



ELECTRIC POWER
RESEARCH INSTITUTE

Climate Policy Compliance from an Electric Utility Perspective

EPRI Global Climate Seminar

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Goal is Build on Discussion of Long-term Analyses of Lieberman-Warner

- Focus is very near term – “Year One” and lead-up period
- Question is how would electric sector respond to “sudden” constraint on CO₂ emissions
 - Impact on emissions and drivers
 - Impact on customers and drivers
- Consistent with long term models, but dig into details
- **“The first step can be a doozie”**

Outline

- Electricity Can Play Key Role in Near Term
- Cutting Electric CO₂ Means Cutting Coal, and that's Expensive
- The Near-term Story is Gas
- The Near-term Story is Offsets
- And the Customer Pays
- The Allocation Scramble

L-W Studies Show: Four Paths to Cut CO₂

	Electric Sector	Trans- -portation	Off-sets	ROE (rest of econ)
Timing				
Near term	✓	0	?	?
Long term	✓	✓	✓	?

For a source of significant cuts in CO₂ in the near term the electric sector may be the economy's best shot at cutting emissions – but the CO₂ price necessary to make that happen could exceed \$100/ton

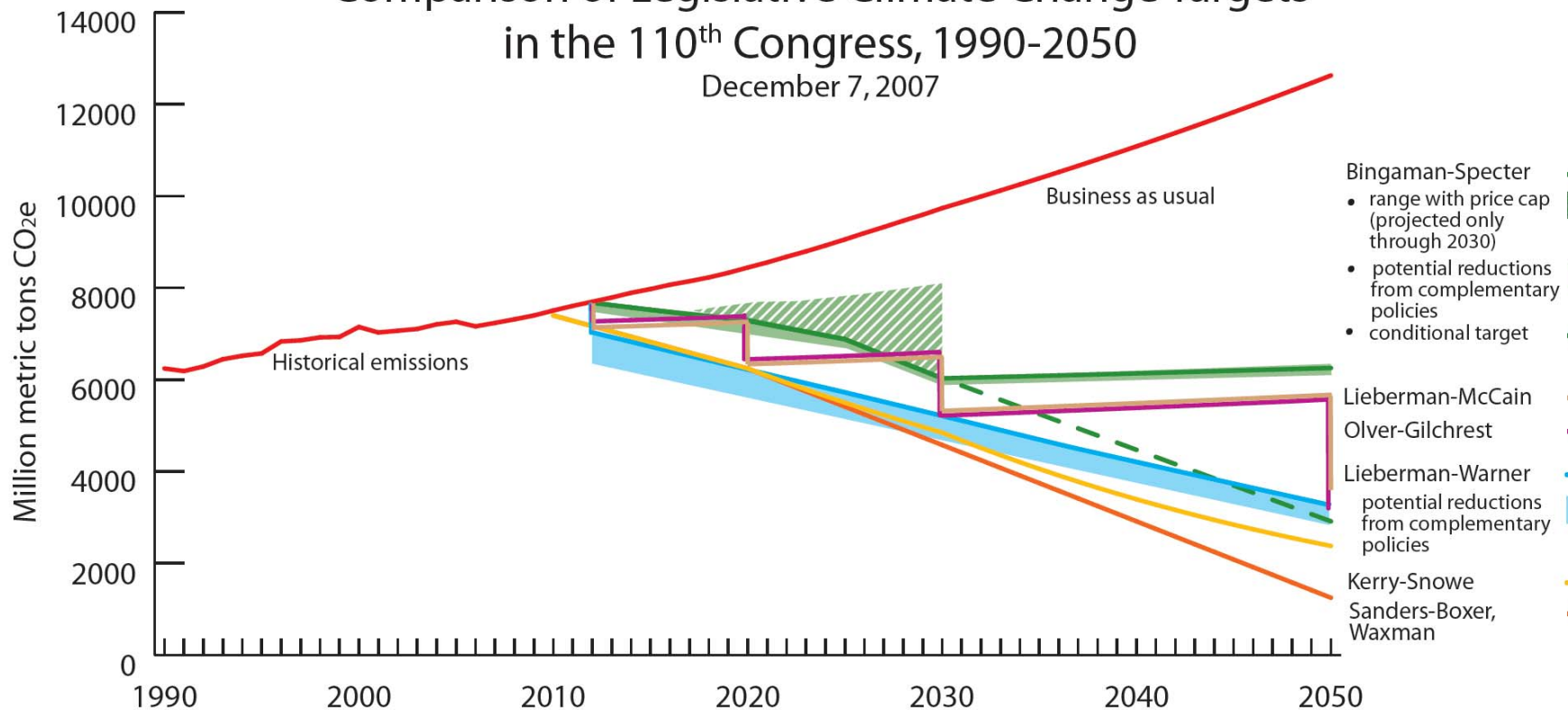
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U.S. Climate Policy Proposals Focused on Cutting Emissions Below Historic Levels

Comparison of Legislative Climate Change Targets in the 110th Congress, 1990-2050

December 7, 2007



 WORLD RESOURCES INSTITUTE

For a full discussion of underlying methodology, assumptions and references, please see <http://www.wri.org/usclimatetargets>. WRI does not endorse any of these bills. This analysis is intended to fairly and accurately compare explicit carbon caps in Congressional climate proposals and uses underlying data that may differ from other analyses. Data post-2030 may be derived from extrapolation of EIA projections.

Electric Sector is Major Source of Emissions

Electric sector's share of national total (2006)

- 33% of total GHGs
- 39% of total CO₂

Shares within the electric sector CO₂

- 15% from natural gas (\$10/MMBtu)
- **83% from coal (\$2.5/MMBtu)**

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Coal-fired Steam – Coal Creek



- Two 550 MW units
- 11,000 Btu/kWh heat rate
- Dispatch cost \$16/MWh
- 1.2 tCO₂/MWh
- 8,100 hrs in 2005

Natural Gas-fired Combined Cycle – Metcalf



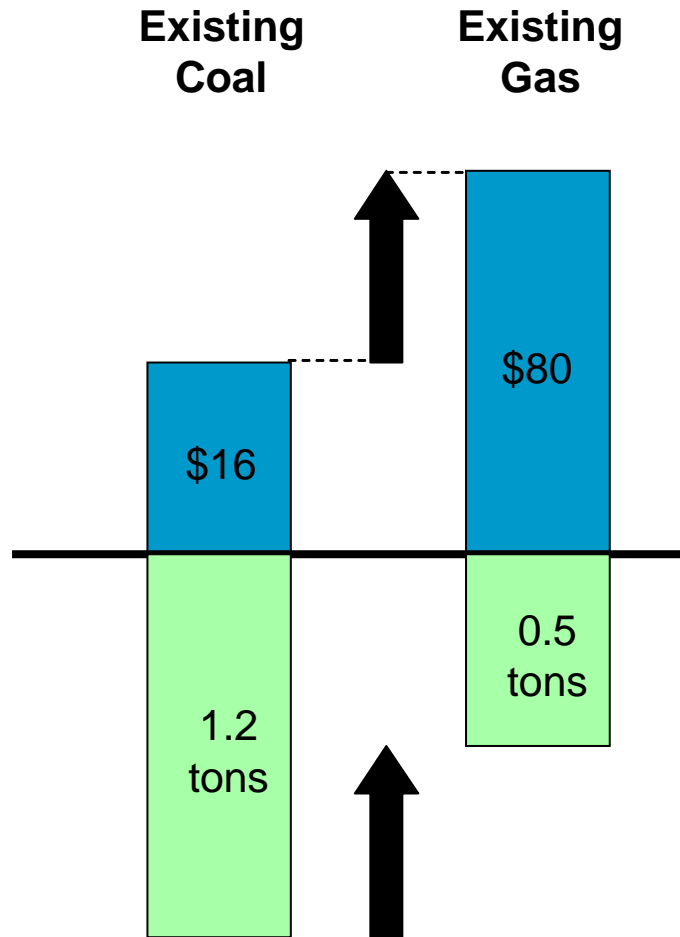
- 417 MW CC
- 8,000 Btu/kWh heat rate
- Dispatch cost \$80/MWh
- 0.48 tCO₂/MWh
- 4,700 hrs in 2005

