ORAL ARGUMENT NOT YET SCHEDULED

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

No. 19-1140 (and consolidated cases)

AMERICAN LUNG ASSOCIATION, *et al.*,
Petitioners,

v.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, *et al.*,
Respondents.

On Petition for Review of Final Agency Action of the
United States Environmental Protection Agency
84 Fed. Reg. 32,520 (July 8, 2019)

BRIEF OF ENERGY MODELERS AS *AMICI CURIAE* IN SUPPORT OF STATE AND MUNICIPAL, PUBLIC HEALTH AND ENVIRONMENTAL, POWER COMPANY, AND CLEAN ENERGY TRADE ASSOCIATION PETITIONERS

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CERTIFICATE AS TO PARTIES, RULINGS, AND RELATED CASES

All parties, intervenors, and amici appearing in this case are listed in the brief for Public Health and Environmental Petitioners, with the exception of *Amici Curiae* Energy Modelers and the following movant *amici curiae* in support of of State and Municipal, Public Health and Environmental, Power Company, and Clean Energy Trade Association Petitioners: Benjamin F. Hobbs, Brendan Kirby, Kenneth J. Lutz, James D. McCalley; Professor Michael Greenstone; Institute for Policy Integrity at New York University School of Law; Senator Sheldon Whitehouse; Service Employees International Union; Patagonia Works, Columbia Sportswear Company; Environment America and the National Trust for Historic Preservation; American Thoracic Society, American Academy of Allergy, Asthma, & Immunology, American College of Occupational and Environmental Medicine, National Medical Association, and American College of Chest Physicians; and National League of Cities, U.S. Conference of Mayors, and 23 Cities, Counties and Mayors.

References to the rulings under review and related cases also appear in the brief for Public Health and Environmental Petitioners.

STATEMENT REGARDING SEPARATE BRIEFING, AUTHORSHIP, AND MONETARY CONTRIBUTIONS

Amici curiae Energy Modelers file this separate amicus brief in compliance with the word limits set forth in the Court's Order of January 31, 2020 (Doc. 1826621). *See* Fed. R. App. P. 29(a)(5), 32(a)(7)(B)(i). A single joint brief is not practicable in this case because the other amicus briefs do not address the unique perspective of *Amici* as experts in energy modeling who have published analyses of the ACE and Clean Power Plan rules. *See* D.C. Circuit Rule 29(d).

Under Federal Rule of Appellate Procedure 29(a)(4)(E), *Amici* state that no party's counsel authored this brief in whole or in part, and no party or party's counsel contributed money intended to fund the preparation or submission of this brief. No person contributed money intended to fund the preparation or submission of this brief.

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GLOSSARY OF ABBREVIATIONS

The ACE rule	The final "Affordable Clean Energy" rule, published in the Federal Register at 84 Fed. Reg. 32,520 (July 8, 2019), and titled "Repeal of the Clean Power Plan; Emission Guidelines for Greenhouse Gas Emissions From Existing Electric Utility Generating Units; Revisions to Emission Guidelines Implementing Regulations"
Best System	The "best system of emission reduction" pursuant to 42 U.S.C. § 7411(a)(1)
CO_2	Carbon Dioxide
EPA	U.S. Environmental Protection Agency
IPM	The "Integrated Planning Model," a proprietary model of North American power markets developed by the consulting firm ICF and utilized by multiple federal and state agencies for regulatory analysis
RIA	Regulatory Impact Analysis

IDENTITY AND INTEREST OF *AMICI CURIAE*

Amici Curiae are experts in the fields of energy modeling and environmental science and engineering. Amici have extensive experience analyzing the impacts of Clean Air Act regulations on the electric power sector and other sectors of the economy. Dallas Burtraw is the Darius Gaskins Senior Fellow and Amelia Keyes is a Research Associate with Resources for the Future, an independent, nonprofit research institution in Washington, DC that focuses on energy, environmental, and natural resource decision-making. Kathy Fallon Lambert is a Senior Advisor with the Center for Climate, Health, and the Global Environment at the Harvard T.H. Chan School of Public Health (Harvard C-CHANGE). Charles T. Driscoll is the University Professor of Environmental Systems Engineering and Distinguished Professor of Civil & Environmental Engineering at Syracuse University. The views expressed in this brief are those of the individual *amici curiae* and may differ from those of other experts, officers, or directors at their respective institutions.

Amici analyzed the ACE rule using model results from the U.S. EPA proposed rule analysis and insights from related research. *Amici* and other coauthors published the results of this analysis in the peer-reviewed journal

Environmental Research Letters.[1] Additionally, *Amici* and other coauthors have utilized independent analysis to examine the final ACE rule, alternative illustrative ACE rule and reference scenarios, and scenarios representing the 2015 EPA Clean Power Plan and an illustrative updated Clean Power Plan.[2]

Amici described the potential for the ACE rule to produce an emission rebound in comments submitted to the EPA during the ACE rule comment period.[3] The April 2019 Keyes et al. article in *Environmental Research Letters* had not been published by the time the comment period closed. *Amici* submitted the article to the EPA as soon as it was publicly available.[4]

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[1] Amelia Keyes, *et al.*, *The Affordable Clean Energy Rule and the Impact of Emissions Rebound on Carbon Dioxide and Criteria Air Pollutant Emissions*, EPA-HQ-OAR-2017-0355-26648 (2019) ("Keyes, *et al.* 2019").

[2] Kathy Fallon Lambert, *et al.*, *Carbon Standards Re-Examined: An Analysis of Potential Emissions Outcomes for the Affordable Clean Energy Rule and the Clean Power Plan*, Harvard C-CHANGE Working Paper (July 17, 2019), https://cdn1.sph.harvard.edu/wp-content/uploads/sites/2343/2019/07/Carbon-Standards-Re-Examined_Final1.pdf ("Lambert, *et al.*"); 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, RFF WP 18-20 (Aug. 2018), https://www.rff.org/documents/1822/RFF20WP2018-20.pdf ("Keyes *et al.* 2018"); Charles T. Driscoll, *et al.*, *US Power Plant Carbon Standards and Clean Air and Health Co-Benefits*, EPA-HQ-OAR-2017-0355-20345 (2015).

