EPA's Clean Power Plan

Potential Implications of the Proposed CO_2 Emissions Standard under CAA Section 111(d)

PRESENTED TO

Harvard Kennedy School Energy Policy Seminar

PRESENTED BY

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September 22, 2014

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Agenda

Key Aspects of the Proposed Rule

EPA's Projected Changes in Emissions and Fuel Use

Impacts on Different Power Generation

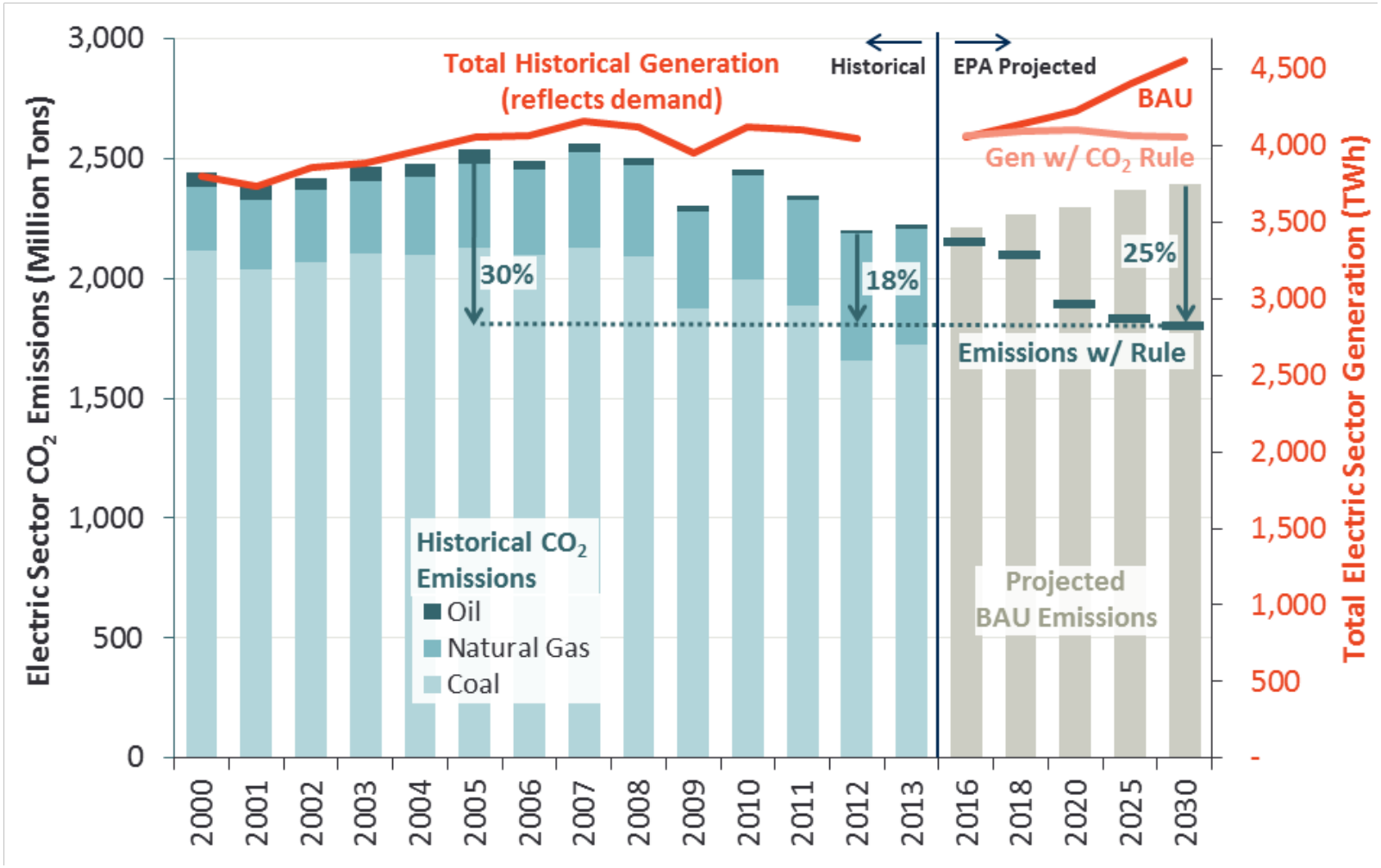
Implications for States

Clean Power Plan Overview and Timeline

- **On June 2, the EPA under Section 111(d) set CO_2 emissions standards on existing fossil generation units (EGUs)**
  - EPA reviewed existing emissions reductions methods to establish the Best System of Emissions Reduction (BSER)
  - BSER is applied to each state's current fossil EGU emissions rate to set state-specific fossil emissions rate standards for 2020-30
  - Option 1: interim goal for 2020-29 (to meet on average); final goal for 2030 and beyond
  - Option 2: less stringent but earlier goals for 2020-24; final goal for 2025 and beyond
  - States given flexibility in how to meet the standards
- **Timeline for compliance**
  - 2014: Proposed Rule; 120 day comment period concludes October 16, 2014
  - 2015: Final Rule
  - 2016: Initial report on State Implementation Plans (SIPs)
  - 2017: Final SIPs (for single-state plans)
  - 2018: Final SIPs (for multi-state plans)
  - 2020-30: Compliance period