Natural Gas-fired Combustion Turbine

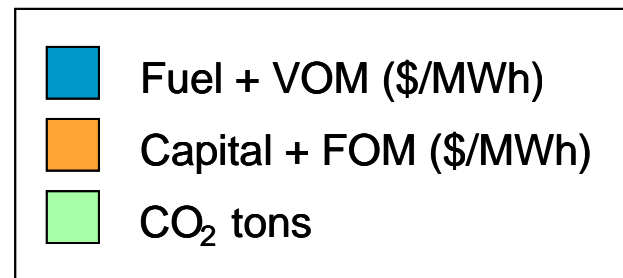


- Five 74 MW CTs
- 13,800 Btu/kWh heat rate
- Dispatch cost \$140/MWh
- 0.81 tCO₂/MWh
- 250 hrs in 2005

Redispatching Metcalf for Coal Creek @ \$91/ton

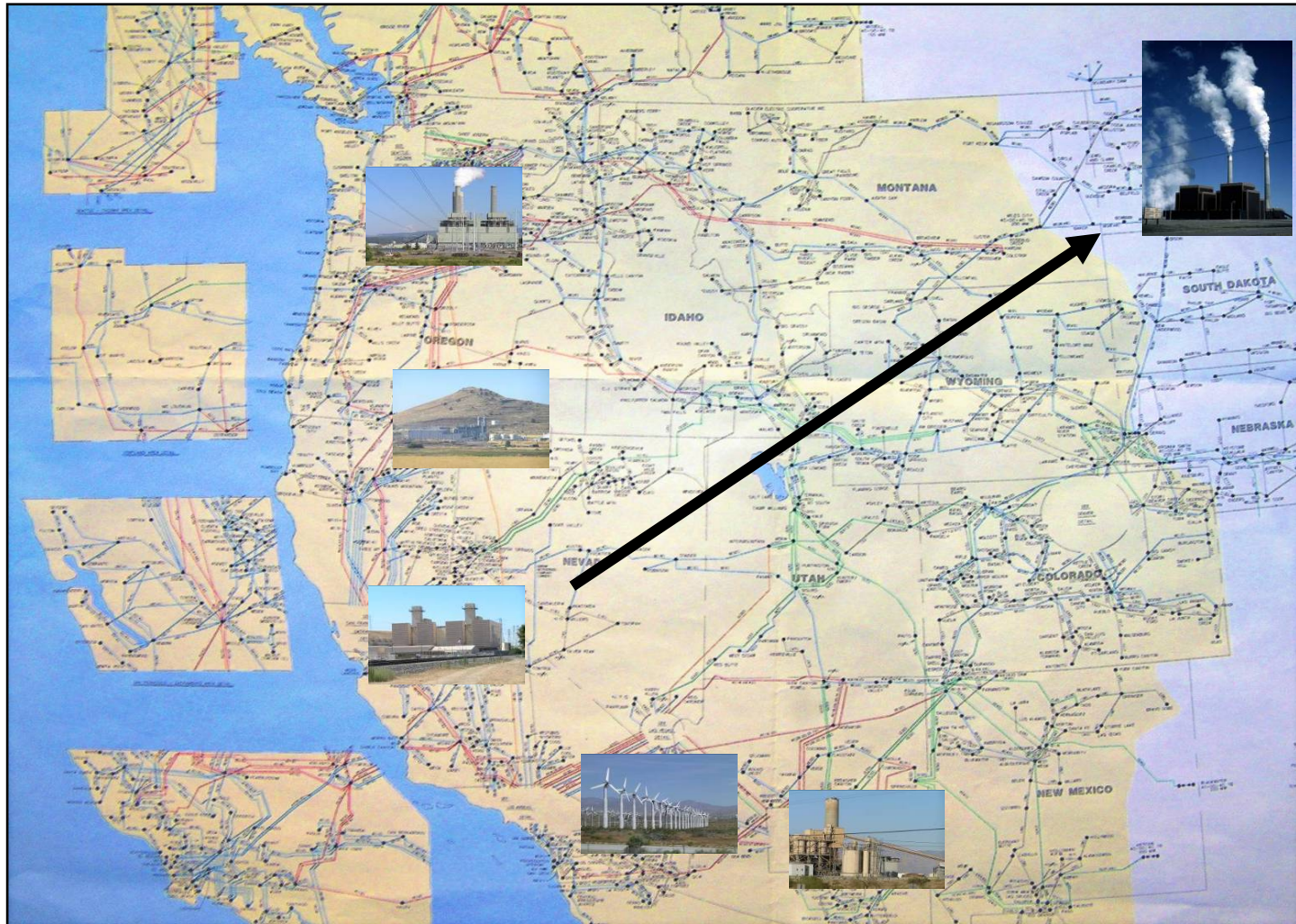


- Extra cost: \$64
- 0.7 tons CO₂ reduced
