EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Assessing Challenges of EPA's Clean Power Plan

Victor Niemeyer, Program Manager
P103: Energy and Environmental Policy Analysis and Company Strategy

14th IEA-IETA-EPRI Annual Workshop
October 9, 2014

Key Features of EPA's Proposal

- States are responsible for compliance with EPA targets
- Lots of flexibility means lots of decisions to make
- Renewables, nuclear, and energy efficiency play key roles in target-setting and compliance
- Proposed metric is an emission rate for covered resources (not more familiar mass-based caps)

$$\frac{CO2\ Emissions}{Covered\ Generation} \rightarrow \text{State Target} \rightarrow \text{Compliance}$$

Interacting details a challenge for comments, for planning, ultimately for compliance

BSER Applies Four Building Blocks (BBs) to Set a Target Covered-Emission Rate Goal

BB1: Coal Units Heat Rate Improvements of 6%

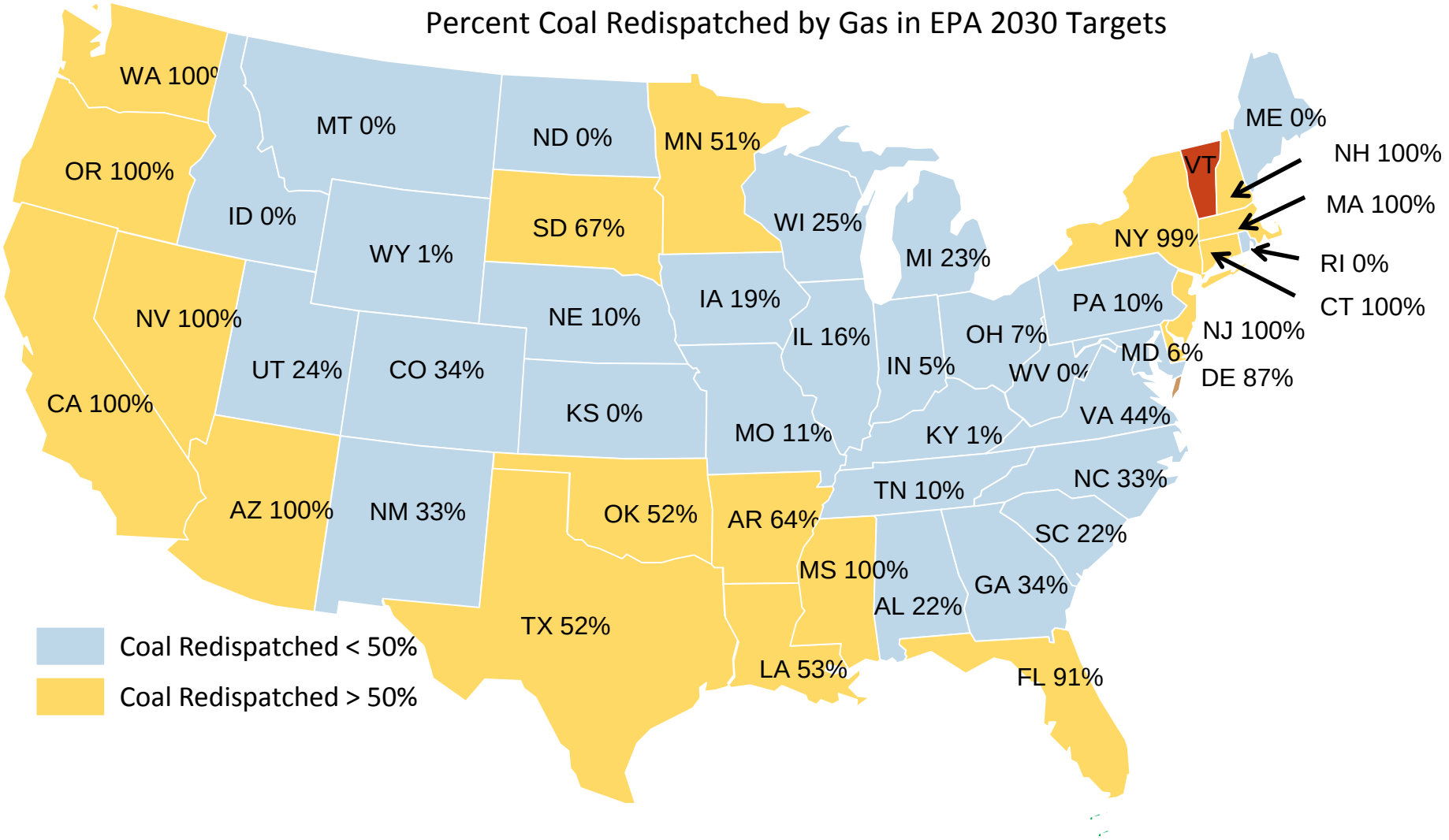
BB2: Re-dispatch to NGCC Units to 70% c.f.

