



ELECTRIC POWER
RESEARCH INSTITUTE

Why Carbon Offset Policy Matters for Electric Companies

Delavane Diaz
EPRI Global Climate Change



Today's Topics

- Pop Quiz – US climate policy
- Offset provisions in Waxman-Markey
- Electric system modeling approach
- Policy impacts on electric generators
- Concluding thoughts and discussion

Thank you to Vic Niemeyer and Tom Wilson for ideas and slides

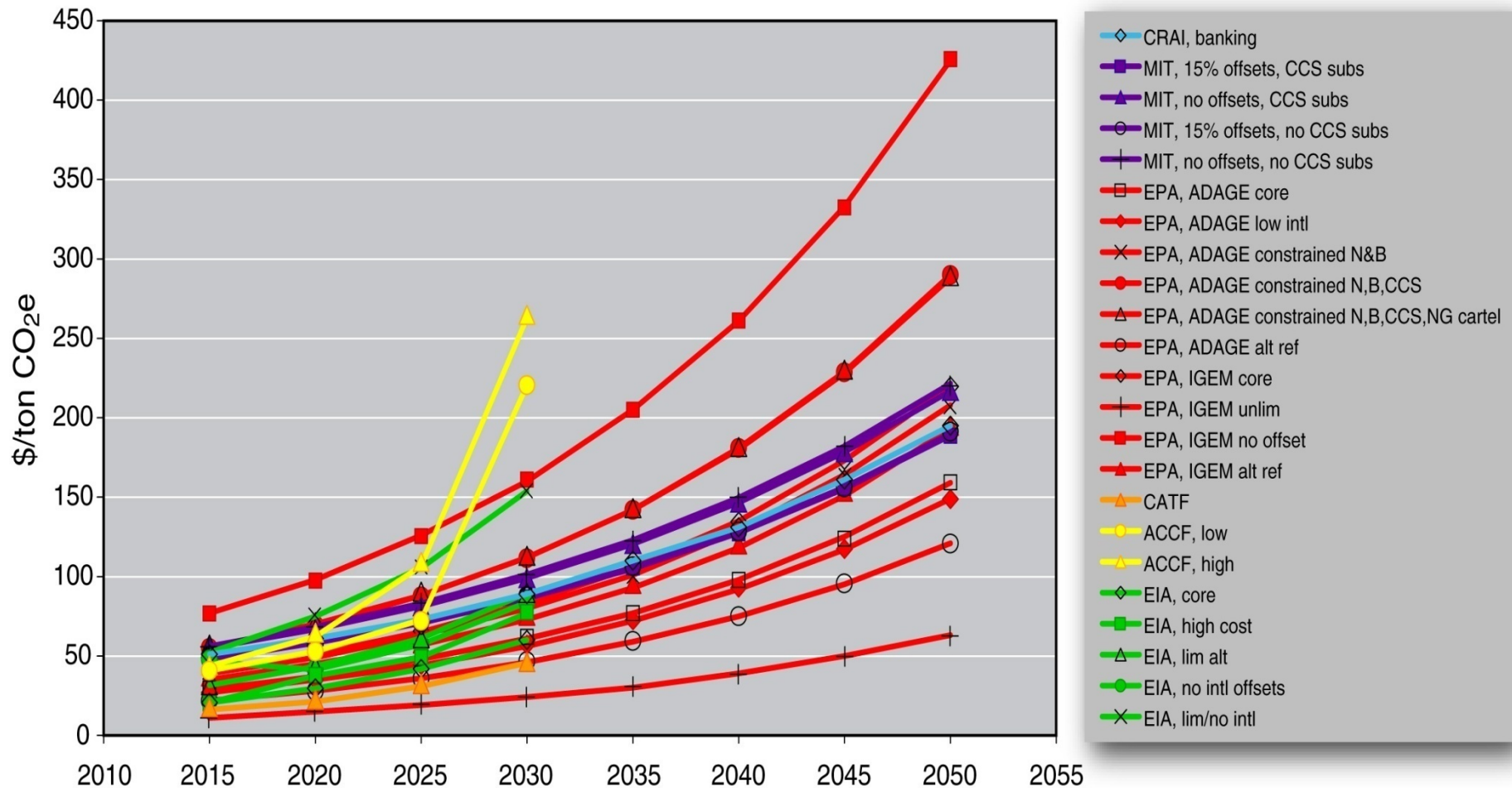
Let's Play Jeopardy!



Category:

**ESTIMATED COST
OF CLIMATE POLICY**

What were the public estimates of the cost of Lieberman-Warner as it went to the Senate floor in 2008?



