Analysis of the Proposed Clean Power Plan

June 15, 2015 | Washington, DC

Summary of the analysis request and the proposed Clean Power Plan rule for existing fossil-fuel generating units

- Requested by Lamar Smith, Chairman of the House Committee on Science, Space, and Technology
  - Request identifies specific baselines and alternative CPP cases with increasingly stringent emission targets beyond 2030 as well as scenarios with alternative assumptions regarding specific power technologies and fuel market conditions
- Analysis was conducted using AEO2015 Reference case, High Economic Growth, and High Oil and Gas Resource cases
- The proposed Clean Power Plan sets state-level limits on the carbon dioxide (CO_2) emissions rate of existing fossil fuel-fired electric generating units based on the application of four building blocks – heat rate improvement, redispatching, low- and zero carbon capacity additions, and demand-side energy efficiency
- States may comply using any combination of measures; the modeling in this report seeks to identify a least-cost compliance strategy

The proposed Clean Power Plan rule does not set a simple emission rate standard for existing units; rules affecting the denominator used for compliance calculations play a key role

Affected Generation
Existing coal (steam and IGCC)
Existing oil/gas steam
Existing gas combined cycle
6% of existing nuclear
Under construction nuclear
Existing non-hydro renewable
New renewables (including hydro)
Energy Efficiency savings

$$\text{Average } CO_2 \text{ intensity rate} = \frac{\text{emissions from affected generators}}{\text{affected generation}} =$$

$$\frac{\text{(coal emissions)} + \text{(oil/gas emissions)}}{\text{(coal gen)} + \text{(oil/gas gen)} + \text{(eligible nuclear gen)} + \text{(eligible renew gen)} + \text{EE}}$$

Analysis centers on 3 baselines and 5 main Clean Power Plan cases; 9 additional sensitivity cases are also included

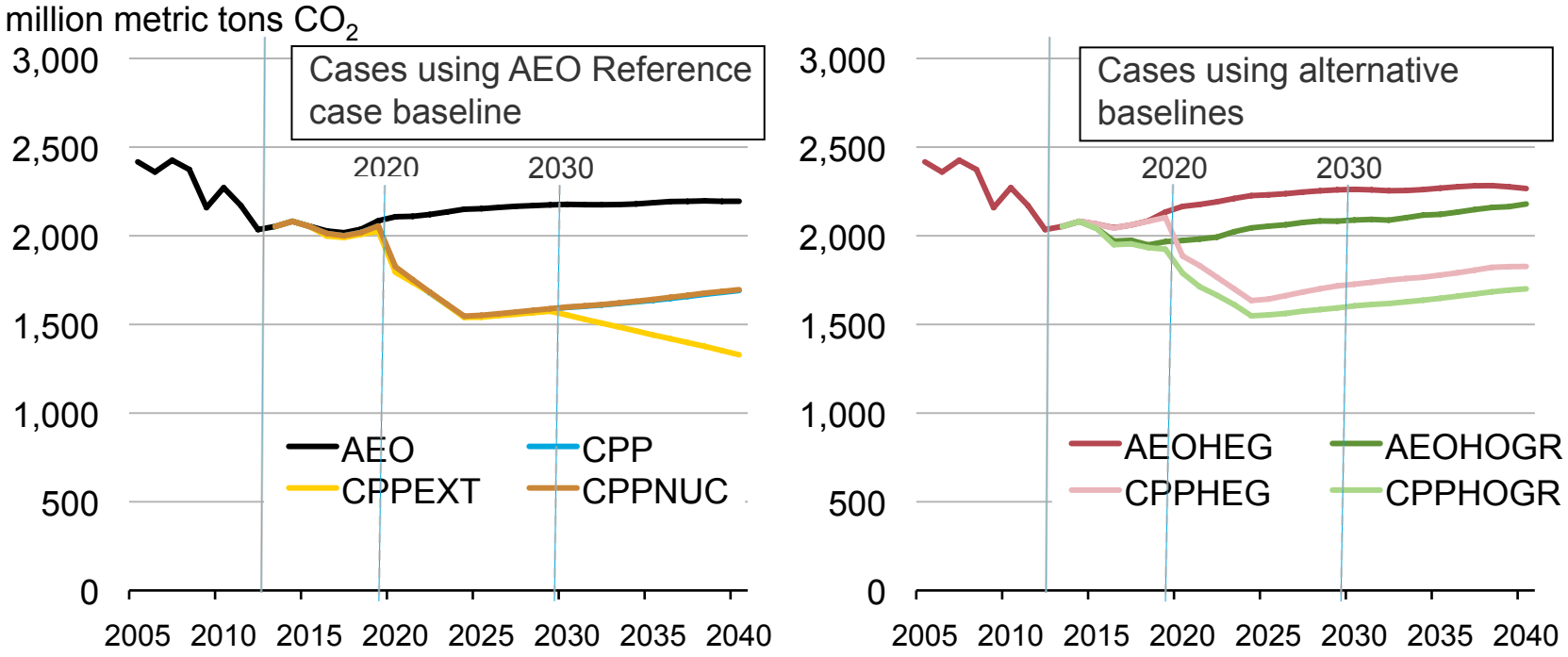
Case name	Description
Reference (AEO)	EIA's *AEO2015* Reference case presents long-term annual projections of energy supply, demand, and prices through 2040. The Reference case is based generally on federal, state, and local laws and regulations in effect as of the end of October 2014.
Policy Cases	***Regional CO_2 emission intensity targets were developed and added as a modeling constraint, based on specified state-level CO_2 emission intensity targets.***
Base Policy (CPP)	The Base Policy case models the proposed Clean Power Plan using the *AEO2015* Reference case as the underlying baseline, allowing regions to choose compliance strategies endogenously from among the four building blocks in EPA's proposed Best System of Emissions Reduction.
Policy Extension (CPPEXT)	The Policy Extension case extends CO_2 reduction targets beyond 2030, in order to reduce CO_2 emissions from the power sector by 45% below 2005 levels in 2040, using the *AEO2015* Reference case as the baseline.
Policy with New Nuclear (CPPNUC)	The CPPNUC case assumes that generation from new nuclear power plants that are not currently under construction is counted in compliance calculations in the same manner as new renewable generation.

