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EPA's Affordable Clean Energy Proposal

(name redacted)
Analyst in Environmental Policy

(name redacted)
Specialist in Environmental Policy

(name redacted)
Legislative Attorney

November 2, 2018

Congressional Research Service
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R45393

CRS REPORT
Prepared for Members and
Committees of Congress

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EPA's Affordable Clean Energy Proposal

In August 2018, the U.S. Environmental Protection Agency (EPA) proposed three actions in the "Affordable Clean Energy Rule" (ACE). First, EPA proposed to replace the Obama Administration's 2015 Clean Power Plan (CPP) with revised emission guidelines for existing fossil fuel steam electric generating units (EGUs), which are largely coal-fired units. Second, EPA proposed revised regulations to implement emission guidelines under Clean Air Act (CAA) Section 111(d). Third, EPA proposed to modify an applicability determination for New Source Review (NSR), a CAA preconstruction permitting program for new and modified stationary sources.

The first action stems from EPA's finding that the CPP exceeded EPA's statutory authority by using measures that applied to the power sector rather than measures carried out within an individual facility. In the ACE rule, EPA proposed to base the "best system of emission reduction" (BSER) for existing coal-fired EGUs on heat rate improvement (HRI) measures. EPA did not propose a BSER for other types of EGUs, such as natural gas combined cycle units. In addition, EPA did not establish a numeric performance standard as the agency did in the CPP. Instead, EPA proposed a list of "candidate technologies" of HRI measures that constitute the BSER. States would establish unit-specific performance standards based on this list and other unit-specific considerations.

SUMMARY

R45393

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name redated
Analyst in Environmental Policy
-re-acte--@crs.loc.gov

name redated
Specialist in Environmental Policy
-re-acte--@crs.loc.gov

name redated
Legislative Attorney
-re-acte--@crs.loc.gov

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Second, EPA proposed to revise the general implementing regulations to clarify EPA's and states' roles under Section 111(d) based on the agency's current legal interpretation that states have broad discretion to establish emissions standards consistent with the BSER. The proposed changes would, among other things, revise definitions and lengthen the time for development and review of state plans.

Third, EPA proposed to revise the NSR applicability test for EGUs. According to EPA, this would prevent NSR from discouraging the installation of energy efficiency measures. EGUs that adopt HRI measures and operate more efficiently may be used for longer time periods, thereby increasing annual emissions and potentially triggering NSR. Under ACE, NSR would not be triggered if the EGU modification did not increase emissions on an hourly basis, even if the modification increases annual emissions.

EPA estimated emission changes under multiple scenarios. EPA projected that power sector emissions of carbon dioxide (CO_2), sulfur dioxide (SO_2), and nitrogen oxides (NO_x) would increase under the ACE proposal compared to the CPP. EPA also projected that ACE would, in most scenarios, decrease CO_2, SO_2, and NO_x emissions compared to a baseline without the CPP.

Power sector emissions projections, comparing CPP and non-CPP scenarios, provide context for evaluating the potential impacts of the ACE proposal. The CO_2 emission reduction differences between CPP and non-CPP scenarios are greater in the studies from earlier years. For example, a comparison between CPP and non-CPP scenarios from the past three Energy Information Administration analyses shows that the percentage difference has decreased from 16% (in 2016) to 8% (in 2018), reflecting the fact that many of the changes EPA expected to result from the CPP (i.e., natural gas and renewables replacing coal-fired units) have happened already due to market forces and other factors. Comparisons between modeling projections of electricity sector CO_2 emissions should be made with caution, however, given potential differences in modeling assumptions about future economic conditions and underlying energy inputs (e.g., natural gas prices).

EPA estimated that compared to the CPP, ACE would reduce compliance costs and yield lower emission reductions, thereby increasing climate-related damages and human health damages ("forgone benefits"). According to EPA, the estimated value of the forgone benefits would outweigh the compliance cost savings when replacing the CPP with ACE, yielding net costs. Specifically, EPA estimated that this replacement would yield net costs ranging from $12.8 billion to $72.0 billion (2016$) over a 15-year period (2023-2037). Excluding forgone human health co-benefits from these comparisons yields estimates that range from a net cost of $5.4 billion to a net benefit of $3.4 billion over a 15-year period (2023-2037).

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Introduction

In August 2018, the U.S. Environmental Protection Agency (EPA) proposed the "Affordable Clean Energy" (ACE) rule.[1] ACE would modify provisions for existing power plants under two major Clean Air Act (CAA) programs. Among other things, ACE would "replace the Clean Power Plan (CPP)," a greenhouse gas (GHG) rulemaking that EPA promulgated under CAA Section 111(d) in 2015.[2] ACE would also modify an applicability determination for New Source Review (NSR), which is a CAA preconstruction permitting program intended to ensure that new and modified stationary sources of air pollution do not significantly degrade air quality.

EPA proposed ACE in response to Executive Order 13783, in which President Trump directed federal agencies to "review existing regulations and policies that potentially burden the development or use of domestically produced energy resources."[3] Among the order's specific directives was that EPA review the CPP, which was one of the Obama Administration's key actions directed at reducing GHG emissions. EPA's review also led the agency to convene an "NSR Reform Task Force" to assess opportunities to simplify the NSR application and review process.[4]

Congress has also considered questions about NSR. A House hearing, held in early 2018, highlighted some long-standing and divergent views on the NSR program.[5] Witnesses speaking in favor of NSR emphasized the program's health and environmental benefits, while other stakeholders described it as an outdated, cumbersome impediment to economic growth. For example, one of the witnesses testified that the complexities and costs of the NSR permitting process discourage pollution control and energy efficiency projects.[6] In addition, two bills—H.R. 3127 and H.R. 3128—were introduced in the 115th Congress that would amend the CAA definition of *modification*, a key term in determining NSR applicability.

Notable interest in the CPP and subsequent proposals to repeal[7] or replace it[8] reflects the perceived importance of their potential effects on the economy and the health, safety, and well-being of the nation. Some stakeholders contend that the U.S. economy would be adversely affected by controls on GHG emissions from power plants. At the same time, national and

[1] EPA, "Emission Guidelines for Greenhouse Gas Emissions from Existing Electric Utility Generating Units; Revisions to Emission Guideline Implementing Regulations; Revisions to New Source Review Program," 83 *Federal Register* 44746, August 31, 2018 (hereinafter ACE Proposal).

[2] ACE Proposal, p. 44746. For the CPP, see EPA, "Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units," Final Rule, 80 *Federal Register* 64661, October 23, 2015 (hereinafter CPP Final Rule).

[3] Executive Order No. 13783, 82 *Federal Register* 16093 §7 (March 31, 2017). For more information on this executive order, see CRS Legal Sidebar WSLG1789, *New Executive Order Directs Agencies to Revise or Rescind Climate Change Rules and Policies*, by (name redacted)

[4] EPA, *Final Report on Review of Agency Actions that Potentially Burden the Safe, Efficient Development of Domestic Energy Resources Under Executive Order 13873*, October 25, 2017, p. 2.

[5] U.S. Congress, House Committee on Energy and Commerce, Subcommittee on Environment, *New Source Review Permitting Challenges for Manufacturing and Infrastructure*, 115th Cong., 2nd sess., February 14, 2018, https://energycommerce.house.gov/hearings/new-source-review-permitting-challenges-manufacturing-infrastructure/.

[6] See testimony of Arkansas Department of Environmental Quality, p. 5, https://docs.house.gov/meetings/IF/IF18/20180214/106852/HHRG-115-IF18-Wstate-SpencerS-20180214.pdf.

[7] EPA, "Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Proposed Rule," 82 *Federal Register* 48035, October 16, 2017.

[8] ACE Proposal.

international scientific assessments of climate change have concluded that there is an increasing likelihood of "severe, pervasive and irreversible" GHG-induced impacts.[9] After EPA proposed the CPP in 2014,[10] the agency received more than 4.3 million public comments, the most ever for an EPA rule.[11] EPA responded by making numerous changes to the rule between proposal and promulgation. Congressional and public interest has continued since EPA promulgated the CPP final rule in 2015.[12]

This report provides background information about the CAA and GHG emissions from the power sector and highlights some of the major components of EPA's ACE proposal. The topics discussed do not represent an exhaustive list of the proposal's elements. For a more comprehensive analysis of the CPP, see CRS Report R44341, *EPA's Clean Power Plan for Existing Power Plants: Frequently Asked Questions*, by (name redacted) et al. For an analysis of the CPP's potential impact on the electric power sector, see CRS Report R44265, *EPA's Clean Power Plan: Implications for the Electric Power Sector*, by (name redacted) .

The report does not provide a legal analysis of the actions and legal interpretations proposed in ACE. For a detailed discussion of legal issues, see:

- CRS Legal Sidebar LSB10198, *EPA Proposes the Affordable Clean Energy Rule to Replace the Clean Power Plan*, by (name redacted)
- CRS Legal Sidebar LSB10199, *EPA Proposes New Permitting Test for Power Plant Modifications*, by (name redacted)
- CRS Report R44480, *Clean Power Plan: Legal Background and Pending Litigation in West Virginia v. EPA*, by (name redacted)
- CRS Legal Sidebar LSB10016, *EPA Proposes to Repeal the Clean Power Plan*, by (name redacted)

Background

This section provides background information on sources of U.S. GHGs emissions (particularly CO_2), CAA Section 111, the CPP, and NSR.

[9] For example, the International Panel on Climate Change concluded that continued emission of GHGs "will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems." See R. K. Pachuri et al. (eds.), *Climate Change 2014: Synthesis Report*, contribution of Working Groups I, II, and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (Geneva, Switzerland: IPCC Secretariat, 2014), p. 8, http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full_wcover.pdf. For discussion about national and international climate change assessments, see CRS Report R45086, *Evolving Assessments of Human and Natural Contributions to Climate Change*, by (name redacted).

[10] EPA, "Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units," Proposed Rule, 79 *Federal Register* 34830, June 18, 2014.

[11] Comments on the proposal can be viewed at http://www.regulations.gov/#!docketDetail;D=EPA-HQ-OAR-2013-0602. An interactive map allowing users to search for comments by state officials can be found at http://bipartisanpolicy.org/energy-map/.

[12] CPP Final Rule.

U.S. GHG Emissions

Anthropogenic GHG emissions[13] are generated throughout the United States from millions of discrete sources: vehicles, power plants, industrial facilities, households, commercial buildings, and agricultural activities (e.g., soils and livestock).[14] CO_2 emissions from fossil fuel combustion account for the largest percentage (76% in 2016) of total U.S. GHG emissions.[15]

Historically, the electricity sector accounted for the largest percentage of U.S. CO_2 emissions from fossil fuel combustion.[16] However, the transportation sector surpassed electricity in 2016. In 2017, the transportation sector accounted for 37% and the electricity sector accounted for 34% of U.S. CO_2 emissions from fossil fuel combustion.[17]

In previous decades (1973-2010), CO_2 emissions from electricity generation followed an upward course—similar to electricity generation levels in the same time period, as illustrated in **Figure 1**. In 2010, their courses diverged. Although electricity generation has remained relatively flat in recent years (2010-2017), CO_2 emissions have generally continued to decline. In 2017, electricity generation was equivalent to generation levels in 2010, while CO_2 emissions were 23% below 2010 levels.

[13] GHGs in the atmosphere trap radiation as heat, warming the Earth's surface and oceans. The primary GHGs emitted by humans (and estimated by EPA in its annual inventories) include carbon dioxide (CO_2), methane, nitrous oxide, sulfur hexafluoride, chlorofluorocarbons, hydrofluorocarbons, and perfluorocarbons.