- Cost/ton = \$91

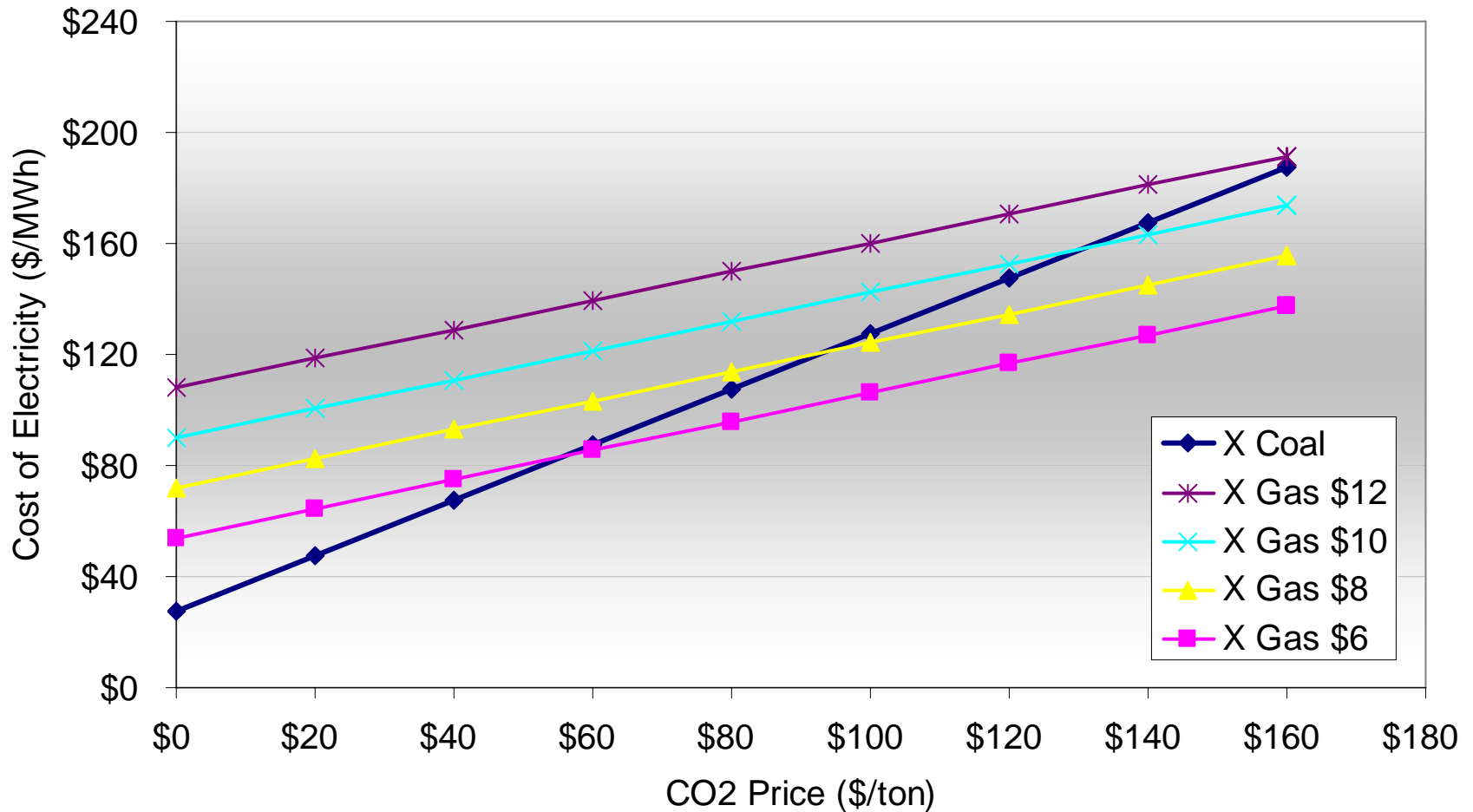


The cost of reducing CO₂ emissions through redispatch is calculated by comparing variable costs

Transmission Charges May Apply

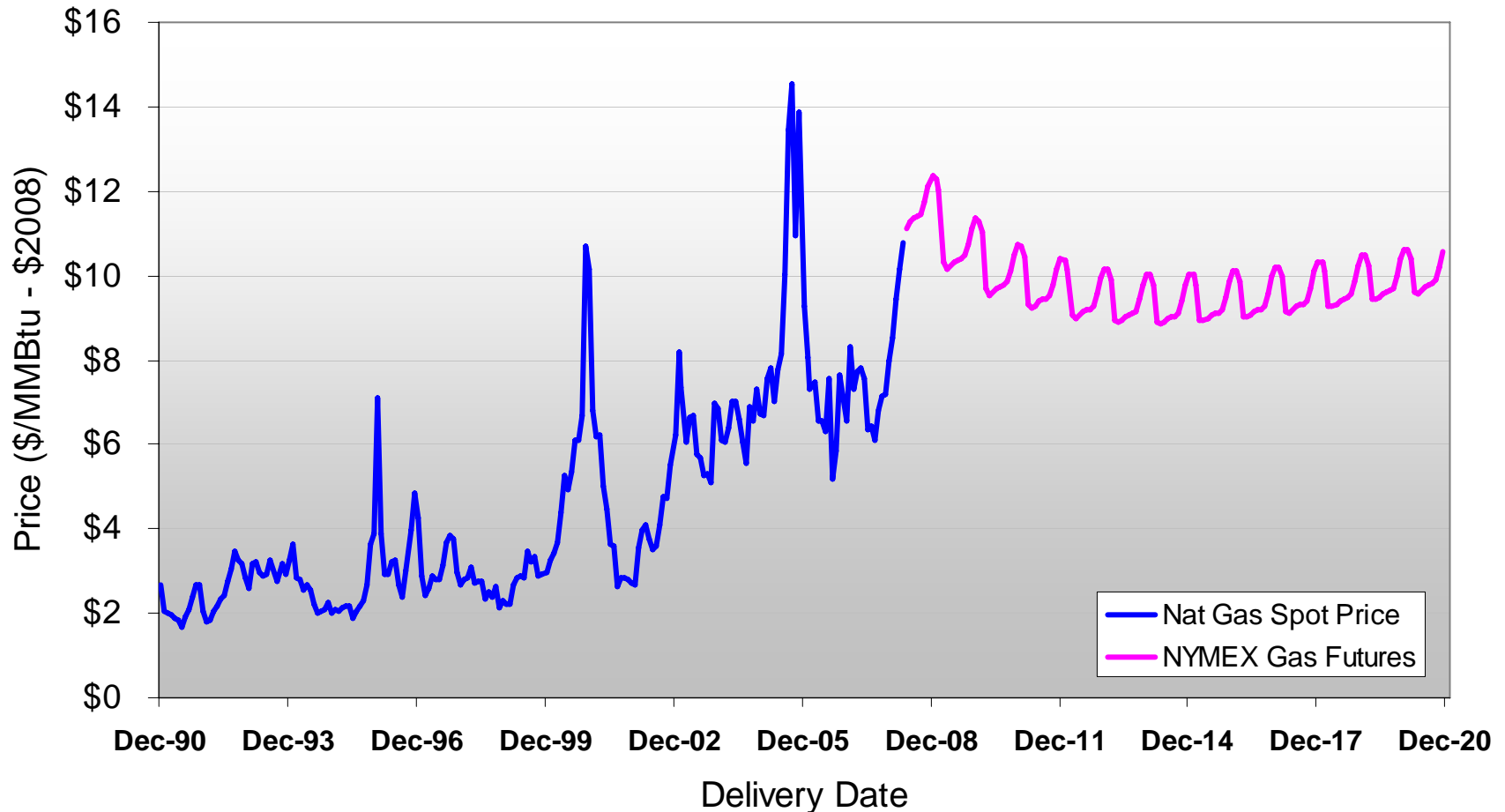


Cost to Cut Emissions by Redispatch Gas for Coal Highly Sensitive to Price of Natural Gas

