

**ORAL ARGUMENT NOT YET SCHEDULED**

No. 19-1140 (and consolidated cases)

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

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

v.

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

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

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**BRIEF OF PROFESSOR MICHAEL GREENSTONE AS AMICUS CURIAE  
IN SUPPORT OF STATE AND MUNICIPAL, PUBLIC HEALTH AND  
ENVIRONMENTAL, POWER COMPANY, AND CLEAN ENERGY  
TRADE ASSOCIATION PETITIONERS**

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Mark Norman Templeton  
Robert Adam Weinstock  
Alexander Valdes (clinical law student)  
Benjamin Nickerson (clinical law student)  
Abrams Environmental Law Clinic  
6020 South University Avenue  
Chicago, Illinois 60637  
(773) 702-9611  
templeton@uchicago.edu  
rweinstock@uchicago.edu  
*Counsel for Amicus Curiae*  
*Professor Michael Greenstone*

Dated: April 24, 2020

## **CERTIFICATE AS TO PARTIES, RULINGS, AND RELATED CASES**

Except for the following, the Brief for State and Municipal Petitioners lists all parties, intervenors, and amici appearing in this case.

### **Amici Curiae for Petitioners:**

In support 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; Dallas Burtraw, Charles T. Driscoll, Jr., Amelia Keyes, Kathy Fallon Lambert; Professor Michael Greenstone; Senator Sheldon Whitehouse; Service Employees International Union; Patagonia Works, Columbia Sportswear Company; Environment America, the National Trust for Historic Preservation; National League of Cities et al., Central Conference of American Rabbis et al., and Maximilian Auffhammer et al.

References to the rulings under review and related cases appear in the Brief for State and Municipal Petitioners.

**STATEMENT REGARDING SEPARATE BRIEFING**

Professor Michael Greenstone files 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 Professor Greenstone as co-leader of the Interagency Working Group that developed the Social Cost of Carbon methodology, the widely adopted metric for the present monetary value of anticipated climate-change damages caused by an incremental ton of carbon dioxide emissions. *See* D.C. Circuit Rule 29(d).

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**GLOSSARY OF ACRONYMS AND ABBREVIATIONS**

- ACE — Affordable Clean Energy (Rule)
- CO<sub>2</sub> — carbon dioxide
- EPA — U.S. Environmental Protection Agency

## STATUTES AND REGULATIONS

The Addendum to the Brief of the State and Municipal Petitioners reproduces pertinent statutes and regulations.

### STATEMENT OF IDENTITY, INTEREST IN CASE, AND SOURCE OF AUTHORITY TO FILE

*Amicus Curiae* Professor Michael Greenstone, the University of Chicago's Milton Friedman Professor of Economics and Director of its Energy Policy Institute, is one of the leading experts on the Social Cost of Carbon (the "Social Cost"), the widely adopted metric for the present monetary value of anticipated climate-change damages caused by an incremental ton of carbon dioxide ("CO<sub>2</sub>") emissions. While serving as Chief Economist for President Obama's Council of Economic Advisers, Professor Greenstone co-led the Interagency Working Group ("Interagency Group") that established the scientifically validated methodology (the "Protocol") for calculating a standardized federal measure of the Social Cost. Professor Greenstone currently leads the Climate Impact Lab, which consists of academic researchers updating the inputs underlying Protocol calculations.<sup>1</sup> His interest in this litigation is in having climate-change impacts monetized correctly.<sup>2</sup>

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<sup>1</sup> See generally <https://www.michaelgreenstone.com>.

<sup>2</sup> All parties consented to the filing of this brief. See Notice filed March 20, 2020 (Doc. No. 1834502).

### **RULE 29(a)(4)(E) STATEMENT**

Under Federal Rule of Appellate Procedure 29(a)(4)(E), Professor Greenstone states 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—other than the amicus curiae or his counsel—contributed money intended to fund the preparation or submission of this brief.

### **SUMMARY OF ARGUMENT**

Professor Greenstone submits this brief to explain how the U.S. Environmental Protection Agency (“EPA”) departed from scientifically and economically appropriate methods for monetizing damages caused by CO<sub>2</sub> emissions when promulgating the Affordable Clean Energy (“ACE”) Rule. *See* Repeal of the Clean Power Plan; Emission Guidelines for Greenhouse Gas Emissions From Existing Electric Utility Generating Units; Revisions to Emission Guidelines Implementing Regulations, 84 Fed. Reg. 32,520, 32,562 (July 8, 2019) [hereinafter ACE Rule]. Monetizing damages using a technically valid approach is critical in accounting for the benefits and costs of the ACE Rule because the express purpose of the ACE Rule is to reduce CO<sub>2</sub> emissions.

Professor Greenstone is exceedingly qualified to evaluate EPA's approach to the Social Cost in the ACE Rule because he co-led the robust and respected federal

effort that established the best available scientific approach to monetizing the impacts of CO<sub>2</sub> emissions, an approach from which EPA departed in significant and arbitrary ways. Specifically, Professor Greenstone will show that (1) EPA undervalued significantly the economic impacts caused by CO<sub>2</sub> emissions by applying inappropriately high discount rates that none of current market conditions, economic theory, or relevant government directives support; (2) EPA's "domestic" approach failed to account fully for impacts on U.S. citizens and businesses, misrepresented underlying climate models, failed to consider reciprocity benefits of using a global value, and was wrong as a matter of law; and (3) EPA failed to provide critical information about high-impact, lower-probability climate-change outcomes that would be particularly harmful to society—information policymakers should consider when regulating CO<sub>2</sub> emissions. EPA failed to respond seriously to numerous comments explaining these flaws and did not correct the unjustified errors in its analysis, leaving EPA well outside the bounds of mainstream economic methods for monetizing benefits from CO<sub>2</sub> emissions reductions.