BB3: Expansion of Renewable and Nuclear Energy

BB4: Use of Energy Efficiency of 1.5%+ per year above baseline

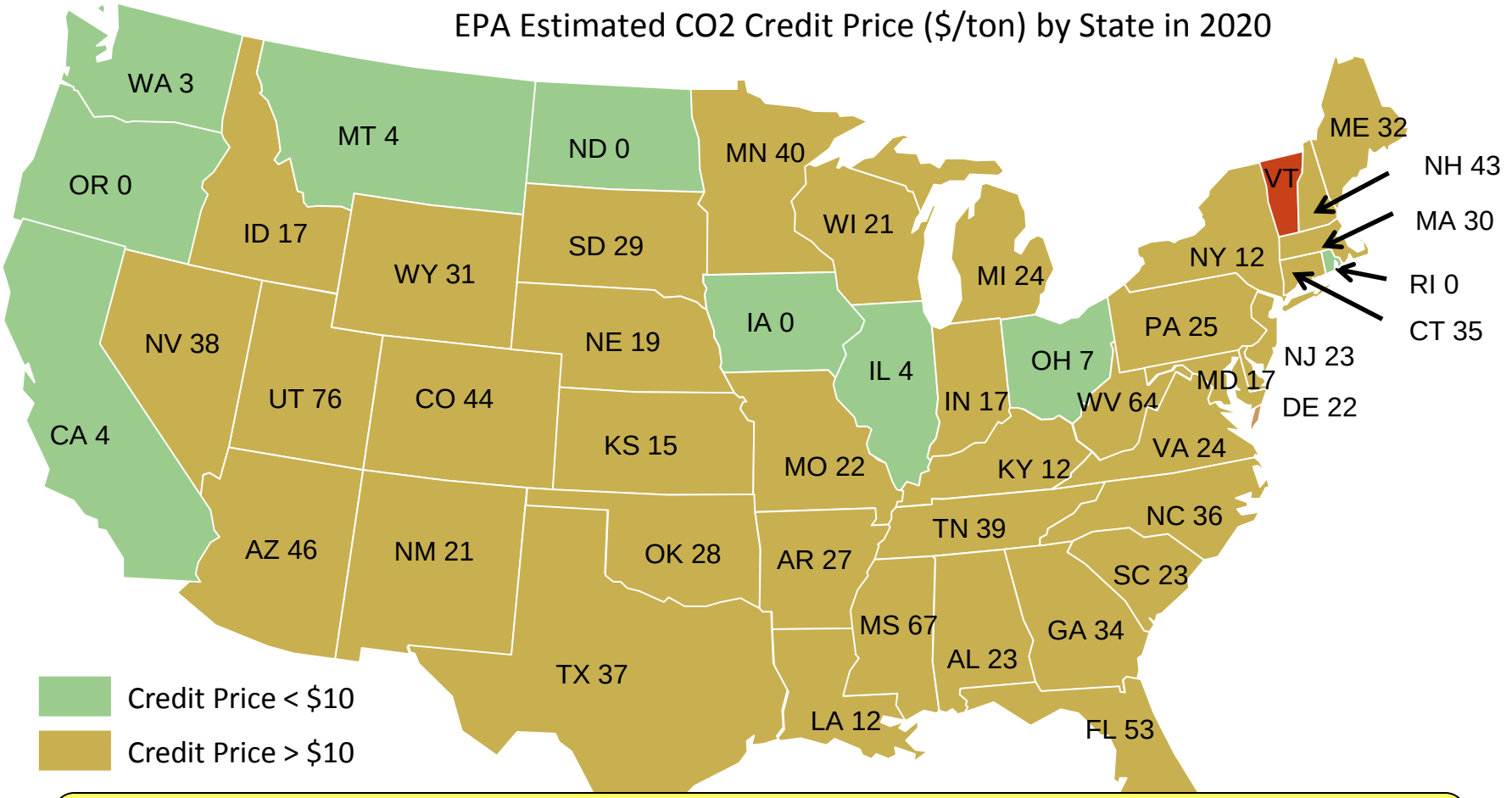
$$Rate^{*} = \frac{(Minimized\ Covered\ Fossil\ CO2\ per\ BB1\ and\ BB2)}{(2012\ Fossil\ MWh)\ +\ (EPA\ target\ BB3\ and\ BB4\ MWh)}$$