[14] While both natural and human-related sources release GHGs and influence climate, "current climate scientific assessment states high confidence (extremely likely) that human influence is the dominant cause of the observed warming over the past half-century." For additional discussion, see CRS Report R45086, *Evolving Assessments of Human and Natural Contributions to Climate Change*, by (name redacted).

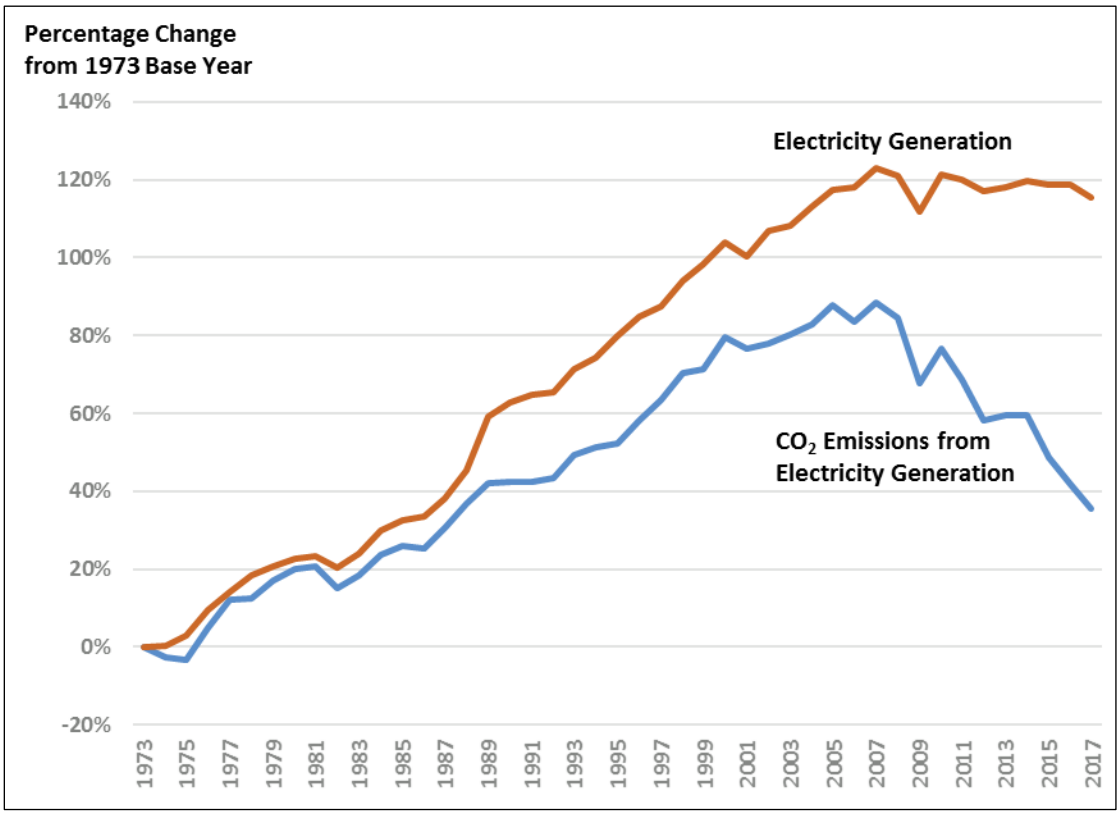
[15] EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2016*, April 2018, https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks.

[16] Fossil fuel combustion accounts for 94% of U.S. CO_2 emissions. The remaining 6% of CO_2 emissions are generated from a range of industrial activities, including iron and steel, cement, and chemical production (EPA, *Inventory*, 2018).

[17] Energy Information Administration (EIA), *Monthly Energy Review*, https://www.eia.gov/totalenergy/data/monthly/.

Figure 1. Electricity Generation and CO_2 Emissions from U.S. Electricity Sector

Percentage Change Comparison, 1973-2017



Source: Prepared by CRS; data from Energy Information Administration (EIA), *Monthly Energy Review*, net electricity generation from Table 7.2 and emissions from Table 12.6, http://www.eia.gov/totalenergy/data/monthly/.

Note: The figure uses 1973 as the base year, because this is the first year of data from EIA's *Monthly Energy Review* that includes both electricity generation and CO_2 emissions from the electricity sector. (Electricity generation data goes back to 1949.)

Multiple factors impact CO_2 emission levels from the electricity sector. One key factor in CO_2 emission levels is the electricity generation portfolio. Electricity is generated from a variety of sources in the United States. Some sources—nuclear, hydropower, and some renewables—directly produce no CO_2 emissions with their electricity generation. Fossil fuels, on the other hand, generate different amounts of CO_2 emissions per unit of generated electricity. For example, natural-gas-fired electricity from a combined cycle unit[18] yields approximately 43% of the CO_2 emissions of coal-fired electricity per kilowatt-hour of electricity.[19] Therefore, shifting the U.S. electricity generation portfolio to lower emissions sources would likely have (all else being equal) a considerable impact on CO_2 emissions from the electricity sector, which in turn, would likely reduce total U.S. GHG emissions.

[18] According to EIA data, natural gas combined cycle units account for 55% of total U.S. natural-gas-powered generator capacity. (Data from Monthly Electric Generator Inventory, May 2018, https://www.eia.gov/electricity/data/eia860M/.)

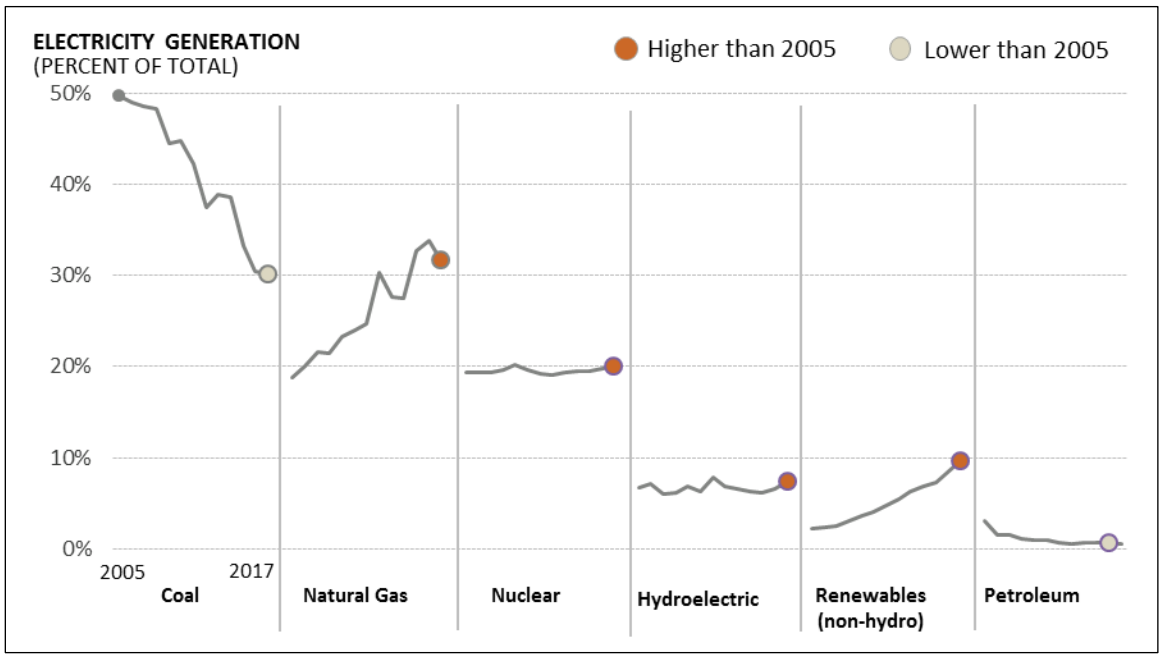
[19] For further discussion, see CRS Report R44451, *U.S. Carbon Dioxide Emissions Trends and Projections: Role of the Clean Power Plan and Other Factors*, by (name redacted) ; and CRS Report R44090, *Life-Cycle Greenhouse Gas Assessment of Coal and Natural Gas in the Power Sector*, by (name redacted) .

As illustrated in **Figure 2**, recent changes in the U.S. electricity generation portfolio between 2005 and 2017 have played a key role in electric power emission levels:

- Coal's contribution to total electricity generation decreased from 50% to 30%.
- Natural gas's contribution to total electricity generation increased from 19% to 32%.
- Non-hydro renewable energy (wind and solar) generation increased from 2% to 10%.

Figure 2. Percentage of Total Electricity Generation by Energy Source

2005-2017



Source: Prepared by CRS; data from EIA, *Electric Power Monthly*, Table 1.1, http://www.eia.gov/beta/epm/.

Notes: Renewable sources include wind, utility scale solar, wood fuels, landfill gas, biogenic municipal solid waste, other biomass, and geothermal. Petroleum includes petroleum liquids and petroleum coke.

Structural changes in the electricity sector are likely playing a role in the electricity generation portfolio changes described above. Over the last decade (2007-2017), the electricity-generating capacity (measured in megawatts) of coal-fired power plants has decreased by 19%, while natural gas capacity has increased by 45%, and (non-hydro) renewable sources has increased by 445%.[20] If these recent changes in the electricity generation portfolio continue, U.S. CO_2 emissions may continue to decline as well—assuming the emission levels in other economic sectors, particularly the transportation sector, do not offset the reductions. As discussed in the section "CO2 Emissions Projections" below, recent analyses of CO_2 emissions project further declines in the near term under baseline scenarios.

[20] EIA, *Electric Power Annual*, Table 4.2A, 2018.

CAA Section 111

CAA Section 111 requires EPA to establish nationally uniform, technology-based standards for categories of industrial facilities, also referred to as stationary sources of air pollution.[21] These standards establish a consistent baseline for pollution control that competing firms must meet and thereby remove any incentive for states or communities to weaken air pollution standards in order to attract industry. They also conserve clean air to accommodate future growth as well as for its own benefits.

CAA Section 111(b) establishes maximum emission levels (called New Source Performance Standards, or NSPS) for new and modified major stationary sources—power plants, steel mills, and smelters, for example. The emission levels are determined by the best system of emission reduction (BSER) "adequately demonstrated," taking costs and any non-air-quality health and environmental impacts and energy requirements impacts into account.[22] Section 111 directs EPA to determine what constitutes the BSER.

Section 111 also addresses existing stationary sources of pollution. Section 111(d) requires EPA to promulgate regulations, which EPA has historically referred to as "emission guidelines."[23] These emission guidelines establish binding requirements that states are required to address when they develop plans to regulate the existing sources in their jurisdictions.[24] In particular, states must establish performance standards for existing sources reflecting the BSER, which is determined by EPA. States, in their plans, provide for their implementation and enforcement of the standards.[25]

Similar to Section 110 of the CAA—which requires states to develop and revise implementation plans to achieve EPA's National Ambient Air Quality Standards (NAAQS) and subsequent changes to those standards—Section 111(d) directs EPA to establish state plan "procedures."[26] EPA promulgated these procedures in 1975 and codified them at 40 C.F.R. Part 60, Subpart B.

Clean Power Plan

In the CPP, EPA established "emission guidelines for states to follow in developing plans to reduce" GHGs from existing fossil-fuel-fired power plants.[27] Specifically, the CPP set national performance standards for CO_2 emissions from existing fossil-fuel-fired power plants. One national performance applied to existing electric steam generating units (which are mostly coal), and the other applied to existing stationary combustion turbines—for example, natural gas combined cycle (NGCC) units. EPA based these standards on BSER. The agency determined BSER based on three "building blocks": (1) improving the heat rate at coal-fired units, (2) shifting generation to lower-emitting natural gas units, and (3) shifting generation from fossil fuel units to renewable energy generation.[28]

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[21] 42 U.S.C. §7411(b).

