NARUC Winter Policy Summit

Subcommittee / Staff
Subcommittee on Clean Coal and Carbon Management

1:30 – 3:00 pm ET

The Net-Negative CO_2 Baseload Power Initiative

Addressing Climate Change Concerns

Protecting the Baseload Power Infrastructure

Securing the Economic Future of Coal Communities

NARUC Winter Policy Summit

February 13, 2022

Steven E. Winberg

Fred Palmer

Net-Negative CO_2 Baseload Generation Technology

- Established in June, 2021 as a 501(c)(6)
- The Team

Steve Winberg
Chairman & CEO

Ken Humphreys
Treas. & Sec.

Fred Palmer
Senior Consultant

- Our Members
  - CONSOL Energy
  - Peabody
  - PFBC-EET

Net-Negative CO_2 Baseload Power Technology

Coal with Biomass Co-firing and CCS

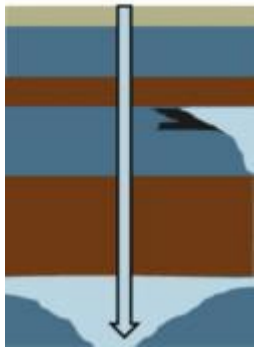
Coal

Biomass

Fuel Transport

Power Generation

CO_2



CO_2 Storage

Baseload Power

CO_2 Footprint

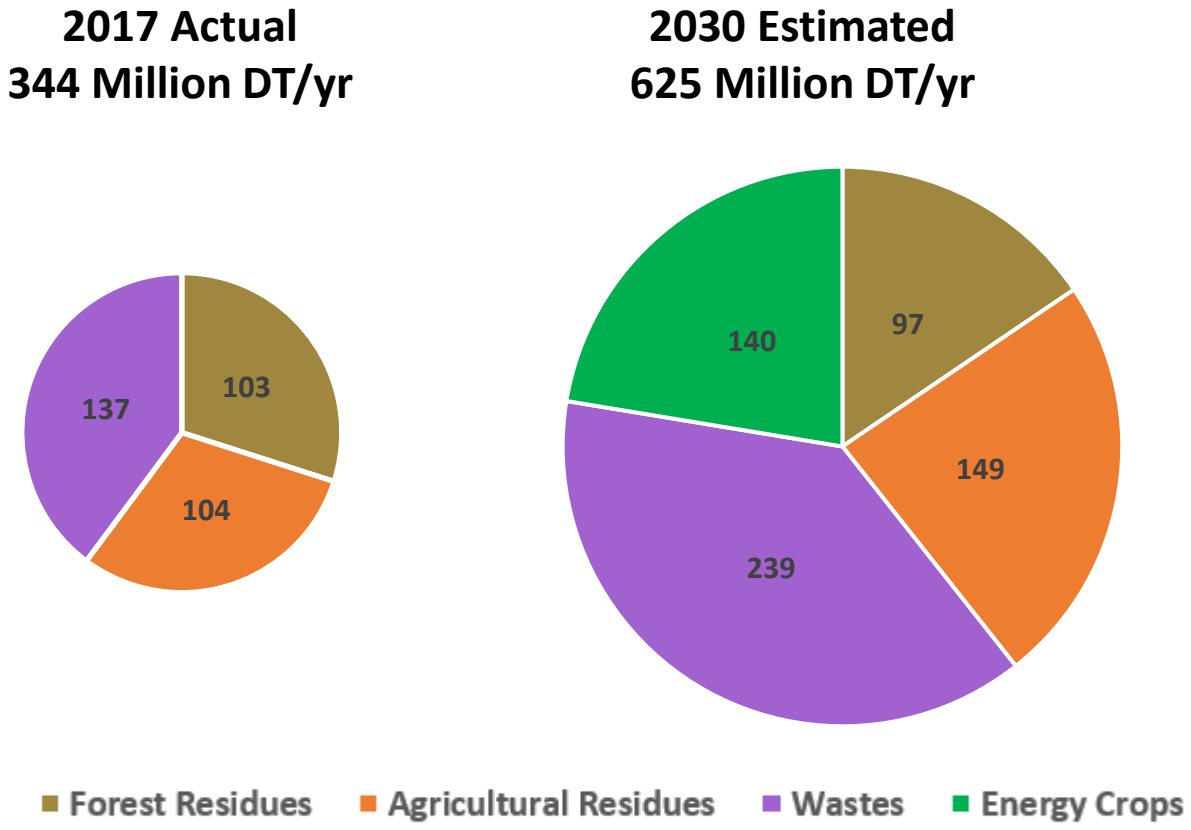
Net-Negative CO_2 Footprint

U.S. Biomass Resource

Quantities are Sufficient to Sustainably Support Coal-Biomass Co-Firing

- In 2017
  - 669 million tons were available
  - 325 million tons produced and consumed
  - 344 million tons were left unused
- By 2030
  - At $20 - $60/ton roadside 625 million tons could be available for new uses
  - Brings total resource (current uses and new uses) to nearly 1 billion tons by 2030