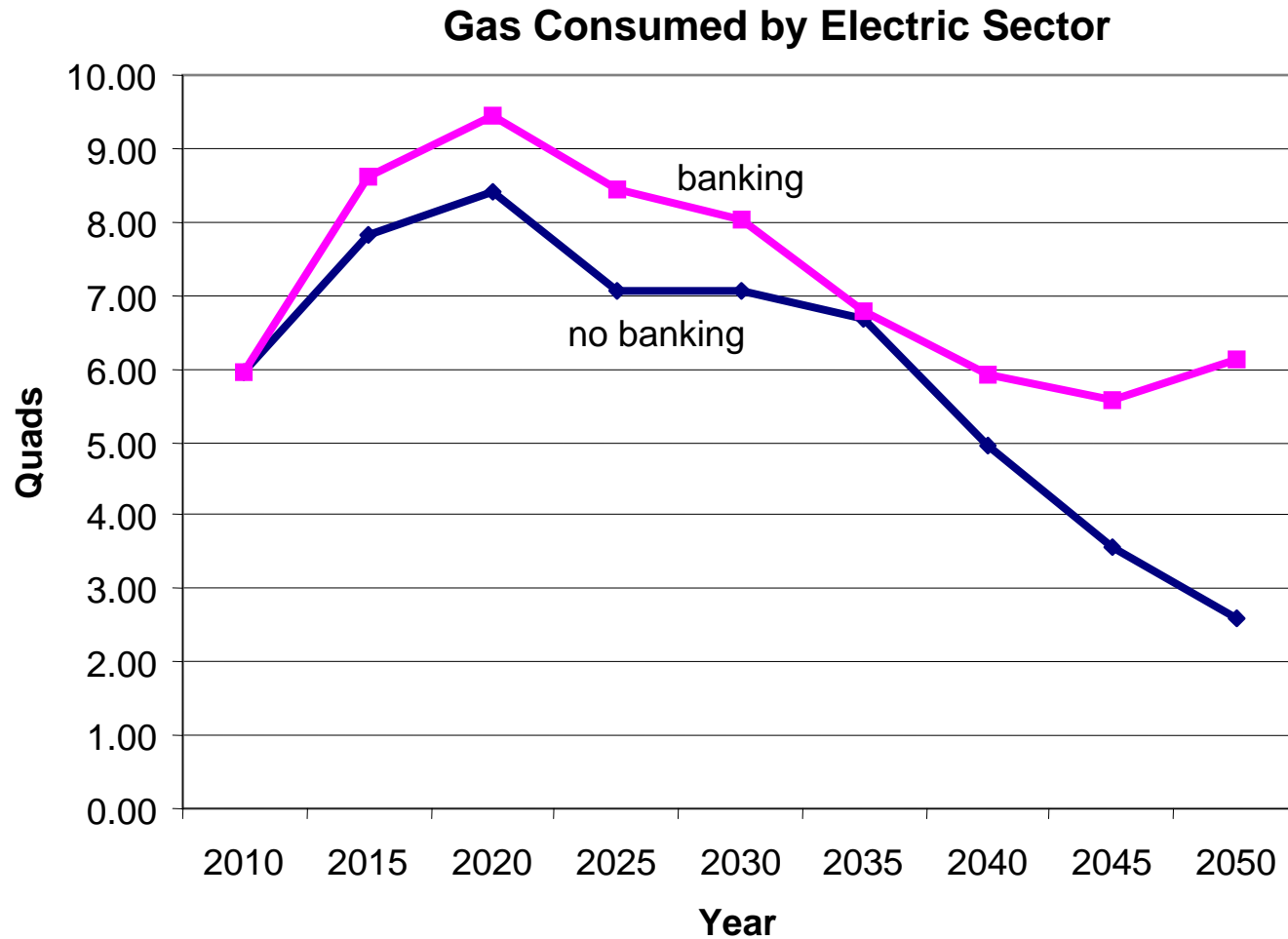


U.S. Natural Gas Prices Near Historic Highs and Expected to Remain High

Henry Hub Natural Gas - Spot Price History and Futures as of 5-16-08

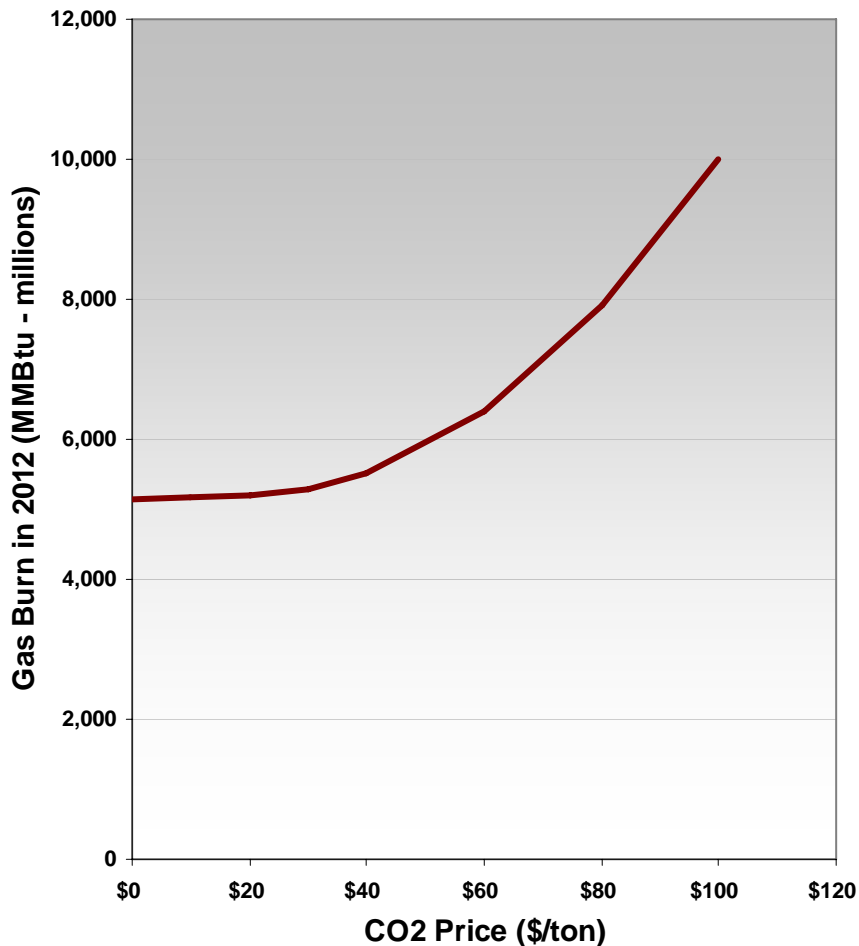


CRAI -- Sensitivity of Natural Gas Consumption to Banking



Total U.S. Electric Sector Gas Burn Highly Sensitive to Higher CO₂ Price

Base Case: Gas Burn in 2012 (MMBtu - millions)



- Gas-intense regions greatly increase gas burn w. high CO₂ prices
- Increased demand for gas should increase gas price
- Buts...
 - Electric sector 1/3 of use
 - Other 2/3's will have incentive to cut demand (\$1/ton → \$0.06/MMBtu)
 - LNG may be swing supply
- **Impact on gas market a critical unknown**

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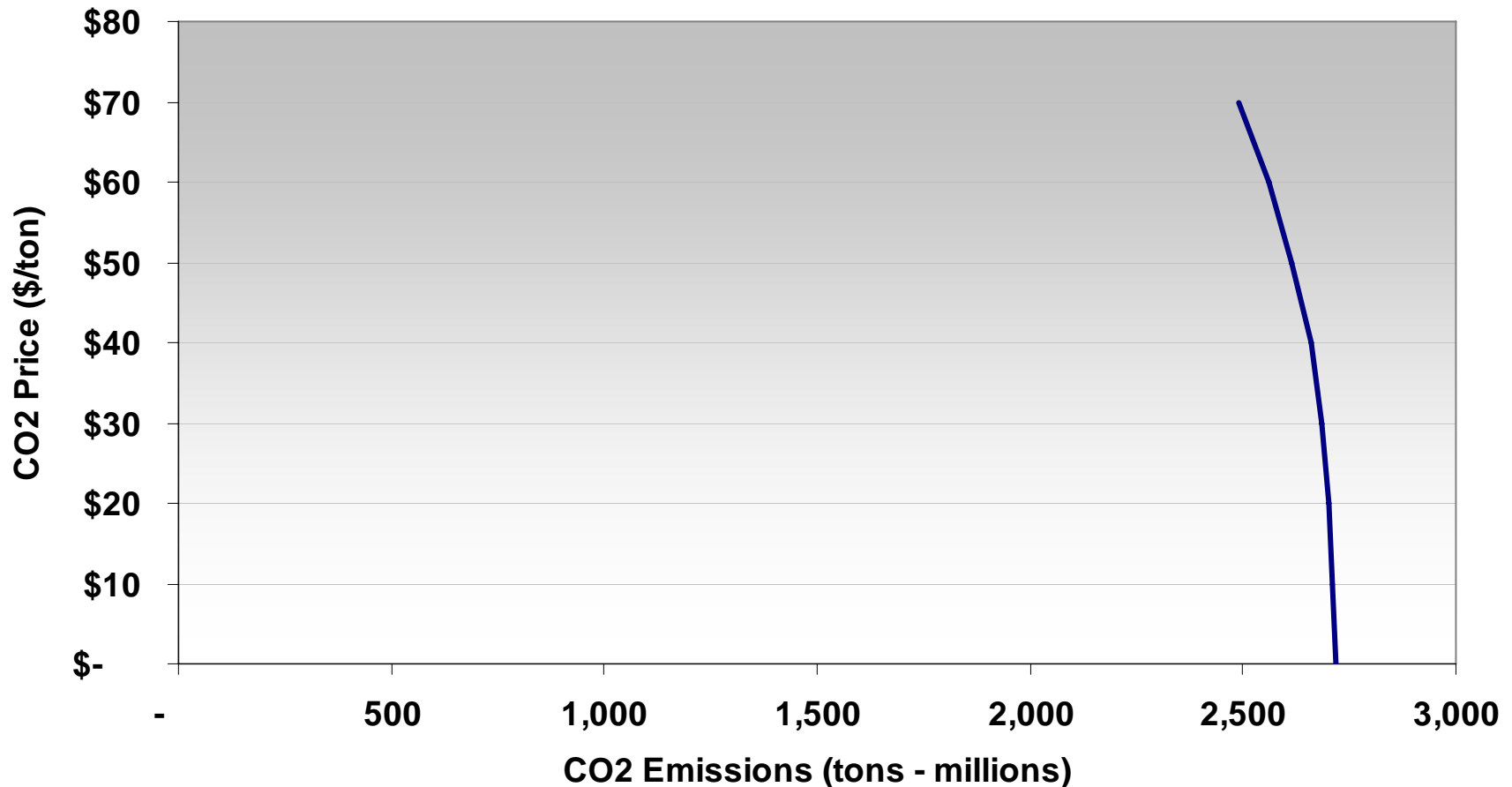
Offsets May be Able to Cut the Electric Sector's Reduction Burden in Short Term