Projected Effect of Standards on Emissions

The proposed standards are designed to bring emissions to 30% below 2005 levels



Sources and Notes:
Historical emissions from EPA's CEMS database; historical generation from EIA; Projected generation and CO_2 from EPA's IPM model results, comparing its "Business as Usual" Base Case to its Policy (Option 1 w/o cooperation) scenario.

EPA's Best System of Emissions Reductions (BSER)

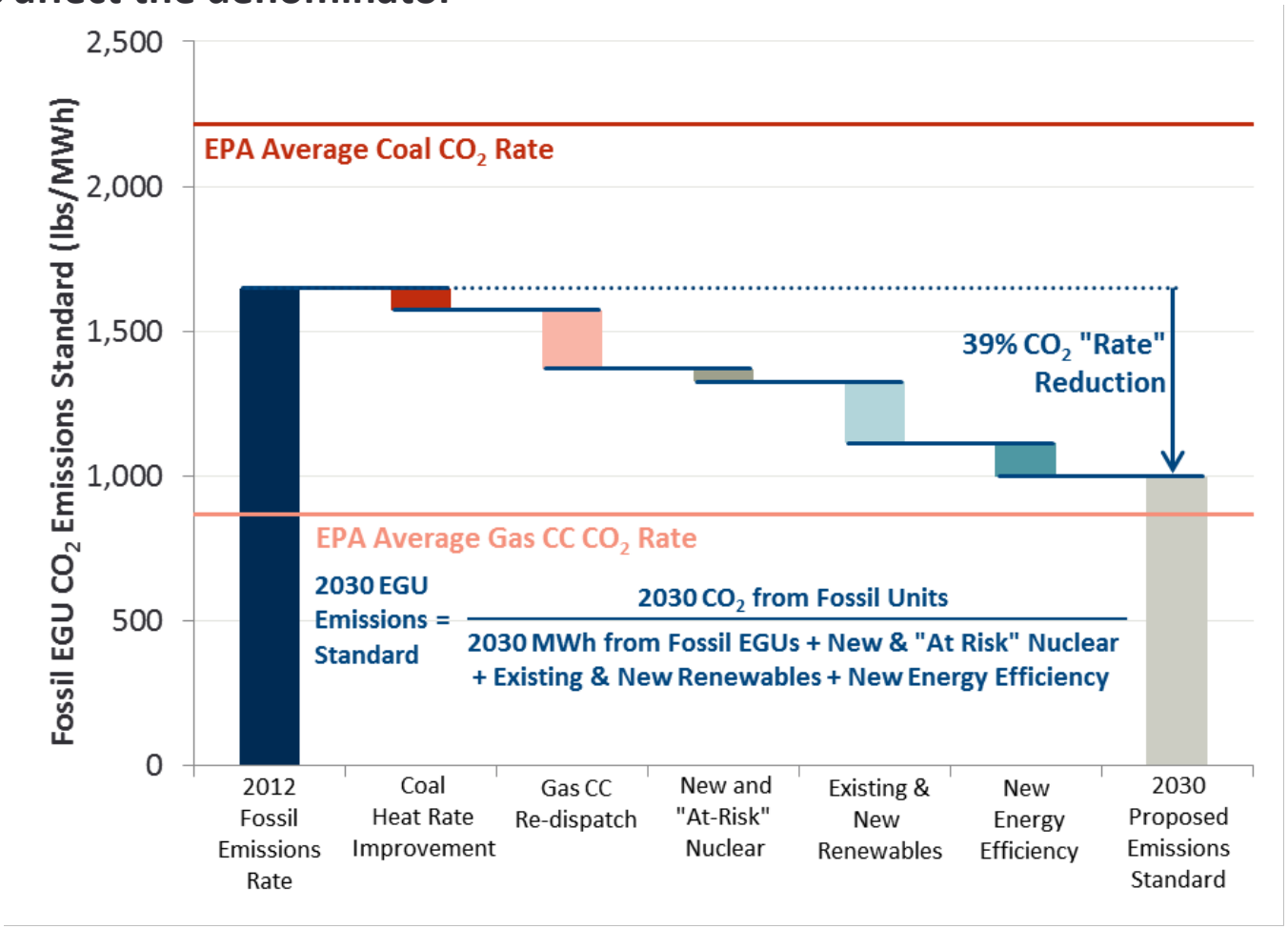
BSER includes four existing methods of emissions reduction, assessed for feasibility in each state

