Preliminary AEO2013 Reference Case Results: Coal

Mike Mellish, Economist
Diane Kearney, Operations Research Analyst
October 4, 2012 | Washington, DC
Key Results for the AEO2013

• Coal’s share of generation is 35 percent in 2040

• Coal consumption increases by 88 million short tons between 2011 and 2040

• 48 GW of retirements

• High estimates for U.S. shale gas resources drive increased production and lower prices for natural gas compared to history

• Slightly higher average minememouth and delivered coal prices in AEO2013 compared to AEO2012

• About 170 million tons of coal exports by 2040
AEO2013: Some relevant assumptions

• Current laws and regulations, excludes a number of pending regulations that will likely affect coal

• Representation of environmental rules:
  – SO2 and NOx: Clean Air Interstate Rule (CAIR) instead of Cross-state Air Pollution Rule (CSAPR)
  – Mercury and Air Toxics Standard (MATS)
    • mercury: reduce uncontrolled mercury emissions by 90% representing an approximation for EPA’s more specific MACT emission limits
    • acid gases: represented by requiring scrubbers or dry sorbent injection and fabric filter
  – CO2: Regional Greenhouse Gas Initiative (RGGI)
  – AB32: California’s greenhouse gas program

• Renewable energy:

  30 States and the District of Columbia have enforceable Renewable Portfolio Standards (RPS)

  Wind production tax credits (PTC) expire at end of 2012

  Hydro, biomass, geothermal PTC expire at end of 2013

  Solar investment tax credit (ITC) reverts from 30% to a permanent 10% ITC in 2016
AEO2013: Some relevant assumptions

- Update of RW Beck’s estimates of capital costs for new power plants in the AEO2013; increase for IGCC coal and status quo for PC

- 3% higher cost of capital for greenhouse gas intensive investments for coal plants (including coal-based synthetic liquid plants)

- Approximately 1 gigawatt of coal with carbon capture and sequestration (CCS) assumed by 2018 (investment tax credits in the Energy Improvement and Extension Act of 2008 and funding from the American Recovery and Revitalization Act of 2009)

- Coal-to-liquids (CTL) plants feasible beginning in 2018

- Removed coal-and-biomass-to-liquids (CBTL) option
AEO2013: Some relevant assumptions

• MATS compliance (either retrofits or retirements) begins in 2016 (assuming one-year reprieve)

• Carbon capture and sequestration for new plants is applied to PC rather than IGCC (due to revision in capital costs from RW Beck)

• Planned coal-fired capacity retirements: 28 gigawatts

• Planned coal-fired capacity additions: 6 gigawatts
Coal consumption by sector, 1970-2040

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012

WORKING GROUP PRESENTATION FOR DISCUSSION PURPOSES
DO NOT QUOTE OR CITE AS RESULTS ARE SUBJECT TO CHANGE
Coal-to-liquids coal consumption, 2010-2040

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012
Generation shares by source, 2008, 2011, 2035, and 2040

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012
Coal exports, 1960-2040

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012
Coal exports by major supply region, 2010-2040

Cumulative electricity generating capacity additions, 2012-2035 and 2012-2040

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012
Coal-fired generating capacity by coal demand region, 2011 and 2035

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012
Cumulative coal-fired capacity retirements by coal demand region, 2012-2035

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012
Cumulative coal-fired capacity retirements: planned and unplanned, 2012-2040

gigawatts

Note: Planned retirements represent those reported to EIA by generators in the electric power sector.

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012
Cumulative SO2 scrubber retrofits, 2012-2040

gigawatts

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012
Total sulfur dioxide emissions, 2005-2040

Million short tons

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012
Coal production, 1970-2040

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012

Coal Analysis Team, Washington, DC, October 4, 2012
Coal production by region, 1970-2040

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012
Appalachian coal production, 1970-2040

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012; Except for Appalachian total, data for 1978-1985 exclude production from small (<10,000 short tons) coal mines.
Interior coal production, 1970-2040

![Graph showing the interior coal production from 1970 to 2040 with projections for AEO2013 and AEO2012 references. The graph includes data for Eastern Interior, Gulf Lignite, and Western Interior.]

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012; Except for Interior total, data for 1978-1985 exclude production from small (<10,000 short tons) coal mines.
Western coal production, 1970-2040

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012; Except for Western total, data for 1978-1985 exclude production from small (<10,000 short tons) coal mines
Average minemouth coal prices by region, 1980-2040

2011 dollars per short ton

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a)
Natural gas and coal prices to the electric power sector, 1980-2040

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012
Natural gas and coal consumption, 1980-2040

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012
Average capacity utilization of natural gas combined cycle and coal generating capacity, 2008-2040

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012
Average delivered price of coal to electricity sector, 2000-2040

2011 dollars short ton

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012
Average delivered price of coal to electricity sector, 2000-2040

Source: EIA, preliminary Annual Energy Outlook 2013 (NEMS run ref2013.d100212a) and Annual Energy Outlook 2012
For more information

Contact Info for NEMS Coal Team

Mike Mellish, Diane Kearney, and Ayaka Jones
Coal and Uranium Team
Office of Electricity, Coal, Nuclear, and Renewables Analysis
Office of Energy Analysis
U.S. Energy Information Administration

michael.mellish@eia.gov, (202) 586-2136

diane.kearney@eia.gov, (202) 586-2415

ayaka.jones@eia.gov, (202) 586-0998