

**WORKING GROUP PRESENTATION FOR DISCUSSION PURPOSES.
DO NOT QUOTE OR CITE AS AEO2016 MODELING ASSUMPTIONS
AND INPUTS ARE SUBJECT TO CHANGE.**

Annual Energy Outlook 2016

2nd Coal Working Group



Coal and Uranium Analysis Team

February 9, 2016/ Washington, D.C.

Key results for the AEO2016 Reference case

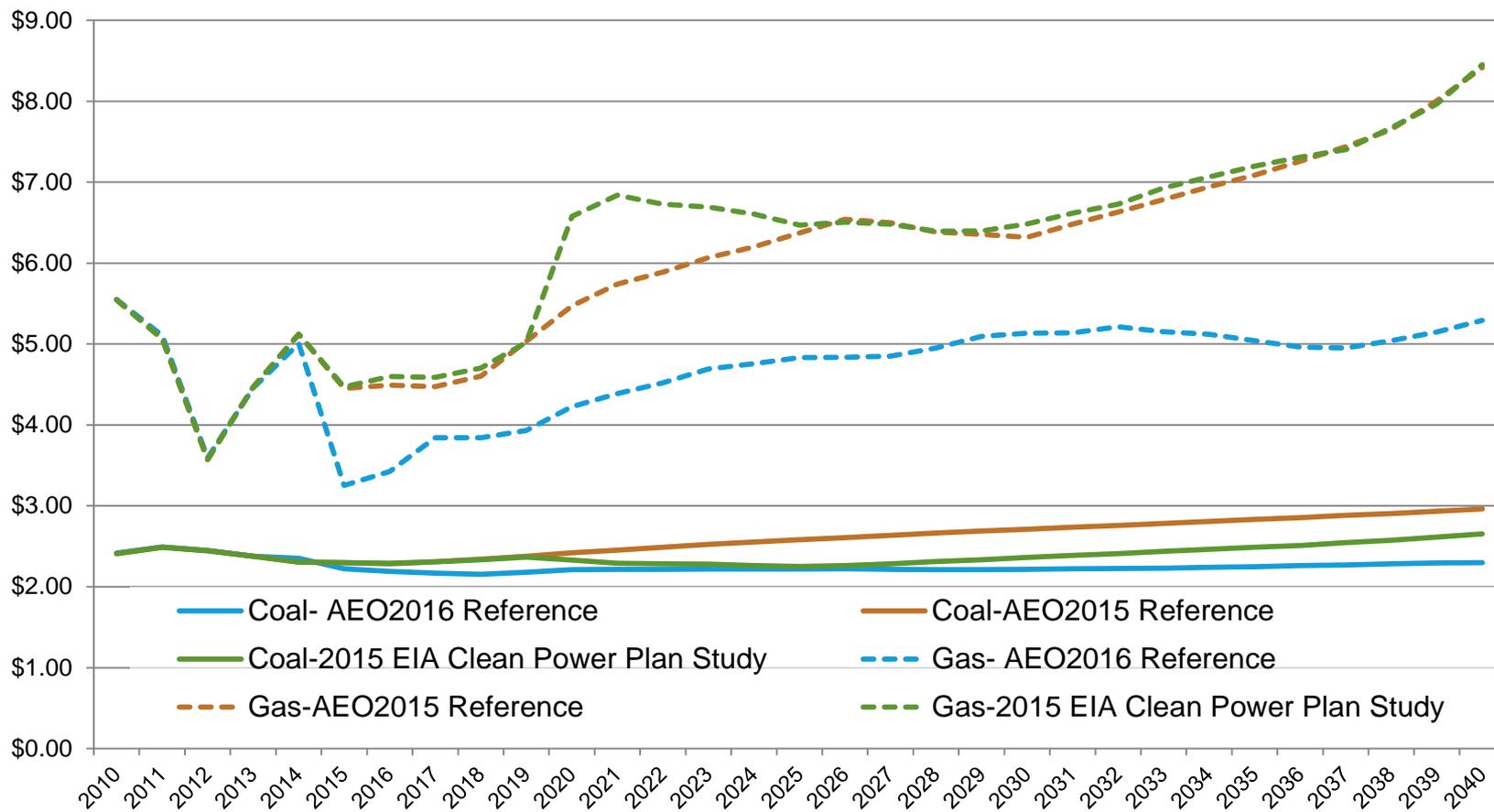
- Coal-fired generation, production, and capacity are all lower in the preliminary AEO2016 Reference case
 - Coal's share of total electricity generation falls from 38% in 2014 to 18% by 2040, compared to 33% in AEO2015
 - Coal production decreases from 996 million tons in 2014 to 640 million tons by 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

Natural Gas prices are significantly lower than AEO 2015

2013\$/MMBtu



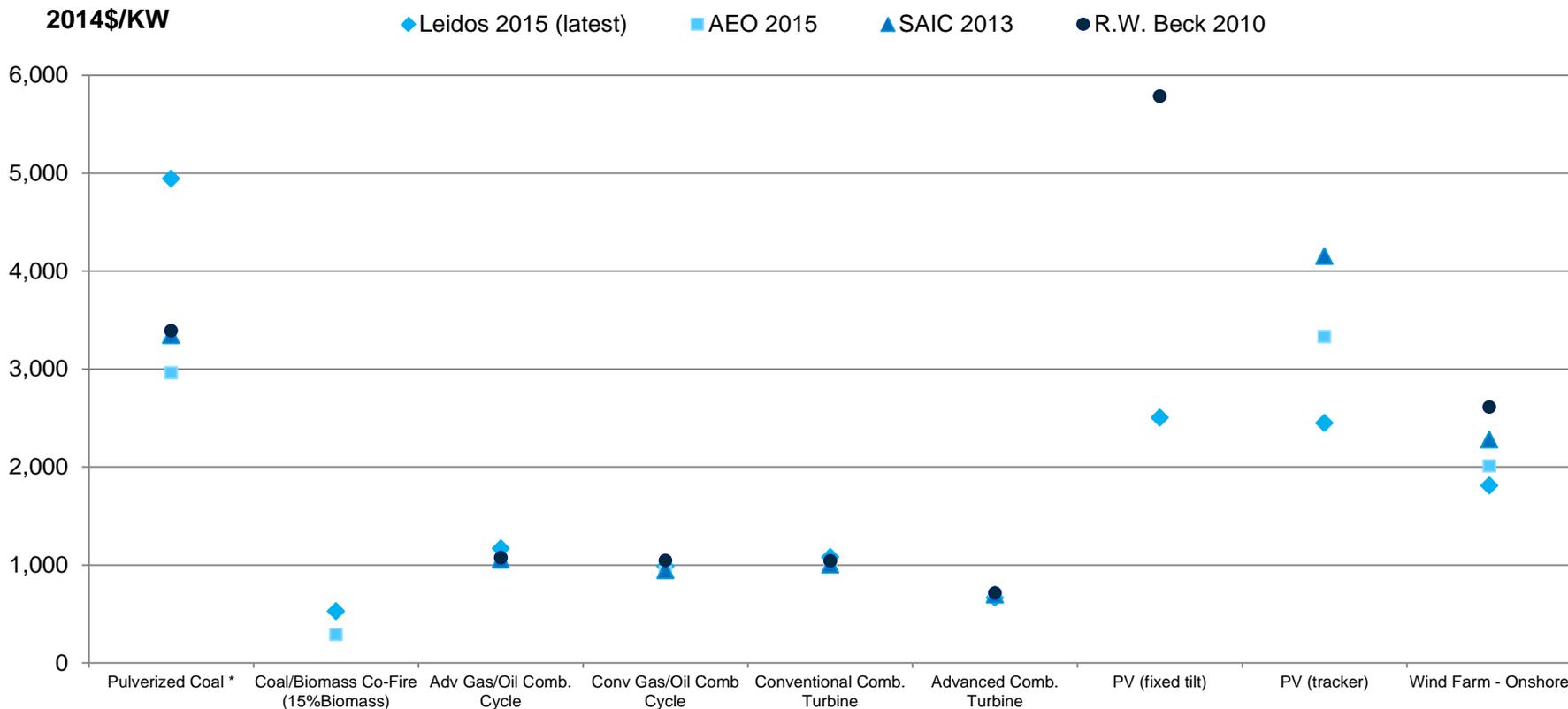
Source: AEO2016 NEMS run ref2016.1.0203a.RAN, AEO2015 Ref2015, rf15_111_all.0306a.RAN

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

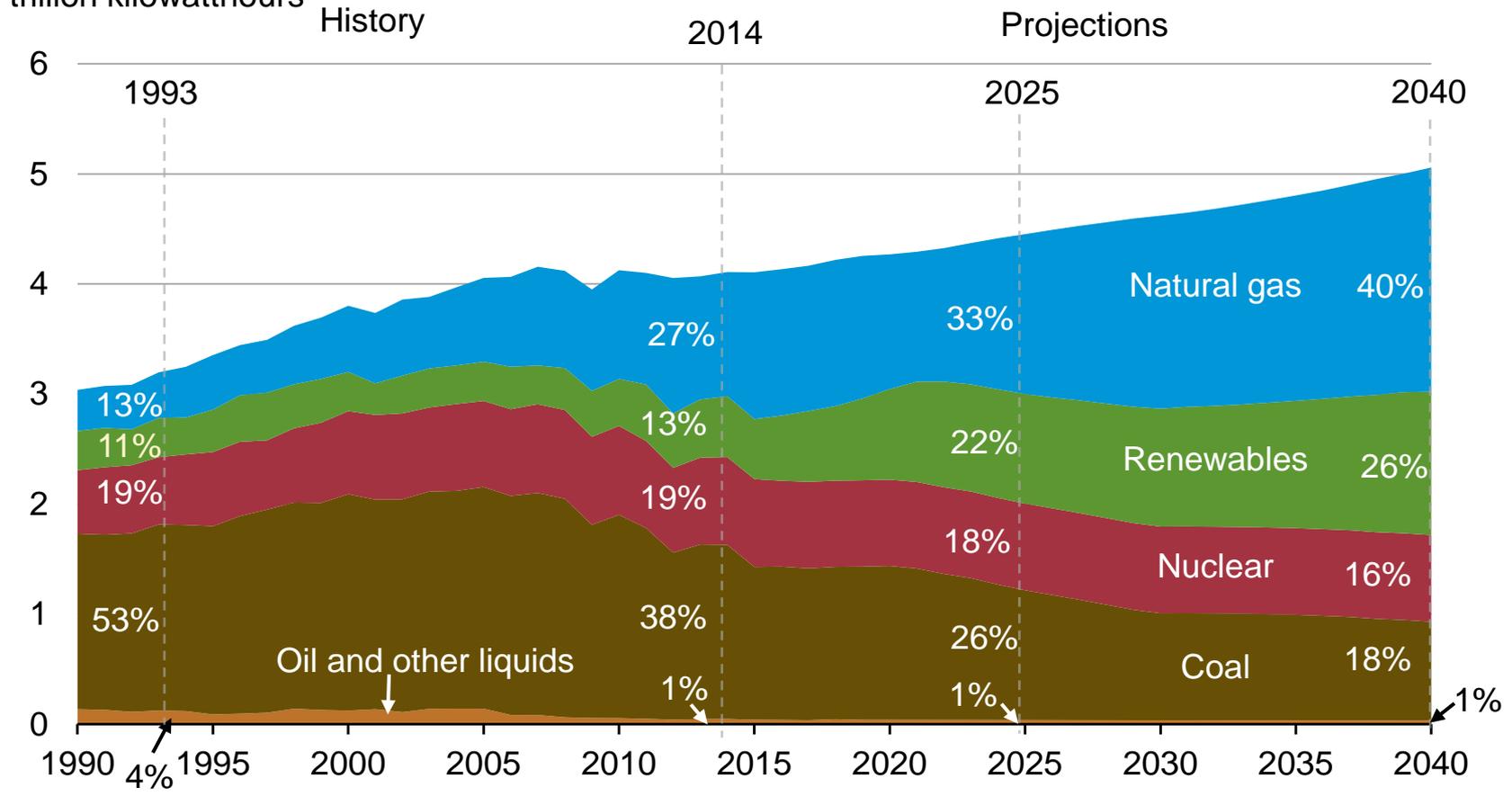
Total Overnight Capital Costs (2014\$/KW)



* 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.