### **ARGUMENT**

EPA promulgated the ACE Rule to address CO<sub>2</sub>, an air pollutant that causes climate change, but EPA used a faulty methodology for valuing climate impacts. EPA departed in three major ways from widely accepted environmental economics

and the well-established Protocol. First, EPA chose inappropriately high discount rates that none of economic theory, current financial markets, or relevant government directives support. By increasing the discount rate arbitrarily, EPA reduced the Protocol's minimum Social Cost by 63 percent.<sup>3</sup> Second, EPA valued as "zero" certain domestic benefits, altered climate-model outputs arbitrarily, and disregarded global benefits of CO<sub>2</sub> emissions reductions, among other errors. By considering only benefits occurring within U.S. borders, EPA reduced the Protocol's global Social Cost by 87 percent.<sup>4</sup> Third, EPA failed to justify why it did not provide critical information about high-impact, lower-probability climate-change outcomes.

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<sup>3</sup> Compare Interagency Working Group, *Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12,866*, 4 (Aug. 2016) [hereinafter Interagency Group 2016 Update] (\$16.09 2025 value using 5 percent discount rate in 2016\$), with EPA, ACE Regulatory Impact Analysis 7-7, EPA-HQ-OAR-2017-0355-26743 (June 2019) [hereinafter ACE Regulatory Impact Analysis] (\$6 2025 value using 7 percent discount rate). Interagency Group values are converted from 2007\$ to 2016\$ for comparison to EPA using U.S. Bureau of Labor Statistics Inflation Calculator.

<sup>4</sup> Compare Interagency Group 2016 Update at 4 (\$52.88 2025 global value using 3 percent discount rate in 2016\$), with ACE Regulatory Impact Analysis at 4-4 (\$7 2025 domestic value using 3 percent discount rate).

Petitioners ask the Court to vacate the ACE Rule because, among other reasons, it is “arbitrary” and “capricious.” *See* Public Health and Environmental Petitioners at 11 (“[F]ailure to address important aspects of the problem is arbitrary and capricious. . . . EPA’s use of an interim estimate of the social cost of carbon did not satisfy its obligation to rationally assess the benefits of reducing CO<sub>2</sub> given a record of severe danger.”) (quotations omitted).

EPA also failed to consider adequately relevant directives on measuring benefits of reducing CO<sub>2</sub> emissions. EPA purports to follow Executive Order 13,783, which states that agencies must “use estimates of costs and benefits . . . that are based on the best available science and economics.”<sup>5</sup> Executive Order 13,783 also states that, when “monetizing the value of changes in greenhouse-gas emissions resulting from regulations, including with respect to the consideration of domestic versus international impacts and the consideration of appropriate discount rates, agencies shall ensure . . . that any such estimates are consistent with the guidance contained in [Office of Management and Budget] Circular A-4[.]”<sup>6</sup> As discussed below, Circular A-4’s instructions are consistent with the Protocol—not EPA’s methodology here.<sup>7</sup>

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<sup>5</sup> Promoting Energy Independence and Economic Growth, Exec. Order No. 13,783, 82 Fed. Reg. 16,093, 16,095 (Mar. 31, 2017).

<sup>6</sup> *Id.* at 16,096.

<sup>7</sup> Office of Mgmt. & Budget, Exec. Office of the President, Circular A-4, 33–34 (2003) [hereinafter Circular A-4].

EPA also failed to address the substance of commenters' criticisms about these problems. EPA gave no reasoned justification for switching from the Protocol—which it adopted in the Clean Power Plan Rule as the best available science—to its new, faulty approach. *See* Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64,662, 64,931 (Oct. 23, 2015) [hereinafter the Clean Power Plan] (“The EPA concurs with the [Interagency Group’s] conclusion that it is reasonable, and scientifically appropriate, to use the current [Social Cost] estimates for purposes of regulatory impact analysis[.]”); Brief of the State and Municipal Petitioners at 22 (“An agency that changes course must ‘provide a more detailed justification than would suffice for a new policy . . . when, for example, its new policy rests upon factual findings that contradict those which underlay its prior policy.’”).

**I. THE INTERAGENCY WORKING GROUP’S SOCIAL COST OF CARBON PROTOCOL REPRESENTS THE BEST AVAILABLE SCIENTIFIC APPROACH TO ESTIMATE THE BENEFITS OF REDUCING CO<sub>2</sub> EMISSIONS**

The Interagency Group developed the Protocol so federal agencies could monetize the benefits of reducing CO<sub>2</sub> emissions when analyzing impacts of

proposed regulations.<sup>8</sup> The Interagency Group process was transparent and consensus-based and drew on expertise of climate scientists, economists, and other specialists from EPA, five additional federal agencies, and six executive offices.<sup>9</sup> The result synthesized decades of scientific research into the most accurate, readily available tool for estimating the benefits of reducing CO<sub>2</sub> emissions.

**A. The Protocol Incorporates Results of Three Models to Provide the Best Estimate of the Benefits of Reducing CO<sub>2</sub> Emissions.**

The Protocol is built upon five decades of integrated assessment models that predict and quantify damages associated with greenhouse-gas emissions.<sup>10</sup> In 2009, the Interagency Group selected three of the most advanced models to estimate the social costs of CO<sub>2</sub> emissions.<sup>11</sup> The three models account for climate-change impacts primarily in terms of human-health effects, net agricultural productivity, property damages from increased flood risk, and the value of certain quantifiable ecosystem services like timber production and livestock grazing.<sup>12</sup> The Interagency

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<sup>8</sup> Interagency Working Group, *Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12,866*, 1 (Feb. 2010) [hereinafter Interagency Group 2010 Report].