- Co-firing the entire existing coal fleet with 20% biomass would require ~125 million tons
- Industrial wood pellets derived from forest product residues would be principal early-mover fuel for co-firing
- As technology advances, energy crops, agricultural, and selected wastes are candidates for use in co-firing

Biomass Resource Available for New Uses



Source: U.S. Department of Energy. 2016. 2016 Billion-Ton Report: Advancing Domestic Resources for a Thriving Bioeconomy, Volume 1: Economic Availability of Feedstocks.

Proposed DOE Net-Negative CO_2 Baseload Power Program

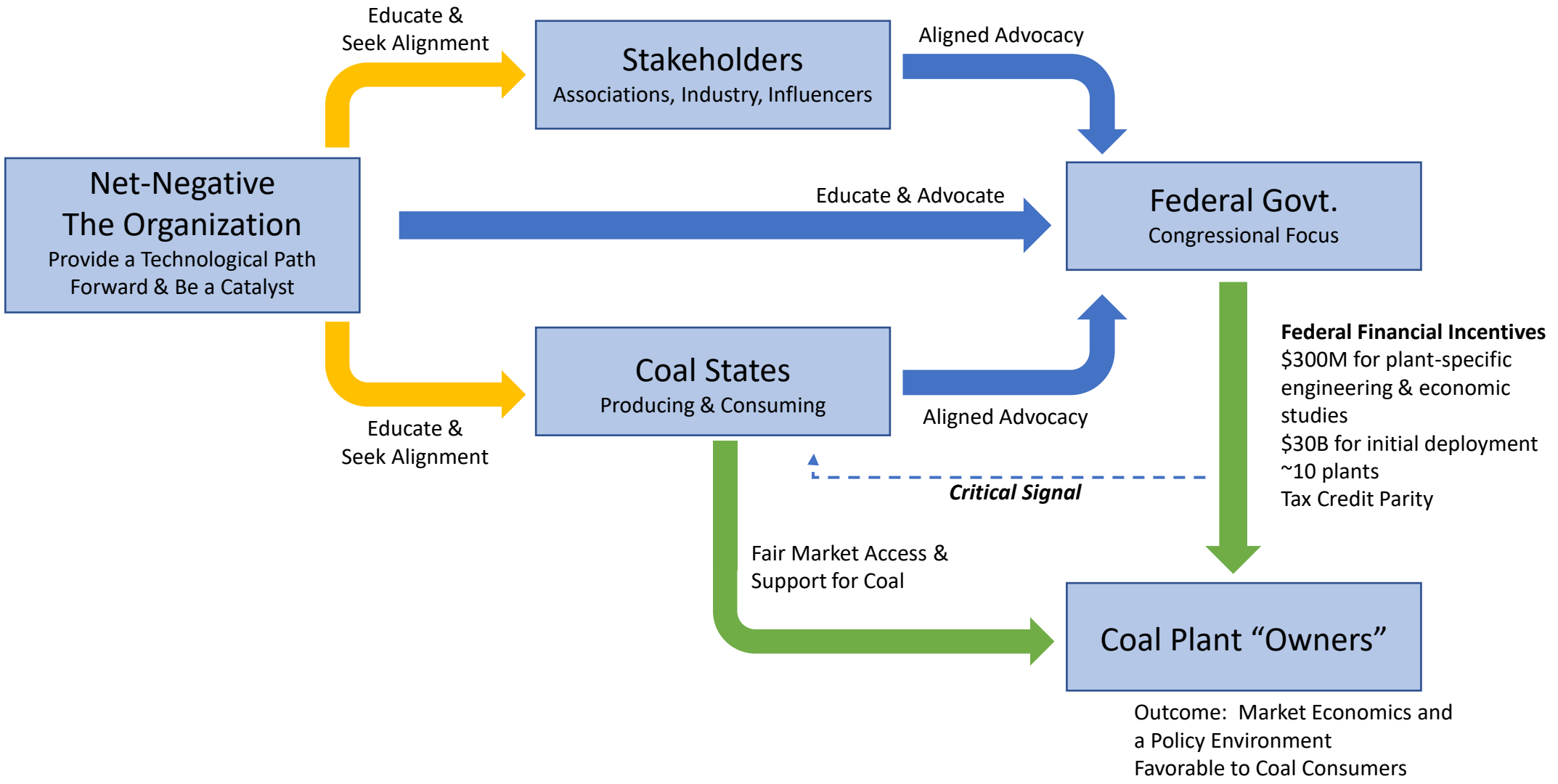
- Qualifying projects:
  - Must retrofit/repower, at the same site, an existing coal-fired power plant to preserve state and community economic benefits.
  - Retrofit or replacement must have net-negative emissions using coal/biomass co-firing with CCS
- $300M for plant-specific engineering and economic studies
- $30B to cost-share deployment of the initial ~10 net-negative plants
- Power plant owners may competitively apply
  - Grants for engineering/economic Project Concept Studies
  - Cost-share for pre-FID Project Development Activities
  - A package of incentives to attract commercial co-investment and limit ratepayer impacts