All but 2 of the policy cases start from the AEO2015 Reference case baseline; those 2 cases show how baselines affect modeled outcomes

Case name	Description
High Economic Growth (AEOHEG)	EIA's *AEO2015* High Economic Growth case, which reflects higher growth in U.S. gross domestic product (GDP) than the Reference case, resulting in higher electricity and natural gas demand and higher fuel prices.
Policy with High Economic Growth (CPPHEG)	The CPPHEG case models the proposed Clean Power Plan using the *AEO2015* High Economic Growth case as the baseline.
High Oil and Gas Resource (AEOHOGR)	EIA's *AEO2015* High Oil and Gas Resource case, which reflects more optimistic assumptions about domestic natural gas supply prospects than the Reference case, resulting in lower natural gas prices.
Policy with High Oil and Gas Resource (CPPHOGR)	The CPPHOGR case models the proposed Clean Power Plan using the *AEO2015* High Oil and Gas Resource case assumptions as the baseline, which has lower fossil fuel prices than the Reference case.

Analysis Results: Emissions and Generation

Power sector CO_2 emissions in the Base Policy case (CPP) are 25% below 2005 levels by 2020 and 34% below 2005 levels by 2030



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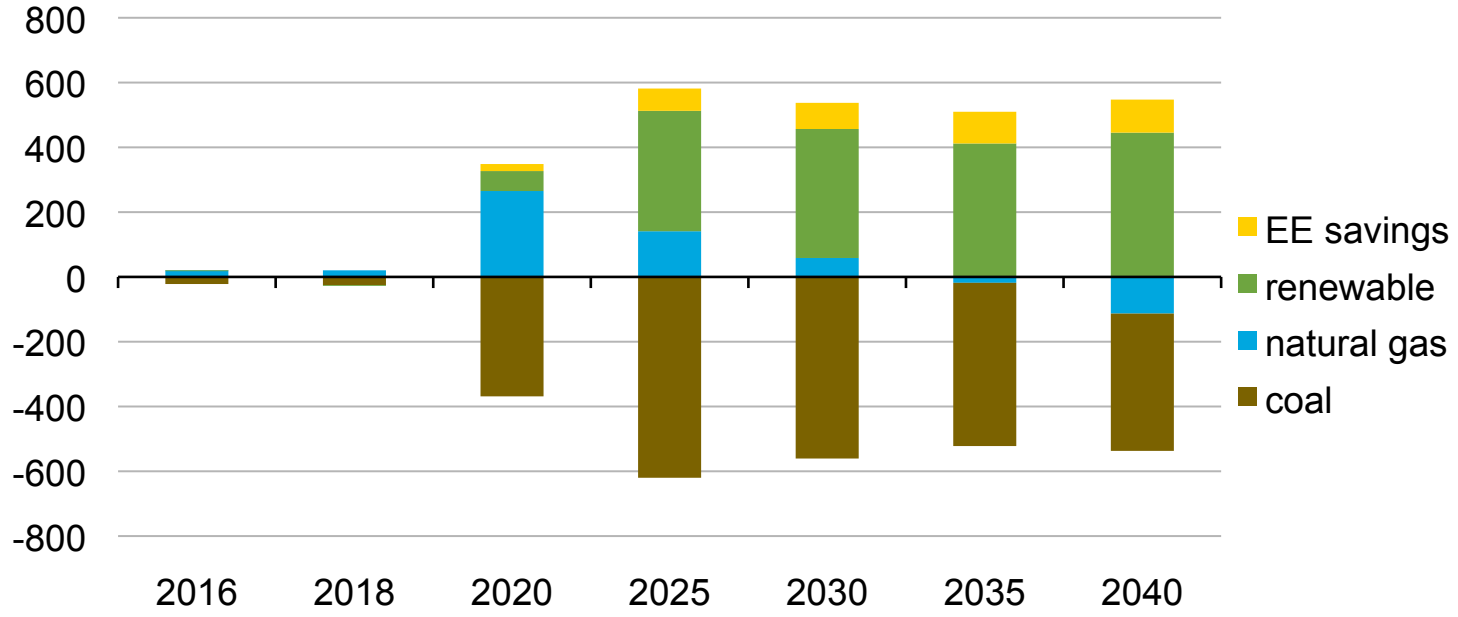
Switching from coal to natural gas-fired generation predominates initially, followed by a shift to renewables starting in the mid-2020s

