





State Planning and Emissions Trading under the CPP

Modeling and Insights

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Key Takeaways

No Clean Power Plan (CPP) pathway is right for every state

- Some states have a clear-cut choice and/or may be in compliance due to existing trends, but other states' choices depend on factors like planned coal retirements, renewable deployment, and other state goals
- Natural gas price path is key factor determining outcomes

Markets for allowances and ERCs could reduce compliance costs, but potential variability in prices creates risks for compliance investments

- Cost of compliance is highly sensitive to a state's planned investments and retirements <u>absent</u> the CPP
- CPP trading mixes cause more variation in coal generation outcomes; renewable and NGCC deployment impacted more by gas price uncertainty

Multi-market interactions (e.g., cross-border trade in power markets and multi-state CPP permit markets) impact CPP outcomes



US-REGEN 48-State Version: EPRI's In-House Electric Sector Model

Capacity Expansion Economic Model, Long Horizon to 2050 State-Level Resolution for Policy and Regulation Analysis Innovative Algorithm to Capture Wind, Solar, and Load Correlations in a Long-Horizon Model





Focus on State-Level Decisions of CPP Compliance Pathways



* US-REGEN modeling of existing mass target is based on the proposed Federal Plan



What if States Were to Comply with the Clean Power Plan as "Islands?"

In other words, each state complies relying solely on resources within its own boundary



Natural Gas Price Uncertainty Represented by EIA's Annual Energy Outlook Paths





2030 Allowance and ERC Prices with "Island" Compliance





2030 Allowance and ERC Prices with "Island" Compliance

<u>High</u> Natural Gas Prices





Observations

- Zero prices imply states are in compliance in 2030 (though extra effort potentially required in other periods)
- Low prices driven by ease of compliance, which are driven by:
 - Low natural gas prices
 - Low incremental cost of wind (especially in high-wind states)
 - Energy efficiency credits from existing programs
 - Announced/expected post-2012 coal retirements
- States do not necessarily know which path is best right now



Technology Deployment under Different Trading Mixes

Points Represent Alternate Rate/Mass Trading Mixes



CPP trading mixes cause more variation in coal generation outcomes; renewable and NGCC deployment impacted more by gas price uncertainty



Observations

Simple economics of rate vs. mass pathways

- Rate compliance achieved with investment in renewables (largely wind), energy efficiency, and coal-to-NGCC re-dispatch
- Mass compliance achieved with investment in more NGCC generation
- State pathway selections and allowance/ERC trading impact CPP compliance costs and generation mix
 - CPP trading mixes cause more variation in coal generation outcomes
 - Renewable and NGCC deployment impacted more by gas price uncertainty (i.e., substitutes)



Example Analysis for State X

How do Clean Power Plan pathway choices impact power sector outcomes?



Reference Case without the CPP: State X Generation





CPP Compliance as an Island Requires Overhaul of the Generation Mix for Either Rate or Mass Pathways





Island Compliance Depends on New Investment in Wind (for Rate Path) or New NGCC (for Mass Path)



Cumulative Capacity Additions through 2030 (State X)



Compliance with Trading

- Opportunity to reduce cost
- Trade-off is reliance on a market
 - Slow to develop?
 - Liquidity?
 - Exposure to additional external forces?
 - Lower volatility?
- Different mixes of rate/mass compliance from other states will impact market prices and the value of trading for State X



With Low Investment (e.g., Mix 5) Comes High ERC/AllowanceImport DependenceCumulative Capacity Additions through 2030 (State X)





Strategic Insights

- Key decisions for states are <u>rate vs. mass</u> selection, but also the <u>degree of market participation</u> in inter-state allowance/ERC trade
- Some states appear to have lower costs with rate, some for mass, but no single lowest-cost choice
- The future matters
 - Big uncertainties and big influence: Natural gas prices, renewable costs
 - Pre-CPP planned retirement/investment decisions
 - Market scope and depth: Supply/demand for ERCs and allowances depend on individual state choices
 - Other state and federal policies, both pre- and post-2030





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Definitions of State Mixes



- Assume all mass states trade together (tons CO₂); all rate states trade together (ERCs)
- California and RGGI states do not trade outside of their borders



Reference Case Assumptions

- Reference load growth and fuel prices per AEO 2016
 - Includes existing energy efficiency (EE) programs
 - Fuel price paths per AEO 2016 Reference case → Gas prices \$4–5/MMBtu
- No forced retirements for existing coal units; retirement for economic reasons possible for any unit
 - Follows AEO assumptions
 - 60–80 year lifetimes for nuclear units
- Limitations on new transmission and nuclear builds
- Technology costs per EPRI Generation Options report
 - Solar and wind costs updated more regularly
- Includes state RPS, RGGI, California AB 32
 - Fleet database as of December 2015, plus announced retirements
 - No additional environmental regulatory costs are included
 - Include CAA § 111(b) CO₂ performance standards for fossil units
 - December 2015 updates of PTC and ITC



With Low Investment (e.g., Mix 5) Comes High ERC/Allowance