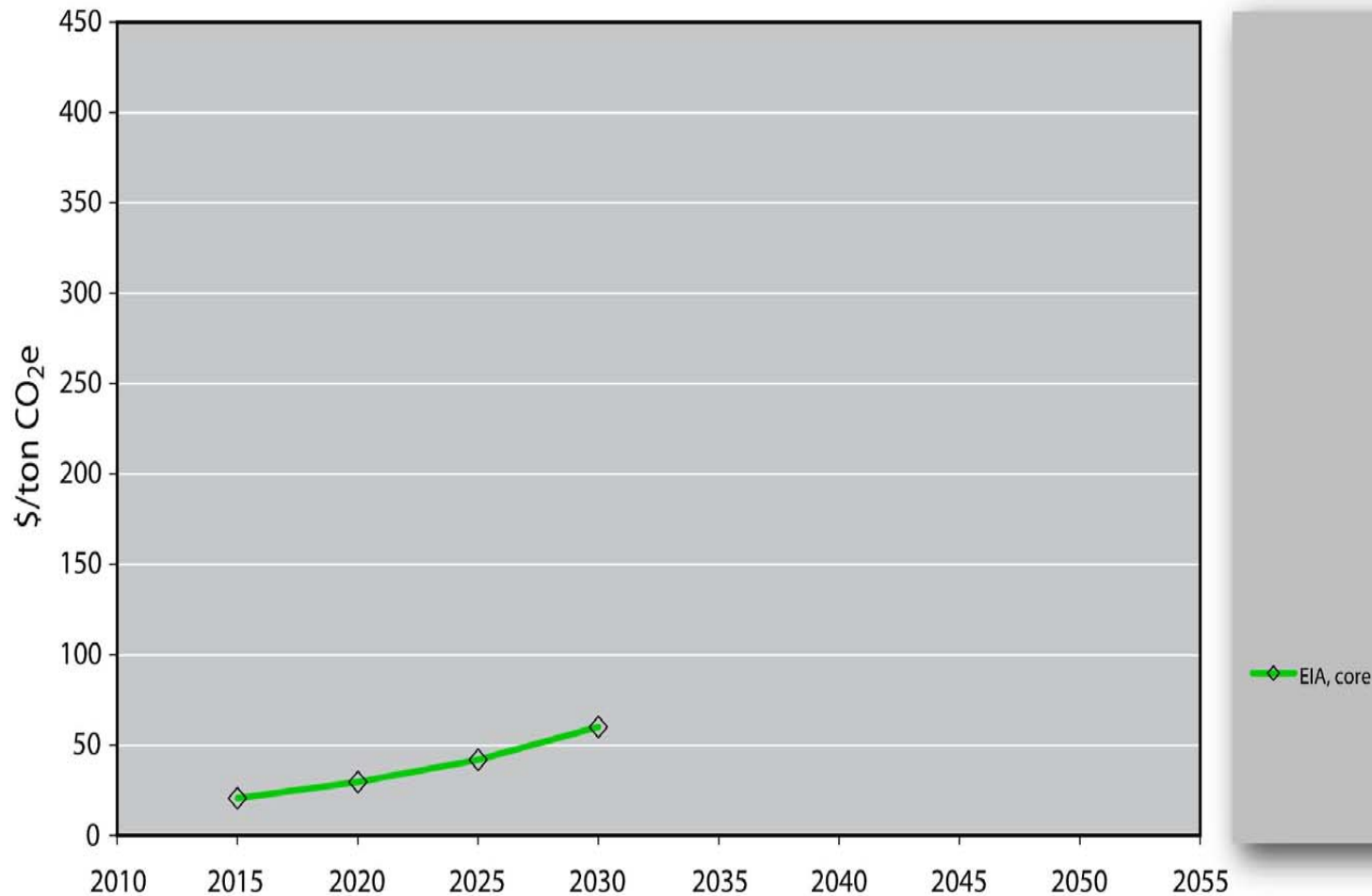
Let's Play Jeopardy!



Category:

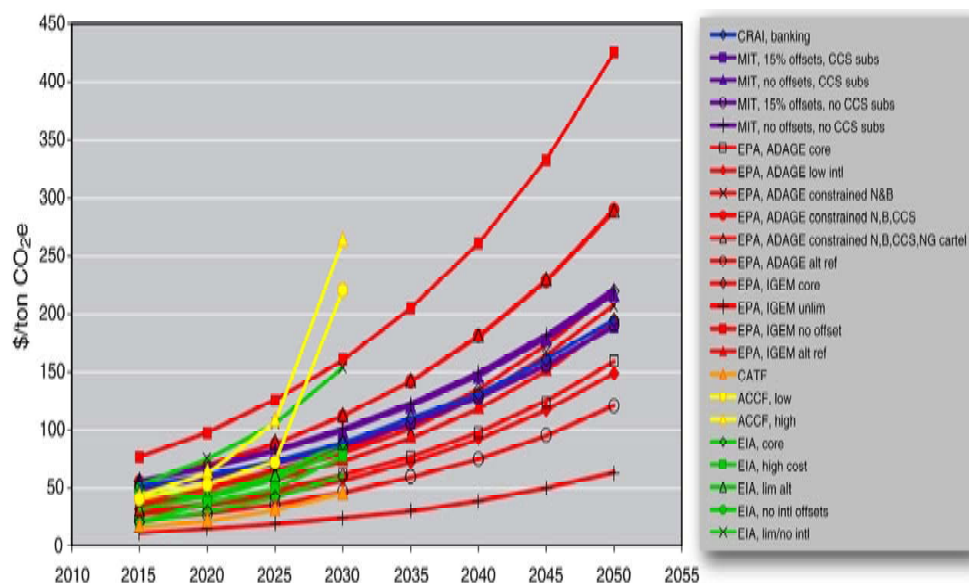
**CONGRESSIONAL
INTERPRETATION
OF COST ESTIMATES**

What single cost estimate was quoted by a leading senator as the bill was debated?



How Do You Make Sense of this Diversity of Results?

- In May 2008, EPRI held a Capitol Hill workshop to understand cost estimates of Lieberman-Warner
 - 6 modeling teams (EIA, ACCF, CATF, EPA, MIT, CRAI) + CBO
 - Differences due primarily to different baselines (AEO) and different electric sector technology cost and deployment assumptions



Presentations and webcast available at the EPRI Newsroom archive:
<http://my.epri.com/portal/server.pt?open=512&objID=342&mode=2>

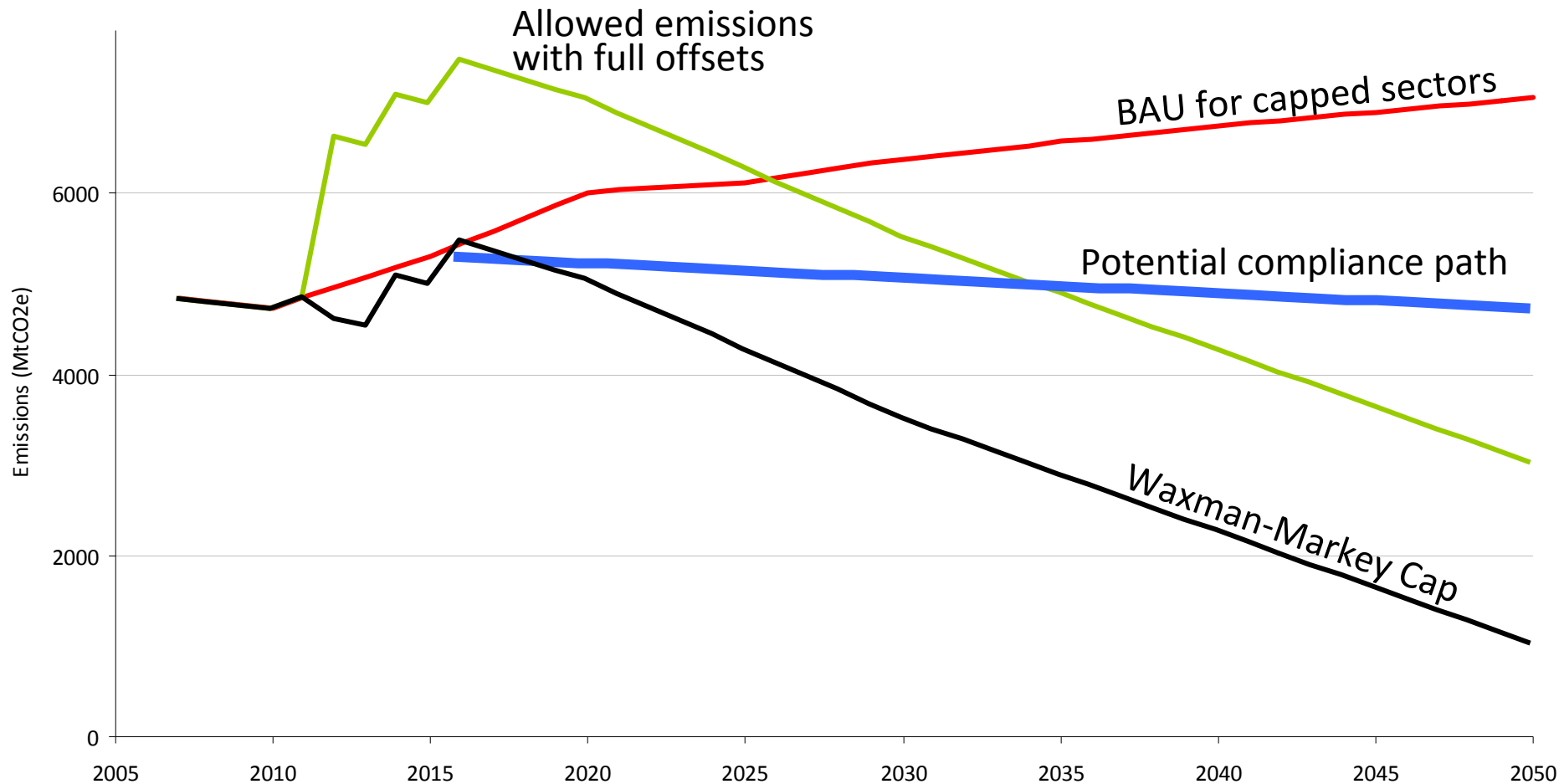
Legislative Proposals in 2009 Are Similar, But Also Fundamental Differences from 2008

