

Annual Energy Outlook 2019: Preliminary Results for Electricity, Coal, Nuclear, and Renewables



For

*Joint Session- AEO2019 Working Groups
September 20, 2018 | Washington, D.C.*

By

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

Welcome to AEO2019 Preliminary Results Working Group

- We will be confirming attendance: **please state your name and affiliation at log-in.**
- NOTE: we will be recording the Working Group presentation to enable preparation of meeting notes. The recording will not be made available to anyone outside the Working Group.
- The meeting is being conducted under Chatham House Rules.

Summary

- Key developments for AEO2019 cycle
- Preliminary AEO2019 outlook results
- Open discussion

Key developments for AEO2019 in electric sector modeling

Electricity/Nuclear

- Revised costs for new generating units CC/CT
- Additional state programs to support non-emitting generation (NJ, CA)
- Shift from risk analysis for individual nuclear plants to common generation-at-risk treatment
- Electric generating capacity updates
- Revised short-term elasticity approach

Renewables

- Improved representation of renewable generation resources
- Updated state RPS programs
- Updated solar costs to reflect policy and market considerations

Coal

- Updated coal supply curve parameters and analysis of coal supply contracts

AEO2019 Cases

- Reference Case
- Core side cases
 - High/low oil price
 - High/low economic growth
 - High/low oil and gas resource and technology
- Additional considerations
 - Affordable Clean Energy rule
 - Revised NSPS alternative cases

Electricity/Nuclear Updates

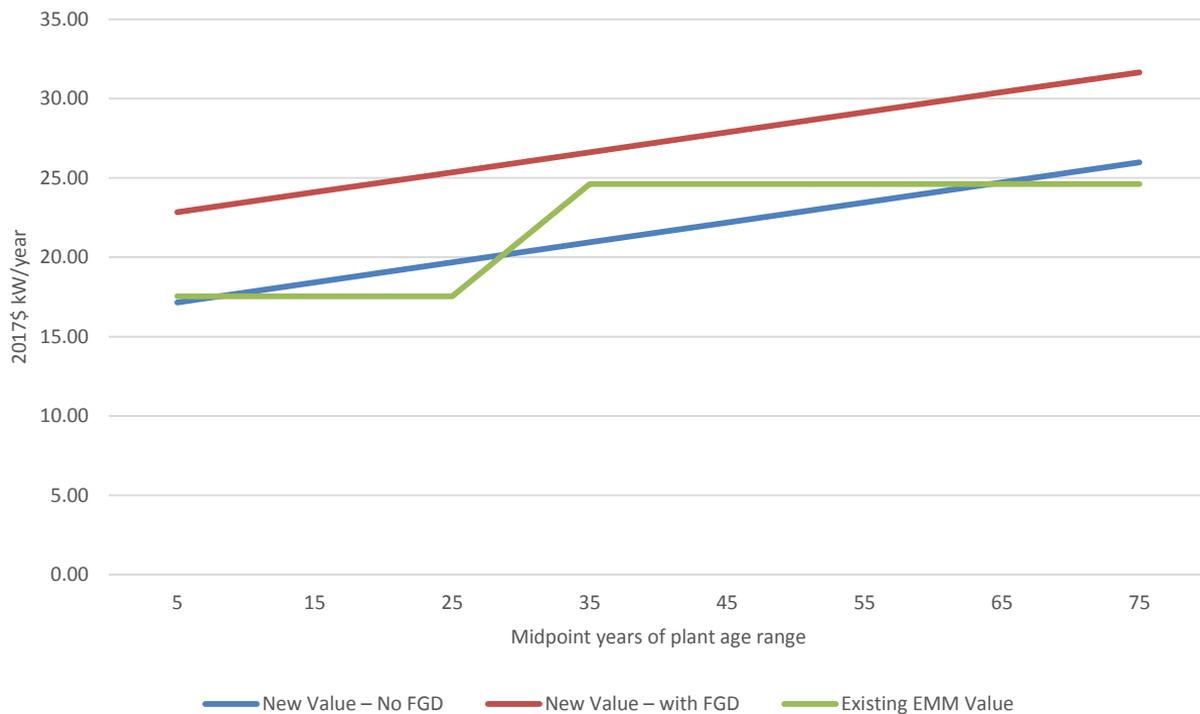
EPA proposed replacement of Clean Power Plan and revision of NSPS

- EPA proposed the Affordable Clean Energy (ACE) rule, replacing the original Clean Power Plan (proposed Aug 2018- currently in 60 day comment period)
 - Revises EPA's BSER (“best system of emission reduction”) finding for GHG emissions from existing power plants to include only heat-rate efficiency improvements
 - Rather than setting specific technology-based standards, gives states a list of “candidate technologies” that can be used to establish performance standards for use in state plans
 - Revises EPA's New Source Review Permitting program so that only projects that increase a plant's hourly rate of pollutant emissions would be subject to full NSR analysis
- EPA is expected to issue revised Standards of Performance (NSPS) for greenhouse gas emissions from new electric generating units shortly
 - Will cover treatment of new, modified, or reconstructed stationary sources
- As in AEO2018 EIA's Reference Case will exclude the CPP and retain current NSPS

Updated treatment of plant aging, generator cost (capital/O&M) and performance for existing units

