Key results for the AEO2016 Reference case

• Coal-fired generation, production, and capacity are all lower in the preliminary AEO2016 Reference case
  – Coal’s share of total electricity generation falls from 38% in 2014 to 18% by 2040, compared to 33% in AEO2015
  – Coal production decreases from 996 million tons in 2014 to 640 million tons by 2040, compared to 1,117 in AEO2015
  – Coal capacity retirements accelerate in the period from 2015 to 2040 to 109 GW, compared to only 37 in AEO2015

• The key drivers behind the reduction in the outlook for coal relative to the AEO2015 results include:
  – The inclusion of the final Clean Power Plan (CPP)
  – Lower projected natural gas prices
  – A reduction in the estimated installation costs for renewables compared to higher costs for coal-fired generation (with partial CCS)
  – Lower coal export expectations
AEO2016 Reference case final Clean Power Plan must assume some policy choices

- The Reference case will assume that states select a mass-based approach that covers both new and existing sources.
- Credit trading will be represented at the EMM region level.
- Allowances will be allocated to load serving entities.
- Side cases will explore alternative approaches:
  - Rate-based regulation
  - Credit trading at the interconnect level
  - Allocation of allowances to generators
  - No Clean Power Plan

WORKING GROUP PRESENTATION FOR DISCUSSION PURPOSES. DO NOT QUOTE OR CITE AS AEO2016 MODELING ASSUMPTIONS AND INPUTS ARE SUBJECT TO CHANGE.
Natural Gas prices are significantly lower than AEO 2015

Source: AEO2016 NEMS run ref2016.1.0203a.RAN, AEO2015 Ref2015, rf15_111_all.0306a.RAN
We have commissioned a new study to update power-sector capital costs

• We have limited the scope of the update to technologies we think may have changed substantially and technologies that are likely to be built in the model

• The initial cost estimates are complete

• Stakeholder outreach identified several key questions/issues
  – Need for a 111b compliant coal technology
  – Lack of differentiation between fixed tilt and tracking PV costs
  – Large discrepancy for wind costs with other public sources
Coal, solar, and wind capital costs differ significantly from AEO2015 assumptions.

* Technology specification on some items may have changed from report to report. Pulverized coal has changed from super-critical to ultra-supercritical with 30% CCS.
Renewables and natural gas together account for 66% of generation in 2040 while coal’s share falls to 18%.
Electricity Generation by Fuel, 1980-2040

Note: Includes generation from plants in both the electric power and end-use sectors.

Source: History: U.S. Energy Information Administration (EIA), Annual Energy Review;
Projections: Preliminary AEO2016 (NEMS run ref2016.d020616a)
Electricity Generation by Fuel, 1980-2040

Note: Includes generation from plants in both the electric power and end-use sectors.

Source: History: U.S. Energy Information Administration (EIA), *Annual Energy Review*;
Natural gas, renewables, and coal-fired generation, AEO2015 Reference Case, EIA CPP Study 2015 vs. preliminary AEO2016

Source: AEO2016 NEMS run ref2016.0206a.RAN, rf15_111_all.0306a.RAN

WORKING GROUP PRESENTATION FOR DISCUSSION PURPOSES. DO NOT QUOTE OR CITE AS AEO2016 MODELING ASSUMPTIONS AND INPUTS ARE SUBJECT TO CHANGE.
Total coal production, 1970-2040

Source: Preliminary AEO2016 (ref2016.d020616a), AEO2015 Reference Case (April 2015), proposed Clean Power Plan (rf15_111_all.d030615a; *2014 data is estimated.
Coal production by region, 1970-2040

million short tons

<table>
<thead>
<tr>
<th>Year</th>
<th>Total U.S.</th>
<th>Appalachia</th>
<th>Interior</th>
<th>Western</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1980</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1990</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2010</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2020</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2030</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2040</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: Preliminary AEO2016 (ref2016.d020616a), AEO2015 Reference Case (April 2015), proposed Clean Power Plan (rf15_111_all.d030615a *2014 data is estimated.
Coal production by region, 1970-2040

Source: Preliminary AEO2016 (ref2016.d020616a), AEO2015 Reference Case (April 2015), proposed Clean Power Plan (rf15_111_all.d030615a)
Coal production, AEO2016 vs. AEO 2015 in 2040 (and 2014*) (million short tons)

**Includes production from mines in both Alaska and Washington.**

* Includes production from all mines in Wyoming’s Powder River Basin.

**U.S. Total:**

640 – 1,117 (996)


WORKING GROUP PRESENTATION FOR DISCUSSION PURPOSES. DO NOT QUOTE OR CITE AS AEO2016 MODELING ASSUMPTIONS AND INPUTS ARE SUBJECT TO CHANGE.
Appalachian coal production, 1970-2040

Except for Appalachian total, data for 1978-1985 exclude production from small (<10,000 short tons) coal mines
Interior coal production, 1970-2040

Source: Preliminary AEO2016 (ref2016.d020616a), AEO2015 Reference Case (April 2015),
Except for Interior total, data for 1978-1985 exclude production from small (<10,000 short tons) coal mines
Western coal production, 1970-2040

million short tons

<table>
<thead>
<tr>
<th></th>
<th>History</th>
<th>2014</th>
<th>Projections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total West</td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
</tr>
<tr>
<td>WY</td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
</tr>
<tr>
<td>PRB</td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
</tr>
<tr>
<td>Other West</td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
</tr>
</tbody>
</table>

Source: Preliminary AEO2016 (ref2016.d020616a), AEO2015 Reference Case (April 2015),
Except for Interior total, data for 1978-1985 exclude production from small (<10,000 short tons) coal mines

WORKING GROUP PRESENTATION FOR DISCUSSION PURPOSES. DO NOT QUOTE OR CITE AS AEO2016 MODELING ASSUMPTIONS AND INPUTS ARE SUBJECT TO CHANGE.
Western coal production, 1970-2040

million short tons

<table>
<thead>
<tr>
<th>Year</th>
<th>History</th>
<th>Projections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1980</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1990</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2010</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2020</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2030</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2040</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: Preliminary AEO2016 (ref2016.d020616a), AEO2015 Reference Case (April 2015),
Except for Interior total, data for 1978-1985 exclude production from small (<10,000 short tons) coal mines

WORKING GROUP PRESENTATION FOR DISCUSSION PURPOSES.
DO NOT QUOTE OR CITE AS AEO2016 MODELING ASSUMPTIONS AND INPUTS ARE SUBJECT TO CHANGE.
Average minemouth coal prices by region, 1980-2040

2014 dollars per short ton

U.S. Coal Exports, 1995-2040

million short tons

Coal exports by major supply region, 2010-2040

Additions to electricity generating capacity, 2000-2040

AEO2016 Reference

AEO2015 Reference
Cumulative coal retirements are up relative to previous CPP study, 2015-2040

Source: AEO2016 NEMS run ref2016.1.0203a.RAN, AEO2015 Ref2015, rf15_111_all.0306a.RAN
Net summer coal-fired generating capacity in the electric power sector by coal demand region, 2014 and 2040

Cumulative net summer coal-fired capacity retirements by coal demand region, 2015-2040

For more information

greg.adams@eia.gov, (202) 586-7343
ayaka.jones@eia.gov, (202) 586-0998
diane.keekearney@eia.gov, (202) 586-2415

Short-Term Energy Outlook | www.eia.gov/steo
Annual Energy Outlook | www.eia.gov/aeo
International Energy Outlook | www.eia.gov/ieo

EIA Information Center
InfoCtr@eia.gov
Our average response time is within three business days.

(202) 586-8800
24-hour automated information line about EIA and frequently asked questions.