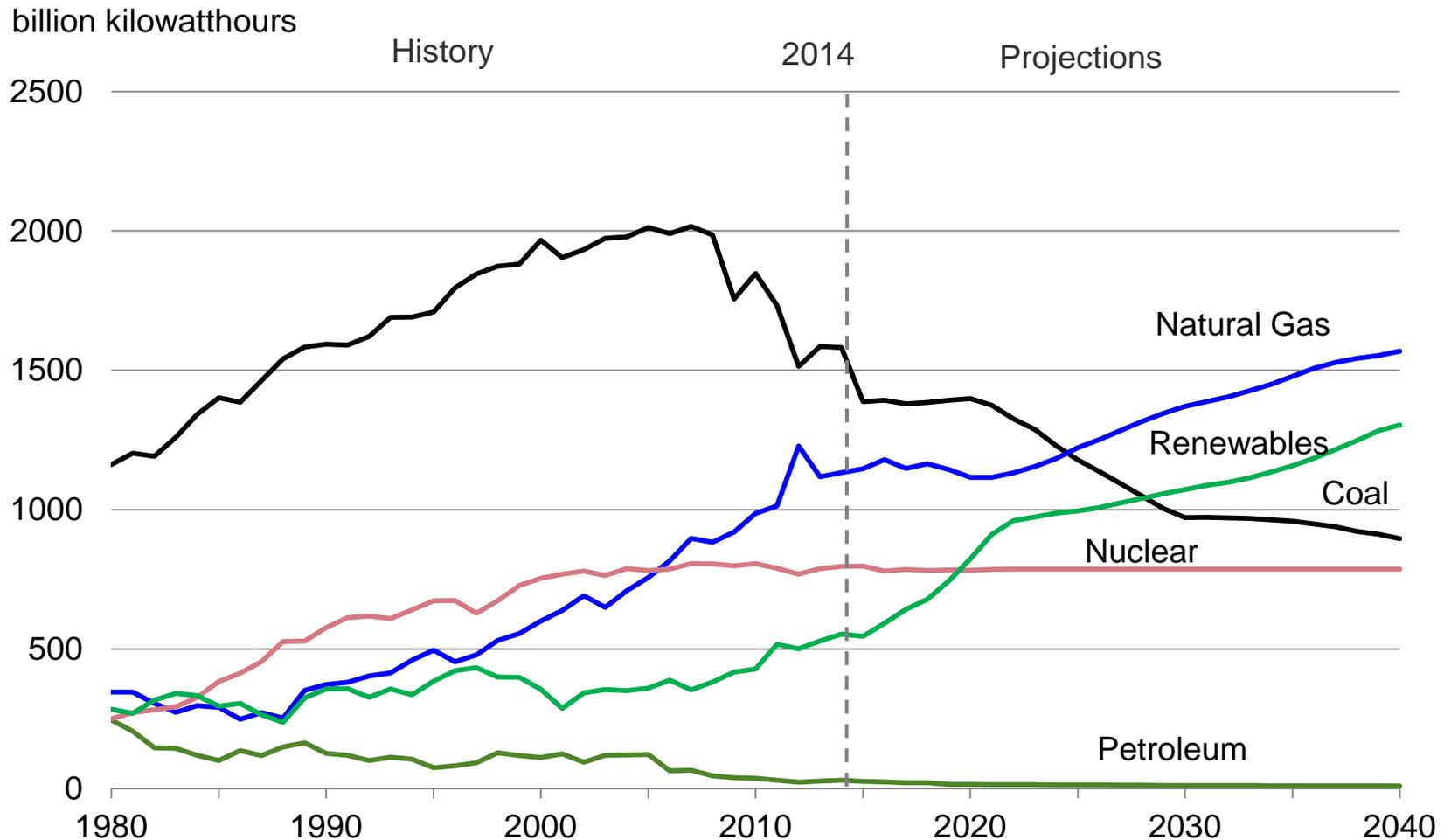
Renewables and natural gas together account for 66% of generation in 2040 while coal's share falls to 18%

U.S. electricity net generation
trillion kilowatthours



Source: Preliminary AEO2016 (NEMS run ref2016.d020616a)

Electricity Generation by Fuel, 1980-2040

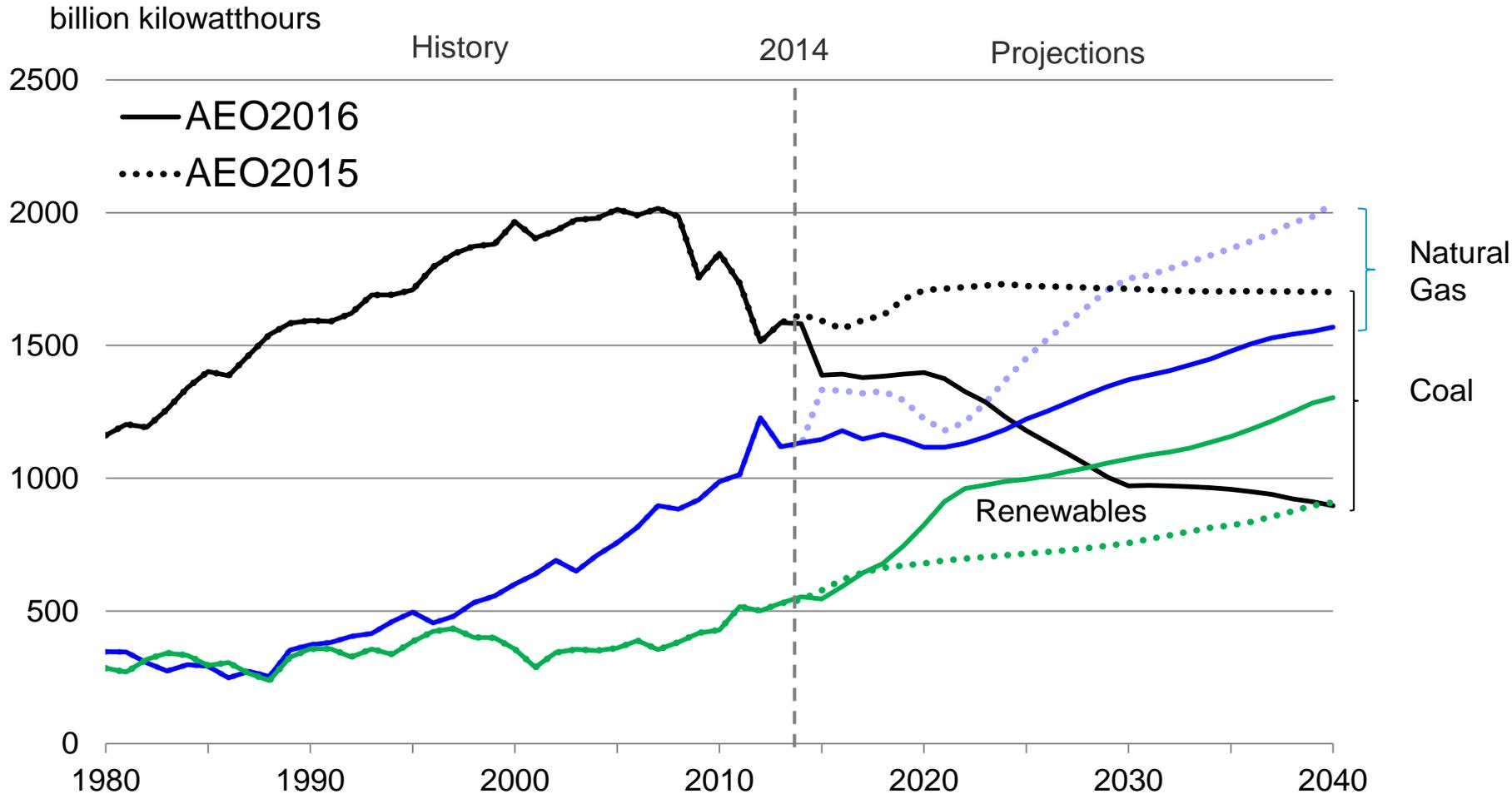


Note: Includes generation from plants in both the electric power and end-use sectors.

Source: History: U.S. Energy Information Administration (EIA), *Annual Energy Review*;

Projections: Preliminary AEO2016 (NEMS run ref2016.d020616a)

Electricity Generation by Fuel, 1980-2040



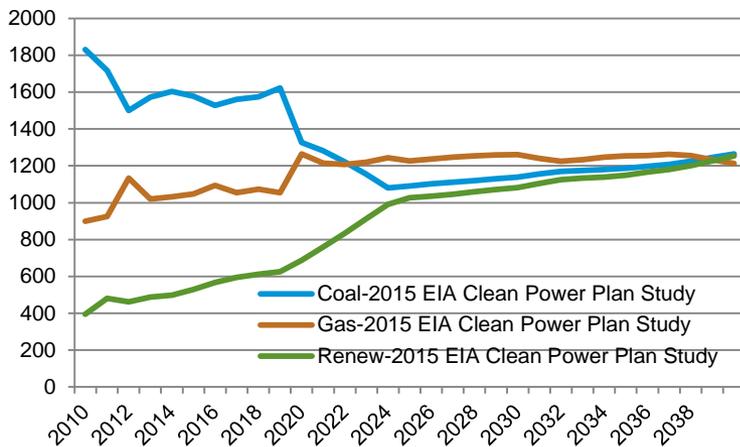
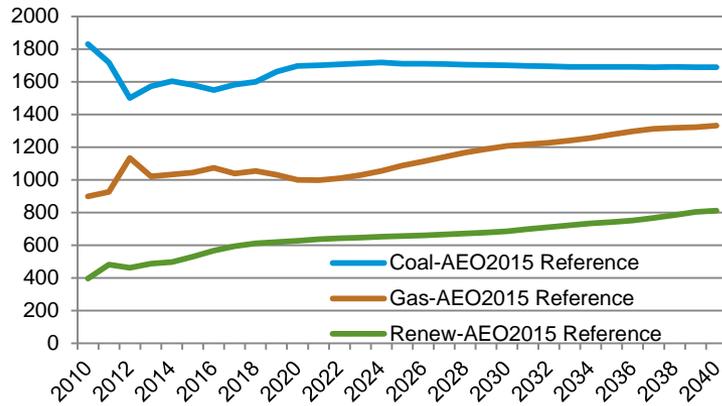
Note: Includes generation from plants in both the electric power and end-use sectors.

