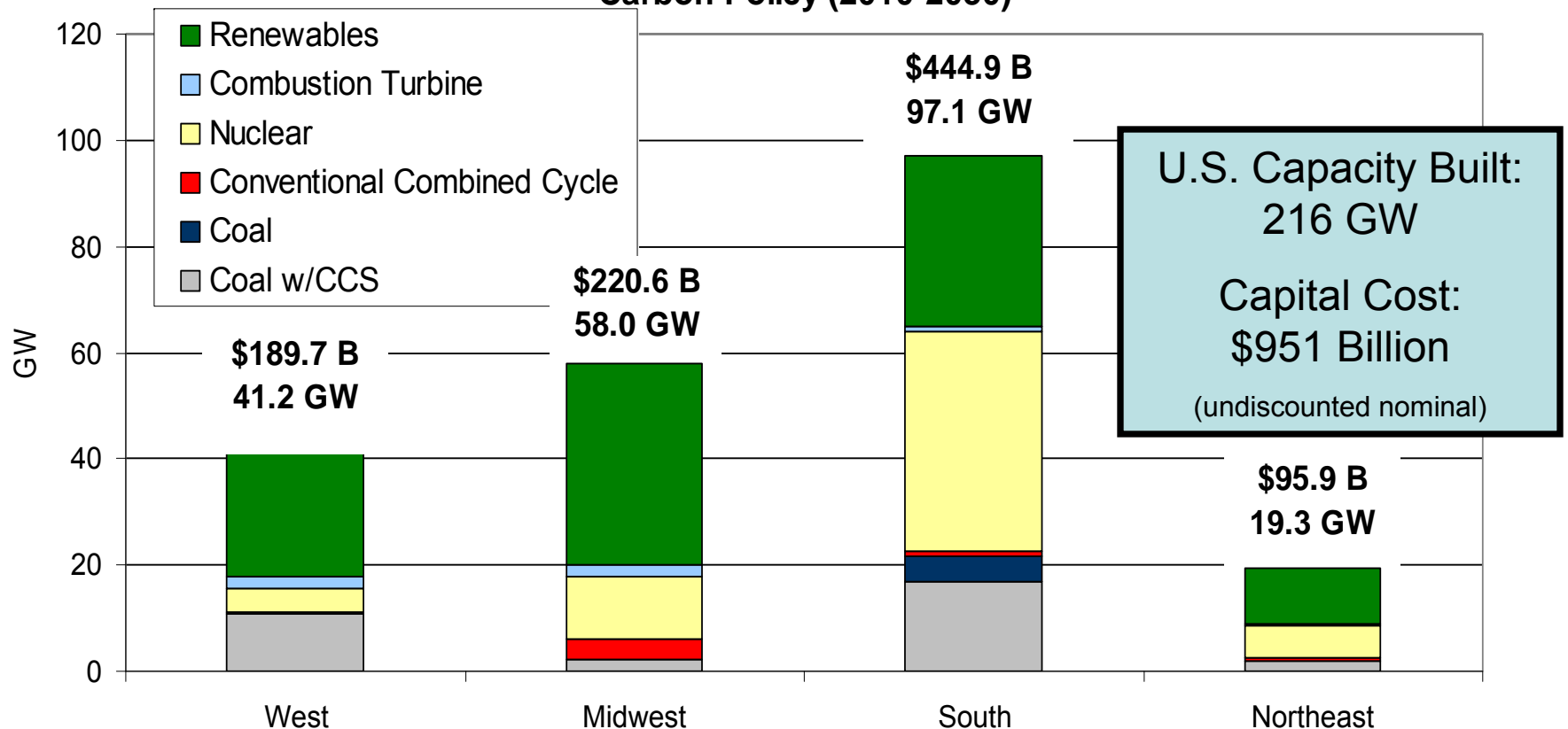
EPRI Prism Carbon Policy Scenario



Source: Marc Chupka *et al.* "Transforming America's Power Industry: The Investment Challenge 2010-2030." prepared for the Edison Foundation Financial Conference, November 10, 2008.