<sup>9</sup> *Id.* at 2–3.

<sup>10</sup> *Id.* at 5–10.

<sup>11</sup> *Id.* at 5.

<sup>12</sup> *Id.* at 2.



Group selected these models, in part, based on their widespread endorsement in the expert community.<sup>13</sup>

The Protocol runs each model with a consistent set of input parameters—the temperature-greenhouse-gas relationship and greenhouse-gas emissions trajectory<sup>14</sup>—that a transparent, consensus-based expert process developed.<sup>15</sup> The Interagency Group applied equal weight to the results of each of the three models because each produces plausible values and has different limitations.<sup>16</sup> For example, one model excludes potentially severe effects, whereas the other two assume small probabilities of severe damages that increase with greater warming.<sup>17</sup>

To convert the models' estimates of future damages into current monetary values, the Protocol discounts those estimates at three different rates: 2.5 percent, 3 percent, and 5 percent. The Interagency Group also presented a fourth value that

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<sup>13</sup> See Michael Greenstone et al., *Developing a Social Cost of Carbon for U.S. Regulatory Analysis: A Methodology and Interpretation*, 7 *Rev. Environ. Econ. Pol.* 23, 25 (2013). See also National Research Council, *Hidden Costs of Energy* 248–308 (2010) (noting that United Nations' Intergovernmental Panel on Climate Change also relied on these models).

<sup>14</sup> See Interagency Group 2010 Report at 6.

<sup>15</sup> *Id.* at 6–8. For example, the Interagency Group developed emissions trajectories by relying on Stanford University's Energy Modeling Forum, a meeting for energy-policy and climate experts. *Id.* at 15.

<sup>16</sup> *Id.* at 5.

<sup>17</sup> *Id.* at 31.

represents the potential for severe impacts from climate change at a discount rate of 3 percent. As Section II.A explains, the Interagency Group selected these discount rates in 2010 because they were appropriate at the time for intergenerational problems like climate change, reflected recent historical financial market conditions, and were consistent with Circular A-4.<sup>18</sup>

Table 1 shows estimated costs of CO<sub>2</sub> emissions in the most recent Interagency Group report.<sup>19</sup>

Table 1: Social Cost of CO<sub>2</sub>, 2010–2040 (in 2016\$ per metric ton of CO<sub>2</sub>)

Year Emissions Occur	5% Discount Rate	3% Discount Rate	2.5% Discount Rate	High Impact (95th Percentile at 3% Discount Rate)
2010	\$11	\$36	\$57	\$99
2020	\$14	\$48	\$71	\$141
2030	\$18	\$57	\$84	\$175
2040	\$24	\$69	\$97	\$210

While the Protocol depends upon predictions about a future climate-changed world, and all predictions come with uncertainty, the Interagency Group both acknowledged inherent uncertainties, assumptions, and data gaps and included methods by which decision-makers could understand those uncertainties and make better-informed policy. The Interagency Group accounted for various sources of

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<sup>18</sup> *Id.* at 23.

<sup>19</sup> Interagency Group 2016 Update at 4.

uncertainty by running 10,000 scenarios over five sets of emissions and socioeconomic inputs for the three different models, for a total of 150,000 scenarios.<sup>20</sup> The Interagency Group's approach to discount rates and the severe-impacts value enables decision-makers to address this uncertainty. Subsequent research affirms this approach.<sup>21</sup>

**B. The Protocol and its Inputs Have Been Updated to Reflect the Best Available Research, and Policymakers and Courts Have Endorsed the Protocol.**

Since its 2010 development, the Interagency Group updated components of the Protocol in consultation with the National Academy of Sciences four times to ensure that Social Cost values reflect the best available science. For example, in 2013, the Interagency Group incorporated the newest versions of the three models after their peer-reviewed publication.<sup>22</sup> The Interagency Group's most recent update occurred in 2016.<sup>23</sup>

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<sup>20</sup> See National Academy of Sciences, *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide*, 28 n.15 (2017) [hereinafter National Academy Report].

<sup>21</sup> See Richard Revesz, Michael Greenstone et al., *Best Cost Estimate of Greenhouse Gases*, 357 *Science* 655 (2017).

<sup>22</sup> Interagency Group 2016 Update at 6.

<sup>23</sup> *Id.*

Federal agencies, oversight organizations, and courts have recognized the value of the Protocol.<sup>24</sup> For example, the Government Accountability Office scrutinized and endorsed the Protocol, finding its approach credible because it used consensus-based decision-making, relied on existing academic literature and models, disclosed limitations, considered public comments, and revised estimates based on updated research.<sup>25</sup>

Approximately 150 federal regulations covering topics from energy efficiency, to forest conservation, to fuel-economy standards, to emissions performance standards have used the Protocol's values.<sup>26</sup> All told, proper analyses using the Protocol have supported federal regulations anticipated to provide more than \$1 trillion in benefits.<sup>27</sup>

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<sup>24</sup> See, e.g., *Zero Zone, Inc. v. U.S. Dep't of Energy*, 832 F.3d 654, 678 (7th Cir. 2016) (“DOE’s determination of [the Social Cost] was neither arbitrary nor capricious.”) (citations omitted); *High Country Conservation Advocates v. U.S. Forest Serv.*, 52 F. Supp. 3d 1174, 1190–93 (D. Colo. 2014); *Mont. Env'tl. Info. Ctr. v. U.S. Office of Surface Mining*, 274 F. Supp. 3d 1074, 1094–99 (D. Mont. 2017); *Sierra Club v. FERC*, 867 F.3d 1357, 1375 (D.C. Cir. 2017).

<sup>25</sup> See U.S. Gov't Accountability Off., *Regulatory Impact Analysis: Development of Social Cost of Carbon Estimates*, 12–20 (2014) (GAO-14-663).

