

Annual Energy Outlook 2017: Preliminary Results for Electricity, Coal, Nuclear and Renewables



For

AEO2017 Working Group

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By

EIA, Office of Electricity, Coal, Nuclear & Renewables Analysis

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Summary

- Most significant changes in AEO2017 outlook
- Present preliminary AEO2017 outlook results
- Open discussion

Most significant changes in electric sector outlook for AEO2017: nuclear/coal

- ✓ Nuclear: projected share of units retiring after license expiration at 60 years
- ✓ Environmental regulation: impact of extensive installation of mercury control equipment
- ✓ Generating unit operating performance: detailed representation of heat rates by operating mode
- ✓ Coal production: treatment of coal productivity
- Yet to be completed: nuclear uprates, final plant file updates, replacement for cost index used in projecting new electric equipment additions

Most significant changes in electric sector outlook for AEO2017: renewables

- ✓ Accounting for regional capital cost differences: solar costs revision to base on as-observed regional cost information
- ✓ Solar assumptions data update for consistency between cost and performance assumptions (using inverter load ratio of 1.2)
- Yet to be completed: more accurate modeling of distributed generation: use of PV load shapes revision to account for impacts of DPV on demand
- Yet to be completed: Still working on incorporating solar curtailments algorithm
- Postponed until AEO2018: energy storage

Summary preliminary results AEO2017 electric generation sector

- Long term replacement of generation from retired nuclear units, principally by renewables and natural gas
 - Nuclear capacity declines by about 22 GW by 2050
 - Renewables generation is up 370% and gas generation increases 43% by 2050.
- Non-hydro renewable capacity additions are net 32 gigawatts higher by 2040 in the AEO2017 than AEO2016, primarily from solar PV
 - Solar PV in AEO2017 is 92 GW higher than AEO2016, while wind additions are 62 GW lower
 - Expansion of solar PV continues through the end of the outlook period, with another 170GW added from 2040-50 in AEO2017.

AEO2017 Reference case and alternative cases

- Reference case includes the Clean Power Plan
 - A mass-based approach by states, covering both new and existing sources
 - Credit trading at the EMM regional level
 - Allowances allocation to load serving entities
- Potential side cases:
 - No CPP
 - High oil price
 - Low oil price
 - High economic growth
 - Low economic growth
 - High oil and gas resource and technology
 - Low oil and gas resource and technology

AEO2017 Reference case key nuclear assumptions

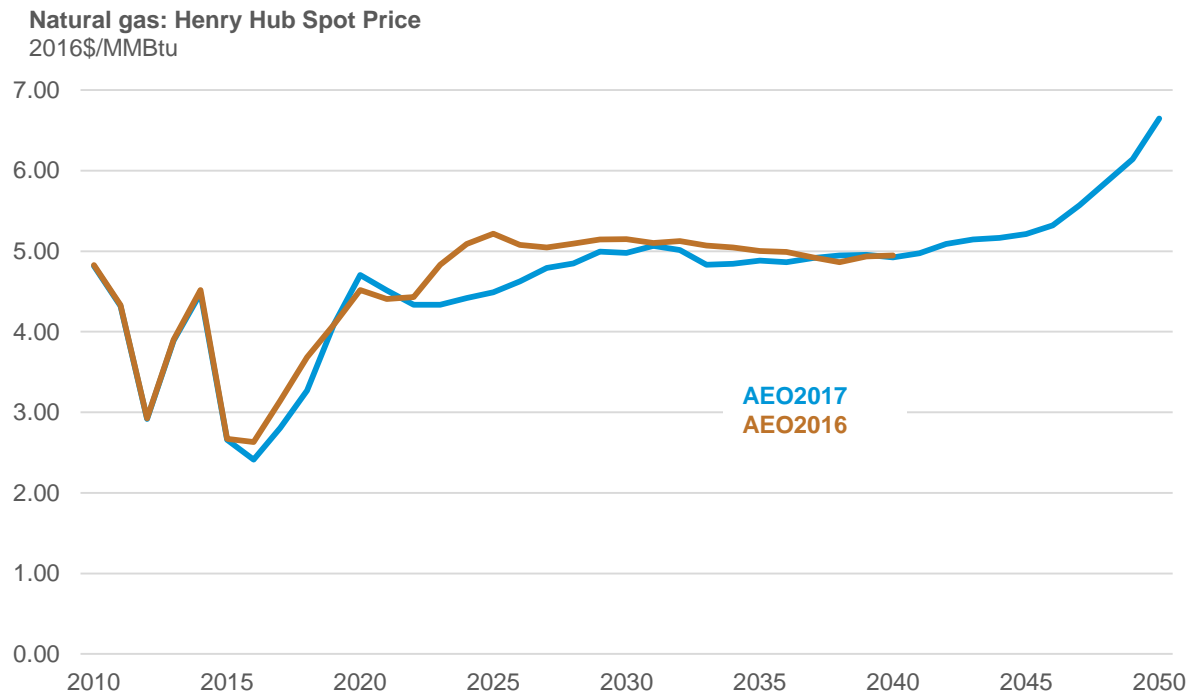
Case Assumptions	Total Capacity Additions	Total Capacity Retirements
Announced New Builds	4.4 GW	
Potential Uprates	About 5 GW	
Additional New Builds	Allowed by Model	
Announced Retirements		6.9 GW
Generic Derates (near-term)		3 GW
Generic Derates (long-term)		About 22 GW