Timing	Electric Sector	Trans- -portation	Off-sets	ROE (rest of econ)
Near term	✓	0	?	?
Long term	✓	✓	✓	?

- Domestic and international opportunities abound
- Not being tied by EU policies opens door wider
- Require rules and process which take time
- New projects take time to arrange, plan, develop, operate, document, verify, record
- Just in time delivery?

With Steep Abatement Curves A Small Number of Offsets Can Have a Big Impact on CO₂ Price

Electric Sector CO₂ Abatement Curve for 2012

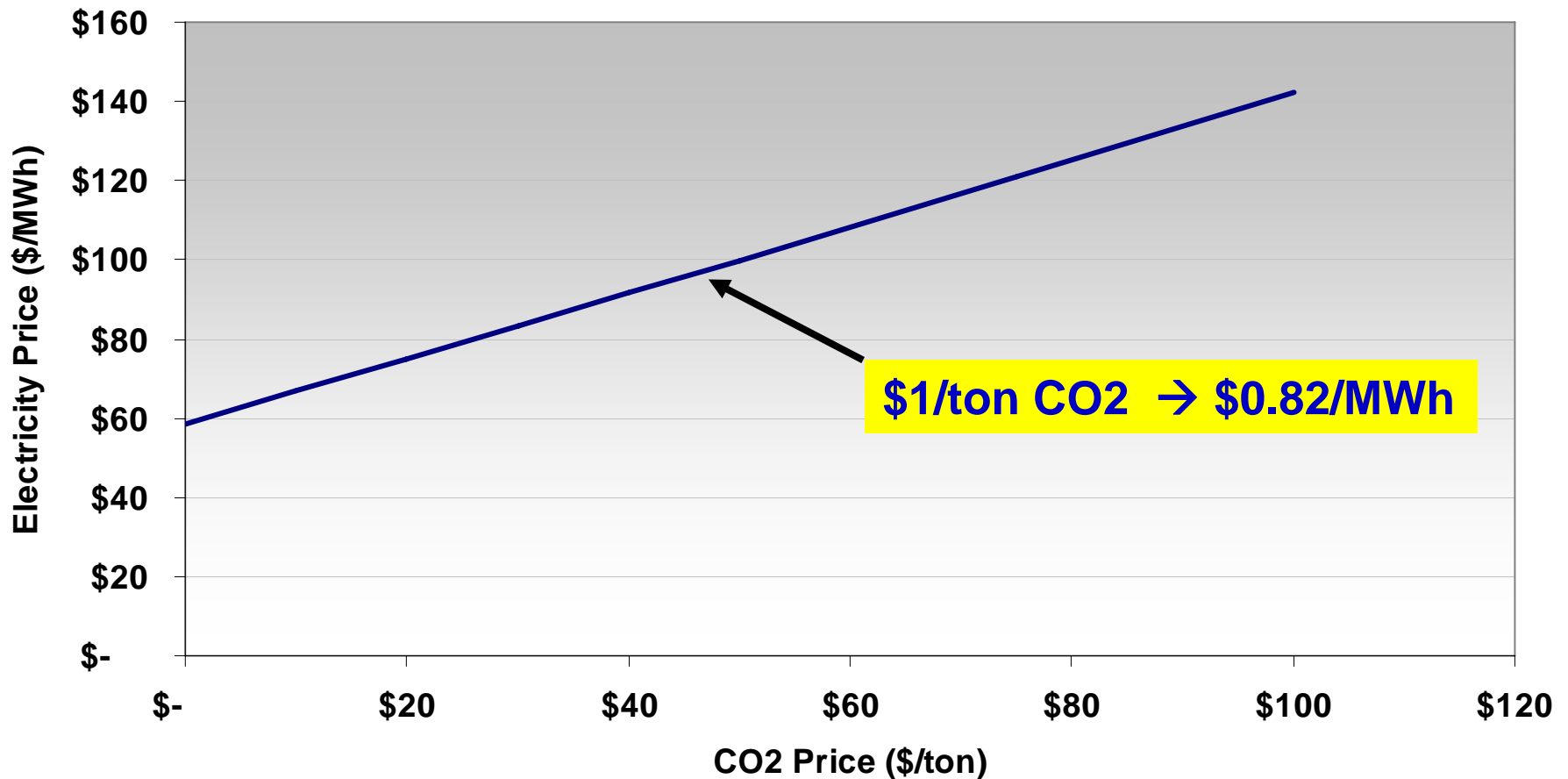


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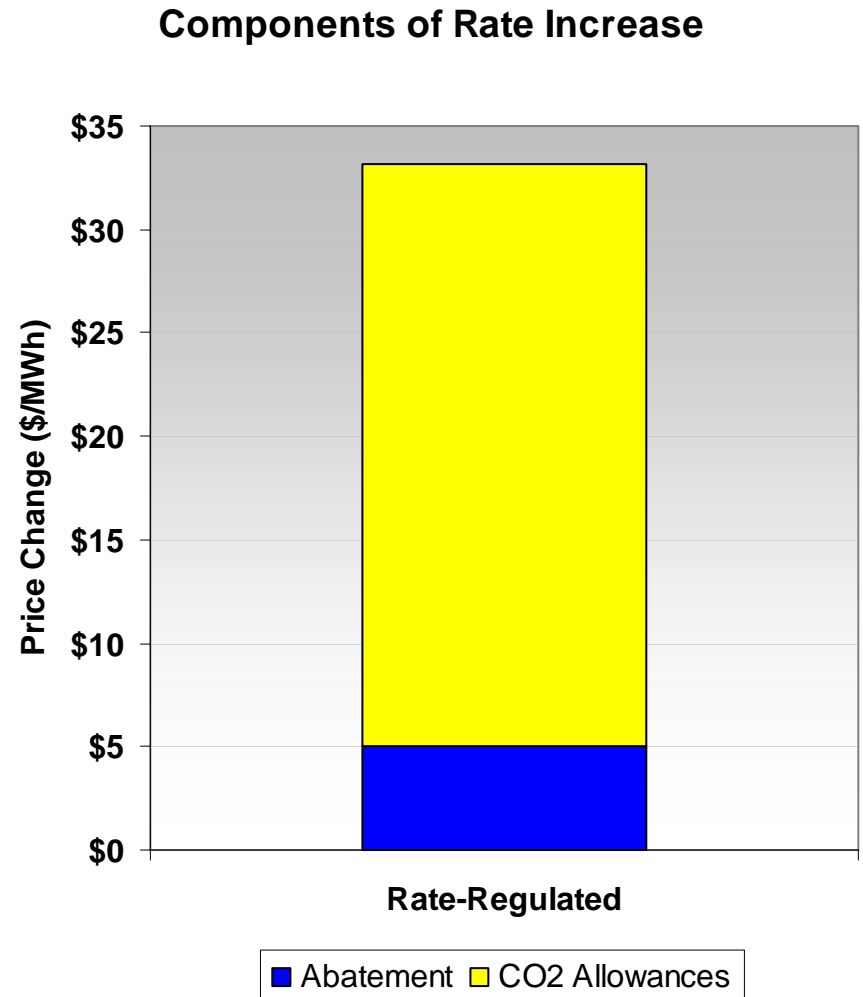
EPRI WECC Collaborative Provides Estimate of Impact of CO₂ Price on Electric Power Prices