- Time horizon the same
- Emission targets roughly the same
- Emissions included roughly the same
- Gases covered roughly the same
- So what is so different between Waxman-Markey & Lieberman-Warner?



2009 House-passed Climate Bill Set Stringent Target but Generous Offset Provisions Could Loosen the Cap

Emission Reductions Under an "80% by 2050" Cap-and-Trade Program



What are Greenhouse Gas Offsets?

Offsets are project-based GHG reductions in sectors or regions **outside** a cap-and-trade program



A coal mine methane destruction facility



Corn fields in MI (part of EPRI's N₂O offsets project)



Wind farms in China can generate CDM offsets



Avoiding deforestation can generate REDD credits

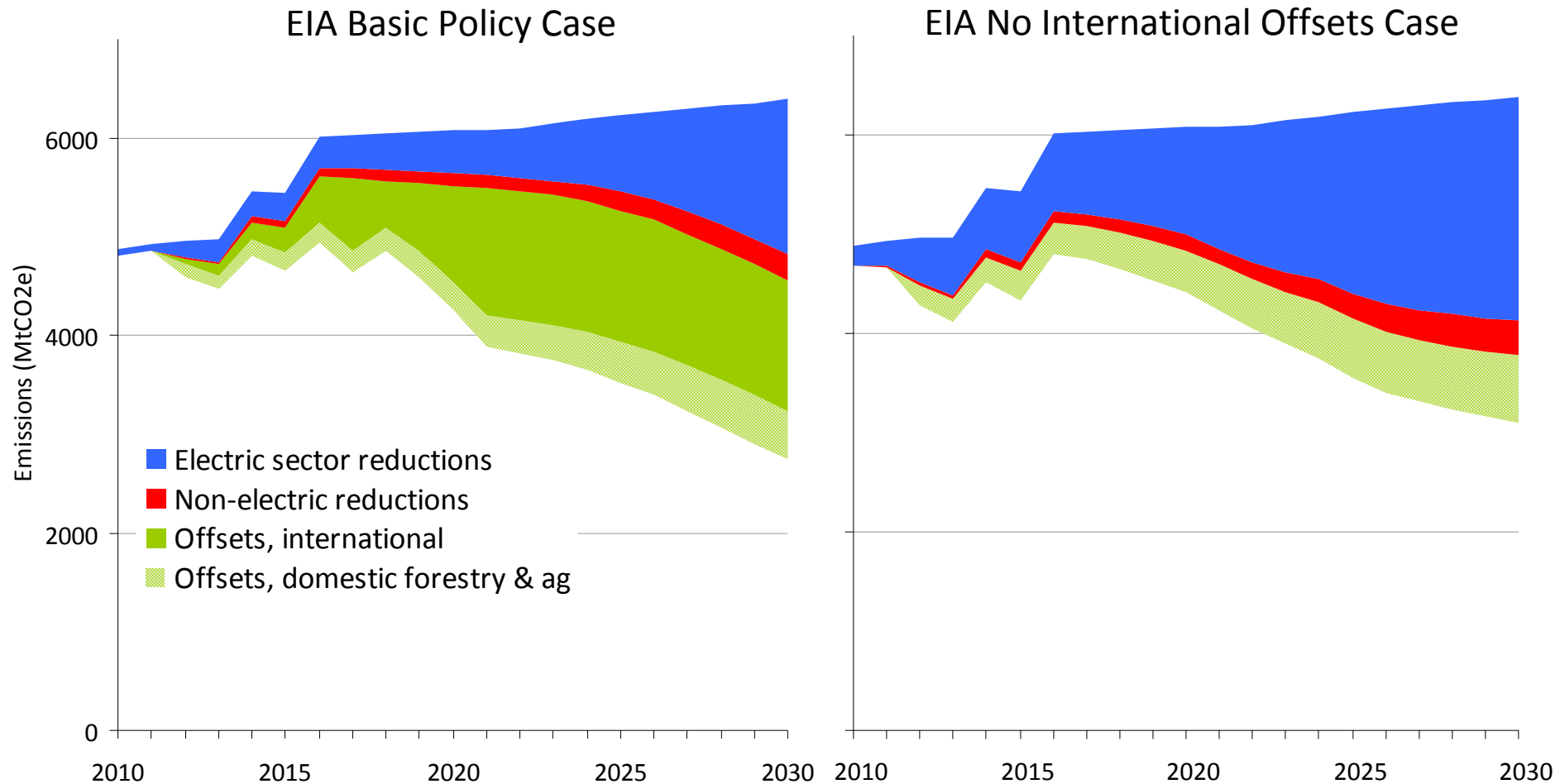
Emission Offsets Offer Promise ... But There are Significant Implementation Challenges & Risks