- S&L did not find data to support EIA's current approach to plant aging costs
 - where aging was a factor its impact was consistent over time rather than an increase in spending at year 30 and it was significant in only a limited number of technology types
- While aging was not as significant a factor in fossil generation cost, S&L found other variables to be significant for capital expenditures, including:
 - Capacity for gas/oil steam plants and wind turbines, and
 - Operating hours for natural gas combined cycle,
 - Number of starts for natural gas combustion turbines.
- S&L recommended additional study to test whether generators incur incremental capital spending to prevent deterioration in operating performance

Comparing S&L recommended capital expenditure levels for coal-fired units to current EMM treatment



Revised costs for new generating units: Gas CC vs. CT

Combined cycle/combustion turbine

- Recent reports¹ suggest a continued decline in the cost of new combined cycle gas turbines, converging on simple cycle cost
- PJM's Cost of New Entry Study estimated that for example in the EMAAC region gas CC overnight capital cost was at \$873/kW (vs. \$898 for CT)
 - Attributed to improved performance, lower unit cost, and lower capital cost
 - EIA confirmed declining costs in evaluation of data for new builds

¹ <https://www.pjm.com/-/media/committees-groups/committees/mic/20180425-special/20180425-pjm-2018-cost-of-new-entry-study.ashx>

Additional state programs to support non-emitting generation

New programs

- New Jersey S-2313 zero emission certificate program
- California SB 100 renewable portfolio standard program
- Revised RPS policies

Implemented in AEO2018

- Illinois: Future Energy Jobs bill
- New York: Clean Energy Standard legislation

Shift from risk analysis for individual nuclear plants to common generation-at-risk treatment

- In both the AEO2018 and AEO2019, a nuclear unit is projected to be retired if the nuclear unit is:
 - In dispatch analysis (EFD): projected to have 3+ years of “negative net revenues” (projected energy only revenues insufficient to cover projected costs) and
 - In capacity expansion modeling (ECP): not required for least cost optimization to meet regional reserve margin requirements
- AEO2018 also included retirement of individual nuclear plants based on an analysis of local market conditions to evaluate economic risk factors
 - Analysis was based on local market prices, fixed costs, deregulated market, load growth, aging costs, state RPS, availability of state support, grid congestion, growth in natural gas use
 - AEO2019 no longer includes retirements based on this generation-at-risk analysis

Renewables Updates

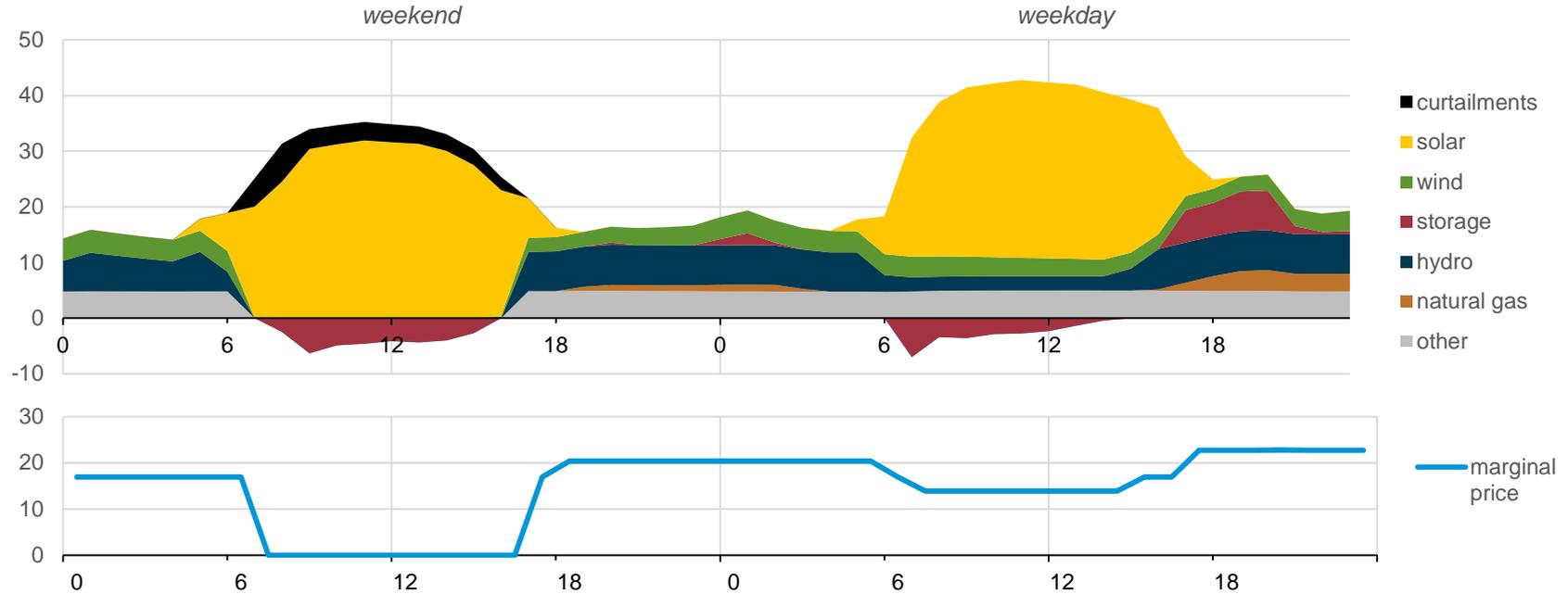
Renewable Electric Power Sector Updates for AEO2019