Tax Credit Parity

- Investment and Production Tax Credits (ITCs and PTCs)
  - Incentivize low-carbon, reliable power
    - Minimum dispatchability requirement (e.g., 90%)
    - Nuclear, Renewable, CCS-enabled fossil plants, and Net-Negative fossil plants can all meet a dispatchability requirement either stand-alone or with battery/low-carbon power back-up
  - Zero-carbon emitting plants would be eligible for a Base PTC.
  - CCS-enabled fossil plants with <100% capture would be eligible for a reduced PTC.
  - Net-Negative plants, effectively with >100% capture would be eligible for an increased PTC.
- 45Q Carbon Capture & Storage Tax Credit
  - Amount should be indifferent to the carbon capture technology employed (e.g., amine capture, ammonia-based capture, or direct air capture). The result “tons captured” not the technology type should be incentivized.

Approach

Creating a Favorable Investment Environment for Coal During an Economy-Wide Transition Toward Net-Zero



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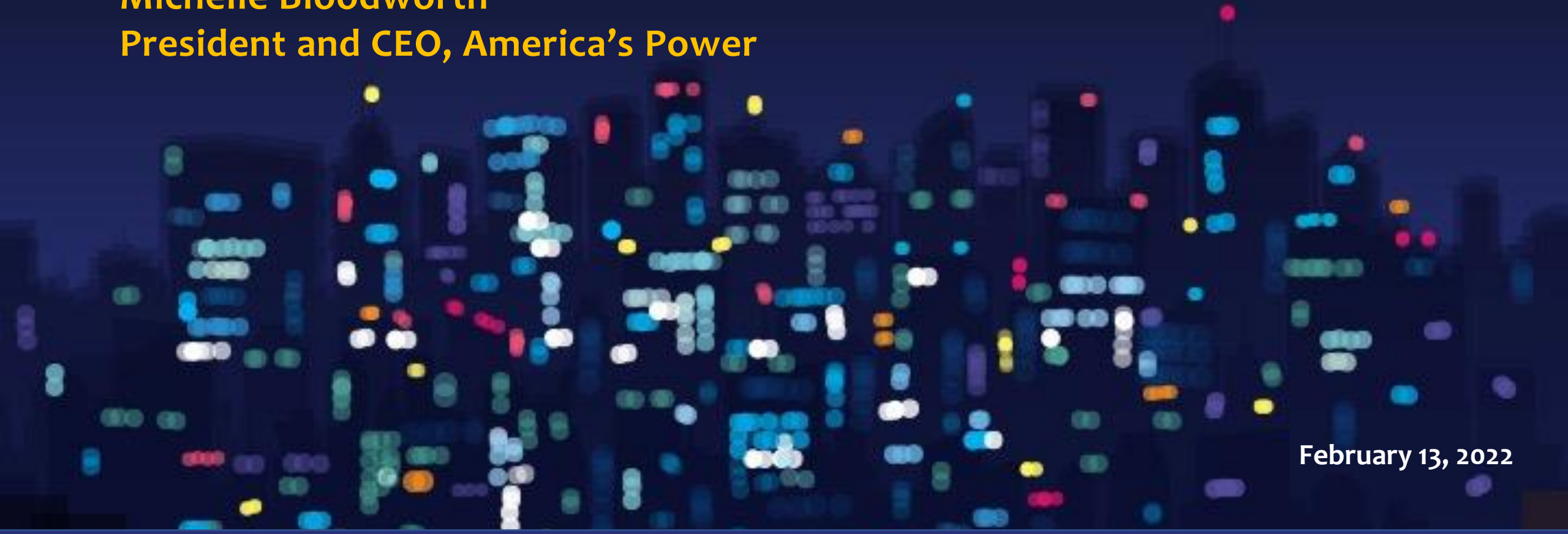
The Grid Transition

NARUC Clean Coal Subcommittee

Michelle Bloodworth
President and CEO, America's Power



February 13, 2022

The grid transition needs to allow time to overcome obstacles and avoid major problems.

An 80 percent carbon-free grid by 2030 and carbon-free electricity by 2035 are not realistic because there are too many major obstacles, including the following:

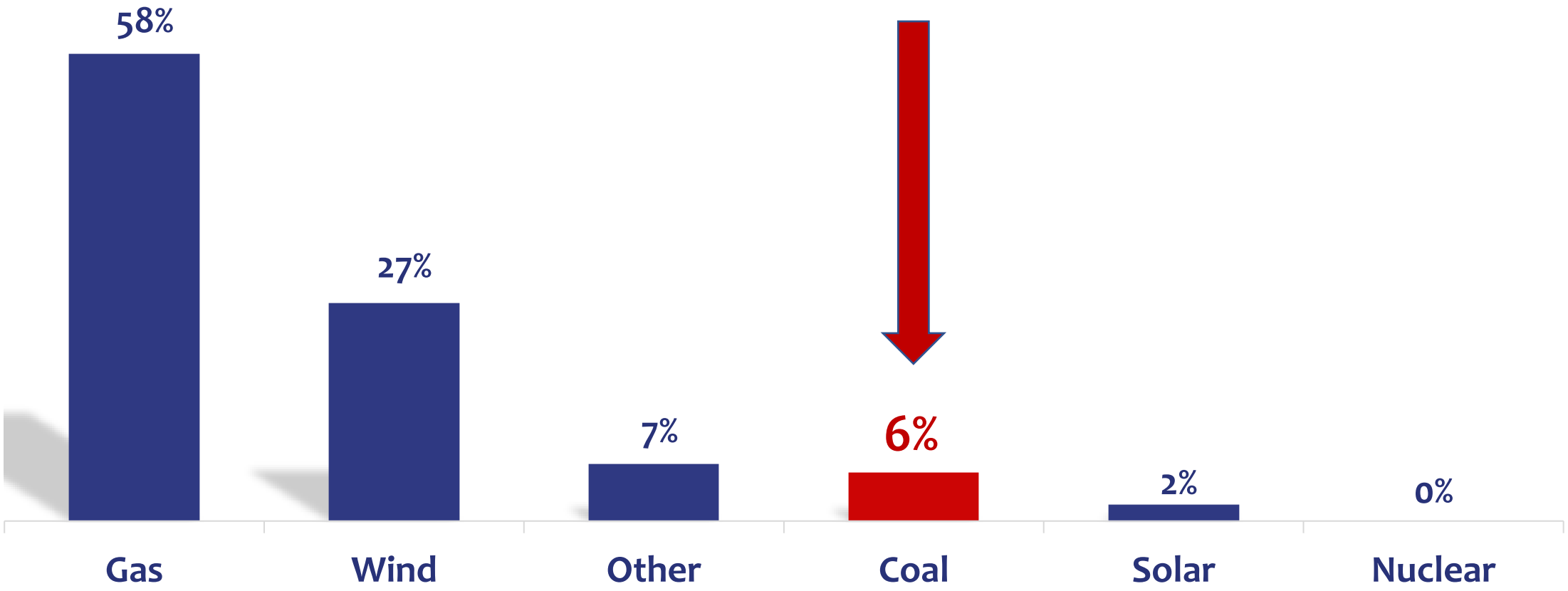
- **Expense of adding massive amounts of wind, solar and storage**
- **Time and cost to add new transmission**
- **Maintaining reliability and resilience with a renewables-heavy grid**
- **Providing time for technology innovation (especially carbon capture and related technologies)**
- **Making changes to market rules**
- **Paying for stranded assets**
- **Maintaining fuel assurance (e.g., complying with new NERC standard)**
- **Mitigating job losses and helping impacted communities**