change in generation and energy efficiency savings in CPP case relative to Reference case

billion kilowatthours



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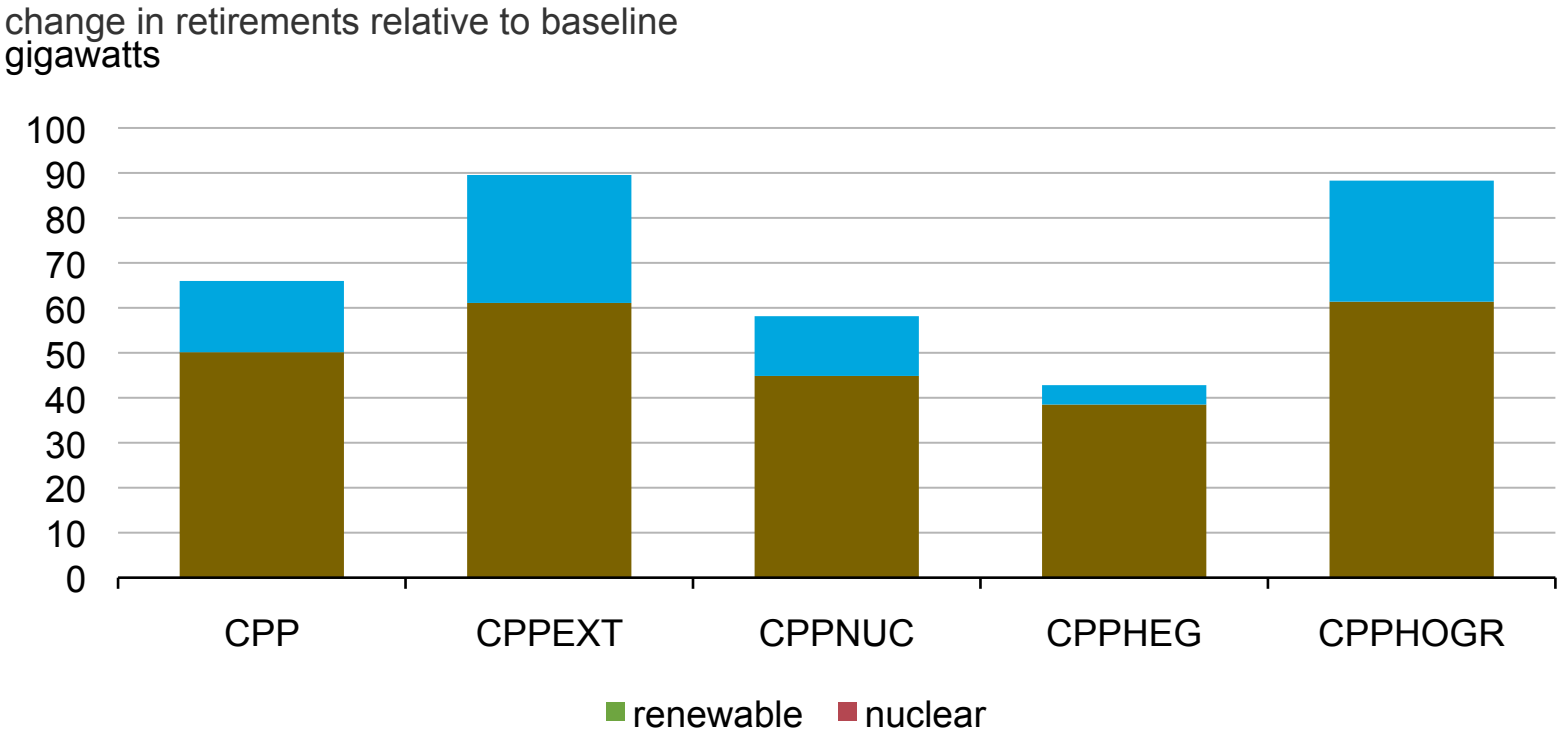
From 2014-2040, retirements are 66 GW higher than baseline (coal retirements are 50 GW higher) in the CPP case