- REStore
- RPS updates
- New capacity credit algorithm
- New spinning reserve parameter
- kWh to BTU conversion
- Solar cost evaluation

EIA has improved its enhanced-resolution treatment of renewables and storage with an integrated dispatch approach

Generation in California, April 2050

megawatthours

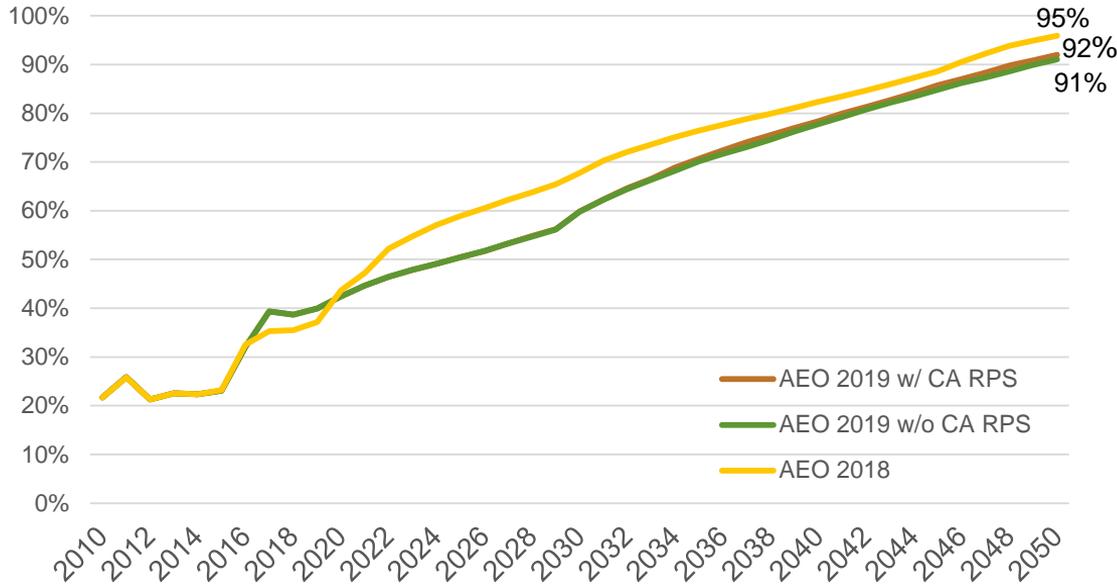


Renewable Portfolio Standard Updates

- Massachusetts
 - 35% renewables by 2030 (up from 25% by 2030)
- New Jersey
 - AB 3723 (SB 2314) 21% from Class I renewables by January 1, 2020
 - 35% by January 1, 2025
 - 50% by January 1, 2030
 - Phase down of solar carve-out
- California
 - 60% renewable generation by 2030, 100% carbon-free by 2045 (to include large scale hydro, CCS, and nuclear)

California 100% carbon-free goal has limited impact on results

Renewable Energy Generation/Total Electric Power Projections
20 - Western Electricity Coordinating Council / California
 All Sectors : Electricity Generation : Total (BkWh)



- RPS projection compliance calculated by:

$\frac{\text{Generation}}{\text{Total Sales}}$

where Total Sales = Total Consumption

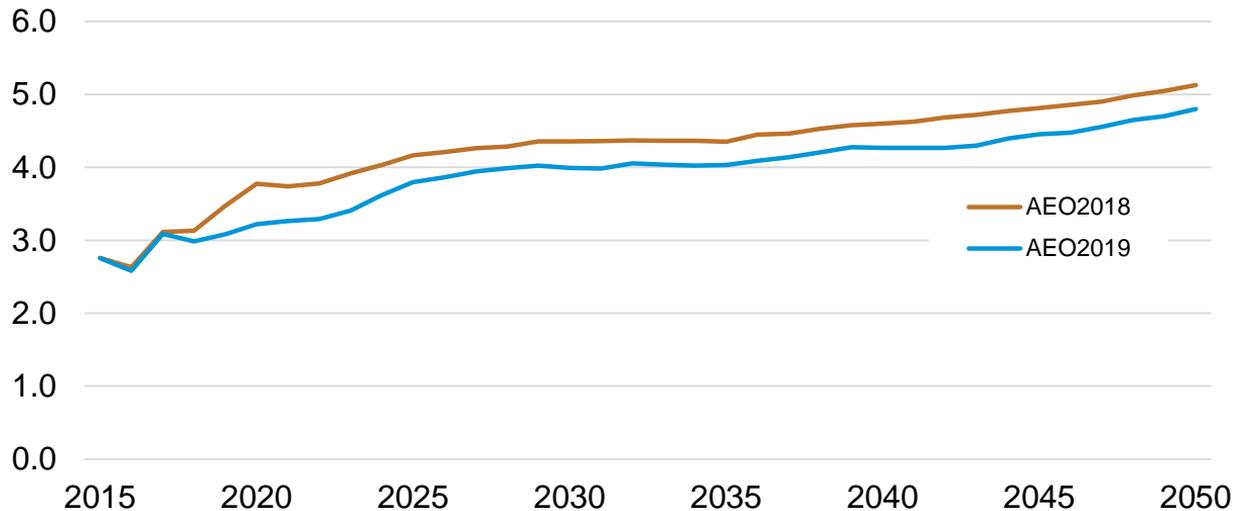
– End–use Generation

- Approximately 92% of RPS compliance met with in-state renewables in 2050 (includes large-scale hydro), even without new targets
- Qualifying ‘clean energy’ resources and additional specifications regarding the CA RPS are pending regulatory determination

