



**ANALYSIS GROUP**  
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

**Appendix Figures for the White Paper:**

**Allocating Investment Risk in Today's Uncertain Electric Industry:  
A Guide to Competition and Regulatory Policy During "Interesting Times"**

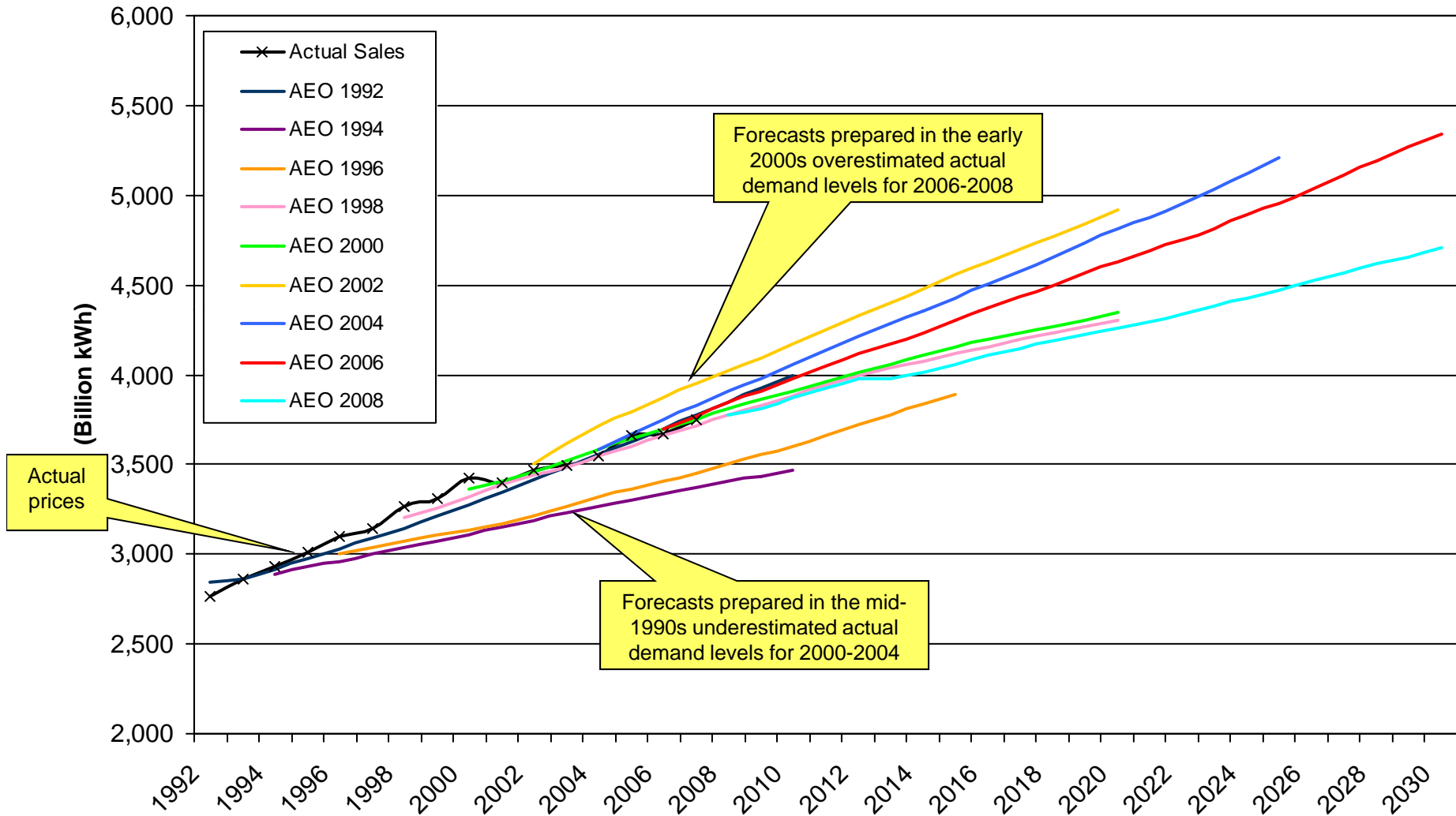
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Analysis Group**

**Boston, Massachusetts  
September 2009**

This White Paper was prepared for the Electric Power Supply Association.  
This paper represents the views of the author, and not necessarily the views of Analysis Group, EPSA, or its members.

# Forecasts of Electricity Sales: Different Views Future Uncertainties as Revealed in Forecasts (and Forecasting Error)

# Uncertainty about Future Electricity Demand Levels: Forecasted and Actual U.S. Total Electricity Sales (U.S. - Retrospective Review) Comparison of Actual Sales in 1992 - 2007 and Biennial Forecasts Prepared in the Years 1992 - 2008 (Billion kWh)



**Notes:**

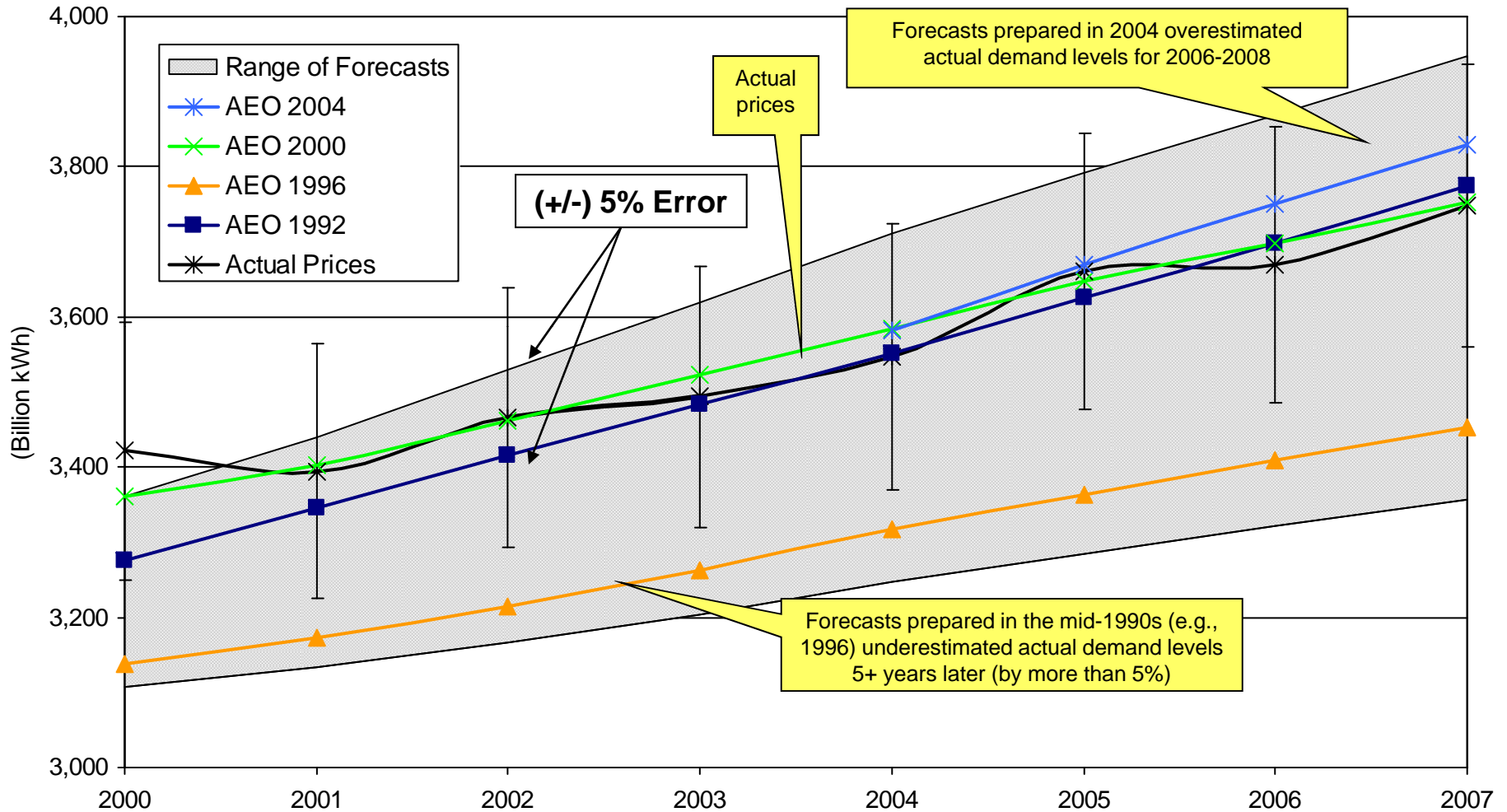
1. Total electricity sales forecasts are based on Annual Energy Outlook mid-price or reference case values.
  2. AEO forecasts are published in the listed forecast year. The first data point of each AEO forecast series, which begin in the publication year, is a forecasted value rather than an actual value.
- Source: Energy Information Administration, "Annual Energy Outlook Retrospective Review, 1982 - 2008," September 2008.