<sup>26</sup> See *Economics of Climate Change: Hearing Before the H. Comm. on Oversight and Reform, Subcomm. on Env't*, 116th Cong. 4 (2019) (statement of Michael Greenstone) [hereinafter Greenstone Congressional Testimony].

<sup>27</sup> William D. Nordhaus, *Revisiting the Social Cost of Carbon*, 114 Proc. Nat'l Acad. Sci. 1518, 1523 (2017) [hereinafter Nordhaus Study].

## **II. EPA'S DEPARTURES FROM THE PROTOCOL WERE ARBITRARY FAILURES TO USE THE BEST AVAILABLE SCIENCE**

EPA's methodology departed from the Protocol in three key ways and ignored critical aspects of how to regulate CO<sub>2</sub> emissions. First, EPA used inappropriately high discount rates: (i) deviating without justification from recent historical averages of real interest rates, (ii) failing to consider correctly the intergenerational aspect of the climate-change problem, and (iii) ignoring how climate-change regulations are like investments that pay off during poor economic conditions. Second, EPA jury-rigged its methodology to consider only so-called "domestic impacts." This approach failed to account fully for impacts on U.S. citizens and businesses, misrepresented the design of underlying models, ignored that a global figure may spur emissions reductions by other nations, and was wrong as a matter of law. Third, EPA departed without justification from consideration of lower-probability but severe climate impacts.

EPA also failed to address the substance of comments that identified these problems. EPA provided no reasoned justification for departing from Circular A-4 or switching from the Protocol—which it previously determined was "the best available science" in the Clean Power Plan Rule—to its new, faulty approach. *See* Clean Power Plan at 64,931.

**A. EPA Contravened the Best Available Science on Discount Rates for Climate-Related Analyses.**

Choosing appropriate discount rates is essential to calculating a valid range of Social Cost values, as discount rates allow one to translate future damages into present-day monetary values. To illustrate the impact that discount rates make, EPA's Social Cost is \$7 per metric ton of CO<sub>2</sub> using a 3 percent discount rate and only \$1 using 7 percent; similarly, the Protocol's value is \$78 using 2.5 percent and \$53 using 3 percent.<sup>28</sup> Multiplied across billions of tons of CO<sub>2</sub> emissions from existing coal-fired power plants, these seemingly small differences in discount rates amount to tens or hundreds of billions of dollars of difference in yearly impacts.<sup>29</sup>

EPA's use of 3 percent and 7 percent as discount rates to value the future harms of CO<sub>2</sub> emissions is wrong under the principles of Circular A-4 and economic theory for at least three reasons: By copying the 3 percent and 7 percent figures mechanically from Circular A-4, EPA failed to update them for significant declines in real interest rates for U.S. government securities. Next, while EPA

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<sup>28</sup> Compare ACE Regulatory Impact Analysis at 4-4 (2025 values), *with* Interagency Group 2016 Update at 4 (2025 values in 2016\$).

<sup>29</sup> See ACE Regulatory Impact Analysis at ES-6 (estimating 1.774 billion short tons of CO<sub>2</sub> emissions in 2025).

recognizes that climate change is an intergenerational problem and that discount rates “play[ ] a critical role” in measuring future harm,<sup>30</sup> EPA failed to incorporate those considerations into its selection of the 3 percent and 7 percent rates. Finally, EPA failed to consider that climate regulations are essentially investments that deliver returns that are especially valuable at times when returns on other types of investments are diminished.

**1. EPA’s discount rates do not reflect recent historical averages for real, long-term U.S. government interest rates.**

While Circular A-4 used a 3 percent discount rate for the real rate of return on long-term U.S. government debt when it was published in 2003, real interest rates for U.S. government securities during the past decade have been significantly lower. Therefore, EPA acted arbitrarily by using a discount rate as high as 7 percent and by not considering rates lower than 3 percent.

In contrast with the real rate of return on 10-year Treasury notes between 1973 and 2003, which was Circular A-4’s basis for the 3 percent figure,<sup>31</sup> the historical average of the real rate of return on 10-year Treasury notes between 2008

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<sup>30</sup> ACE Regulatory Impact Analysis at 7-5 (“[T]he assumed discount rate plays a critical role in the ultimate estimate of the social cost of carbon. This is because CO<sub>2</sub> emissions today continue to impact society far out into the future[.]”).

<sup>31</sup> Circular A-4 at 33–34.

and 2017 was 0.63 percent according to the Federal Reserve Bank of St. Louis.<sup>32</sup> Similarly, the Congressional Budget Office's 2016 forecast for the real rate of return on 10-year Treasury notes was 1.2 percent.<sup>33</sup> Accordingly, the Council of Economic Advisers concluded in its most recent report on how to update the discount rates in Circular A-4 that the discount rate for regulatory analysis should be less than 3 percent and "should be *at most* 2 percent."<sup>34</sup> It is apparent that a multitude of sources would suggest that the logic of Circular A-4 would now support replacing the 3 percent discount rate with something that ranges from roughly 0.6 percent to 2 percent. Thus, in selecting 3 percent as its lowest discount rate, EPA failed to consider the recent state of financial markets, which runs counter to Circular A-4 and evidence before the agency.

Circular A-4 supports updating discount rates based on more current averages and predictions of future interest rates. Circular A-4 directs agencies to

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<sup>32</sup> One way to derive real interest rates is to look at the value of the 10-Year Treasury Inflation-Indexed Security. Board of Governors of the Federal Reserve System, 10-Year Treasury Inflation-Indexed Security, Constant Maturity [DFII10], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/DFII10> (last visited April 23, 2020).