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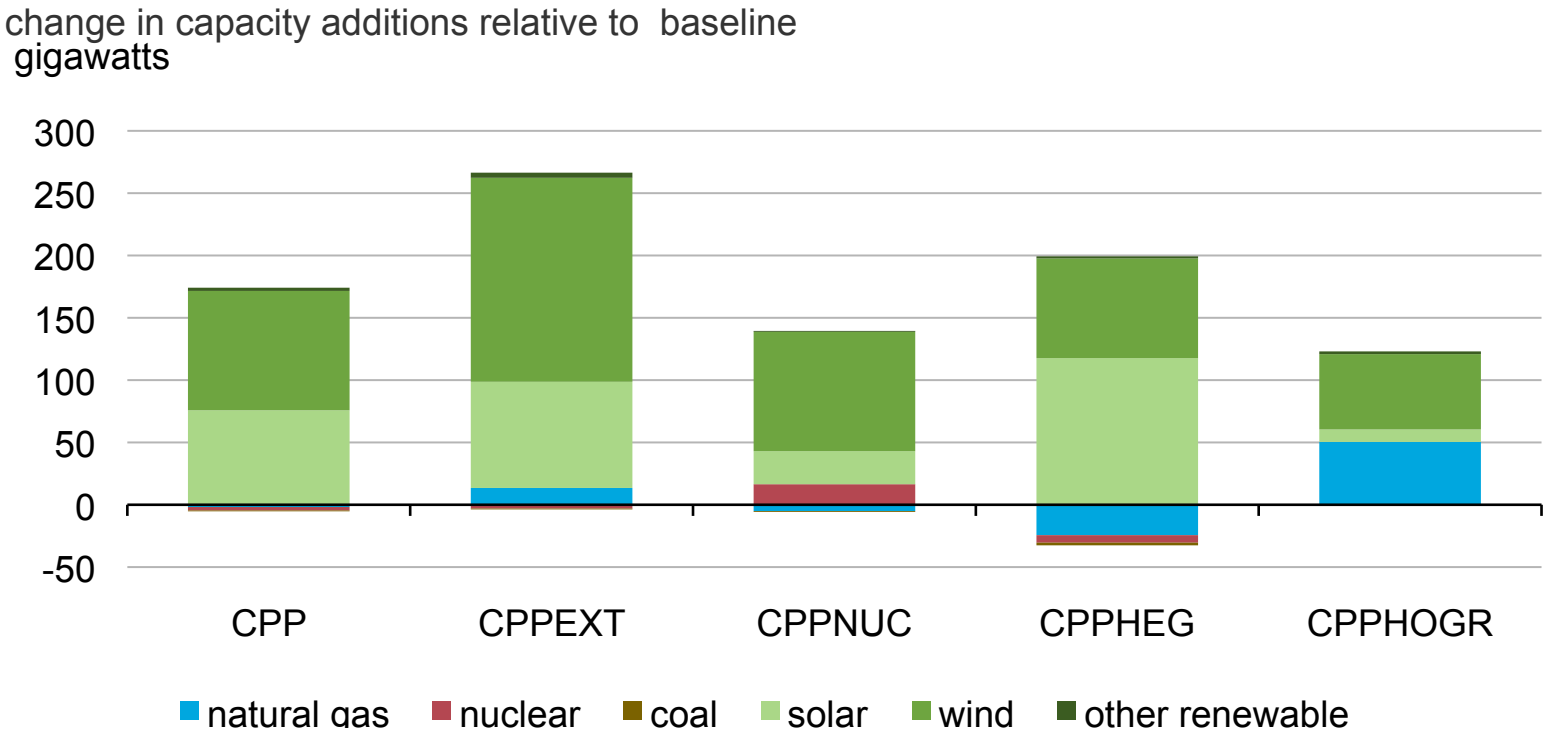
From 2014-2040, 174 GW of renewable capacity is added relative to the baseline in the Base Policy case



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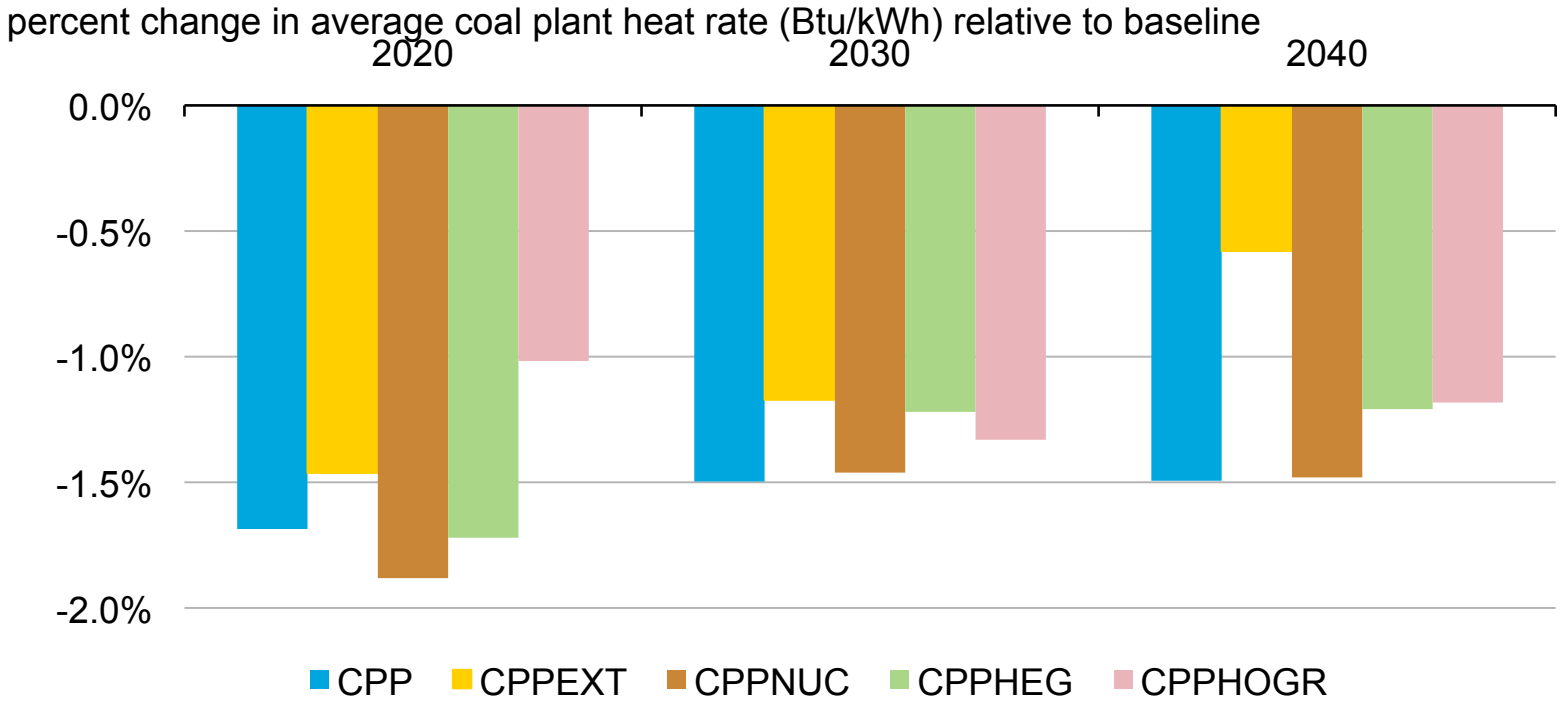
Heat rates for coal-fired generators that remain in use improve modestly under the Clean Power Plan