Source: History: U.S. Energy Information Administration (EIA), *Annual Energy Review*;

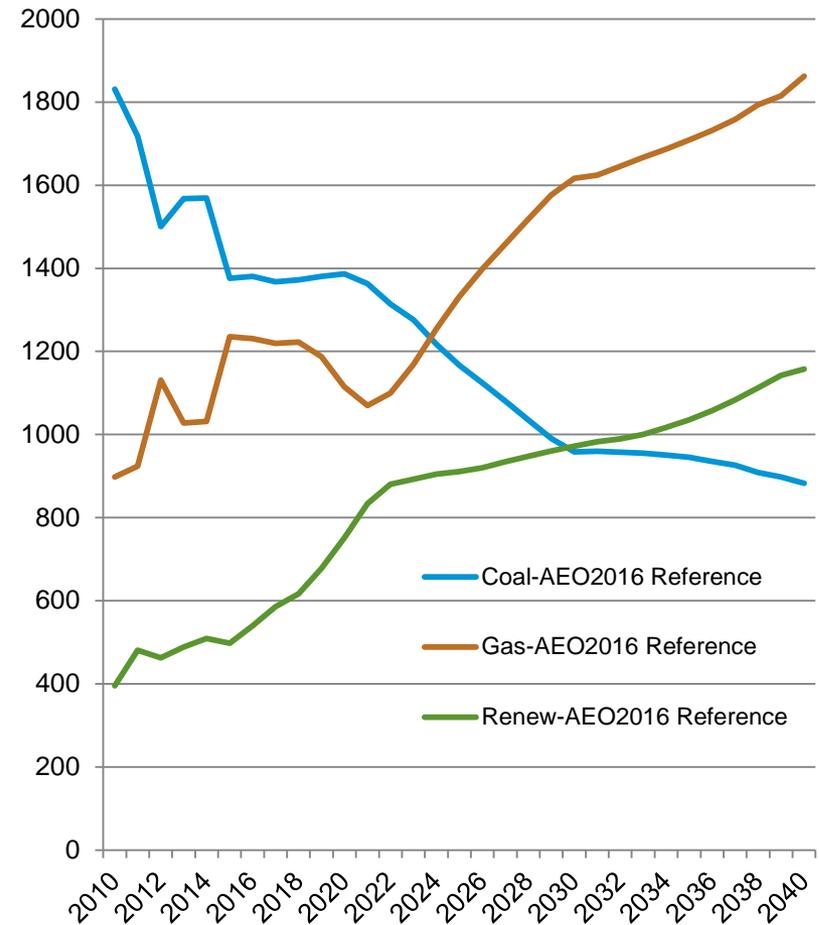
Projections: Preliminary AEO2016 (NEMS run ref2016.d020616a), AEO2015 Reference Case (April 2015).

Natural gas, renewables, and coal-fired generation, AEO2015 Reference Case, EIA CPP Study 2015 vs. preliminary AEO2016

Billion kilowatthours

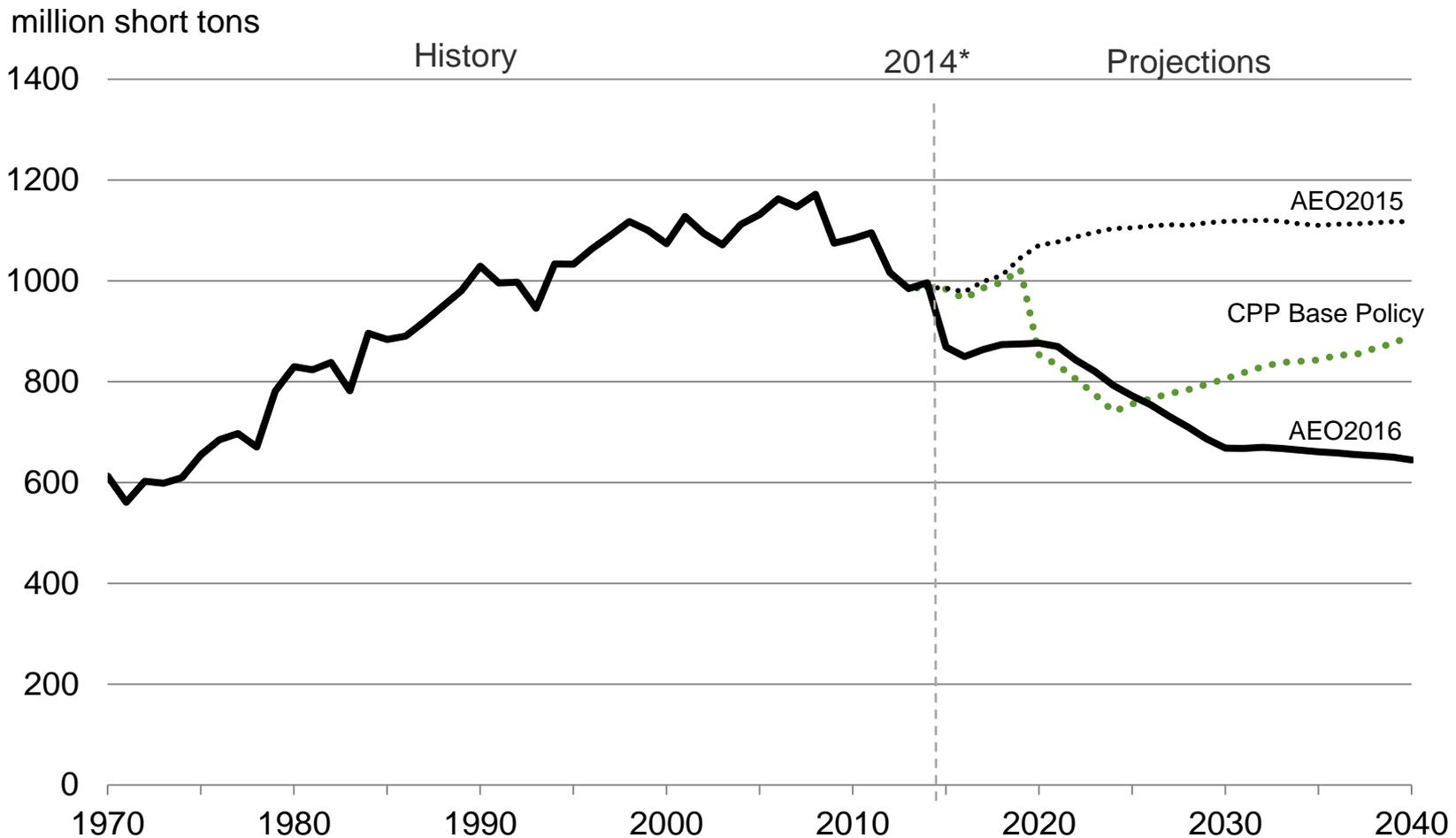


Billion kilowatthours



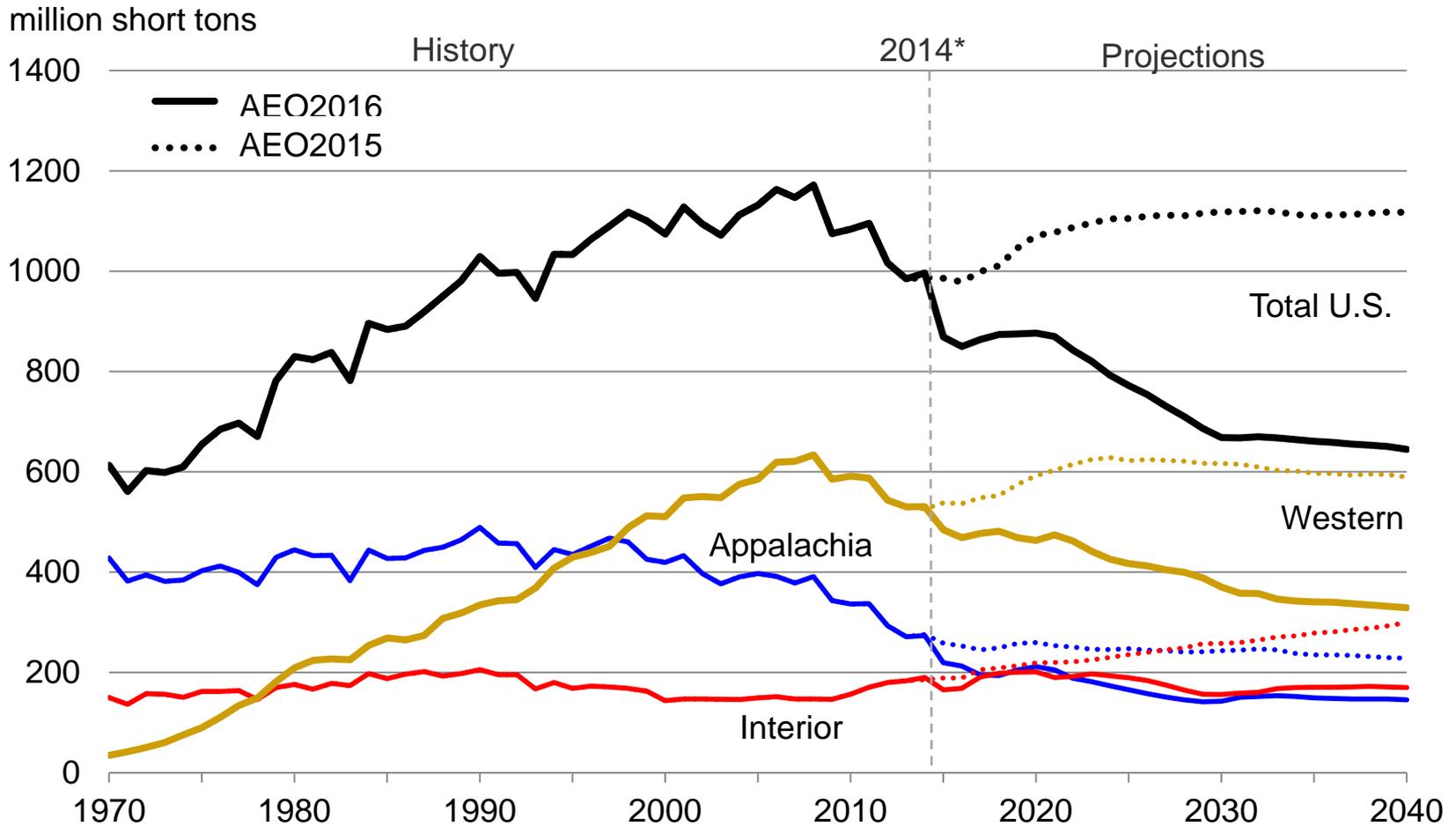
Source: AEO2016 NEMS run ref2016.0206a.RAN, rf15_111_all.0306a.RAN