[3] Charles T. Driscoll, *et al.* Comments, EPA-HQ-OAR-2017-0355-20345.

[4] Charles T. Driscoll, *et al.*, Supplemental Comments, EPA-HQ-OAR-2017-0355-26648.

SUMMARY OF ARGUMENT

The Affordable Clean Energy rule ("ACE rule"), 84 Fed. Reg. 32,520 (July 8, 2019), purportedly aims to reduce carbon dioxide ("CO_2") emissions from coal-fired electric generating units. The EPA's analysis of the ACE rule, as well as independent analysis by *Amici*, demonstrate that the rule will have the opposite effect. If implemented, the ACE rule will cause an *increase* in CO_2 emissions for many power plants and many states.

Section 111(d) of the Clean Air Act requires the EPA to identify the "best system of emission reduction" ("Best System") for a target pollutant and use the Best System determination to establish guidance for the state rulemaking. 42 U.S.C. § 7411(a)(1)&(d). The ACE rule identifies heat rate improvements as the Best System for reducing CO_2 emissions at existing coal-fired power plants.

Power plants with lower heat rates operate more efficiently, using less fuel to generate the same amount of electricity. Increasing efficiency by improving the heat rate reduces the CO_2 emissions per unit of electricity produced, thereby improving the emissions *rate* of coal-fired power plants. However, improving efficiency may increase the *total* emissions at the modified plant due to a phenomenon referred to as an emission rebound effect. The emission rebound effect occurs when efficiency improvements lead to greater utilization of the modified power plants.

The EPA claims that any emission rebound effect resulting from the ACE rule would be minimal. 84 Fed. Reg. 32542-43. However, this conclusion is not supported by the EPA's own data. In many cases, the emission rebound effect following heat rate improvement investments is projected to increase total emissions of CO_2 and other harmful air pollutants from individual coal plants. Depending on the magnitude of the emission increase at individual plants, the rebound effect may also increase total emissions of CO_2 or co-pollutants at state and national scales.

The EPA's modeling shows that CO_2 emissions increase with greater heat rate improvements. Furthermore, the CO_2 emission rebound effect will likely exceed EPA estimates, particularly if the EPA finalizes its proposed revisions to the New Source Review permitting program.

Because of the CO_2 emission rebound effect, the ACE rule may be worse for climate change and public health than no carbon regulations at all. This is in direct conflict with the Clean Air Act's requirement that the EPA identify the "best system of *emission reduction*" (emphasis added). As *Amici*'s analysis demonstrates, there are alternative regulatory options that are cost-effective and would produce greater CO_2 emission reductions than the ACE rule.

ARGUMENT

I. THE ACE RULE FAILS TO EFFECTIVELY ADDRESS THE EMISSION REBOUND EFFECT

When promulgating a rule under Clean Air Act Section 111(d), the EPA must identify the "best system of emission reduction" for a target pollutant and use the Best System determination to establish guidance for the state rulemaking. 42 U.S.C. § 7411(a)(1)&(d). Unlike the repealed Clean Power Plan, which calculated the Best System using numerous options for reducing CO_2 emissions at the unit level as well as throughout the electricity system, the ACE rule's Best System determination is limited to efficiency improvements at the covered sources, coal-fired electricity generating units.

The statute grants the EPA discretion when determining the Best System, but the plain language of the Clean Air Act should prohibit options that will likely cause an *increase* in CO_2 emissions for many power plants and many states. The EPA's analysis, as well as independent analysis by *Amici* and their coauthors, demonstrate that the ACE rule fails this test.

A. The Emission Rebound Effect

The ACE rule defines the "best system of emission reduction" as a combination of heat rate improvement technologies and other upgrades at coal-fired electricity generating units. 84 Fed. Reg. at 32,536. Heat rate is a measure of the amount of fuel input used to produce a unit of electricity. Many coal-fired

power plants can invest in technologies that improve their heat rate and efficiency. Power plants with lower heat rates operate more efficiently, using less fuel to generate the same amount of electricity. Increasing efficiency reduces the CO_2 emissions per unit of electricity produced, thereby improving the emissions *rate* of coal-fired power plants. However, improving efficiency may increase the *total* emissions at the modified plant due to a phenomenon referred to as an emission rebound effect.

An emission rebound effect can occur when a coal plant invests in heat rate improvements that allow it to operate more efficiently and thus produce electricity at a lower cost per unit. Lower operating costs makes this plant more competitive in electricity markets; as a result, it may operate more frequently and for longer periods. Moreover, efficiency improvements may extend the operating life of the plant. These are critical considerations related to the interconnected nature of the grid and the dispatch of power plants. Any rule aimed at reducing emissions should account for these effects.

The EPA claims that any emission rebound effect resulting from the ACE rule would be minimal. 84 Fed. Reg. at 32,542-43. However, this conclusion is not supported by the EPA's data. Increased operation of modified coal-fired power plants causes an increase in CO_2 emissions that counteracts the benefits from the

plant's lower CO_2 emission rate.[5] In many cases, the emission rebound effect following heat rate improvement investments can be large enough to increase the total annual emissions of CO_2 and other harmful air pollutants from an individual coal plant.[6] Depending on the magnitude of the emission increase at individual plants, the rebound effect may also increase total emissions of CO_2 or co-pollutants at state and national scales.

B. Background on Model Analysis

The EPA projects the ACE rule's impacts by simulating an illustrative ACE rule scenario and comparing it to a reference scenario with no ACE regulation in place. The EPA's final ACE rule Regulatory Impact Analysis (RIA) specifies an illustrative ACE scenario, which assumes that the rule would achieve a nationwide average heat rate improvement of 1.2 percent at coal-fired units.[7] The analysis projects power sector outcomes from 2021 to 2050; the expected first year of implementation is 2025.[8]

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[5] *See Infra*, Parts II & IV.