Long-term retirements related to subsequent license renewal uncertainty are assumed in AEO2017

- Not all reactors will operate for 80 years.
- Uncertainty related to the likelihood of achieving a subsequent license renewal was examined qualitatively, and AEO2017 includes about 22 GW of long-term retirements (generic derates) to address this uncertainty.
- AEO2018 will address long-term operations beyond 60 years in more detail, and the project to do so is underway.

Preliminary Results

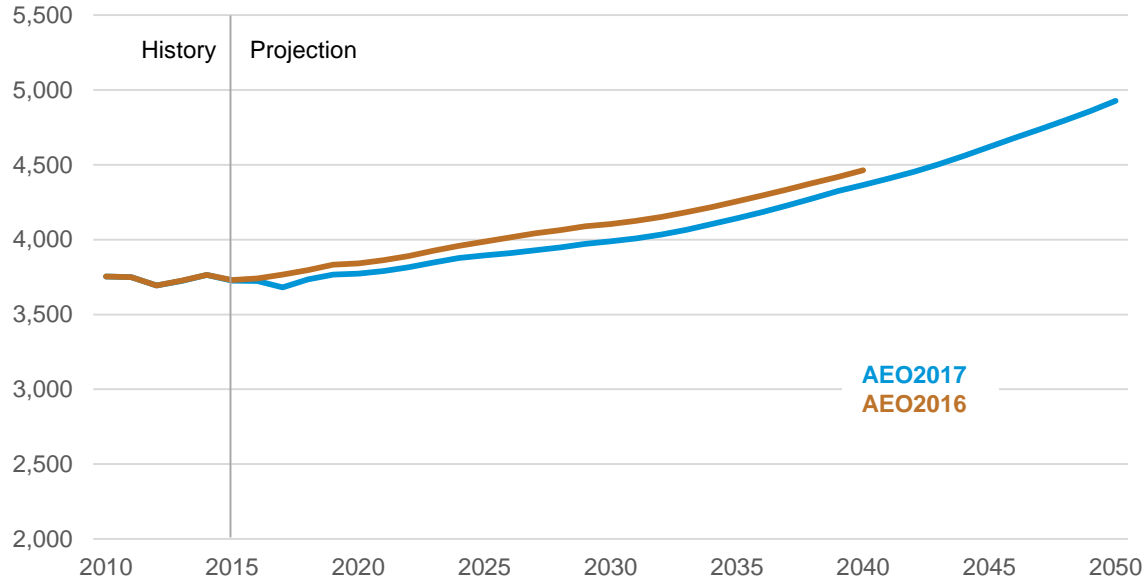
Similar natural gas price path through 2040, but rising significantly after