Preliminary Results

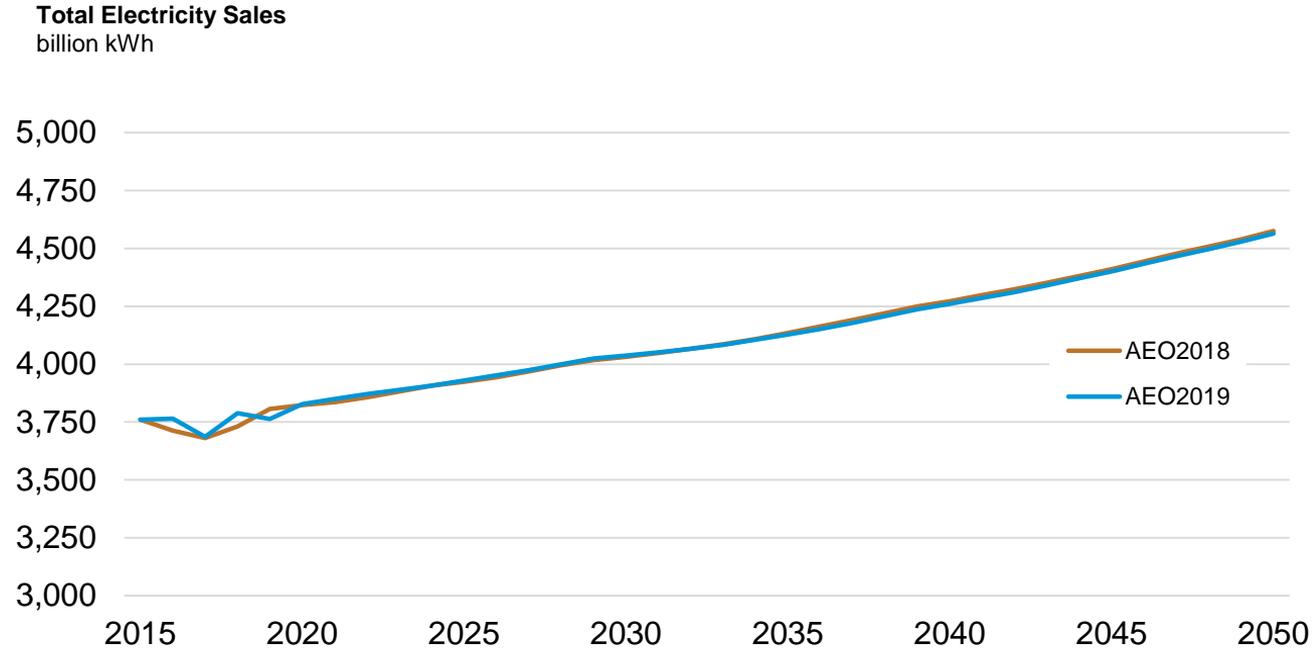
Lower short term natural gas price path in AEO2019, stabilizing at 7-8% lower than AEO2018