BSER Building Block	EPA Basis for BSER Determination	EPA Estimated Average Cost	% of BSER CO_2 Reductions
1. Increase efficiency of fossil fuel power plants	EPA reviewed the opportunity for coal-fired plants to improve their heat rates through best practices and equipment upgrades, identified a possible range of 4–12%, and chose 6% as a reasonable estimate. BSER assumes all coal plants increase their efficiency by 6%.	$6–12/ton	12%
2. Switch to lower-emitting power plants	EPA determined for re-dispatching gas for coal that the average availability of gas CCs exceeds 85% and that a substantial number of CC units have operated above 70% for extended periods of time, modeled re-dispatch of gas CCs at 65–75%, and determined 70% to be technically feasible. BSER assumes all gas CCs operate up to 70% capacity factor and displace higher-emitting generation (*e.g.* , coal and gas steam units).	$30/ton	31%
3. Build more low/zero carbon generation	EPA identified 5 nuclear units currently under construction and estimated that 5.8% of all existing nuclear capacity is "at-risk" based on EIA analysis. BSER assumes the new units and retaining 5.8% of at-risk nuclear capacity will reduce CO_2 emissions by operating at 90% capacity factor.	Under Construction: $0/ton "At-Risk": $12–17/ton	7%
	EPA developed targets for existing and new renewable penetration in 6 regions based on its review of current RPS mandates, and calculated regional growth factors to achieve the target in 2030. BSER assumes that 2012 renewable generation grows in each state by its regional factor through 2030 (up to a maximum renewable target) to estimate future renewable generation.	$10–40/ton	33%
4. Use electricity more efficiently	EPA estimated EE deployment in the 12 leading states achieves annual incremental electricity savings of at least 1.5% each year. BSER assumes that all states increase their current annual savings rate by 0.2% starting in 2017 until reaching a maximum rate of 1.5%, which continues through 2030.	$16–24/ton	18%

Source: EPA's Proposed Rule.

National Average Fossil EGU Emissions Standard from BSER

The EPA standards are not true emission rates for fossil plants, because some BSER elements affect the numerator (emissions) and other, non-fossil CO_2 abatement elements affect the denominator