# Uncertainty about Future Electricity Demand Levels: Forecasted and Actual Electricity Sales (U.S. - Retrospective Review)

## Comparison of the Maximum and Minimum Forecast Values to the Actual Values for the Years 2000 - 2007

### Forecasted Range Includes Forecasts Prepared in Each Year from 1992 - 2007

(Billion kWh)

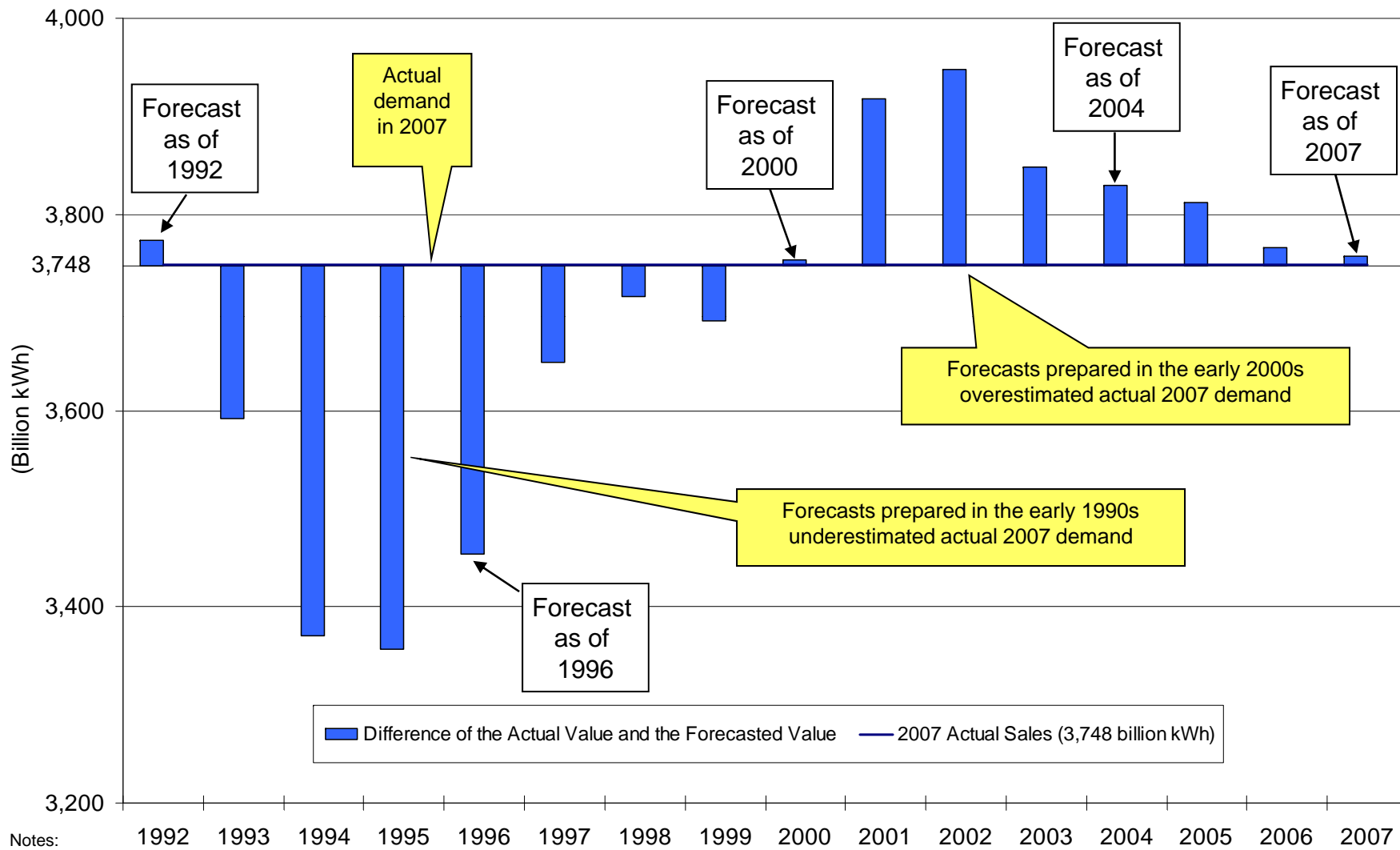


**Notes:**

1. Maximum and minimums are the absolute values from all data points from a given year from the 1992 - 2007 forecasts.
2. The number of forecasted data points varies each year. There are seven forecasted data points for 2000 and an additional data point in each subsequent year.
3. The error bars represent a (+/-) 5% range from the actual sales value for each year.

Source: Energy Information Administration, "Annual Energy Outlook Retrospective Review, 1982 - 2008," September 2008.

# Uncertainty about Future Electricity Demand Levels: Annual Differences of Forecasts of 2007 Electricity Sales Compared to the Actual 2007 Electricity Sales Comparison of Forecasts Prepared in Each Year from 1992 - 2007 (U.S. – Retrospective Review) (Billion kWh)



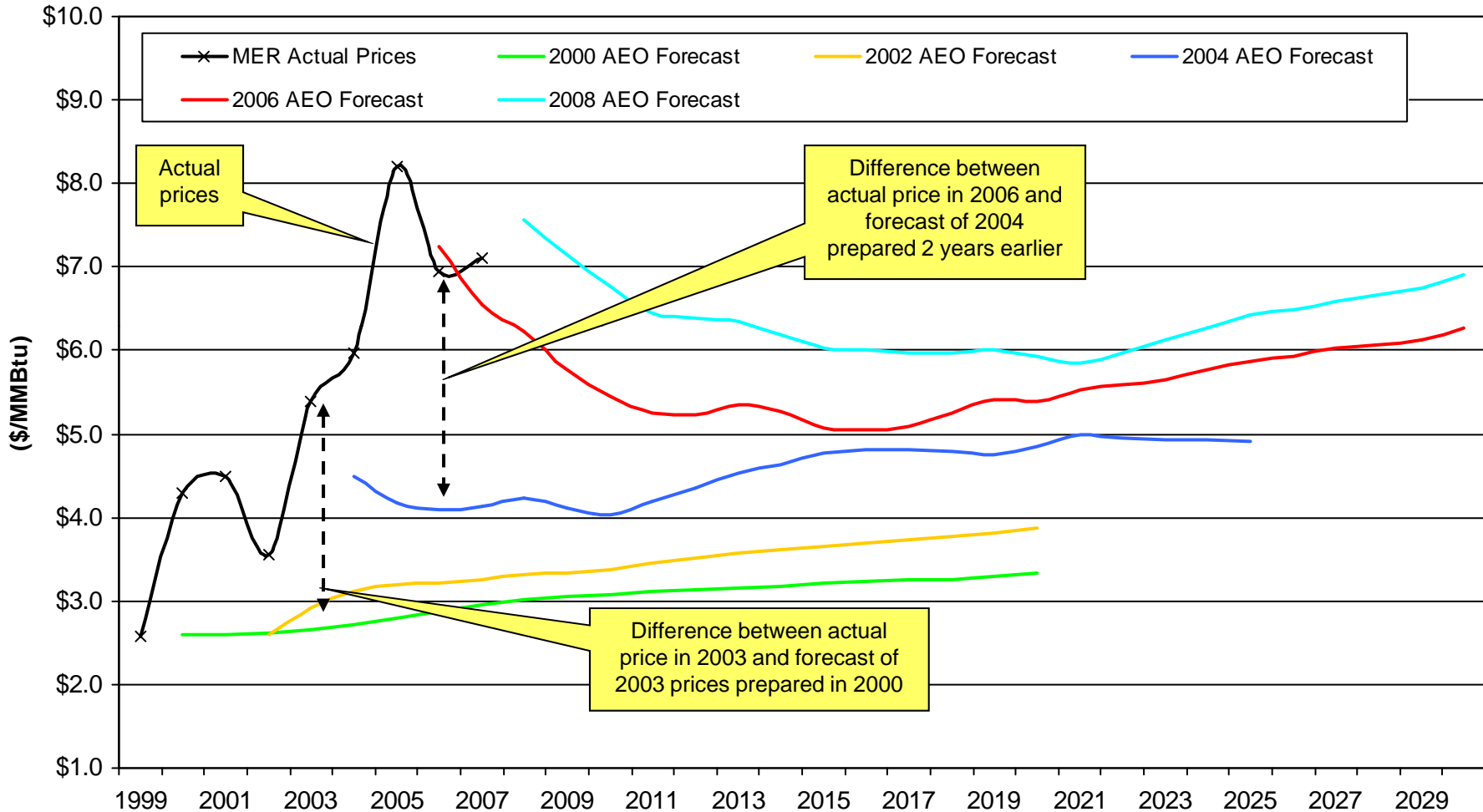
Notes:

1. Each bar represents the difference between the actual 2007 sales value (3,748 billion/kWh) and the forecasted sales value made in that year.
2. Forecasts begin in 1992 and end in 2007.
3. Electricity sales forecasts are based on Annual Energy Outlook mid-price or reference case values.

Source: Energy Information Administration, "Annual Energy Outlook Retrospective Review, 1982 - 2008," September 2008.

# Forecasts of Fossil Fuel Prices: Comparing Past Forecasts with Actual Prices

## Uncertainty about Future Natural Gas Prices: Forecasted and Actual Prices of Natural Gas to Electric Generators (U.S. – AEO and MER) Comparison of Biennial Forecasts Prepared in Years 2000 - 2008 and Actual Prices From 1999 - 2007 (Nominal Dollars/MMBtu)