[22] 42 U.S.C. §7411(a)(1).

[23] EPA defines *emission guideline* for purposes of CAA Section 111(d) at 40 C.F.R. §60.21(e). As discussed later in this report, ACE proposes to revise this definition.

[24] 42 U.S.C. §7411(d)(1).

[25] EPA cannot compel a state to submit a state plan pursuant to CAA Section 111(d). If a state does not submit a satisfactory plan by EPA's regulatory deadline, CAA Section 111(d) directs EPA to prescribe a plan for the state, often described as a federal implementation plan (42 U.S.C. §7411(d)).

[26] 42 U.S.C. §7411(d)(1); 42 U.S.C. §7410.

[27] CPP Final Rule, p. 64662.

[28] 42 U.S.C. §7411(d). For CRS analysis of the CPP, see CRS Report R44341, *EPA's Clean Power Plan for Existing*

The CPP rule also set individual state targets for average emissions from existing power plants based on the CO_2 performance standards. In particular, it set interim targets for the period 2022-2029 and final targets to be met by 2030. Although EPA set state-specific targets, states would determine how to reach these goals.

The CPP is the subject of ongoing litigation and has not gone into effect. The Supreme Court in 2016 stayed the implementation of the rule until the lawsuit challenging its legality is resolved.[29] The U.S. Court of Appeals for the District of Columbia Circuit heard oral arguments in the case in September 2016 but agreed to an EPA request to continue to hold the case in abeyance while the agency reviewed the CPP and considered next steps.[30]

Upon its review of the CPP and its 2015 legal justification, EPA has now determined that the CPP exceeds its statutory authority based on a change in the agency's legal interpretation of Section 111 of the CAA. Thus, on October 10, 2017, EPA proposed to repeal the CPP.[31] EPA also published an Advanced Notice of Proposed Rulemaking on December 28, 2017, which requested information on a potential replacement to the CPP.[32]

New Source Review

The 1977 CAA amendments established NSR, a preconstruction permitting program intended to support attainment of federal air quality standards and also limit air quality deterioration in areas that have met or exceeded federal air quality standards. In general, the NSR program requires the installation of modern pollution controls when new facilities are built or when existing facilities make a change that substantially increases emissions. Owners or operators must obtain an NSR permit before the construction or modification begins.[33] Permit applicants must demonstrate, among other things, that the proposed new source or modification will not violate or worsen a violation of a NAAQS or that, in areas complying with the NAAQS, it will not exceed the increments of increased air pollution allowed under Prevention of Significant Deterioration (PSD) regulations.[34]

The CAA defines *modern pollution controls* as the "best available control technology" (BACT), which would achieve the maximum degree of emissions reductions, taking into consideration

Power Plants: Frequently Asked Questions, by (name redacted) et al.

[29] Order in Pending Case, West Virginia v. EPA (S. Ct. No. 15A773, Feb. 9, 2016), https://www.supremecourt.gov/orders/courtorders/020916zr_21p3.pdf.

[30] For additional information regarding the CPP litigation, see CRS Report R44480, *Clean Power Plan: Legal Background and Pending Litigation in West Virginia v. EPA*, by (name redacted), and CRS Legal Sidebar WSLG1797, *Update: D.C. Circuit Pauses the Clean Power Plan Litigation*, by (name redacted)

[31] For the proposed repeal, see EPA, "Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Proposed Rule," 82 *Federal Register* 48035, October 16, 2017. For additional analysis of the proposed repeal, see CRS Legal Sidebar LSB10016, *EPA Proposes to Repeal the Clean Power Plan*, by (name redacted)

[32] EPA, "State Guidelines for Greenhouse Gas Emissions from Existing Electric Utility Generating Units," 82 *Federal Register* 61507, December 28, 2017.

[33] The NSR permit is a legal document that establishes site-specific requirements for the source, detailing approved types of construction, emission limits during operation, monitoring and reporting requirements, and other construction and operating conditions. State and local permitting agencies generally implement NSR and issue the permits. EPA generally oversees the state's implementation. For general overview, see EPA, *Final Report on Review of Agency Actions That Potentially Burden the Safe, Efficient Development of Domestic Energy Resources Under Executive Order 13873*, October 25, 2017, p. 2.

[34] CAA §165(a), 42 U.S.C. §7475(a). CAA §173(a), 42 U.S.C. §7503(a).

energy, environmental, and economic impacts.[35] The way that the CAA applied NSR to existing facilities is described as "grandfathering," meaning that facilities that were in existence before August 7, 1977, were not required to install BACT immediately following enactment of the 1977 CAA amendments. Rather, the NSR provisions did not require existing facilities to install BACT until such facilities made major modifications.[36] This approach was premised in part on an expectation that the "grandfathered" facilities would "either be upgraded or replaced over time and that, whenever changes were made later, existing facilities would install new, cleaner technologies to prevent or control air pollution."[37]

Historically, NSR applicability determinations have been contentious and extensively litigated.[38] The CAA broadly defines *modification* as "any" physical or operational change in a stationary source "that increases the emissions of any air pollutant or results in the emission of any air pollutant not previously emitted."[39] EPA and state air pollution control agencies have interpreted this definition to implement NSR through regulations and policy guidance. EPA's interpretation of *modification* under the NSR program has been subject to various legal challenges. Since 1974, EPA has construed the term to not include "routine maintenance, repair, and replacement" at a stationary source[40]—despite the CAA's inclusion of "any" physical or operational change that increases emissions in its definition of *modification*.[41] Courts have long accepted this agency-created exemption as reasonable.[42] For additional discussion about legal interpretations of NSR applicability, see CRS Report R43699, *Key Historical Court Decisions Shaping EPA's Program Under the Clean Air Act*, by (name redacted)

[35] Specifically, CAA Section 169(3) defines BACT as "an emission limitation based on the maximum degree of reduction of each pollutant subject to regulation under this Act emitted from or which results from any major emitting facility, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems, and techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques for control of each such pollutant." 42 U.S.C. §7479(3).

[36] William S. Eubanks, "The Clean Air Act's New Source Review Program: Beneficial to Public Health or Merely a Smoke-and-Mirrors Scheme?," *Journal of Land, Resources and Environmental Law*, vol. 29 (2009), p. 364. See also CAA §165(a); 42 U.S.C. § 7475(a).

[37] National Academy of Public Administration, *A Breath of Fresh Air: Reviving the New Source Review Program*, April 2003, p. 13, https://www.napawash.org/studies/academy-studies/a-breath-of-fresh-air-reviving-the-new-source-review-program.

[38] For discussion of key legal decisions on NSR, see CRS Report R43699, *Key Historical Court Decisions Shaping EPA's Program Under the Clean Air Act*, by (name redacted)

[39] CAA Section 111(a)(4), 42 U.S.C. Section 7411(a)(4), defines *modification* for purposes of the NSPS section of the Clean Air Act. CAA Section 169(2)(C), 42 U.S.C. Section 7479(2)(C), specifies that that definition applies as well within the PSD portion of the statute.

[40] 40 C.F.R. §60.14(e) (as to applicability of NSPS); 40 C.F.R. §52.21(b)(2)(iii)(a) (as to applicability of PSD program).

[41] CAA §111(a)(2); 42 U.S.C. §7411(a)(2).

[42] See, for example, Wisconsin Elec. Power Co. v. Reilly, 893 F.2d 901,906 (7th Cir. 1990).

The ACE Proposal

Proposed Emission Guidelines to Replace the CPP

EPA proposed to replace the CPP with revised emission guidelines for existing fossil fuel steam generating units,[43] which are largely coal-fired units.[44] Specifically, EPA proposed a new BSER for these electric generating units (EGUs) based on heat rate improvement (HRI) measures, discussed below. EPA did not propose a BSER for other types of EGUs, such as stationary combustion turbines, which includes NGCC units.

Under the proposal, states would establish unit-specific performance standards based on the list of candidate technologies identified by EPA and other considerations, such as the remaining useful life of the unit. In other words, EPA would not establish a numeric performance standard for steam EGUs, as the agency did as part of the CPP.

EPA based the proposal on its finding that the BSER set in the CPP exceeded EPA's statutory authority by using measures that applied to the power sector rather than measures carried out within an individual facility. EPA stated that under Section 111(d), BSER should "be determined by evaluating technologies or systems of emission reduction that are applicable to, at, and on the premises of the facility for an affected source."[45]

EPA also proposed revisions to the corresponding emission guidelines in order to clarify the roles of the agency and of states under Section 111(d) and to "provide states with needed time and flexibility to accomplish their role."[46] The ACE proposal would alter the CPP's allocation of tasks for establishing emission standards between EPA and the states. Under ACE, EPA would continue to determine "nationally applicable BSER," but the states would establish numeric performance standards based on source-specific considerations.[47] EPA noted that the CAA directs EPA to allow states to account for source-specific factors, such as the remaining useful life of the source, when developing performance standards.[48]

[43] A steam unit generates electricity by creating heat, which creates high pressure steam. The unit releases the steam, which rotates turbines, thereby generating electricity. Coal-fired steam EGUs burn crushed coal to heat water into steam. For a general description of how coal-fired power plants generate electricity and potential efficiency improvements, see CRS Report R43343, *Increasing the Efficiency of Existing Coal-Fired Power Plants*, by (name redacted) .

[44] Based on data from the Emissions & Generation Resource Integrated Database (eGRID), coal-fired steam generation (MWh) accounted for 92% of total fossil-fuel-fired steam generation in 2016, https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid. Natural gas and petroleum accounted for the remaining 8% of fossil-fuel fired steam generation. Nuclear power plants also use steam to generate electricity.

[45] ACE Proposal, p. 44748.

[46] EPA, *Fact Sheet: Proposed Affordable Clean Energy Rule—Overview*, 2018, p. 2, https://www.epa.gov/sites/production/files/2018-08/documents/ace_overview_0.pdf. See also ACE Proposal, pp. 44749 and 44769.

[47] ACE Proposal, p. 44748.

[48] ACE Proposal, p. 44748.

Proposed BSER for Existing Coal-Fired Power Plants

The ACE proposal applies a narrower interpretation of BSER compared to the CPP. Specifically, EPA proposed to define BSER for existing, fossil fuel steam EGUs[49] as on-site HRI.[50]

The ACE proposal would limit the BSER for CO_2 emissions to existing fossil fuel steam EGUs, which are largely coal-fired units. While the ACE preamble discusses the BSER based on existing coal-fired EGUs, the proposal's applicability to other existing fossil-fuel-fired steam EGUs—namely natural gas steam units and fuel oil units—is ambiguous.[51] In particular, EPA proposed to define *affected EGU* as a fossil-fuel-fired "steam generating unit" that exceeds a specified nameplate capacity and base load rating.[52]

The ACE preamble specifies that it would not establish BSER for other types of existing EGUs. EPA proposed to exclude integrated gasification combined cycle units and stationary combustion turbines (e.g., NGCC units) from the definition of *affected source*. EPA stated that it could not establish BSER for these sources because it did not have sufficient information "on adequately demonstrated systems of emission reduction—including HRI opportunities—for existing natural gas-fired stationary combustion turbines."[53]

For the CPP, EPA took a broader view of BSER for existing power plants and based it on three "building blocks": (1) HRI at coal-fired EGUs, (2) shifting generation from higher-emitting coal units to lower-emitting NGCC units, and (3) shifting generation from fossil fuel units to renewable energy generation. From these building blocks, the agency established two national CO_2 emission performance standards, one for fossil steam units (e.g., coal-fired units) and one for stationary combustion turbines (e.g., NGCC units).[54] Based on these national standards, EPA calculated emission reduction targets for each state. The CPP allowed states to choose various options to meet those emission targets.[55]

HRI and Potential Emission Impacts

The "heat rate" measures the amount of energy that a power plant uses to generate one kilowatt-hour of electricity.[56] A power plant with a lower, more efficient heat rate uses less fuel to generate

[49] A steam unit generates electricity by creating heat, which creates high pressure steam. The unit releases the steam, which rotates turbines, thereby generating electricity. Coal-fired steam EGUs burn crushed coal to heat water into steam. For a general description of how coal-fired power plants generate electricity and potential efficiency improvements, see CRS Report R43343, *Increasing the Efficiency of Existing Coal-Fired Power Plants*, by (name redacted) .