Reference Case: Year 2012 - Wholesale Power Price by CO₂ Price



Impacts of CO2 Price on Electricity Price Shows Critical Role of Allocations

- Link varies by region, time horizon, and is non linear
- This example shows rate increases needed to cover \$75/ton CO₂ price in WECC
- Example assumes rate-regulated average costs
- **Assumes utility purchases 100% of allowances**

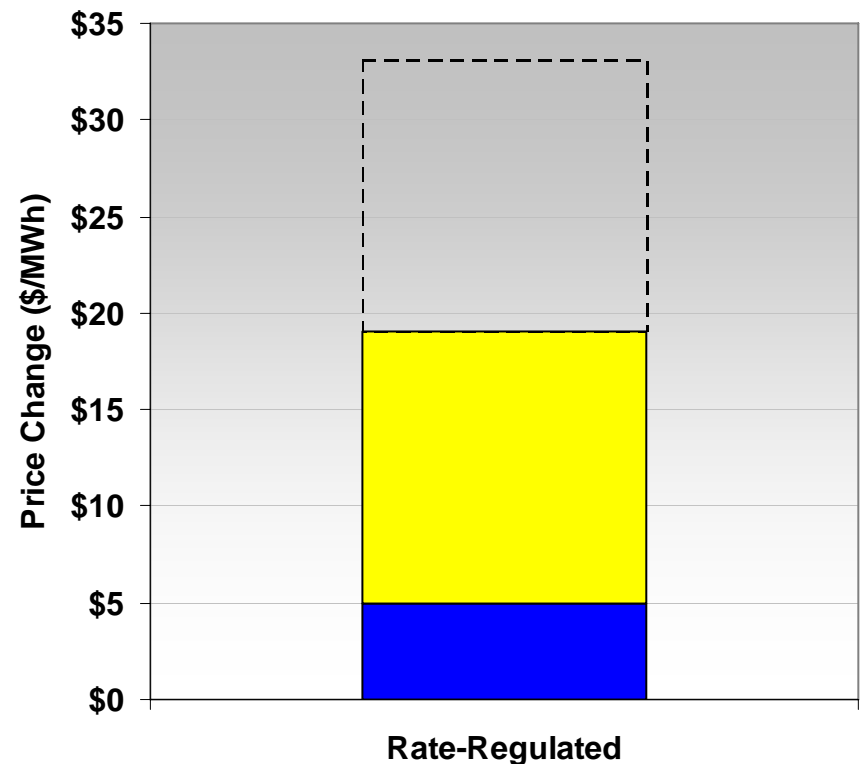


Impacts of CO2 Price on Electricity Price Shows Critical Role of Allocations

- Varies by region, time horizon, and is non linear
- This example shows rate increases needed to cover \$75/ton CO₂ price in WECC
- Example assumes rate-regulated average costs
- **Assumes utility purchases 50% of allowances**

Calculations for competitive customers more detailed

Components of Rate Increase



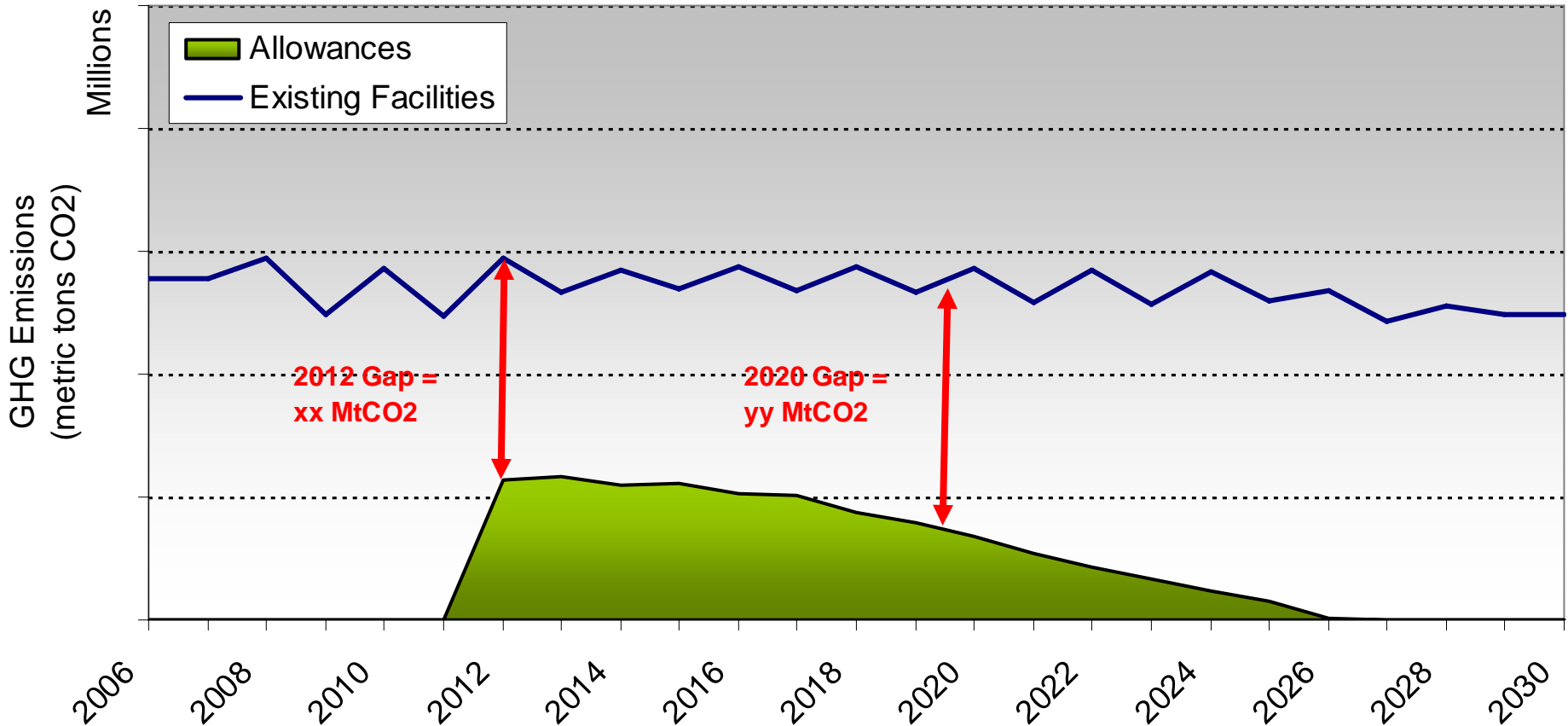
- Abatement
- Allowance Purchases
- Free Allocation to Customer