Natural Gas: Henry Hub Spot Price
2018\$ per MMBtu



Source: ref2018.1213a, ref2019.0914a

Electricity sales largely unchanged from AEO2018

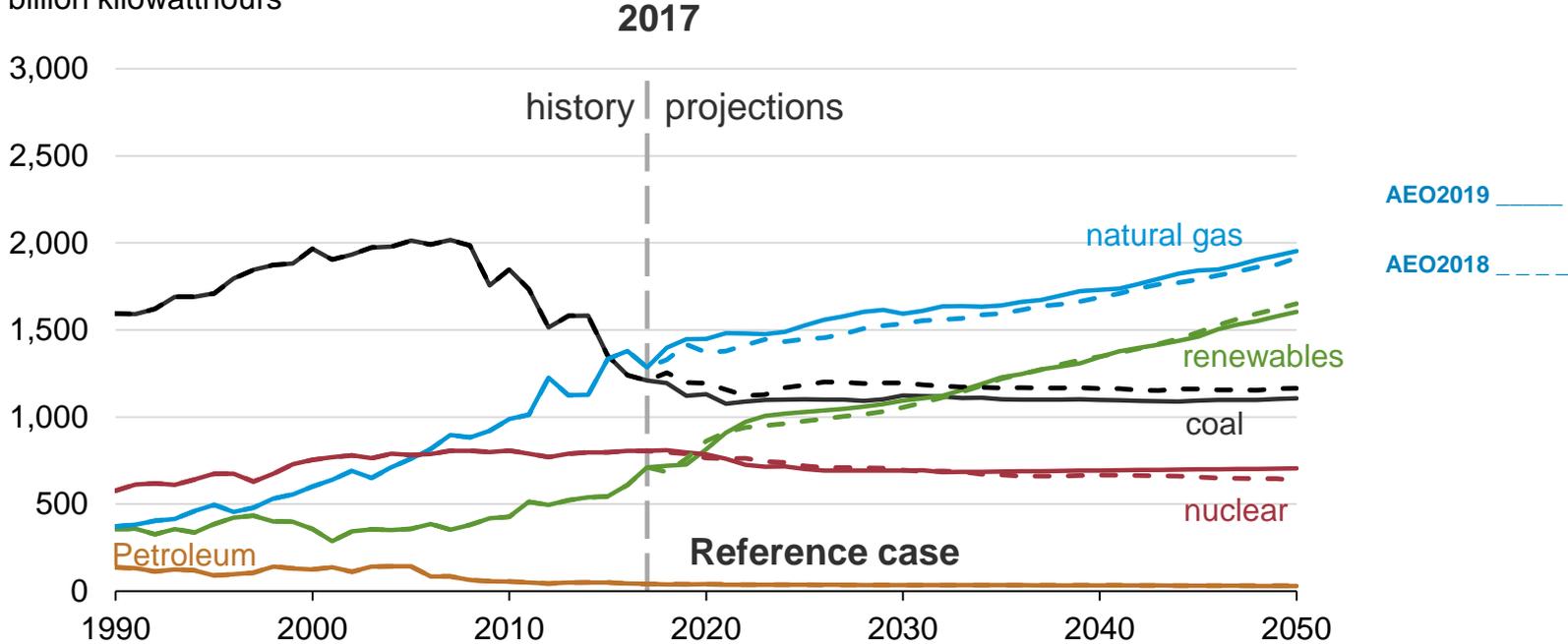


Source: ref2018.1213a, ref2019.0914a

Generation mix is similar to AEO2018, with slightly less coal and higher mid-term natural gas use due to lower projected natural gas prices

Electricity generation from selected fuels

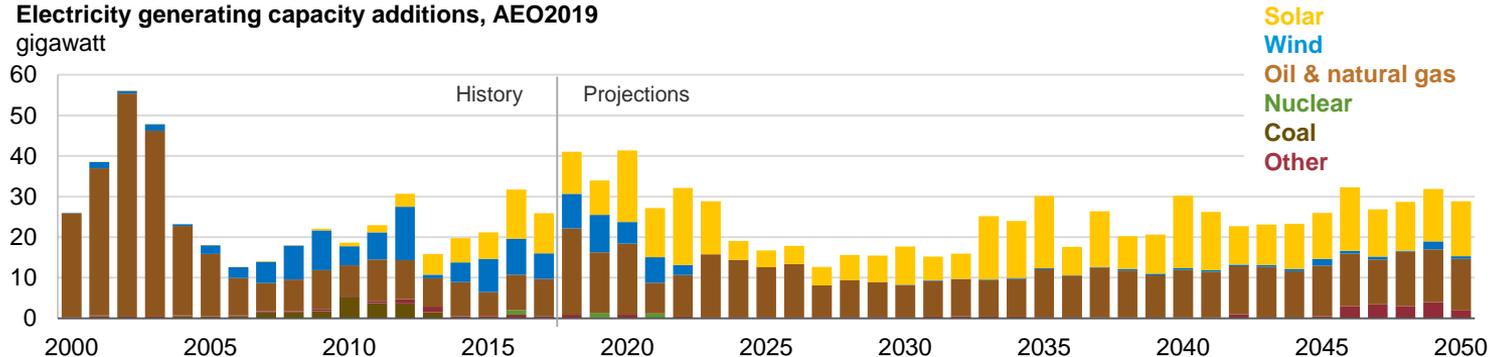
billion kilowatthours



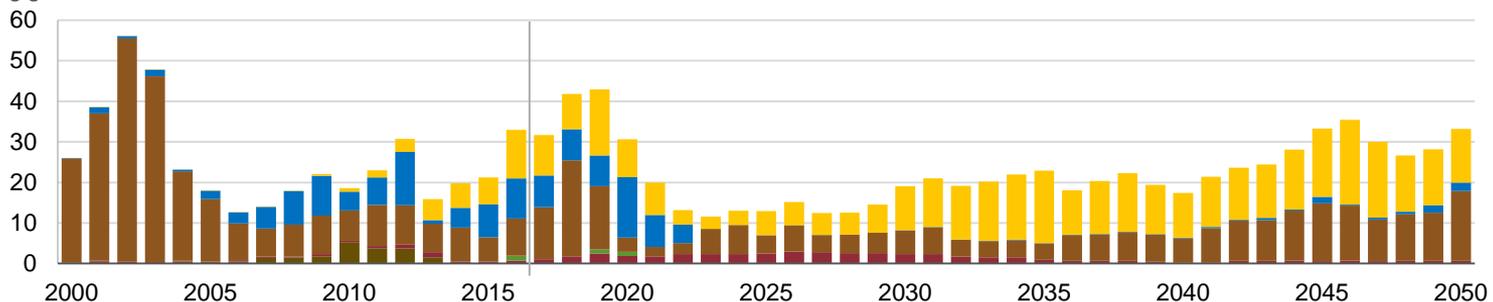
Source: ref2018.1213a, ref2019.0914a

Similar to AEO2018, primarily solar and natural gas-fired capacity is added after 2025