[50] Similar to the CPP, the proposed BSER in ACE targets CO_2 emissions. Under ACE, EPA proposed to establish emission guidelines for GHGs based on HRI that "target achieving lower carbon dioxide (CO_2) emission rates at affected EGUs" (ACE Proposal, p. 44808).

[51] An EPA official confirmed this characterization of the scope of affected sources (personal correspondence with CRS on 9/7/18).

[52] See proposed 40 C.F.R. §60.5805a.

[53] ACE Proposal, p. 44755.

[54] The CPP defined *stationary combustion turbine* to mean the equipment "comprising any simple cycle stationary combustion turbine, any combined cycle combustion turbine, and any combined heat and power combustion turbine based system." The definition also clarified that if a stationary combustion engine "burns any solid fuel directly it is considered a steam generating unit." For complete definition, see CPP Final Rule, p. 64961.

[55] For more detail about implementation of BSER under the CPP, see CRS Report R44341, *EPA's Clean Power Plan for Existing Power Plants: Frequently Asked Questions*, by (name redacted) et al. .

[56] EIA, *Analysis of Heat Rate Improvement Potential at Coal-Fired Power Plants*, May 19, 2015, https://www.eia.gov/analysis/studies/powerplants/heatrate/.

the same amount of electricity as a power plant with a higher heat rate. Using less fuel per kilowatt-hour may result in lower emissions of CO_2 as well as sulfur dioxide and nitrogen oxides.[57]

HRI can also lead to greater use of the more efficient fossil-fuel-fired power plants, which contributes to a "rebound effect."[58] That is, efficiency gains may lead to increased electricity generation by fossil-fuel-fired plants instead of relying on other electricity generation technologies, thereby increasing absolute emissions and, to some extent, offsetting the emission reductions from the HRI.

According to EPA, its ACE analysis "indicates that the system-wide emission decreases due to reduced heat rate are likely to be larger than any system-wide increases due to increased operation."[59] In the CPP, EPA raised concerns about the rebound effect—particularly when using an HRI approach in isolation (as is done in the ACE proposal)—and concluded in 2015 that a combined approach using all three building blocks would alleviate such concerns. Specifically, EPA stated that

> applying building block 1 [HRI at coal-fired EGUs] in isolation can result in a "rebound effect" that undermines the emissions reductions otherwise achieved by heat rate improvements…. [T]he building block 1 measures described below cannot by themselves constitute the BSER because the quantity of emission reductions achieved—which is a factor that the courts have required EPA to consider in determining the BSER—would be of insufficient magnitude in the context of this pollutant and this industry. The potential rebound effect, if it occurred, would exacerbate the insufficiency of the emission reductions. However, applying building block 1 in combination with other building blocks can address this concern.[60]

See "CO2 Emissions Projections" later in this report for a more detailed discussion about rebound effects in the context of EPA's CO_2 emission projections under ACE and the CPP.

States Establish Performance Standards Using "Candidate Technologies"

Under ACE, EPA is not proposing specific performance standards for the BSER.[61] EPA stated that the agency is not required to establish a performance standard that "presumptively reflects such degree of emission reduction which is achievable through application of the BSER, as that is appropriately the states' role."[62]

Instead, EPA proposed a list of "candidate technologies" of HRI measures that constitute the BSER.[63] States could use this list to establish standards of performance for existing steam-fired units under Section 111(d). Specifically, states would need to evaluate each HRI measure on the candidate technology list to (1) determine which ones are appropriate for each power plant and

[57] EIA, *Analysis of Heat Rate Improvement Potential at Coal-Fired Power Plants*.

[58] ACE Proposal, pp. 44756 and 44761.

[59] ACE Proposal, p. 44761. For a summary of EPA's ACE analysis—including the level of potential HRI modeled and the estimated emission impacts—see "Estimated Impacts of the ACE Proposal."

[60] EPA concluded that limiting BSER to building block 1 could "weaken or potentially even eliminate the ability of building block 1 to achieve CO_2 emission reductions." See CPP Final Rule, pp. 64758 and 64787.

[61] ACE Proposal, p. 44764.

[62] Furthermore, the agency stated that a presumptive standard "could be viewed as limiting a state's ability to deviate from the prescribed methodology and that the approach could ultimately be more limiting than helpful." ACE Proposal, p. 44764.

[63] ACE Proposal, p. 44756.

(2) establish the source-specific "standard of performance that reflects the degree of emission reduction" from application of the technology.[64]

The candidate technologies list includes HRI measures that EPA determined were "most impactful."[65] The list of candidate measures, which the agency based partly on a 2009 EPA-funded study,[66] includes steam turbine blade upgrades—which according to EPA, may offer the greatest potential for HRI—seal improvements to reduce air leaks, and use of computer models that can optimize combustion conditions.[67] The proposed rule does not explicitly identify criteria used to classify these particular measures as the "most impactful," though it presents the estimated range of HRI potential for each listed candidate technology.[68] EPA also considered the cost of the candidate technology measures, reporting estimates from the 2009 study.

EPA proposes to allow affected sources to use "either BSER technologies or some other non-BSER technology or strategy" to comply with the standards established in the state plan.[69] EPA identified examples of non-BSER technologies that were not on the candidate technologies list, including carbon capture and storage and fuel co-firing (natural gas or certain biomass). EPA noted, however, that the agency "takes no position regarding whether there may be other methods or approaches to meeting such a standard."[70]

Proposed Flexibilities for States to Establish Performance Standards

In ACE, EPA proposes that states have "considerable flexibility" in establishing performance standards generally and "considerable latitude for implementing measures and standards" for affected EGUs specifically.[71] EPA proposes that states may account for various factors, including the remaining useful life of the source, when establishing unit-specific performance standards.[72] Consideration of source-specific factors would allow states to establish less stringent standards "than would otherwise be suggested by strict implementation of the BSER technologies."[73]

EPA notes that Congress explicitly identified one factor—remaining useful life of the source—in the CAA and proposes to codify this and other factors in its implementing regulations.[74] These factors include "unreasonable cost of control resulting from plant age, location, or basic process design" and "physical impossibility of installing necessary control equipment."[75]

EPA also proposed to allow states to include in their plans "emissions averaging among [affected] EGUs across a single facility" but not between affected and non-affected units or between units at

[64] EPA, *Fact Sheet: Proposed Affordable Clean Energy Rule—Overview*, 2018, p. 1. See also ACE Proposal, p. 44756.

[65] ACE Proposal, p. 44756.

[66] Sargent and Lundy, *Coal-Fired Power Plant Heat Rate Reductions*, January 22, 2009, https://www.epa.gov/sites/production/files/2015-08/documents/coalfired.pdf.

[67] ACE Proposal, p. 44757.

[68] EPA stated that the "actual performance for each of the candidate technologies will be unit-specific and will depend upon a range of unit-specific factors." ACE Proposal, p. 44763. For estimated range of HRI potential, see ACE Proposal, Table 1, p. 44757.

[69] ACE Proposal, p. 44765.

[70] ACE Proposal, p. 44765.

[71] ACE Proposal, p. 44765.

[72] ACE Proposal, p. 44766.

[73] ACE Proposal, p. 44764.

[74] 42 U.S.C. §7411(d)(1).

[75] ACE Proposal, p. 44766.

separate facilities.[76] EPA identified several concerns about averaging between affected and non-affected units at the same facility, in particular that it would be "contrary to the intention of the rule which is to focus on reducing the rate at coal-fired EGUs when they run, not to reduce the amount they run."[77] Averaging across existing affected EGUs at a single facility would be consistent with the proposed BSER, according to EPA's determination. However, EPA determined that "legal and practical concerns may weigh against the inclusion of averaging and trading between existing sources" located at different facilities.[78] EPA acknowledged that averaging and trading could provide states flexibility, however, and requested comment on ways to permit trading between affected units without "encouraging generation shifting."[79]

Compliance Timelines

EPA's ACE proposal would allow states to determine the appropriate compliance deadlines for affected units based on the standards of performance determined as part of the state plan process (discussed below). That is, EPA proposes that "states will include custom compliance schedules for affected EGUs as part of their state plan."[80] States that choose a compliance schedule extending more than 24 months beyond the submission of the state plan would have to specify "legally enforceable increments of progress for that source" in the state plan.[81]

Under the CPP, EPA directed states to establish interim targets that would be measured between 2022 and 2029. The CPP also required states to demonstrate their progress in implementing a gradual application of BSER with "glide paths" that the states identify for reductions in three time periods: 2022-2024, 2025-2027, and 2028-2029.

Proposed Revisions to Regulations That Implement Section 111(d) Emission Guidelines

The second action that EPA proposed in ACE would revise the "general implementing" regulations (40 C.F.R. Part 60, Subpart B). Originally promulgated in 1975, these regulations establish procedures for state plans. EPA determined that these regulations "do not reflect section 111(d) in its current form as amended by Congress in 1977, and do not reflect section 110 in its current form as amended by Congress in 1990."[82] In particular, EPA seeks to codify its current legal interpretation that states have "broad discretion in establishing and applying emissions

[76] ACE Proposal, p. 44767.

[77] ACE Proposal, p. 44767. The term *unit* is used as shorthand for an EGU. In general, an individual facility or power plant may have more than one unit that generates electricity. The ACE proposal would establish emission guidelines for GHGs based on HRI that "target achieving lower carbon dioxide (CO_2) emission rates at affected EGUs" (ACE Proposal, p. 44808). ACE would define *affected EGU* as a fossil-fuel-fired "steam generating unit" that exceeds a specified nameplate capacity and base load rating. (See proposed 40 C.F.R. §60.5805a.)

[78] For example, EPA "is concerned that averaging and trading across affected sources (or between affected sources and non-affected sources, e.g., wind turbines) would be inconsistent" with the agency's proposed interpretation that BSER is "limited to measures that apply at and to an individual source" (ACE Proposal, p. 44767).

[79] EPA stated that averaging that includes non-affected units may not actually reduce emissions if it involves units that would have been operating anyway. EPA further stated that generation shifting to lower emitting units is "contrary to the intention of the rule which is to focus on reducing the rate at coal-fired EGUs when they run, not to reduce the amount they run" (ACE Proposal, pp. 44767-44768).

[80] ACE Proposal, p. 44763.

[81] ACE Proposal, p. 44763.

[82] ACE Proposal, p. 44769.

standards consistent with the BSER."[83] EPA therefore proposed changes that would, among other things, revise some definitions, lengthen the time for development and review of state plans, add a step for EPA to determine whether state plan submissions are complete, and modify a variance provision.