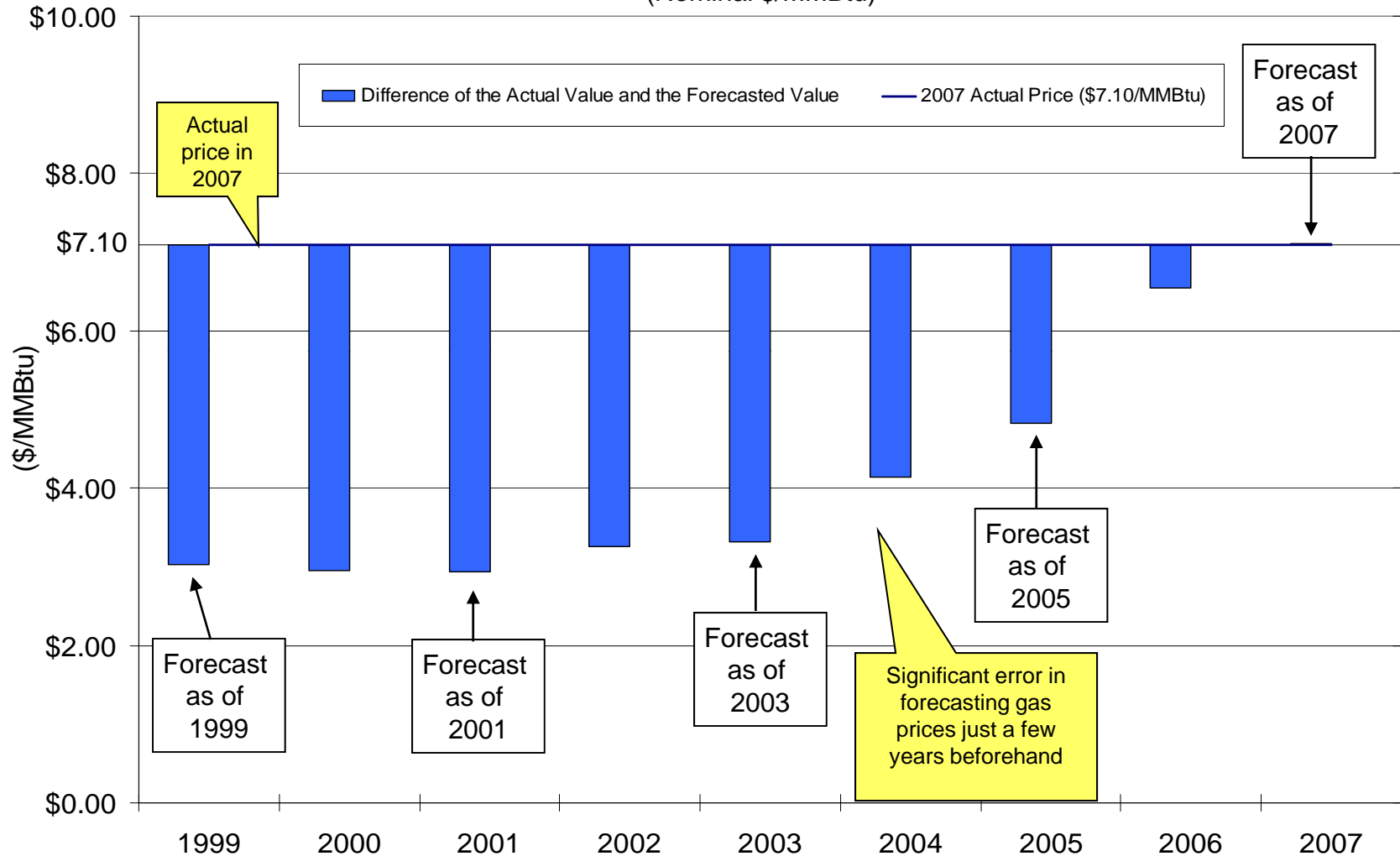
**Notes:**

- Actual prices are from the Monthly Energy Review and are defined as the cost of natural gas receipts at electric generating plants including taxes.
- Prices to electric generators include electricity-only and combined heat and power plants whose primary business is to sell electricity, or electricity and heat, to the public. It also includes small power producers and exempt wholesale generators.

**Sources:**

- Energy Information Administration, Annual Energy Outlook Forecasts, 1999 - 2008, Table 3.
- Energy Information Administration, 2008 Monthly Energy Review, Energy Prices, October 22, 2008.

## Uncertainty in Expectations about Future Natural Gas Prices: Annual Differences of Forecasts of 2007 Prices versus the Actual 2007 Natural Gas Price to Electric Generators Comparison of Forecasts Prepared in Each Year from 1999 - 2007 (U.S. – AEO and MER) (Nominal \$/MMBtu)



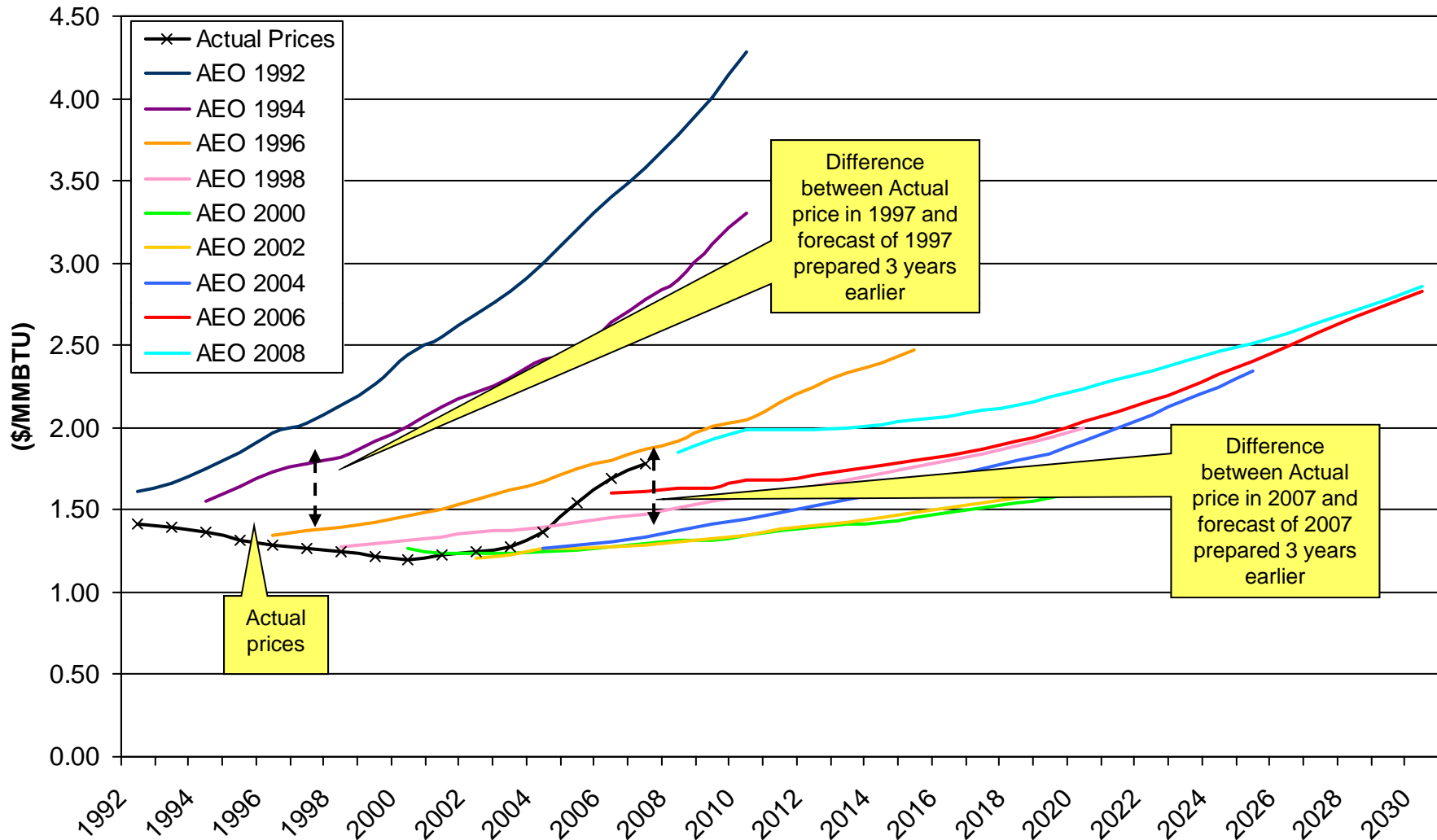
**Notes:**

1. Each bar represents the difference between the actual 2007 price of natural gas (\$7.10/MMBtu) and the forecasted price made in that year.
2. Forecasts begin in 1999 and end in 2007.
3. Natural gas prices forecasts are based on Annual Energy Outlook mid-price or reference case values.

**Sources:**

1. Energy Information Administration, Annual Energy Outlook Forecasts, 1999 - 2008, Table 3.
2. Energy Information Administration, 2008 Monthly Energy Review, Energy Prices, October 22, 2008.

# Uncertainty about Future Coal Prices: Forecasted and Actual Prices of Coal to Electric Generating Plants (U.S. - Retrospective Review) Comparison of Actual Prices from 1992 - 2007 and Biennial Forecasts for the Years 1992 - 2008 (Current Dollars/MMBtu)