Electricity generating capacity additions, AEO2019
gigawatt



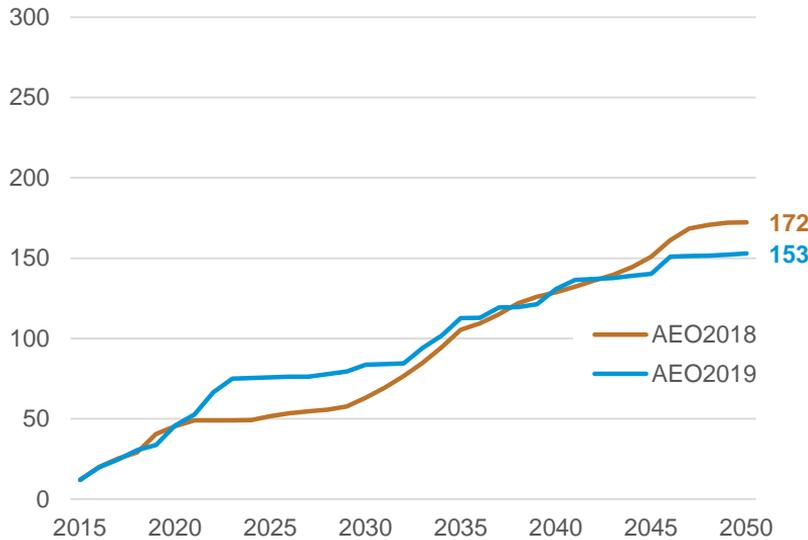
Electricity generating capacity additions, AEO2018
gigawatt



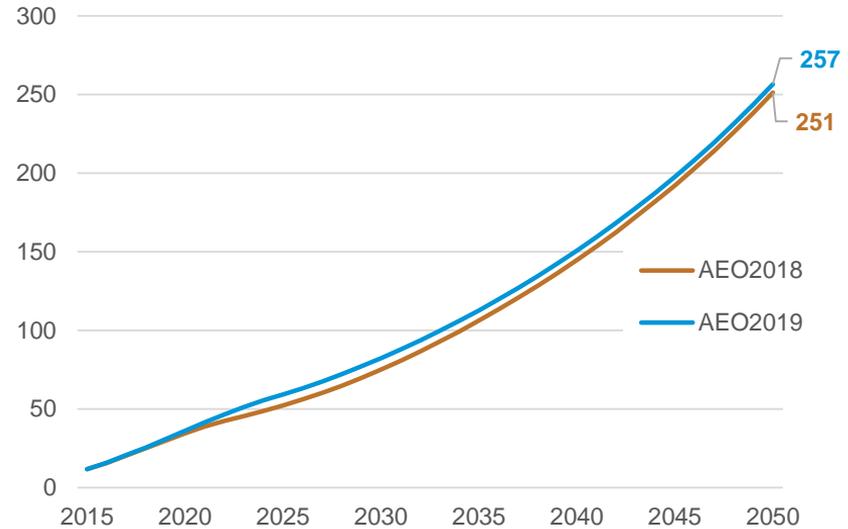
Source: ref2018.d091617a, ref2017.d120816a

Utility and end-use PV capacity is lower due to lower natural gas & electricity prices and a re-specification of the end-use PV model

Utility-scale solar PV generating capacity
gigawatts



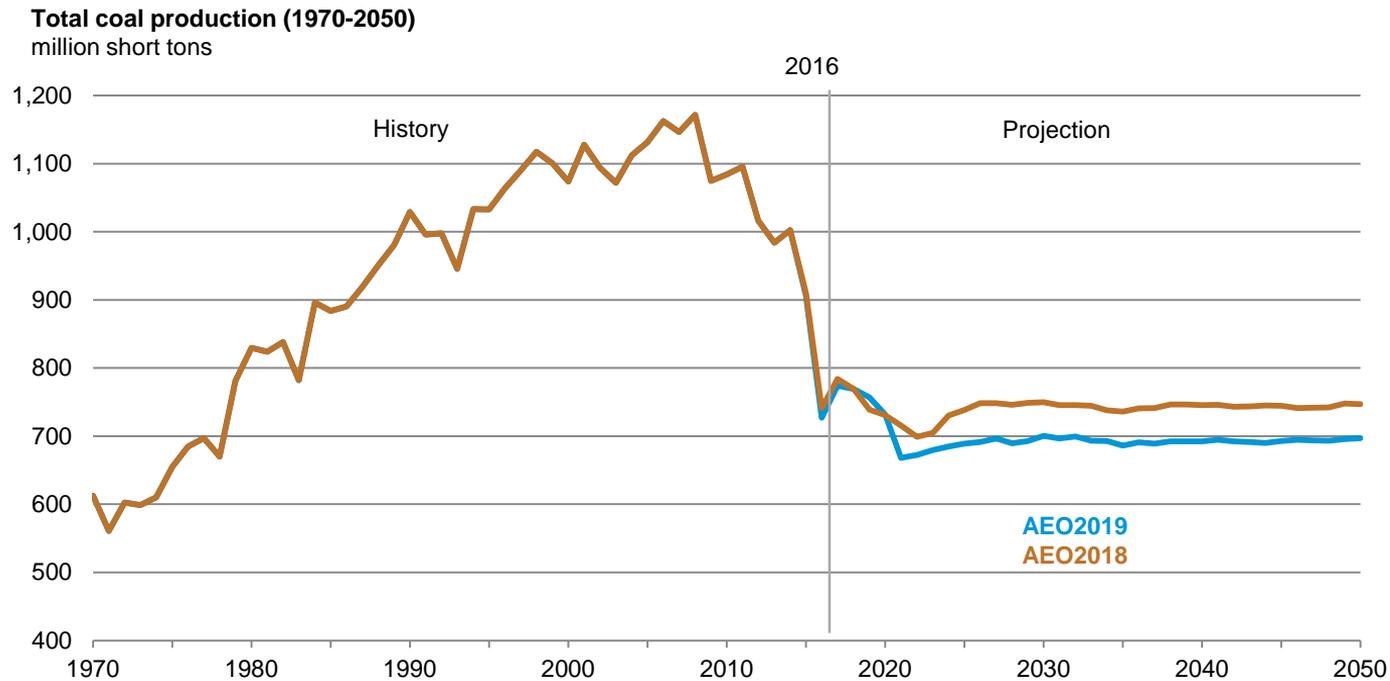
End-use solar PV generating capacity
gigawatts