EPA proposed to codify the revised implementing regulations in a new subpart—40 C.F.R. Part 60, Subpart Ba. Subpart Ba would apply to the proposed ACE emission guidelines for affected EGUs and corresponding state plans as well as any future emission guidelines and associated state plans issued under Section 111(d).[84]

Proposed Revisions to Definitions

EPA proposed to redefine the phrase *emission guideline* as a "final guideline document" to reflect the agency's current interpretation that Section 111 does not require EPA to establish a presumptive standard.[85] The current regulations define *emission guideline* as a "guideline set forth in subpart C of this part, or in a final guideline document published under §60.22(a)."[86] EPA concluded that the current regulatory definition has "arguably required EPA to provide a presumptive emission standard"—that is, a standard that reflects the degree of emission limitation achievable through BSER application.[87]

EPA determined that nothing in CAA Section 111(a)(1) or Section 111(d) "compels EPA to provide a presumptive standard." Moreover, the agency regards a presumptive standard as a potential limitation, because it "could be viewed as limiting a state's ability to deviate from the prescribed methodology."[88] EPA proposed instead to provide "information" about the emission limit that could be achieved.[89]

EPA also proposed to replace the term *emission standard* with *performance standard*. The current regulations, which EPA promulgated in 1975, reflect the CAA of 1970 (P.L. 91-604), which required state plans to include "emission standards" for existing sources.[90] EPA has since twice amended the regulatory definitions, including for *emission standards*. Congress replaced "*emission standards*" with *standard of performance* in the CAA amendments of 1977 (P.L. 95-95).[91] While EPA has since amended some of the definitions in this section,[92] the agency stated

[83] ACE Proposal, p. 44748.

[84] ACE Proposal, pp. 44769-44770.

[85] EPA proposed that *emission guideline* "means a final guideline document published under §60.22a(a), which includes information on the degree of emission reduction achievable through the application of the best system of emission reduction which (taking into account the cost of such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator has determined has been adequately demonstrated for designated facilities." ACE Proposal, p. 44804. See also pp. 44764 and 44770-44771 for discussion about presumptive standards.

[86] 40 C.F.R. §60.21(e).

[87] ACE Proposal, p. 44770.

[88] ACE Proposal, p. 44771. Furthermore, the agency stated that a presumptive standard "could ultimately be more limiting than helpful." ACE Proposal, pp. 44764 and 44770-44771.

[89] ACE Proposal, pp. 44764 and 44771.

[90] ACE Proposal, p. 44772.

[91] ACE Proposal, p. 44772.

[92] See EPA, "Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units; Final Rule," 70 *Federal Register* 28649, May 18, 2005. See also EPA, "National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-

that it has not revised the regulations to reflect the "standard of performance"[93] terminology from the CAA amendments of 1977.

Proposal to Lengthen Timeline for Development and Review of State Plans

EPA proposed to lengthen the time periods for the development and review of state plans as well as federal plans under Section 111(d).[94] EPA cited workload considerations as one reason for lengthening the timelines.[95] EPA also stated that it proposed this change in order to be consistent with the timelines for development and review of state implementation plans and federal implementation plans under Section 110.[96]

The existing regulations require state plans to be submitted to EPA within nine months after publication of a final emission guideline unless otherwise specified in an emission guideline.[97] For example, the CPP required each state to submit an initial state plan within 13 months, at which time the state could seek a two-year extension for the submittal of its final plan.[98] EPA is proposing to provide states with three years after the notice of the availability of the final emission guideline to adopt and submit a state plan to EPA.[99]

The existing regulations provide EPA four months after the submittal deadline to review the state plan submissions. EPA's proposal would give the agency six months to determine whether a state plan is complete.[100] Once the EPA made a determination of completeness, the agency would have 12 months to review the state plan.[101]

The completeness determination would be a new addition to the Section 111(d) implementing regulations. EPA proposed 14 criteria—eight items pertaining to administrative issues and six items pertaining to the state plan's technical support—that the agency would consider to determine whether the state plan is complete.[102]

Finally, if states do not submit an approvable state plan, EPA would promulgate a federal plan. The current regulations direct EPA to promulgate a federal plan six months after the state's

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Commercial-Institutional Steam Generating Units; Final Rule," 77 *Federal Register* 9447, February 16, 2012.

[93] CAA Section 111(a) defines *standard of performance* as "a standard for emissions of air pollutants which reflects the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated" (42 U.S.C. §7411(a)(1)).

[94] ACE Proposal, p. 44771.

[95] ACE Proposal, p. 44771.

[96] ACE Proposal, p. 44771. Section 111(d) of the CAA directs EPA to establish a state plan procedure "similar to that provided by section 110" (42 U.S.C. §7411(d)(1), 42 U.S.C. §7410).

[97] ACE Proposal, p. 44771.

[98] CPP Final Rule, p. 64669. After EPA promulgated the CPP, two states reported intentions to submit final state plans in 2016, and another state reported that it would submit a final plan in 2017. According to EPA, "at least twenty-five states suggested they would submit the initial submittal due in September 2016." At least two states reported that they would not submit a state plan at all. See EPA, *Basis for Denial of Petitions to Reconsider and Petitions to Stay the CAA Section 111(d) Emission Guidelines for Greenhouse Gas Emissions and Compliance Times for Electric Utility Generating Units*, Appendix 1—States' Progress and Trends, January 2017, p. 5, https://archive.epa.gov/epa/sites/production/files/2017-01/documents/cpp_rd_appendix_1_-_states_progress_and_trends.pdf.

[99] ACE Proposal, p. 44771.

[100] ACE Proposal, p. 44772.

[101] ACE Proposal, p. 44772.

[102] ACE Proposal, pp. 44770, 44772.

submittal deadline.[103] EPA proposed that the agency would have two years to promulgate a federal plan after finding that a state has failed to submit a complete plan or after EPA disapproves a state plan.[104]

Proposed Revisions to Variance Provisions

The current implementing regulations specify that state plans for health-based pollutants must be as stringent as the emission guideline established by EPA unless the state demonstrates, on a case-by-case basis, that a source meets certain factors. This so-called variance provision would allow a state to apply less stringent standards for health-based pollutants if the state demonstrates any of the following factors:

- Unreasonable cost of control resulting from plant age, location, or basic process design;
- Physical impossibility of installing necessary control equipment; or
- Other factors specific to the facility (or class of facilities) that make application of a less stringent standard or final compliance time significantly more reasonable.[105]

Under ACE, EPA proposed a new variance provision that includes these three factors verbatim but also explicitly accounts for a statutory factor—the remaining useful life of the source.[106]

Proposed Change to New Source Review

Under ACE, EPA proposed to revise the test used to determine whether physical or operational changes to an EGU constitute a "major modification" that triggers NSR. The proposed revision would not be mandatory. Rather, states would have the option to decide whether to incorporate it into state regulations.[107] EPA expects that the proposed NSR revision would "help prevent NSR from being a barrier to the implementation of efficiency projects at EGUs" for states that adopt the new applicability test.[108]

The current test for NSR permits, which is codified in the NSR regulations,[109] requires consideration of emissions increases on an *annual* basis. EPA proposed to consider whether the modification at an existing EGU would increase emissions on an *hourly* basis. Under ACE, NSR would not be triggered if the modification to an existing EGU does not increase emissions on an hourly basis. These EGUs would not be required to install additional pollution controls, even if the modification leads to an increase in the annual emissions.[110]

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[103] ACE Proposal, p. 44771.

[104] ACE Proposal, p. 44771.

[105] 40 C.F.R. §60.24(f). Paragraph c specifies that state plans for health-based pollutants must be as stringent as the emission guideline established by EPA.

[106] For CAA link to "remaining useful life," see 42 U.S.C. §7411(d)(1)(B). For proposed variance, see ACE Proposal, pp. 44773 and 44805 (§60.24(e)). The proposed variance applies to both health- and welfare-based pollutants.

[107] ACE Proposal, p. 44782.

[108] Some stakeholders have commented that NSR requirements discourage facilities from undertaking "beneficial plant improvement projects" such as HRI. Summarized in ACE Proposal, pp. 44746 and 44775.

[109] 40 C.F.R. §§52.21(b)(2)(i), 52.21(b)(23)(i). See also 40 C.F.R. Part 50, Subpart I.

[110] On the other hand, if the modification increases hourly emissions, the owner or operator would need to continue with the NSR applicability test as it is currently codified (ACE Proposal, pp. 44780-44781).

EPA acknowledged that adoption of HRI measures could increase a facility's annual emissions despite the decrease in the hourly rate of emissions.[111] For example, EGUs that adopt HRI measures may operate more efficiently, which in turn may lower their operating costs. The reduced operating costs may lead these units to be dispatched for more hours in a year, thereby increasing emissions on an annual basis. Under existing law, the higher annual emissions may trigger the NSR process.[112] Under ACE, however, the annual emissions would not be considered in states that adopt the revised NSR test. That is, facilities in those states would not be required to consider the potential increase in annual emissions, provided the hourly rate of emissions does not increase.

EPA explained the basis for the proposed NSR revision partly as a way to facilitate "prompt implementation of a revised CAA Section 111(d) standard for EGUs."[113] EPA stated that "over the years, some stakeholders have asserted that the NSR rules discourage companies" from implementing energy efficiency projects.[114] Other stakeholders, however, have suggested that the proposed NSR revision has broader implications for the energy and air quality programs.[115] For example, one state agency described ACE as "a significant overhaul" of NSR that would increase the number of "projects that are excluded from requirements to install reasonable controls," thereby allowing "poorly controlled and grandfathered sources to continue to operate without cost-effective controls."[116]

Moreover, it is uncertain how the proposed NSR revision would affect each state's air quality objectives. In general, it is difficult to discern the incremental effect of the proposed NSR change from the scenarios that EPA analyzed. As a result, the extent to which the proposed NSR provisions contribute to the estimated emissions changes and the associated projections of air quality impacts is unclear.[117]

EPA conducted air quality modeling—based on the agency's estimated emission changes under several implementation scenarios—and projected that ACE would increase ambient concentrations of particulate matter and ozone in some areas relative to the CPP. While EPA's air quality modeling did not identify areas that would experience a change in attainment status as a result of ACE, these projections do not account for potentially important factors, such as

[111] EPA concluded, based on its regulatory impact analysis, that despite the potential for annual emissions to increase at one facility, the emission decreases across the entire sector due to efficiency improvements "are likely to be larger" than sector-wide emission increases due to increased operation (ACE Proposal, p. 44761).

[112] ACE Proposal, p. 44775.

[113] ACE Proposal, pp. 44775-44776.

[114] ACE Proposal, p. 44775. EPA has previously sought to address this concern through the rulemaking process, most recently through a 2007 proposed rulemaking that was never finalized. See EPA, "Supplemental Notice of Proposed Rulemaking for Prevention of Significant Deterioration and Nonattainment New Source Review: Emission Increases for Electric Generating Units; Proposed Rule," 72 *Federal Register* 26202, May 8, 2007.

[115] William T. Pound, Executive Director, National Conference of State Legislatures, et al., letter to Andrew Wheeler, EPA Administrator, September 13, 2018, https://www.regulations.gov, see EPA-HQ-OAR-2017-0355-21870.

[116] John Linc Stine, Commissioner, Minnesota Pollution Control Agency, letter to Andrew Wheeler, EPA Administrator, September 17, 2018, https://www.regulations.gov, see EPA-HQ-OAR-2017-0355-21873.

