

THE FEDERAL OUTLOOK FOR COAL

Virginia Coal & Energy Alliance and Southern States Energy Board
“The New Vision for Coal”
Kingsport, TN
Shannon Angielski, CURC
May 21, 2018

Carbon Utilization Research Council (CURC) Members

Coal Producers

Arch Coal, Inc.
Cloud Peak Energy Resources LLC *
Lignite Energy Council
Peabody Energy*

Equipment Suppliers

B&W Power Generation Group, Inc.
Caterpillar Global Mining
General Electric*
Mitsubishi Heavy Industries America,
Inc. (MHIA)

Labor Unions

United Mine Workers of America
International Brotherhood of Boilermakers
International Brotherhood of Electrical
Workers

NGOs

ClearPath Action
EnergyBlue Project

Technology Developers

Jupiter Oxy Corp
NET Power

Research Organizations

Battelle
Electric Power Research Institute (EPRI)
Gas Technology Institute
University of North Dakota Energy &
Environmental Research Center

State Organizations

Energy Industries of Ohio
Greater Pittsburgh Chamber of
Commerce
Illinois Coal Association
Kentucky Energy & Environment Cabinet
Southern States Energy Board
West Virginia Coal Association
Wyoming Infrastructure Authority

Trade Associations

American Coal Council
American Coalition for Clean Coal
Electricity (ACCCE)
Edison Electric Institute (EEI)
National Rural Electric Cooperative
Association (NRECA)

Universities

Lehigh University
Ohio State University
Pennsylvania State University
Southern Illinois University
University of Kentucky/CAER
University of Wyoming
West Virginia University