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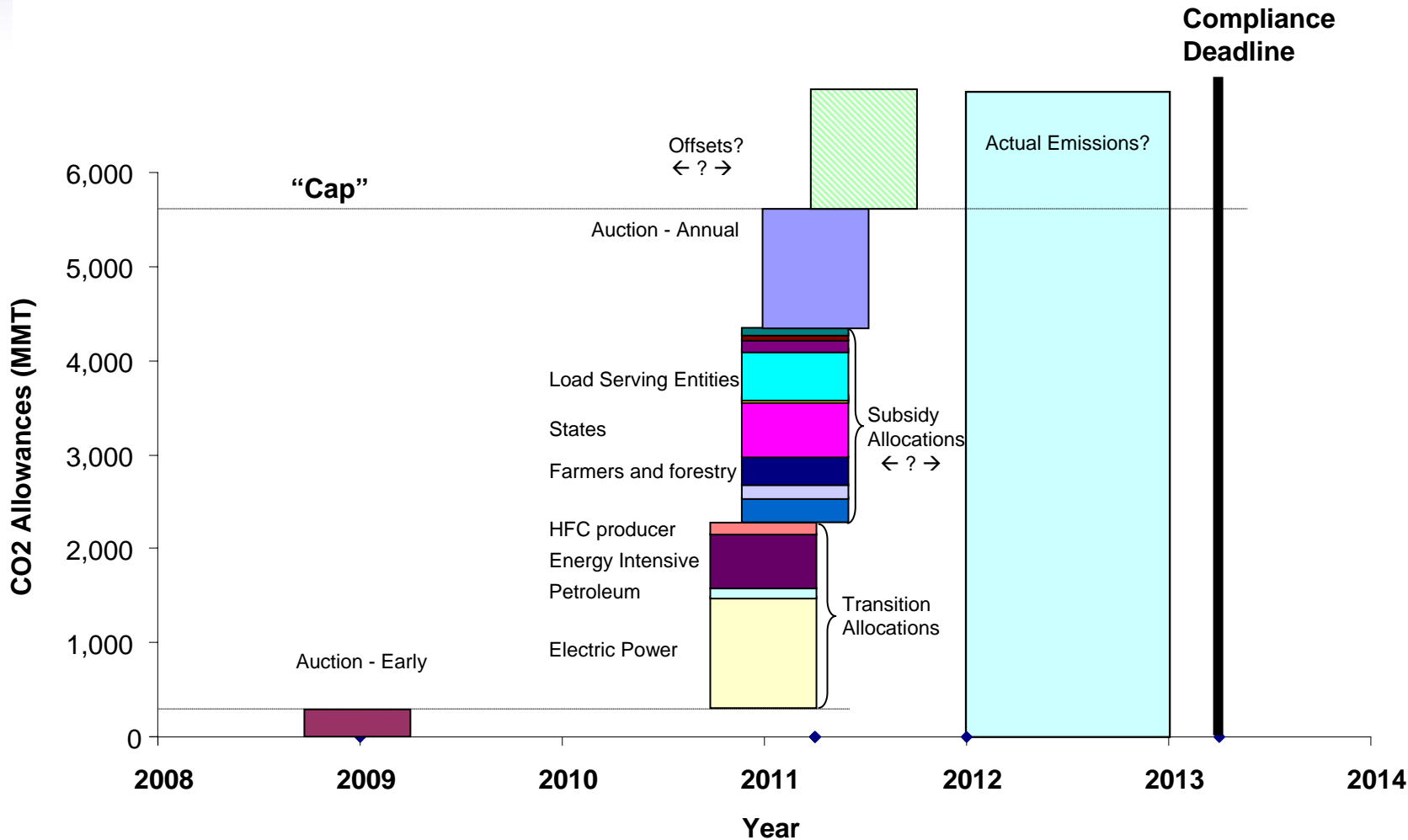
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Emission Reductions from a Utility Perspective