- Unprecedented limits in US legislation
 - Recent bills allowed 2B offsets per year
 - CDM has issued < 1/5th of this to date
- International Offsets – large potential, but hard to implement
 - Offsets issued by an international body (e.g., CDM)
 - Reduced Emissions from Deforestation and Degradation (REDD)
 - Sectoral offsets
- Domestic offsets – relatively small potential
 - EPA estimates ~170MtCO₂/yr through 2020
 - Mostly forest management & afforestation
 - Protocols & methodologies will take time to develop



Lowest Cost Emission Reductions Will Come From Offsets and the Electric Sector

Compliance Sources in 2009 EIA Analysis of Waxman-Markey



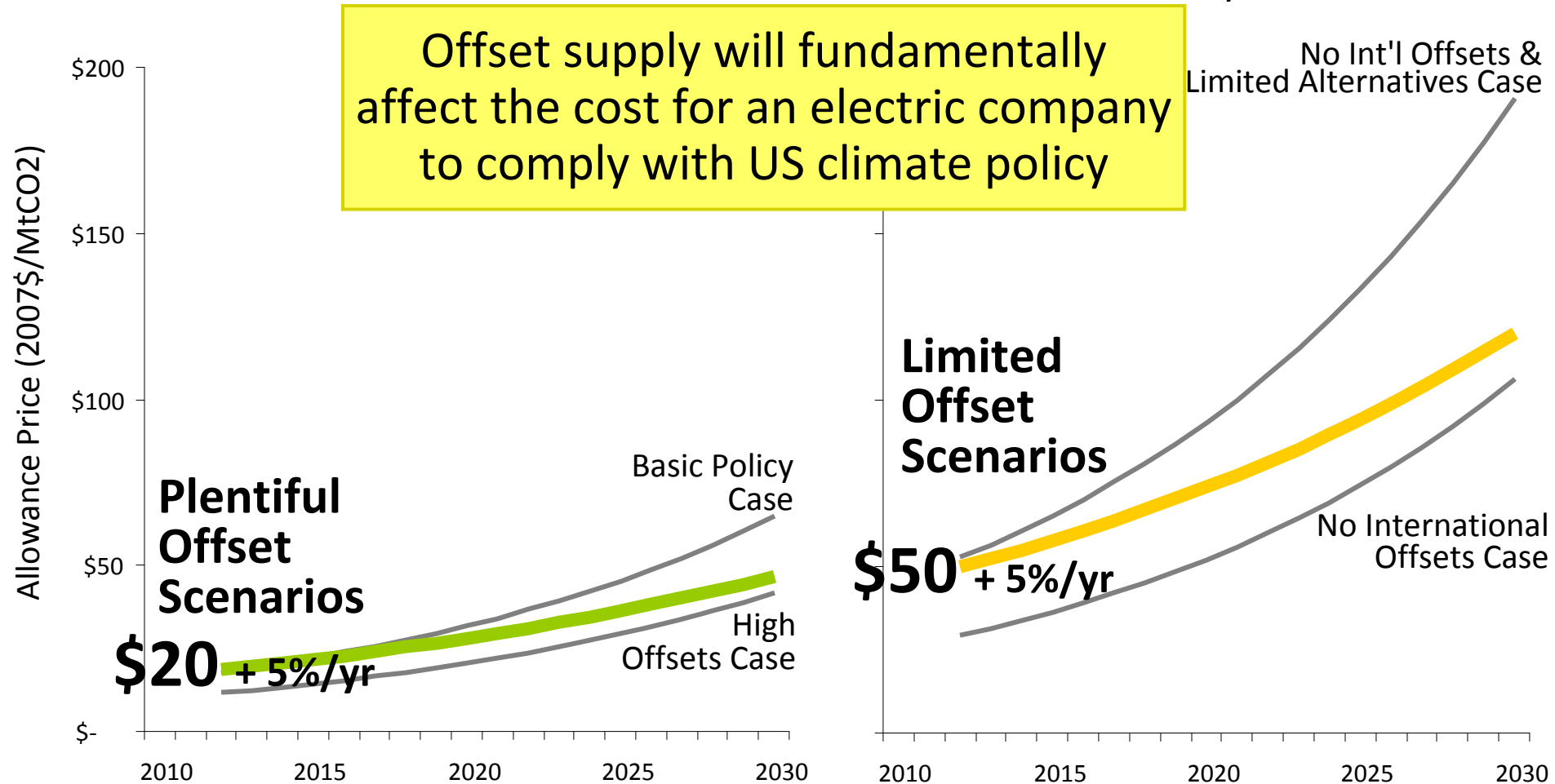
Source: EIA NEMS runs, HR2454 Cap, HR2454 No Int Offsets

© 2009 Electric Power Research Institute, Inc. All rights reserved.

Two Possible CO₂ Price Paths Represent Alternative Assumptions about Offset Availability

EIA Allowance Price Estimates for Waxman-Markey

Offset supply will fundamentally affect the cost for an electric company to comply with US climate policy



Source: EIA NEMS runs, HR2454 Cap, No Int Offsets, No Int Offsets/Lim, High Cost, High Offsets

Model Assesses the Potential Risk and Opportunity from CO₂ Targets on the Electric Sector

Model adds/retires capacity based on value of generating asset relative to fuel prices, CO₂ targets, load growth, and costs for new capacity

Combines 3 CO₂ reduction activities in cost-minimizing mix

1. Redispatch existing capacity (short-term)
 - Substitute gas-fired plants for coal-fired plants
2. Replace old with new (long-term)
 - Displace existing fossil with new / retrofit low-emitting generation
3. Add new capacity (long-term)
 - Select low-emitting alternatives for capacity additions

Framework provides an analytically consistent approach for evaluating economics of generation over annual operating cycles over time as

- CO₂ targets evolve,
- fuel prices change, and
- the generation mix shifts to reflect new economic incentives / drivers & the availability of advanced generation technologies