<sup>33</sup> See Council of Economic Advisers, *Discounting for Public Policy: Theory and Recent Evidence on the Merits of Updating the Discount Rate*, 6 n.6 (Jan. 2017) (citing Congressional Budget Office forecasts).

<sup>34</sup> *Id.* at 1 (emphasis added).



use “the best reasonably obtainable scientific, technical, and economic information available” when making assumptions such as discount rates and to “[u]se sound and defensible values.”<sup>35</sup> Circular A-4 also requires that agencies state “what assumptions were used” and explain “clearly how [they] arrived at [their] estimates[.]”<sup>36</sup> Indeed, in 2015 the Office of Management and Budget reaffirmed this approach, stating that “Circular A-4 is a living document” and adding that “the use of 7 percent *is not considered appropriate* for intergenerational discounting.”<sup>37</sup> Therefore, EPA was wrong to apply mechanically the 7 percent rate used in 2003 to its decisions about the ACE Rule more than 15 years later.

By applying discount rates of 7 percent and 3 percent in its main analysis, EPA disregarded this logic and set a wholly inappropriate range for evaluating climate-change impacts. EPA offered no expert- or evidence-based justifications for its rates; rather, it copied the values mechanically without considering the basis for those numbers or updating them appropriately.

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<sup>35</sup> Circular A-4 at 17, 27.

<sup>36</sup> Circular A-4 at 3.

<sup>37</sup> See Interagency Working Group, *Response to Comments: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12,866*, 36 (July 2015) (emphasis added) [hereinafter Interagency Group 2015 Response to Comments]. See also *id.* (“There is wide support for this view in the academic literature, and it is recognized in Circular A-4 itself.”).

## 2. EPA departed from economic principles for how to address intergenerational problems.

EPA's discount rates are arbitrarily inconsistent with how economic theory views intergenerational problems such as climate change. Future generations, by definition, cannot voice their preferences or protect their interests now. For that reason, setting discount rates for intergenerational decisions is fundamentally different than doing so for decisions in which those alive evaluate the difference between their present and future consumption.<sup>38</sup>

Circular A-4 incorporates this understanding and recommends that agencies present future benefits with discount rates between “1 and 3 percent” when dealing with intergenerational policies.<sup>39</sup> Due to the dramatic decline in interest rates since Circular A-4's publication, that 1 to 3 percent range should be lower now.

As such, when EPA used 3 and 7 percent rates in its main analysis, it ignored a central aspect of the problem by not considering the massive intergenerational effect of greenhouse-gas emissions, which justifies including an analysis using a significantly lower discount rate.<sup>40</sup>

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<sup>38</sup> See Circular A-4 at 35–36.

<sup>39</sup> *Id.* at 36.

<sup>40</sup> EPA presented an analysis using a 2.5 percent discount rate in Appendix 7.2 of the ACE Regulatory Impact Analysis, rather than in the Rule, the main analysis of the Regulatory Impact Analysis, or anywhere that indicates policymakers considered intergenerational discounting in decision-making. See ACE Regulatory Impact Analysis at 7-6. Further, 2.5 percent does not reflect the dramatic decline in interest rates since Circular A-4's publication.

**3. EPA failed to consider that lower discount rates are appropriate because climate regulations are essentially investments with substantial payoffs in bad economic times.**

EPA failed to consider that discount rates used to assess proposed climate regulations must reflect the anticipated state of the world at the time the “investment” in emission reductions will pay out. Because climate change creates risks of economic disruptions similar to a recession or even war, regulators should consider investments in climate mitigation similarly to other investments that pay off during difficult economic circumstances, not just during times of normal economic growth. Such assets, like gold and U.S. Treasuries, tend to have lower returns than typical investments in stock or real estate, but investors are willing to accept low average returns from investments that deliver returns when the value of additional income is especially high.

Applying this principle to potential climate regulations should have led EPA to consider discount rates in the main ACE Rule that are no higher than the real riskless rate (i.e., 10-year U.S. Treasuries) of 0.63 percent and possibly lower.

Commenters made the criticisms identified in each subsection of Section II.A, but EPA failed to address them substantively.<sup>41</sup> For example, EPA claimed

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<sup>41</sup> EDF et al., Joint Comments 20–28, EPA-HQ-OAR-2017-0355-24812 [hereinafter Joint Comments]; Abrams Environmental Law Clinic, Comment 7–10,

that it was abiding by Circular A-4 by using Circular A-4's stated discount rates,<sup>42</sup> but EPA did not follow or even discuss Circular A-4's fundamental reasoning, which requires significantly lower rates. EPA also claimed that it could not use updated values before completion of the five-year update recommended by the National Academy of Sciences.<sup>43</sup> But EPA cannot credibly claim to wait for that update when EPA rejected the methodology that the National Academy has endorsed—namely, the Protocol. In addition, EPA stated that it was not basing its ultimate regulatory decision on a cost-benefit analysis and that the Social Cost is for informational purposes only.<sup>44</sup> These arguments miss the point: EPA is regulating CO<sub>2</sub> because of its climate impacts, and EPA must use the best available science when considering how best to regulate.

In sum, EPA arbitrarily and capriciously contradicted recent market conditions, economic theory, and long-established government directives in Circular A-4 when it presented only 3 and 7 percent discount rates. A 7 percent

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EPA-HQ-OAR-2017-0355-23647; California Air Resources Board, Comment 31–32, EPA-HQ-OAR-2017-0355-19929; Appalachian Mountain Club et al., Comment 24, EPA-HQ-OAR-2017-0355-24413.

<sup>42</sup> See EPA, Responses to Public Comments on EPA's Proposed Emission Guidelines 7-18, 7-19, EPA-HQ-OAR-2017-0355-26741 [hereinafter Responses to ACE Comments]. See also EPA, Responses to Public Comments on EPA's Proposed Repeal of the Clean Power Plan 7-20, 7-29, EPA-HQ-OAR-2017-0355-26742 [hereinafter Responses to Clean Power Plan Repeal Comments].

