



Key takeaways: AEO2017 Electricity Sector Outlook

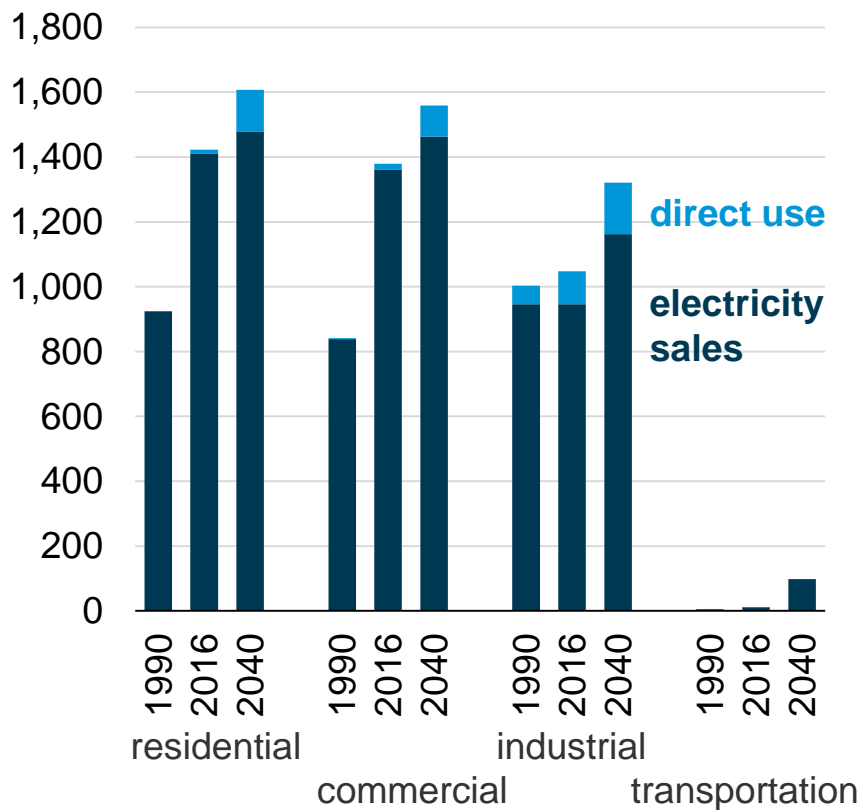
- As demand grows modestly, the primary drivers for new generation capacity in the Reference case are:
 - retirement of older, less efficient fossil fuel units—largely spurred by the Clean Power Plan (CPP)—and
 - the near-term availability of renewable tax credits. Federal tax credits drive near-term growth in renewables, displacing growth in natural gas.
- Even if the CPP is not implemented, low natural gas prices and the tax credits result in natural gas and renewables as the primary sources of new generation capacity.
- The future generation mix is sensitive to the price of natural gas and the growth in electricity demand.



