Economic and Energy Market Implications of the Clean Power Plan

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Overview of Clean Power Plan
Overview of Clean Power Plan (CPP)

- To reduce total US-wide CO₂ emissions from existing fossil-fueled power plants by 30% from 2005 levels
- Establishes CO₂ limits for each state from 2022-2030, in two alternative forms:
  - “Rate-based” (i.e., maximum lb/MWh generated in state)
  - “Mass-based” (i.e., maximum tons emitted in state)
- Each state’s environment agency must prepare a plan demonstrating how to achieve that state’s limit
- Many implementation options for a state to use:
  - Rate or mass based approach?
  - Design of market-based mechanisms for flexibility within state?
  - If mass-based trading: how to allocate emissions allowances?
  - Work with other states for multi-state emissions or credit trading?
- Initial state plans were due September 2016 … until the US Supreme Court stayed CPP’s implementation on Feb 9, 2016
Who Should Care About Potential Impacts of the CPP?

- Electricity generating unit owners (all fuel types)
- Coal and gas sector entities (mines, RRs, pipelines)
- Power plant builders (all types)
- Industries whose costs are highly dependent on electricity &/or natural gas inputs
- Household and commercial rate payers
- Electric utilities (local distribution companies - LDCs)
- State and local governments
  \((revenues\ from\ allowances;\ revenues\ from\ economic\ activity)\)
- Grid operators and transmission providers
There will be “winners” and “losers” within each general category of affected entities.

Impact on specific companies may vary with different state regulator choices and market outcomes:

- State choices of implementation approaches
- Extent of trading that emerges among states
- Timing of actual implementation (legal uncertainty)
- Fuel price fundamentals (esp. natural gas prices)
- Technology fundamentals
  - Relative costs of lower-carbon generation options
  - Role of end-use efficiency vs. low-emitting generation

How a Specific Company Will Be Affected Is Highly Uncertain.
Role of Economic Models

- Can help understand the interactions of all the players in the economy under a given set of assumptions

- By testing multiple different sets of assumptions:
  - Can help inform policy makers of general magnitude and form of economic impacts
  - Can help companies develop understanding of likelihood of different potential outcomes to their own business

NERA’s “NewERA” model is a state-of-the-art integrated electric-sector and macroeconomic model developed specifically for both business and policy analysis of climate and other regulatory policies
Highlights of Analysis Results of CPP Using the NewERA Macroeconomic Model
NERA’s Study for ACCCE

- NERA performed a model-based analysis for ACCCE of the CPP’s potential energy market and consumer impacts *(released November 2015)*


- NERA’s analysis for ACCCE considered 3 broadly different scenarios for how CPP might be implemented

<table>
<thead>
<tr>
<th>Implementation Type</th>
<th>Extent of Trading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mass-Based</td>
</tr>
<tr>
<td>2</td>
<td>Mass-Based</td>
</tr>
<tr>
<td>3</td>
<td>Rate-Based</td>
</tr>
</tbody>
</table>
Allowance Allocation Assumptions (for the Mass-Based Scenarios)

- Mass-based implementation also requires the state to decide how to distribute the allowances … which can affect the retail electricity rate impact of a given cap

- ACCCE study’s mass-based scenarios were run for 2 assumptions on allocation of allowance value to electric local distribution companies (LDCs):
  - 0% allocation to LDCs
  - 50% allocation to LDC (the value of which is assumed to be used to reduce retail electricity rates in the state)

- 100% of value of the remaining auctioned allowances is returned to the economy in our analysis
  - Thus, spending by EGUs on allowance purchases impose no net cost to overall economy
  - But they can have strong redistributional impacts across businesses, sectors, and consumer groups in the state
Key Findings for Mass-Based Scenarios

- Energy sector expenditure increases compared to baseline:
  - $220 to $292 billion (present value from 2022 to 2033)
  - $29 to $39 billion/year (annual average)
  - **Includes**: changes in electricity generation costs (including allowance costs), energy efficiency costs, and increased natural gas costs for non-electric consumers
  - **Does not include**: potential increased costs for electricity transmission and distribution and natural gas infrastructure

- Net costs to U.S. households:
  - $64 billion to $79 billion (present value from 2022 to 2033)

- Retail electricity rate increases compared to baseline
  - 11% to 14% (U.S. average for 2022-2033)
Total EGU Coal Consumption Declines Dramatically in All Scenarios

- Reflects 2 market responses to CPP limits:
  - About 80 GW of coal plant retirements
  - Reduced utilization of remaining coal plants

- Not all coal mines or coal supply regions are equally affected
Electricity Rate Increases May Be Very High in Many States

Peak % change in state-average retail electricity rates over years 2022-2030, relative to no-CPP price projection

Source: ACCCE, based on model outputs provided by NERA
# Electricity Rate Increases – Tabular Summary

## State-Level Electricity Price Increases (Relative to Baseline Prices)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Number of States With Average Rate Increases</th>
<th>Number of States With &quot;Peak&quot; Model Year Rate Increases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≥ 10%</td>
<td>≥ 20%</td>
</tr>
<tr>
<td>Mass-Based</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Allocation</td>
<td>37</td>
<td>16</td>
</tr>
<tr>
<td>50% Allocation</td>
<td>30</td>
<td>6</td>
</tr>
<tr>
<td>Mass-Based with Regional Trading</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Allocation</td>
<td>37</td>
<td>14</td>
</tr>
<tr>
<td>50% Allocation</td>
<td>31</td>
<td>8</td>
</tr>
<tr>
<td>Across Any Scenario</td>
<td>40</td>
<td>17</td>
</tr>
</tbody>
</table>

