Why Carbon Offset Policy Matters for Electric Companies

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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

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

- Allowed emissions with full offsets
- BAU for capped sectors
- Potential compliance path
- Waxman-Markey Cap
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

Emissions (MtCO2e)

- Electric sector reductions
- Non-electric reductions
- Offsets, international
- Offsets, domestic forestry & ag

Source: EIA NEMS runs, HR2454 Cap, HR2454 No Int Offsets
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 CO$_2$ Targets on the Electric Sector

Model adds/retires capacity based on value of generating asset relative to fuel prices, CO$_2$ targets, load growth, and costs for new capacity

Combines 3 CO$_2$ 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
• CO$_2$ 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

Supply Stack Chart Shows Marginal Cost Curve for Economic Dispatch

Illustrative Example

Units with low operating costs (hydro/renewables, nuclear, & coal) are the first to dispatch, and run most of the hours of the year.

Highest cost gas & oil units run fewer hours of the year.

Source: EPRI Regional Stack Model
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Load Duration Curve Determines How Many Hours in the Year Each Unit Runs

Illustrative Example

Cumulative Regional Capacity (MW)

Hours of Operation

Dispatch Price ($/MWh)

- Gas
- Coal
- Nuclear
- Renewables
- Biomass

Source: EPRI Regional Stack Model
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**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
Given a Portfolio of Generation Technologies, CO₂ Policy Guides Electric System Choices

Midwest Region Electricity Supply by Source

$20 CO₂ Case

+$5%/yr

Source: EPRI Regional Stack Model, Midwest ISO results

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

- **Policy takes effect 2012**
- **BAU “no policy” emissions reference**
- **5% biomass co-firing**
- **2% heat rate improvements**
- **Avoided emissions from dispatch lost under $20/ton policy**
- **Actual emissions after abatement**

**Emissions covered with allowances or offsets**

- **Biomass co-fire reductions**
- **Heat rate improvements**
- **Lost dispatch (reduced operation)**
- **Allowance market & offset credit purchase**
- **Actual emissions**

Source: Midwest ISO and illustrative electric company results

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

Native load met by purchasing power or adding capacity

Source: Midwest ISO and illustrative electric company results
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
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