Electricity use continues to increase—

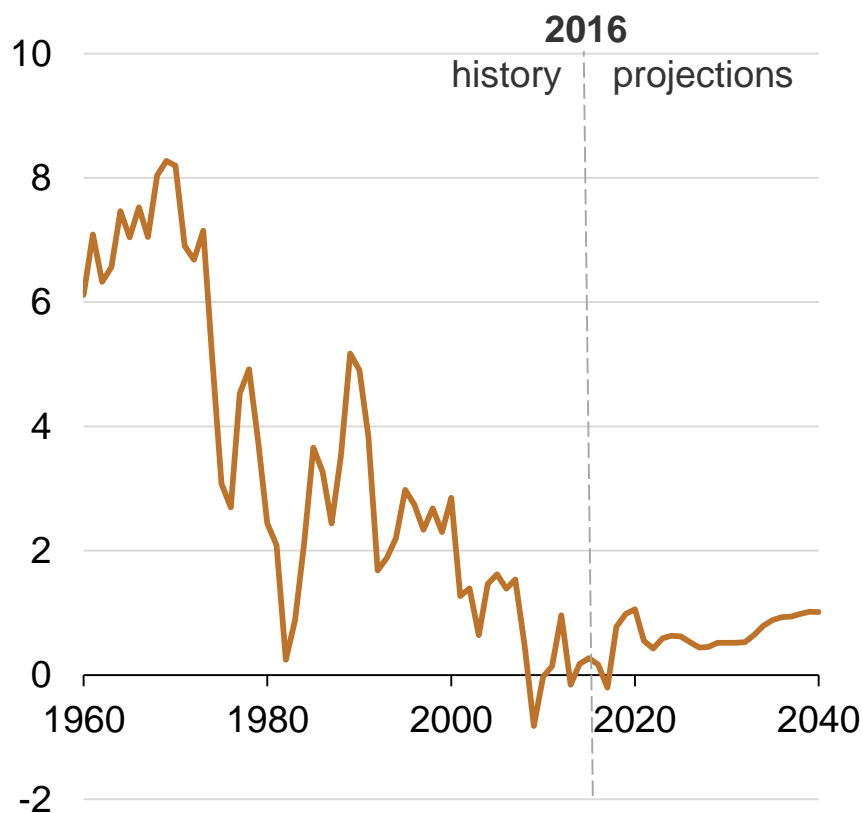
Electricity use by sector

billion kilowatthours



Electricity use growth rate (Reference case)

percent growth (three-year rolling average)





—but the rate of growth remains lower than historic averages in the Reference case

- In recent history, the growth in electricity demand has slowed as older equipment was replaced with newer, more efficient stock, as efficiency standards were implemented and technology change occurred, particularly in lighting and other appliances. The demographic and economic factors driving this trend included slowing population growth and a shifting economy toward less energy-intensive industries.
- While growth in the economy and electricity demand remain linked, historically the linkage has continued to shift toward much slower electricity demand growth relative to economic growth.