Notes: Retail electricity prices were modeled from 2022-2033 using NewERA output and other information that contributes to estimating cost-of-service and competitive pricing. The average rate increase is calculated at the state-level by comparing the price under the policy to the price in the baseline. The “peak” rate increase is calculated at the state-level by comparing, across model years, the percent increase in the price under the policy relative to the baseline price during that model year. The highest percent increase across all model years is the “peak” price increase. Results across any scenario include the four scenario/case combinations above.
NERA’s Study for Large Energy-Consuming Industrial Groups

- NERA performed a model-based analysis for the American Forestry and Paper Association and 5 other associations of major energy consuming industries (released January 2016)

- NERA’s analysis assessed uncertainties in energy price impacts under rate- vs. mass-based Federal Plans using similar modeling inputs assumptions as those for the ACCCE study

Electricity Price Forecasts Are Generally Higher Under Mass-Based than Rate-Based

Source: Data in NERA report on CPP Federal Plan for AFPA and 5 other large energy-consumer groups, Jan 2016
Allocations to LDCs Can Reduce Retail Electricity Prices Under a Mass-Based Approach, Depending on the State

Source: Data in NERA report on CPP Federal Plan for AFPA and 5 other large energy-consumer groups, Jan 2016

Range of prices in rate-based scenarios

Range of prices in mass-based scenarios

arrows indicate maximum potential retail price reduction from LDC allocations in each state
Concluding Points
Using These Findings

- Potential aggregate impacts appear substantial and robust to a wide range of implementation assumptions
  - To electricity generators
  - To sectors that supply or support the electricity sector
  - To electricity consumers
- Which specific generating units & coal mines will bear the brunt is a question demanding more detailed sensitivity analyses
- Electric utilities operating within a state may face extremely different retail rate implications than the state-average impacts reported here, and requires a company-specific analysis
Broader Implications of the CPP

- CPP is just the first of many greenhouse gas emissions regulations that can be expected under the federal Clean Air Act
  - Petroleum refineries have long been identified as “next” after EGUs
  - March 10, 2016: Intention to regulate methane emissions from existing oil and gas operations announced by Administration
  - Cement manufacturing is a likely target soon after

- Although the Supreme Court has granted a stay on the CPP, possibility remains that the CPP’s initial limit in 2022 may not be delayed if the Court ultimately upholds the CPP
  - The only definite temporal relief provided by the stay is for the initial state plan submission deadline, which had been Sept 2016
Contact Us

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More Information on NERA’s Modeling Methodology and Input Assumptions
NERA’s NewERA Model

- NewERA combines a bottom-up electricity sector model with a top-down model of the full U.S. (macro)economy
  - Electricity sector model optimizes compliance with CPP and estimates electricity rate impacts and other system operational changes such as natural gas and coal usage
  - Macroeconomic model incorporates demand response to electricity price changes, and natural gas and coal price responses to changes in fuel usage

- Economic impact analysis thus offers a comprehensive understanding of not just electricity sector compliance but also overall impacts on consumer spending power

- Appendix provides more details on the NewERA model
NERA Baseline

- NewERA model and its baseline projections are calibrated to the Department of Energy’s AEO 2015 reference case
  - Power plant retirements were updated based on public announcements of firm closures as of August 2015

- Baseline includes effects of existing environmental regulations, including RGGI and California AB 32
  - Baseline does not reflect the possibilities of proposed or future regulations (similar to AEO methodology)

- Baseline does not include the additional end-use energy efficiency that EPA assumes is available for CPP compliance
  - Exception is that NERA assumes California adopts end-use energy efficiency as part of its compliance with the AB 32 program, and thus these costs and demand effects are assumed to be in the baseline
Illustrative CPP Compliance Scenarios in ACCCE Analysis

1. Mass-Based
   - State compliance with emissions targets (includes new sources)
   - Intra-state trading (least-cost compliance)
   - Range based on two illustrative allowance allocations to LDCs

2. Mass-Based with Regional Trading
   - Same as Mass-Based except six trading regions
   - Regional boundaries same as EPA used in its draft Regulatory Impact Analysis
   - Range based on two illustrative allowance allocations to LDCs

3. Rate-based with intra-state trading
6 Emission Trading Regions (As Used by EPA in its Proposal RIA)
NERA Assumptions Related to CPP Compliance Options

1. Coal Efficiency Retrofits
   - EPA assumptions on the cost and effectiveness of coal heat rate improvements (4.3% for the Eastern Interconnection, 2.1% for the Western Interconnection, and 2.3% for the Texas Interconnection)
   - Units undertaking unit efficiency improvements are subject to New Source Review

2. Natural Gas Generation
   - Natural gas generation based upon least-cost generation mix using AEO 2015 information on fuel prices and costs for alternative generation

3. Renewable Generation
   - Renewable generation based on least-cost generation mix using AEO 2015 information on fuel prices and costs for alternative generation

4. Energy Efficiency
   - Use EPA assumption on initial cost ($1,100/MWh), which NERA applies to all energy efficiency programs (split 50/50 between utilities and consumers)
   - Use EPA assumptions on total potential for energy efficiency in each state