Coal retirements continue, even though balancing resources are needed to maintain reliability and resilience as renewables increase.

- Nationwide coal retirements total 86,000 MW during 2022-2030. Currently, the U.S. coal fleet totals roughly 210,000 MW.
- Announced coal retirements in MISO total 27,000 MW during 2022-2030. Currently, MISO has the largest coal fleet totaling 55,000 MW.
- Announced coal retirements in PJM total 24,000 MW during 2022-2030. PJM has the second largest coal fleet with 48,000 MW.
- EPA regulations and policies (CCR, ELG, MATS, regional haze, etc.) are likely to cause even more retirements.

Coal was resilient in ERCOT, SPP and MISO South during Storm Uri

Unplanned outages and derates



Grid operators and NERC are evaluating the increase in renewables combined with the loss of conventional resources.

- PJM "*Renewable Integration in PJM*" (ongoing)

  PJM evaluated an "aggressive" scenario of 50 percent renewables by 2050. (We think this assumption is not aggressive enough.) At 50 percent penetration of renewables, PJM would need 78 percent more nameplate capacity than its peak load forecast.

- MISO "*Renewable Integration Impact Study*" (RIIA) (ongoing) Next slide

- NERC "*Fuel Assurance Standard*" (under development)

  NERC has begun developing a standard because "unassured deliverability of fuel supplies, coincident with the timing and inconsistent output from variable renewable energy resources … can result in insufficient amounts of capacity and/or energy." One fuel assurance risk is "the increased use of just-in-time delivery of fuel." NERC also said that "more scenarios for planning and extreme events are needed …"

MISO's RIIA

- The RIIA evaluated increasing amounts of wind and solar up to 50 percent. MISO's analysis suggests that for 50 percent renewables penetration, about 125,000 MW of non-renewable capacity would be needed in order to integrate about 117,000 MW of renewable capacity.

- " … as renewable penetration increases, so does the variety and magnitude of system risk requiring transformational thinking and problem-solving." These risks include grid stability, grid stress, energy shortage, flexibility, and insufficient transmission capacity.

- "Integration complexity increases sharply after 30% renewable penetration."

- We offered two recommendations to MISO:

  - ✓ The timing of renewables matters. MISO should assume specific time frames for integrating renewables. This would provide better insight into the challenges MISO faces.
  - ✓ MISO should determine whether its grid is not just reliable but also resilient.

We are asking utility commissioners to consider the following:

- Engage in grid operator renewables studies to make sure analysis leads to solutions
- Be cautious about retiring balancing / fuel assured resources too soon
- Understand both the advantages and drawbacks of adding renewables quickly
- Engage on EPA regulations and policies
- Support the development and deployment of advanced technologies like carbon capture
- Please pay attention to *both* reliability (normal circumstances) and resilience (infrequent but extreme disturbances)

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