[6] *Id.*

[7] EPA, *ACE Regulatory Impact Analysis*, EPA-HQ-OAR-2017-0355-26743, at 3-14 (July 2019) ("ACE RIA"). The 1.2% average heat rate improvement is a generation-weighted average emission rate from coal-fired electric generating units larger than 25 MW in the years 2025, 2030, and 2035. *Id.*

[8] EPA, *IPM State-Level Emissions: EPAv6 November 2018 Reference Case*,

The EPA utilizes an engineering-economic model—the Integrated Planning Model (IPM)—for its RIAs. IPM contains a set of model electricity generation plants that are representations of actual power plants.[9] The EPA uses IPM to simulate illustrative ACE rule scenarios as well as reference scenarios with no ACE regulation, but existing regulations continue to be implemented. For each scenario, IPM projects various outcomes at model plants including electricity generation, CO_2 and criteria air pollutant emissions, and investment in new generating facilities. The impacts of the ACE rule can be estimated by comparing outcomes under the illustrative ACE scenarios to outcomes under the reference scenarios with no ACE regulation. The EPA published two versions of the RIA: the final ACE rule RIA published in June 2019[10] and the proposed ACE rule RIA

EPA-HQ-OAR-2017-0355-26720 (2019) ("IPM State-Level Emissions: November 2018 Reference Case").

[9] Model power plants are aggregations of actual power plants, but they preserve a great deal of granularity. IPM contains approximately 305 operating model coal plants, and 381 coal-fired power plants were operating in the US in 2016. U.S. Energy Information Administration, *Electric Power Annual 2016,* Table 4.1 (Dec. 2017), https://www.eia.gov/electricity/annual/archive/2016/.

[10] ACE RIA, *supra* note 7.

published in August 2018.[11] This brief primarily examines the analysis of the final rule but draws comparisons to the proposed rule analysis.

II. THE ACE RULE WOULD INCREASE CARBON EMISSIONS AT MANY COVERED SOURCES DUE TO THE REBOUND EFFECT

The likelihood and consequences of an emission rebound effect under the ACE rule were well documented prior to the finalization of the ACE rule.[12] *Amici* submitted comments to the EPA detailing the ACE rule's potential for emission rebound using the EPA's own modeling analysis and subsequently published the findings in a peer-reviewed journal.[13]

The EPA's analysis projects that the ACE rule will cause CO_2 emissions to increase at many coal plants. Specifically, the EPA's analysis of the final ACE rule projects that the improved efficiency of coal plants will increase total national coal-fired electricity generation by 0.3 to 2 percent between 2025 and 2050.[14] This

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[11] EPA, *Proposed ACE Regulatory Impact Analysis*, EPA-HQ-OAR-2017-0355-21182 (2018) ("Proposed ACE RIA").

[12] *See*, *e.g.*, Keyes, *et al.* 2019, *supra* note 1; Keyes *et al.* 2018, *supra* note 2; Charles T. Driscoll, *et al.*, *US Power Plant Carbon Standards and Clean Air and Health Co-Benefits*, EPA-HQ-OAR-2017-0355-20345 (2015).

[13] Keyes, *et al.* 2019, *supra* note 1; Charles T. Driscoll, *et al.* Comments, EPA-HQ-OAR-2017-0355-20345.

[14] These conclusions reflect *Amici*'s independent analysis of the EPA's policy scenario modeling for the final ACE RIA using data from the IPM model runs. EPA, *IPM Run Files (Final Rule),* EPA-HQ-OAR-2017-0355-26710 (2019) ("IPM Run Files (Final Rule)"). *Amici* used the same methodology to analyze the final

change would result in an increase in projected CO_2 emissions at 54 of 305 model coal plants (18 percent) by 2030 compared to having no ACE rule in place.[15] The analysis also projects that two additional model coal plants will remain operating in 2030 that would have retired were there no ACE rule in place.[16]

The projections for all other modeled years from 2021 to 2050 are similar: in each year, 17 to 21 percent of coal plants are projected to have higher emissions compared to having no rule in place.[17] By 2050, four additional coal plants will remain operating that would have otherwise retired in the absence of the ACE rule.[18] This emission rebound effect at covered sources is inherent to the ACE rule and is especially significant in light of the fact that the EPA projects that the rule will only reduce total national CO_2 emissions by 0.7 percent by 2030 compared to having no ACE rule in place.[19] A system that increases emissions at many

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ACE rule as they did for their 2019 peer-reviewed article analyzing the proposed ACE rule. *See* Keyes, *et al.* 2019, *supra* note 1, at 3-4 (describing the methodology for analysis).

[15] *Id.*; Lambert, *et al.*, *supra* note 2, at 2.

[16] *Amici*'s independent analysis of the IPM Run Files (Final Rule). *See supra* note 14.

[17] *Id.*

[18] *Id.*

[19] ACE RIA, *supra* note 7, at 3-11, Table 3-3.

regulated sources and produces trivial overall reductions cannot reasonably qualify as the "best" system of emission reduction.