[117] EPA designed two of the three ACE scenarios to account for the proposed NSR change. The third ACE scenario does not account for the proposed NSR change. The level and cost of HRI improvements also vary among the three ACE scenarios, making it difficult to understand how much the proposed NSR revisions and assumed level of HRI affects the benefit-cost estimates. For summary of the scenarios, see EPA, *Regulatory Impact Analysis for the Proposed Emission Guidelines for Greenhouse Gas Emissions from Existing Electric Utility Generating Units; Revisions to Emission Guideline Implementing Regulations; Revisions to New Source Review Program* (hereinafter RIA), 2018, p. ES-3. In addition, the proposal may also have implications for interstate transport of air emissions. A discussion of these considerations is beyond the scope of this report.

implementation decisions made at the state level.[118] For example, the extent to which the actual impacts diverge from the agency's projections will depend in part on "a variety of federal and state decisions with respect to NAAQS implementation and compliance, including [PSD] requirements."[119] In addition, EPA's analysis did not account for federal initiatives that may extend the life of coal-fired power plants beyond planned retirement dates.[120] That is, actual emissions under ACE could be higher than estimated emissions if the coal-fired power plants that were assumed to retire in EPA's analysis continue operating beyond planned retirement dates.

ACE Does Not Address New Power Plants

The ACE proposal does not repeal or otherwise change CO_2 performance standards for new and modified power plants,[121] sometimes referred to as the "111(b) standards." Once EPA lists a source category, such as fossil-fuel-fired EGUs, Section 111(b) requires EPA to establish NSPS for new and modified sources within a listed source category.[122] Once EPA promulgates NSPS under Section 111(b) for new or modified sources in that category, EPA is to require the states, under 111(d), to submit plans establishing standards of performance for existing sources that would be subject to NSPS if they were new, unless the sources or the pollutants regulated by the NSPS are already subject to standards under other sections of the act.[123]

EPA promulgated the performance standards for new power plants in 2015 under CAA Section 111(b)—the "111(b) rulemaking"—concurrent to the 111(d) standards for existing plants in the CPP. Although the performance standards for new power plants remain in effect, EPA stated that it is "currently considering revising" them.[124]

ACE Does Not Reconsider the Endangerment Finding

In 2009, EPA made two findings under CAA Section 202: (1) that GHGs currently in the atmosphere potentially endanger public health and welfare and (2) that new motor vehicle emissions cause or contribute to that pollution. (Collectively, these findings are known as the "endangerment finding.") The endangerment finding triggered EPA's duty under CAA Section 202(a) to promulgate emission standards for new motor vehicles.[125]

In the 2015 NSPS rule for new and modified power plants,[126] EPA concluded that it did not need to make a separate endangerment finding under Section 111, which directs EPA to list categories

[118] RIA, pp. ES-23, 4-9, 4-30. While the RIA presents maps showing air quality changes under each scenario relative to the CPP baseline, it did not specify how air quality under the ACE scenarios would change relative to the alternative "No CPP" baseline.

[119] RIA, p. ES-23.

[120] Kathryne Cleary and Karen L. Palmer, *A Giant Rebound? How the Coupling of ACE and Federal Energy Policies to Protect Coal Could Drive Up CO_2 Emissions*, Resources for the Future, September 18, 2018, http://www.rff.org/blog/2018/giant-rebound-how-coupling-ace-and-federal-energy-policies-protect-coal-could-drive-co2.

[121] EPA, "Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units," Final Rule, 80 *Federal Register* 64509, October 23, 2015.

[122] 42 U.S.C. §7411(b)(1).

[123] 42 U.S.C. §7411(d)(1).

[124] ACE Proposal, p. 44751.

[125] EPA, "Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act; Final Rule," 74 *Federal Register* 66496, December 15, 2009.

[126] EPA, "Standards of Performance for Greenhouse Gas Emissions from New Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units," Final Rule, 80 *Federal Register* 64510, October 23, 2015.

of stationary sources that cause or contribute significantly to "air pollution which may reasonably be anticipated to endanger public health or welfare."[127] EPA reasoned that because EGUs had been listed previously under Section 111, it was unnecessary to make an additional endangerment finding for a new pollutant emitted by a listed source category.[128] The agency also argued that, even if it were required to make a finding, EGUs would meet that endangerment requirement given the significant amount of CO_2 emitted from the source category.[129]

The ACE proposal does not reconsider EPA's 2009 GHG endangerment finding or the conclusions related to the endangerment finding in the 2015 NSPS for new and modified power plants. EPA clarified that ACE is "not re-opening any issues" related to the trigger for power plant CO_2 standards under Section 111.[130] Without reconsidering the GHG endangerment finding, EPA appears to have a continuing obligation to limit emissions of CO_2 from power plants and other sources.[131]

Estimated Impacts of the ACE Proposal

EPA estimated the emission changes and the monetized benefits and costs under four scenarios, comparing each one to a baseline that assumed implementation of the CPP.[132] The first scenario—the "No CPP" scenario—modeled a world without either the CPP or the ACE proposal. The remaining three scenarios considered implementation of the ACE proposal and modeled different levels of HRI at corresponding levels of assumed capital costs at affected coal-fired EGUs in the contiguous United States.[133] EPA explained that data limitations required the agency to assume a uniform level of HRI and capital cost within each ACE scenario rather than modeling a "more customized HRI and cost functions to specific units."[134]

Projected Emission Impacts Under ACE

EPA projected that power sector emissions of CO_2, SO_2, and NO_x would increase under the ACE proposal compared to the CPP. For example, compared to the CPP in the year 2030, EPA estimated that CO_2 emissions would increase 3%[135] (47 million short tons to 61 million), SO_2 emissions would increase 5.0-5.9%[136] (45,000 short tons to 53,000), and NO_x emissions would

[127] 42 U.S.C. §7411(b)(1).

[128] 80 *Federal Register* at 64529. As discussed elsewhere in this report, the 111(b) rulemaking triggered the need to regulate existing power plants under CAA Section 111(d).

[129] 80 *Federal Register* at 64529.

[130] ACE Proposal, p. 44751.

[131] See Massachusetts v. EPA, 549 U.S. 497, 533 (2007) ("Under the clear terms of the Clean Air Act, EPA can avoid taking further action only if it determines that greenhouse gases do not contribute to climate change or if it provides some reasonable explanation as to why it cannot or will not exercise its discretion to determine whether they do.").

[132] The CPP baseline scenario does not assume any interstate trading, as was allowed by the CPP, and it does not include incremental demand-side energy efficiency investments. Instead, EPA included an additional CPP scenario that assumed that certain demand-side energy efficiency activities were undertaken as part of compliance with the CPP. Results from this scenario are included in **Table 1**.

[133] Each ACE scenario modeled applied the assumed level of HRI and the corresponding assumed capital costs uniformly to affected coal-fired EGUs in the contiguous United States. RIA, pp. ES-2, 1-7, 3-7.

[134] RIA, p. 3-9.

[135] RIA, p. ES-8.

[136] RIA, p. 3-16.

increase 4.1-5.0%[137] (32,000 short tons to 39,000) in the year 2030 under each of the ACE scenarios.[138]

EPA also projected that ACE would, in most scenarios, decrease CO_2, SO_2, and NO_x emissions compared to a baseline without the CPP.[139] For example, compared to a baseline without the CPP in the year 2030, EPA estimated that CO_2 emissions would decrease 1%[140] (13 million short tons to 27 million), SO_2 emissions would decrease 0.7-1.6%[141] (7,000 short tons to 15,000), and NO_x emissions would decrease 1.0-1.8%[142] (8,000 short tons to 15,000) in 2030 under ACE.[143] EPA also compared this No-CPP baseline to a CPP implementation scenario, which showed that CO_2 emissions would decrease 4%[144] (74 million short tons), SO_2 emissions would decrease 6.3%[145] (60,000 short tons), and NO_x emissions would decrease 5.7%[146] (47,000 short tons) in 2030.[147] In sum, EPA's projections show that, compared to a world without the CPP, ACE would generally reduce CO_2, SO_2, and NO_x emissions, but the reductions are lower than those projected for the CPP. As discussed below, however, the emissions estimates for the ACE scenarios are particularly uncertain given the "considerable uncertainty regarding the specific technology measures that might be applied by States."[148]

CO_2 Emissions Projections

This section compares projections of CO_2 emissions from each of the scenarios EPA modeled in its 2018 proposed rule and emission projections from other organizations.

EPA's ACE proposal and its supporting documents contain estimates of CO_2 emission projections in future years for several different scenarios,[149] including:

- **No CPP.** This scenario models a repeal of the CPP without any replacement. It assumes that none of the affected sources adopt HRI.[150]
- **CPP.** This scenario, which EPA refers to as its baseline scenario, assumes states use their mass-based targets to comply with the 2015 CPP. In particular, EPA

[137] RIA, p. 3-16.

[138] ACE Proposal, p. 44784. EPA reported these estimates in short tons. Applying a conversion factor (0.90718474 metric tons in a short ton) results in the following estimates: 43 million to 55 million metric tons CO_2; 41,000 to 48,000 metric tons SO_2; and 29,000 to 35,000 metric tons NO_x.

[139] EPA's projections showed an increase in SO_2 emissions (4 million short tons) under one of the ACE scenarios in 2025 compared to a baseline without the CPP that same year (ACE Proposal, p. 44784).

[140] RIA, p. ES-8.

[141] RIA, p. 3-17.

[142] RIA, p. 3-17.

[143] ACE Proposal, p. 44784. Applying a conversion factor (0.90718474 metric tons in a short ton) results in the following estimates: 12 million metric tons to 24 million CO_2; 6,000 metric tons to 14,000 SO_2; and 7,000 metric tons to 14,000 NO_x.

[144] RIA, p. 3-15.

[145] RIA, p. 3-17.

[146] RIA, p. 3-17.

[147] ACE Proposal, p. 44784. Applying a conversion factor (0.90718474 metric tons in a short ton) results in the following estimates: 67 million metric tons CO_2; 54,000 metric tons SO_2; and 43,000 metric tons NO_x.

[148] RIA, p. 3-1.

[149] For further details regarding these policy scenarios, see RIA, p. 3-7.

[150] RIA, p. 3-8.

assumes intrastate trading between covered sources but no incremental demand-side energy efficiency investments.[151]

- **CPP with demand-side energy efficiency.**[152] This scenario is the same as the above CPP scenario, except that it assumes that demand-side energy efficiency measures are undertaken as a compliance option under the CPP framework.[153]
- **ACE (2% HRI at $50/kilowatt).** This scenario models "modest improvements" in HRI in the absence of the NSR revisions also proposed in ACE.[154] The model required each affected coal-fired EGU to improve its heat rate by 2% at a capital cost of $50 per kilowatt. The model allowed a source to either adopt the improvement or retire, depending on the economics of either option.[155]
- **ACE (4.5% HRI at $50/kilowatt).** This scenario assumes implementation of the proposed NSR revisions and, at each source, models a 4.5% HRI at a capital cost of $50 per kilowatt. The model allowed a source to either adopt the improvement or retire, depending on the economics of either option.[156]
- **ACE (4.5% HRI at $100/kilowatt).** This scenario assumes implementation of the proposed NSR revisions and, at each source, models a 4.5% HRI at a capital cost of $100 per kilowatt. The model allowed a source to either adopt the improvement or retire, depending on the economics of either option.[157]

EPA's CO_2 projections show that, compared to a world without the CPP, ACE would generally reduce CO_2 emissions, but the reductions are lower than those projected for the CPP. See **Figure 3**, which indicates that EPA's projected CO_2 emissions are generally lower than recent historical emissions. **Figure 3** also presents a magnified view of EPA's scenario projections in the subset box, which shows that CO_2 emissions do not vary much under the different ACE scenarios.

While uncertainty is inherent in any projection, the emission estimates for the ACE scenarios may contain more uncertainty than the estimates for the CPP. The CPP would establish unit-specific, federally enforceable performance standards underpinning the state-specific emission rate and emission reduction targets. In contrast, the ACE proposal would not establish a numeric performance standard for coal-fired EGUs. The proposed rule authorizes states to determine performance standards at individual EGUs based on the technology options identified in EPA's proposed rule (i.e., BSER) and other considerations, such as the remaining useful life of the unit. EPA states that "affected sources may not be able to apply the technology options because they have already adopted these technologies, they are not applicable to the source, or for other

[151] RIA, p. 3-7.

