

**WORKING GROUP PRESENTATION FOR DISCUSSION PURPOSES
DO NOT QUOTE OR CITE AS RESULTS ARE SUBJECT TO CHANGE**

Annual Energy Outlook 2016: Electricity Sector Preliminary Results



For

*Electricity AEO2016 Working Group
February 10, 2016/ Washington, DC*

By

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



U.S. Energy Information Administration

Independent Statistics & Analysis | www.eia.gov

Summary

- Address issues raised by stakeholders
- Discuss recent developments- updates to generator status and capital costs
- Present preliminary AEO2016 forecast results

Issues raised by stakeholders

(EWG Meeting #1)

1. How will EIA model trading under the Clean Power Plan: a) level of cooperation, b) rate v. mass, c) allocation type?
2. What technology options will be available for new sources coal-fired generation under CPP?
3. What level of retirements result from MATS compliance?
4. How will EIA implement reinstatement of CSAPR?
5. What side cases will be included in AEO2016?

At what level will trading be modeled under the Clean Power Plan?

- Will trading markets clear at state, regional, ISO/RTO, interconnect, or national level?
- Based on review of public commentary/analysis, EIA decided to model trading at the regional (EMM) level:
 - balances policy objectives of states to maintain reliability/support wholesale market activity vs.
 - increasing complexity of arranging interregional cooperation
 - EMM regions designed to replicate current power market trading patterns.

What form of trading program will states choose: rate- or mass-based?

- Majority of state comments suggest preference for mass-based trading program,
 - based on familiarity with mass-based (cap & trade) programs
- Apparent advantage: states can use mass-based allowance allocation to compensate affected parties
- Potential disadvantage of rate-based program: experience suggests less-actively traded markets (e.g., Ca. LCFS)

How will CPP allowances be allocated?

- Evolution of allowance allocation approaches tends to favor methods used to offset potential rate increases
 - (e.g., Ca. AB 32 electric utility allocations)
- If so, allocation to load-serving entities preferred based on potential to “zero-out” price impact for consumers
- Contrast to allowance auction programs, which can result in higher price impacts for electricity customers

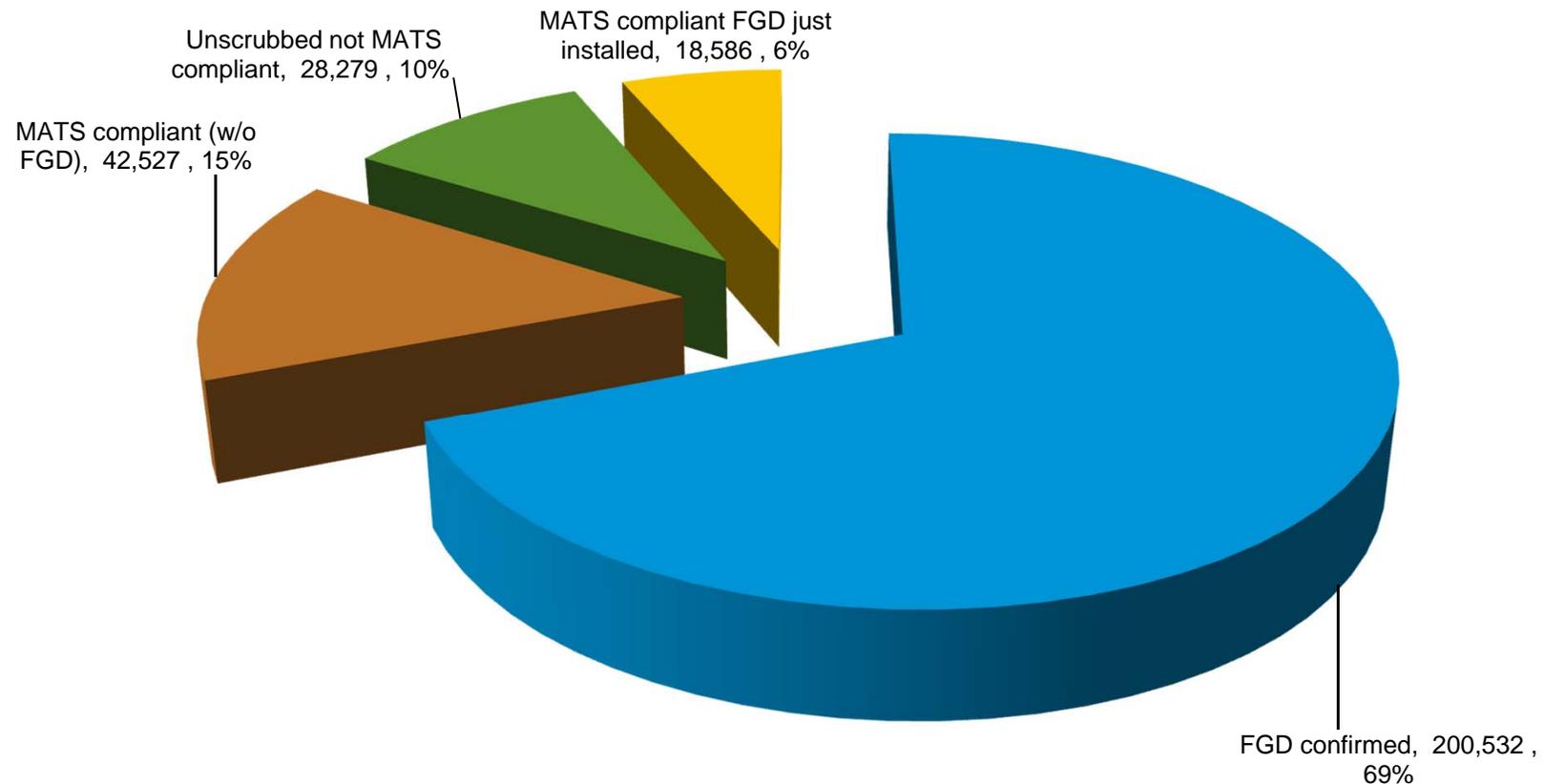
For Sec. 111(b), will NEMS be revised to include coal with partial carbon capture?

- BSER is set at ultra-supercritical pulverized coal with partial CCS (to meet 1,400 lbs CO₂/mWh)
- Based on recent studies, our provisional compliance definition is ultra-supercritical PC at 30% removal

What level of retirements result from compliance with EPA MATS regulation?

- We completed a comprehensive update of retirement announcements from a variety of sources
- We updated generating plant file compliance data to reflect complete EIA-860 mercury compliance strategy
- By combining proposed mercury & SO₂ technology with compliance date created a “MATS-compliant” definition
- Permit fate of remaining unscrubbed generation to be determined by NEMS cost recovery algorithm

Preliminary update indicates ~30gW of coal still “undetermined” for MATS compliance