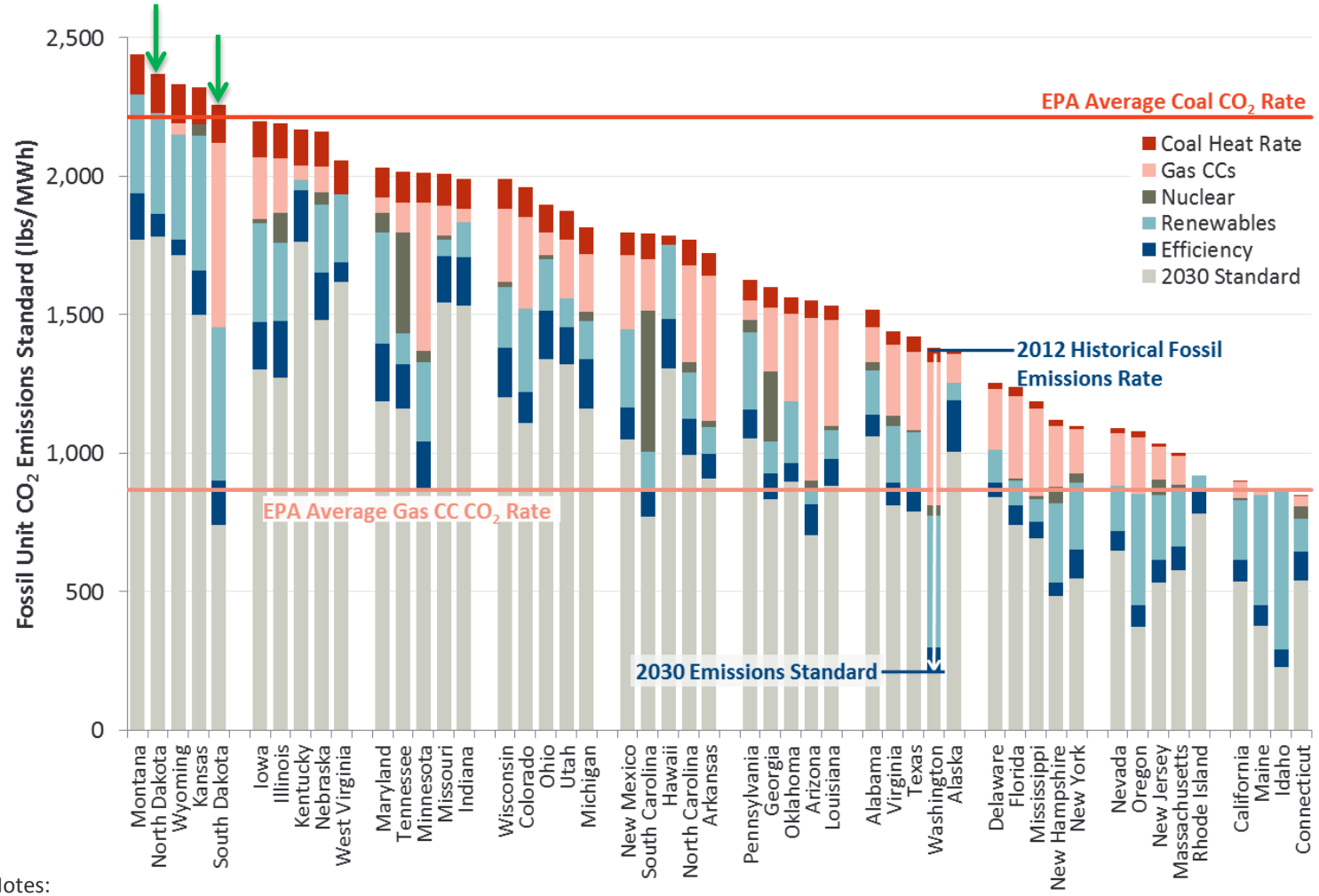


Sources and Notes:
Reflects Option 1 final rate for year 2030 from EPA Technical Support Document: Goal Computation, Appendix 1.

Fossil EGU Emissions Standard by State

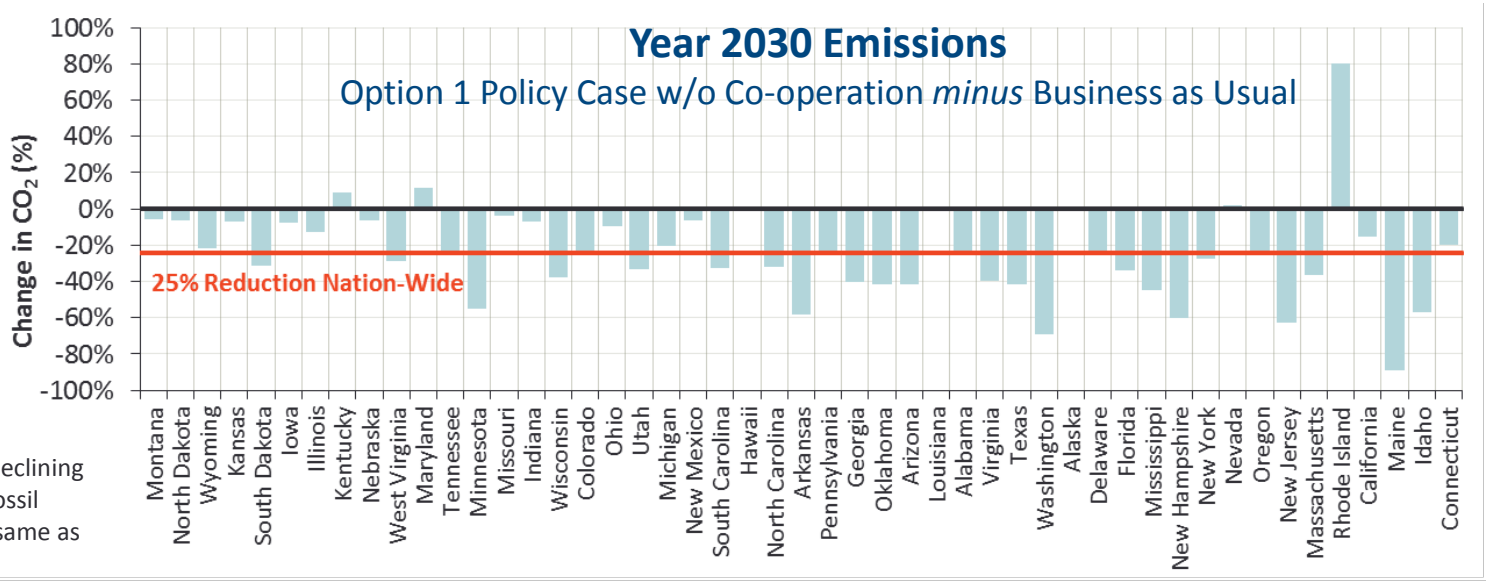
States have significantly different GHG emissions standards