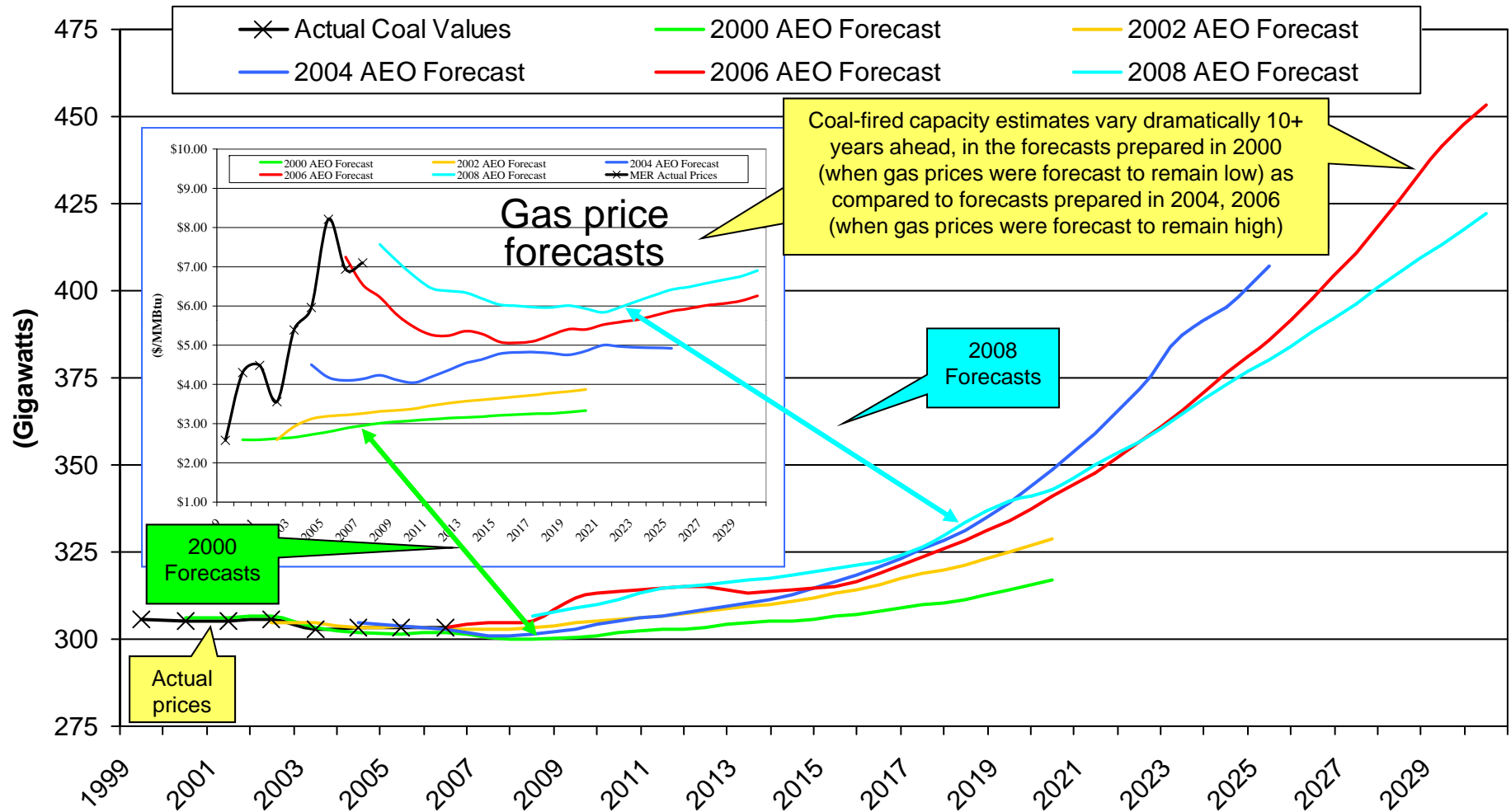
**Notes:**

1. Coal prices forecasts are based on Annual Energy Outlook mid-price or reference case current dollar values.
  2. AEO forecasts are published in the listed forecast year. The first data point of each AEO forecast series, which begin in the publication year, is a forecasted value rather than an actual value.
- Source: Energy Information Administration, "Annual Energy Outlook Retrospective Review, 1982 - 2008," September 2008.

# Forecasts of and Uncertainty Surrounding Various Other Factors Affecting Investment Conditions in the Electric Industry:

Expectations Over Time about:  
Coal-Fired Capacity, Wind and Other Renewable Generation,  
Commodity Input Costs, Power Plant Construction Costs, Carbon  
Allowance Prices and Emission Reduction Requirements, Political Winds

# Uncertainty about Future Coal Capacity Compared with Expectations about Natural Gas Prices: Forecasted and Actual Coal Capacity (U.S. - AEO) Comparison of Biennial Forecasts Prepared in Years 2000 - 2008 and Actual Prices From 1999 - 2007 (Gigawatts)



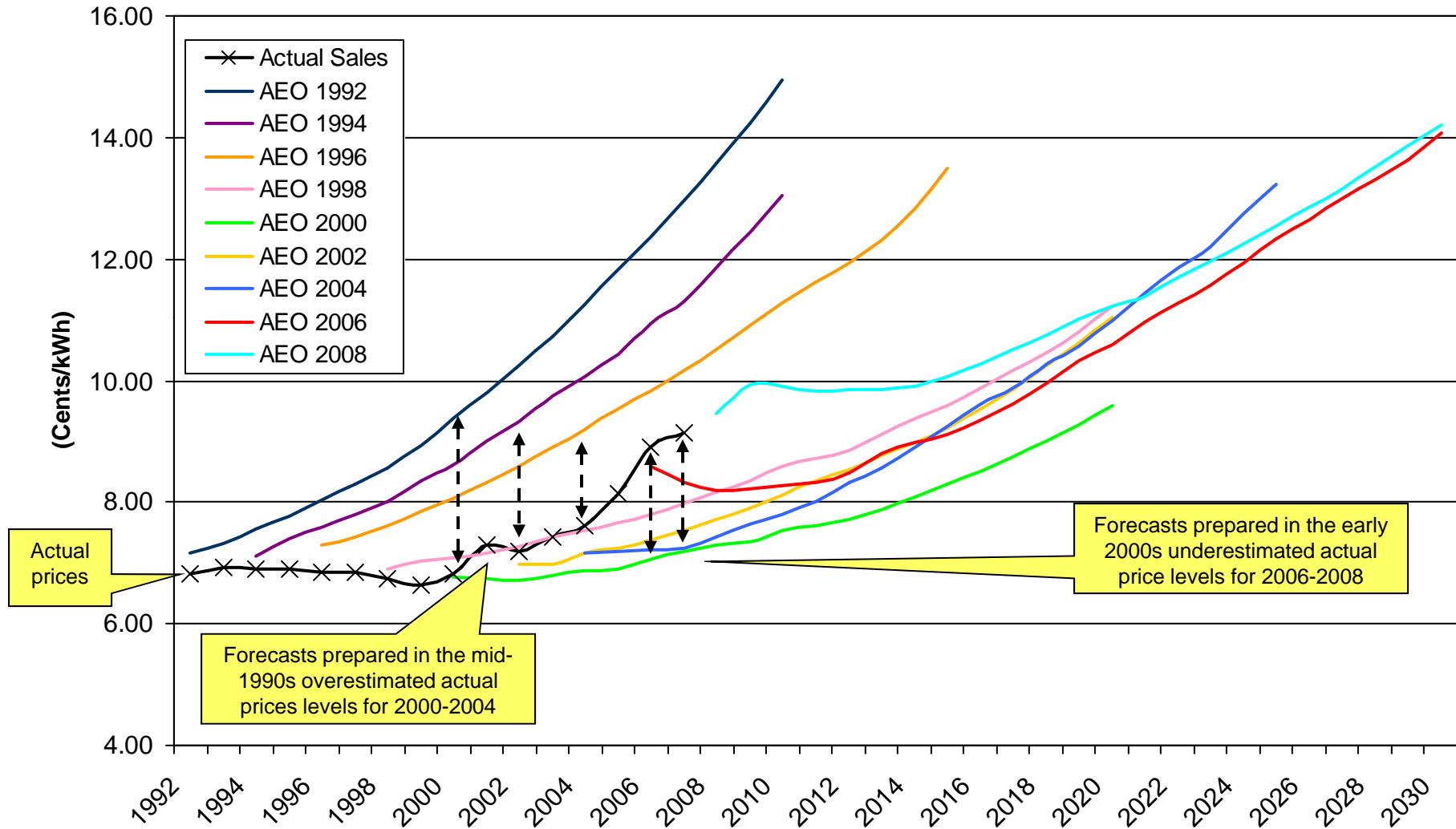
**Notes:**

1. Actual coal capacity values are from the Electric Power Annual and are defined as existing net summer capacity.
2. Capacities include plants that use coal for electric power only and therefore exclude combined heat and power.

**Sources:**

1. Energy Information Administration, Annual Energy Outlook Forecasts, 1999 - 2008, Table 9.
2. Energy Information Administration, 2006 Electric Power Annual, Table 2.1. Existing Net Summer Capacity by Energy Source and Producer Type, 1995 - 2006, October 22, 2007.

# Uncertainty about Future Electricity Prices: Forecasted Average Electricity Prices (U.S. - Retrospective Review) Comparison of Actual Prices in 1992 - 2007 and Biennial Forecasts Prepared in the Years 1992 - 2008 (Nominal Cents/kWh)