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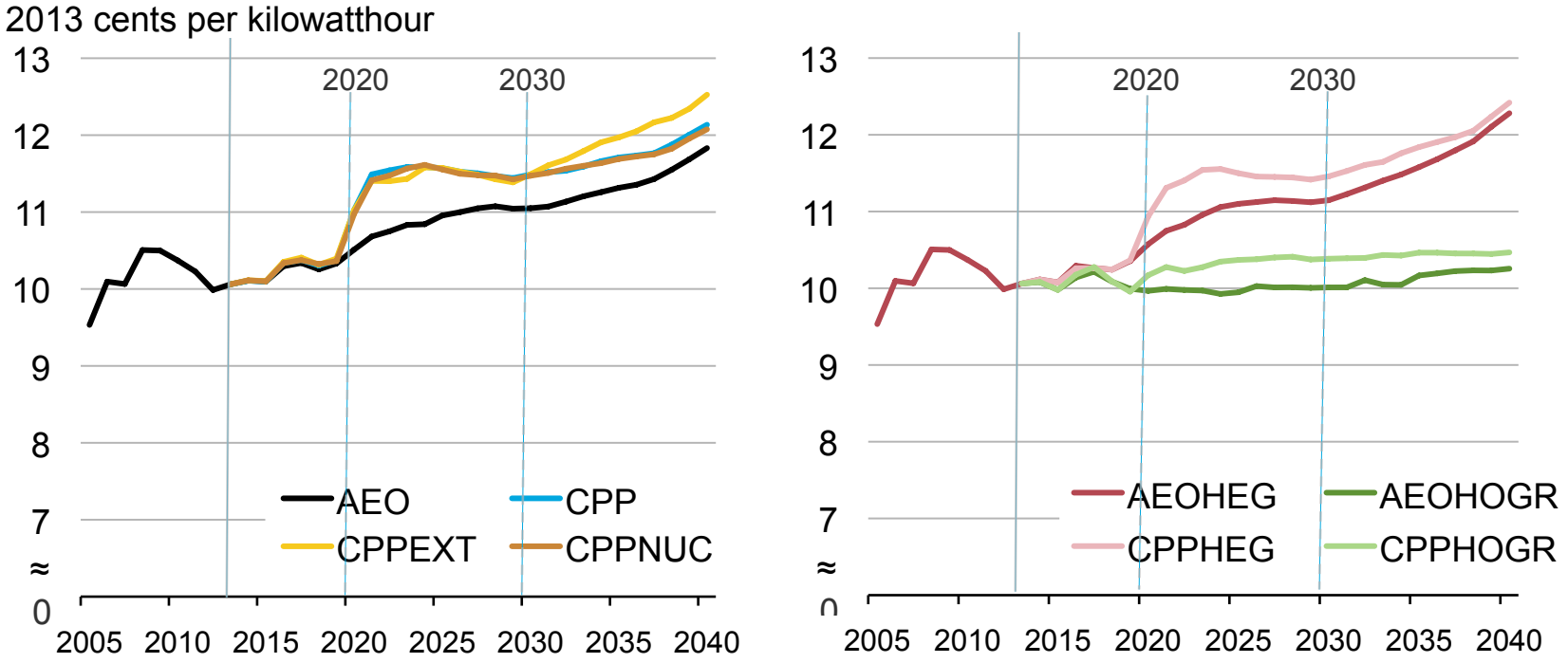
Retail electricity prices and expenditures increase; prices average 3% to 7% higher from 2020-2025 relative to baseline