III. THE ACE RULE WOULD INCREASE EMISSIONS IN MANY STATES DUE TO THE REBOUND EFFECT

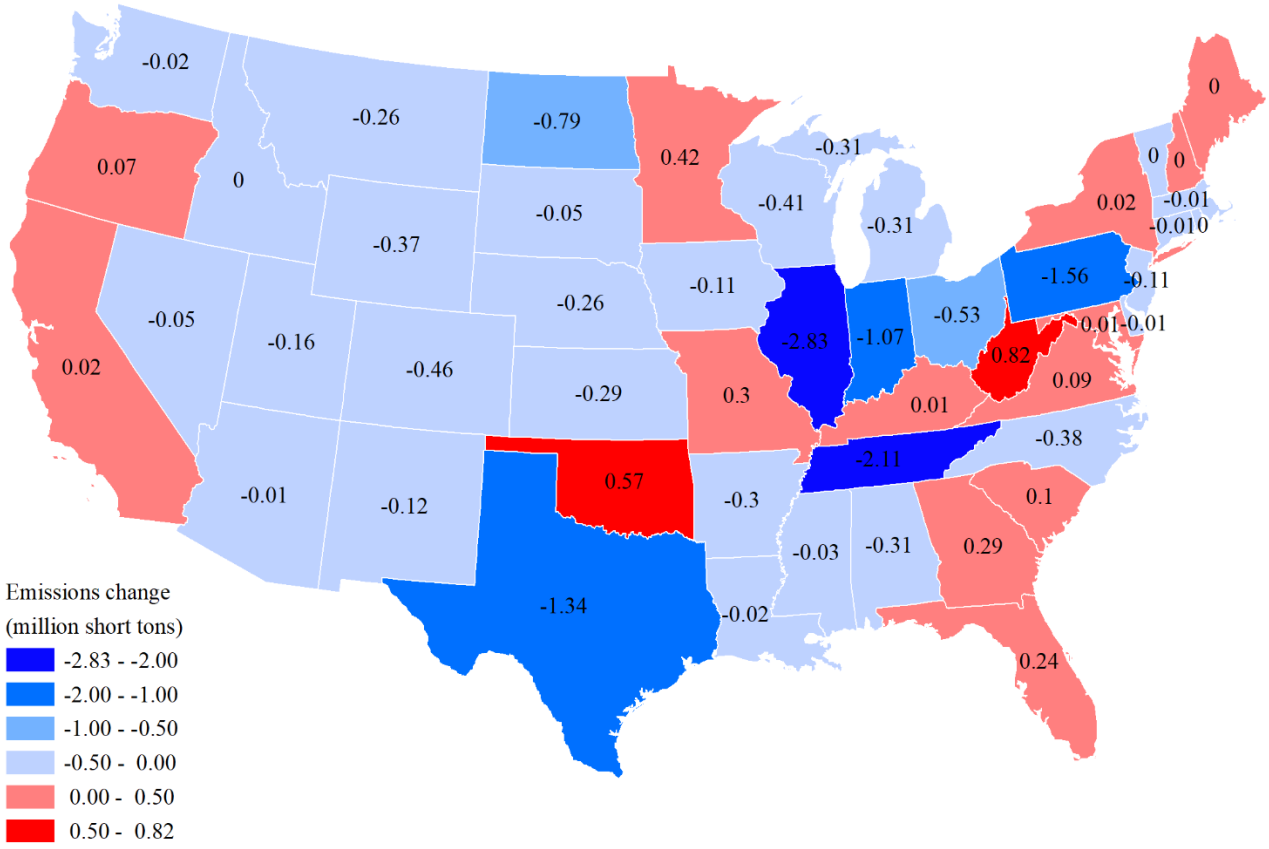
In addition to increasing emissions at many individual coal-fired power plants, the ACE rule will likely result in higher *cumulative* power sector emissions for many states. The EPA projects that the ACE rule will increase total CO_2 emissions in 15 states and the District of Columbia in 2030 compared to having no ACE rule in place (Figure 1). The coal emission rebound effect is directly responsible for the projected increases in many states' net emissions. For example, Oklahoma, Minnesota, Florida, and Georgia are projected to experience greater CO_2 emissions primarily due to increased coal generation.

Due to the interconnected nature of the electricity grid, the ACE rule will also lead to higher emission levels in some state and regional electricity markets where coal-fired generation decreases as a result of the ACE rule because natural gas generation is projected to increase to fill in the gap.[20] These increases in natural gas generation increase total CO_2 emissions in several states, including West Virginia, Arkansas, California, and Oregon. Unlike the Clean Power Plan, the ACE

[20] *Supra* note 14.

rule does not address natural gas-fired electricity generation and therefore fails to account for these electricity market responses that further increase CO_2 emissions.

Figure 1. CO_2 Emissions Changes, Comparing ACE Rule Scenario vs. No-rule Scenario 2030[21]



[21] EPA, *IPM State-Level Emissions: Illustrative ACE Scenario*, EPA-HQ-OAR-2017-0355-26724 (2019) ("IPM State-Level Emissions: Illustrative ACE Scenario"); IPM State-Level Emissions: November 2018 Reference Case, *supra* note 8. The 0 values on the map are due to rounding small negative or positive values for display purposes.

IV. THE EPA'S OWN ANALYSIS SHOWS THAT CARBON EMISSIONS INCREASE WITH GREATER HEAT RATE IMPROVEMENTS

The EPA is aware that the ACE rule will likely increase CO_2 emissions. While the final ACE rule analysis includes only one illustrative policy scenario with an average heat rate improvement of 1.2 percent at coal-fired units, the EPA's analysis of the proposed ACE rule includes two additional illustrative policy scenarios with average heat rate improvements of 2 percent and 4.5 percent at coal-fired units.[22] The three illustrative heat rate improvement scenarios reflect a range of assumptions about the amount of heat rate improvement investments that could reasonably occur, based on technological constraints and the presence of other regulations affecting investment costs. Comparing the three scenarios provides an important insight: the emission rebound effect worsens as the average heat rate improvement increases.

The EPA's analysis of the proposed ACE rule shows the stark differences in emission outcomes. There, the EPA found that a 4.5 percent heat rate improvement

[22] Proposed ACE RIA, *supra* note 11, at ES-3 (2018). The final rule RIA incorporates in its modeling the changes in electricity market conditions that occurred in the ten months after publication of the proposed rule analysis. Therefore, the baseline electricity market projections in the two analyses are not identical: the final rule analysis projects lower annual CO_2 emissions in the baseline scenario. However, these modeling updates have minimal effects on projections, and it is appropriate to compare the policy impacts in the final rule policy scenario to those in the proposed rule policy scenarios.