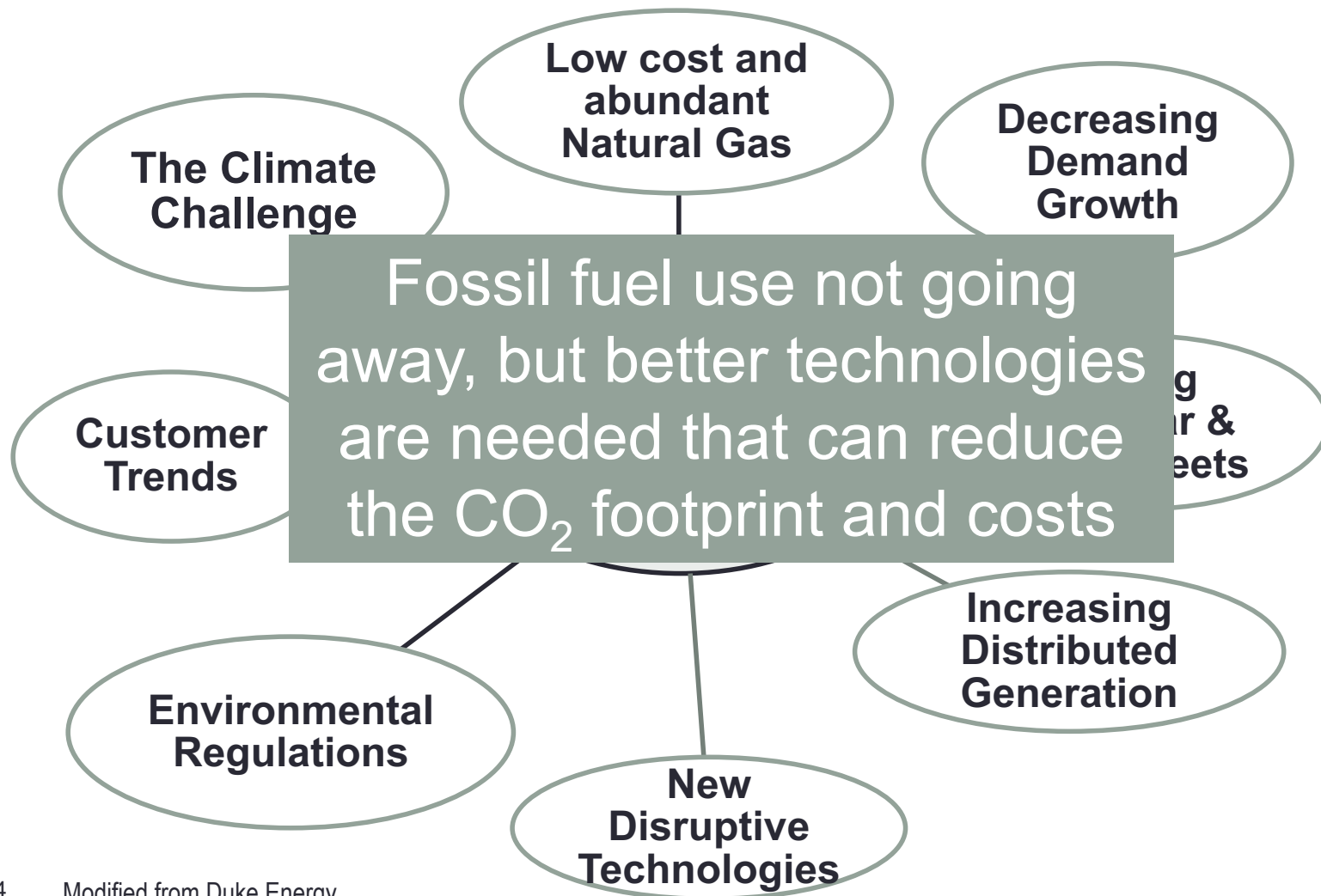
Utilities

American Electric Power (AEP)
Basin Electric Power Cooperative*
Duke Energy Services
LG & E and KU Services Company
Southern Company*
Tri-State Generation &
Transmission Association