<sup>43</sup> Responses to ACE Comments at 7-23, 7-24.

<sup>44</sup> *Id.* at 7-18.

rate is entirely invalid, and proper discount rate selection would have included values between 0.63 and 2 percent. EPA failed to consider any of the relevant factors explained above in choosing discount rates and provided no substantive response to comments articulating these problems.

**B. EPA’s Domestic-Only Methodology “Zeroed Out” Relevant Domestic Climate Benefits, and the “Domestic-Only” Approach Is Wrong for Prudential and Legal Reasons.**

The evidence before EPA contradicts its explanation for limiting its analysis to “the direct impacts of climate change that are anticipated to occur within U.S. borders.” ACE Rule at 32,562. Even under its own flawed terms, the agency ignores at least two important aspects of the “domestic” portion of the global problem—namely, effects of climate change that occur internationally yet affect domestic interests and the domestic benefits of reciprocal actions by other countries.

**1. EPA’s domestic-only approach contradicts evidence before the agency about incorporating international impacts on domestic interests and contravened best available science on climate-change modeling.**

The evidence before EPA about climate-change modeling contradicted the agency’s approach to setting a domestic-only value. EPA’s domestic-only approach deserves no deference as an expert judgment because it is incomplete on its own terms and contradicts the expert on whom EPA relies.

First, EPA's domestic-only approach did not account for changes in climate that affect directly U.S. citizens who reside abroad, property owned by U.S. citizens and residents outside the territorial United States, and U.S. military assets overseas.<sup>45</sup> By considering effects only "within U.S. borders," ACE Rule at 32,562, EPA's analysis arbitrarily zeroed out those impacts, which are important climate-change effects the ACE Rule must address.<sup>46</sup>

This failure was arbitrary also because EPA contradicted the specific expert report on which the agency purported to rely,<sup>47</sup> which stated that a domestic Social Cost should include "international implications that would impact the United States."<sup>48</sup> While the 2017 National Academy of Sciences report discussed the

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<sup>45</sup> See Circular A-4 at 15 ("Your analysis should focus on benefits and costs that accrue to citizens and residents of the United States."). See also Dep't of Defense, *Report on Effects of a Changing Climate to the Department of Defense* 16, 17 (2019) ("About two-thirds of the 79 [military] installations [a]re vulnerable to current or future recurrent flooding[;] more than one-half are vulnerable to current or future drought[;] [and] about one-half are vulnerable to wildfires.") [hereinafter Dep't of Defense 2019 Report].

<sup>46</sup> See *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1200 (9th Cir. 2008) (holding arbitrary and capricious agency treatment of CO<sub>2</sub> emissions reduction benefits as effectively zero because "while the record shows that there is a range of values, the value of carbon emissions reduction is certainly not zero").

<sup>47</sup> See ACE Regulatory Impact Analysis at 4-5, 4-6.

<sup>48</sup> National Academy Report at 52-53 ("Climate damages to the United States cannot be accurately characterized without accounting for consequences outside

possibility of calculating a domestic-only value, it also stated that “[t]horoughly estimating a domestic [value] would therefore need to consider the potential implications of climate impacts on, and actions by, other countries, which also have impacts on the United States.”<sup>49</sup> However, EPA failed to do that in its main analysis: EPA’s domestic-only values “focus on the direct impacts of climate change that are anticipated to occur within U.S. borders.” ACE Rule at 32,562.

Moreover, EPA’s approach disregarded climate effects on U.S. national security interests and indirect effects of political unrest and migration due to climate change that affect the United States. The Department of Defense concluded recently, “The effects of a changing climate are a national security issue.”<sup>50</sup> The Department also declared that climate effects “will aggravate stressors abroad such as poverty, environmental degradation, political instability, and social tensions—conditions that can enable terrorist activity and other forms of violence,” and as a result “climate change may increase the frequency, scale, and complexity of future

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U.S. borders. . . . The current [climate models] do not fully account for these types of interactions among the United States and other nations or world regions in a manner that allows for the estimation of comprehensive impacts for the United States.”).

<sup>49</sup> *Id.*

<sup>50</sup> Dep’t of Defense 2019 Report at 2.

missions.”<sup>51</sup> Also, for example, the World Bank stated that climate-change impacts on agricultural productivity have contributed to record northward migration from Central America.<sup>52</sup> The U.S. government has meanwhile invested billions of dollars in resources to stop Central American migrants from entering the United States.<sup>53</sup> By adopting a domestic-only approach to CO<sub>2</sub> damages and omitting these kinds of effects, EPA failed to engage with these important aspects of the problem.<sup>54</sup>

Second, to generate its domestic-only values, EPA misused the outputs of models designed to generate global values, not values of impacts “within U.S. borders.” In the study EPA cited to support its use of domestic-only values,<sup>55</sup> Nobel Prize–laureate William Nordhaus, developer of one model upon which EPA relied, stated “regional damage estimates”—including his own—vary so much that they “are both incomplete and poorly understood.”<sup>56</sup> Nordhaus expanded: “A key

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<sup>51</sup> Dep’t of Defense, *Quadrennial Defense Review 2014* vi, 8 (2014).

<sup>52</sup> World Bank Group, *Groundswell: Preparing for Internal Climate Migration* (Mar. 2018).

<sup>53</sup> See, e.g., Kevin Sieff and Mary Beth Sheridan, *U.S., Mexico Pledge Billions to Reduce Migration from Central America*, Wash. Post (Dec. 18, 2018) (noting U.S. contribution of \$10.6 billion).

<sup>54</sup> Responses to ACE Comments at 7-26 to 7-30.