ref2017.0928a

Electricity sales are slightly down from AEO2016

Total electricity sales
billion kilowatthour

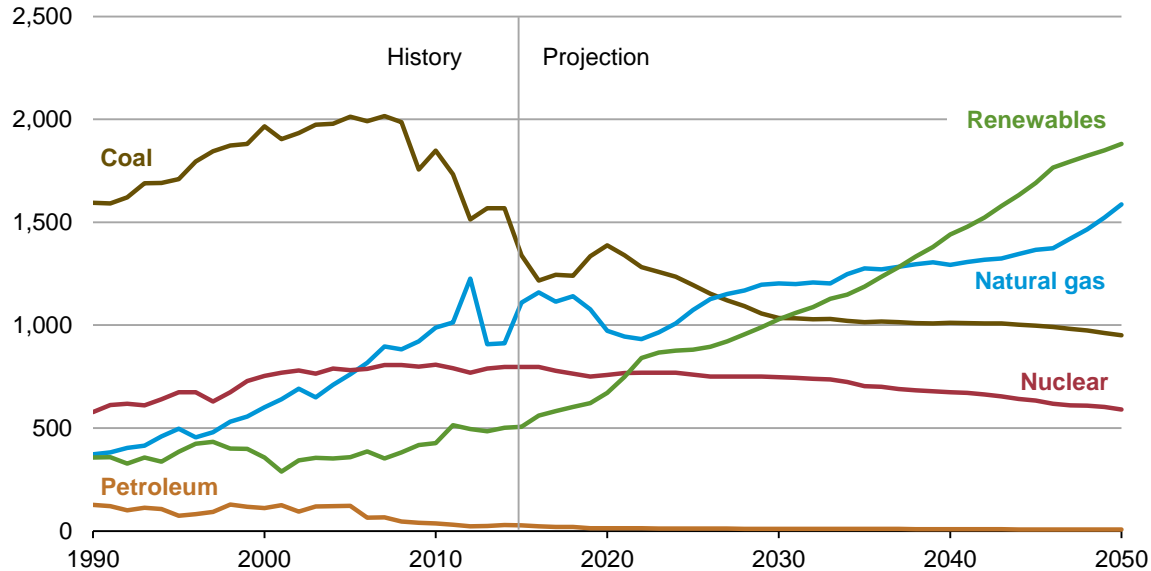


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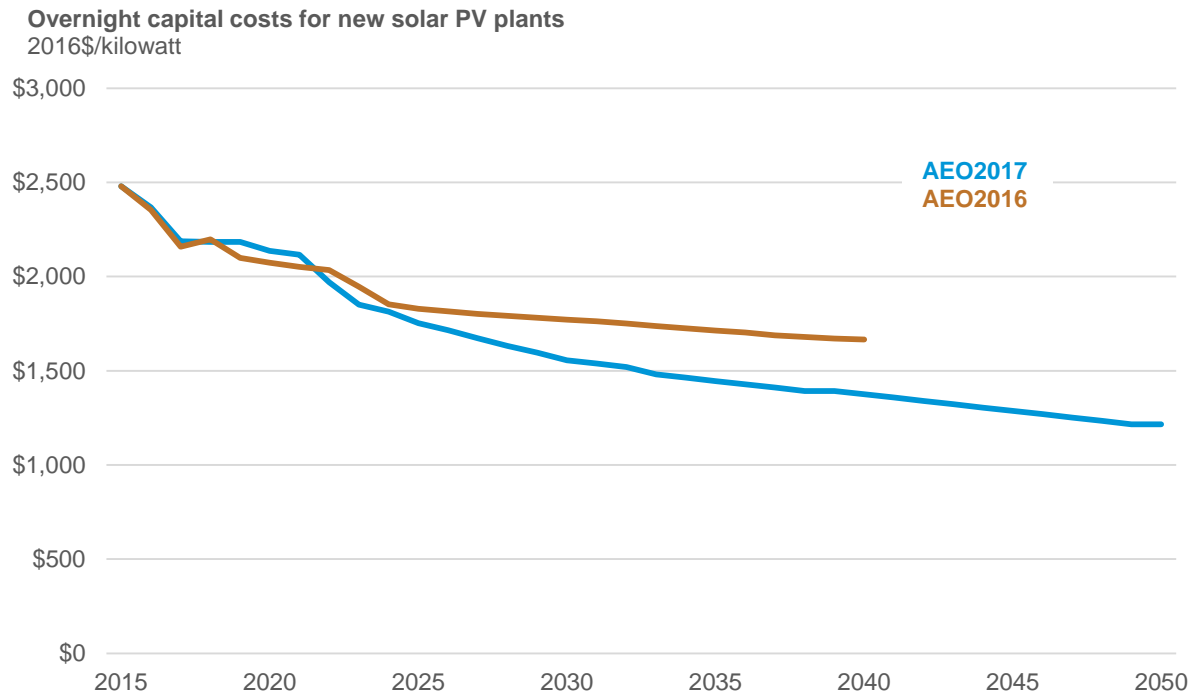
Renewables and natural gas replace lost nuclear generation in long-term and are primary resource to meet new demand

Net U.S. power sector electricity generation
billion kilowatt-hour



ref2017.0928a

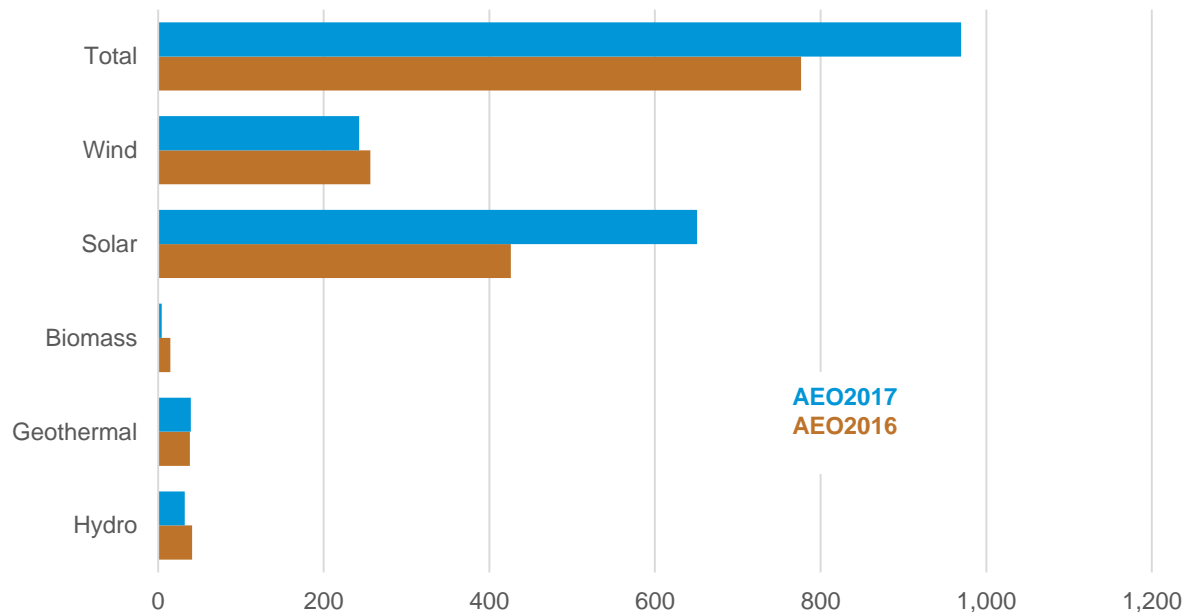
Overnight capital costs for new solar PV plants declines much faster after 2025, partly due to declining metals cost index