- N. Dakota, Missouri, Indiana: ≥1,600 lbs/MWh, mostly coal capacity
- S. Dakota, Minnesota, Arkansas, Louisiana, Texas: ~800 lbs/MWh, mix of coal and CCGT

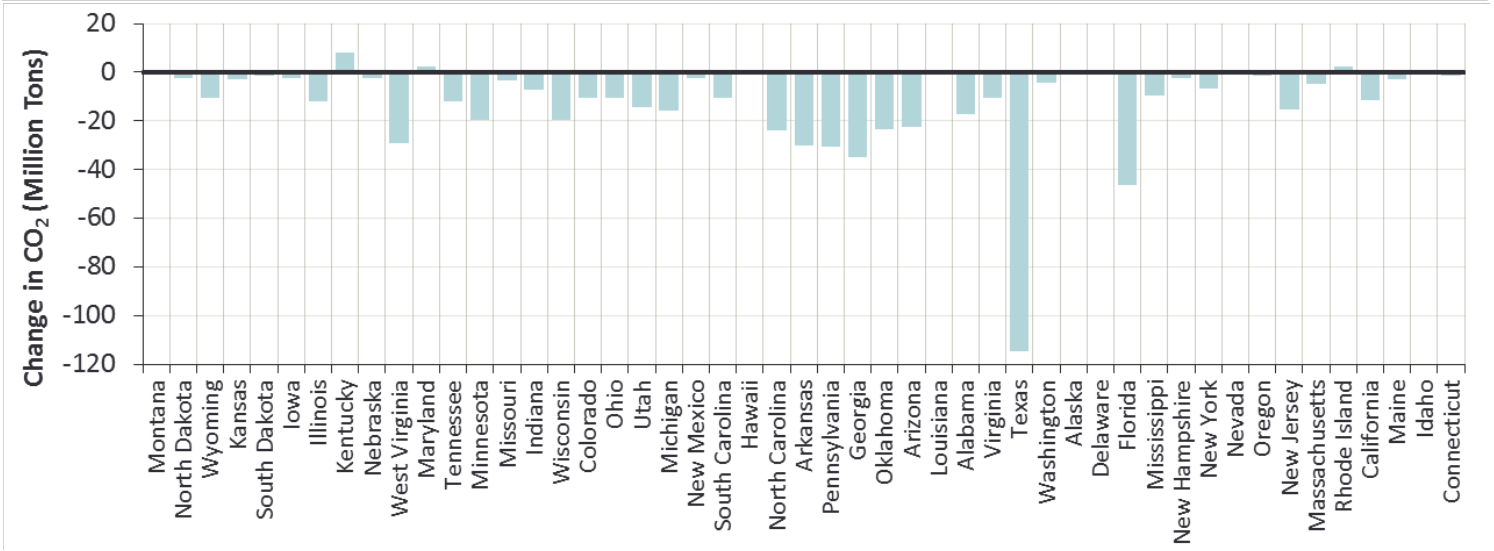


Sources and Notes:
Reflects Option 1 final rate for year 2030 (and beyond) from EPA Technical Support Document: Goal Computation, Appendix 1.