Source: ref2018.1213a, ref2019.0914a

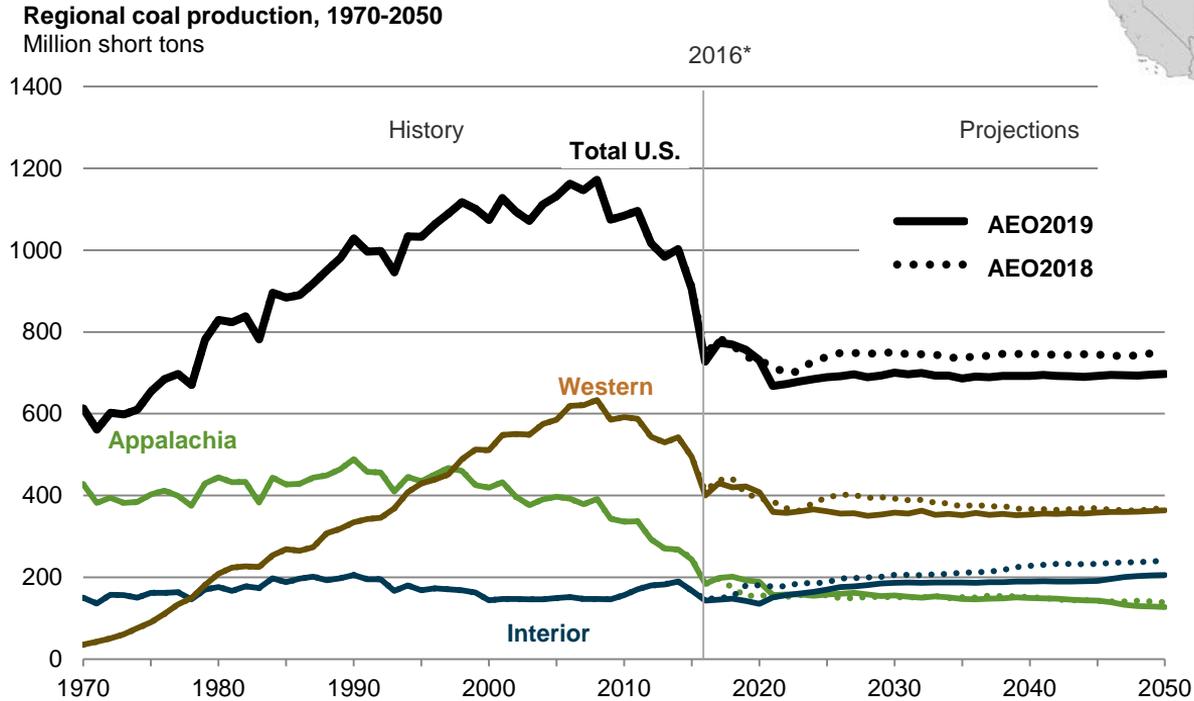
Coal Production and Exports

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



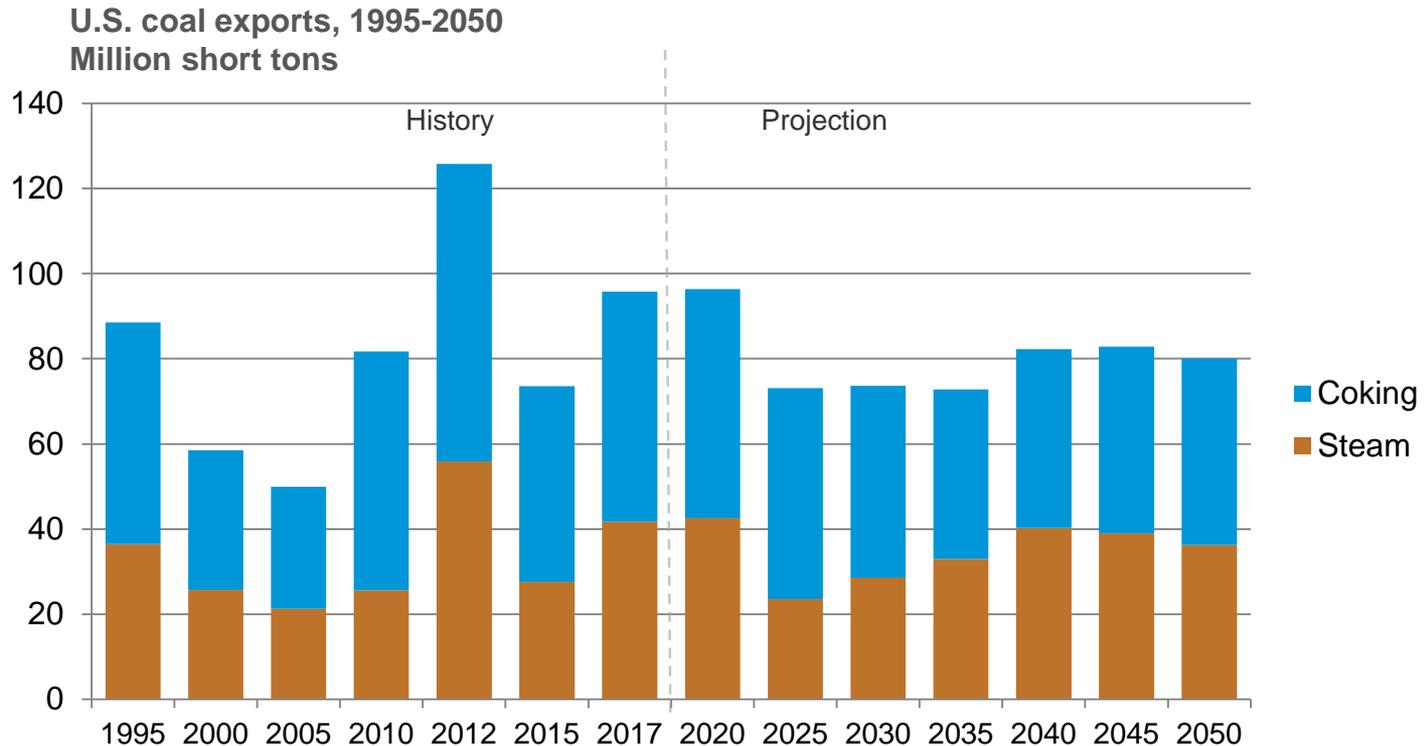
Source: ref2018.1213a, ref2019.0914a *2017 - 2019 data is estimated per the STEO projections

Coal production by region, 1970-2050



Source: ref2018.1213a, ref2019.0914a *2017 - 2019 data is estimated per the STEO projections

U.S. coal exports are expected to recover only gradually through 2050



Source History: U.S. Energy Information Administration, Quarterly Coal Report

Projections: AEO2019 Reference case (Preliminary Ref2019.d0914a)

For more information

U.S. Energy Information Administration home page | www.eia.gov

Short-Term Energy Outlook | www.eia.gov/steo

Annual Energy Outlook | www.eia.gov/aeo

International Energy Outlook | www.eia.gov/ieo

Monthly Energy Review | www.eia.gov/mer