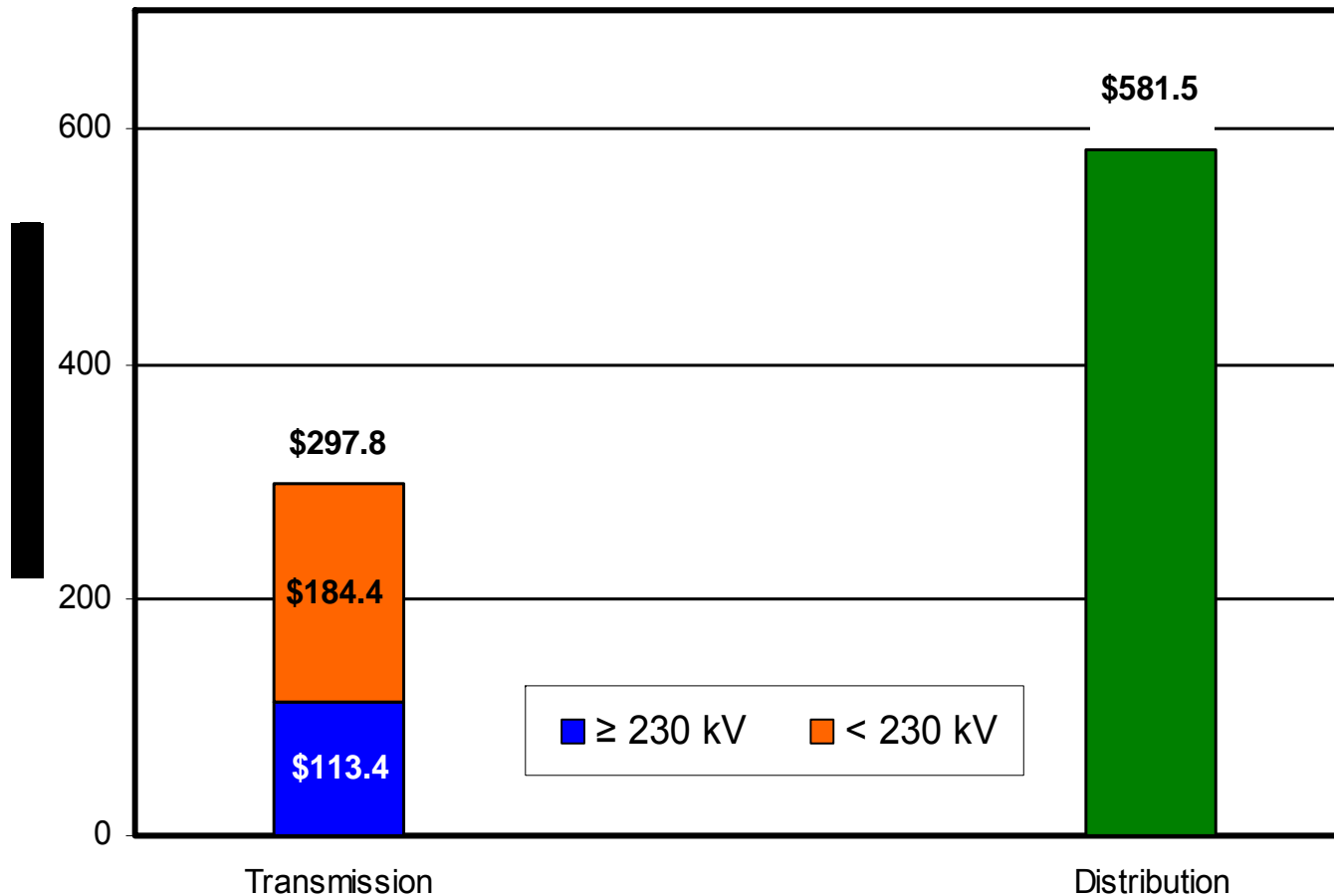
Regional Capacity Additions and Generation Capital Cost in Carbon Policy (Prism) Scenario

Regional Capacity Additions and Generation Capital Costs in Prism RAP Scenario with Carbon Policy (2010-2030)



Source: Marc Chupka *et al.* "Transforming America's Power Industry: The Investment Challenge 2010-2030." prepared for the Edison Foundation Financial Conference, November 10, 2008.