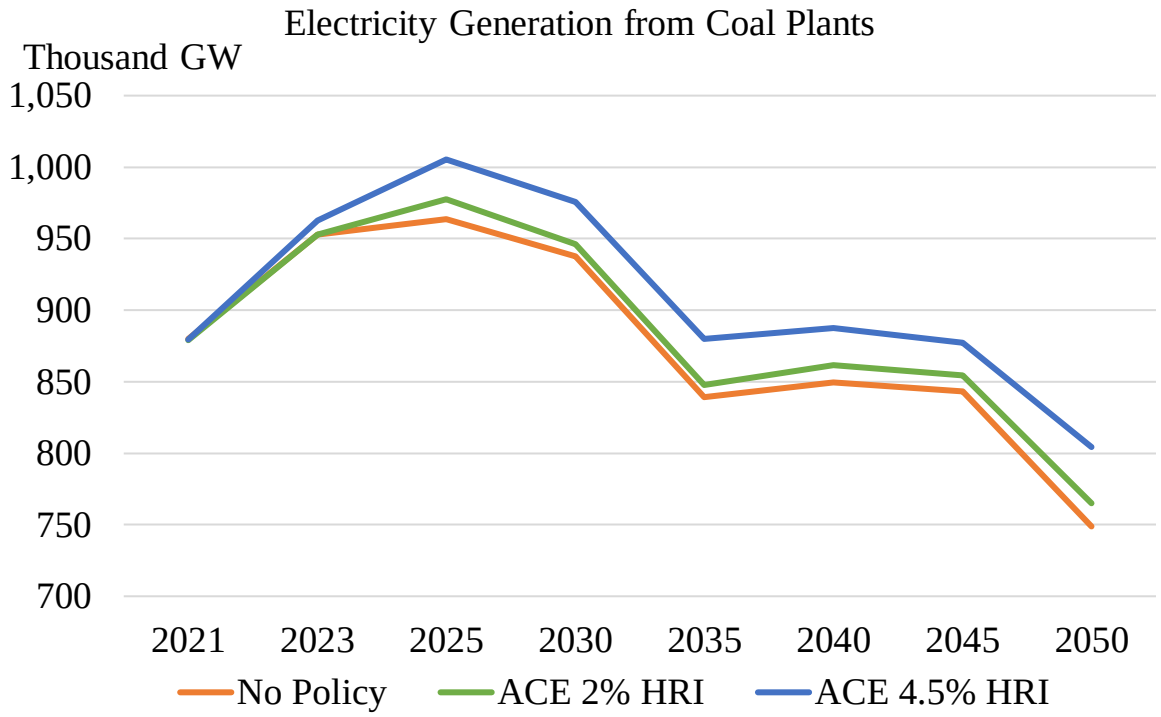
would lead to greater coal-fired electricity generation compared to both the no-policy reference scenario and the 2 percent heat rate improvement scenario over the 2021 to 2050 period (Figure 2). As a result of the increased electricity generation from these facilities, the 4.5 percent heat rate improvement scenario *increases* cumulative national CO_2 emissions by 66 million short tons for the period of 2021 to 2050 compared to a 2 percent average heat rate improvement (Table 1). Paradoxically, the more the electric power sector were to implement the system the EPA has defined as the best system of emission reduction, the more CO_2 emissions would increase.

Table 1. National Power Sector CO_2 Emissions (million short tons)[23]

Year	No Policy	ACE 2% Heat Rate Improvement	ACE 4.5% Heat Rate Improvement
2021	1,710	1,709	1,709
2023	1,801	1,801	1,814
2025	1,829	1,816	1,812
2030	1,811	1,798	1,797
2035	1,794	1,783	1,787
2040	1,849	1,840	1,841
2045	1,843	1,833	1,832
2050	1,804	1,801	1,815
2021–2050 Cumulative (interpolated)	**54,469**	**54,195**	**54,261**
Percent Change (ACE - No Policy)		**-0.50%**	**-0.38%**

[23] Proposed ACE RIA, *supra* note 11, at 3-15, Table 3-5 (2018) (reporting projections for years 2025, 2030, and 2035); EPA, *IPM Run Files (Proposed Rule)*, EPA-HQ-OAR-2017-0355-21140 (2018) ("IPM Run Files (Proposed Rule)").

Figure 2.[24]



Amici have not directly compared the projected CO_2 emissions quantities for the proposed and final ACE rules because the EPA used different data for the analyses. However, it is possible to examine the projected impacts of each of the heat rate improvement scenarios relative to their respective baseline no-policy conditions. This examination reveals that the final ACE rule scenario, with an illustrative average heat rate improvement of 1.2 percent at coal-fired units, would produce a smaller emission rebound effect compared to the two more ambitious heat rate improvement scenarios in the proposed rule. According to the EPA's

[24] Proposed ACE RIA, *supra* note 11, at 3-23, Table 3-17 (2018) (reporting projections for years 2025, 2030, and 2035); IPM Run Files (Proposed Rule), *supra* note 23.

projections, the 1.2 percent fleetwide average heat rate improvement scenario would increase CO_2 emissions at 18 percent of coal plants and in 15 states plus the District of Columbia. The two higher heat rate improvement scenarios are projected to result in even greater emission rebounds. This pattern would lead to emission increases at more plants and in more states with the larger heat rate improvements (Table 2), reinforcing that heat rate improvements alone cannot satisfy the "best system of emission reduction" requirement of the Clean Air Act.

Table 2. CO_2 Emission Rebound Effect: Comparison Across Illustrative ACE Scenarios in 2030 (compared to no CO_2 emission standards in place)[25]

	1.2% heat rate improvement (Final Rule)	2% heat rate improvement (Proposed Rule)	4.5% heat rate improvement (Proposed Rule)
Percent of Coal Plants with Increased CO_2 Emissions	18%	20%	28%
Number of States with Increased CO_2 Emissions	15 states and D.C.	16 states and D.C.	18 states and D.C.

Note: Results represent the difference between the ACE scenario and its associated no-policy reference case. Emissions from tribal lands included in state results.

[25] Keyes, *et al.* 2019, *supra* note 1, at 8 (2019); *IPM Run Files (Final Rule)*, *supra* note 14; IPM Run Files (Proposed Rule), *supra* note 23.