- Growth in electricity demand, while relatively low historically, begins to rise slowly across the projection period as demand for electric services is only partially offset by regulatory compliance and efficiency gains in electricity-using equipment.



Changing market conditions

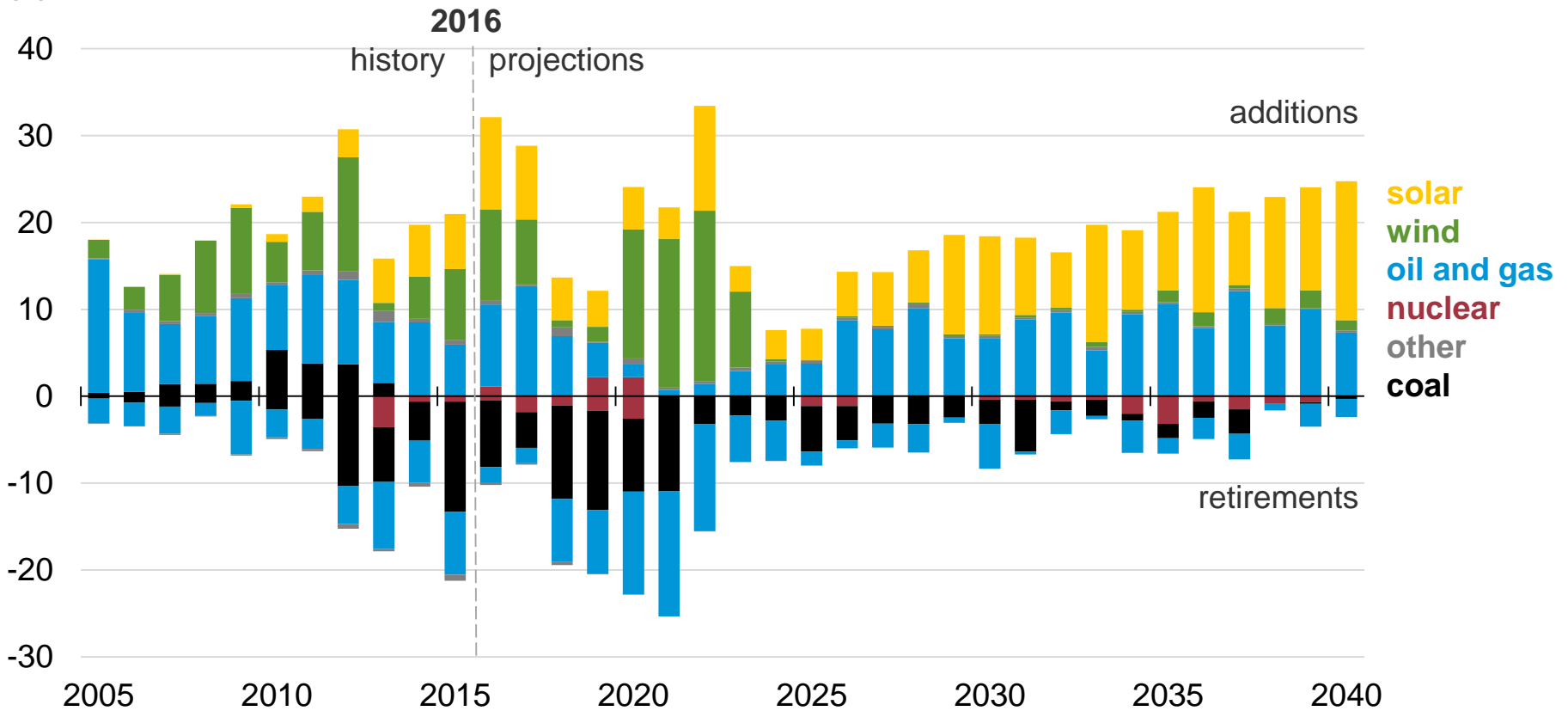
- Policy-driven economic incentives accelerate renewable generation. With a continued (but reduced) tax credit, solar capacity growth continues throughout the projection period, while tax credits provided for plants entering service until, but no later than 2024, provide incentives for new wind capacity in the near term.
- With solar energy's declining capital costs and solar electricity output that is highest during times of high (on-peak) demand, solar capacity is anticipated to grow throughout the projection period.