[152] According to EPA, "demand-side energy efficiency refers to an extensive array of technologies, practices and measures that are applied throughout all sectors of the economy to reduce energy demand while providing the same, and sometimes better, level and quality of service." EPA, Technical Support Document, Greenhouse Gas Abatement Measures (supporting the CPP proposed rule), 2014, p. 5-3, https://archive.epa.gov/epa/sites/production/files/2014-06/documents/20140602tsd-ghg-abatement-measures.pdf.

[153] RIA, p. 3-35.

[154] RIA, p. 3-7.

[155] RIA, p. 3-7.

[156] RIA, p. 3-8.

[157] RIA, p. 3-8.

reasons."[158] For these reasons, EPA states that HRI outcomes of the proposed rule contain "considerable uncertainty."[159]

Another factor in the uncertainty of the emissions projections involves the "rebound effect." As discussed above (see "HRI and Potential Emission Impacts"), EPA raised concerns about the rebound effect in its 2015 CPP final rule, stating that "improved competitiveness and increased generation at the EGUs implementing heat rate improvements could weaken or potentially even eliminate the ability of building block 1 [i.e., HRI] to achieve CO_2 emission reductions." However, in its 2018 proposed rule, EPA stated that its "analysis indicates that the system-wide emission decreases due to reduced heat rate are likely to be larger than any system-wide increases due to increased operation."[160] A Resources for the Future study examined the emission impacts of the rebound effect with an "inside the fence line" approach and found that implementing an average fleet-wide HRI of 4% at coal-fired power plants could reduce CO_2 emissions at power plants by 2.6% in 2030 compared to a no-policy baseline scenario.[161] The study pointed out that this result was a national estimate and that eight states would see CO_2 emission increases (and corresponding increases in co-pollutants) at their power plants in 2030 (compared to a baseline scenario).

A more recent Resources for the Future analysis of rebound effects noted that the agency's analysis did not account for federal energy sector initiatives that may extend the life of coal-fired power plants beyond planned retirement dates.[162] That is, actual emissions under ACE could be higher than estimated emissions if the coal-fired power plants that were assumed to retire in EPA's analysis continue operating beyond planned retirement dates. As of October 2018, CRS is unaware of analyses other than the EPA's that model the ACE proposal and examine potential rebound effects.

[158] RIA, p. 3-1.

[159] RIA, p. 3-1.

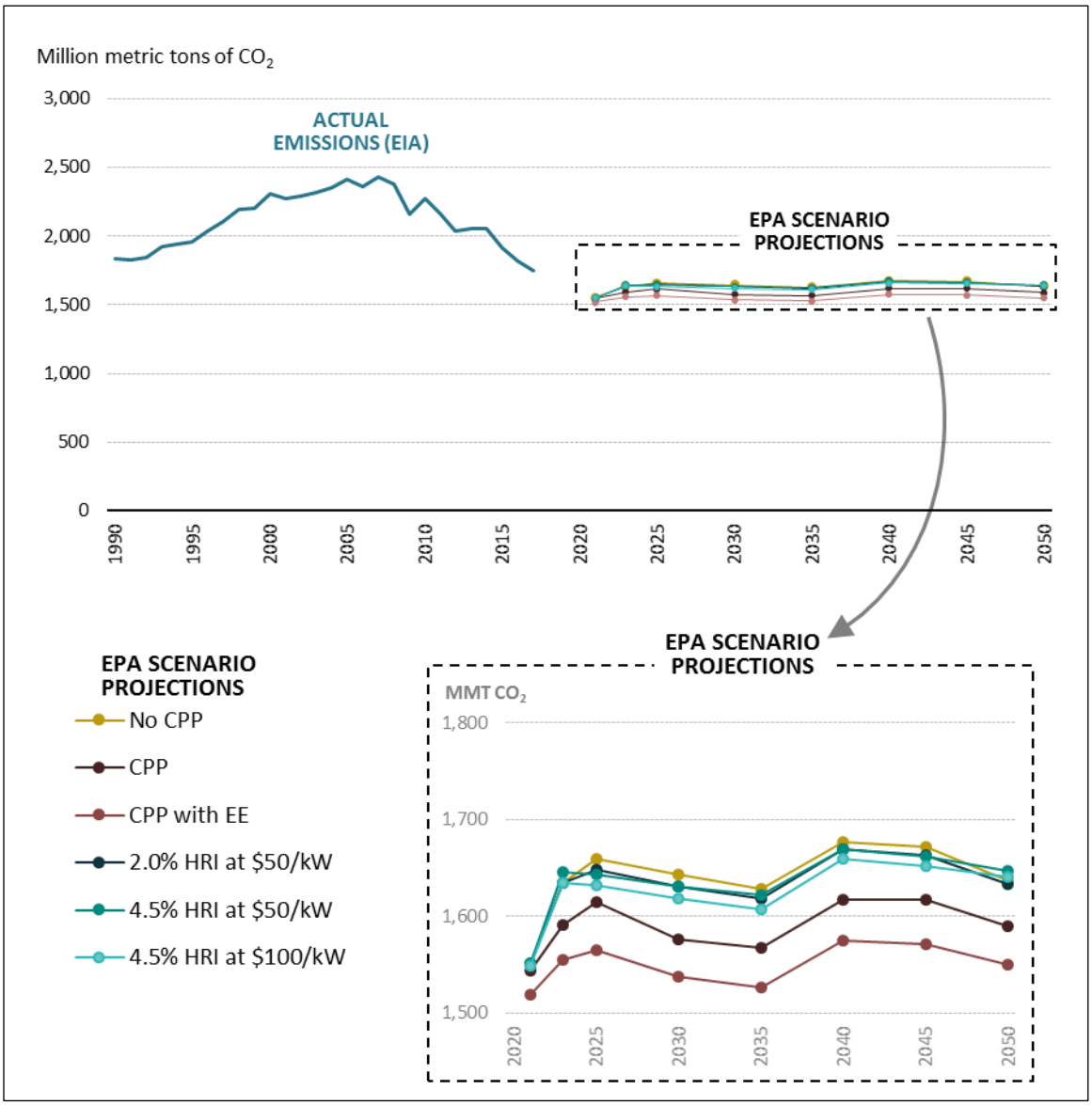
[160] ACE Proposal, p. 44761.

[161] Amelia Keyes et al., *Carbon Standards Examined: A Comparison of At-the-Source and Beyond-the-Source Power Plant Carbon Standards*, Resources for the Future, 2018. The authors stated that "a limitation of this study is that it develops analysis based on the electricity industry as it was configured in 2014. The industry has been undergoing substantial change, including retirement of many fossil units…. [I]t is not clear whether these changes would lead to a decrease or increase in the rebound effect and other unintended consequences of a heat rate improvement standard." The no-policy baseline scenario used energy demand projections from the 2013 Annual Energy Outlook and included state-level requirements for power sector emissions and renewable energy portfolio standards that were finalized as of 2013.

[162] Cleary and Palmer, *A Giant Rebound?*

Figure 3. CO_2 Emissions in the Electricity Sector

Actual Emissions Compared to EPA's Scenario Projections



Source: EPA, Analysis of the Proposed ACE Rule (modeling results), https://www.epa.gov/airmarkets/analysis-proposed-ace-rule; EIA, *Annual Energy Outlook 2018*, 2018.

In recent years, other organizations have prepared CO_2 emissions projections, comparing policy scenarios with and without the CPP. Selected results from the 2018 proposed rule and other groups are identified in **Table 1**. The emission estimates in **Table 1** include (1) electricity sector CO_2 emission projections for 2030 and (2) the percent reduction in 2030 compared to 2005 electricity sector CO_2 emission levels.[163]

[163] In recent years, 2005 emission levels have often been used as a benchmark for comparison and analysis. This is likely due to the U.S. GHG emission targets in the 2009 Copenhagen Accord (17% below 2005 levels by 2020) and the 2015 Paris Agreement (26%-28% below 2005 levels by 2025), which are both based on 2005 emission levels. In

Table 1. Selected Modeling Projections of CO_2 Emissions in the Electricity Sector

Source of Estimate	Scenario	CO_2 Emissions in 2030 (million metric tons)	Percent Reduction of CO_2 Emissions in 2030 Compared to 2005 Levels in Electricity Sector
EPA, ACE Proposed Rule (2018)	No CPP	1,643	32%
EPA, ACE Proposed Rule (2018)	2% HRI at $50/kW	1,631	32%
EPA, ACE Proposed Rule (2018)	4.5% HRI at $50/kW	1,630	33%
EPA, ACE Proposed Rule (2018)	4.5% HRI at $100/kW	1,619	33%
EPA, ACE Proposed Rule (2018)	CPP	1,576	34%
EPA, ACE Proposed Rule (2018)	CPP with demand-side energy efficiency	1,538	36%
EIA, AEO (2018)	No CPP, Reference Case	1,739	28%
EIA, AEO (2018)	CPP, Reference Case	1,534	36%
EIA, AEO (2017)	No CPP, Reference Case	1,886	21%
EIA, AEO (2017)	CPP, Reference Case	1,537	36%
EIA, AEO (2016)	No CPP, Reference Case	1,942	19%
EIA, AEO (2016)	CPP, Reference Case	1,559	35%
Rhodium Group (2018)	No CPP (CPP scenario not estimated)	1,571	35%
Rhodium Group (2017)	No CPP	1,774	26%
Rhodium Group (2017)	CPP	1,524	37%
EPA, Final CPP (2015)	No CPP	2,021	16%
EPA, Final CPP (2015)	CPP, Mass-Based Targets Case	1,645	31%

Source: EPA, *Regulatory Impact Analysis for the Proposed Emission Guidelines for Greenhouse Gas Emissions from Existing Electric Utility Generating Units; Revisions to Emission Guideline Implementing Regulations; Revisions to New Source Review Program*, 2018; EPA, *Regulatory Impact Analysis for the Clean Power Plan Final Rule*, 2015; EIA, *Annual Energy Outlook 2018*, 2018; EIA, *Annual Energy Outlook 2017*, 2017; EIA, *Annual Energy Outlook 2016*, 2016; Rhodium Group, "Taking Stock 2017: Adjusting Expectations for US GHG Emissions," 2017; Rhodium Group, "Taking Stock 2018," 2018. CRS converted short tons to metric tons in EPA's 2018 and 2015 analyses.

Notes: CPP = Clean Power Plan; HRI = heat rate improvement. According to EPA's GHG Emissions Inventory, Table 3-7, (2018), the 2005 CO_2 emissions level from the electricity sector was 2,401 million metric tons. This value is used in the table for comparison purposes. Other analyses may have used different values for 2005 emissions from the electricity sector, which may explain why some of the percentages above may differ slightly from the percentages identified in the original sources. For example, in EPA's 2015 CPP analysis, the agency used a value of 2,434 million metric tons, resulting in a percentage reduction of 32% instead of 31% as listed above.

Observations regarding the CO_2 emissions percentage reduction in 2030 compared to 2005 emissions levels include the following:

addition, during the debate over the 2015 CPP, EPA's estimate of the rule's emission reduction potential was measured in terms of 2005 emission levels in the electricity sector. Other groups prepared their own estimates using 2005 emission levels as a point of comparison.