Companies in orange indicate
Steering Committee Members

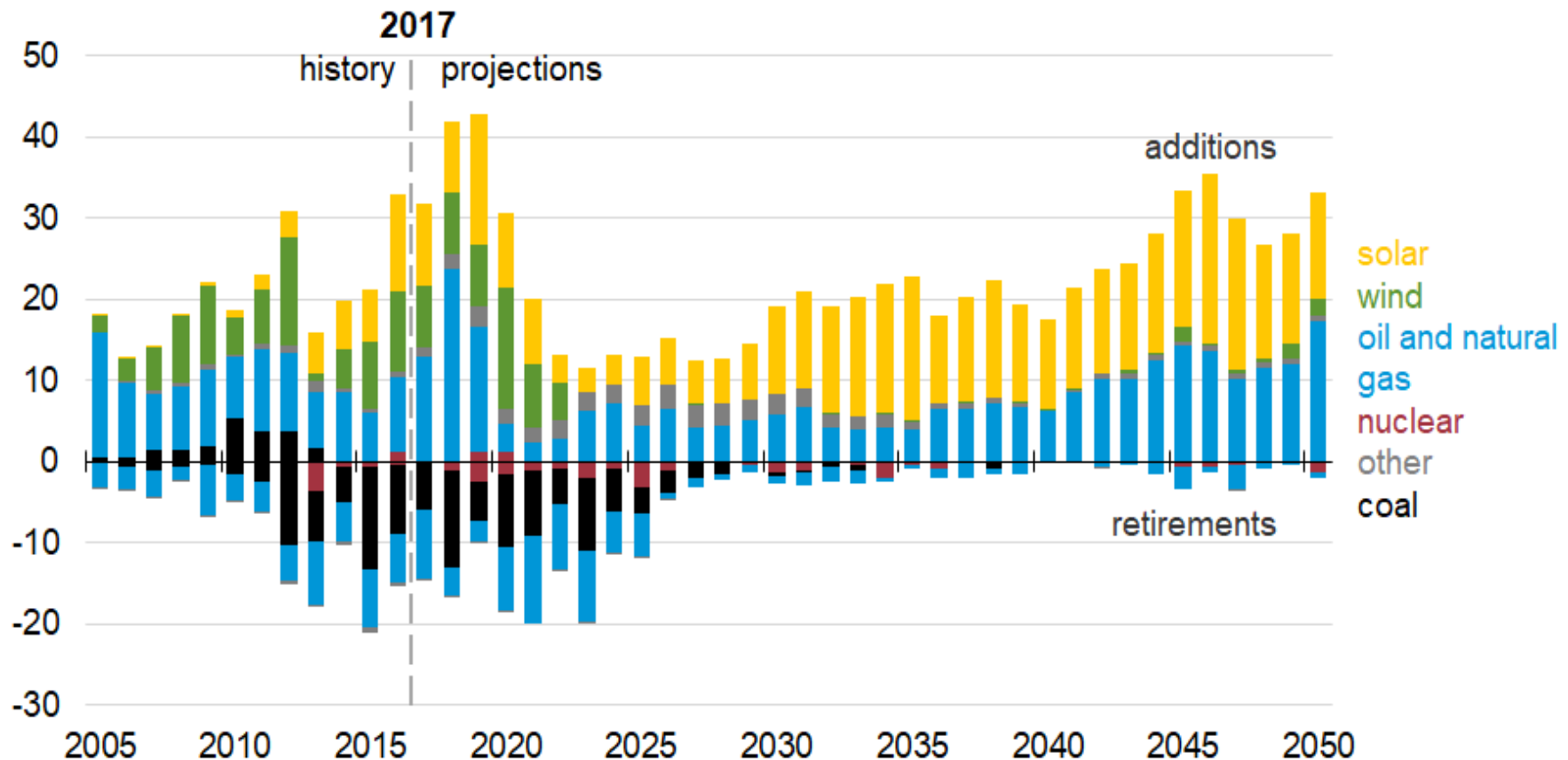
*CURC Leadership Council

Forces Impacting U.S. Power Sector Generation and Technology Investments