Transmission and Distribution Investment 2010-2030- Including Smart Grid



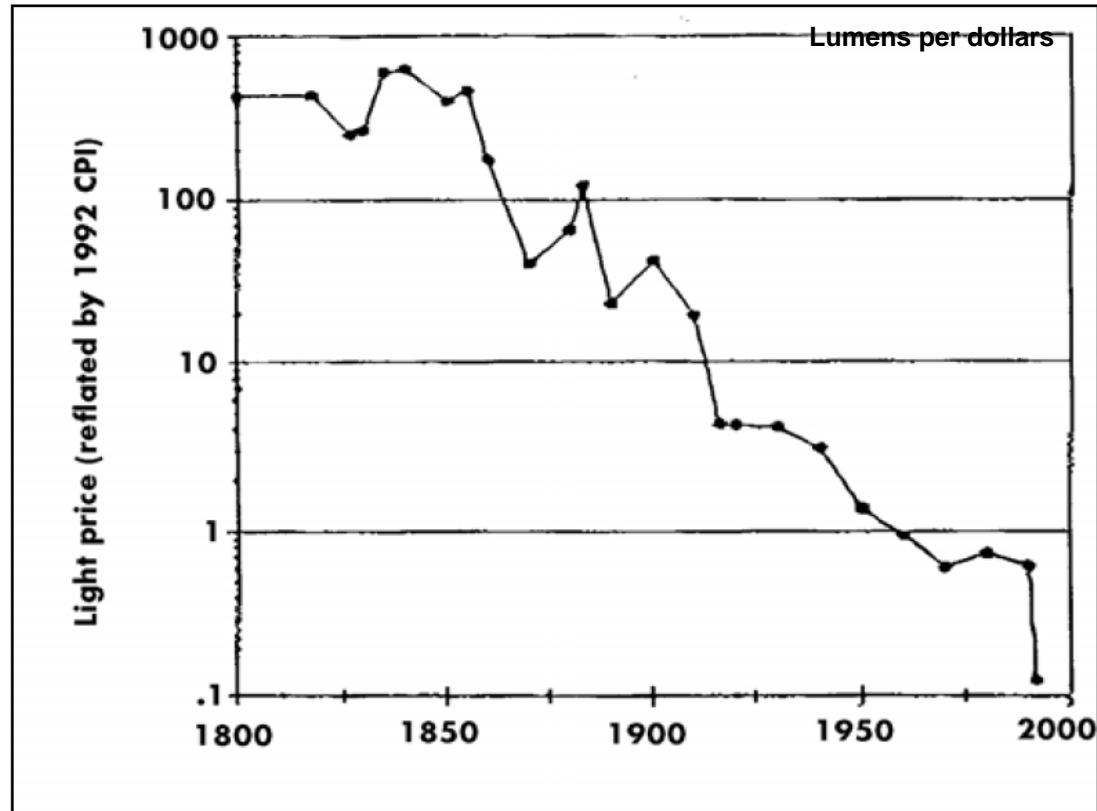
Source: Marc Chupka *et al.* "Transforming America's Power Industry: The Investment Challenge 2010-2030." prepared for the Edison Foundation Financial Conference, November 10, 2008.

Electric Industry Outlook

- ◆ Slow sales growth – 0.69%/yr or less
- ◆ High investment needs -- \$1 - \$2 Trillion
- ◆ Rising unit prices for commodity or green electrons
- ◆ The silver lining – energy services are still getting cheaper