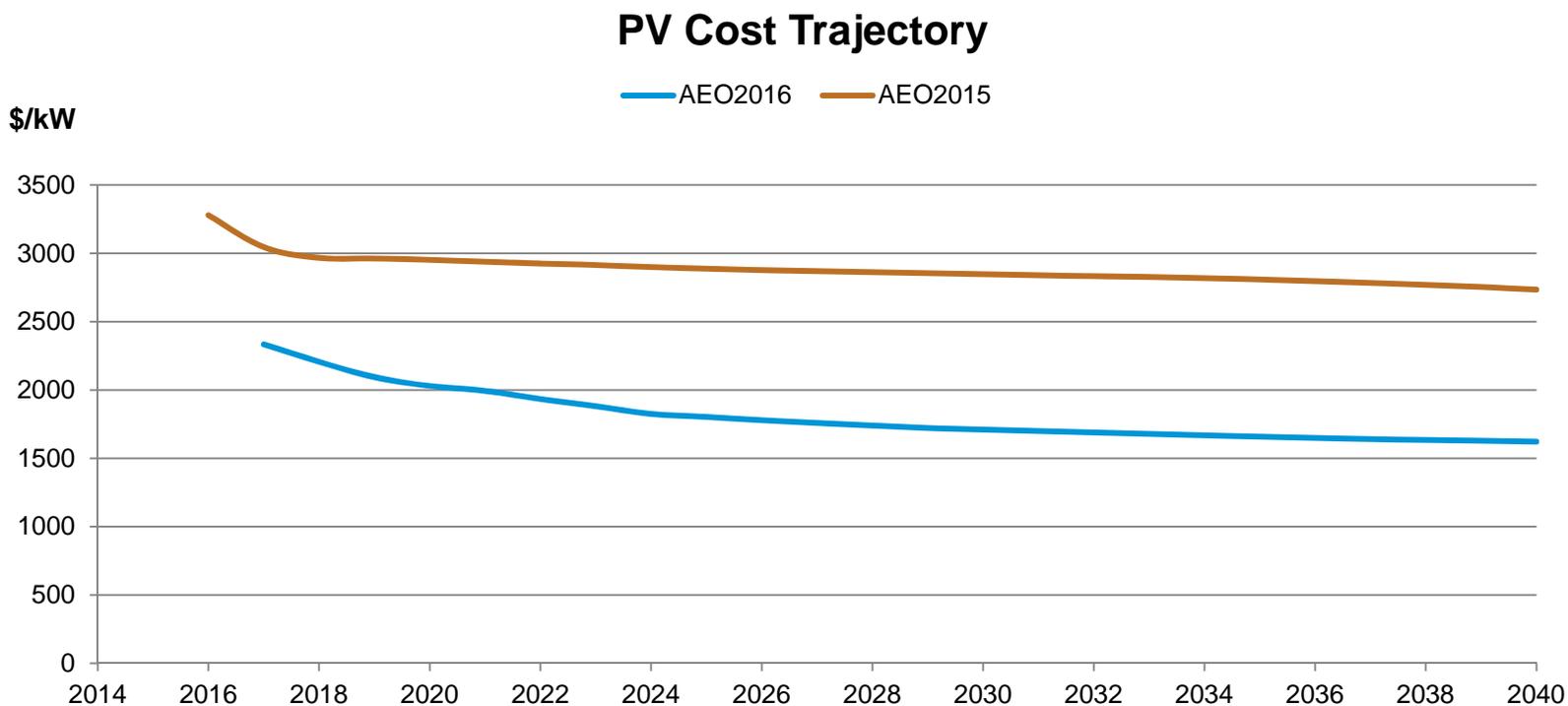


Source: EIA Form 860 (2014)

How will EIA implement reinstatement of CSAPR?

- Since some state budgets were remanded (not vacated) EIA will model the original CSAPR budgets
- EPA released new seasonal NOx budgets in its CSAPR Update proposal (Nov. 2015)
 - based on the tighter 2008 Ozone NAAQs standard, rather than the current 1997 Ozone NAAQs standards (basis for current NOx budgets)
 - however, since CSAPR Update budgets are still in the proposal stages they will not be modeled

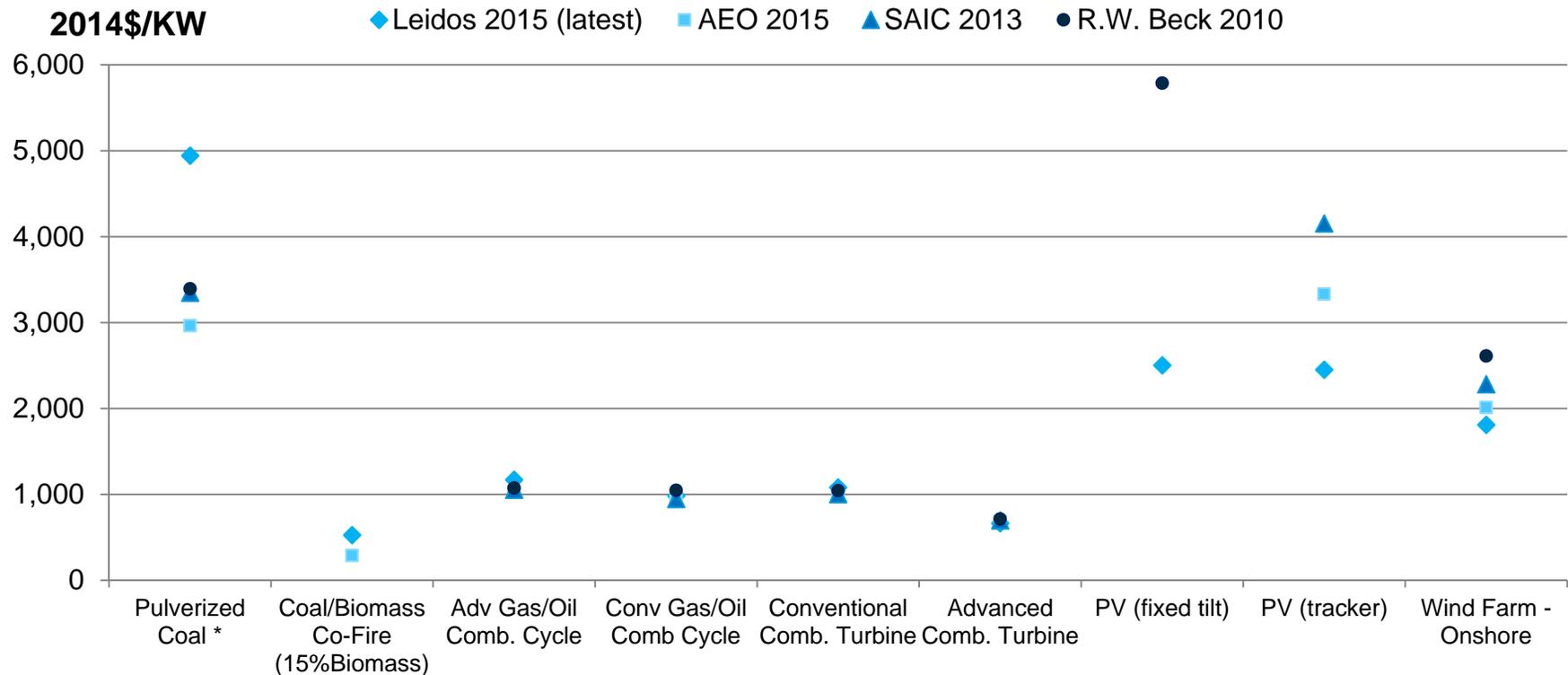
Solar PV costs decline sharply in the short-term, and continue to decrease slowly in the long-term



- Initial PV costs are ~20% lower; increased PV uptake results in faster, deeper cost reductions over time
- For 2014, LBNL reports \$3,800/kW cap-wt average (all tech), with \$2,800/kW median for fixed-tilt c-Si

Costs have seen the most change for coal, solar, and wind

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.

What side cases will be included in AEO2016?