Lower capital costs and the availability of tax credits boost near-term wind additions and sustain solar additions—

Annual electricity generating capacity additions and retirements (Reference case)

gigawatts





Coal-fired plant retirements in the Reference case are driven by low load growth and the Clean Power Plan

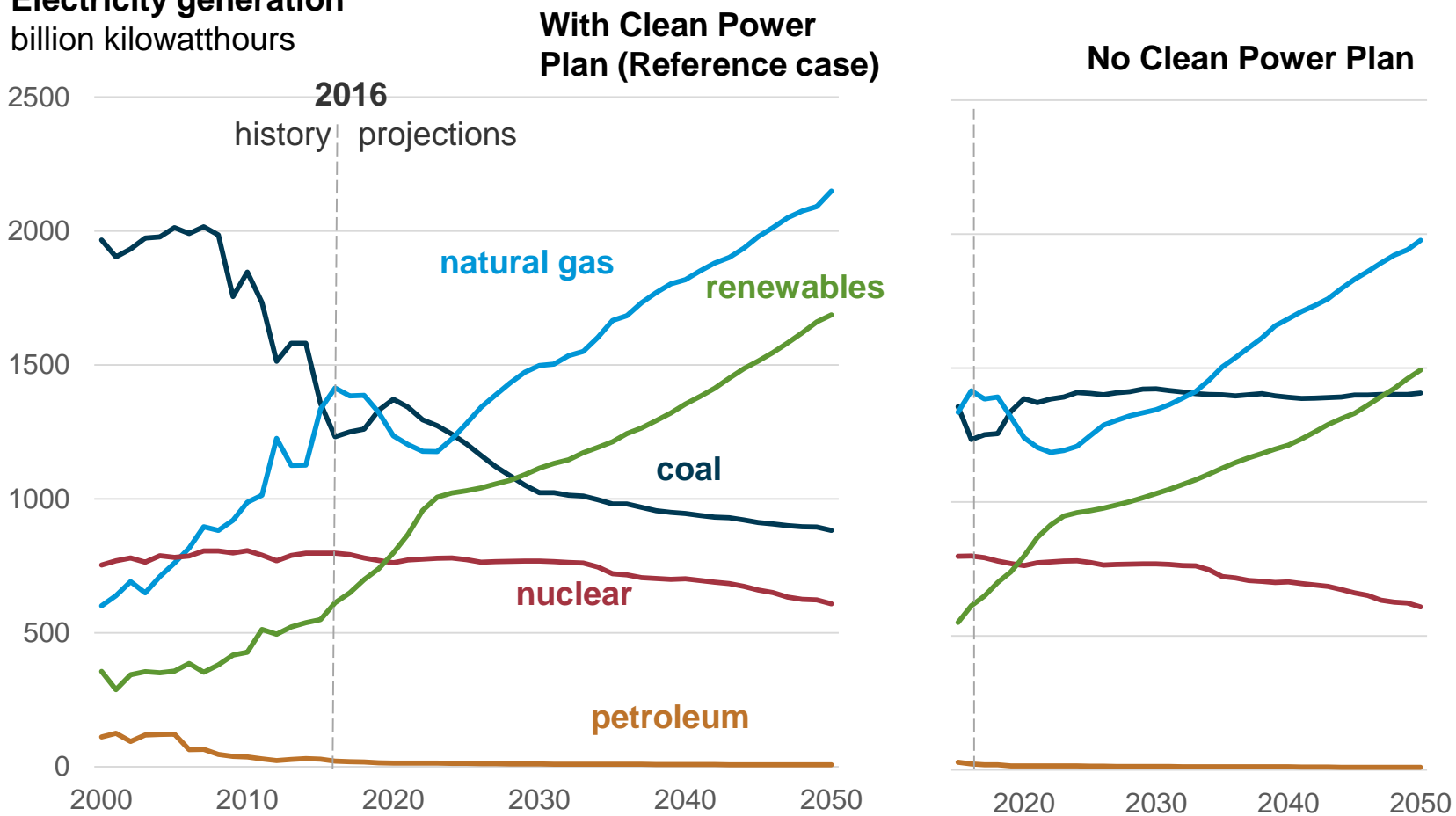
- In the Reference case, nearly 70 gigawatts (GW) of new wind and solar photovoltaic (PV) capacity is added over 2017–21, encouraged by declining capital costs and the availability of tax credits.
- Most of the wind capacity used to comply with the Clean Power Plan (CPP) is built prior to the scheduled expiration of the production tax credit for wind in 2025, although wind is still likely to be competitive without the tax credits.
- Continued coal retirements under the CPP support a consistent market for new generating capacity throughout the projection period.
- After 2030, new generation capacity additions are split primarily between solar and natural gas, with solar capacity representing more than 50% of new capacity additions in the Reference case.