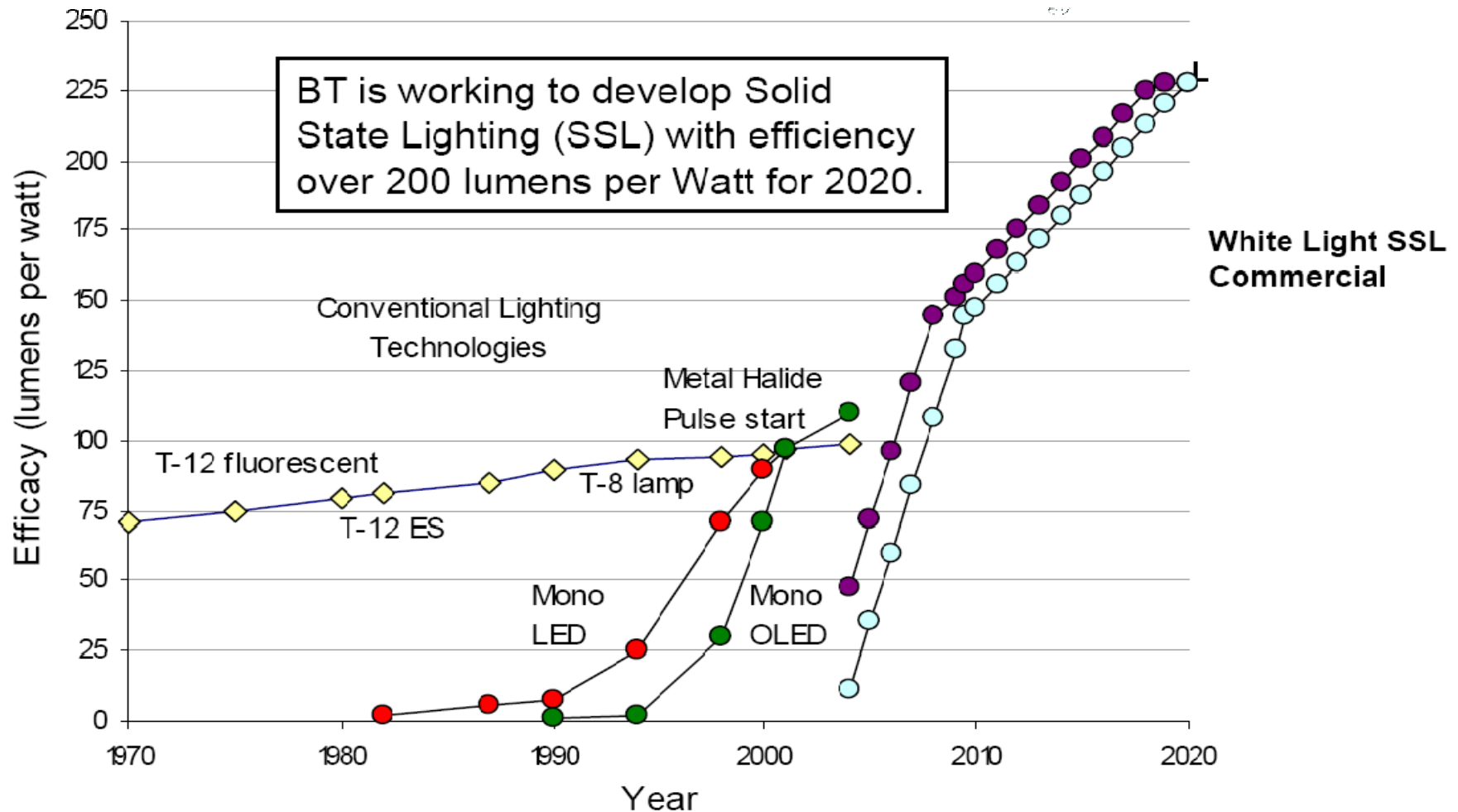
Selling Lighting Services

Figure 12. Price of Lighting from Electricity in the United Kingdom



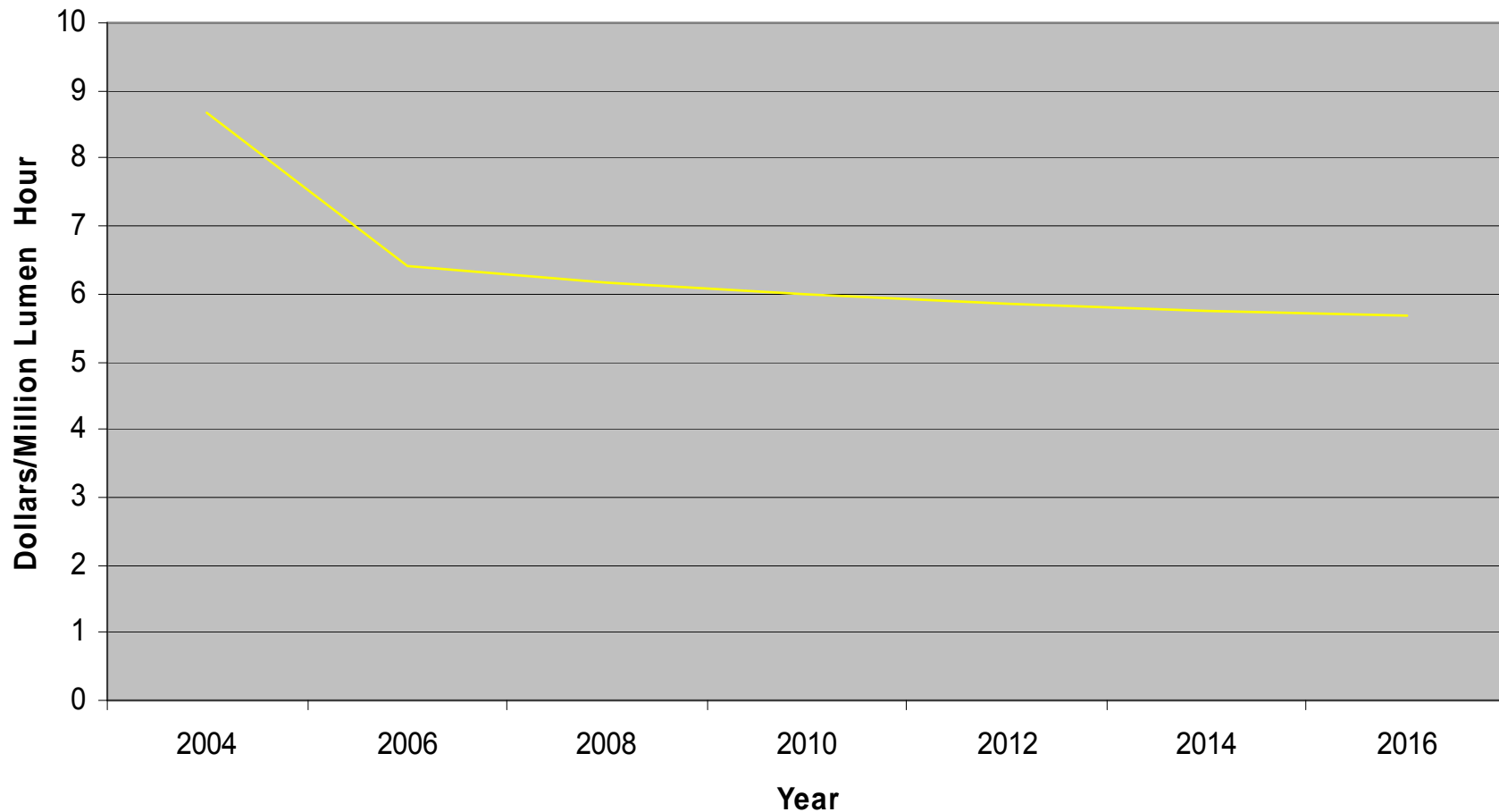
Source: "Do real-output and real-wage measures capture reality? The history of light suggests not," from Nordhaus, William, *The Economics of New Goods*, University of Chicago Press, 1997 (29-70).

Lighting Technologies Will Continue to Improve . . .



Source: McCabe, Michael. "Technology Commercialization Showcase 2008 Buildings Technology Program," pre-read materials for the *Technology Commercialization Showcase 2008*, August 2008.

... And The Cost of Light Could Keep Falling



Sources: McCabe, Michael. "Technology Commercialization Showcase 2008 Buildings Technology Program," pre-read materials for the Technology Commercialization Showcase 2008, August 2008; and Fouquet, Roger and Pearson, Peter J.G. "Long Run Trends in Energy Services 1300-2000," *Environmental and Resource Economists 3rd World Congress*, January 2005.

Conclusion

Investment on the order of \$1.5 trillion will be required over the 2010 – 2030 period

- ◆ Distribution - \$582 billion
- ◆ Transmission - \$298 billion
- ◆ AMI and EE/DR- \$85 billion
- ◆ Generation - \$505 billion, with no changes in carbon policy

While enhanced energy efficiency measures will reduce sales growth and generating capacity needs substantially, overall capital requirements are less affected:

- ◆ Reduced peak demand tends to displace less expensive generation capacity
- ◆ Costs of energy efficiency measures add back significant cost

Source: Marc Chupka *et al.* "Transforming America's Power Industry: The Investment Challenge 2010-2030." prepared for the Edison Foundation Financial Conference, November 10, 2008.