- Side cases will explore alternative approaches to Clean Power Plan
 - rate-based trading program
 - credit trading at the interconnect level
 - allocation of allowances to generators
 - No CPP case
- Traditional side cases
 - high/low economic growth
 - high/low oil and gas resource
 - allocation of allowances to generators

Results



Summary preliminary results AEO2016 electric generation sector

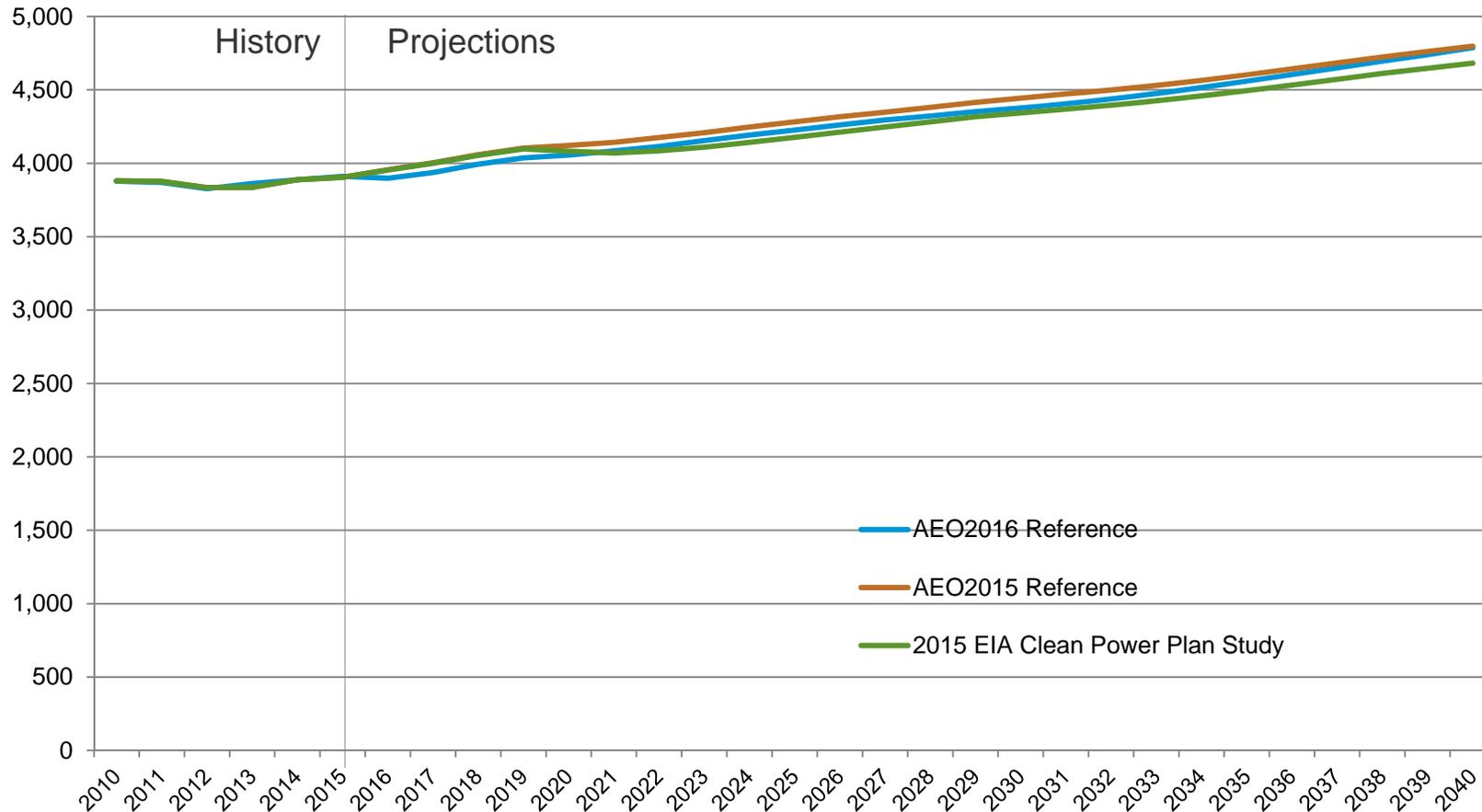
- Significant shift from coal to renewables and gas generation in preliminary AEO2016 results (compared to AEO2015)
 - renewable generation is 43% higher by 2040, (primarily solar PV and wind)
 - coal generation is down 44% by 2030, culminating in 48% drop by 2040;
 - gas generation is up 34% by 2030, and 40% higher by 2040.
- The four most significant changes in electric sector outlook for AEO2016 are:
 - inclusion of EPA's final Clean Power Plan Rule in the Reference case
 - continued decline in projected natural gas prices
 - extension of the production tax credit and investment tax credit
 - significant reduction in the cost of solar PV and wind

Summary preliminary results AEO2016 electric generation sector (*cont.*)

- Preliminary assessment of the Clean Power Plan
 - increases projected coal retirements by 25 gW (from 87 to 112 gW by 2030) vs. AEO2015 Clean Power Plan analysis
 - while contributes to higher costs of generation, CPP costs are offset by lower gas prices, as AEO2016 electricity prices are projected to be 7% below AEO2015 by 2030
 - combined with lower costs of solar PV, CPP results in significant additions of renewables and gas capacity by 2030 relative to AEO2015 projections, yet lower renewables additions relative to the AEO2015 Clean Power Plan analysis