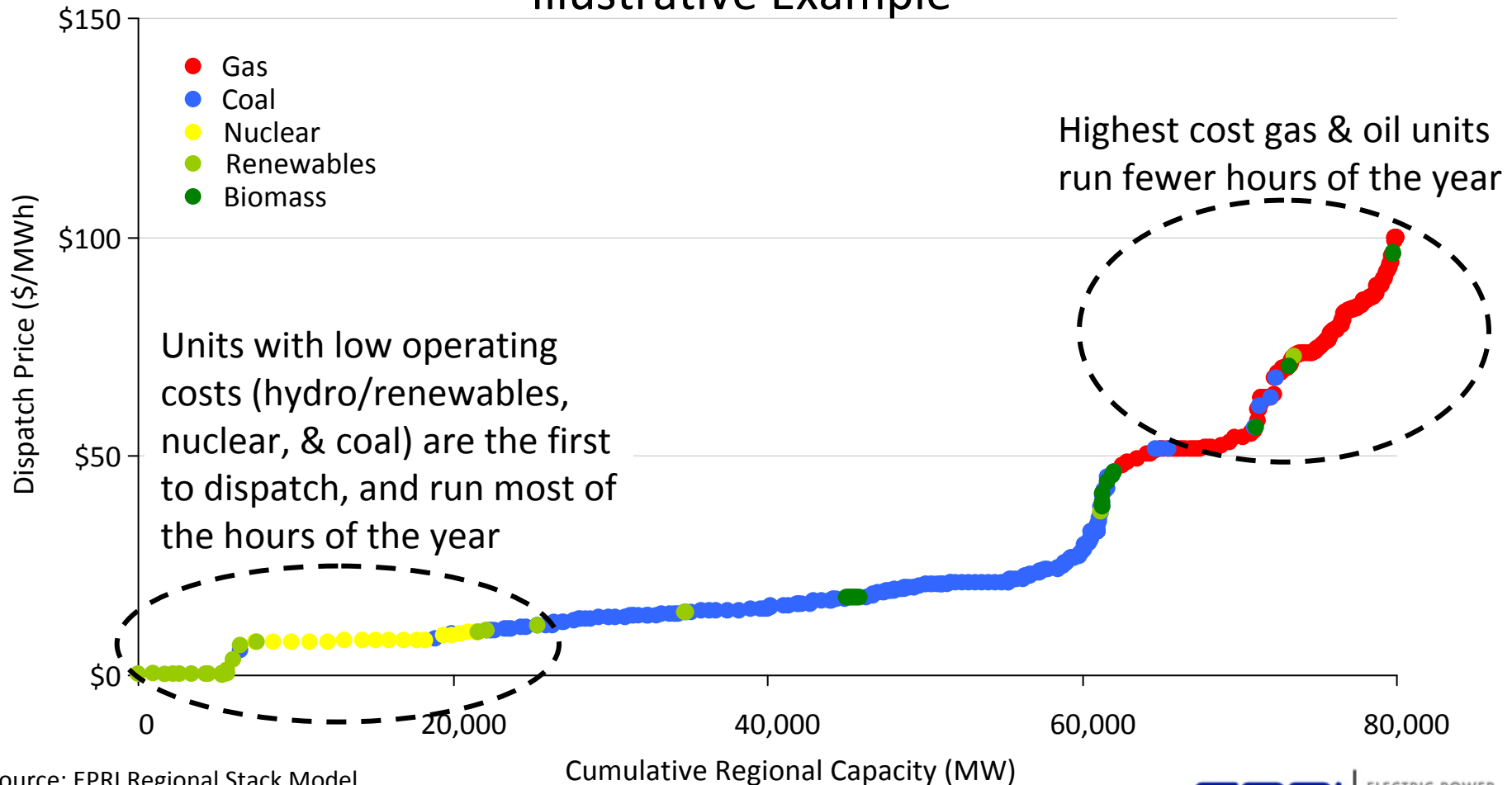
Regional Market Analysis Overview

- Models regional generation investment, operation, emissions, fuel use, and daily peak and off-peak power prices from 2007 to 2030
 - Calibrated to 2007 publicly available data on generation and market prices
- Captures full electric sector detail at the unit-level
 - Characterizes every power plant in a regional market
- Simulates annual operations by matching load shapes; result is comprehensive simulation of generation technology deployment, use and value in a competitive market
 - Does not incorporate detailed system constraints on operations, transmission or new investment
 - Reflects lead times to build new capacity
 - Includes role of customer load response to higher power prices (and interaction over time with needs for new generation)
 - Range of CO2 price scenarios starting in 2012 reveal impact on electric sector and dynamics of its response over time
- Reference case realistic point of reference but not a forecast
- Uncertainty surrounds gas prices, construction costs, technology constraints, demand response, etc. which drive specific results
- Focused on electric sector response only — does not assume any cost-mitigating impact of low-cost emission offsets

Described in EPRI report, “The Costs of Reducing Electricity Sector CO2 Emissions” (TR-1014044), Dec 2007