Total coal production, 1970-2040



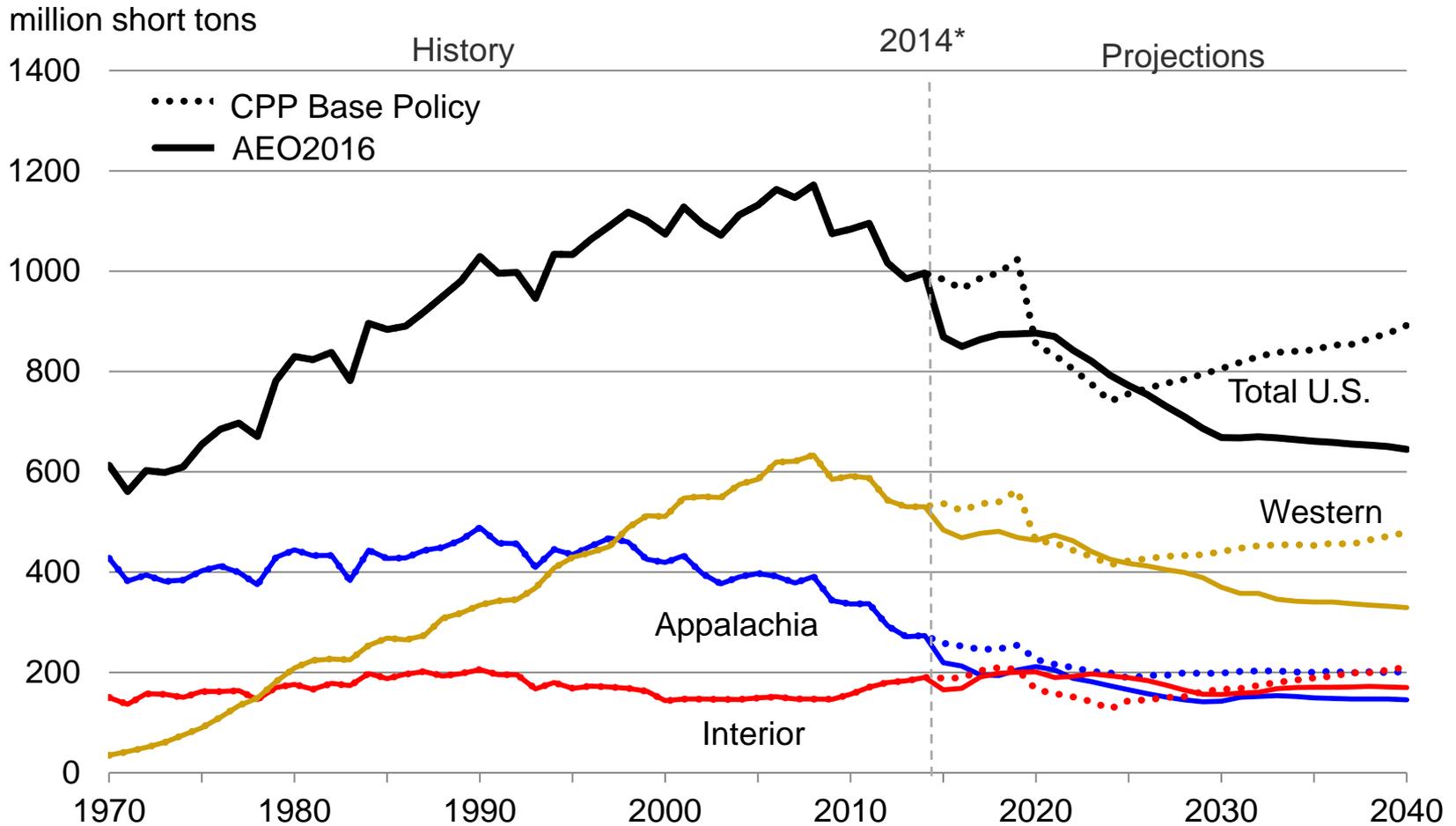
Source: Preliminary AEO2016 (ref2016.d020616a), AEO2015 Reference Case (April 2015), proposed Clean Power Plan (rf15_111_all.d030615a; *2014 data is estimated).

Coal production by region, 1970-2040



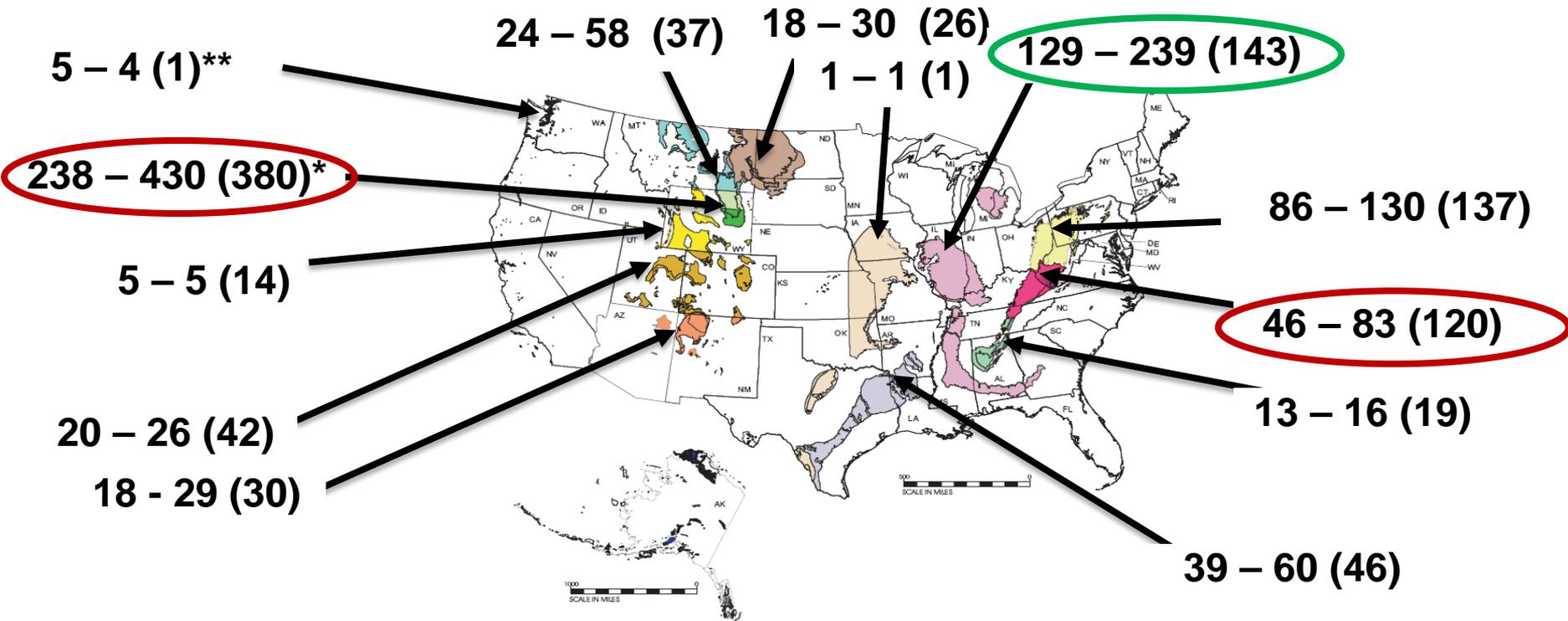
Source: Preliminary AEO2016 (ref2016.d020616a), AEO2015 Reference Case (April 2015), proposed Clean Power Plan (rf15_111_all.d030615a *2014 data is estimated).

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 all mines in Wyoming's Powder River Basin.

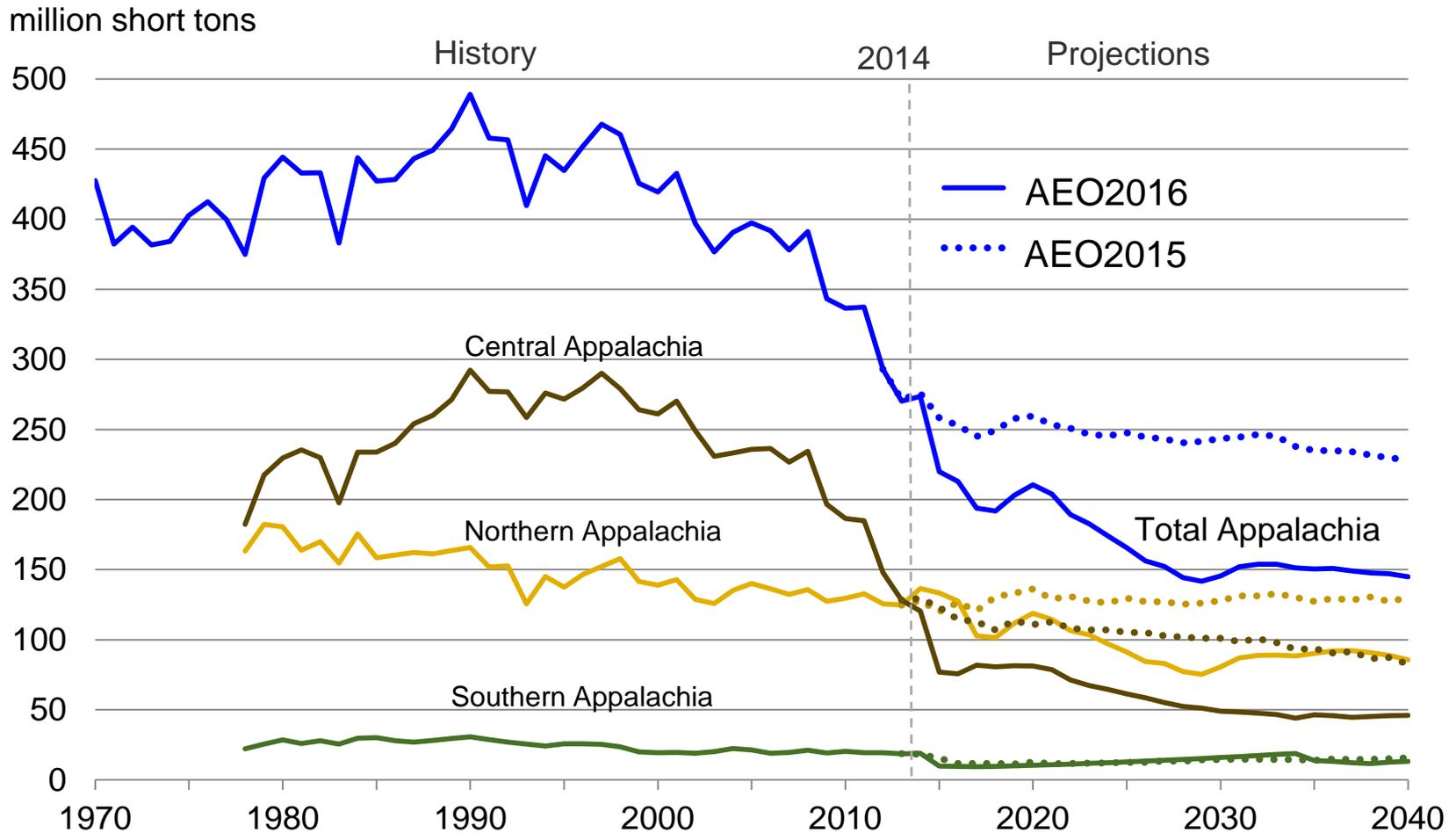
** Includes production from mines in both Alaska and Washington.