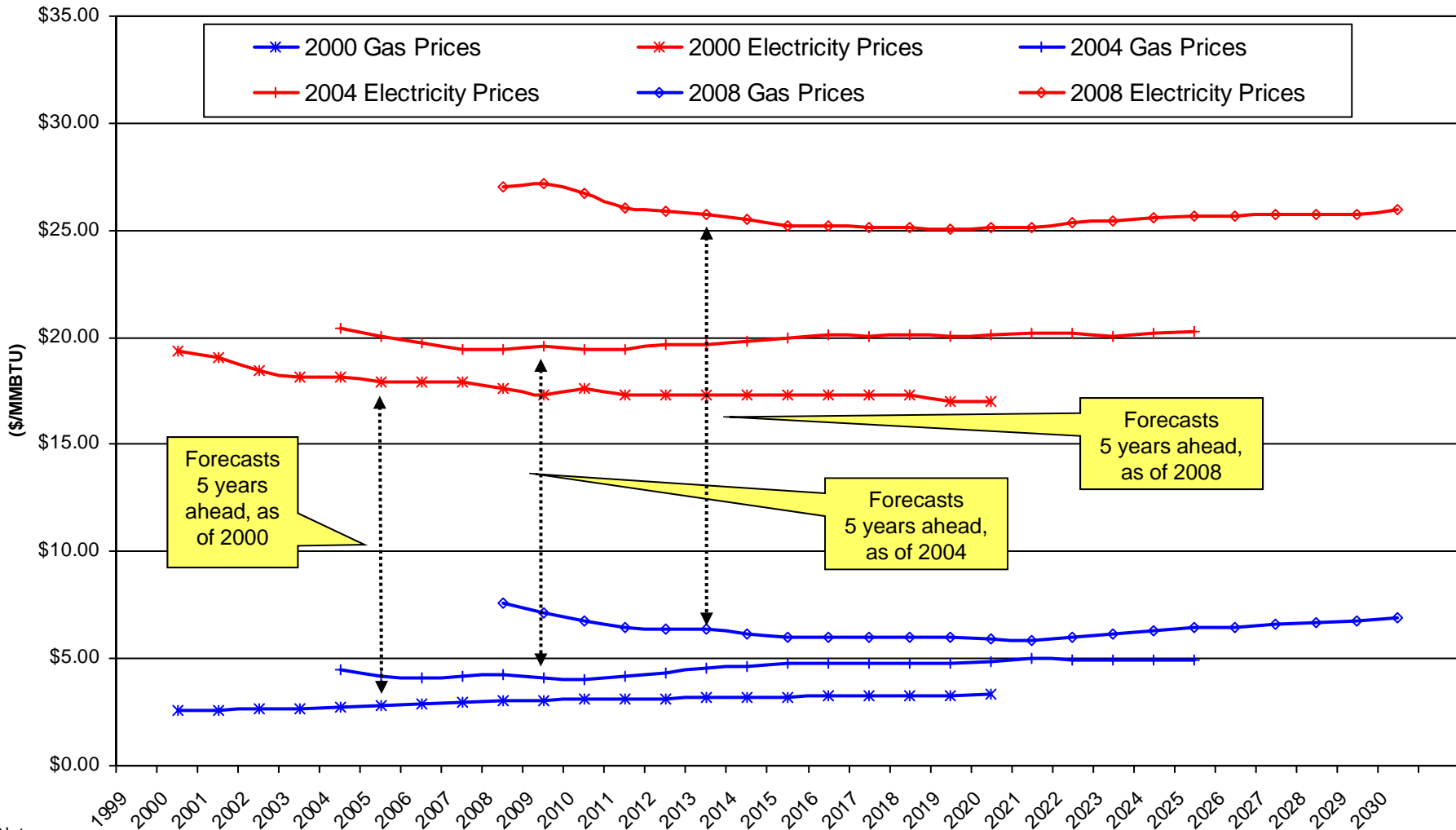


**Notes:**

1. Average electricity price forecasts are based on Annual Energy Outlook mid-price or reference case values.
2. Forecasted series begin in the year of the listed AEO publication.

Source: Energy Information Administration, "Annual Energy Outlook Retrospective Review, 1982 - 2008," September 2008.

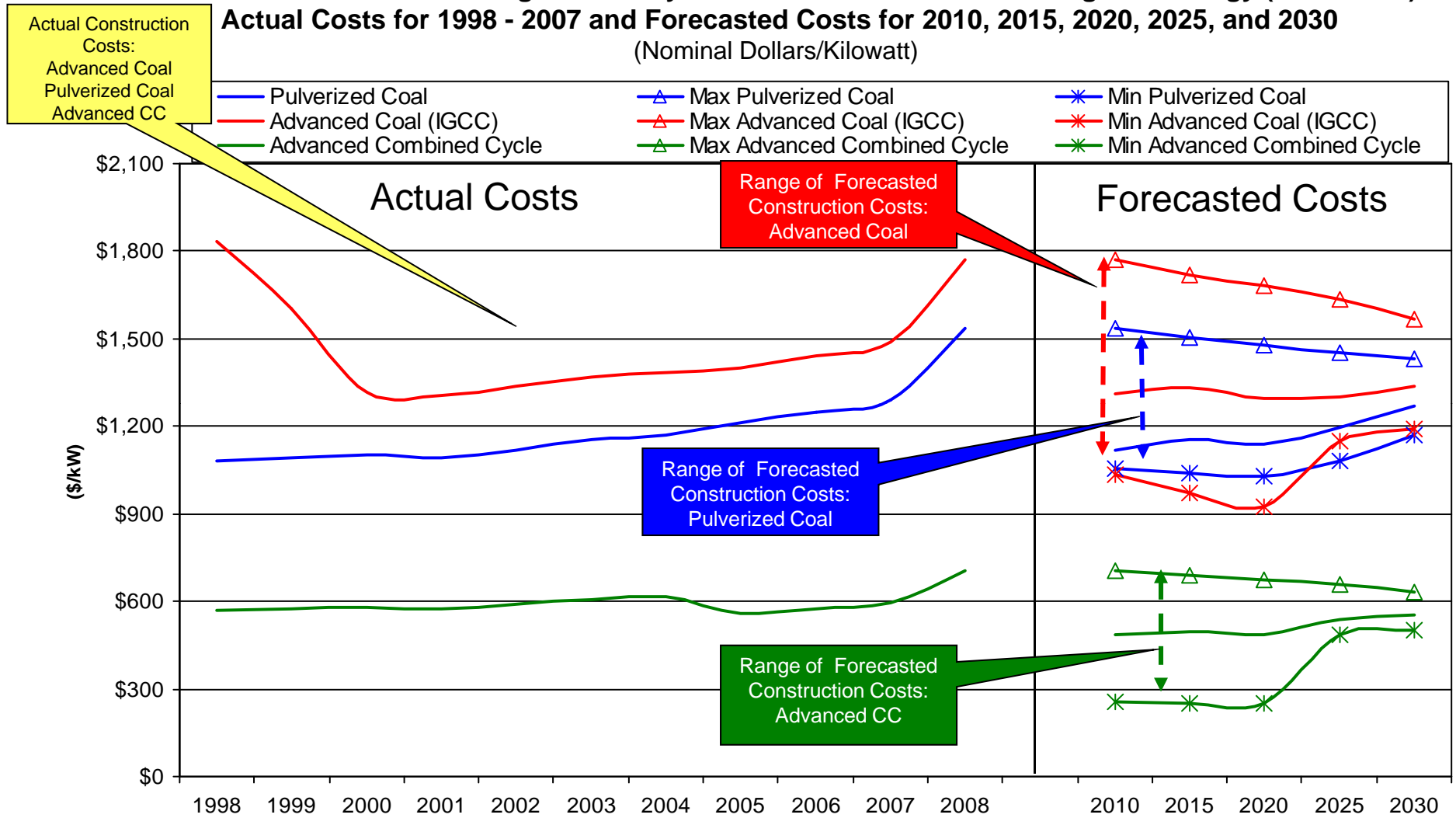
# Uncertainty about Natural Gas Prices and Electricity Prices : Forecasted Long Run Natural Gas Prices and Electricity Prices (U.S. - AEO) Comparison of Forecasts Prepared in the Years 2000, 2004, and 2008 (Nominal Dollars/MMBtu)



Notes:  
 1. Natural Gas prices are the prices to electric generators and include electricity-only and combined heat and power plants whose primary business is selling electricity (with or without heat) to others.  
 2. Electricity prices are revenues per kilowatt-hour and represent the average of all sectors. These prices have been converted from cents per kilowatt-hour to dollars per MMBtu by using the conversion factor of 1 kWh = 3,412 Btu.  
 Sources: Energy Information Administration, Annual Energy Outlook Forecasts, 1999 - 2008, Tables 3, 8; Energy Information Administration, "Conversion Factors," from Appendix H of the 2001 Annual Energy Outlook, available at <http://www.eia.doe.gov/oiaf/archive/aeo01/pdf/apph.pdf>.

# Uncertainty about Future Power Plant Construction Costs: Actual and Forecasted Overnight Costs by Conventional Power Generating Technology (U.S. - AEO)