<sup>55</sup> See ACE Regulatory Impact Analysis at 7-1.

<sup>56</sup> Nordhaus Study at 1522.



message here is that there is little agreement on the distribution of the [Social Cost] by region.”<sup>57</sup> A domestic-only Social Cost is thus unsupported by and contrary to the evidence the agency considered.

Third, EPA acted arbitrarily by taking 10 percent of the global damages figure generated from one of the models as representative of damages occurring within U.S. borders. To support that decision, EPA cited Nordhaus’s study, as Nordhaus was the lead developer of the model.<sup>58</sup> But when pressed for a domestic-only figure for purposes of discussion, Nordhaus himself used 15 percent, not 10 percent.<sup>59</sup> Despite commenters noting this,<sup>60</sup> EPA offered no explanation to support its choice of 10 percent or departure from the expert upon whom it relied.

**2. EPA’s domestic-only approach is arbitrary given the United States’ role in international climate policy and legal requirements.**

EPA’s domestic-only approach also fails to account for the fact that CO<sub>2</sub> reductions by the United States can lead, and have led, other countries to take their own actions to reduce CO<sub>2</sub> emissions.<sup>61</sup> For example, in 2014 when the EPA proposed the Clean Power Plan and used the Protocol to account for the full global

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<sup>57</sup> *Id.*

<sup>58</sup> ACE Regulatory Impact Analysis at 7-1.

<sup>59</sup> *See* Nordhaus Study at 1521.

<sup>60</sup> Joint Comments at 16–17.

<sup>61</sup> *See* Revesz et al., 357 *Science* 655.

benefits of reducing emissions, it helped spur other countries like China to enact reciprocal climate policies to reduce their emissions, which benefits the United States.<sup>62</sup>

The Interagency Group recognized this benefit to a global Social Cost.

“Climate change presents a problem that the United States alone cannot solve.”<sup>63</sup>

“Even if the United States were to reduce its greenhouse gas emissions to zero, that step would be far from enough to avoid substantial climate change.”<sup>64</sup> Presenting

the global climate impacts of CO<sub>2</sub> emissions promotes bi-lateral and multi-lateral international agreements to reduce emissions, such as the U.S.-China accord and

the Paris Agreement.<sup>65</sup> “Using a global estimate of damages in U.S. regulatory

analyses sends a strong signal to other nations that they too should base their

emissions reductions strategies on a global perspective, thus supporting a

cooperative and mutually beneficial approach to achieving needed reduction.”<sup>66</sup>

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<sup>62</sup> See National Academy Report at 53 (explaining “use [of] a global [Social Cost] in order to leverage reciprocal measures by other countries”).

<sup>63</sup> See Interagency Group 2016 Update at 17.

<sup>64</sup> See Interagency Group 2010 Report at 10.

<sup>65</sup> See Press Release, U.S.-China Joint Announcement on Climate Change, The White House (Nov. 12, 2014), <http://obamawhitehouse.archives.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change>; Paris Agreement to the United Nations Framework Convention on Climate Change, Dec. 12, 2015, T.I.A.S. No. 16-1104. See also Greenstone Congressional Testimony at 6 (“The Paris Climate Agreement between 187 nations followed a year later when other countries made larger than expected pledged reductions.”).

<sup>66</sup> See Interagency Group 2016 Update at 17.

U.S. EPA's "domestic-only" Social Cost undermines U.S. interests by making it more difficult to secure emissions reductions in other countries that will benefit U.S. citizens.

The Clean Air Act and Circular A-4, also support consideration of all global impacts. By ignoring impacts experienced outside of U.S. borders, EPA treated those impacts as having zero value, although the Clean Air Act's broader economic impacts section provides that "a default assumption of zero value shall not be assigned to such benefits unless supported by specific data." 42 U.S.C. § 7612(b) (requiring comprehensive analysis of "economic, public health, and environmental benefits" of each standard issued under Clean Air Act).<sup>67</sup> Circular A-4 also calls for an analysis that matches the scope of the problem,<sup>68</sup> which would be a global analysis for climate change. Accordingly, the Office of Management and Budget agreed with the Interagency Group that a global approach is more appropriate for analyzing climate change.<sup>69</sup>

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<sup>67</sup> See also *Ctr. for Biological Diversity*, 538 F.3d at 1200.

<sup>68</sup> See Circular A-4 at 3 ("Different regulations may call for different emphases in the analysis, depending on the nature and complexity of the regulatory issues.").

<sup>69</sup> See Interagency Group 2016 Update at 17.

EPA failed to address the substance of commenters' criticisms of its approach to a domestic-only value or to explain why it changed its determination from the Clean Power Plan that a global Social Cost is appropriate.<sup>70</sup> For example, EPA claimed consistency with Circular A-4, but failed to explain how its domestic-only approach matches the scope and nature of the global climate-change problem.<sup>71</sup> Also, although EPA asserted that the Social Cost is for informational purposes only and is not a basis for regulation,<sup>72</sup> EPA must use the best available science, and that science incorporates effects beyond those that occur within the territorial United States because climate change impacts go well beyond U.S. borders. Additionally, EPA did not respond to comments that noted EPA used models inappropriately to generate domestic-only values.<sup>73</sup>

In sum, EPA's domestic-only approach is untenable because it ignores important aspects of the problem targeted by the ACE Rule, including direct climate-change impacts on U.S. interests located abroad, indirect impacts including

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<sup>70</sup> See, e.g., Joint Comments at 6. EPA only mentioned global climate benefits as an afterthought in Appendix 7.3 of the ACE Regulatory Impact Analysis, rather than accounting for the global climate benefits in its main analysis or in the Rule where the results would be useful to policymakers. ACE Regulatory Impact Analysis at 7-7.