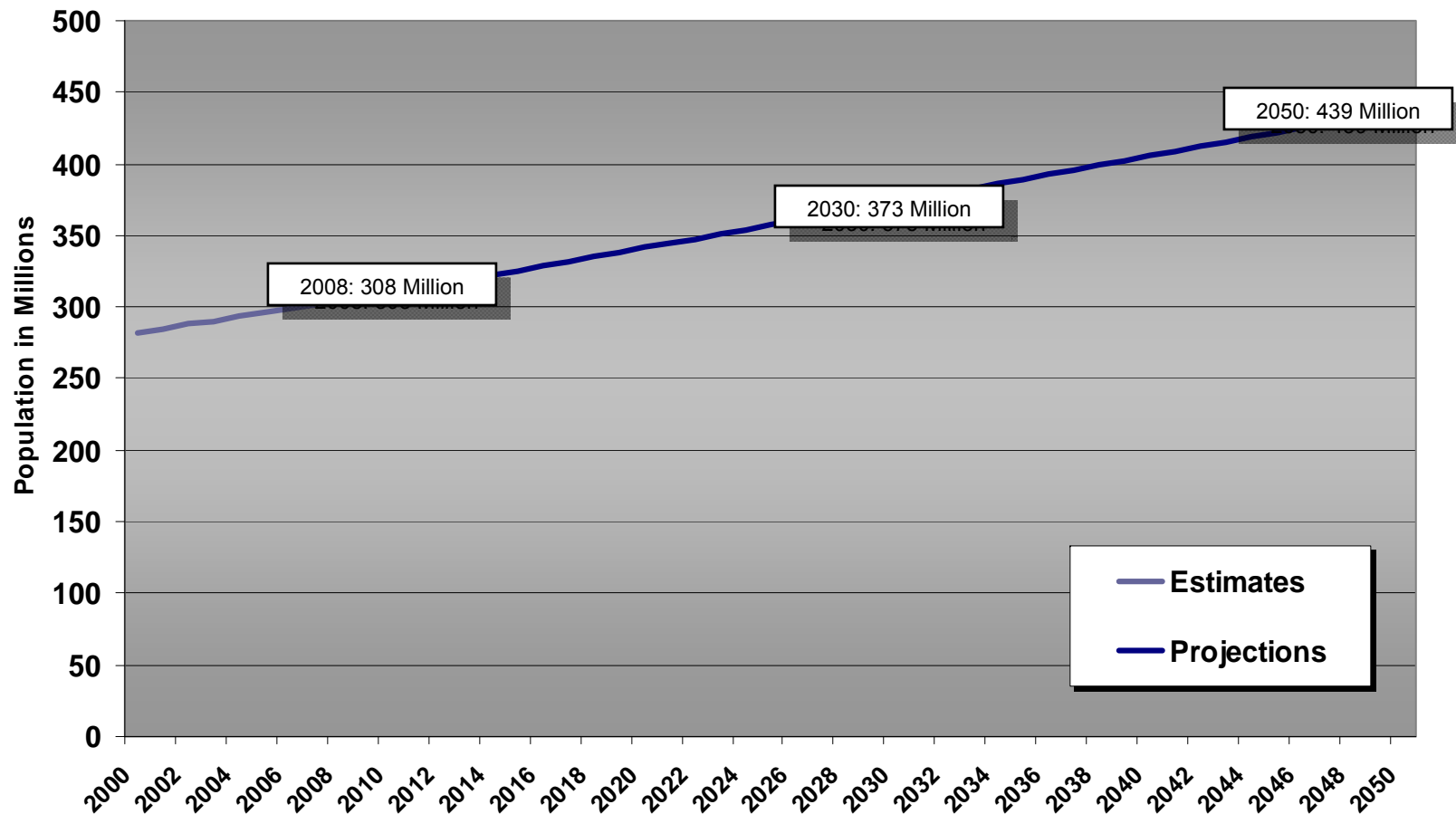
Conclusion (continued)

- ◆ The industry is caught between flattening sales and enormous investment needs – long-term cycle of per-unit rate increases
 - High commodity and fuel prices and energy efficiency/climate policies reduce the long term outlook for electricity sales
 - At least \$1.5 trillion investment needed 2010-2030

- ◆ Smart Grid technologies enable a new business and regulatory model
 - Smart Grid enables an energy service model that pulls in the positive growth part of the value chain
 - Energy services prices will rise less quickly than kWh