EPA's Projected 2030 Emissions Reductions

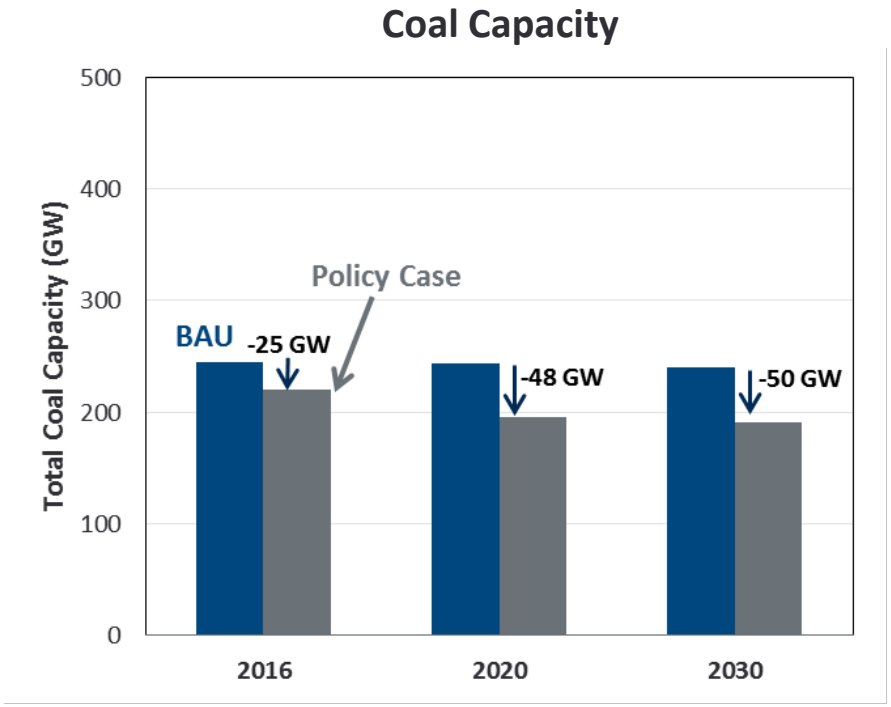


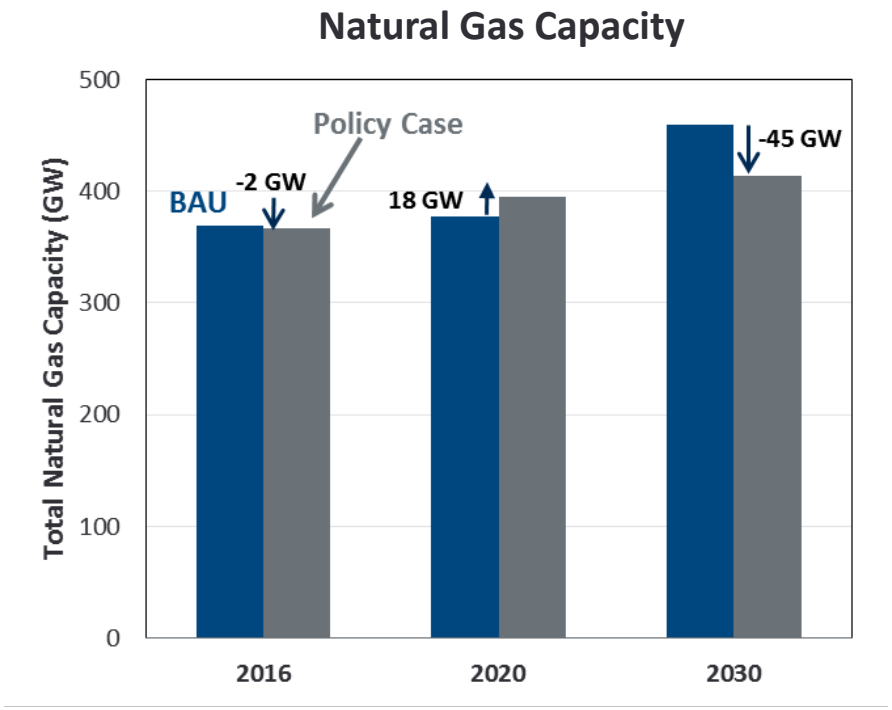
States listed in declining order of 2012 fossil emission rates (same as prior slide)



Sources and Notes:
Reflects differences in state emissions from EPA IPM model results, comparing its Policy (Option 1 w/o cooperation) scenario to its "Business as Usual" Base Case .