ref2017.0928a

Renewable generation is 15% higher in 2040 than AEO2016, primarily from solar

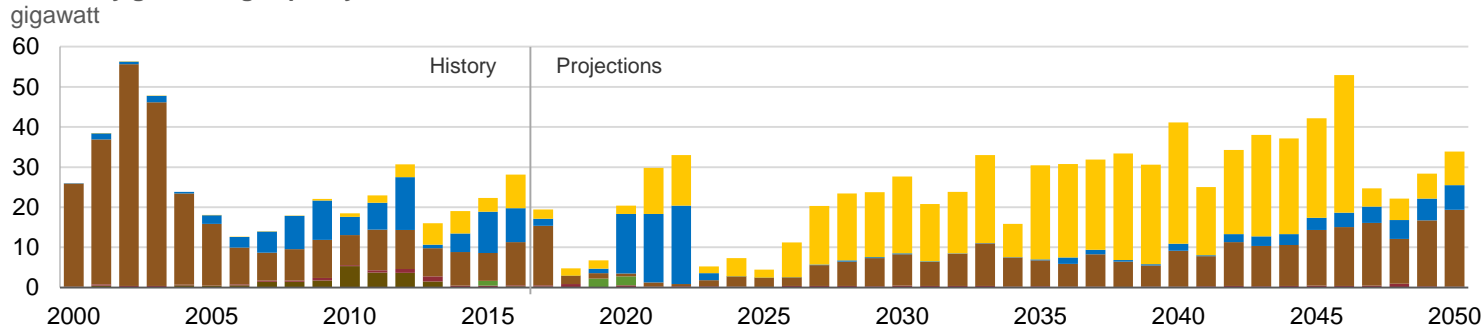
Renewable generation between 2016 and 2040
billion kilowatthour



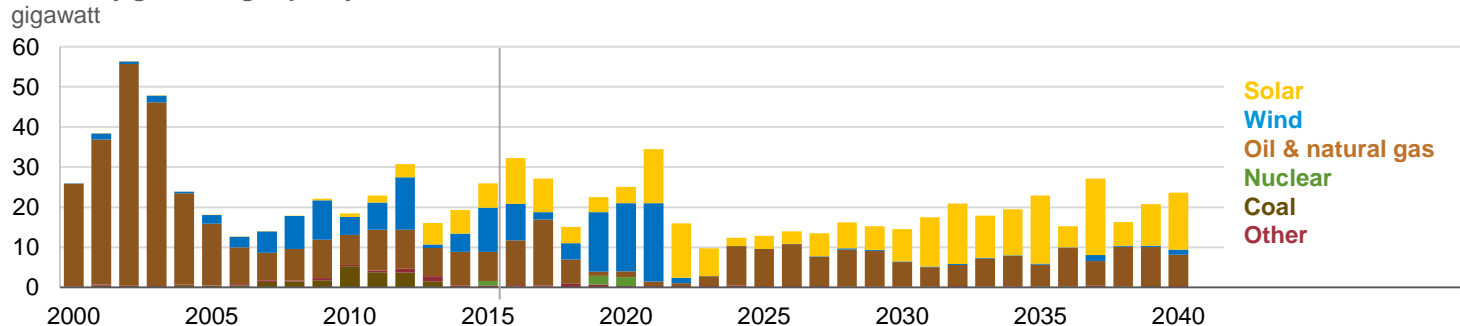
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Long-term nuclear retirements create substantial additional opportunity for new capacity additions for wind and solar