Fuel prices and regulations drive growing shares of renewables and natural gas as coal's share declines in the Reference case

Electricity generation

billion kilowatthours

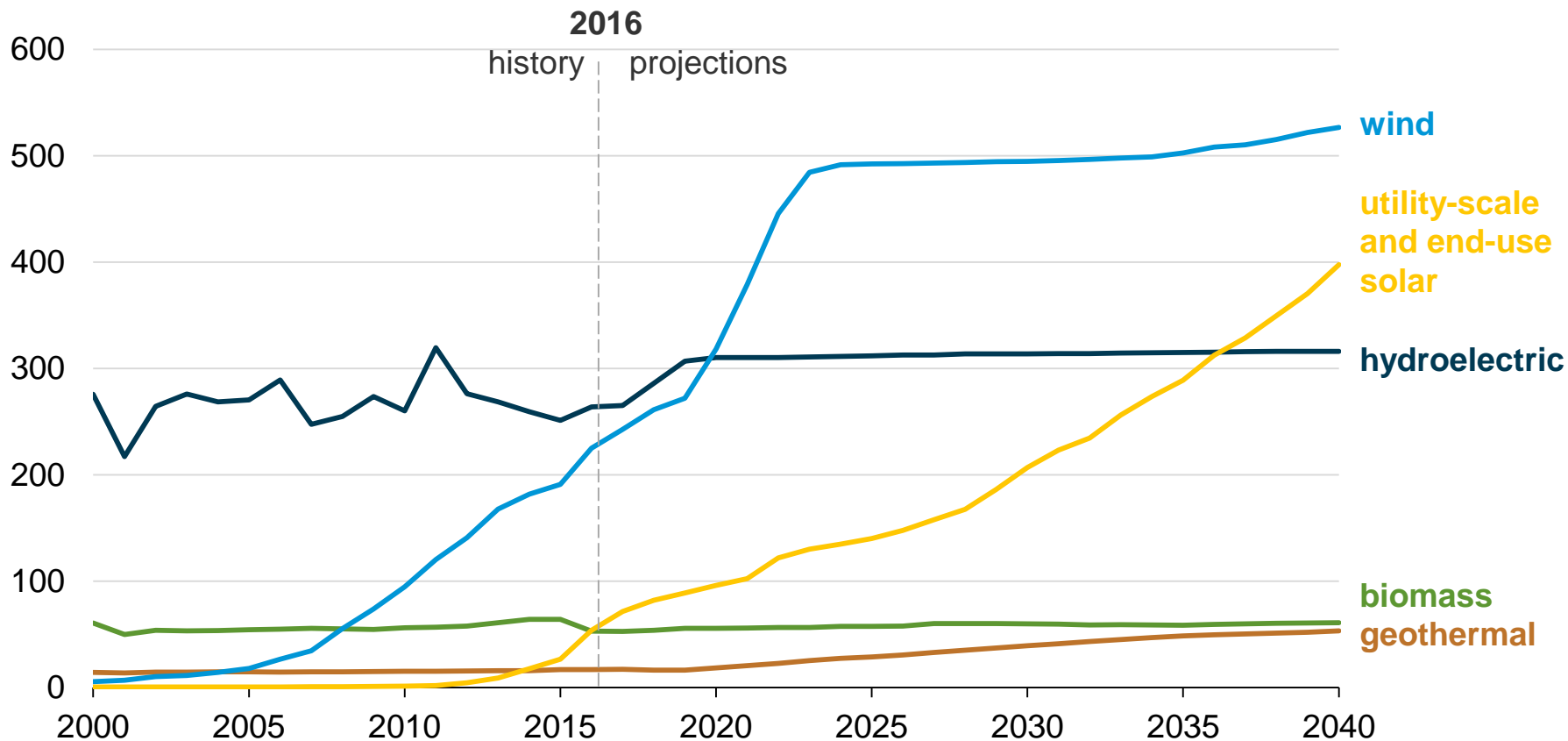




Wind and solar generation become the predominant sources of renewable generation in the Reference case—

Renewable electricity generation (Reference case)

billion kilowatthours





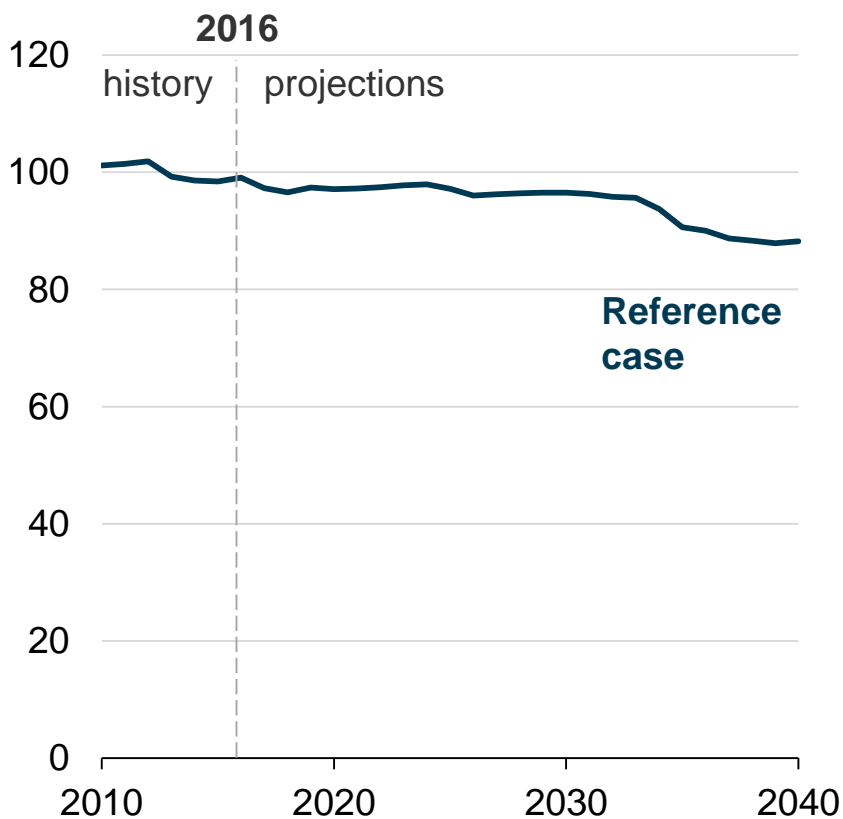
—each surpassing hydroelectric generation

- The Clean Power Plan (CPP) and state-defined Renewable Portfolio Standards (RPS) increase demand for wind and solar electricity generation throughout the projection period.
- The scheduled expiration of production tax credits encourage an increase in wind capacity additions ahead of CPP implementation. While many wind projects would be economic without the tax credits, most of the profitable wind capacity will be added to take advantage of the tax credits prior to their expiration.
- Substantial cost reductions, performance improvements, and a permanent 10% investment tax credit support solar generation growth throughout the projection period.
- Some geothermal resources are also competitive sources of new generation, but these lowest-cost resources are geographically limited and are only expected to be exploited slowly.