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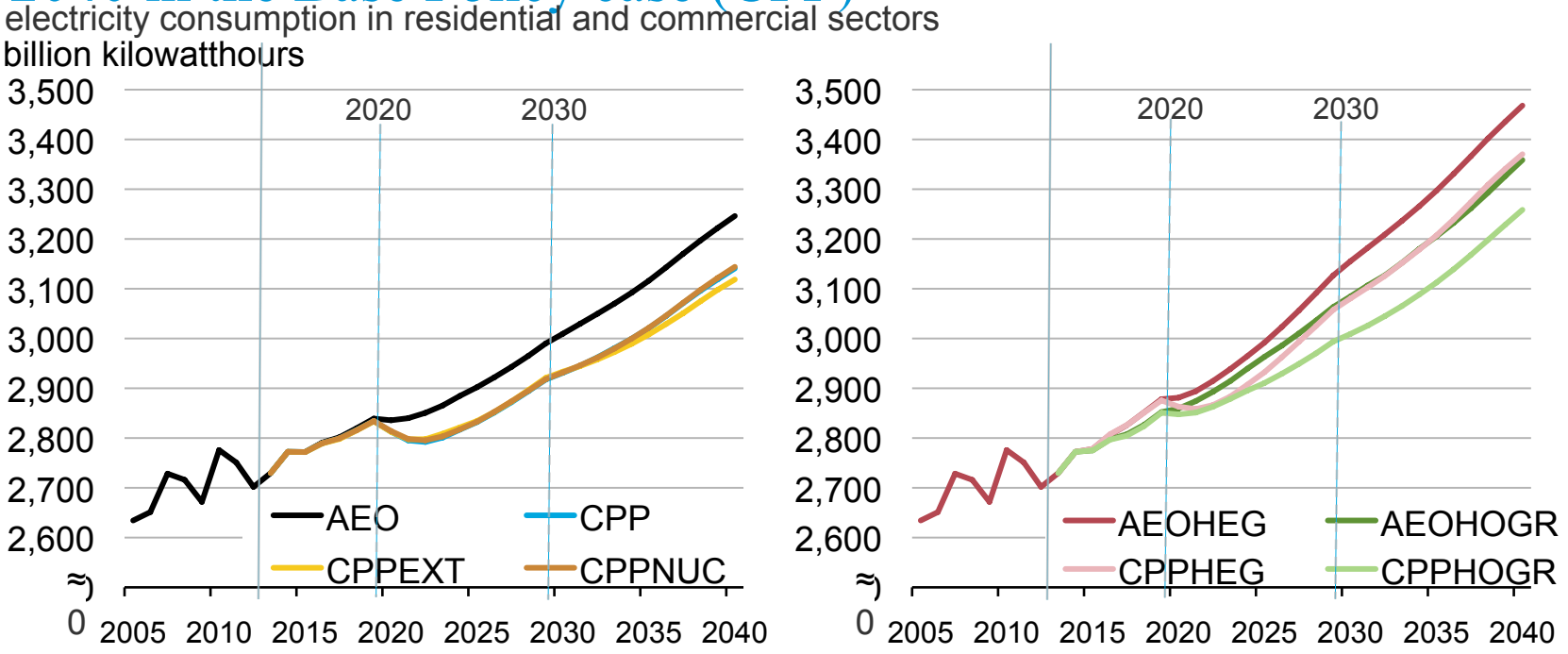
Analysis points to, but cannot resolve, regional power flow, contract, and system coordination issues

- The electric system already incorporates interregional trade, which continues to evolve in the baselines
- Some regions have natural advantages relative to others, including higher renewable resource quality; in EIA's analysis these regions send more power to other regions when the Clean Power Plan is implemented
- The degree to which increased interregional electricity trade as well as other possible cooperation, related contract payments, etc., will occur as the Clean Power Plan is actually implemented is uncertain
- These issues affect calculation of regional cost impacts but are unlikely to be significant at a national level

Relative to the baseline, electricity consumption in residential & commercial sectors is 2.6% less in 2030 and 3.2% less in 2040 in the Base Policy case (CPP)