Electricity generating capacity additions, AEO2017

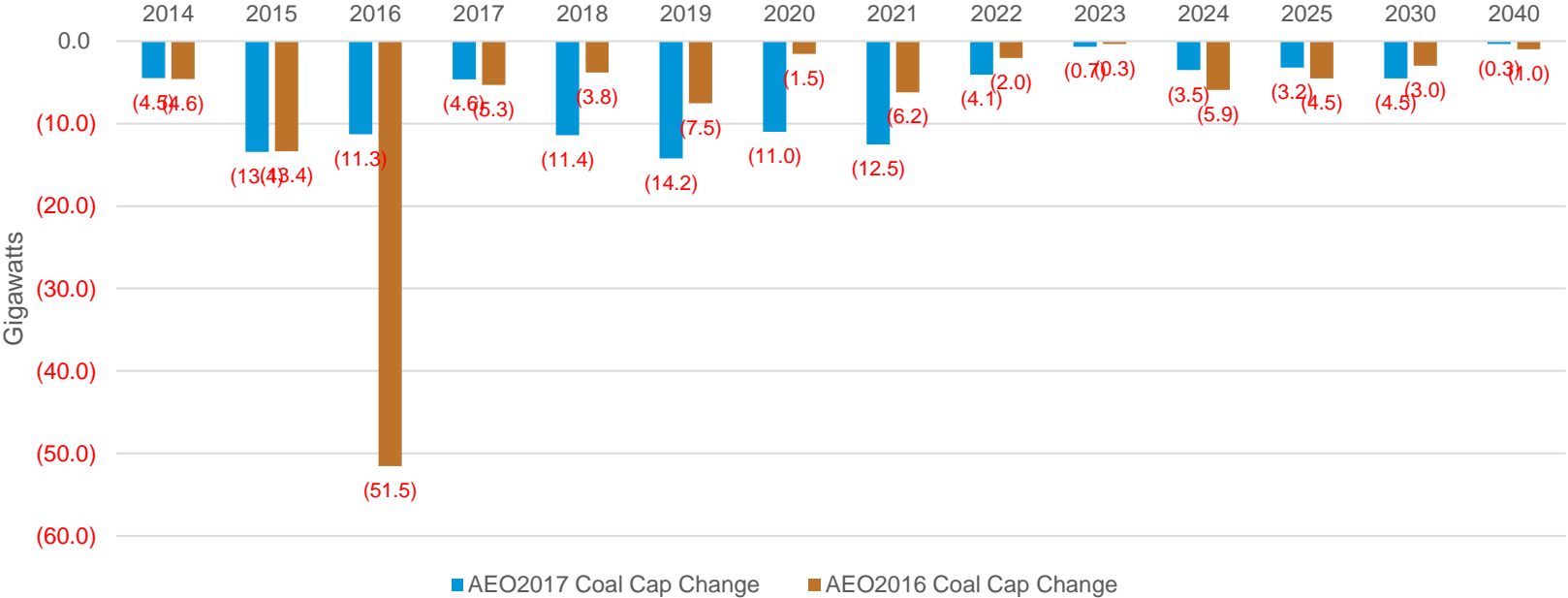


Electricity generating capacity additions, AEO2016



ref2017.0928a

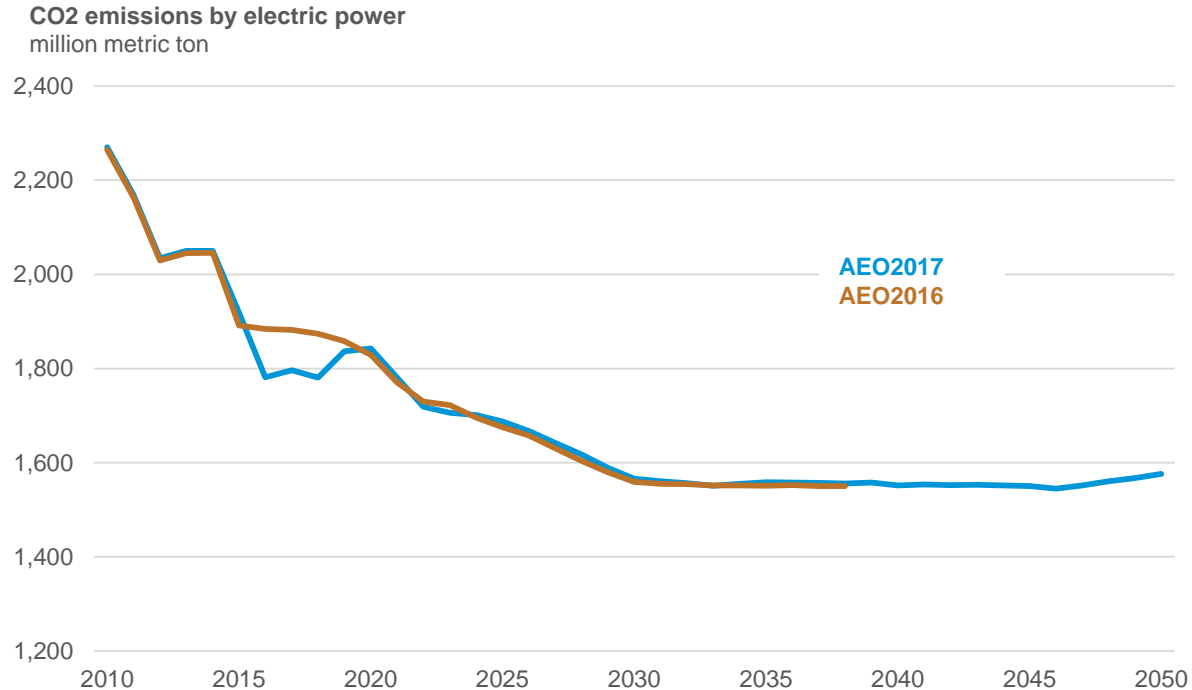
Coal capacity is higher than AEO2016 due to extensive installation of MATS controls