Electricity sales are slightly down from AEO2015

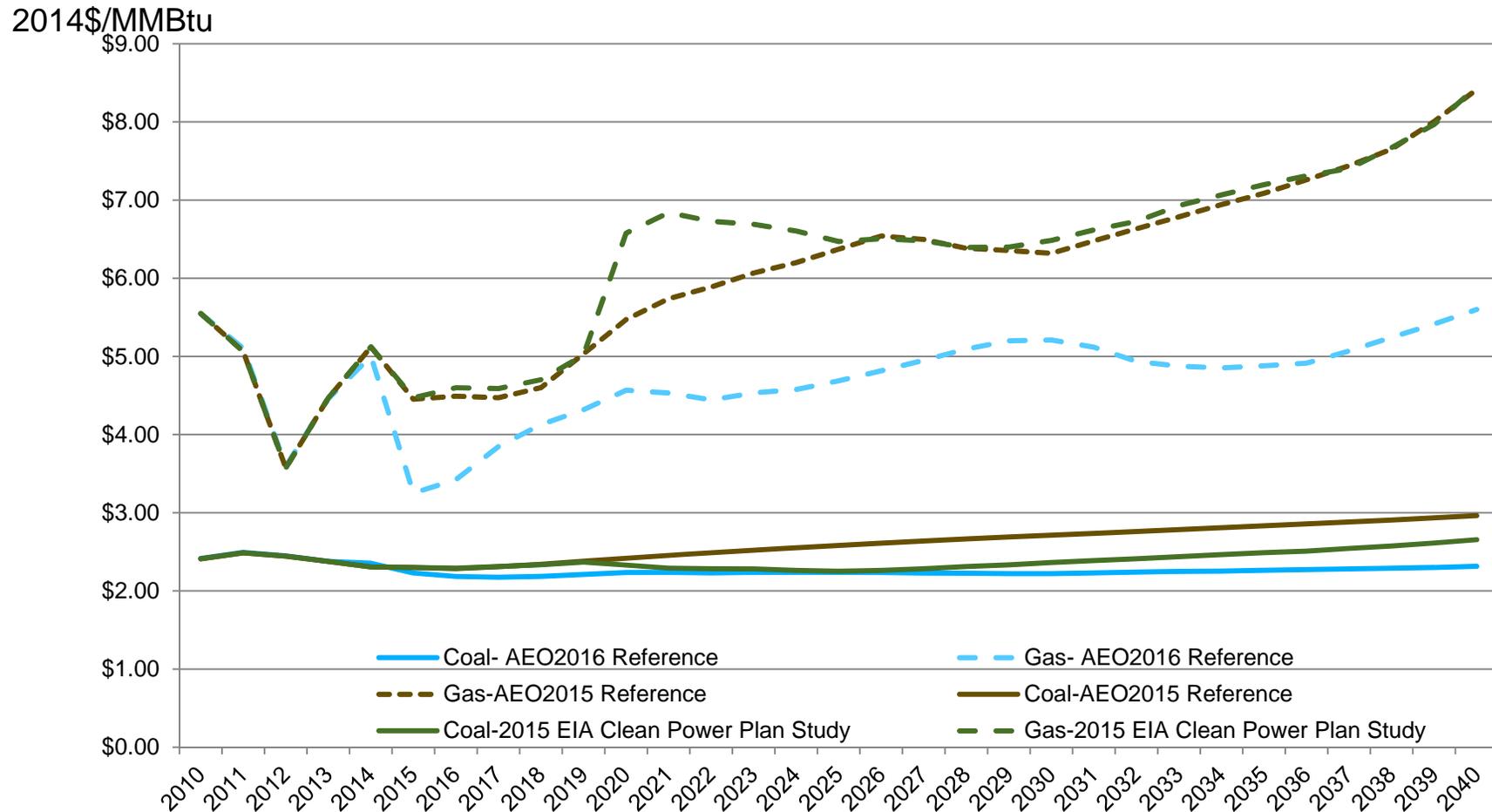
billion kilowatthours



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



Natural gas prices are significantly lower than AEO 2015

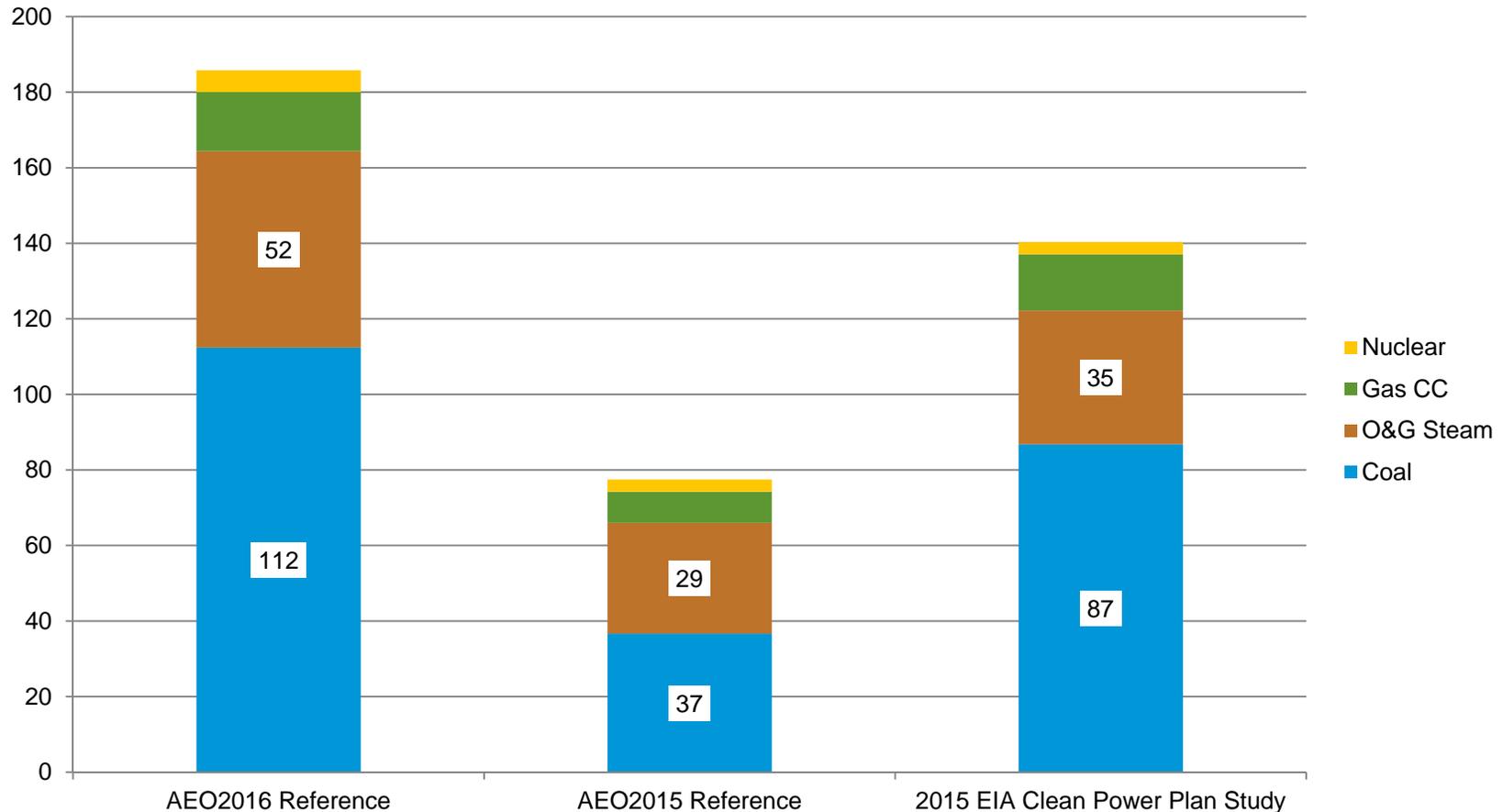


Source: AEO2016 NEMS run ref2016.0206a.RAN, AEO2015 Ref2015, rf15_111_all.0306a.RAN



Coal retirements are up relative to previous CPP study

gigawatts

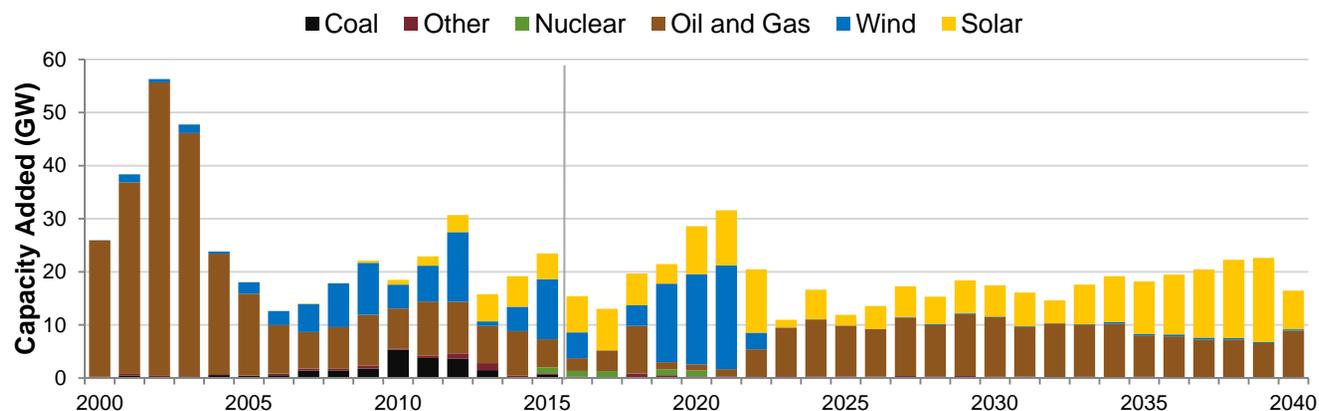


Source: AEO2016 NEMS run ref2016.1.0203a.RAN, AEO2015 Ref2015, rf15_111_all.0306a.RAN