V. THE CO_2 EMISSION REBOUND EFFECT WILL LIKELY BE LARGER THAN THE EPA ESTIMATES

The ACE rule relies on a set of heat rate improvement technology investments to define the Best System and then directs each state to develop implementation plans based on the specific circumstances of their constituent coal plants. 84 Fed. Reg. at 32536-37. Importantly, the EPA's illustrative policy scenario for analysis of the final rule (nationwide average heat rate improvement of 1.2 percent at coal-fired units) excludes consideration of two heat rate improvement technologies that the EPA lists as "'candidate technologies' constituting the [Best System]." 84 Fed. Reg. at 32537. These two technologies, blade path upgrades and redesign and replacement of economizers, are among those with the highest potential to improve heat rates of all candidate technologies identified in the final ACE rule. *Id.*, Table I. By choosing an average nationwide heat rate improvement scenario that excludes two technologies that are explicitly identified as Best System candidate technologies, the EPA has likely underestimated the total magnitude of heat rate improvements that will occur under the ACE rule.

The rebound effect will be significantly greater if the EPA implements its proposed changes to the New Source Review permitting process.[26] 83 Fed. Reg. at 44,776-80. The existing New Source Review process requires evaluating whether a "major modification" at a covered source would increase emissions of regulated pollutants on an hourly or annual basis. *Id.* at 44,775. If the modification would likely increase emissions, the source may have to install additional control technologies. *Id.*

The EPA's proposed changes to the New Source Review process would require that the project increase a unit's maximum hourly emissions rate; if not, a "modification" would not occur even if the changes resulted in a significant emissions increase. *Id.* at 44,780-82. As discussed in Part I.A., heat rate improvements may reduce a source's hourly emissions but increase annual emissions because the source operates for more hours during the year. Allowing covered sources to avoid installing additional pollution control technologies would improve the cost-effectiveness of many heat rate improvement investments and make larger heat rate improvements more feasible—particularly for the two Best System candidate technologies that the EPA excluded from the analysis.

[26] The final ACE rule states that the EPA plans to complete the NSR revisions "at a later date." 84 Fed. Reg. at 32521.

The EPA acknowledges that its proposed New Source Review revision would have significant implications for potential heat rate improvements. In fact, the EPA's analysis of the proposed ACE rule explicitly selected the illustrative ACE scenario of a 4.5 percent average heat rate improvement in order to represent a scenario including New Source Review revisions. 83 Fed. Reg. at 44783. In contrast, the EPA selected the illustrative scenario with a 2 percent average heat rate improvement to represent a scenario without NSR reform—2.5 percentage points lower. *Id.* Thus, the proposed changes to NSR could more than double the average heat rate improvement under the ACE rule. Although the EPA has indicated that it will analyze the implications of NSR reform for the ACE rule if and when it finalizes the reform, it remains critical to consider the potential for NSR reform anytime the projected impacts of the ACE rule are addressed.

The EPA's failure to adequately evaluate the potential CO_2 emission rebound from candidate Best System technologies, and the failure to consider the potential impacts of the proposed New Source Review revisions, are arbitrary and capricious under the Clean Air Act.

VI. THE ACE RULE MAY BE WORSE FOR CLIMATE CHANGE AND PUBLIC HEALTH THAN NO CARBON REGULATIONS

The emission rebound effect at coal plants will have two major consequences. First, as described above, increases in CO_2 emissions at coal plants will contribute to climate change and fail to satisfy the stated goal of the ACE rule.

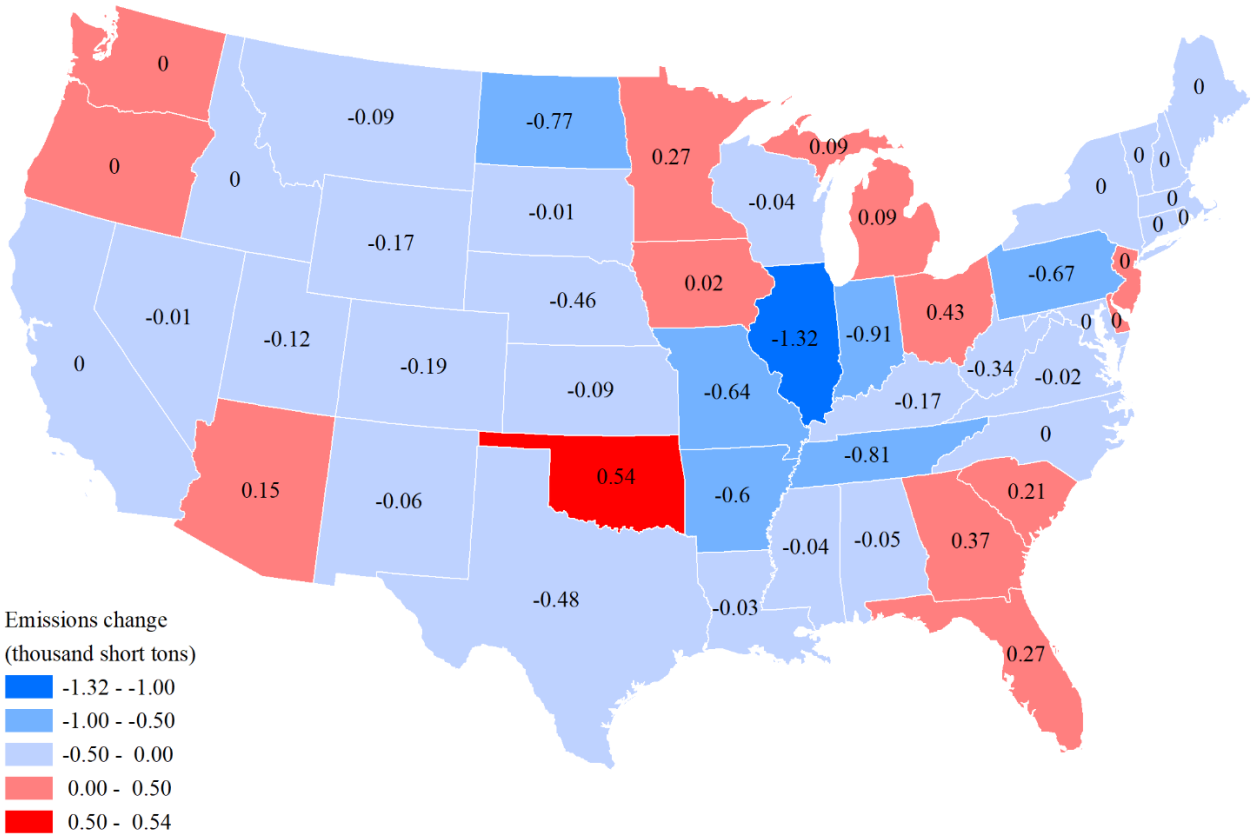
Furthermore, many states have targets for CO_2 reductions. The emission rebound effect from the ACE rule may make it more difficult for these states to attain their respective targets.