Supply Stack Chart Shows Marginal Cost Curve for Economic Dispatch

Illustrative Example

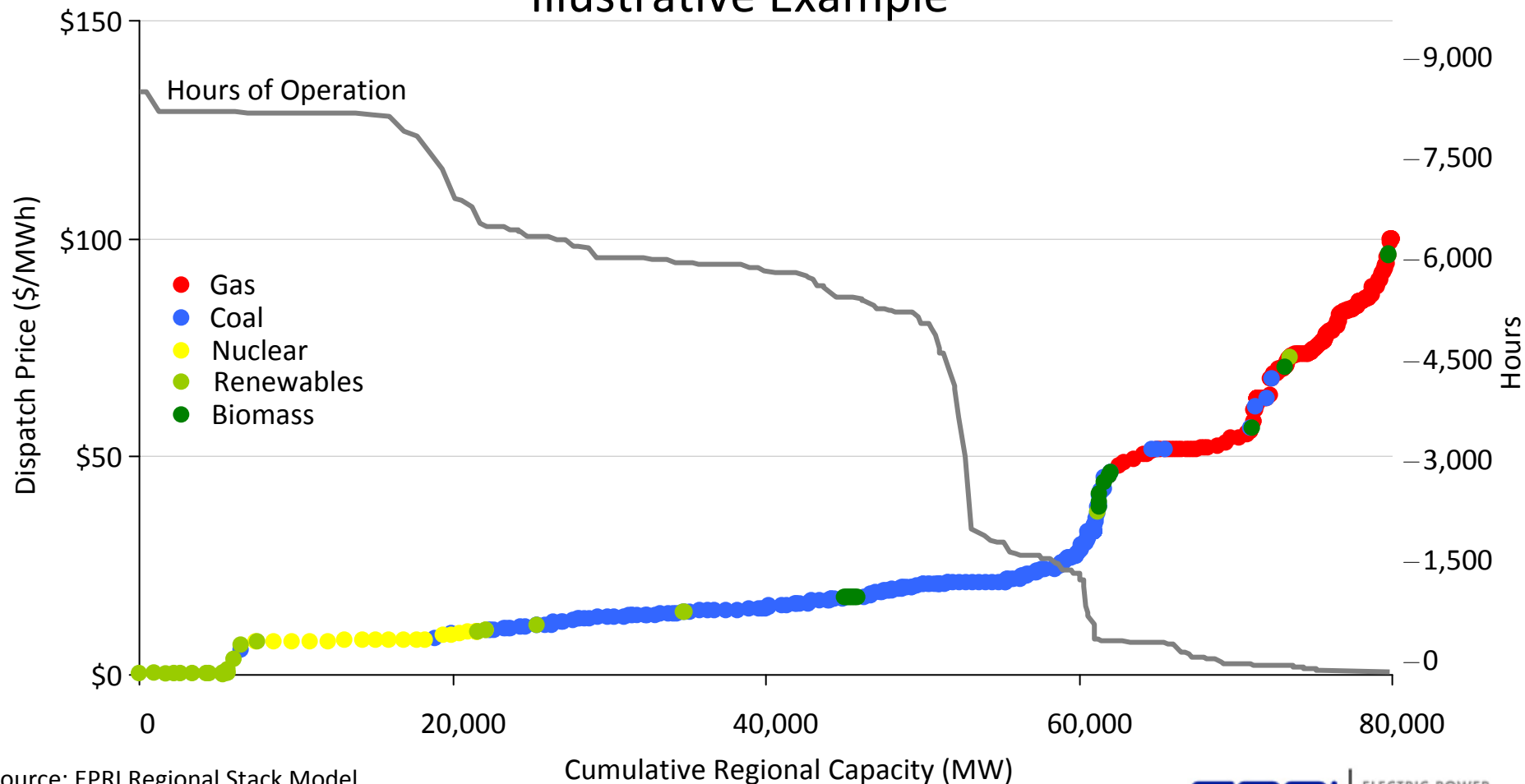


Source: EPRI Regional Stack Model

© 2009 Electric Power Research Institute, Inc. All rights reserved.

Load Duration Curve Determines How Many Hours in the Year Each Unit Runs

Illustrative Example

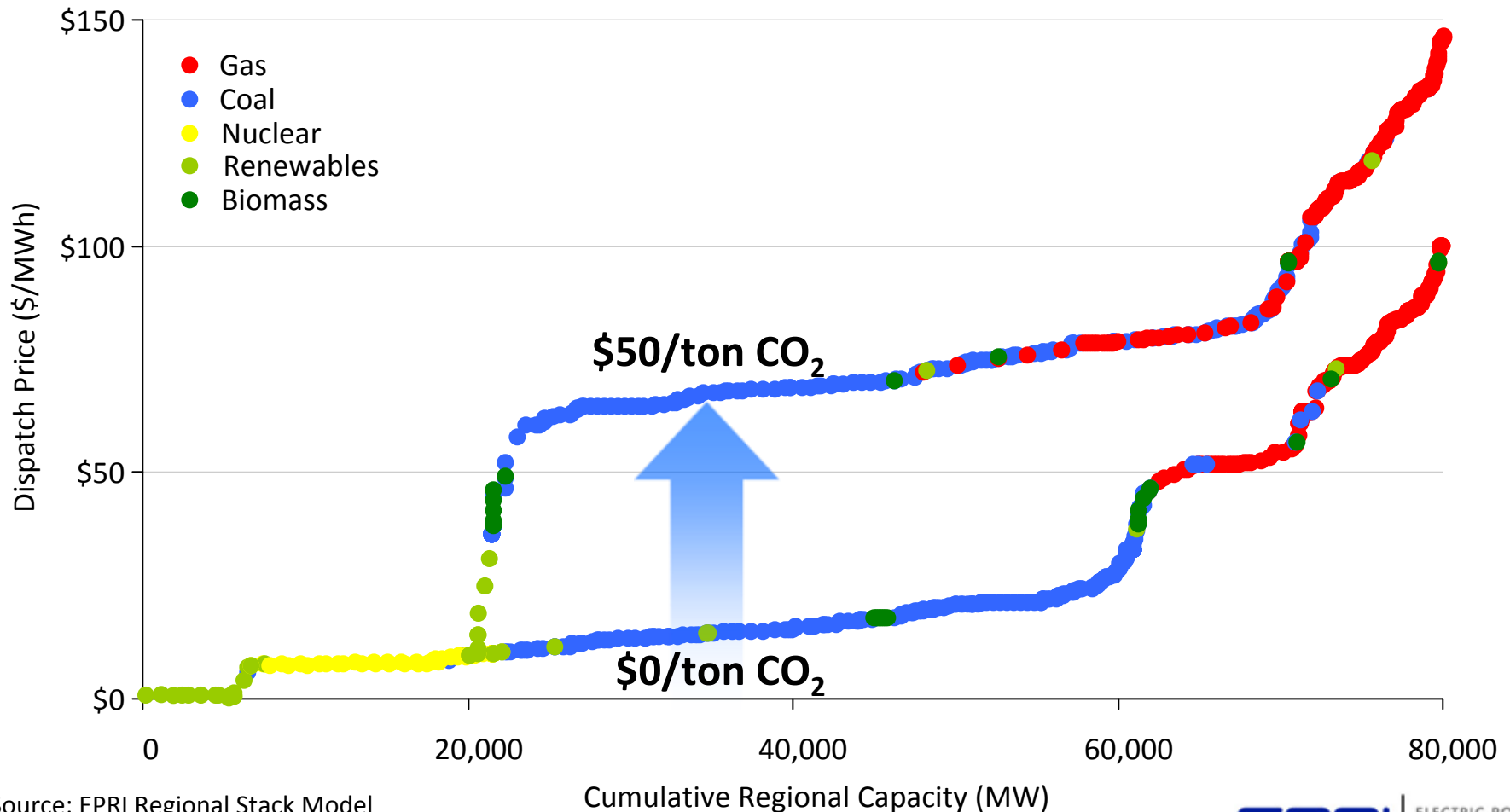


Source: EPRI Regional Stack Model

© 2009 Electric Power Research Institute, Inc. All rights reserved.