Many States Face Targets Based on Expectation that > 50% of Coal Will be Re-dispatched by Gas



Source: EPA's target calculation spreadsheet

Lower Cost Compliance for Some States (credit 2020 prices as estimated by EPA)

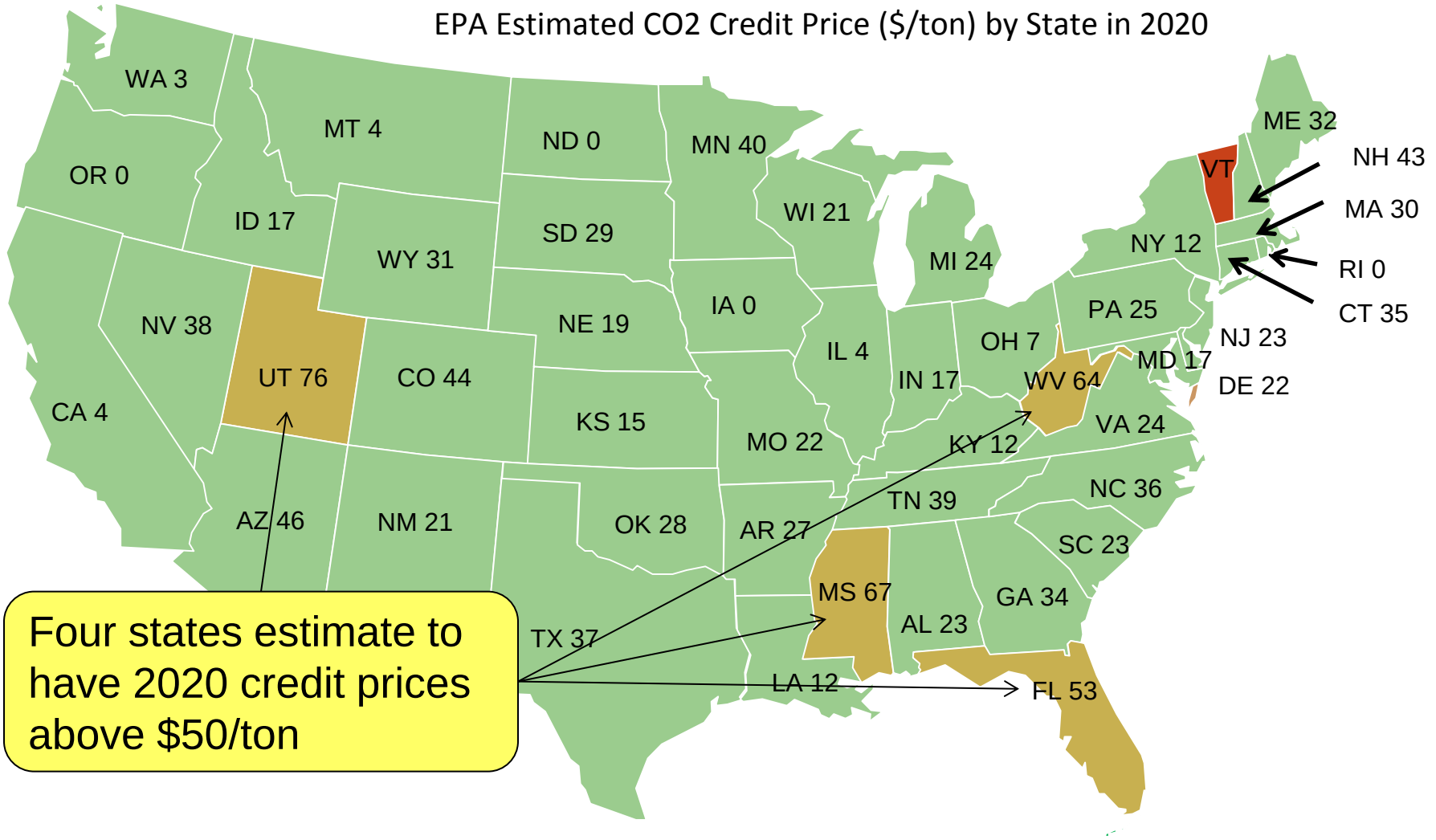


Nine states (in green) estimated to have credit prices below $10/ton

Source: EPA's Option 1 IPM modeling results

EPRI ELECTRIC POWER RESEARCH INSTITUTE

Compliance Could be a Bigger Challenge for Other States (high estimated credit prices)