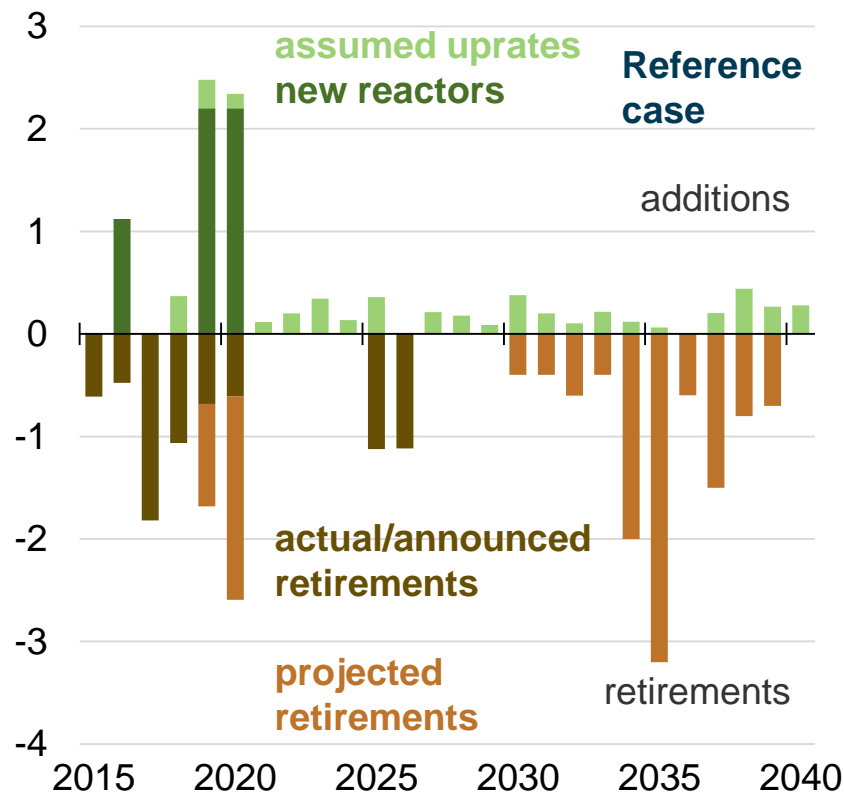


Assumptions about license renewals in AEO2017 increase nuclear retirements—

Nuclear electricity generating capacity gigawatts



Year-over-year nuclear capacity changes gigawatts





—leading to net nuclear capacity decreases

- No new, unannounced nuclear capacity is added in the Reference case over the projection period because of the combination of low natural gas prices, higher renewables penetration, low electricity load growth, and relatively high capital costs.
- New capacity additions are limited to reactors under construction from 2017 onward and to projected uprates at existing reactors. From 2018 through 2040, 4.7 gigawatts (GW) of capacity is projected to come online, based on an assessment of the remaining uprate potential at existing reactors.



—leading to net nuclear capacity decreases (*cont.*)

- A significant reduction in nuclear capacity occurs because of 6.4 GW of total announced retirements; 3.0 GW of projected retirements in 2019–20 to address near-term, market uncertainty; and approximately 10.6 GW of long-term retirements through 2040 to address the uncertainty of reactors achieving a subsequent license renewal. As many nuclear plants reach the 60-year subsequent license renewal decision after 2040, retirements continue, with another 11.7 GW of nuclear capacity projected to retire by 2050.
- All nuclear plant retirements other than those already announced were modeled as capacity reductions for the regional nuclear fleets (i.e., as generic derates), rather than as retirements of specific plants.



Coal's generation mix share declines over time

- Fuel prices drive near-term natural gas and coal shares. As natural gas prices rebound from their 20-year lows which occurred in 2016, coal regains a larger generation share over natural gas through 2020.
- Federal tax credits drive near-term growth in renewables, displacing growth in natural gas.
- In the longer term, policy (Clean Power Plan, renewables tax credits, and California's SB32) and unfavorable economic conditions compared with natural gas and renewables result in declining coal generation and growing natural gas and renewables generation in the Reference case.



EIA will continue to update and refine the market dynamics and technologies in future AEOs, especially with the projection extended to 2050. Ongoing work aims to:

- Energy storage: Improve the representation of energy storage to accommodate multiple grid services including spinning reserve and renewables integration.
- Renewable generation: Include improved representation of intermittent generation resources such as wind and solar. Examine the potential for transmission enhancements to mitigate regional effects of high levels of wind and solar generation. Develop higher resolution time-of-day and seasonal value and operational impact of wind.



Ongoing work aims to: (*cont'*.)

- Utility rate structure: Estimate the impact of high levels of distributed photovoltaic generation on utility rate structure.
- Generator retirement: Assess the vintage of the electric generation fleet and potential for future retirements and life extension for all technologies, including existing nuclear, coal, natural gas, and renewable fleets.