**Actual Costs for 1998 - 2007 and Forecasted Costs for 2010, 2015, 2020, 2025, and 2030**  
(Nominal Dollars/Kilowatt)

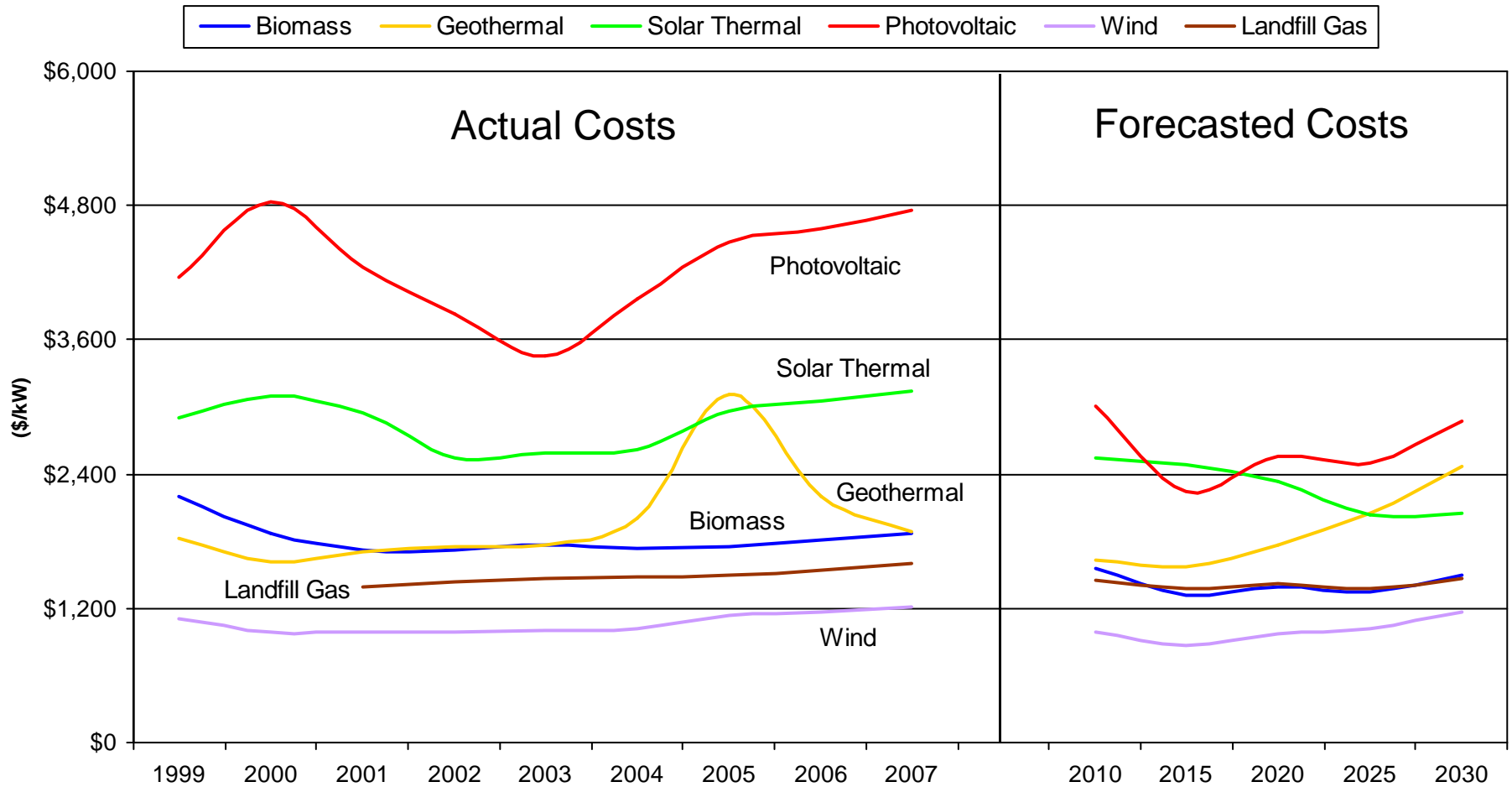


**Notes:**

- Overnight capital costs represent costs of new projects as of the forecast year. The actual costs include contingency factors and exclude regional multipliers and learning effects. Forecasted costs include contingency factors, technological optimism, and learning effects and exclude regional multipliers.
- Costs to the left of the vertical line represent actual overnight costs for 1998 - 2008. Costs to the right represent the average, maximum, and minimum forecast costs for each technology.
- The vertical line highlights the different intervals on the horizontal axis.
- The actual number of forecasts per year vary due to inconsistencies with EIA forecasts and the timing of the forecast.

Source: Energy Information Administration, Supplemental Tables to the Annual Energy Outlook, Tables from the Electric Market Module, 1998 - 2008.

**Uncertainty about Future Power Plant Construction Costs:  
Actual and Forecasted Overnight Costs by Renewable Energy Technology (U.S. - AEO)  
Actual Costs for 1999 - 2007 and Forecasted Costs for 2010, 2015, 2020, 2025, and 2030  
(Nominal Dollars/Kilowatt)**



**Notes:**

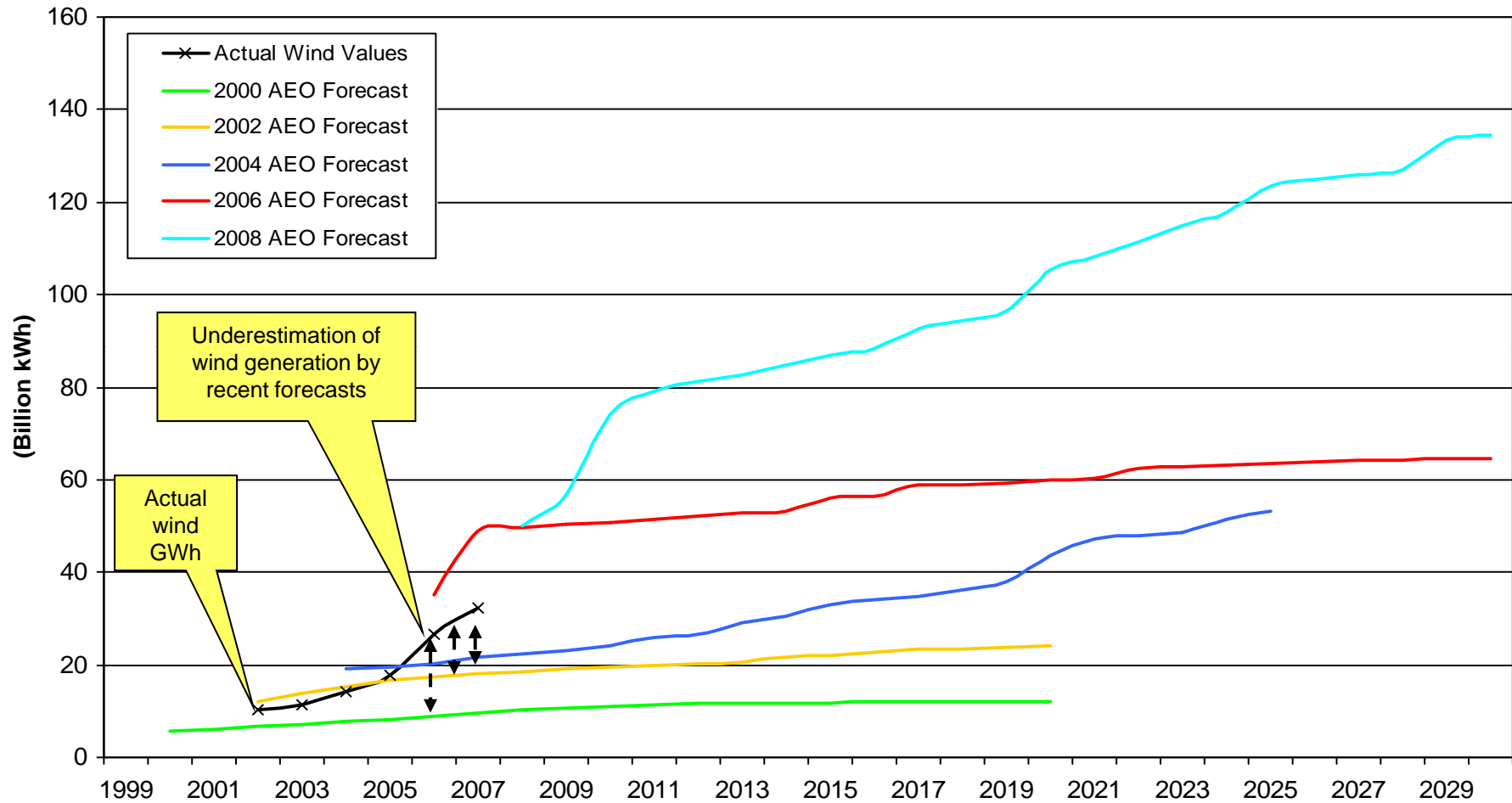
- Overnight capital costs represent costs of new projects as of the forecast year. The actual costs include contingency factors and exclude regional multipliers and learning effects. Forecasted costs include contingency factors, technological optimism, and learning effects and exclude regional multipliers.
- Actual data for landfill gas is reported starting in 2001.
- Costs to the left of the vertical line represent actual overnight costs for 1999 - 2007. Costs to the right represent the average, maximum, and minimum forecast costs for each technology.
- The vertical line highlights the different intervals on the horizontal axis.
- The actual number of forecasts per year may or will vary due to inconsistencies with EIA forecasts and the timing of the forecast.

Source: Energy Information Administration, Supplemental Tables to the Annual Energy Outlook, Tables from the Electric Market Module, 1998 - 2008.

# Uncertainty about Future Wind Generation: Forecasted and Actual Values of Wind Generation (U.S. - EIA)

## Comparison of Biennial Forecasts Prepared in Years 2000 - 2008 and Actual Values From 2002 - 2007

(Billion kWh)



**Notes:**

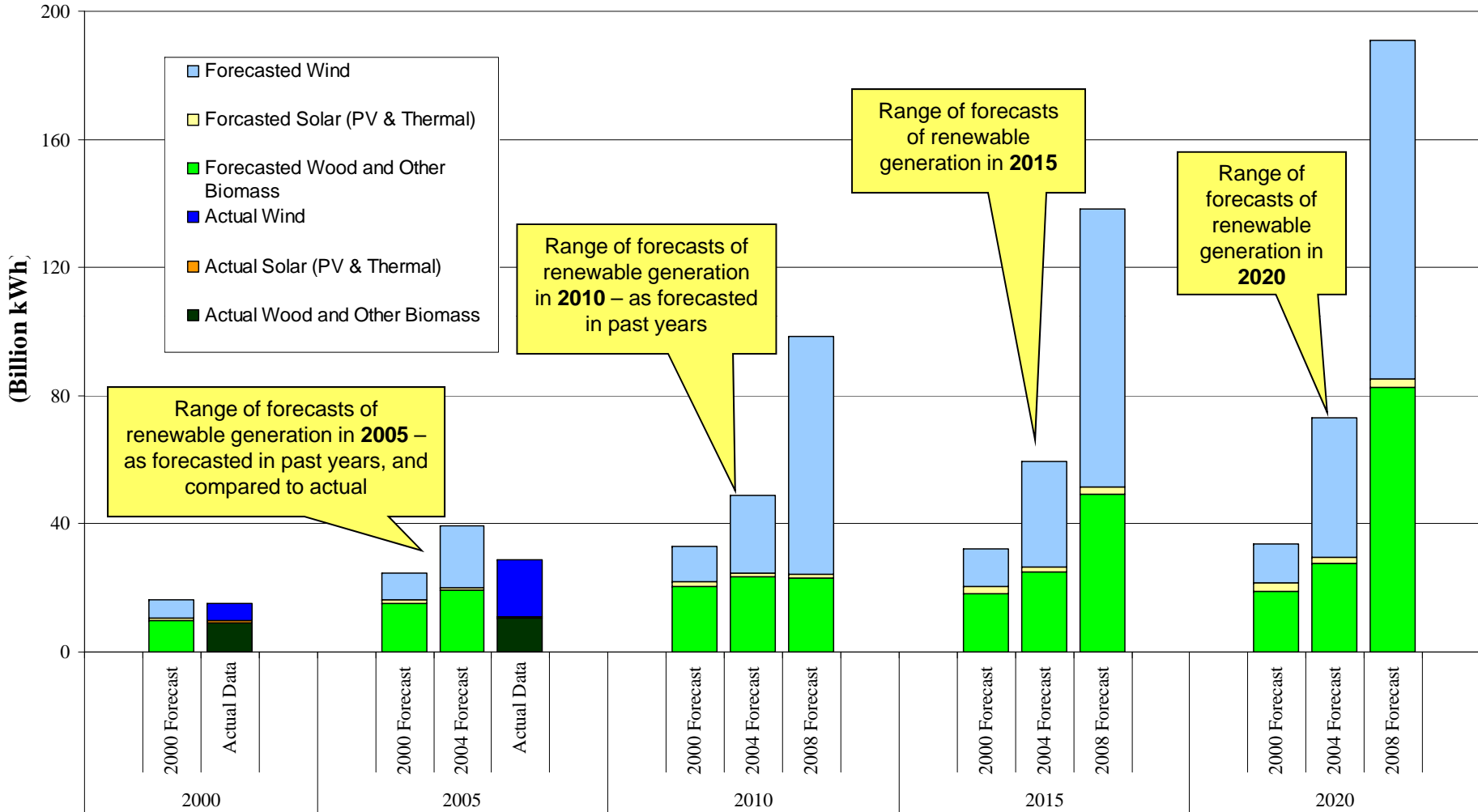
1. Actual generation values for 2002 – 2006 are from the “Renewable Energy Trends in Consumption and Electricity” and are defined as net generation of wind. The actual value for 2007 is from the EIA 906/920 Database and is the sum of wind net generation in the December 2007 data.
2. Actual data only exist from 2002 - 2007.