Projected "Compliance Gap"
PowerCo Existing Facilities

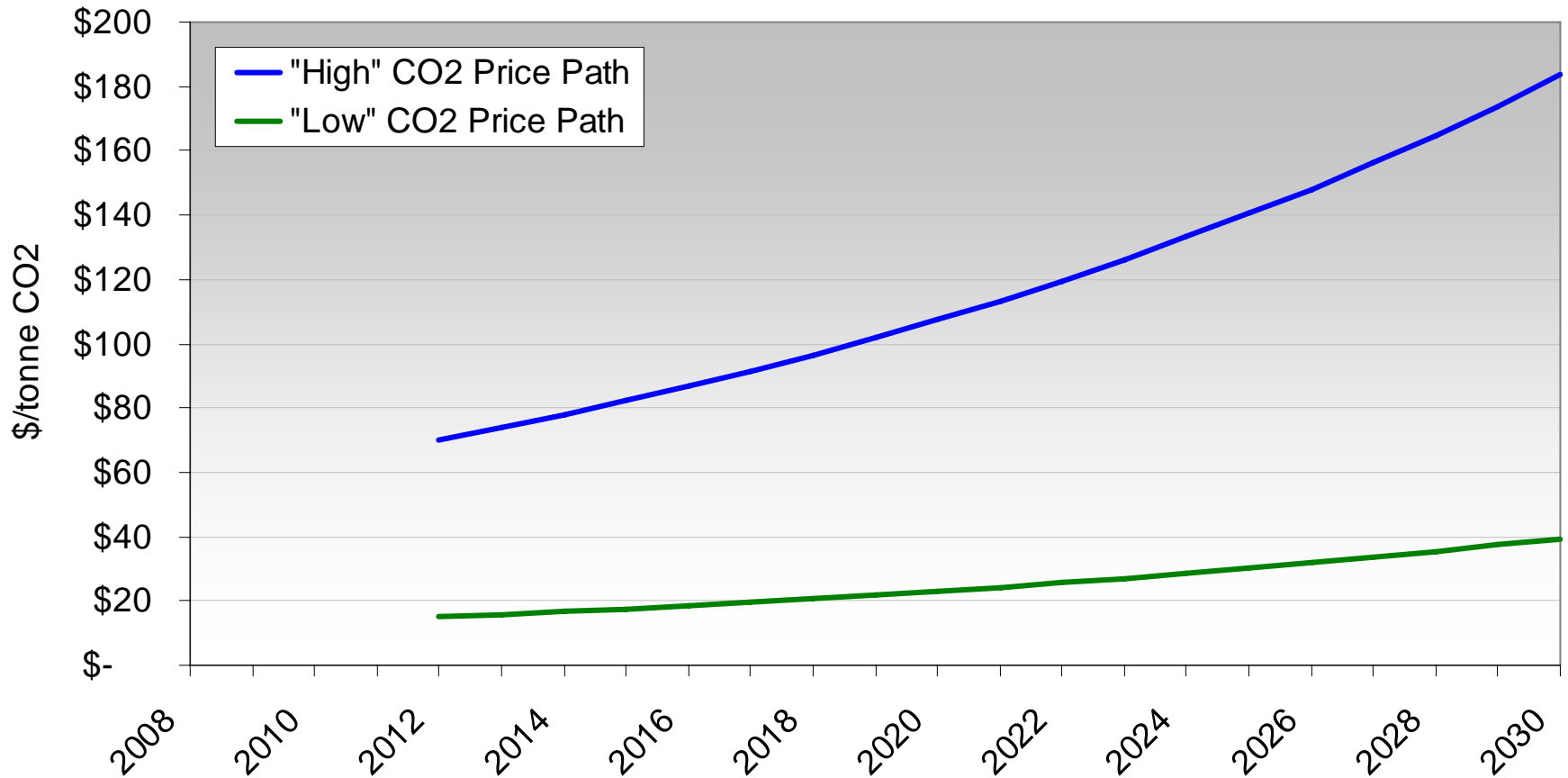


Timing of Allowance Distribution and Compliance for Policy Starting in 2012



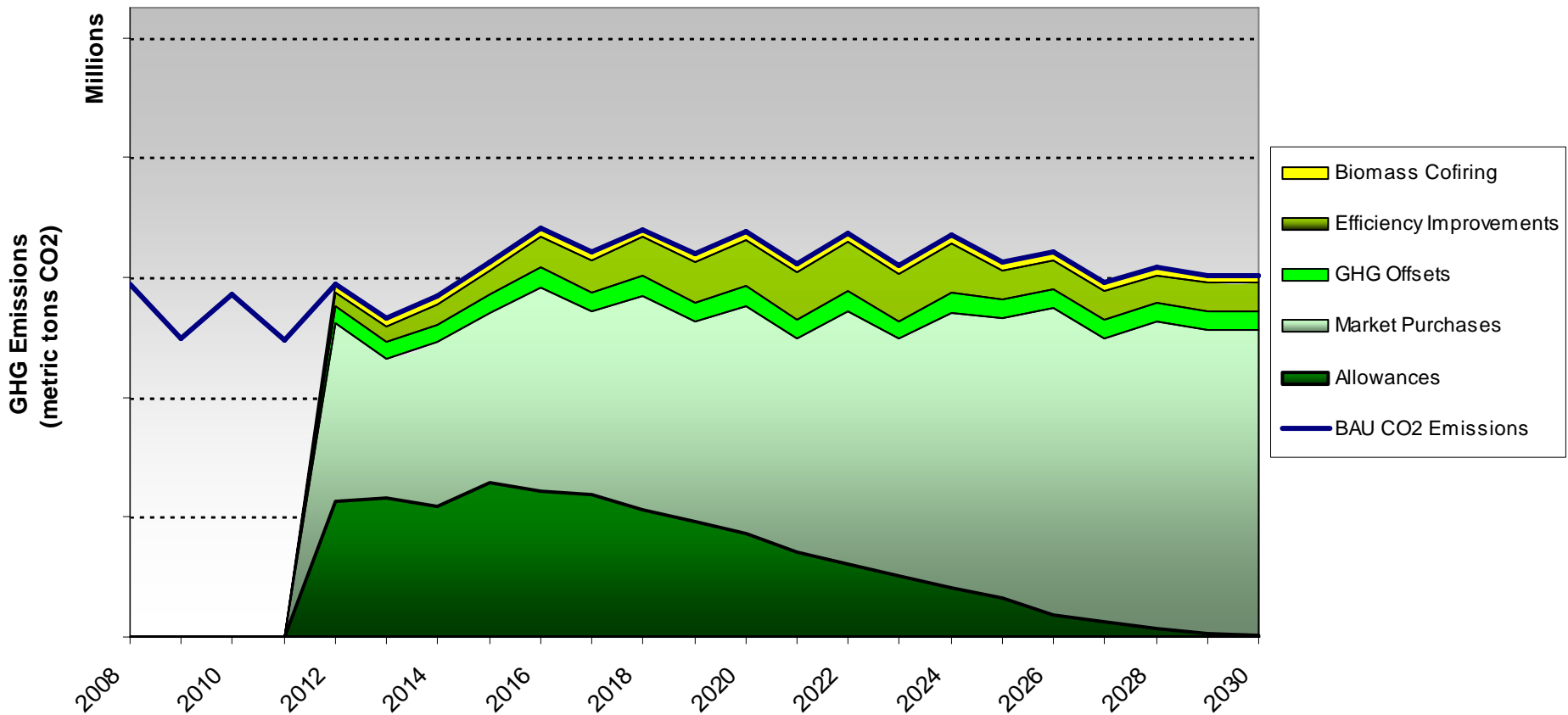
Compliance Planners Need to Recognize Price Uncertainty

Illustrative CO2 Emissions Price Paths



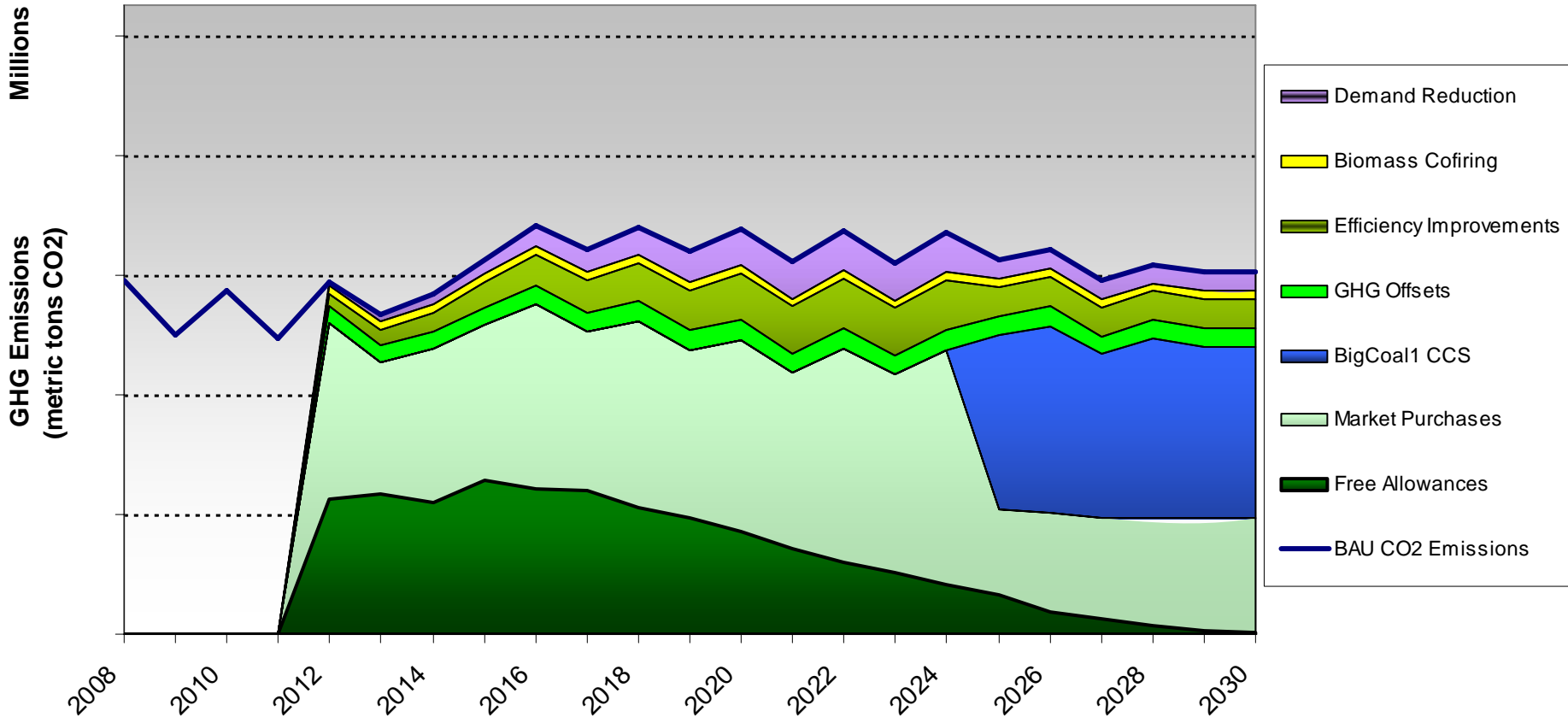
Compliance in a "Low" Price Regime

Closing PowerCo's Projected "Compliance Gap"
("Low" Expected \$/tCO2 Price)



Compliance in a "High" Price Regime

Closing PowerCo's Projected "Compliance Gap"
("High" Expected \$/tCO2 Price)



Insights

- Electric sector has potential to significantly cut emission in the near term
- Cutting electric sector emission below existing levels means backing off existing coal
- As existing coal is an extreme bargain compared to gas, very high CO₂ prices are needed to effect reductions
- Any offsets in early years can make big difference in CO₂ prices needed to meet the cap
- High CO₂ prices will lead to significant jumps in retail rates, but allocations that reach customers can cut impact
- Compliance will force utilities to juggle participation in volatile markets with lead times for a mix of abatement activities