Natural Gas and Renewables Dominate New U.S. Generation through 2050 – No New Coal

Annual electricity generating capacity additions and retirements (Reference case)
gigawatts



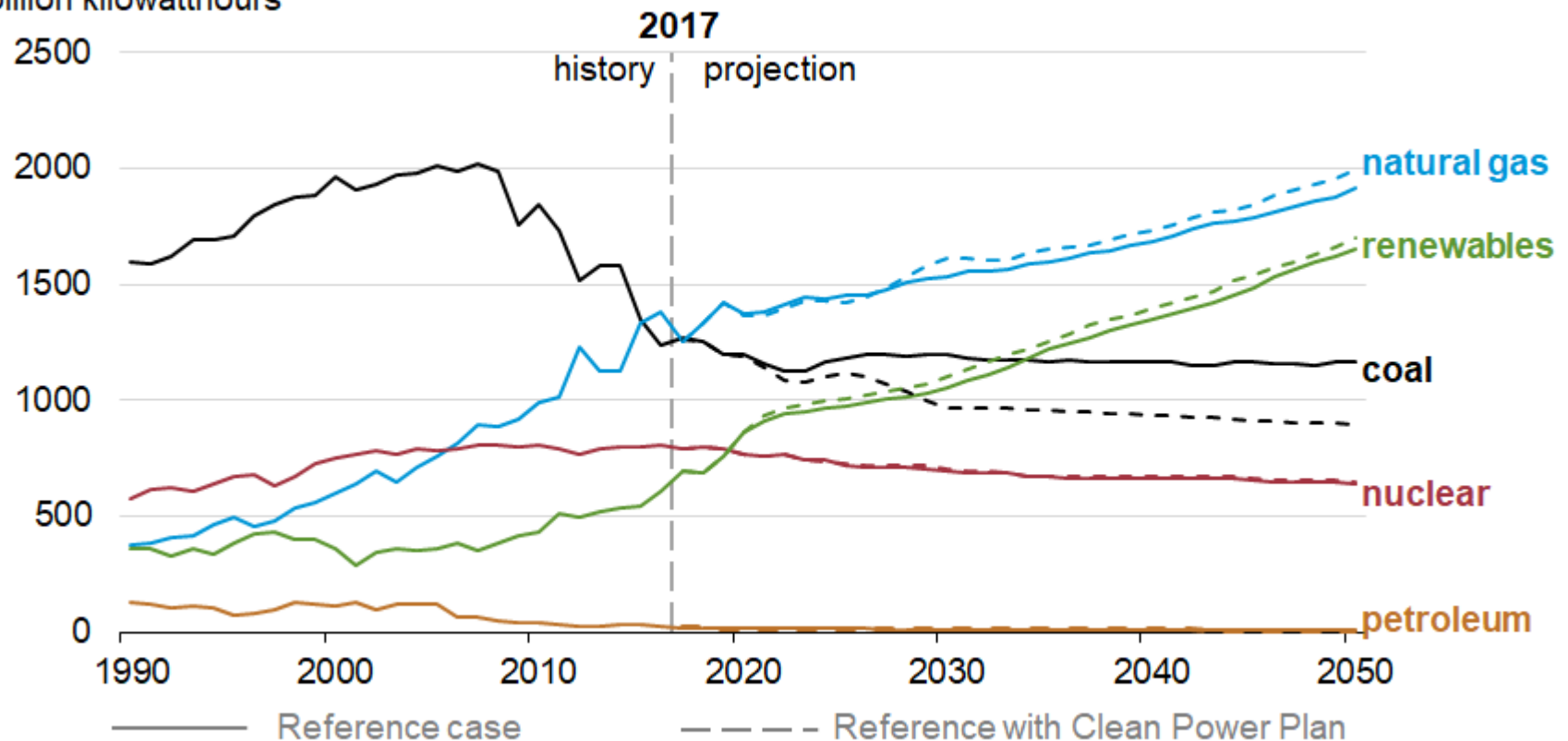
(Source: EIA AEO 2018)