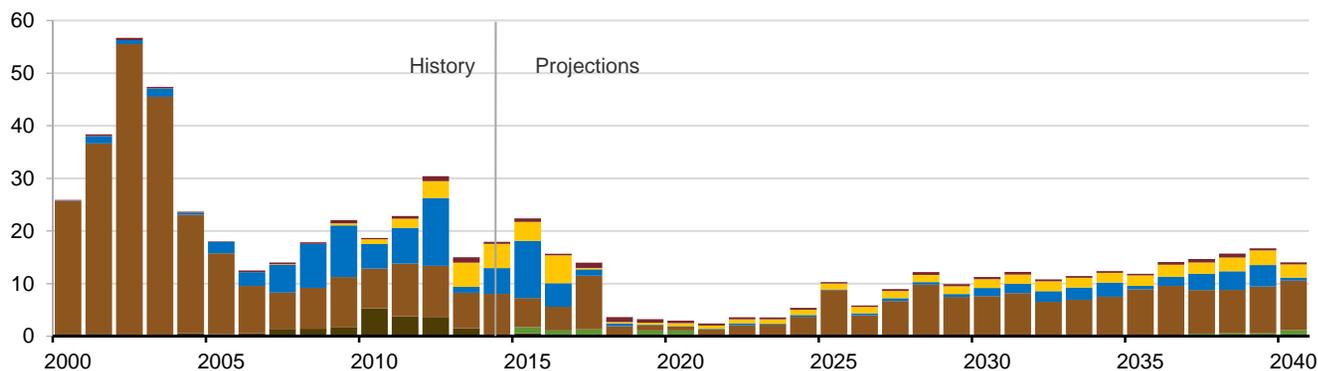


Near-term coal retirements create substantial additional opportunity for new capacity additions of gas, wind, & solar

AEO2016 Reference



AEO2015 Reference

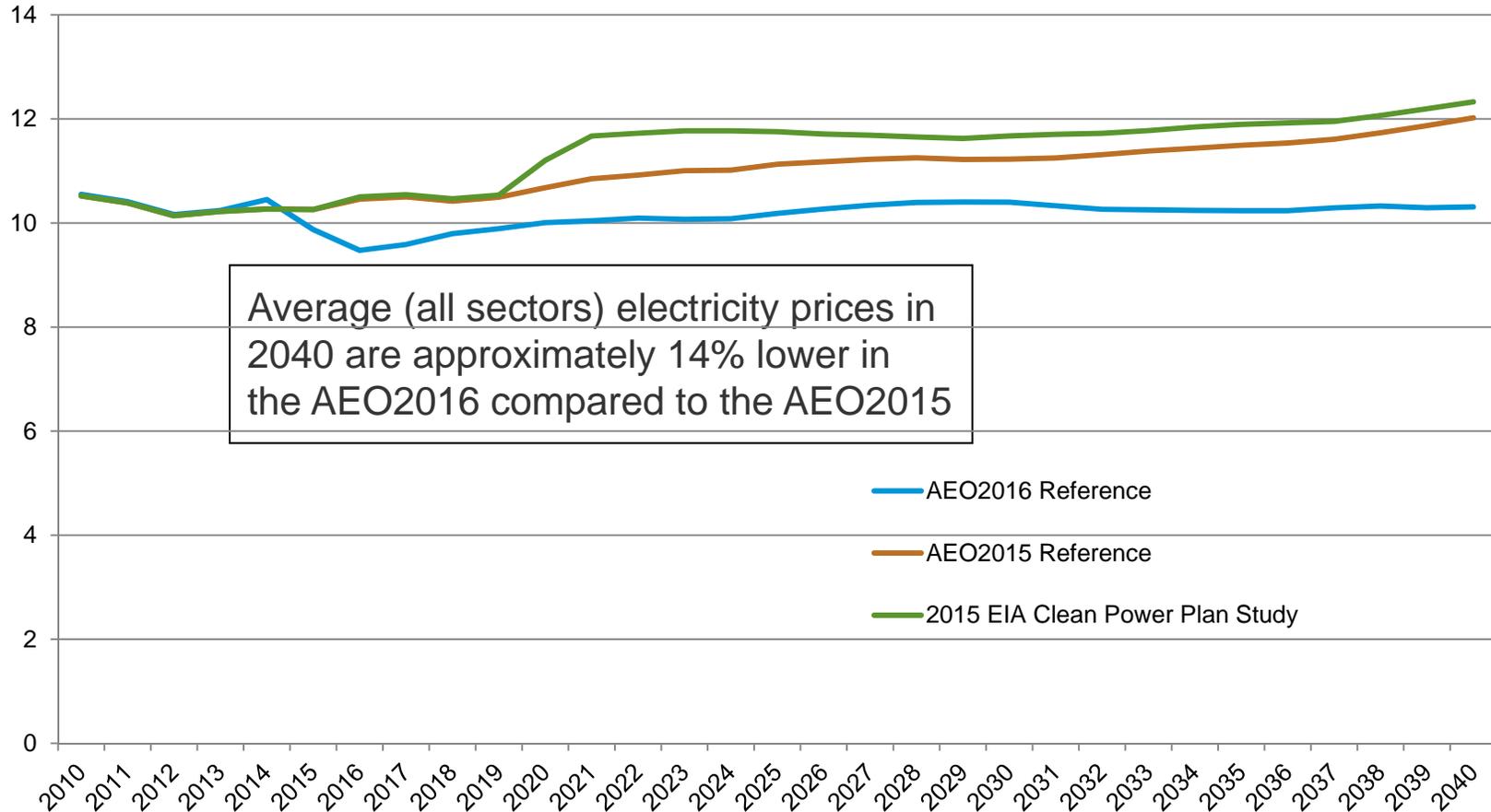


Nuclear retirement and uprate assumptions in the AEO2016 Reference case

- We have identified 2,139 MW of announced or planned retirements (in addition to plants recently retired)
 - 2016 FitzPatrick (New York), 852 MW
 - 2019 Pilgrim (Massachusetts); 678 MW
 - 2019 Oyster Creek (New Jersey); 610 MW
- We assumed 3 GW of generic retirements to address financial uncertainty based on a review of investment reports to determine the distribution and timing
 - 2018: 2 GW in RFC West (Region 11)
 - 2019: 1 GW in RFC East (Region 9)
- No potential uprates were included

Lower fuel prices result in lower electricity prices than AEO 2015, despite CPP

cents /kWh (2014\$)