- APPALACHIA**
 - Northern Appalachia
 - Central Appalachia
 - Southern Appalachia
- INTERIOR**
 - Eastern Interior
 - Western Interior
 - Gulf Lignite
- NORTHERN GREAT PLAINS**
 - Dakota Lignite
 - Western Montana
 - Wyoming, Northern Powder River Basin
 - Wyoming, Southern Powder River Basin
 - Western Wyoming
- OTHER WEST**
 - Rocky Mountain
 - Southwest
 - Northwest

U.S. Total:
640 - 1,117 (996)

Source: *2014 (preliminary): Mine Safety and Health Administration, Form 7000-2, "Quarterly Mine and Employment and Coal Production Report;" 2040: Preliminary AEO2016 (NEMS run ref2016.d020616a); and AEO2015.

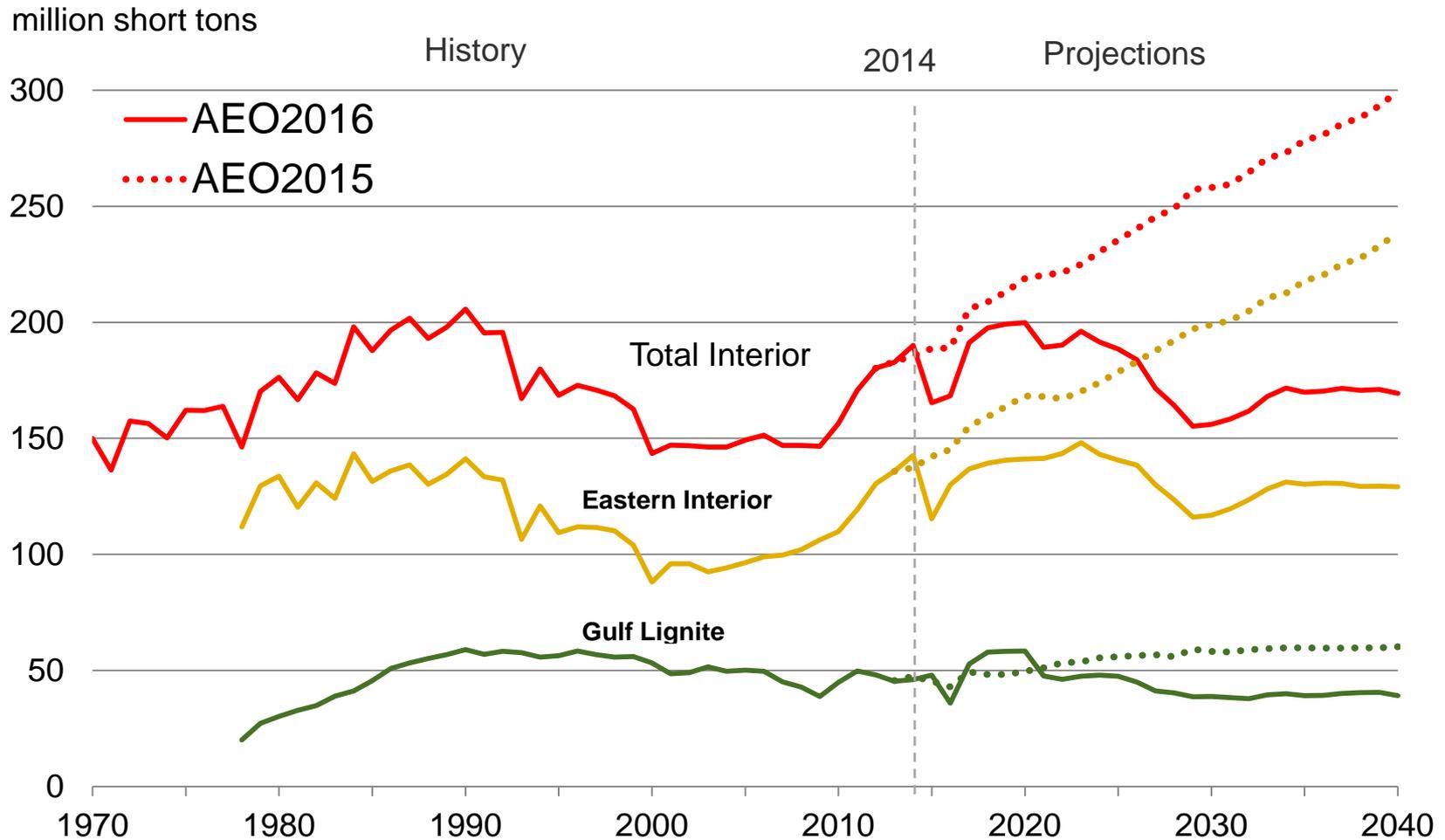
Appalachian coal production, 1970-2040



Source: Preliminary AEO2016 (ref2016.d020616a), AEO2015 Reference Case (April 2015)

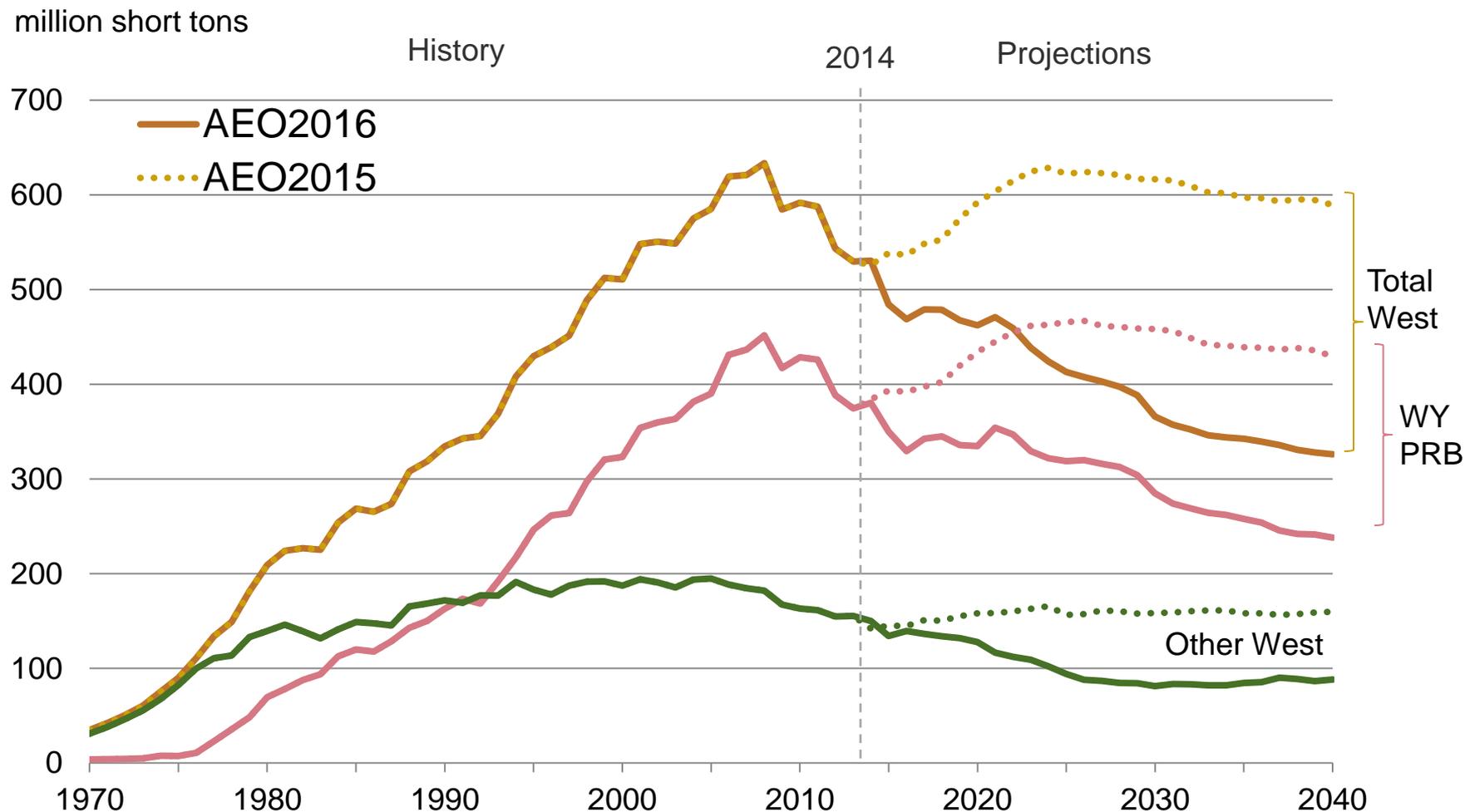
Except for Appalachian total, data for 1978-1985 exclude production from small (<10,000 short tons) coal mines

Interior coal production, 1970-2040



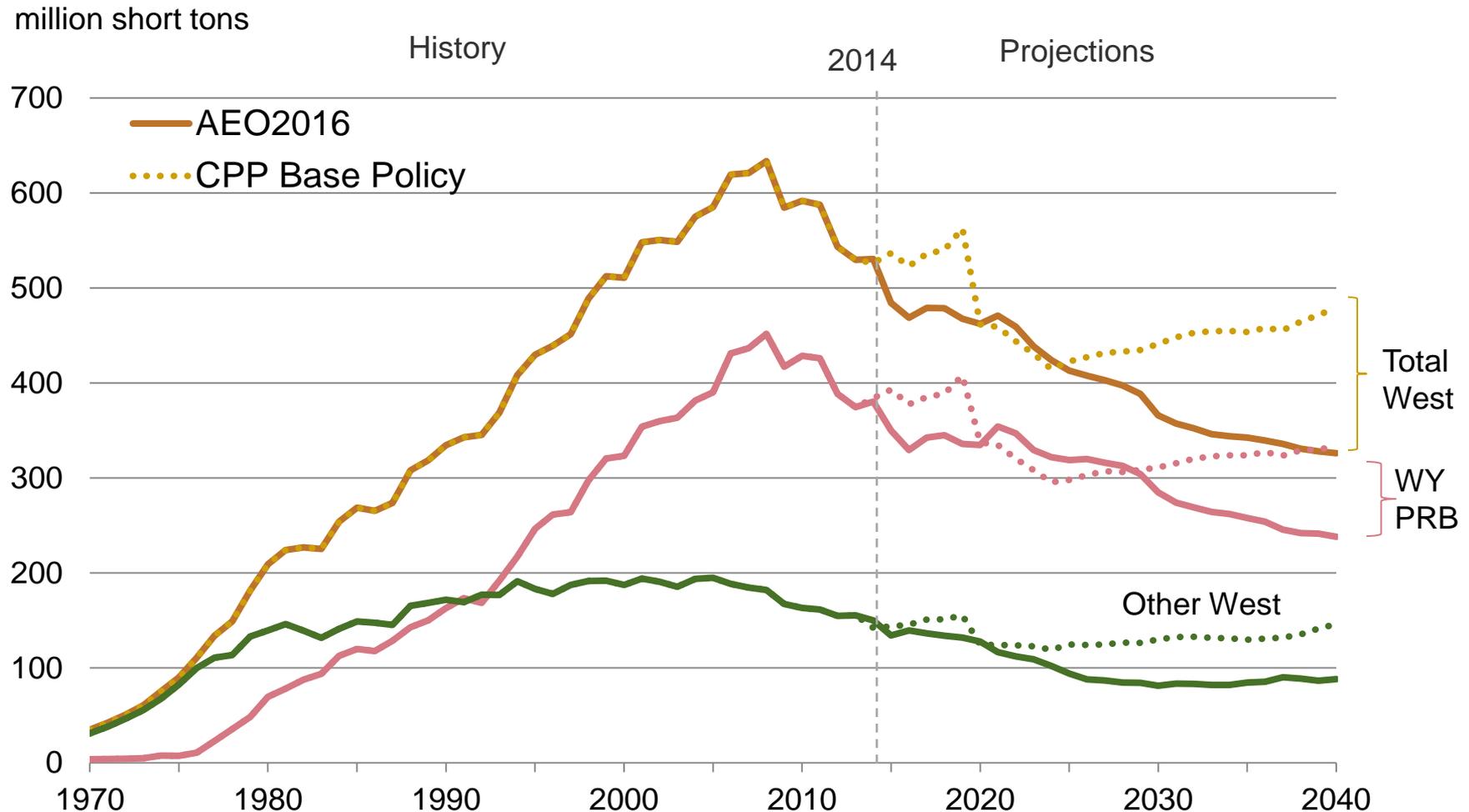
Source: Preliminary AEO2016 (ref2016.d020616a), AEO2015 Reference Case (April 2015),
 Except for Interior total, data for 1978-1985 exclude production from small (<10,000 short tons) coal mines