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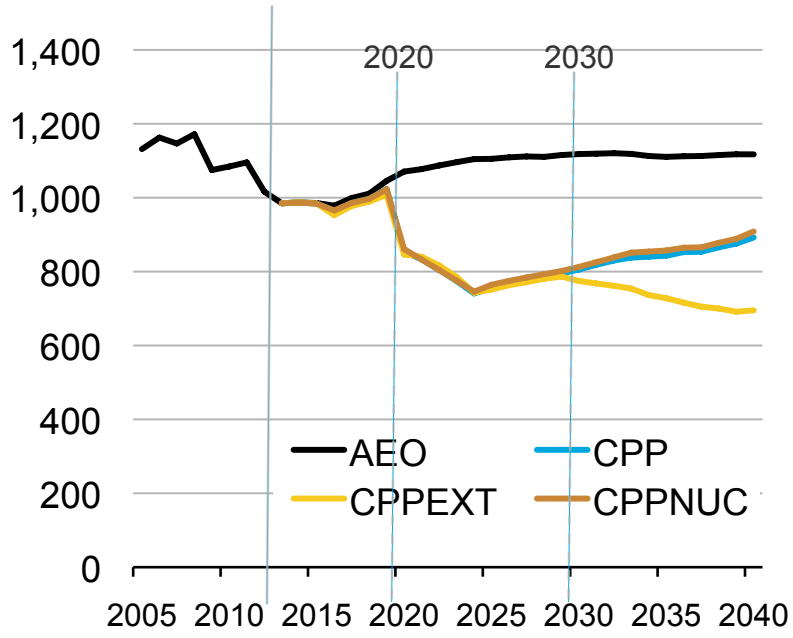
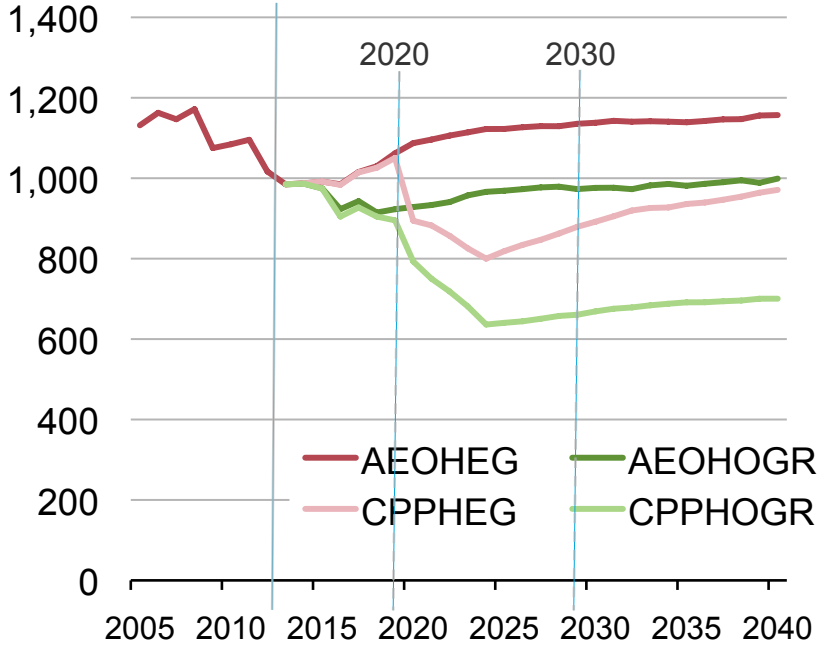
Analysis Results: Fuel Production

Coal production for Base Policy case (CPP) is substantially below baseline – 20% lower in 2020 and 32% lower in 2025

million short tons





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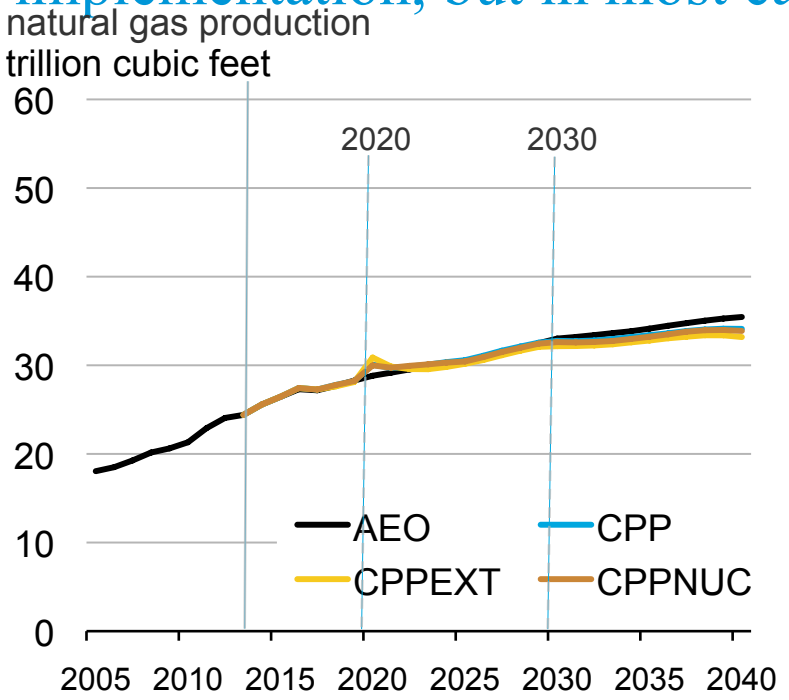
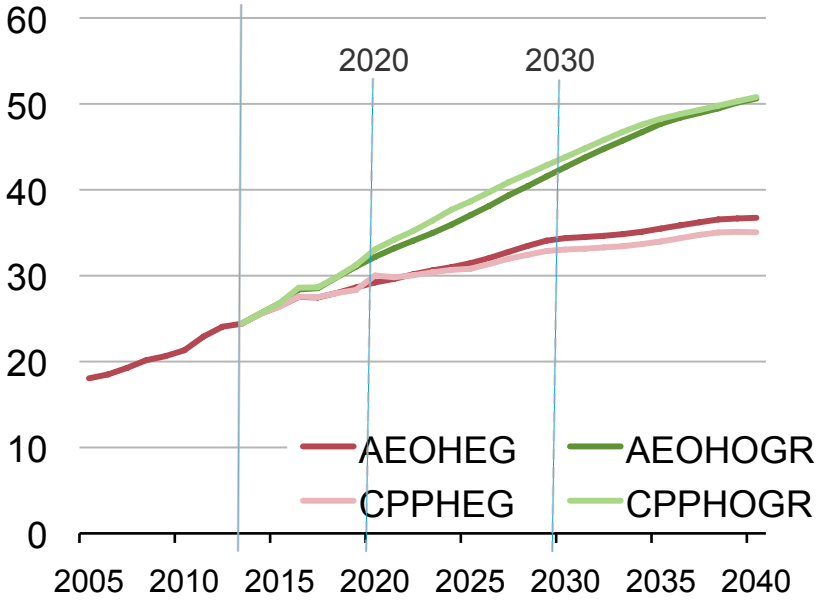
Natural gas production varies widely across baselines; the Clean Power Plan itself raises gas production modestly following implementation, but in most cases lowers it in later years