APPENDIX

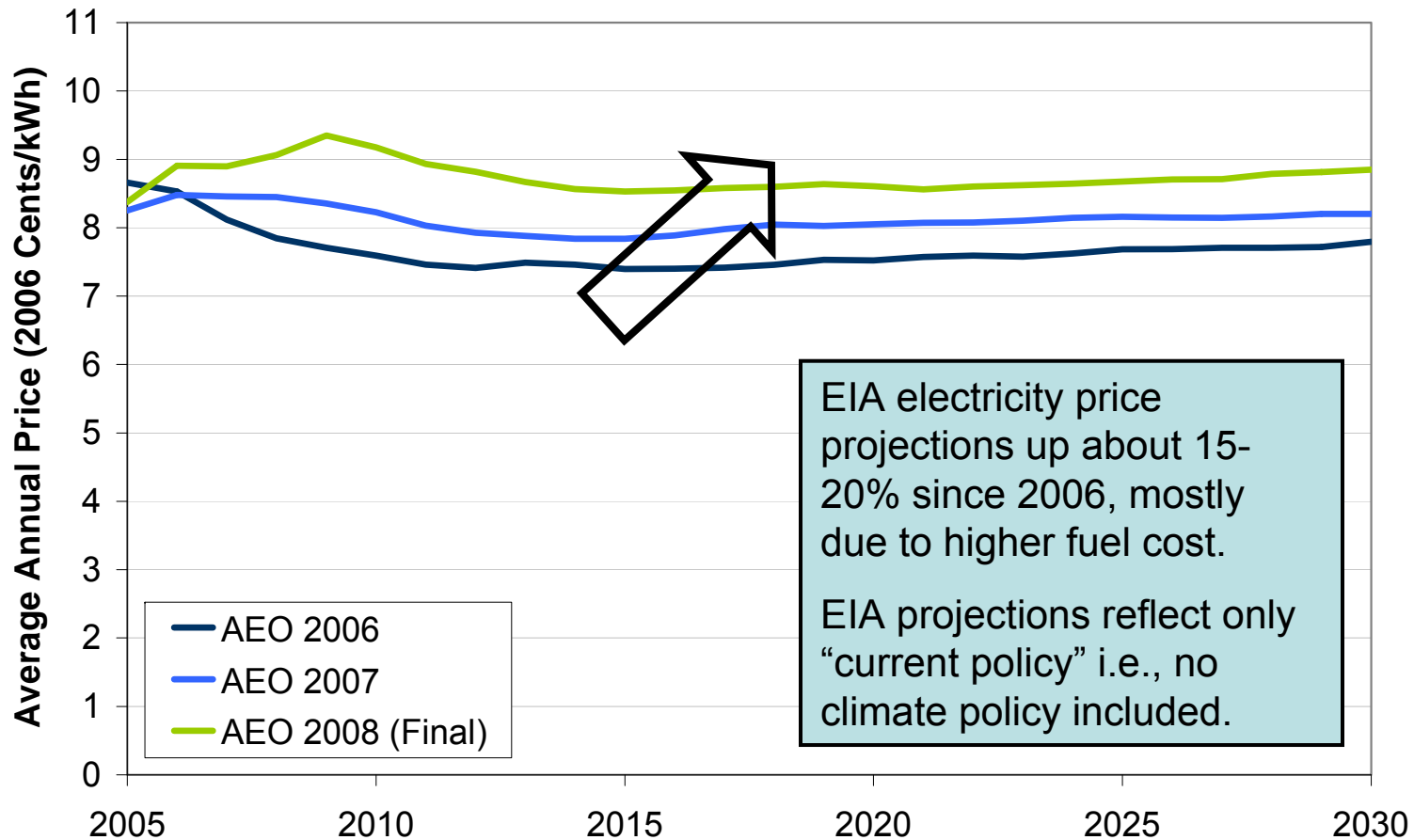
U.S. Population- Estimated and Projected (2000-2050)



Sources: "Annual Projections of the Total Resident Population as of July 1, Middle, Lowest, Highest, and Zero International Migration Series, 1999 to 2100," U.S. Census Bureau, 2000. www.census.gov/population/projections/nation/summary/np-t1.pdf (accessed September 23, 2008); and "Annual Estimates of the Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2007," U.S. Census Bureau, 2007. <http://www.census.gov/popest/states/NST-ann-est.html> (accessed September 23, 2008).