Western coal production, 1970-2040



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

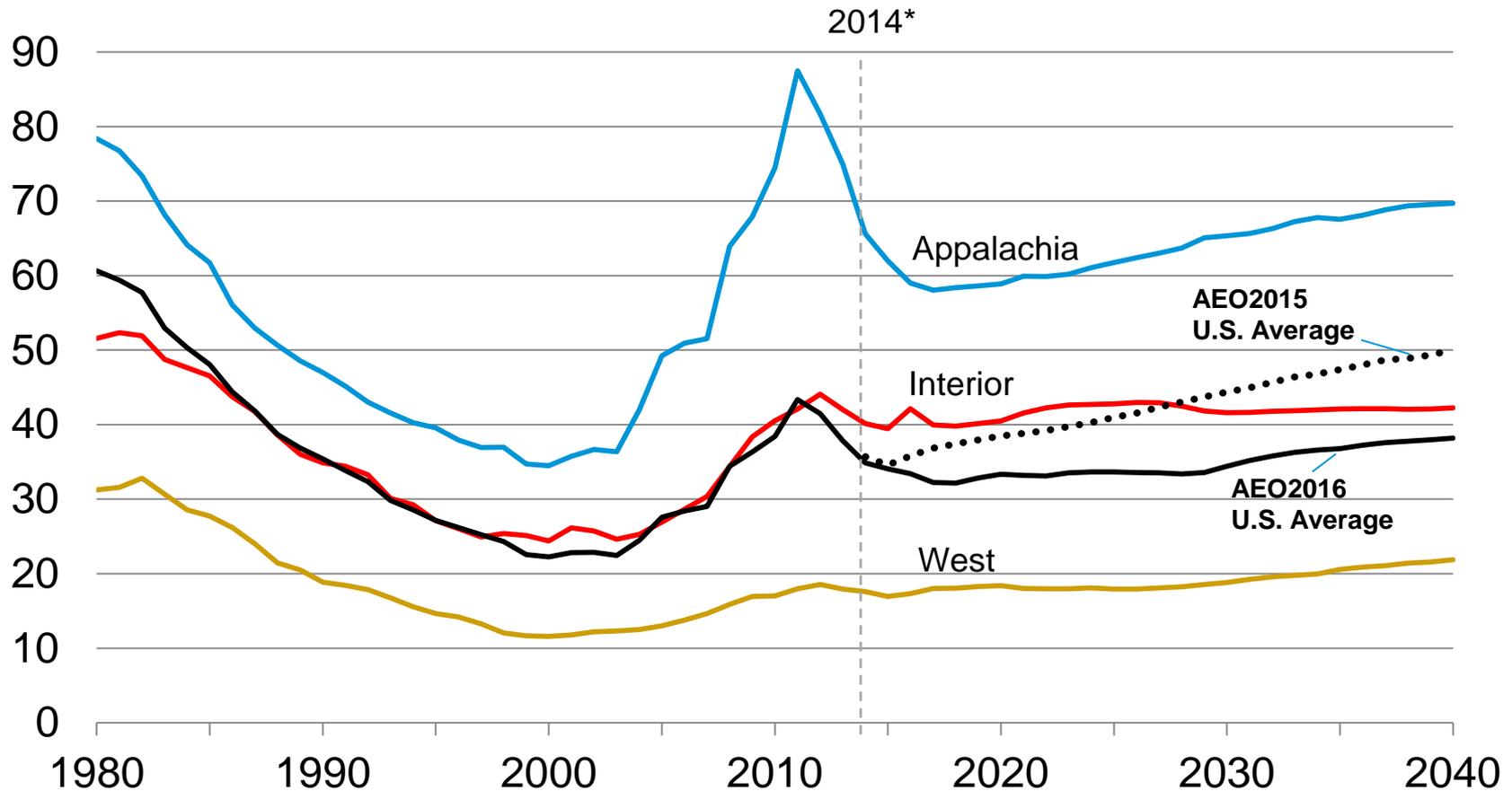
Western coal production, 1970-2040



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

Average minemouth coal prices by region, 1980-2040

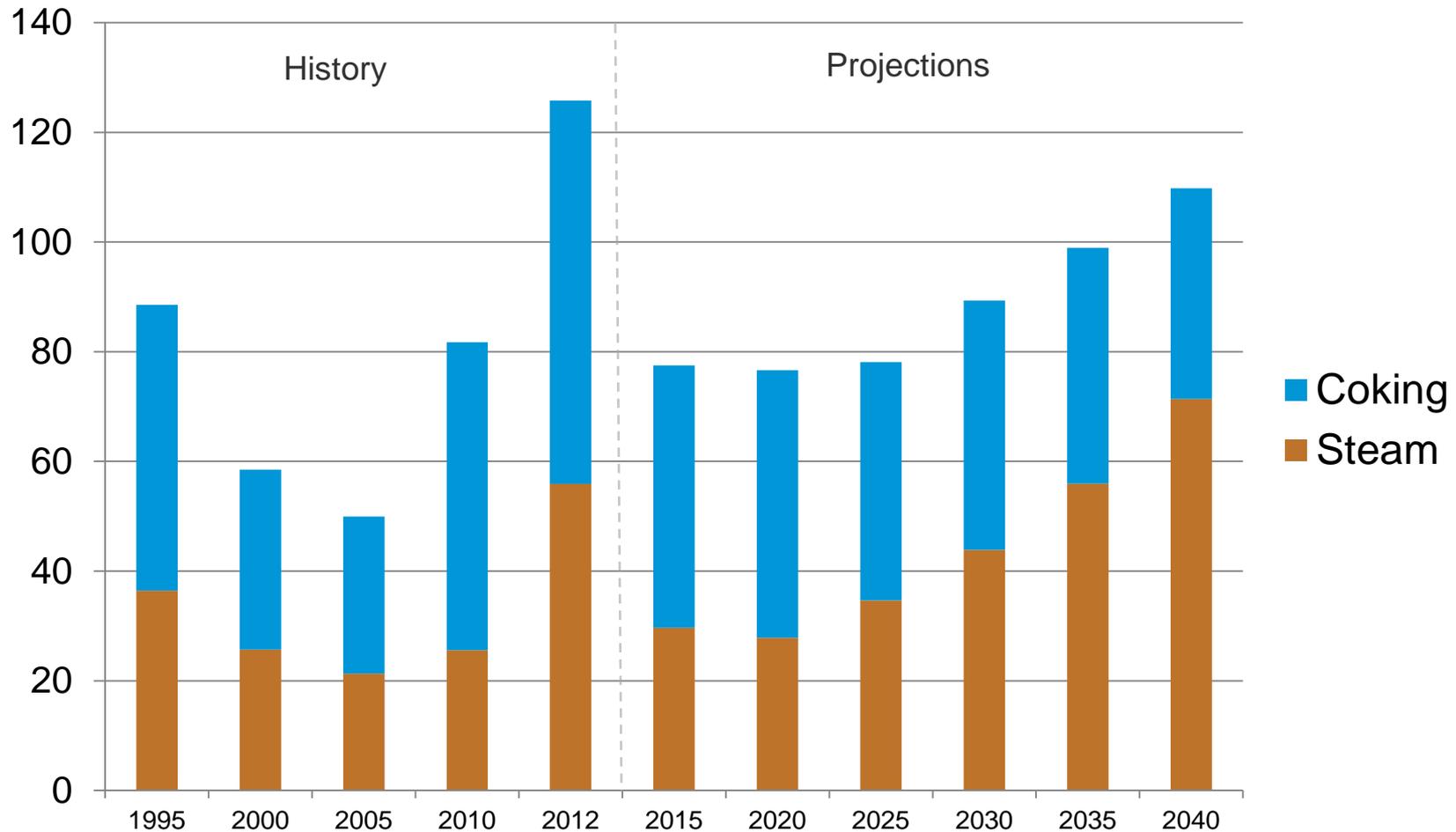
2014 dollars per short ton



Source: Preliminary AEO2016 (ref2016.d020616a), AEO2015 Reference Case (April 2015), *2014 is estimated.