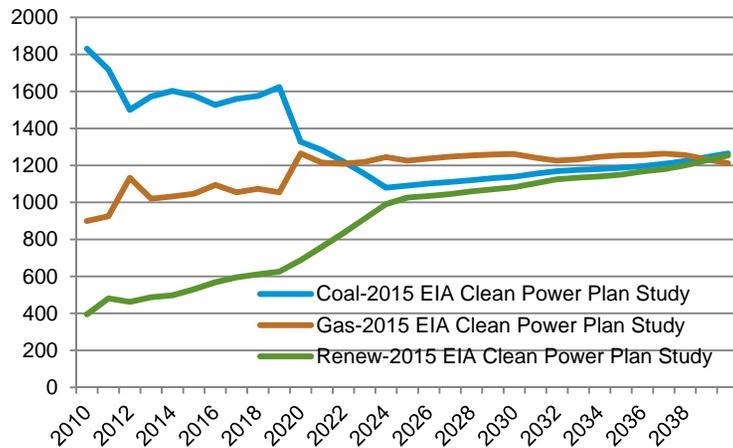
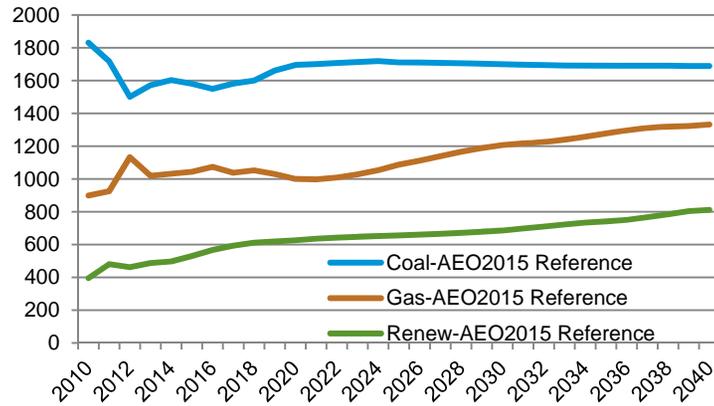


Source: AEO2016 NEMS run ref2016.1.0203a.RAN, AEO2015 Ref2015, rf15_111_all.0306a.RAN

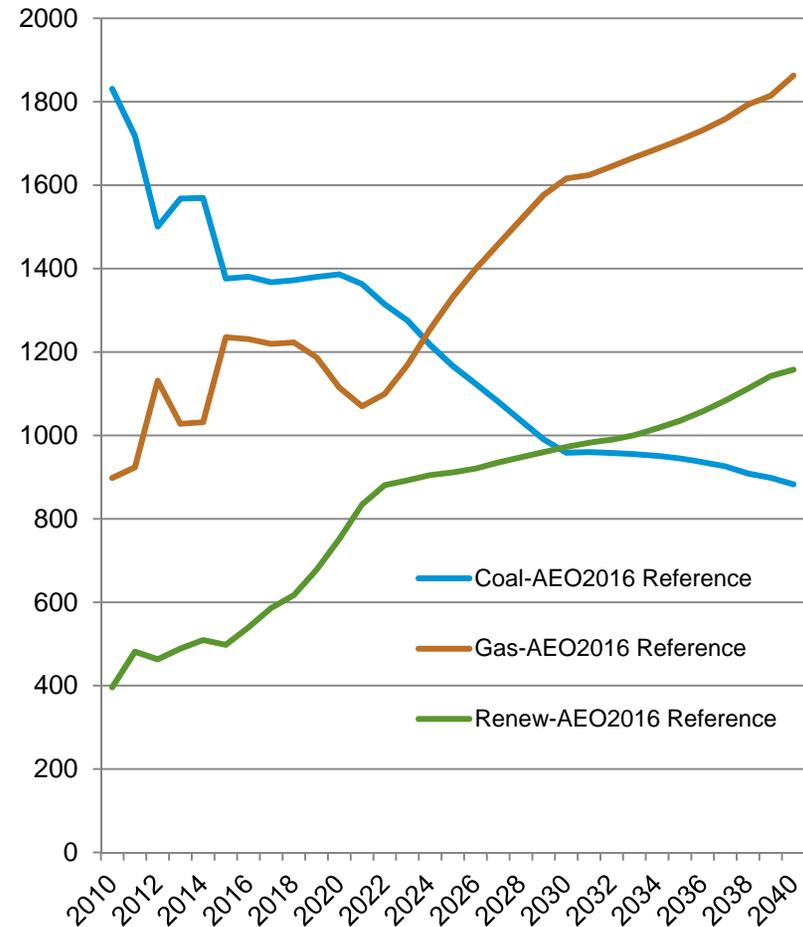


Gas, renewables, & coal generation, AEO2015 Reference, EIA CPP 2015 vs. preliminary AEO2016

Billion kilowatthours



Billion kilowatthours



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

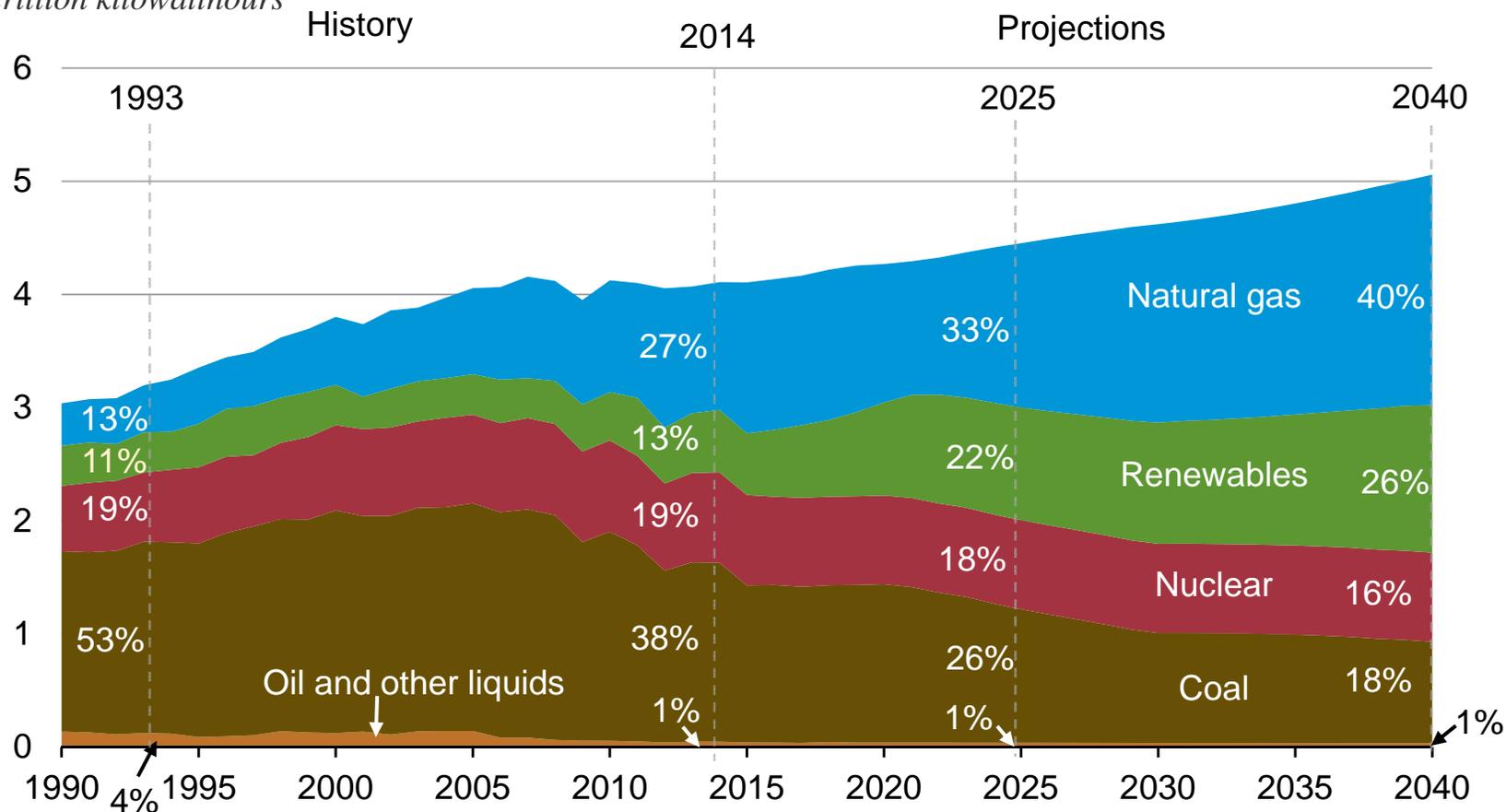


Electricity Analysis Team
February 10, 2016

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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)

