

June 14, 2021

**MEMORANDUM FOR:** Angelina LaRose  
Assistant Administrator for Energy Analysis

**FROM:** Jim Diefenderfer  
Director, Office of Long-Term Energy Modeling

**SUBJECT:** Summary of First AEO2022 Coal Working Group, held on May 26, 2021

This memorandum summarizes the presentation given during the *Annual Energy Outlook (AEO) 2022* Coal Working Group meeting and the discussions that followed. The meeting recapped the AEO2021 results and then highlighted the major modeling and data updates planned for AEO2022. The presentation for this meeting is available in a separate document on our website. We encouraged stakeholders to discuss the information provided in the presentation, our coal modeling methodology, and other issues facing coal supply and use. We guided participants and other stakeholders to contact [David Fritsch](#) or [Chris Namovicz](#) with follow-up questions or comments.

### **Overview**

We began by outlining the schedule for AEO2022. AEO2022 will include the Reference Case and the eight core side cases. We explained that we will include additional side cases and we have *Issues in Focus* articles planned, but we have not yet determined what the topics will be. We also advised that we will likely release an update of the coal model documentation in early 2022.

### **AEO2022 model and policy updates**

Looking forward, we highlighted development initiatives for AEO2022 and beyond. We plan to roll forward the base year to 2020 in the Coal Market Module (CMM), which will include updates to coal production, coal prices, and coal transportation rates between regions. We will also review firm coal contracts between electric generators and coal producers.

Model development items include:

- Enable code modifications to allow the CMM to use AIMMS v4.76 (64bit) or later (already completed)
- Use the new International Coal Market Module (ICMM) developed for the *International Energy Outlook (IEO) 2021* to determine the international coal trade projection for the AEO as well as the IEO (This change will result in different regional reporting of coal trade than in previous AEOs.)
- Integrate the coal trade projections from the new ICMM so that U.S. coal imports and exports reflect the IEO2021 results to be released later in the year

The presentation included slides on coal power plant retirements through 2020 along with planned and announced retirements for the projection period. We will include planned retirements as firm

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retirements in AEO2022, and the model will continue to retire plants based on the economics of continued operation. We also showed coal plants retired and not repurposed versus coal boilers converted to natural gas or replaced with natural gas combined-cycle plants.

We provided an update on the ICM model we developed and implemented in the World Energy Projections System Plus (WEPS+) that we are using for the IEO2021.

### *Legislation and Regulations*

The U.S. Court of Appeals for the District of Columbia vacated the U.S. Environmental Protection Agency's (EPA) Affordable Clean Energy (ACE) rule in January 2021 (which we included in AEO2021). As a result, we will not include ACE in AEO2022. At this time, EPA has not reinstated the Clean Power Plan or any new Clean Air Act regulations to limit greenhouse gas emissions for generating units.

For New Source Performance Standards (NSPS), EPA released proposed revisions that would eliminate the Carbon Capture and Sequestration (CCS) requirement and would set CO<sub>2</sub> emission rates at:

- 2,000 pounds of CO<sub>2</sub> per megawatt-hour (MWh) gross for large units (super-critical)
- 1,900 pounds of CO<sub>2</sub>/MWh gross for small units (sub-critical)
- 2,200 pounds of CO<sub>2</sub>/MWh gross for new coal refuse-fired units

EPA also proposed to adjust the rules for modified units. We are monitoring these proposed rule changes for AEO2022, and we will include them if they are finalized in time to incorporate.

All cases, for both AEO2021 and planned for AEO2022, we include a 3% adder on the cost of financing new coal investments in facilities that do not achieve 90% carbon sequestration. As in AEO2021, the 45Q tax credit for carbon capture sequestration (CCS) will be included in AEO2022.

EPA's Mercury and Air Toxics Standards (MATS) and the Cross-State Air Pollution Rule (CSAPR), both reflected in AEO2021, will remain in AEO2022. As in AEO2021, other EPA regulations on regional haze, coal combustion residuals, cooling water intakes, and effluent limitation guidelines will be included in AEO2022 as coal plant operators report resulting capacity changes on survey Form EIA-860.

We will incorporate state actions into AEO2022 as related rules are finalized. The AEO2022 will continue to include existing Oregon and California regulations, the Northeast's Regional Greenhouse Gas Initiative (RGGI), as well as state-level renewable portfolio standards (RPS) and zero emission credit (ZEC) programs.

### **Review of AEO2021 Assumptions, Trends, and Results**

#### *AEO2021 Assumptions and Trends*

The meeting included a review of assumptions and trends affecting the AEO2021 projections. We highlighted three key assumptions affecting the Reference Case coal projection:

- Relatively low electricity demand growth
- Coal plant retirement decisions and planned new plant builds for natural gas and renewable generation (wind and solar)

- Capital costs for adding new coal-fired electric generation relative to renewables and natural gas-fired generation

We also noted key trends affecting coal projections:

- The increasing operating cost competitiveness of electricity generated from renewable sources
- Modestly increasing projected prices for natural gas (in real dollar terms), which are influenced by the natural gas supply and demand balance

### *AEO2021 Results*

We highlighted the results for the AEO2021 Reference Case for coal demand and supply and demonstrated how the coal generation and capacity projections are sensitive to changes in natural gas prices. The current increase in coal plant retirements continues through approximately 2025 as a result of compliance with the ACE rule, already-planned retirements, and low natural gas prices. After 2025, coal plant retirements slow, resulting in 116 gigawatts less coal-fired generating capacity in operation in 2050 than in 2020. Coal disposition, which shows all coal consumption plus exported coal, is projected to be about 500 million short tons (MMst) per year by 2030.