U.S. Coal Exports, 1995-2040

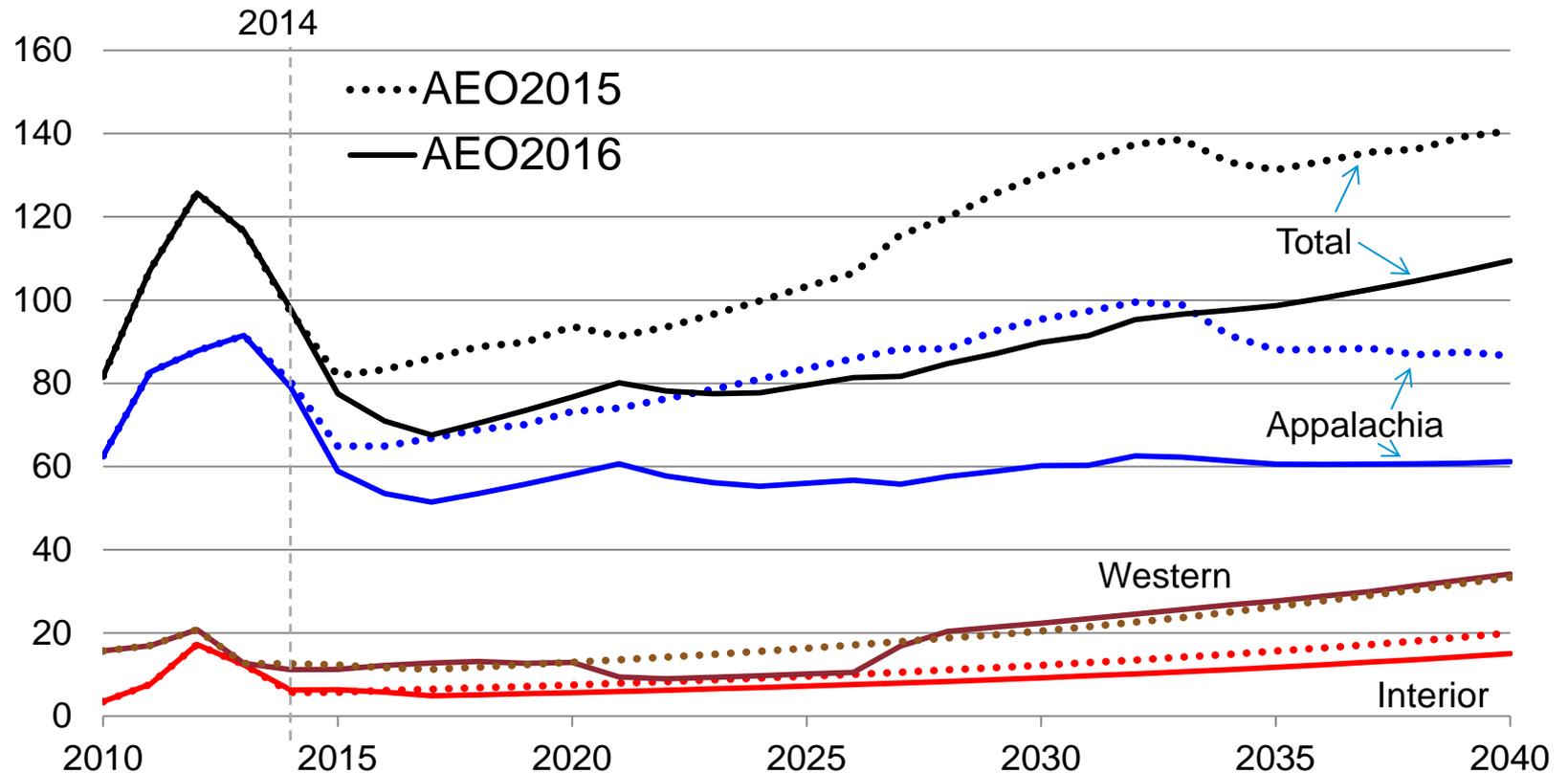
million short tons



Source: History: U.S. Energy Information Administration (EIA), *Quarterly Coal Report*;
Projections: Preliminary AEO2016 (NEMS run ref2016.d020616a).

Coal exports by major supply region, 2010-2040

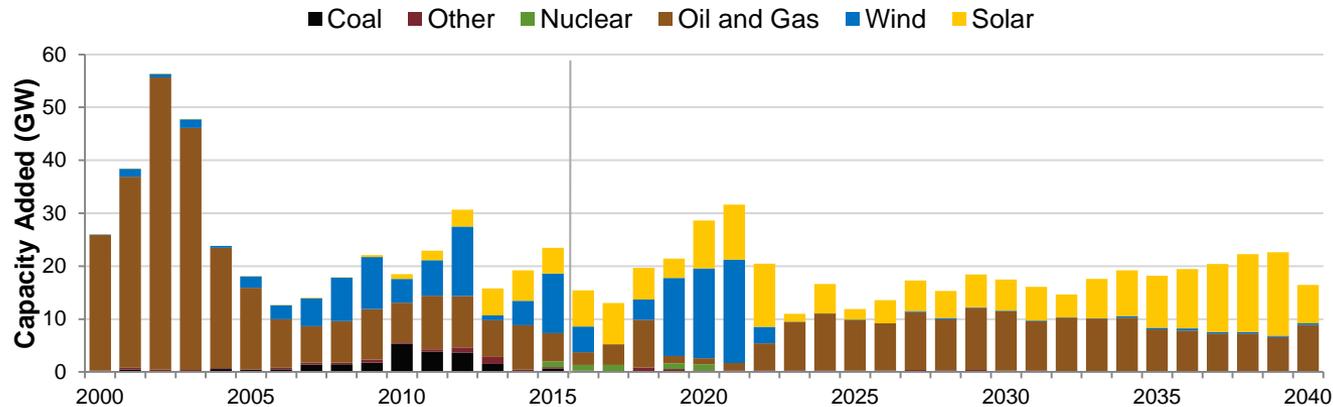
million short tons



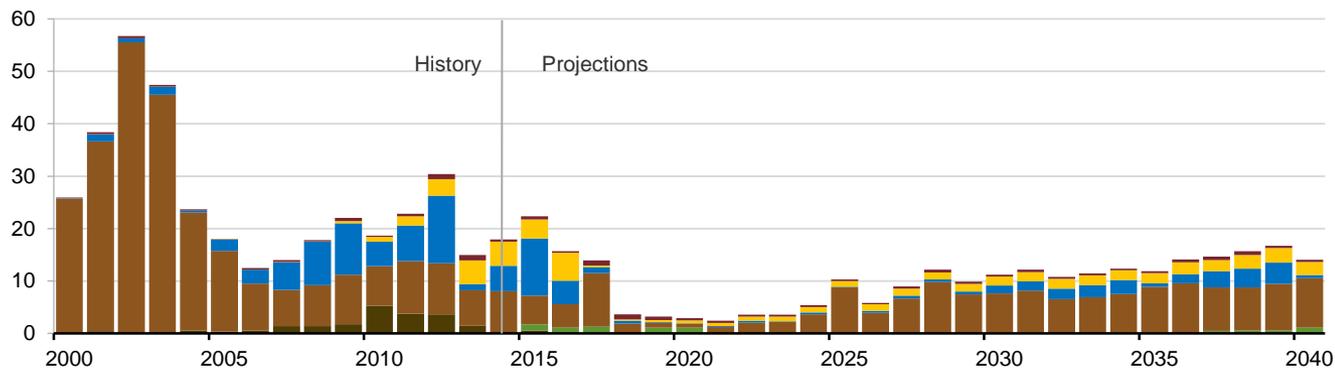
Source: 2010-2012: U.S. Energy Information Administration (EIA), Annual Coal Distribution Report;
2013-2040: Preliminary AEO2016 (ref2016.d020616a), AEO2015 Reference Case (April 2015)

Additions to electricity generating capacity, 2000-2040

AEO2016 Reference



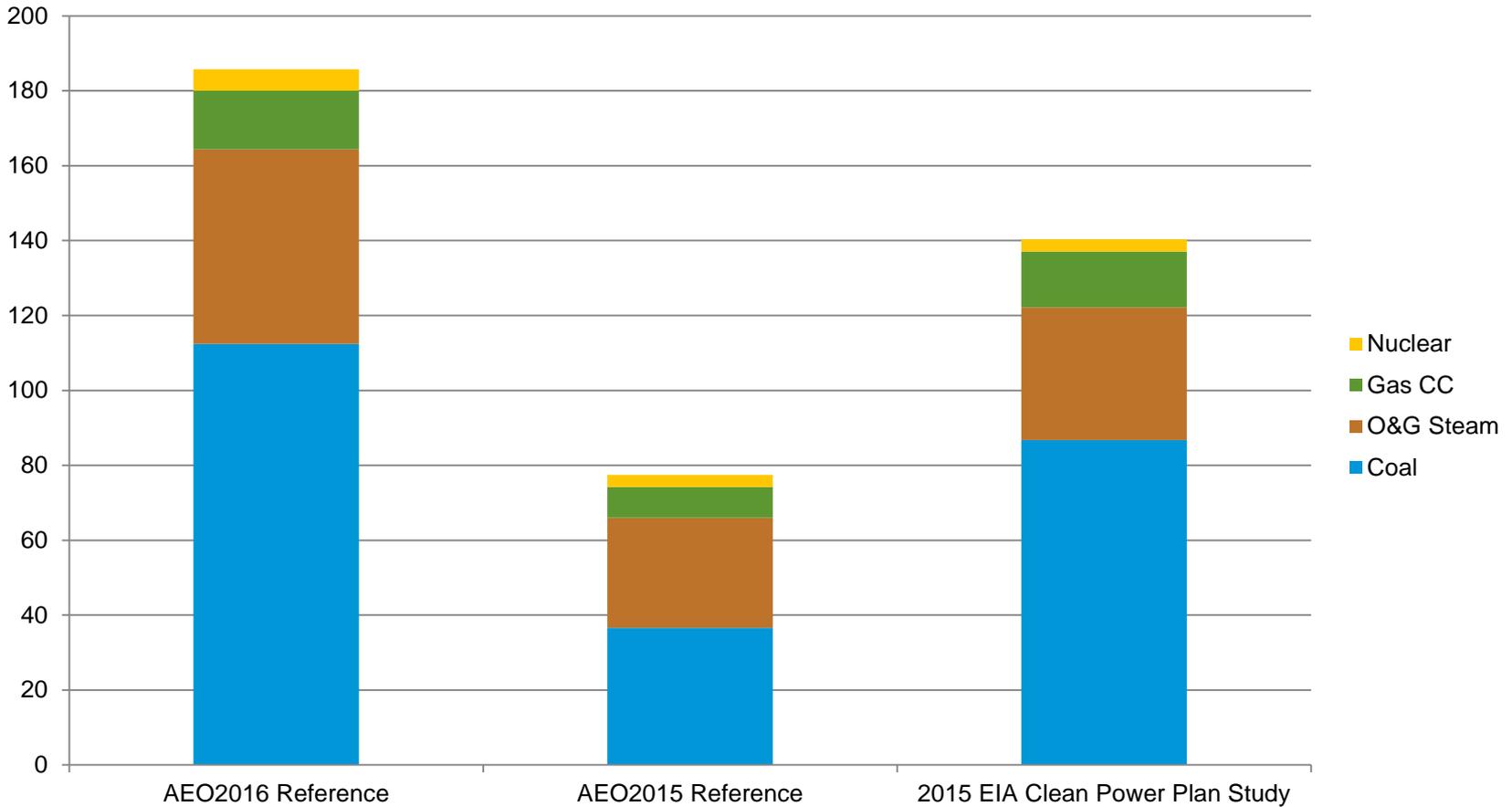
AEO2015 Reference



**WORKING GROUP PRESENTATION FOR DISCUSSION PURPOSES.
DO NOT QUOTE OR CITE AS AEO2016 MODELING ASSUMPTIONS AND
INPUTS ARE SUBJECT TO CHANGE.**