ref2017.0928a



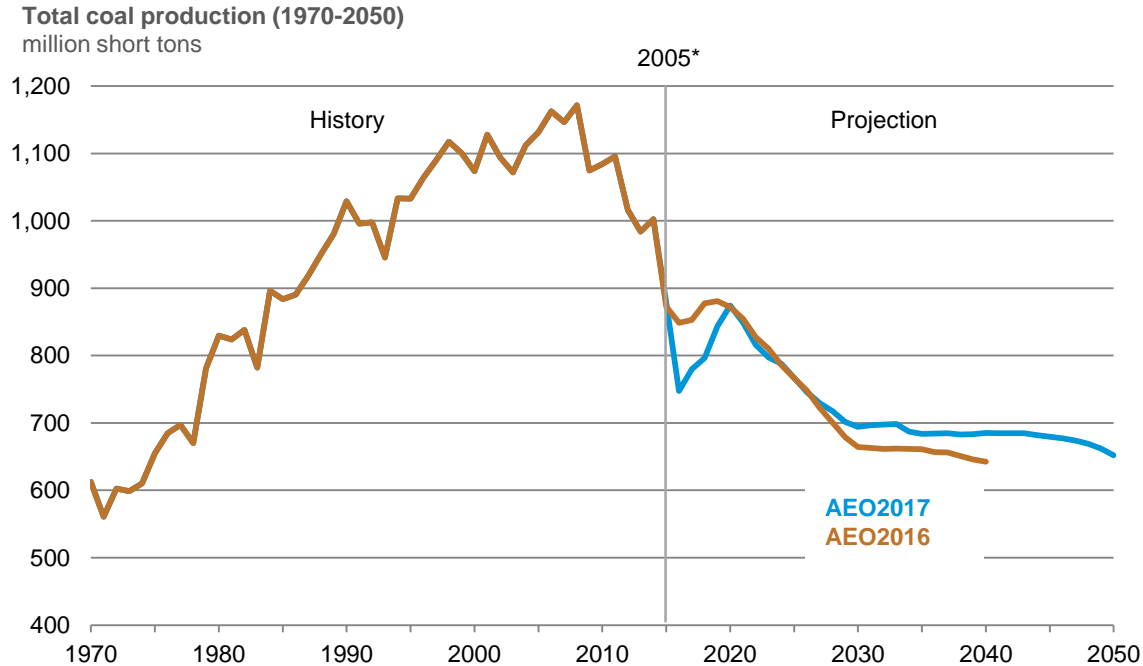
CO2 emissions post-2020 decline to meet CPP mass-based targets which are assumed to remain constant after 2030



ref2017.0928a

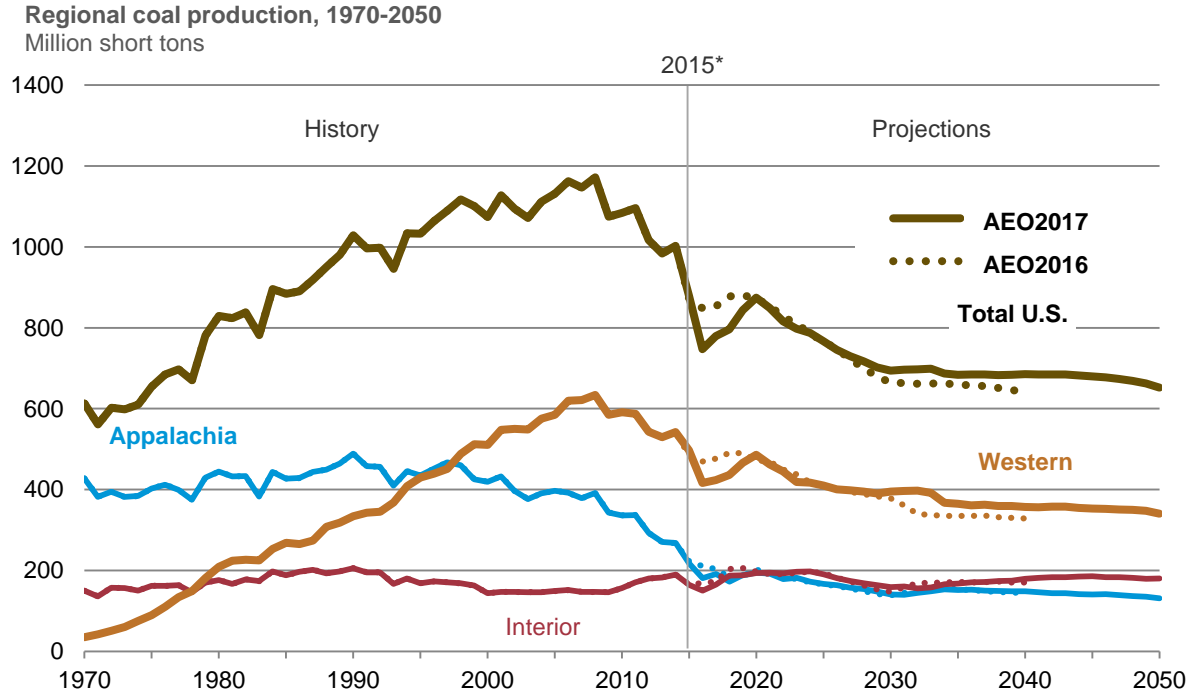


Total coal production down slightly in short-term, but increases slightly in later year