Today in Energy | www.eia.gov/todayinenergy

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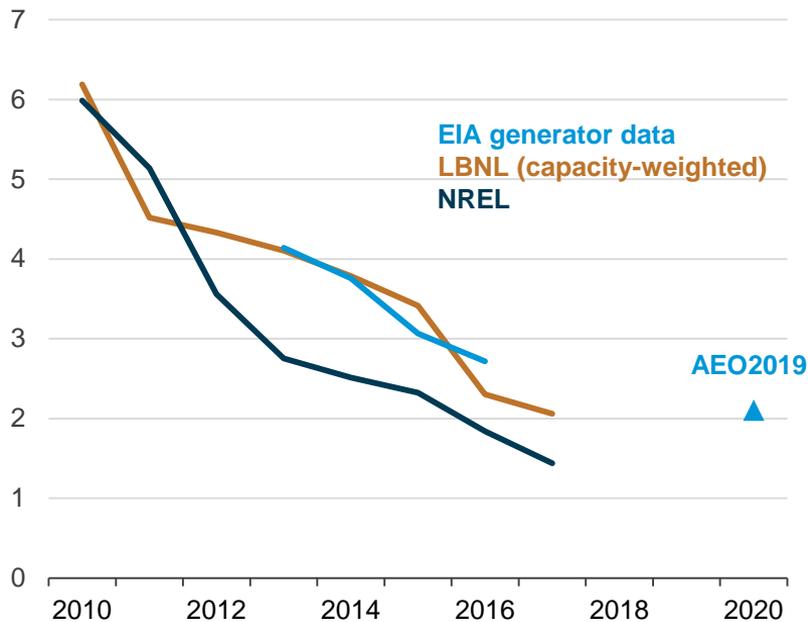
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Supplemental Slide

Solar PV cost assumption is reasonably in-line with cost trends across various sources

Solar photovoltaic with tracking installed costs comparison
2017 dollars per watt-ac



- The effect of the solar PV tariff is expected to be offset by excess solar panel supply resulting from reset of Chinese policy
- Recent IRS safe-harbor guidance is expected to have a significant effect on solar PV build decisions, as it effectively allows up to a 4-year construction period

Source: U.S. Energy Information Administration, [Form EIA-860 Annual Electric Generators Report](#), Lawrence Berkley National Laboratory, [Utility-Scale Solar 2018](#), and National Renewable Energy Laboratory, [U.S. Solar Photovoltaic System Cost Benchmark: Q1 2017](#)