Electricity from Existing Coal Fleet Projected to Remain Steady

Net electricity generation from select fuels

billion kilowatthours

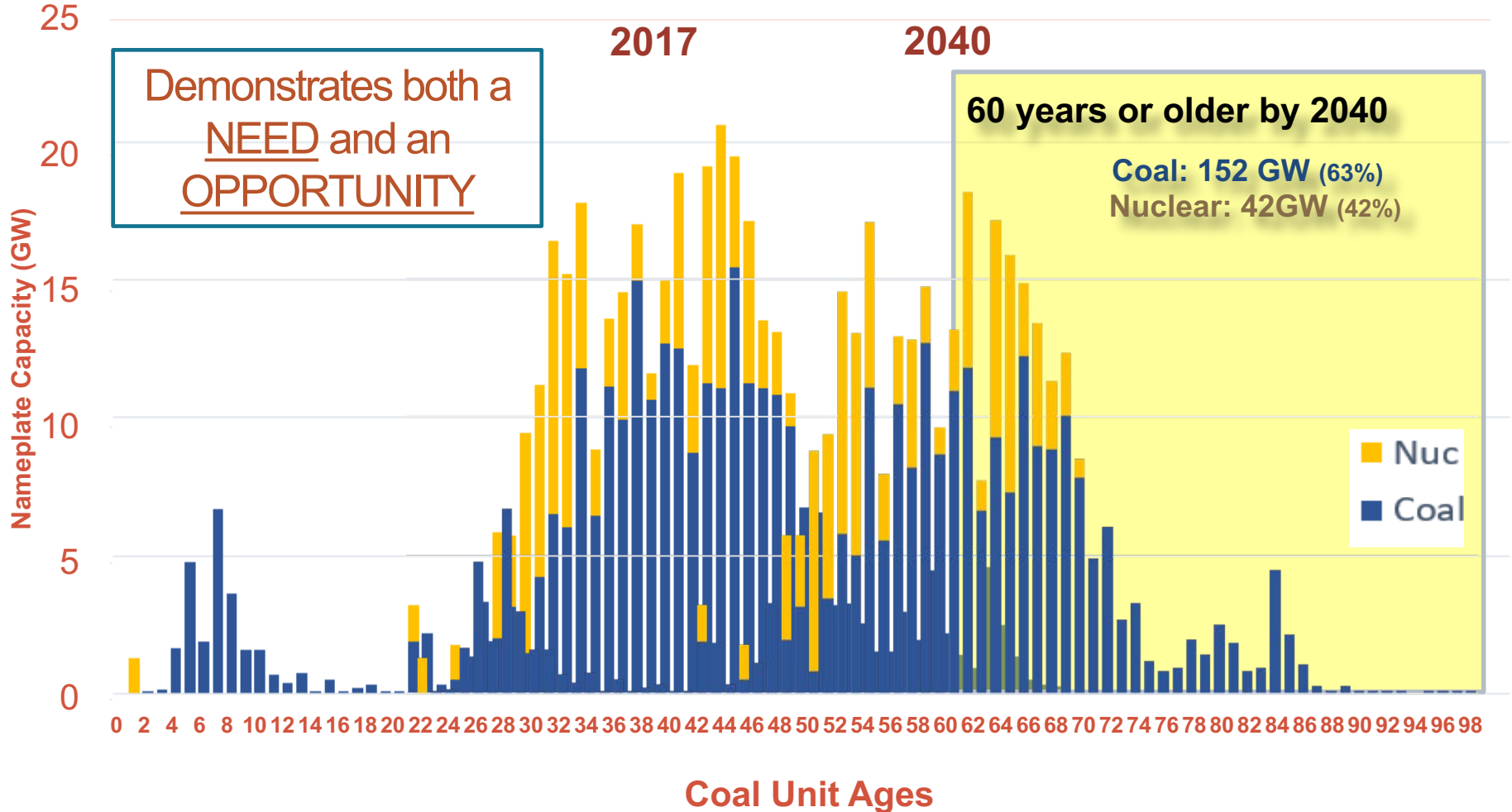
(Source: EIA AEO 2018)