**Sources:**

1. Energy Information Administration, Annual Energy Outlook Forecasts, 1999 - 2008, Tables 16 and 17.
2. Energy Information Administration, “Renewable Energy Trends in Consumption and Electricity 2006,” Table 1.11, July 2008.
3. Energy Information Administration, Form EIA-906 and EIA-920 Databases, December 2007, available at [http://www.eia.doe.gov/cneaf/electricity/page/eia906\\_920.html](http://www.eia.doe.gov/cneaf/electricity/page/eia906_920.html).

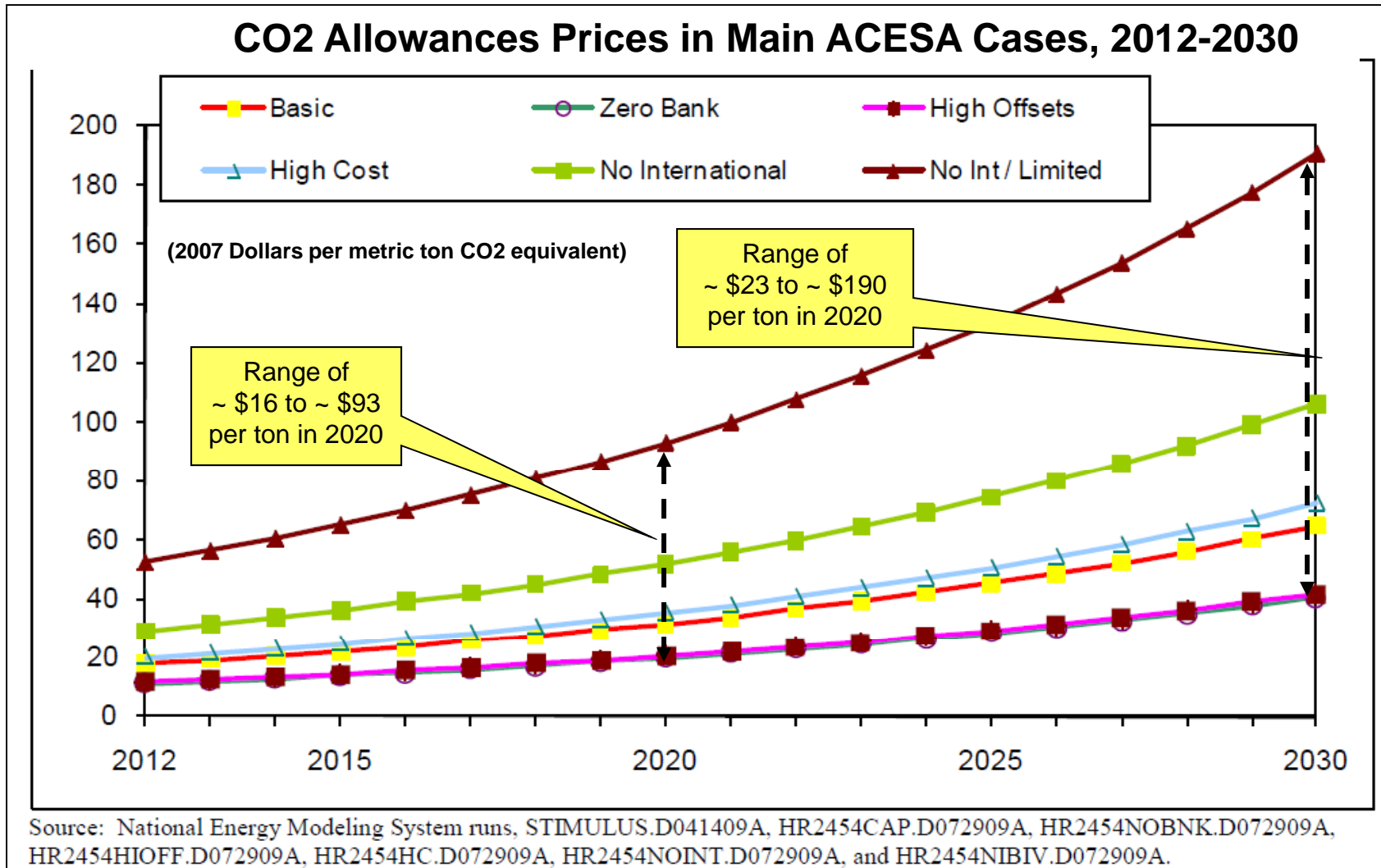
# Uncertainty about Future Renewable Generation:

Forecasted and Actual Generation for Wind, Solar (PV & Thermal), and Wood and Other Biomass (U.S. - AEO)  
 Comparison of Forecasts Made for the Years 2000, 2005, 2010, 2015 & 2020 and Actual Generation in 2000 & 2005  
 (Billion kWh)



Notes:  
 1. Actual generation values are from the most recent AEO edition that contains those data points. The 2000 actual data are from the 2003 AEO and the 2005 actual data are from the 2008 AEO.  
 2. Solar does not include off-grid photovoltaics.  
 3. Wood and other biomass includes projections for energy crops after 2010.  
 Source: Energy Information Administration, Annual Energy Outlook Forecasts, 2000, 2003, 2004, 2008, Table 17.

**Uncertainty about Cost of Future CO2 Allowances:  
Forecasts of Allowance Prices Under Different Policy Assumptions  
Forecasts of Carbon Dioxide Allowances - Results from Various Model Projections  
(2007 Dollars per metric ton CO2 equivalent)**

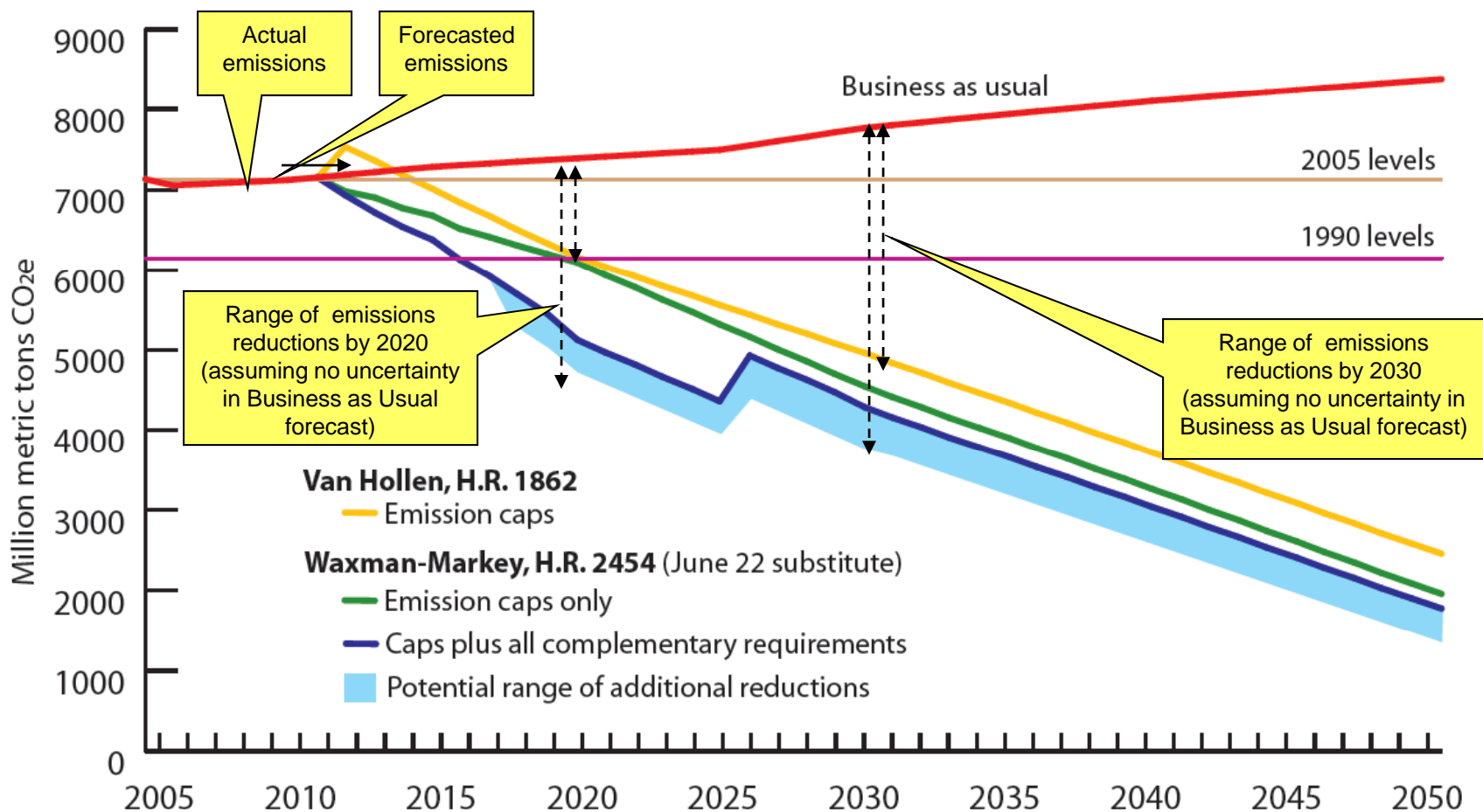


Source: Energy Information Administration, "Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009," 8-2009, SR/OIAF/2009-05, Figure ES-3.