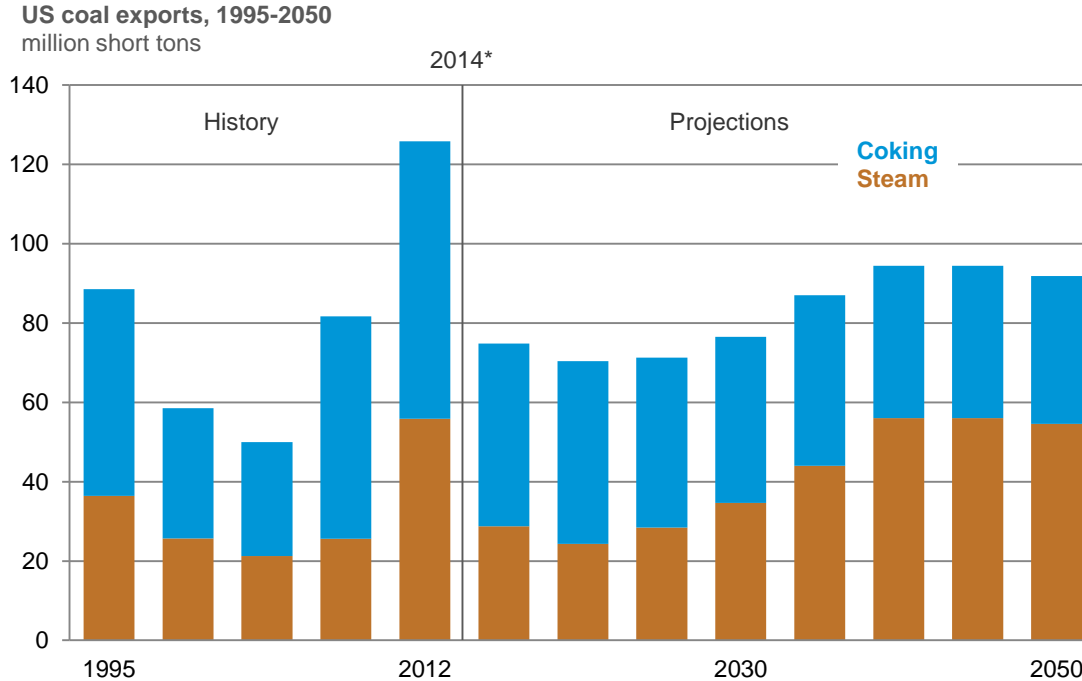
ref2017.0928a, *2014 and 2015 data is estimated

Coal production by region, 1970-2050



ref2017.0928a, *2014 and 2015 data is estimated

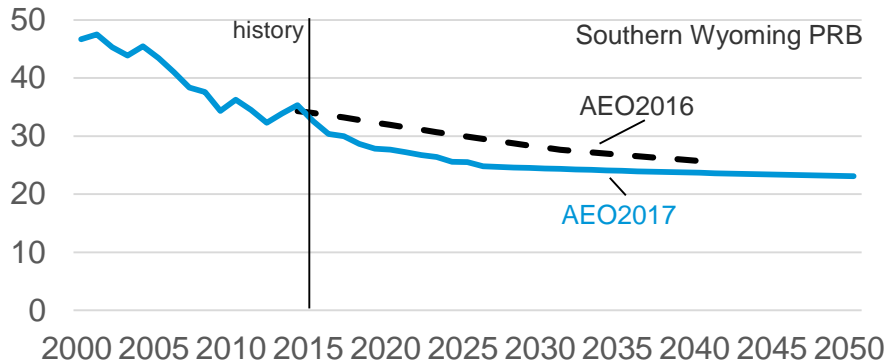
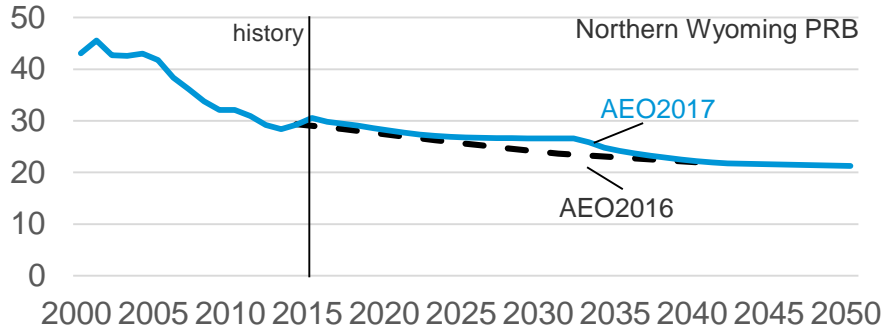
U.S. coal exports



ref2017.0928a, *2014 and 2015 data is estimated

Reassessment of Wyoming Powder River Basin (PRB) Coal Mining Productivity Assumptions