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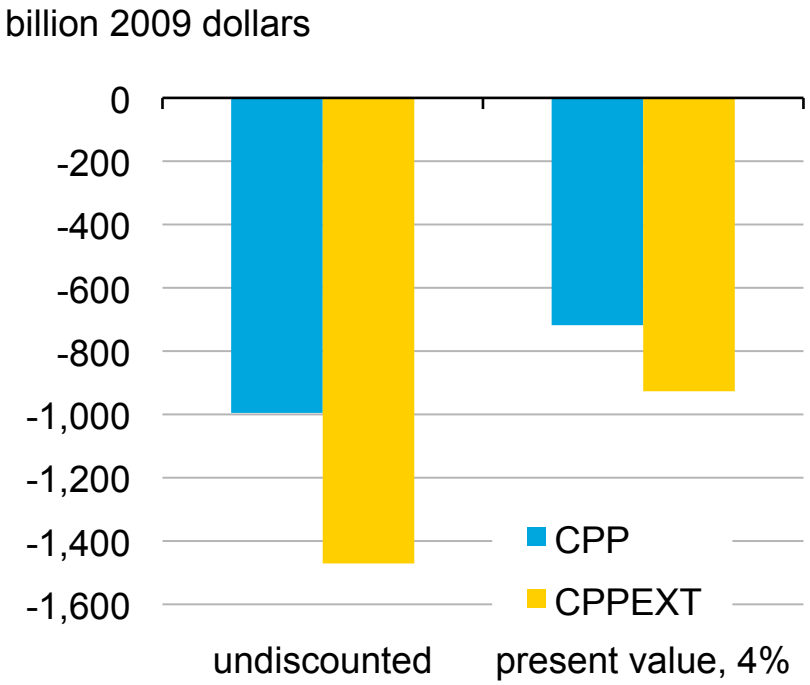
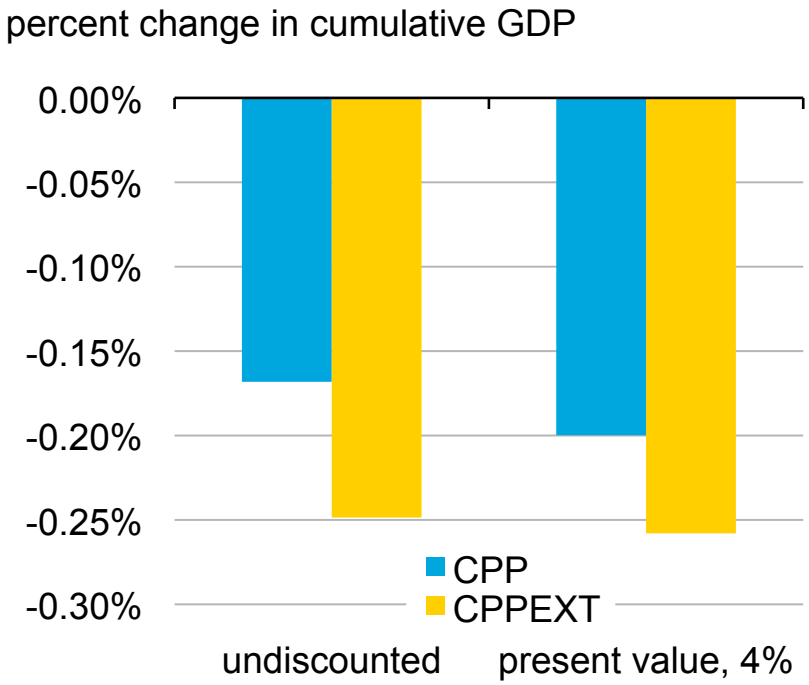
The proposed plan reduces cumulative GDP over 2014 -2040 by 0.17% relative to baseline in the Base Policy case (CPP)





Base Policy case – summary of key results

- Clean Power Plan reduces power sector CO_2 emissions to 25% below 2005 levels by 2020 and 34% below 2005 levels by 2030
- Switching from coal to natural gas-fired generation predominates during the initial compliance years, followed by a shift to renewables starting in the mid-2020s, as 174 GW of additional renewable capacity is built above the Reference case through 2040
- End-use electricity prices rise by 5% on average between 2020-2030 relative to Reference case
- Natural gas prices rise in 2020 to meet increased demand from the power sector, then fall back; after 2030 natural gas use by the power sector is lower than the Reference case due to lower demand and higher renewable generation
- Combination of higher prices and compliance expenditures leads to a modest reduction in GDP and disposable income; impacts abate as energy prices subside
- Increased energy efficiency, as well as price-related demand reductions result in a 2030 sales reduction of 107 billion kwh (3%) relative to the Reference case