- Compared to the other studies, the emissions projections from EPA's 2018 ACE proposed rule display a more narrow range across the policy scenarios EPA modeled. For example, the CPP and non-CPP scenarios differ by 2% (4% with the CPP demand-side efficiency scenario). The estimated percentage emission reductions between the ACE proposed HRI scenarios and the CPP and non-CPP scenarios range between 0% and 1%.
- The emission reduction differences between CPP and non-CPP scenarios are greater in the studies from earlier years. For example, a comparison between CPP and non-CPP scenarios from the past three EIA analyses shows the percentage difference has decreased from 16% (in 2016) to 8% (in 2018). This reflects the fact that many of the changes EPA expected to result from the CPP (e.g., natural gas and renewables replacing coal-fired units) have already happened as the result of market forces in the electric power sector.
- The reference case scenarios in more recent studies project significantly lower emissions in 2030 when compared to earlier studies. For example, the reference case in the 2015 EPA analysis projected an emission reduction of 16% below 2005 levels in 2030, while the 2018 EPA analysis projected an emission reduction of 32% below 2005 levels in 2030. As EPA notes in its 2018 analysis, "over the past few years, the power sector has changed notably."[164] In particular, EPA's 2015 projections do not include the renewable energy tax extensions enacted in December 2015.[165]

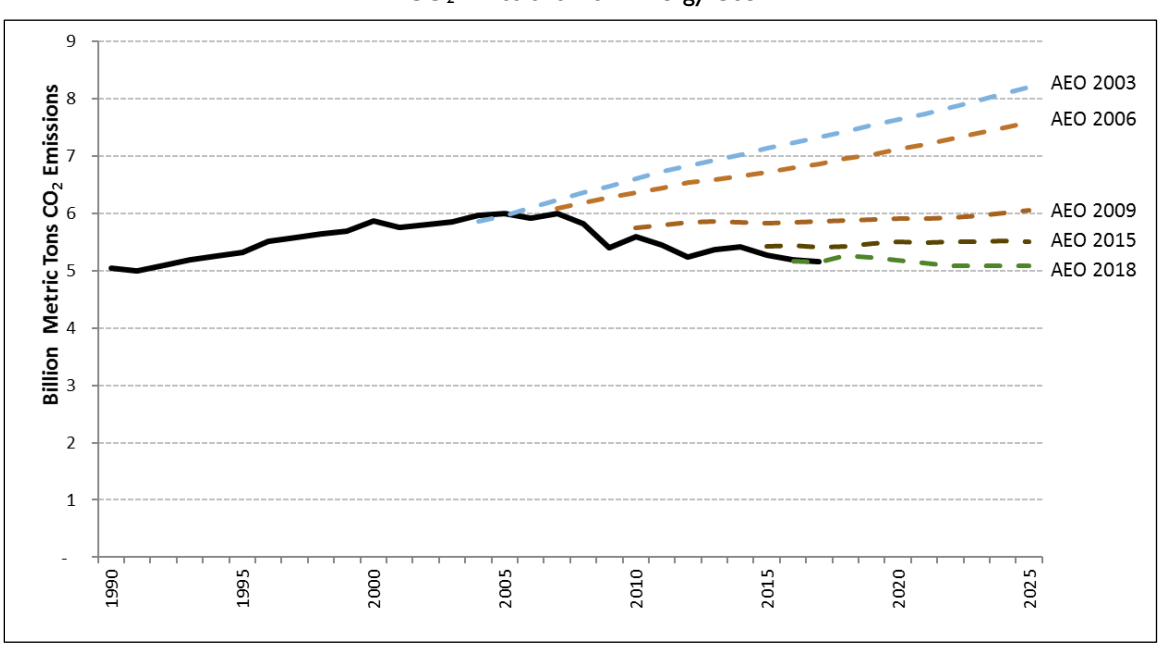
Comparisons between the projections in **Table 1** should be made with caution for several reasons. Models from different organizations may include different assumptions about future economic conditions and underlying energy inputs (e.g., natural gas prices). As noted above, the underlying conditions have changed considerably in the past few years. There is also uncertainty related to factors previously discussed, including potential rebound effects and about which technology measures would be adopted under ACE.

A comparison between CO_2 emissions projections and actual CO_2 emissions illustrates the uncertainties of emission projections. **Figure 4** compares actual U.S. CO_2 emissions between 1990 and 2017 with selected EIA emission projections made in past years. In general, actual emissions have remained well below projections. For example, the AEO from 2006 projected that CO_2 emissions would be almost 6.9 billion metric tons in 2017, about 33% higher than observed emissions.

[164] RIA, p. 3-5.

[165] On December 18, 2015, President Obama signed into law the Consolidated Appropriations Act, 2016 (P.L. 114-113). The act, among other provisions, extended and modified the production tax credit (PTC) and the investment tax credit (ITC) for specific renewable energy technologies. Prior to the December 2015 development, the PTC had expired and the ITC was scheduled to expire at the end of 2016. The PTC will not be available to projects starting construction after December 31, 2019. However, PTC tax expenditures will continue after that date, because the PTC is available for the first 10 years of renewable electricity production. The ITC for solar is scheduled to decline from 30% to 26% in 2020 and 22% in 2021 before returning to the permanent rate of 10% after 2021. For further information, see CRS Report R44852, *The Value of Energy Tax Incentives for Different Types of Energy Resources: In Brief*, by (name red acted) . See also National Renewable Energy Laboratory, *Impacts of Federal Tax Credit Extensions on Renewable Deployment and Power Sector Emissions*, February 2016, http://www.nrel.gov/docs/fy16osti/65571.pdf.

Figure 4. Actual CO_2 Emissions and Selected EIA CO_2 Emission Projections



Source: Prepared by CRS; data from EIA *Annual Energy Outlook* and *Monthly Energy Outlook* publications, http://www.eia.gov.

Notes: EIA publishes annual projections. The above figure includes projections from every third year since 2003. The projection from AEO 2012 is omitted because it is nearly identical to the AEO 2015 projection.

Comparison of Monetized Benefits and Costs

Compared to the current regulation—which is the CPP—the ACE proposal would reduce compliance costs but would also yield lower emission reductions, thereby increasing the climate-related damages (forgone benefits) and human health damages (forgone benefits). EPA's analysis shows that the estimated value of the forgone benefits would outweigh the compliance cost savings when replacing the CPP with ACE, yielding net costs.[166] Specifically, EPA estimated that the net costs of replacing the CPP with ACE range from $12.8 billion to $72.0 billion (2016 dollars) over a 15-year period (2023-2037).[167] These estimates account for forgone benefits—the forgone domestic climate benefits and the forgone co-benefits—that is, the human health benefits from emission reductions not targeted by either ACE or the CPP: SO_2 and NO_x emissions.[168]

[166] Traditionally, benefit-cost comparisons are shown as estimates of the "net impact," which is the difference between total benefits and total costs. "Net benefits" result when the benefits outweigh the costs, and "net costs" result when the costs outweigh the benefits. While the net impact can provide a rough measure of how the estimated benefits compare to the estimated costs, it does not necessarily determine whether the benefits justify costs. For example, the net impact does not account for potentially important qualitative impacts.

[167] Estimates are reported on a present value basis and cover years 2023-2037. See RIA, p. ES-16.

[168] EPA used a similar approach in its analysis of the proposed repeal of the CPP. For more information about the consideration of domestic—and exclusion of global—climate benefits as well as the treatment of human health co-benefits, see CRS Report R45119, *EPA's Proposal to Repeal the Clean Power Plan: Benefits and Costs*, by (name re dacted).

EPA's analysis also shows that repealing and not replacing the CPP would yield net costs ranging from $14.8 billion to $76.2 billion (2016$) over a 15-year period (2023-2037).[169] This range accounts for forgone domestic climate benefits and forgone human health co-benefits.

Consideration of co-benefits and other indirect impacts is typically viewed as a principle of benefit-cost analysis and consistent with federal guidance. In particular, OMB Circular A-4 directs agencies to "look beyond the direct benefits and direct costs" of a rulemaking and quantify and monetize co-benefits as well as adverse impacts not already considered in the direct cost estimates.[170] Likewise, EPA's Guidelines for Preparing Economic Analyses recommends that the agency's economic analysis "include directly intended effects and associated costs, as well as ancillary (or co-) benefits and costs."[171]

EPA excludes the forgone human health co-benefits from some of the benefit-cost comparisons. EPA explained these comparisons as a way to consider the benefit of reducing the "targeted pollutant" (CO_2) against the compliance cost.[172] The estimated compliance costs are the same regardless of whether EPA counts the human health co-benefits. Therefore, the benefit-cost comparisons that exclude the co-benefits show a lower net impact—that is, they weigh a lower estimate of the forgone benefits against compliance cost savings.

Specifically, the exclusion of forgone human health co-benefits from these comparisons yields estimates that range from net costs to net benefits. These benefit-cost comparisons, which are limited to compliance cost savings and forgone domestic climate benefits—range from a net cost of $5.4 billion to a net benefit of $3.4 billion over a 15-year period (2023-2037).[173] In addition, repealing without replacing the CPP appears more favorable when EPA excludes the forgone human health co-benefits. Under this scenario, the estimated present value of repealing the CPP ranges from a net benefit of $1.2 billion to $2.7 billion (2016$) over a 15-year period (2023-2037).[174] EPA also compares the three ACE scenarios to an alternative baseline that does not include the CPP. When EPA excludes the forgone human health co-benefits, these comparisons yield present value estimates that range from a net cost of $6.6 billion to a net benefit of $2.0 billion (2016$) over a 15-year period (2023-2037).[175] The net cost figure signifies that the estimated value of the forgone domestic climate benefits outweighs the estimated compliance cost savings. The net benefit figure signifies that the estimated compliance cost savings outweigh the estimated value of the forgone domestic climate benefits.

While these comparisons provide some perspective on the potential effects of ACE (separate from the CPP), the scenario design makes it difficult to discern the incremental effect of key components of the ACE proposal. EPA designed two of the ACE scenarios to account for "benefits from the proposed revisions to NSR." The third ACE scenario does not.[176] The level and

[169] Estimates are reported on a present value basis, covering years 2023-2037, and are based on a comparison of the "No CPP" scenario to one that assumed mass-based implementation of the CPP (RIA, p. ES-16).

[170] Circular A-4 refers to co-benefits as "ancillary benefits." See OMB Circular A-4, p. 26.

[171] EPA, National Center for Environmental Economics, Guidelines for Preparing Economic Analyses, May 2014, p. 11-2, https://www.epa.gov/environmental-economics/guidelines-preparing-economic-analyses.

[172] ACE Proposal, p. 44786; RIA, p. 6-6.

[173] Estimates are reported on a present value basis and cover years 2023-2037. See RIA, p. ES-14.

[174] Based on a comparison to the baseline of mass-based implementation of the CPP without interstate trading. See RIA, p. ES-14.

[175] RIA, p. ES-18.

[176] RIA, p. ES-3. In the two ACE scenarios that accounted for the proposed NSR change, EPA assumed that two additional HRI technologies—steam turbine upgrade and redesign/replace the economizer—would be available to facilities. For details, see RIA, pp. 1-13 to 1-19.

cost of HRI improvements also vary among the three scenarios, making it difficult to understand how much the proposed NSR revisions and assumed level of HRI affects the benefit-cost estimates.

Author Contact Information

(name redacted)
Analyst in Environmental Policy
[redacted]@crs.loc.gov, 7-....

(name redacted)
Specialist in Environmental Policy
[redacted]@crs.loc.gov, 7-....

(name redacted)
Legislative Attorney
[redacted]@crs.loc.gov, 7-....

Acknowledgments

(name redacted), Specialist in Environmental Policy, has written many CRS reports on the CAA and the CPP specifically. This report benefited from his expertise and incorporated his written analysis to the extent that it was relevant.