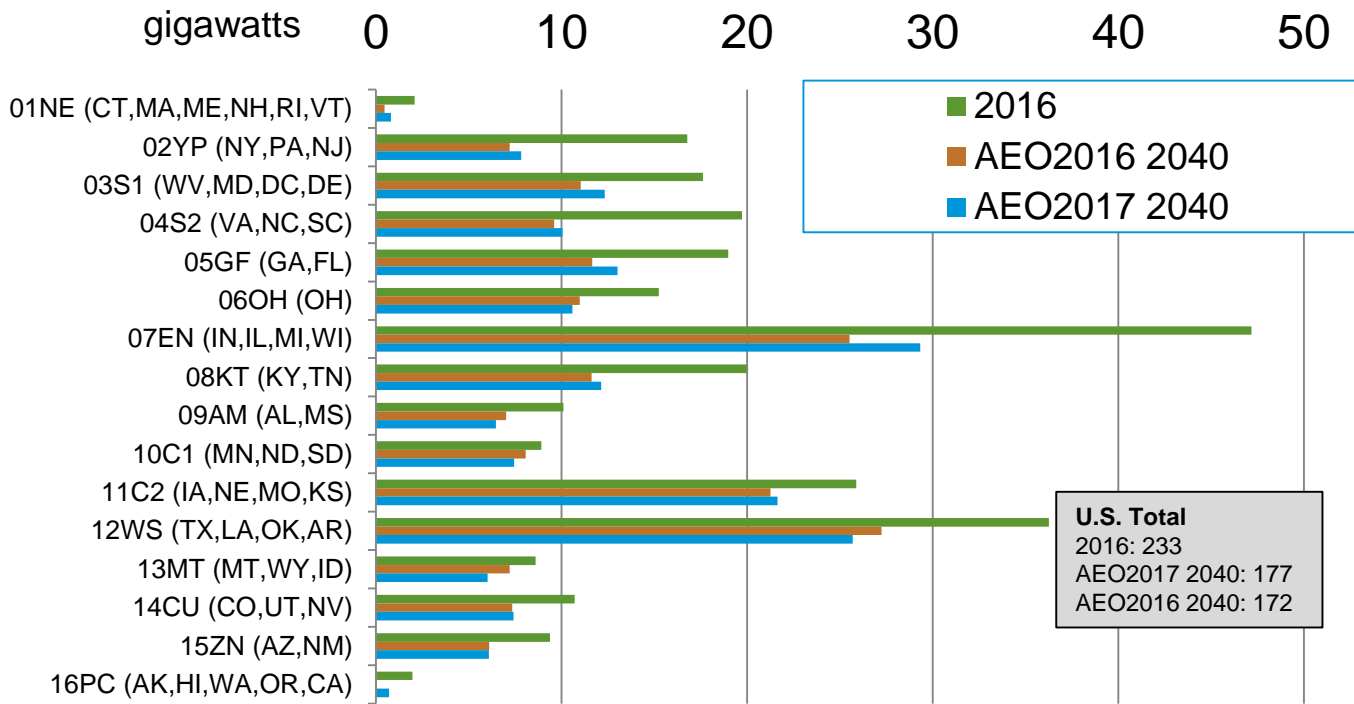
Short tons per miner hour



preliminary AEO2017 assumptions; ref2016.d032416a

- Compared to AEO2016:
 - Higher in Northern WY PRB
 - Lower in Southern WY PRB
- Net effect: lower productivity assumptions for the region push prices higher and production lower early in the projection; but similar to AEO2016 in out years
- Methodology includes a mine by mine assessment relating stripping ratios and approximate, expected production tons to derive overburden tons. Greater overburden tons lead to an increase in labor hours and lower productivity.

Net summer coal-fired generating capacity in the electric power sector by coal demand region, AEO2017 vs AEO2016



ref2017.d092816a and ref2016.d032416a; excludes Two Elk and Texas Clean Energy Project



Coal-Fired Capacity Omitted from AEO2017

FACILITY CODE	PLANT NAME	GENERATOR ID	STATE	PLANT TYPE	ENERGY SOURCE	REPORTED START YEAR	SUMMER CAPABILITY
55360	Two Elk Generating Station	GEN1	WY	PC	waste coal	2020	275 MW
	Texas Clean Energy Project		TX	IGCC	WY PRB	2017	400 MW
Total Capacity							675 MW

Source: U.S. Energy Information Administration, Form EIA-860 “Annual Electric Generator Report”

- While the Two Elk is reported as ‘under construction’ on the Form EIA-860, other references suggest that the project is, minimally, delayed as the developer has recently cancelled an appeal hearing. The hearing would have appealed the denial of its request for a permit extension.
- DOE has suspended funding for the Texas Clean Energy Project. This project is not reported on the Form EIA-860.

<http://wyomingpublicmedia.org/post/two-elk-power-plant-hearing-cancelled>

<https://insideclimatenews.org/news/12052016/departement-energy-moniz-carbon-capture-ccs-climate-change-texas-clean-energy-project>

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