EIA projects that the existing coal fleet will generate roughly 38% of electricity generation in 2040 when the fleet is an average of 60 years of age?

Coal & Nuclear Baseload Capacity

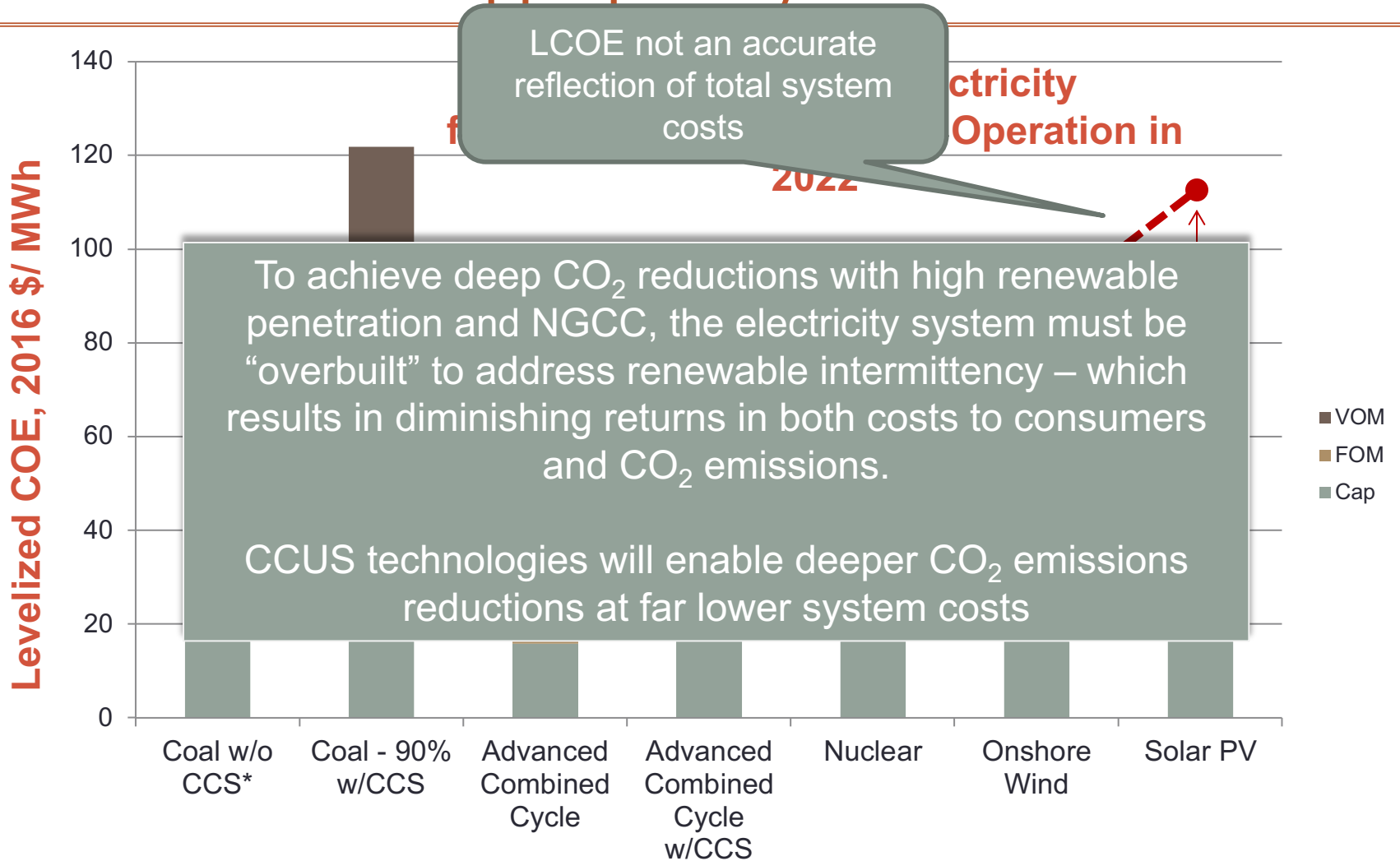
2017-2040



Other Considerations for Coal:

- **NEED:** EIA projects the existing fleet will operate at 85% capacity and supply nearly 40% of our electricity needs in 2040 based on current trends – need to invest in operations and improvements to maintain the electricity needs being forecasted for that fleet
- **OPPORTUNITY:** While we continue to benefit from affordable and reliable electricity from the existing fleet, we have an opportunity to accelerate development of cost-competitive coal-based CCUS technologies that will be candidate replacement options for the aging fleet in the next 10-20 years.

Need to Decarbonize Fossil Use, but Dispatchable Generation Not Appropriately Valued



CURC Policy Agenda Designed to Stand Up the “Need” and “Opportunity”:

- **Preserve Value of Existing Fleet:** R&D aimed at improving efficiency and policies to maintain reliability of operations of existing units in response to growing intermittent generation
- **Ensure Diversity of Energy Supply Options:** CURC advocates for federal policies and incentives to address technical, regulatory and financial barriers to new technology deployment (i.e. Section 45Q Carbon Sequestration Tax Credits)
- **Implement Transformational Technology Roadmap:** CURC-EPRI Roadmap identifies industry RD&D priorities and the public-private sector support for development of new, transformational technologies which serves as basis for CURC federal RD&D funding recommendations to Congress and DOE
 - Recommendations embedded in House and Senate RD&D legislation and annual federal funding priorities

2018 CURC-EPRI Roadmap: Advancing Transformational Fossil Energy Technologies

Technology	Methods	Description
Pressurized Oxygen Combustion	Entrained Flow & Fluidized Bed	The combustion of fossil fuels in nearly pure oxygen, rather than air, carbon capture in power plants. Pressurized oxygen-combustion oxygen to the combustion process by separating oxygen from air.
Chemical Looping	MeOx and CaOx	A metal oxide instead of air is used as a carrier to provide the oxygen for combustion in the fuel reactor or boiler.
SCO ₂ Cycles	Indirect & Direct	Replaces steam in traditional rankine cycle with supercritical CO ₂ as the working fluid. Enables compact turbomachinery to be used with higher temperature cycle and results in significantly improved performance.
Advanced Ultrasupercritical Materials	700° C+ and high pressure materials	Development of components using AUSC materials will enable highly efficient combustion systems as well as the materials needed for sCO ₂ high temperature and pressure technologies
Carbon Capture	Pre- and post-combustion	Advances in solvents, sorbents and membranes focused on lowering regeneration energy requirements, higher CO ₂ adsorption capacity, improved permeability and selectivity, and lower costs. Hybrids and cryogenic applications under development.
CO ₂ Storage	Onshore and offshore	Saline, enhanced oil and gas recovery, and other geologies being explored. Focusing on R&D as well as CO ₂ storage infrastructure in the U.S.