EPA's Expected Retirements and New Builds



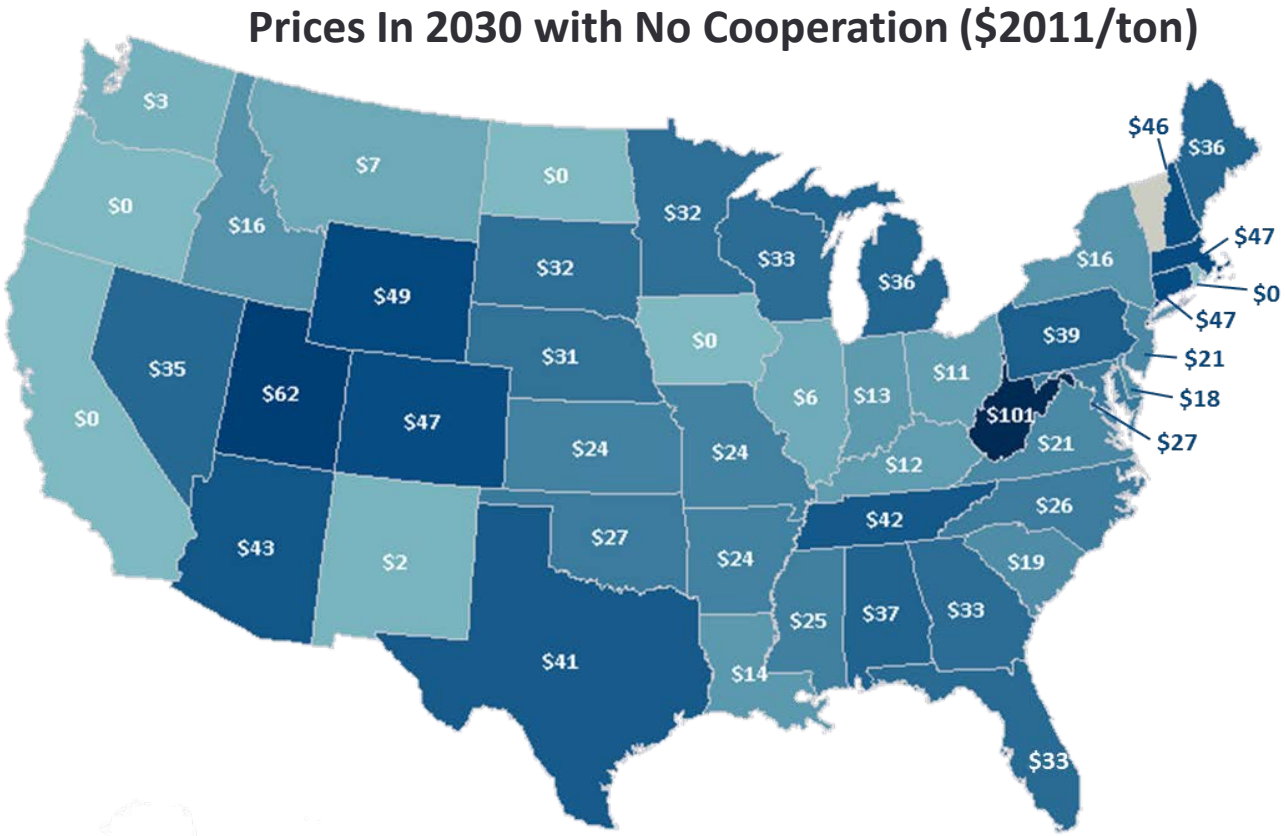


EPA projects that the rule would:

- Induce about 1/5 of the coal fleet to retire by 2020
- Increase investment in gas-fired generation capacity by 2020
- Long-term, entry would be less than in BAU due to energy efficiency`

Sources and Notes:
Coal and gas capacity numbers from EPA's IPM model results, comparing its BAU Base Case to its Policy (Option 1 w/o cooperation) scenario.

EPA Indicative Marginal CO_2 Prices

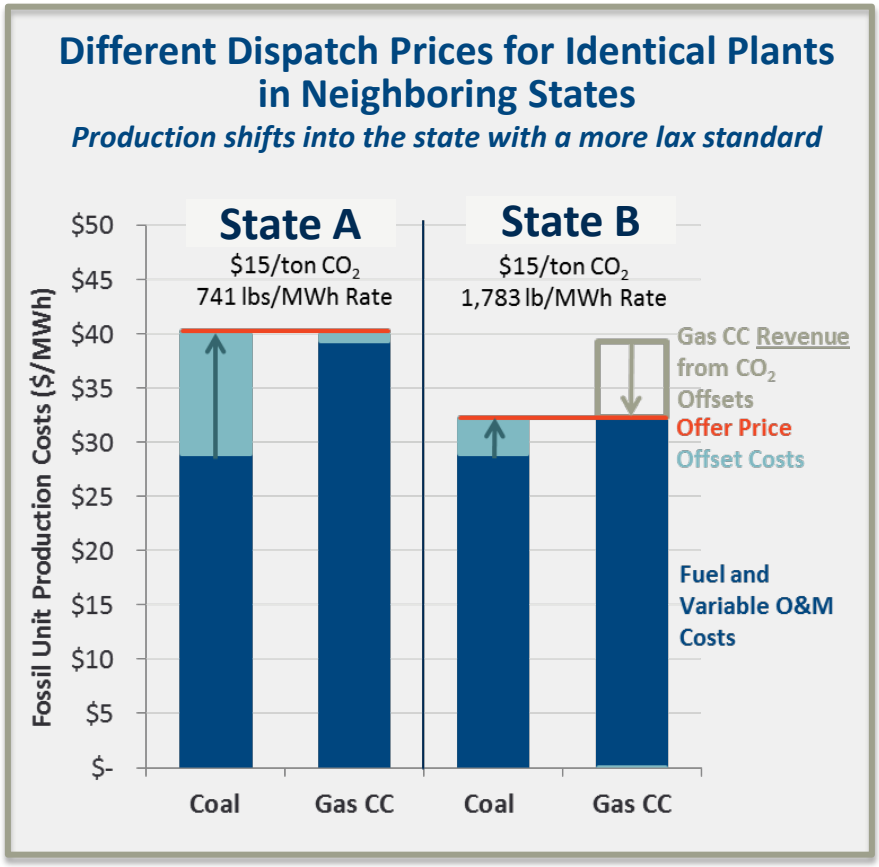


- Disparity of prices suggests large benefits from cooperation
- National average cost of compliance is $15 per ton without interstate cooperation
- EPA's modeled rate-based cooperation reduces the average compliance cost to $13/ton

Sources and Notes:
Values reflect shadow prices on emissions rate constraint, expressed in $2011/ton of CO_2.
Values from EPA's IPM model results for its Policy (Option 1 w/o cooperation) scenario.