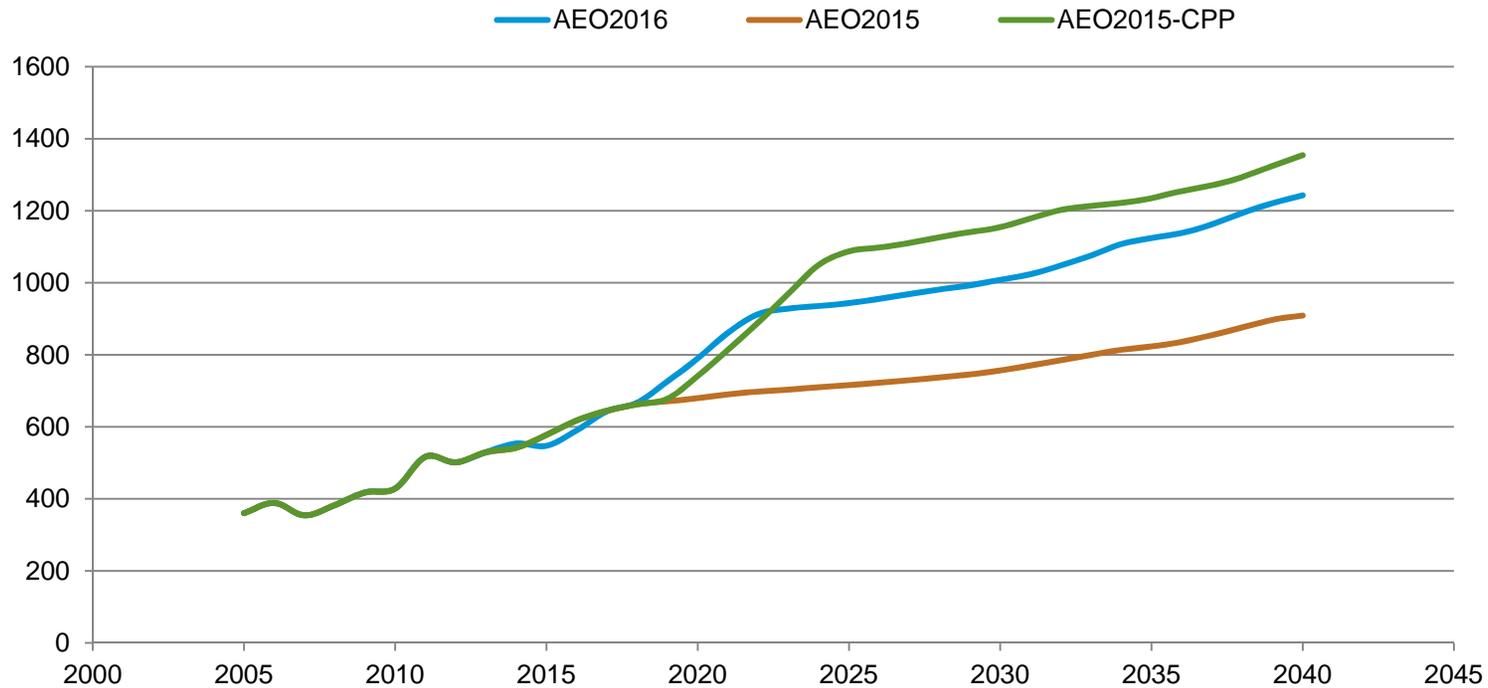


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Renewable generation in AEO2016 is 37% higher by 2040 than in AEO 2015, but lower than proposed CPP rule analysis

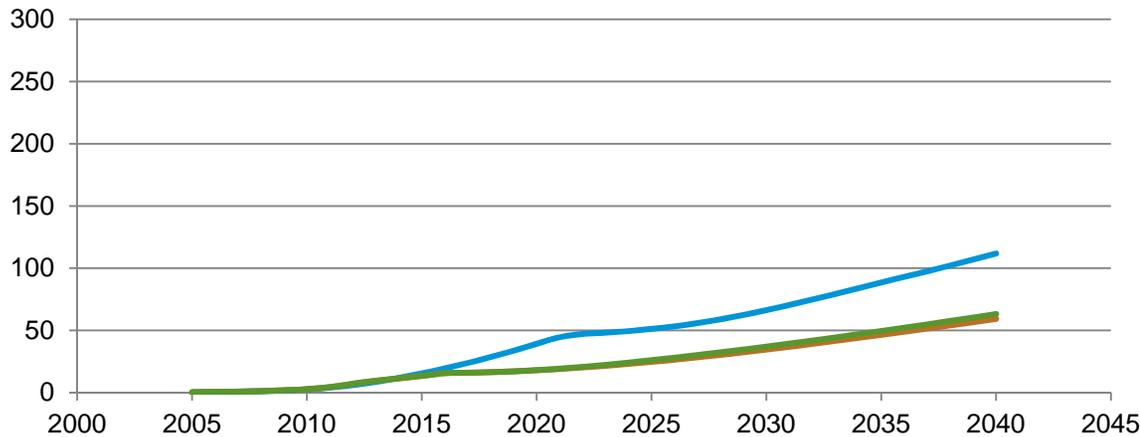
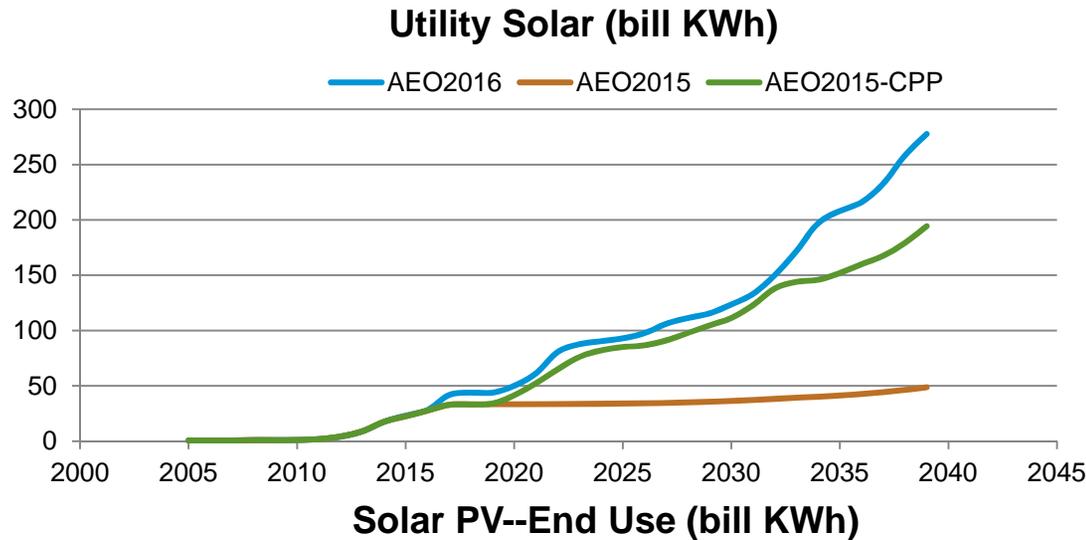
Renewable Generation (bill KWh)