Second, increases in electricity generation at coal plants will lead to higher emissions of criteria air pollutants, which contribute to local air pollution and can harm public health and damage ecosystems. The EPA's final ACE rule analysis provides projections of emissions of sulfur dioxide and nitrogen oxides, two criteria pollutants regulated under the Clean Air Act. Sulfur dioxide and nitrogen oxides contribute to the formation of fine particulate matter and nitrogen oxides contribute to the formation of ozone, which increase premature deaths and illnesses. Elevated ozone can decrease the productivity of trees and crops. These pollutants also contribute to acidification and eutrophication of ecosystems.

The EPA projects that the ACE rule will increase sulfur dioxide emissions in 13 states and nitrogen oxide emissions in 13 states and the District of Columbia in 2030 (Figures 3 & 4). Some of these projected increases would occur in counties that are currently in nonattainment for fine particulate matter, ozone, and sulfur dioxide. As a result, some areas in the US may experience increased air quality-related deaths and illnesses compared to having no regulation in place.

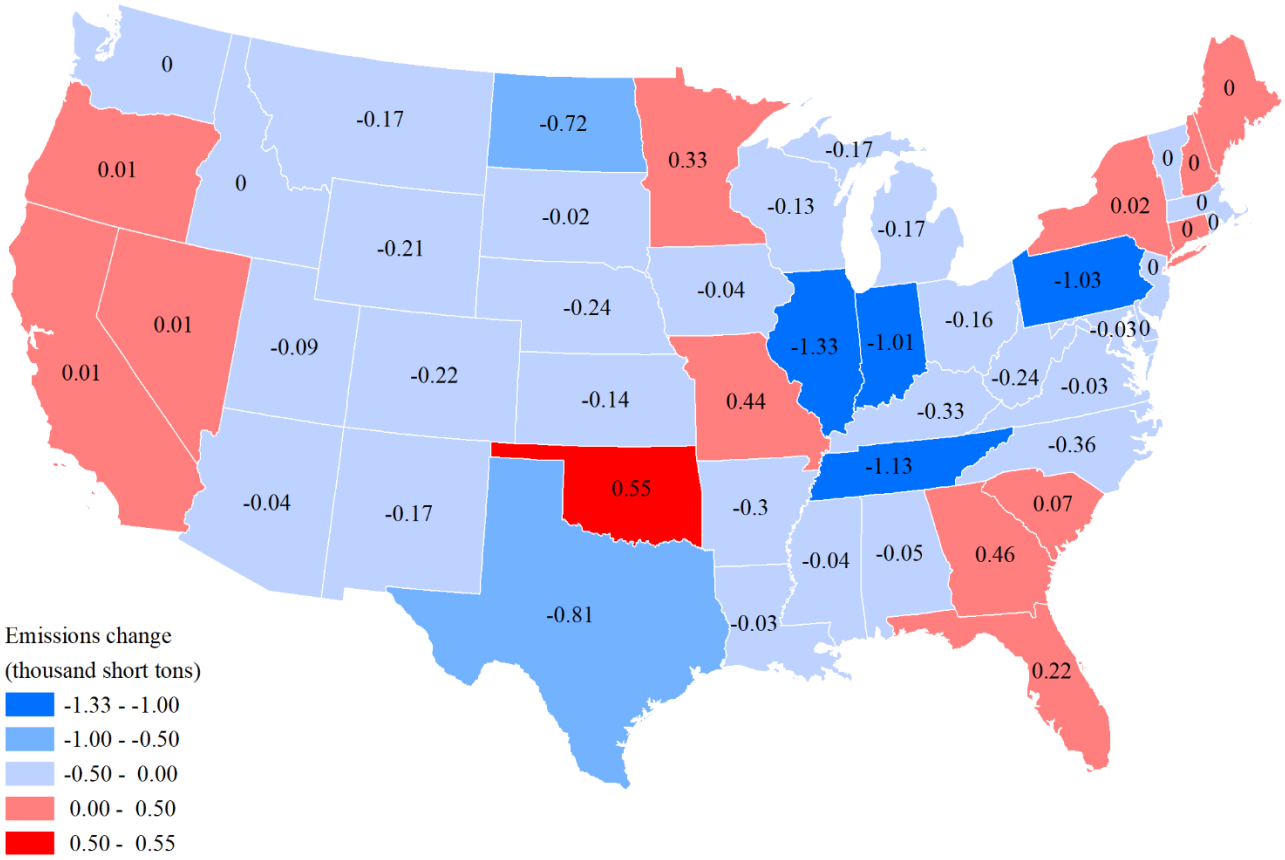
Therefore, the ACE rule may have worse effects for climate change, public health, and the environment than no carbon regulation due to the rebound effect.

Figure 3. Sulfur Dioxide Emissions Changes, Comparing ACE Rule Scenario vs. No-rule Scenario 2030[27]



[27] IPM State-Level Emissions: Illustrative ACE Scenario, *supra* note 21; IPM State-Level Emissions: November 2018 Reference Case, *supra* note 8. The 0 values on the map are due to rounding small negative or positive values for display purposes.

Figure 4. Nitrogen Oxide Emissions Changes, Comparing ACE Rule Scenario vs. No-rule Scenario 2030[28]



VII. THE ACE RULE WILL BE WORSE FOR CLIMATE CHANGE AND PUBLIC HEALTH THAN OTHER REGULATORY OPTIONS

The ACE rule will generate minimal national CO_2 emissions reductions that may increase in later years (Table 1). In contrast, other regulatory options with more comprehensive definitions of the Best System that accounts for the

[28] *Id.* The 0 values on the map are due to rounding small negative or positive values for display purposes.

interconnected nature of the electricity grid will better mitigate climate change and protect public health.