## Uncertainty About Future CO2 Reduction Requirements: Forecasts of Allowance Prices Under Different Policy Assumptions

### Emission Reductions Under Cap-and-Trade Proposals in the 111th Congress, 2005-2050

June 25, 2009

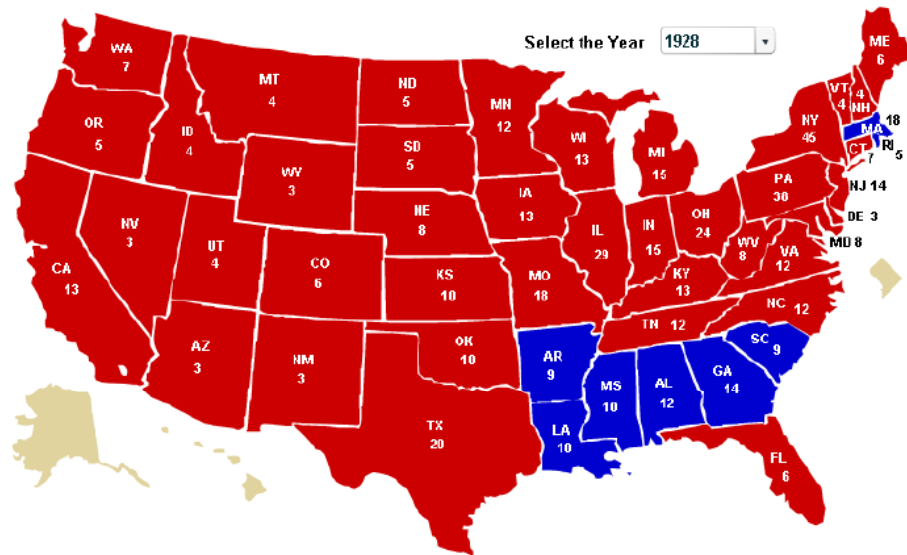


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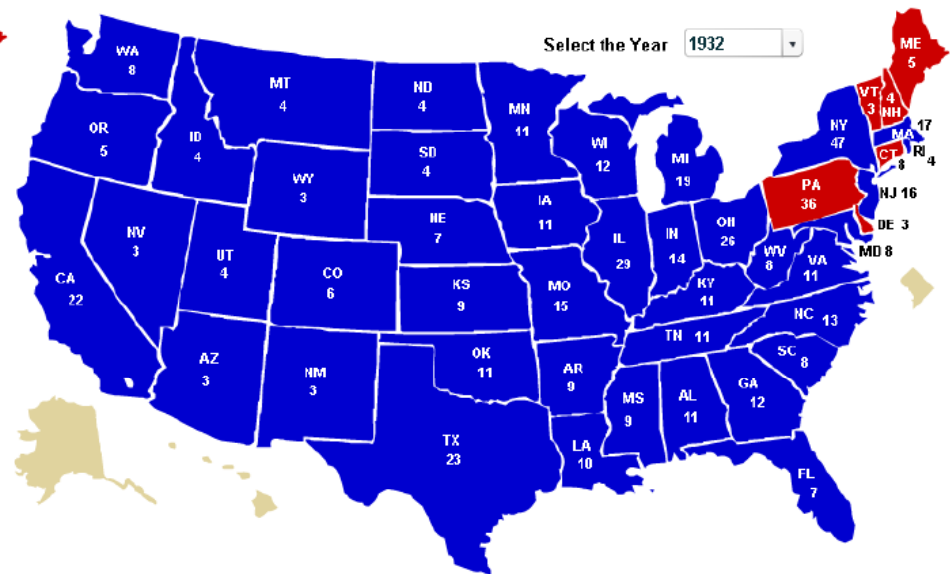
For a full discussion of underlying methodology, assumptions and references, please see <http://www.wri.org/usclimatetargets>.

# Uncertainty About Future Policy Directions: Changes in Actual Maps of Presidential Electoral Votes – 1928 v. 1932

## Electoral Votes – 1928 Presidential Election Republican Majority



## Electoral Votes – 1932 Presidential Election Democratic Majority



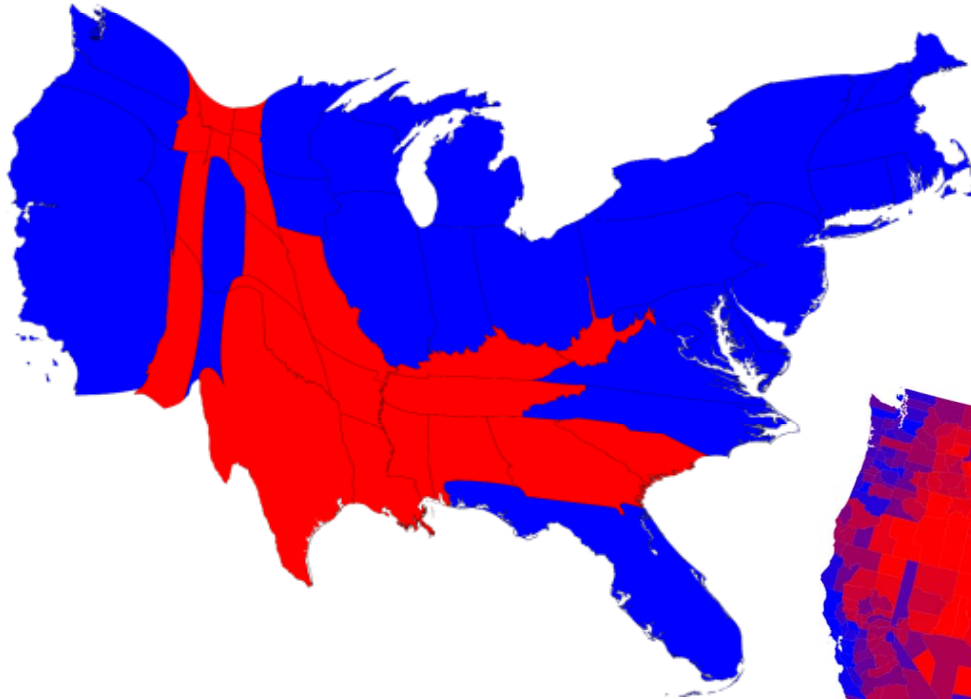
Source: <http://www.270towin.com/> [for 1928 and for 1932]

# Uncertainty About Future Policy Directions: Maps of Presidential and Congressional Electoral Votes – 2008

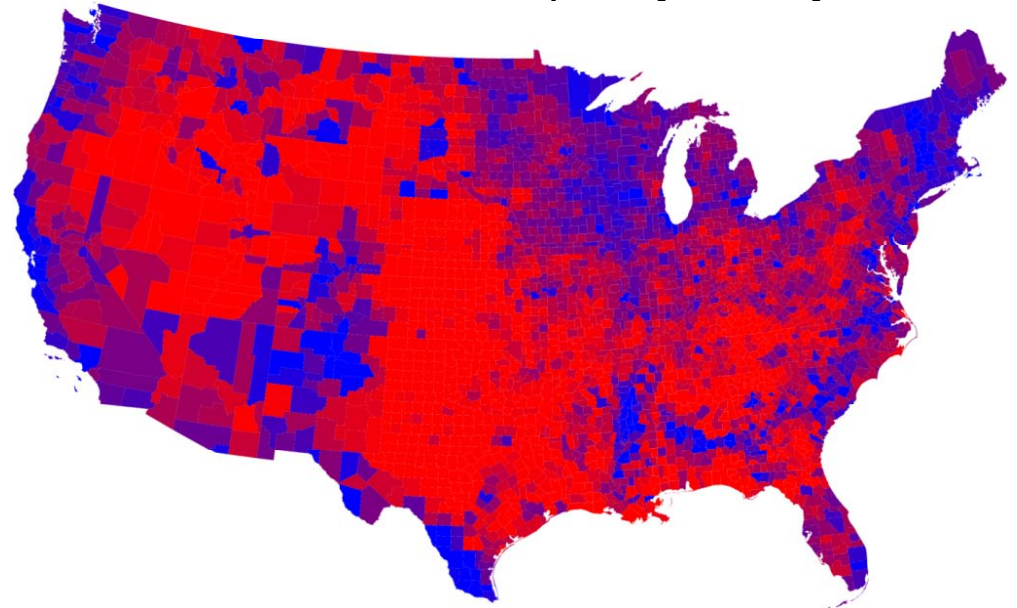
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## The Presidential electoral map – 2008

(weighted by population)



## The electoral map – by county – 2008



Source: <http://www-personal.umich.edu/~mejn/election/2008/>