Source: EPA's Option 1 IPM modeling results

Hard to Catch Dynamic Implications of the Clean Power Plan with Planning Models

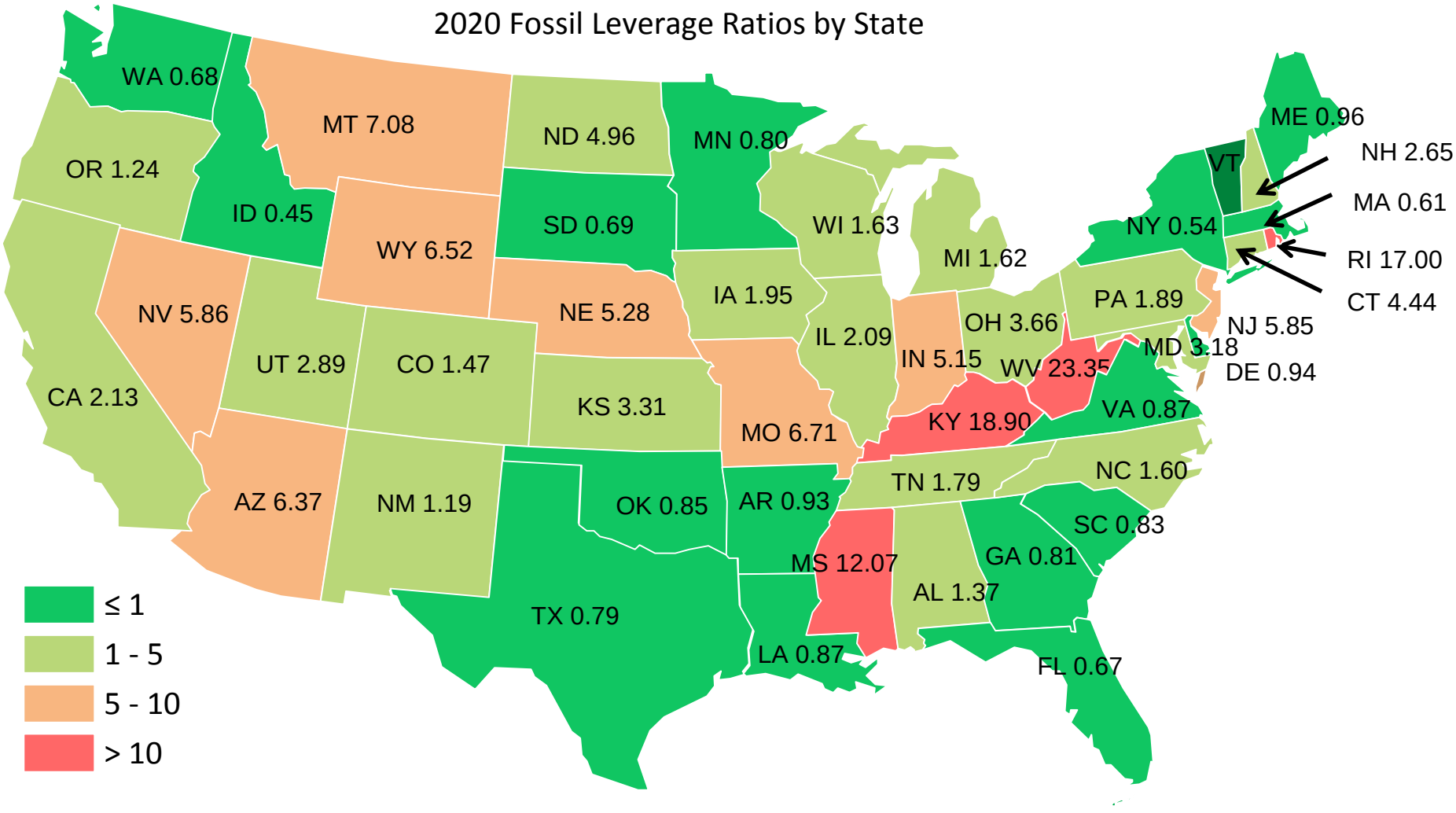
- Models optimize compliance for no-surprise futures
- Limited representation of lead times
- Energy Efficiency levels/potential an input assumption
- Little representation of RE integration constraints
- Make full use of interstate power to minimize total cost
- Yet controversy over RE and EE supply, nuclear credits
- What happens if “things don’t go as planned”

“In theory, there is no difference between theory and practice. But in practice, there is.”
— Yogi Berra

Dynamics of BSER Compliance Challenge Electricity Supply

- MWh from nuclear, RE and EE (BB3/4) in the denominator of the BSER compliance calculation caps the allowed amount of covered fossil generation
- Key implication is that under-delivery of BB3/4 generation forces additional decreases in fossil generation – not what you want for reliability
  - Compliance requirement ranges from a reduction of 0.81 MWh of fossil per MWh of BB3/4 shortfall in GA, to 23.4 MWh of fossil per MWh of BB3/4 shortfall in WV
- Serious consequences
  - Long-term: must add new NGCC generation at high cost
  - Short-term: states may have to choose between compliance and reliability

2020 State Fossil Output Leverage Factors



Leverage Factors are fossil MWh lost (gained) for each 1 MWh change in BB3 or BB4

EPRI ELECTRIC POWER RESEARCH INSTITUTE

Challenge of High Leverage for Zero-CO2 EE/REN/NUC (BB3 + BB4) Resources

EE/REN/Nuc output leverages ability to utilize existing fossil under BSER

- For over 20 states each MWh of EE/RE/Nuc supports over 2 fossil MWh
- EE/RE/Nuc shortfalls force additional fossil curtailments

AZ 2020 example (900 lbs/MWh = NGCC rate; 778 lbs/MWh = Target rate)

For every MWh missed here in 2020

AZ requires 6.4 MWh reduced here

[6.4 = 778/(900-778)]

Will States have to choose between compliance and reliability?