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



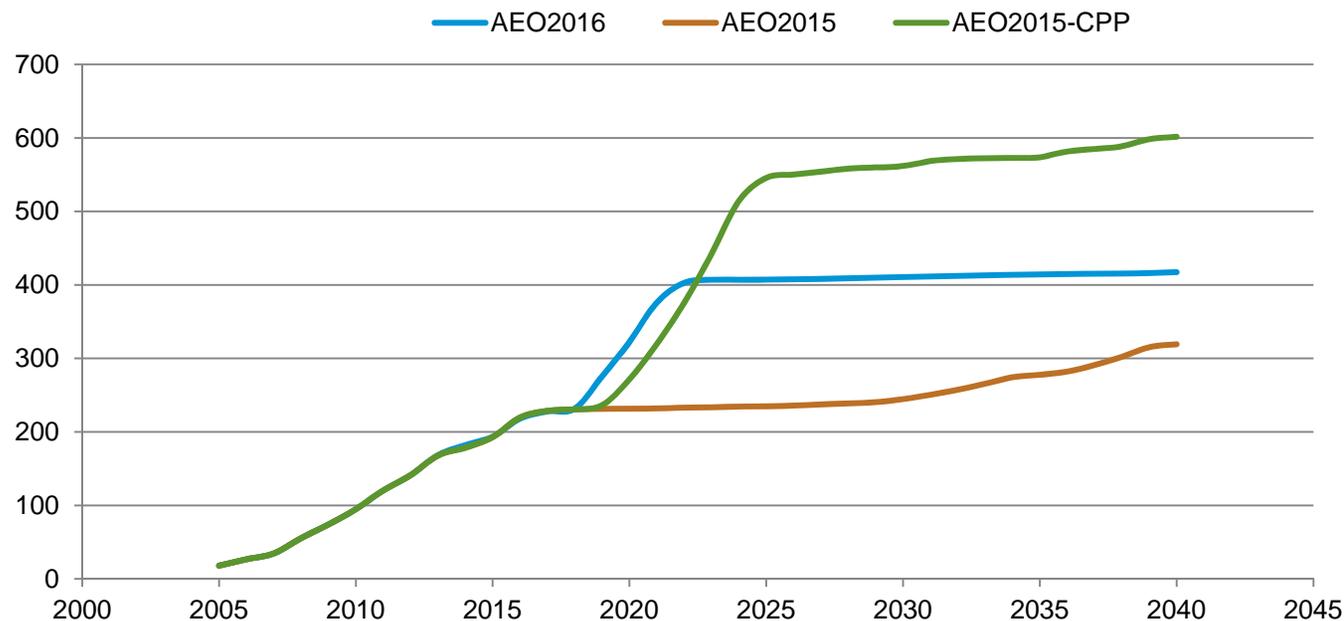
Solar grows to over 200 GW by 2040, with growth in both utility and distributed sectors



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

Wind generation by 2040 is 31% higher in AEO2016 than in AEO2015, but lower than proposed CPP rule analysis

Wind Generation (bill KWh)

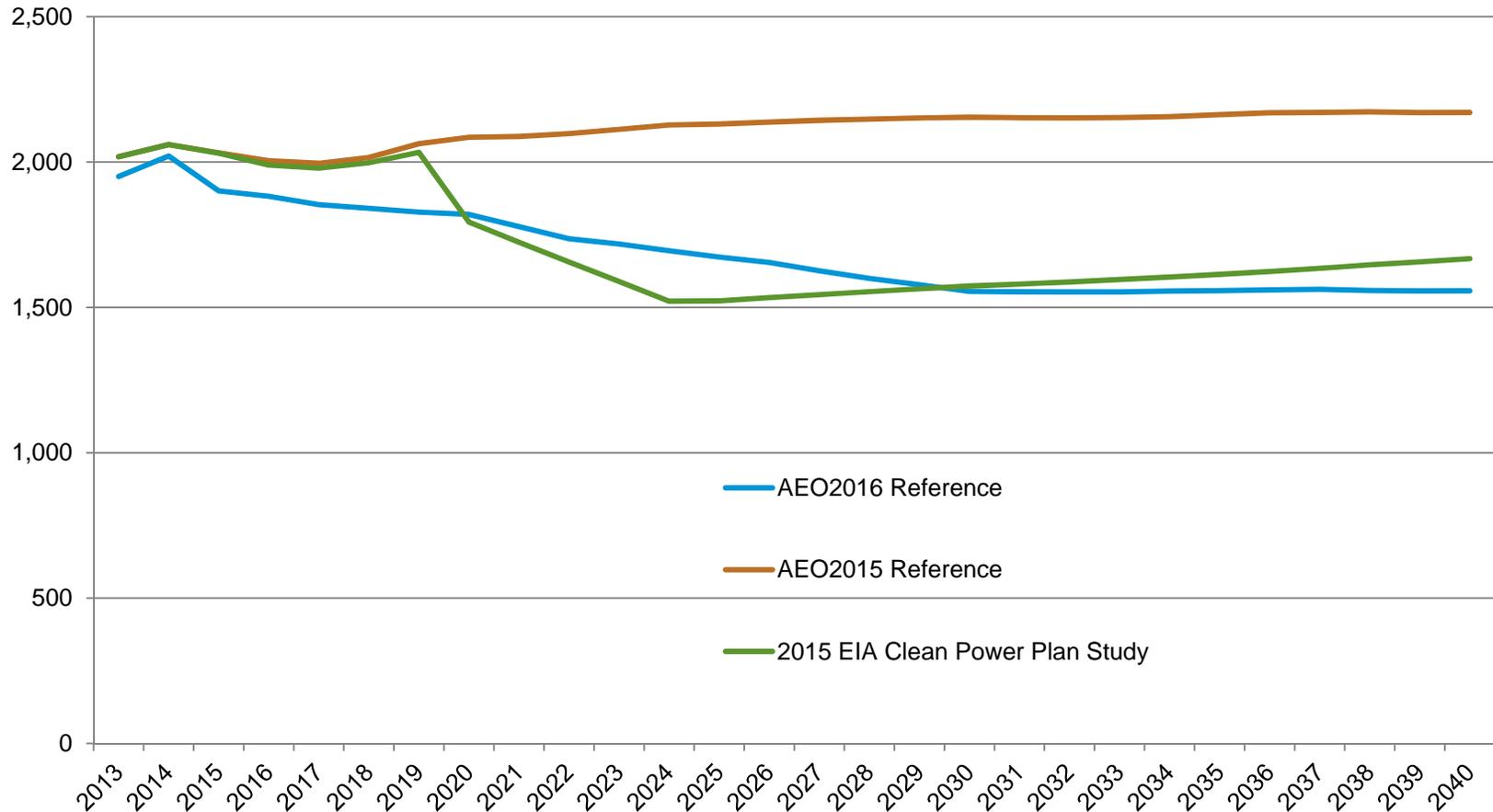


Source: AEO2016 NEMS run ref2016.1.0203a.RAN, AEO2015 Ref2015, rf15_111_all.0306a.RAN

- Near-term growth is accelerated by PTC extension
 - In longer-term, PV and low NG prices constrain growth

CO2 emissions by 2030 are the same as preliminary CPP, but shift from rate-to mass-based targets caps emissions growth

million metric tons



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



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