Federal Policy Efforts for Existing Fleet

- CURC and DOE-supported R&D to improve the efficiency and maintain the reliability of operations of existing units under a range of “cycling modes”
 - DOE FY19 budget requests funding for similar efforts
- New Source Review
 - Hearings in House and Senate
 - Griffith NSR Reform legislation in House
 - EPA Administrative Action?
- EPA Repeal of the Clean Power Plan
- FERC NOPR on Market Pricing Reform
- O&M Tax Credit for Existing Coal Units
- There is also a critical need to maintain the capacity of the U.S. supply chain if we want to have the capability to deliver new coal technology options in the future

Federal Policies to Develop and Deploy Technology

- Policies focused on deploying coal with CCS today:
 - 45Q carbon sequestration tax credits
 - 48A advanced coal with carbon capture investment tax credits
 - Private Activity Bonds and Master Limited Partnerships legislation
 - Makes CCS eligible
- Policies to develop and enable new technologies:
 - S. 2803 – the FUEL Act introduced by Senators Manchin (D-WV) and Heitkamp(D-ND)
 - H.R. 5745 – the Fossil Energy Research and Development Act introduced by Congressmen Veasey (D-TX) and McKinley (R-WV)
 - Both bills prioritize coal RD&D programs and funding as well as CCUS technology priorities
 - S. 2602 – the USE IT Act (Senators Barrasso, Whitehouse, Capito and Heitkamp):
 - Streamlines CO₂ pipeline permitting
 - R&D through Clean Air Act authorities on direct air capture and CO₂ utilization
 - FY 2018 and FY 2019 Fossil Energy RD&D funding for large-scale, transformational pilots and prioritize coal RD&D

FUTURE Act:

45Q Carbon Sequestration Tax Credits

- Enacted into law on Friday, February 9
- Functions like a production tax credit, with a \$/ton value for CO₂ capture and sequestered
- Tax credit
 - \$10 to \$35 (depending on the period to:)
 - \$10 to \$35 (depending on the utilization)
 - \$20 to \$50 (depending on the utilization)
- Can assign tax credit to a separate project
 - For a CCS project that captures 2 million tons per year and uses it for EOR, - at \$35/ton - the raw calculation of the tax credit is equal ~\$840 million/year
- CO₂ capture equipment owner the tax credit entity
- CO₂ Thresholds
 - 500,000 tons of CO₂ for EGUs
 - 100,000 tons for industrial emitters
 - 25,000 tons for pilot projects in which the CO₂ is sequestered in a utilization project

Federal Budget for Coal and CCS RD&D

- Current program funding mainly for coal related R&D work – not a fuel agnostic approach
- FY 2018 Omnibus and Proposed FY 2019:

Coal, CCS & Power Systems	FY18 Omnibus	FY19 Request	CURC FY19	House FY19 Mark
(All figures in \$ Thousands)	481,117	343,000	553,000	532,730

- FY18: \$20 million in FY18 omnibus for DOE to focus on modular, high efficiency and flexible coal technologies
- FY19 House Bill:
 - \$37 million in FY19 House bill for transformative power generation
 - Supports new solicitation for FEED studies
 - Maintains prioritization of funding for coal-based research
- Need federal funding for projects beyond basic R&D and for testing at scale – pilots and demonstrations

Thank you and Questions

Shannon Angielski

Executive Director

Carbon Utilization Research Council (CURC)

www.curc.net

sma@vnf.com