Observation: Flexible Planning Followed by Inflexible Compliance

- Few options for states that don't meet their BB3/4 targets
  - Limited room for further redispatch
    - Coal may already be gone, or
    - NGCC's at 70% already
  - BB3/4 components are slow-response
    - Lead times limit ability to compensate for initial under-compliance within 3-year rolling compliance periods
  - New NGCCs also have time lag
  - Remaining option is dial-back covered fossil generation creating gap that can only be made up by
    - Cutting exports
    - Increasing imports
- Shortages in any one state may spread through power market

Observations on Arizona

- Low target of 778 lb/MWh due to large number of merchant NGCCs (built to serve California market?)
- Target rate below emission rate for a new NGCC (~850)
- If any shortfall of zero-emitting BB3/4 output, only source of make-up is imports or new NGCCs (if time to build)
- May end up with new NGCC's being installed in New Mexico or Utah to back down existing NGCCs in Arizona

- 13 states are similarly situated: i.e., have 2020 goals below the emission rate of a new NGCC, 850 lb/MWh

Observations on the West Virginia

- West Virginia exports over half its generation
- A 1 TWh shortfall in BB3/4 output in 2020 means WV must cut total generation by a third (23 TWh) for compliance
- If reduction taken out of exports, they decline by 2/3^{rds}
- Reduced WV exports puts a squeeze on trading partners
- If EPA allowes “White Tag” RE credits from other states WV likely to be primary destination
- If WV can count new NGCC output for 111(d) compliance impacts of any BB3/4 shortfalls greatly moderated
  - This could make WV the place to locate any new NGCC’s in the region

Observations on Georgia

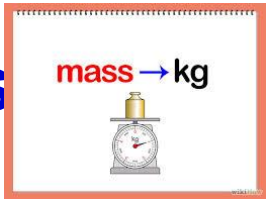
- 2,500 MW of new nuclear expected by 2020
- Counted in BSER goals for state
- GA leverage ratio is 0.8 for 2020
- This means that for each 1 MWh either of the new units comes in below a 90% CF will require a 0.8 cutback in existing coal
- Adjusting for capacity factors, any outage of these units (below 90% CF) requires an additional cutback of coal by the same amount
- 2,500 nuclear outage → 5,000 nuclear+coal outage
- South Carolina and Tennessee have similar issue

Observation: No Easy Fixes

- Three-year averaging for compliance no help unless EE or RE shortfalls made up quickly by subsequent surpluses
  - Not likely for nuclear outages or EE program failures
  - Need luck to recover from weather-driven RE shortfalls
- If EE and RE goals in state targets are unrealistic the consequences for utilization of covered fossil may be severe

1. Strong incentive to "over comply" on BB3/4 (leverage works both ways)
2. Converting to a mass target breaks the link to BB3/4 that forces curtailments of covered fossil

Rate-based to Mass Based Goals: Different results from alternative paths



From EPA's Proposal and Technical Support Document:

1. EPA **assumptions** used to create the state covered emission rate goals **(Data/proposal based)**

2. Apply EPA/IPM Option 1 **simulation** results per TSD on "Projecting EGU CO2 Emission Performance in State Plans" (**Model/simulation-based)**

3. Apply **proposal te**xt from §60.5770(3) using EPA/IPM Base Scenario results **(Covered units bear bulk of reductions)**

Results from alternative paths can vary 30%

Vic's Summary Perspective

- EPA's proposal seeks significant CO2 reductions from existing sources within limits of the Clean Air Act
- BSER approach is novel, and complex
- Application of the BSER formula leads to:
  - Widely different impacts across states
  - Compliance depends heavily on supply of zero-emitting resources that may be uncertain
  - Compliance dynamics negatively impact power supply
- EPA, states, generators, and other stakeholders will need to work together to address these challenges
- EPA actively engaged with all stakeholder throughout the regulatory process: expects 5 million comments

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Together…Shaping the Future of Electricity

Victor Niemeyer
650-855-2262
niemeyer@epri.com