CO₂ Price Increases Dispatch Costs — Supply Stack Re-orders to Favor Less Emitting Generation

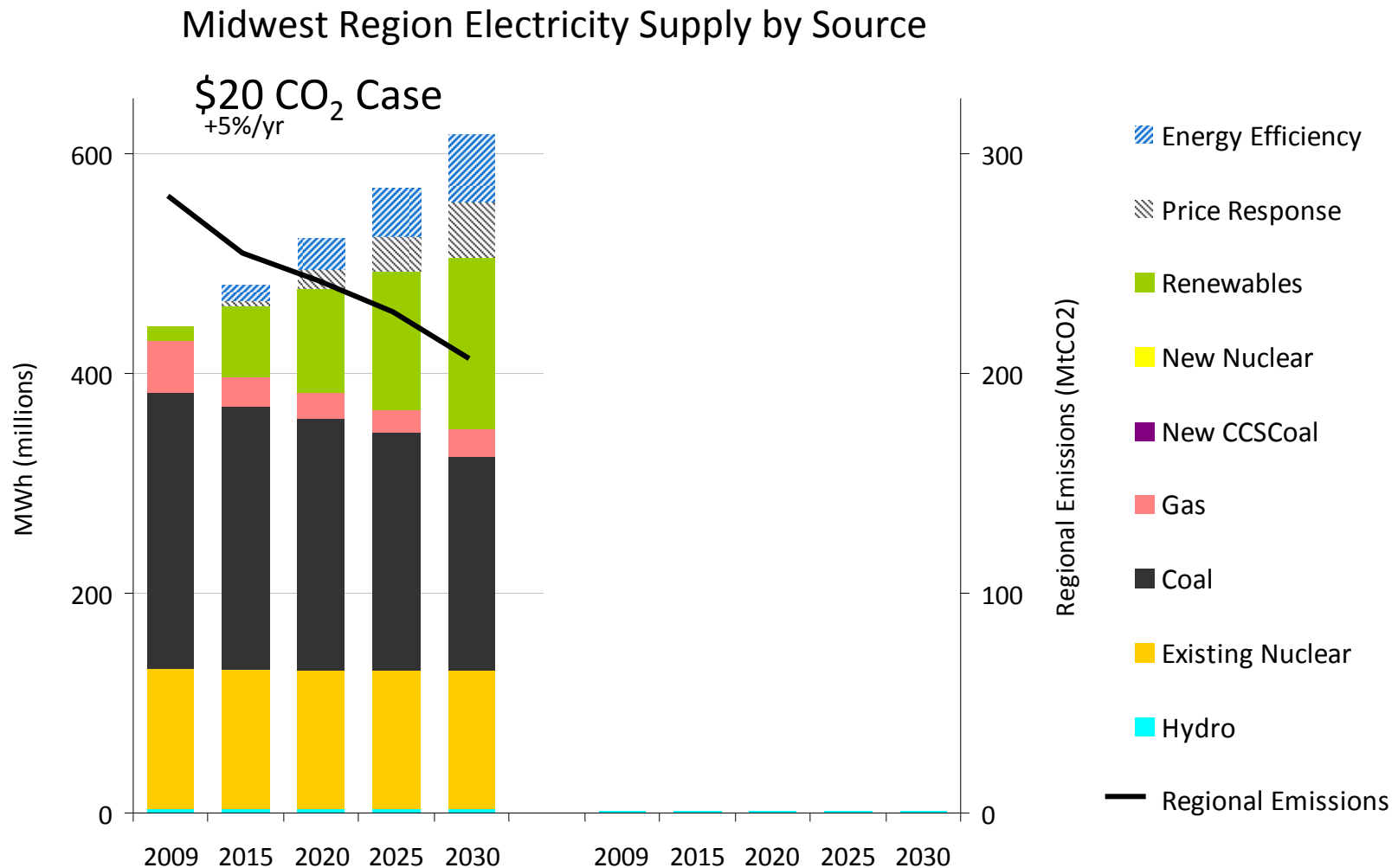
Midwest Regional Supply Stack in 2012
(Gas at \$6.82/MMBTU)



Source: EPRI Regional Stack Model

© 2009 Electric Power Research Institute, Inc. All rights reserved.

Given a Portfolio of Generation Technologies, CO₂ Policy Guides Electric System Choices