EIA Price Projections Rising Over Time

Comparison of AEO U.S. End-Use Price Forecasts

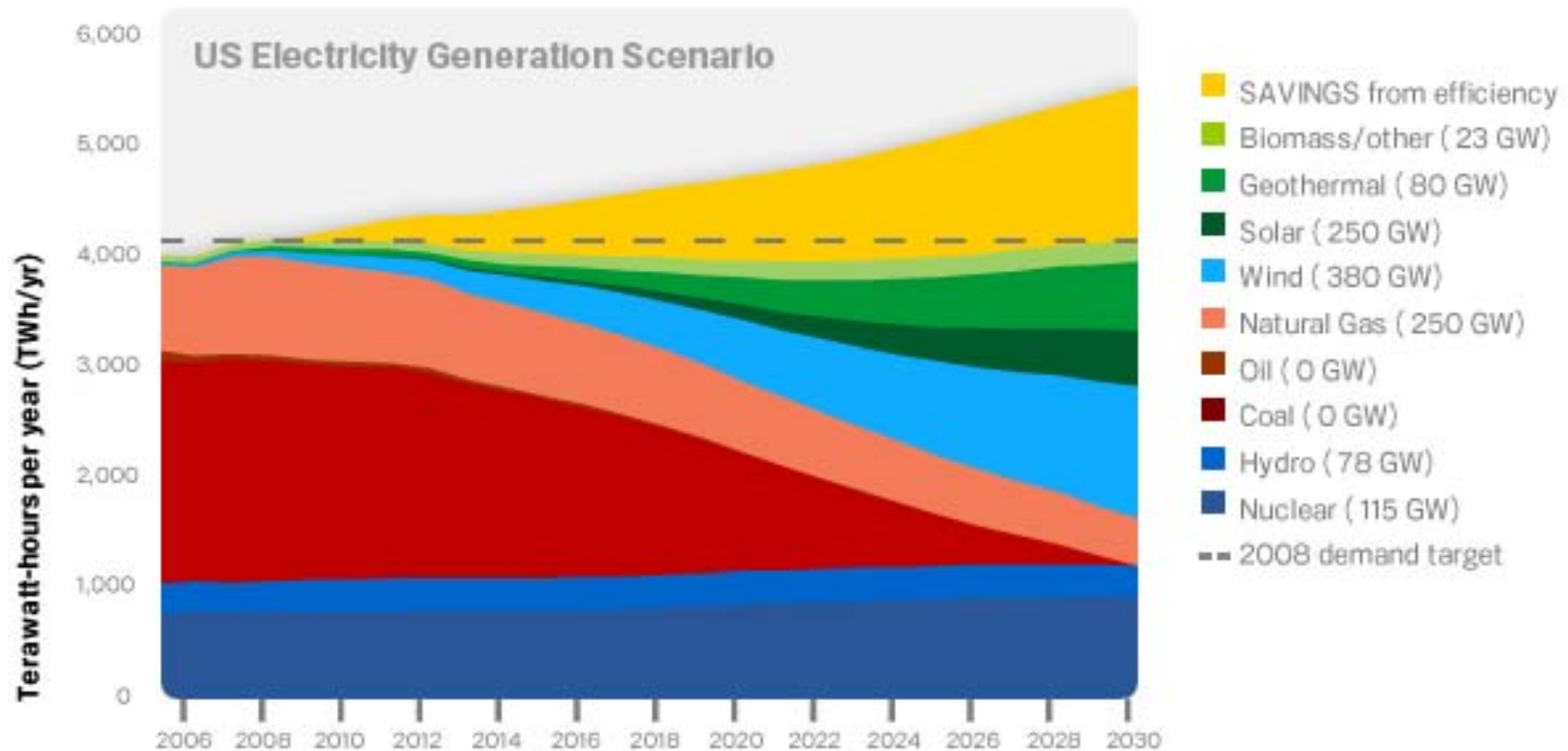


Source: "The Annual Energy Outlook 2008," The Energy Information Administration, September 2008.
[http://www.eia.doe.gov/oiarf/aeo/pdf/0383\(2008\).pdf](http://www.eia.doe.gov/oiarf/aeo/pdf/0383(2008).pdf) (accessed October 8, 2008).

A Declining Sales Industry?

Clean Energy 2030

Google's Proposal for reducing U.S. dependence on fossil fuels



Source: Greenblatt, Jeffrey. "Clean Energy 2030: Google's Proposal for reducing U.S. dependence on fossil fuels," October 6, 2008. <http://knol.google.com/k/-/15x31uzlqeo5n/1#> (accessed October 7, 2008).

Old Business Model – Under Assault