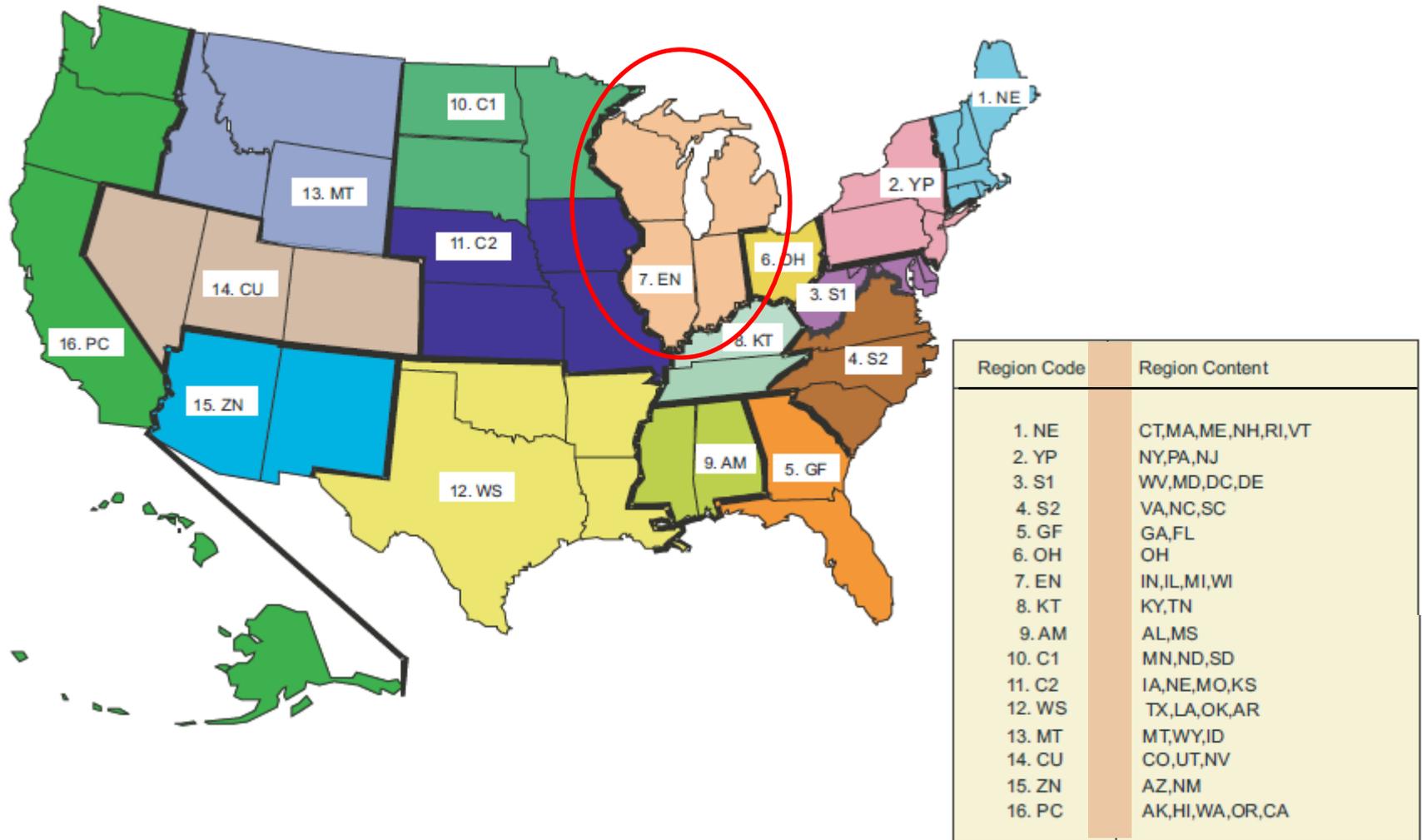
Cumulative coal retirements are up relative to previous CPP study, 2015-2040

gigawatts



Source: AEO2016 NEMS run ref2016.1.0203a.RAN, AEO2015 Ref2015, rf15_111_all.0306a.RAN

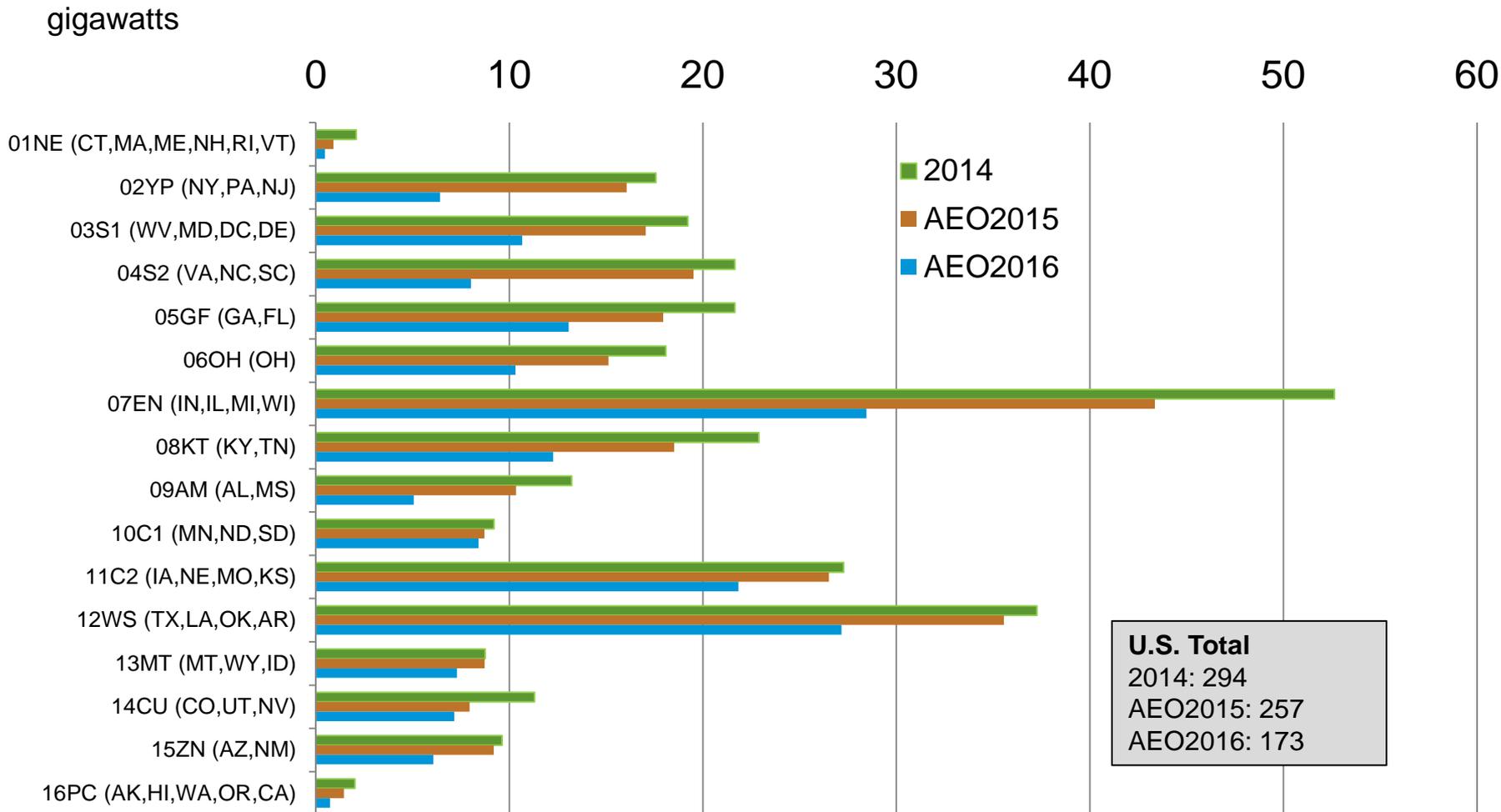
Coal demand regions



Source: U.S. Energy Information Administration, Office of Energy Analysis

**WORKING GROUP PRESENTATION FOR DISCUSSION PURPOSES.
DO NOT QUOTE OR CITE AS AEO2016 MODELING ASSUMPTIONS AND
INPUTS ARE SUBJECT TO CHANGE.**

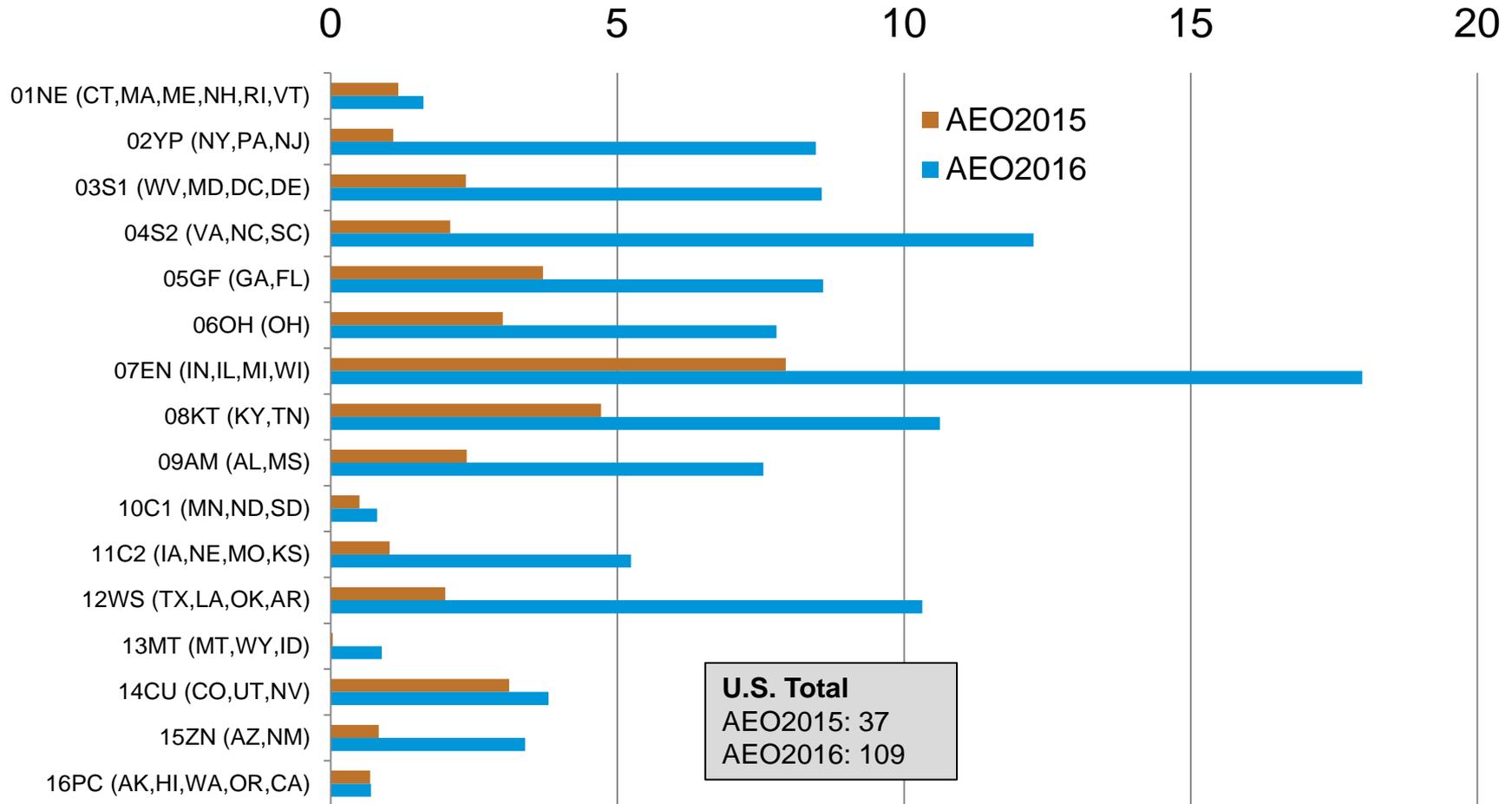
Net summer coal-fired generating capacity in the electric power sector by coal demand region, 2014 and 2040



Source: Preliminary AEO2016 (ref2016.d020616a), AEO2015 Reference Case (April 2015)

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

gigawatts



Source: Preliminary AEO2016 (NEMS run ref2016.d020616a), AEO2015 Reference Case (April 2015).

For more information

greg.adams@eia.gov, (202) 586-7343

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

diane.kearney@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.