Amici's independent analysis examines an alternative regulatory approach that includes options to reduce CO_2 emissions throughout the electricity system, similar to the approach included in the Clean Power Plan.[29] This alternative option sets state-level caps on CO_2 emissions and allows the electricity sector to identify cost-effective emission reductions opportunities to meet those caps. The state-level caps reflect reasonable targets based on 2019 electricity market conditions, including the price of natural gas and renewable energy availability.

Amici's analysis also employs two reference scenarios: one reflects moderate expectations for electricity demand and natural gas and renewable energy costs, similar to the reference case used in EPA's analysis. The other reflects high expectations for electricity demand and natural gas and renewable energy costs; this reference scenario illustrates a potential future in which baseline CO_2 emissions are higher than currently expected. The use of two reference cases allows *Amici* to assess how the regulations might perform under alternative future electricity market conditions.

[29] Lambert, *et al.*, *supra* note 2, at 1.

This modeling shows that, as EPA has projected, the ACE rule would create only minimal CO_2 emission reductions in 2030.[30] In contrast, the alternative regulation would reduce CO_2 emissions by 37 percent compared to no policy in 2030 and would produce significantly larger climate and public health benefits than the ACE rule.[31]

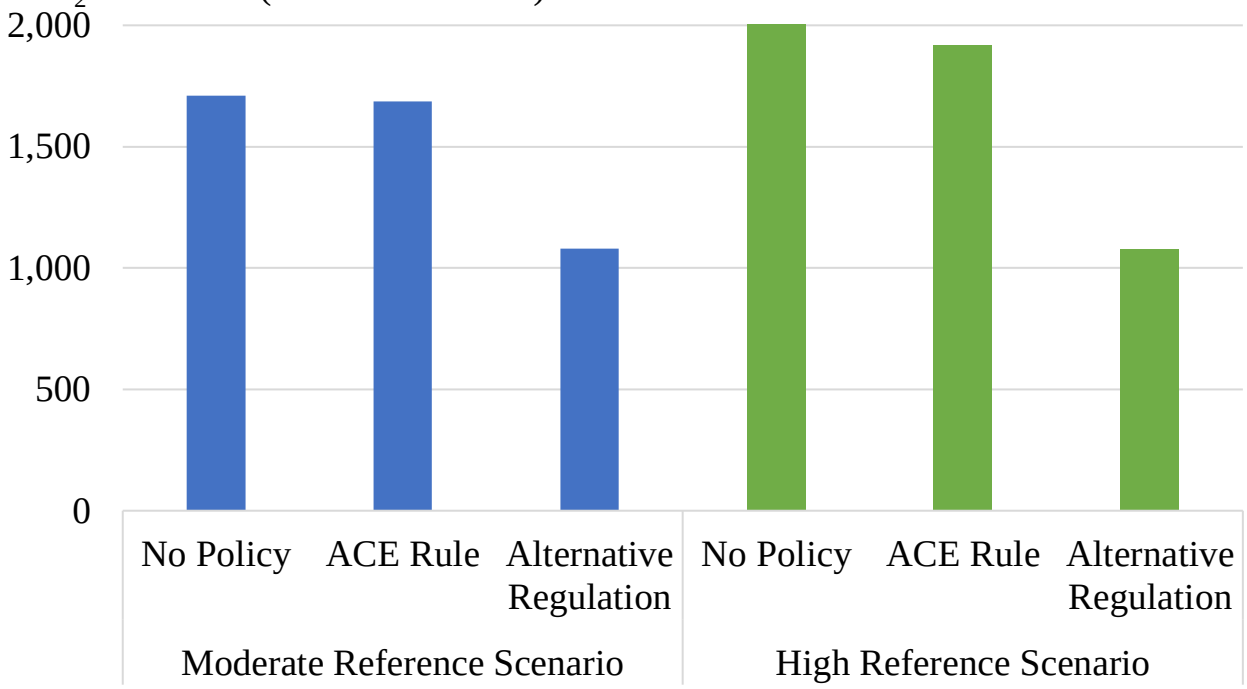
Amici's second reference scenario, in which baseline national CO_2 emissions are higher than expected, demonstrates another advantage of the alternative regulation. Under the second reference scenario with high baseline CO_2 emissions, the ACE rule would provide only modest CO_2 abatement compared to no regulation and the total emissions would be significantly higher than they would be with moderate reference conditions (Figure 4). Total emissions under the alternative regulation, on the other hand, would be robust to unforeseeable changes in market conditions and preserve the same CO_2 emission levels under both the moderate baseline conditions and the high CO_2 baseline conditions.

[30] *Id.* at 4, Table 2.

[31] *Id.* at 4-5.

Figure 5.[32]

Projected CO_2 Emissions under Alternative Reference Scenarios, 2030



* Selected ACE scenario assumes 4.5% average coal plant heat rate improvement at $50 per KW

CONCLUSION

For reasons stated herein, the Clean Power Plan repeal and ACE rule are unlawful and should be set aside.

[32] *Id.* at 5, Figure 1.

CERTIFICATE OF COMPLIANCE WITH WORD LIMITATION

Pursuant to Federal Rules of Appellate Procedure 29(a)(4)(G) and 32(g)(1), counsel hereby certifies that the foregoing Brief of Environmental Economists as Amici Curiae in Support of State, Public Health and Environmental, Power Company, and Clean Energy Trade Association Petitioners contains 4,891 words, as counted by counsel's word-processing system, and this complies with the applicable word limit established by the Court.

DATED: April 24, 2020

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CERTIFICATE OF SERVICE

I hereby certify that, on April 24, 2020, I electronically filed the foregoing with the Clerk of the Court for the United States Court of Appeals for the District of Columbia Circuit using the appellate CM/ECF system, which served a copy on all counsel of record in the case.

DATED: April 24, 2020

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