Asymmetric Treatment of Similar Plants

The same coal plants located in different state are treated differently during dispatch, putting economic viability of some coal assets at risk, even if they might be just as efficient as others.



Regional Approach Should be Cheaper for All

- Economic theory suggests that reducing emissions in two or more states to a combined reduction target is cheaper than achieving individual reduction targets state by state
- Some states may have low cost reduction options not needed for their own goal achievement
- In a coordinated approach, those could be put to use
- Therefore, regional coordination would likely lower the total compliance cost across the coordinating states
- In theory, all coordinating states can benefit
- But for that to happen, there may need to be financial transfers (or their equivalent) between states

Coordination is Tricky but Desirable

- Given the way EPA has proposed to calculate required changes to emissions intensity, it may not be very costly for North Dakota, Missouri, or Indiana to comply with 111(d) if ultimately adopted in its currently proposed form
- This may lead to the temptation to "go it alone"
- But since cooperation reduces total cost, N. Dakota, Missouri, and Indiana could actually have net benefits (or perhaps close to no cost) of compliance through cooperation
- States with high compliance costs/fewer low cost compliance options should be willing to pay N. Dakota, Missouri, and Indiana rather than engage in costly state-level compliance options
- But psychologically, the "fairness" factor may get in the way
- States also may rather spend money locally, even if more expensive (we see this in meeting RPS mandates with higher cost in-state renewable resources)
- Further, it is not clear how states "pay" each other….

Regional Approach Is Consistent with Current Market

- In a regional approach, coal plants that are more efficient can be utilized more than less efficient ones; keeping the competitive nature in the market today
- The Great Plains have excellent wind resources; in a regional setting, those wind resources would be attractive to meet the region's EPA emissions targets in other states, and some states may be willing to pay for incremental wind resources to meet 111(d) targets

What Should States Ask?

- All states should understand the most likely individual state-by-state compliance approaches
- What would be the impact on important generation asset?
- How would joint compliance differ from “go-it-alone” approaches?
- How would the capacity factor of the coal plants change?
- How much would the capacity factor of gas fired capacity in the region change?
- How much new renewable capacity in the region may become an economic option?
- It will also be critically important to understand how wind resources would be “counted” toward compliance for the states in the region

Preliminary Observations

- Many states could benefit from a regional approach
- Given relatively easy target for a few states, “over-compliance”, e.g. by retiring some of the least efficient coal units, could generate credits to be sold to other states
- The excellent wind resources could help meet regional reduction targets, leading to incremental wind development (above what is needed to meet individual states’ own standard)
- Likely requires some states to “pay” for investments that reduce everyone’s compliance costs
- Could lead to asymmetric effects across utilities/states (coal-heavy versus wind-heavy utilities, regional job impacts of coal-retirements versus wind development, etc.); but those effects might be acceptable to all states because everyone is better off by trading
- A regional simulation of a pricing approach can be used to estimate the potential effects on different utilities and states

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Note:

The views expressed in this presentation are strictly those of the presenter and do not necessarily state or reflect the views of *The Brattle Group, Inc*.

Ms. Judy Chang is an energy economist and policy expert with a background in electrical engineering and over 17 years of experience in advising energy companies and project developers with regulatory and financial issues. Ms. Chang has submitted expert testimonies to the U.S. Federal Energy Regulatory Commission, U.S. state and Canadian provincial regulatory authorities on topics related to transmission access and renewable energy. She also has authored numerous reports and articles detailing the economic issues associated with system planning, including comparing the costs and benefits of transmission. In addition, she assists clients in comprehensive organizational strategic planning, asset valuation, finance, and regulatory policies.

Ms. Chang has presented at a variety of industry conferences and has advised international and multilateral agencies on the valuation of renewable energy investments. She holds a Bachelor of Science in Electrical Engineering from University of California, Davis, and a Master's in Public Policy from Harvard Kennedy School, is a member of the Board of Directors of the Massachusetts Clean Energy Center, and the founding Executive Director of New England Women in Energy and the Environment.

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