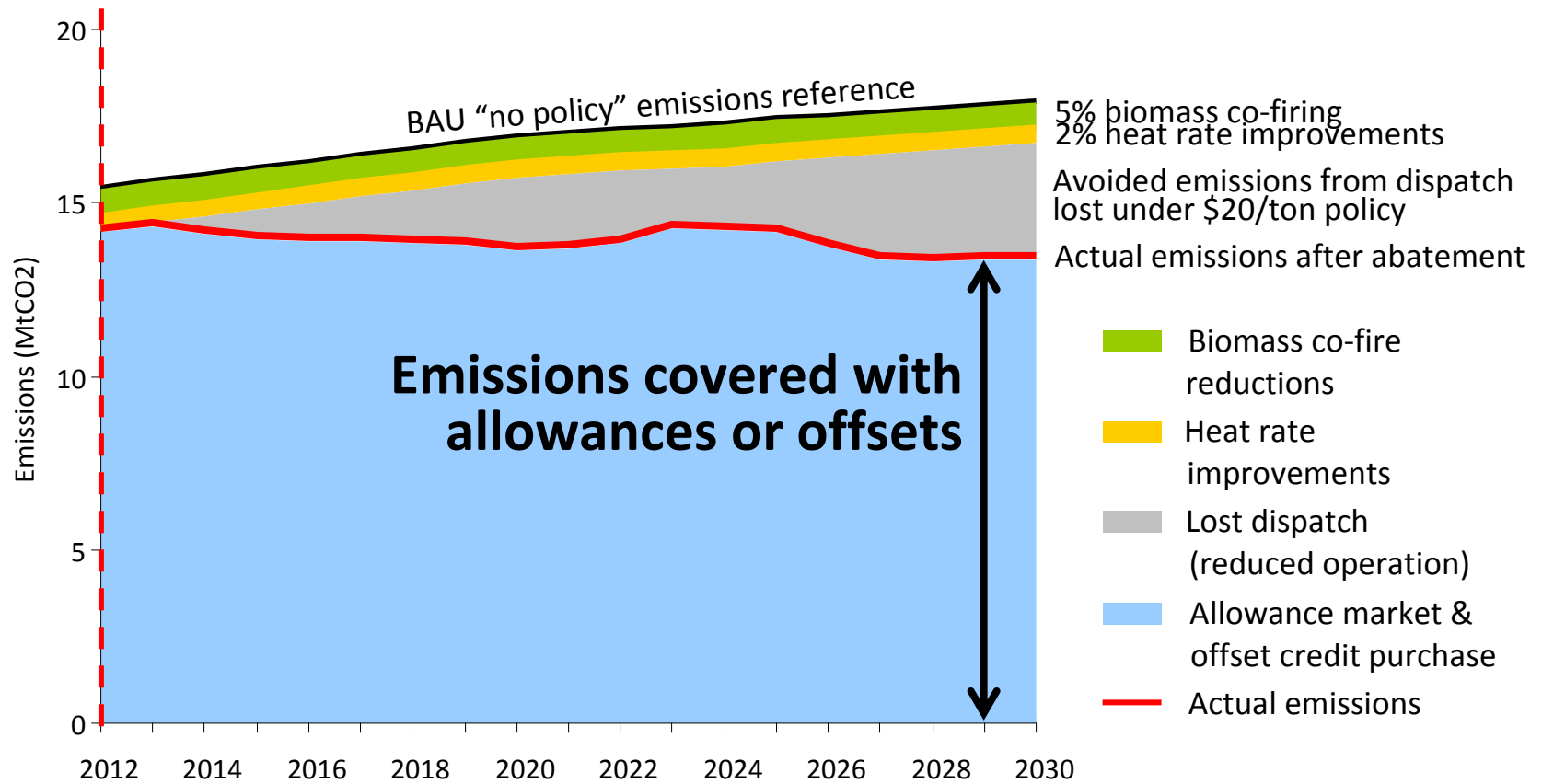


Source: EPRI Regional Stack Model, Midwest ISO results

© 2009 Electric Power Research Institute, Inc. All rights reserved.

Companies Can Comply With Modest Abatement and Allowances at \$20/tCO₂

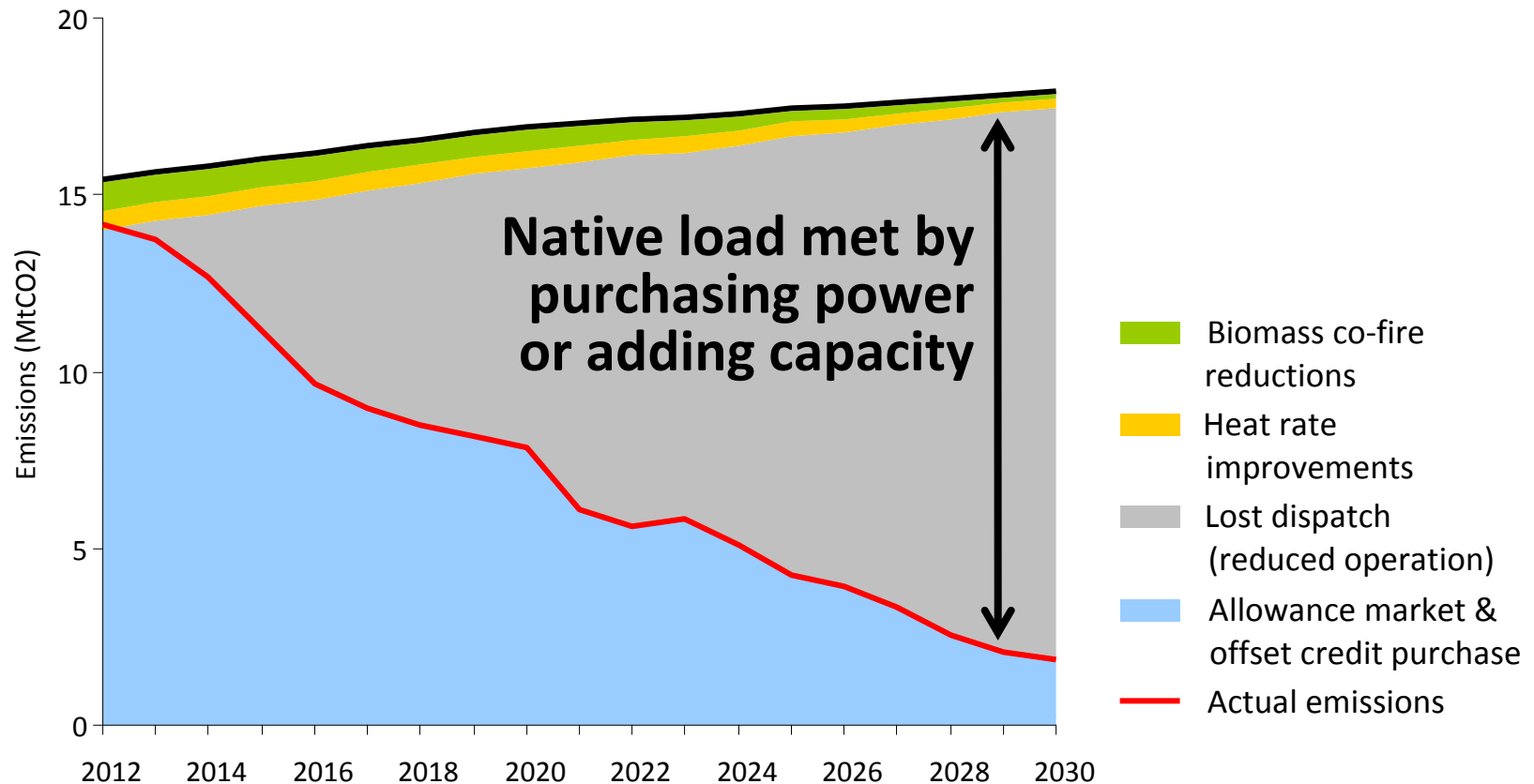
Policy takes
effect 2012



Source: Midwest ISO and illustrative electric company results

© 2009 Electric Power Research Institute, Inc. All rights reserved.

\$50 CO₂ Adder Transforms the Generation System — Existing Coal is No Longer Competitive



Source: Midwest ISO and illustrative electric company results

© 2009 Electric Power Research Institute, Inc. All rights reserved.

Policy Insights for Electric Company Strategy

- CO₂ price expectations guide electric sector investments
 - \$20 and \$50/tCO₂ paths could present dramatically different futures
- Key drivers of CO₂ prices becoming clear
 - Ultimate supply of offsets (quantity, timing, cost)
 - If offsets scarce, cost and availability of low-emitting generation
- Offset potential hinges on governments and institutions
- **Recent offset provisions in Congress make international policy a domestic compliance issue**
 - With limited offsets, electric sector reductions (once again) drive costs



Delavane Diaz

Project Manager

Global Climate Change Program

Electric Power Research Institute

3420 Hillview Avenue

Palo Alto, CA 94304

ddiaz@epri.com