We also presented coal production trends by major regions. All regions had a drop in coal production for 2020 because of projected low coal demand. According to the AEO2021 projection, coal production increases in 2021 and 2022 because natural gas prices rise back above \$3 per million British thermal units (MMBtu) after being nearly \$2/MMBtu in 2020. Coal production then declines to 430 MMst in 2050 in the Reference Case, matching coal disposition in all years. Declining demand from the electric power sector is primarily driving the decline in coal production; exports and non-electric power sector coal consumption remain relatively constant. We project export demand for coking and steam coal to return to nearly 100 million tons per year by 2025 and to maintain a similar export level through 2050.

### **Discussion**

An attendee asked if we adjust capital costs for fossil fuel investment for ESG. We understood ESG to mean *environmental, social, and governance*, or a type of investment analysis where investors apply non-financial factors as part of their analysis process to identify material risks and growth opportunities. We do not call it ESG in our model, but we do have a 3% adder to the cost of capital for all new coal projects (as listed on Slide 9). This adder “applies to new coal units or upgrades to existing units without maximum CO<sub>2</sub> sequestration options (90% removal) to account for the risk of future tightening of CO<sub>2</sub> emissions standards and other policies affecting coal use.” This adder reflects the prevailing financial environment where power producers and financial lenders perceive significant risk in making large investments in coal power plants.

An attendee asked if we could explain why we project a downward trend in U.S. labor productivity in many regions. Turning back to Slide 21, we explained that many of the coal-producing areas of the country, most notably Central Appalachia, are producing coal seams that are thinner and deeper. As a result, the labor costs are increasing because more *overburden* must be removed on surface mines and additional roof bolting and safety measures are required in underground mines. The Eastern Interior region is the only region modeled where labor productivity increases because the Illinois Basin longwall mines achieve some productivity improvements. The Powder River Basin (which has the most

productive mines in the United States, producing over 25 tons per hour at its large surface mines) is still experiencing declines in productivity because mining has moved deeper into the coal seam, which requires more top earth overburden to be put aside and replaced after the coal is removed.

An attendee asked if the Low Oil and Gas Production Case assumes a ban on fracking or includes any other policy assumptions. We answered that the Low Oil and Gas Production Case contains no policy assumptions. The case assumes 50% lower oil and natural gas well recovery rates and 50% higher drilling costs, which result in higher prices for crude oil and natural gas produced in the United States.

An attendee asked if the model contains any changes in how natural gas prices affect coal prices. We answered that the fundamentals of the NEMS modules representing how the two fuels interact and compete as delivered energy commodities in the power generation and other sectors remain unchanged. However, the current market conditions will change from year to year as the model is calibrated to actual historical data and benchmarked to our *Short-Term Energy Outlook* (STEO) in the near-term projection years. In AEO2021 coal demand in 2021 and 2022 increased over 2020 resulting in higher projected natural gas prices coming out of the pandemic.

We reiterated that we plan to model the eight standard core cases for AEO2022 and will include additional side cases of interest that have yet to be decided. We expressed that we are interested in input from stakeholders on what additional cases we should consider for AEO2022.

We will hold a second set of working group meetings in September or October 2021 to highlight preliminary AEO2022 results.

We hosted the working group meeting entirely online, and 38 people attended, including both EIA staff and external participants.

## Attendees

### *Registered guests (WebEx/phone)*

<b>Name</b>	<b>Affiliation</b>
Jose Benitez	U.S. Department of Energy, Office of Fossil Energy
Leslie Coleman	National Mining Association
Naveen Dasari	Rhodium Group
Mark Gehlhar	U.S. Department of Interior, Office of Surface Mining Reclamation and Enforcement (OSMRE)
Whitney Herndon	Rhodium Group
Robert Hershey	Consultant
Jordan Kislear	U.S. Department of Energy, Office of Fossil Energy
Hannah Kolus	Rhodium Group
Osmond Lindo	U.S. Department of Labor, Mine Safety and Health Administration
Carl Lundgren	U.S. Department of Labor, Mine Safety and Health Administration
Emily Medine	Energy Ventures Analysis Inc. (EVA)
Paul Pierce	U.S. Geological Survey (USGS)
Brain Shaffer	U.S. Geological Survey (USGS)
Ken Walsh	Leidos
Steven Yates	U.S. Army Corps of Engineers, Planning Center of Expertise for Inland Navigation, PCXIN

### *EIA attendees (WebEx/phone)*

<b>Name</b>	<b>Name</b>
Greg Adams	Mary Lewis
Rosalyn Berry	Perry Lindstrom
Richard Bowers	Laura Martin
Caroline Campbell	Mark Morey
Kien Chau	Kyle Morley
Jim Diefenderfer	Chris Namovicz
Kathryn Dyl	April Patel
Mindi Farber-DeAnda	Fadi Shadid
Margaret Freeburn	Manussawee Sukunta
David Fritsch	Bonnie West
Peter Gross	Stephen York
Mala Kline	