<sup>71</sup> Responses to ACE Comments at 7-25.

<sup>72</sup> *Id.* at 7-26.

<sup>73</sup> Responses to ACE Comments at 7-34.

national security and migration, and domestic benefits resulting from reciprocal foreign actions.

### **C. EPA Underrepresented Costs of High-Impact Events.**

Incremental increases in greenhouse gases may lead to nonlinear increases in damages. As the climate warms, the risk of “recession-like or even war-like disruptions,” such as “sea level rise in short time periods” and “human responses like mass migration,” grows.<sup>74</sup> While recognizing uncertainty associated with estimating such large damages and their likelihood, the Interagency Group noted that the best available science shows that average emissions scenarios may result in high levels of warming, and thus severe social and economic consequences.<sup>75</sup>

Accordingly, projections of climate damages do not have a symmetric, “normal” distribution around a central estimate. Rather, as Figure 1 (reproduced from Interagency Group 2016 Update) shows, there are “long tails” of higher-impact, potentially severe outcomes.<sup>76</sup>

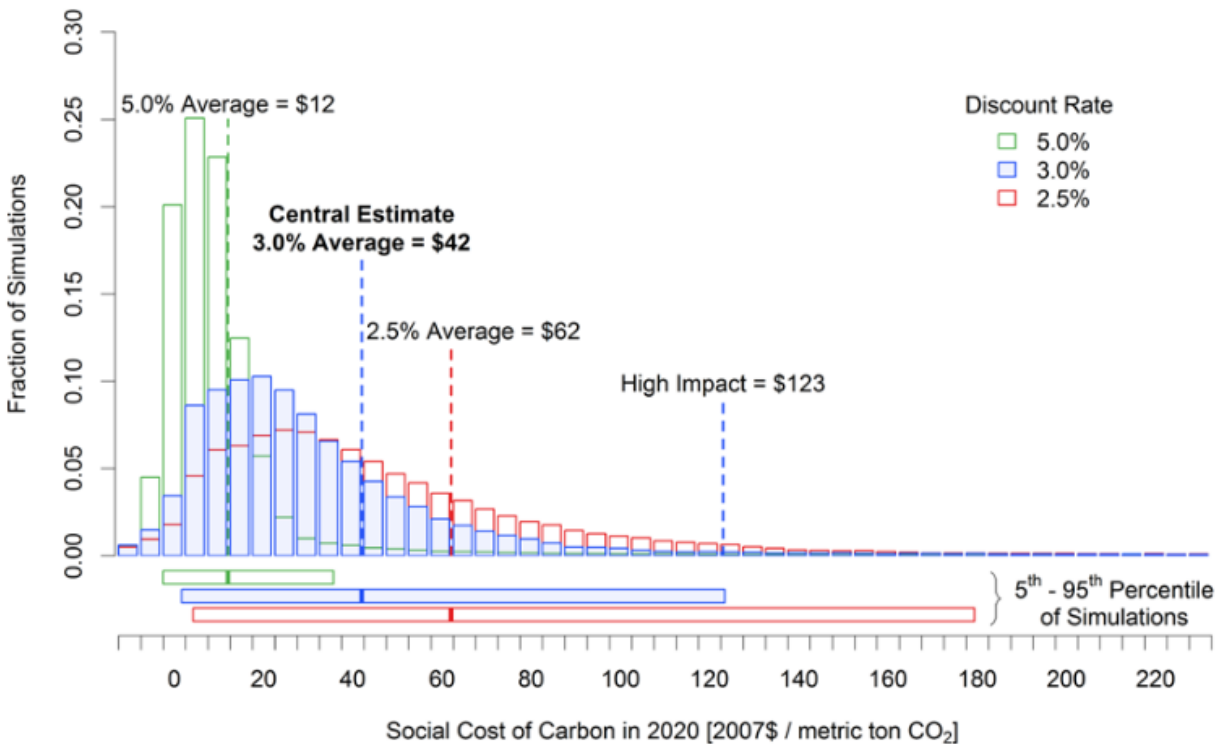
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<sup>74</sup> Greenstone Congressional Testimony at 5.

<sup>75</sup> See Interagency Group 2010 Report at 31.

<sup>76</sup> No similarly systematic biases point in the other direction or support including a low-percentile estimate. See Interagency Group 2015 Response to Comments at 26–27) (specifically rejecting a 5th percentile estimate).

Figure 1: Frequency Distribution of Social Cost Estimates in 2020  
Resulting from 150,000 Scenarios<sup>77</sup>



The Interagency Group’s 95th percentile value shows the present value of the particularly severe climate change outcomes that have a 1-in-20 chance of occurring—“95th percentile” outcomes.<sup>78</sup> To illustrate the difference, Figure 1 shows that at the same discount rate of 3 percent, the Interagency Group’s average value was \$42 and its 95th percentile value was \$123, both in 2007 dollars.

<sup>77</sup> See Interagency Group 2016 Update at 5.

<sup>78</sup> Interagency Group 2010 Report at 1 (discounting future damages at a rate of 3 percent to develop a present value).

EPA considered the 95th percentile value when promulgating the Clean Power Plan, but it did not do so in the ACE rule. EPA provided no reason for this change, despite commenters alerting EPA to the importance of considering the 95th percentile value.<sup>79</sup>

Economic research and casual observation have long revealed that people exhibit a strong propensity toward risk-aversion—that is, people are willing to pay a premium to avoid uncertainty when there is a possible outcome in which it is difficult for them to absorb the potential losses. This logic underlies decisions people make in insurance markets. For instance, homeowners choose to purchase fire insurance despite the fact that it would be cheaper to self-insure over the long run; this is because they would rather face the certain payment of an insurance premium than an uncertain range of outcomes that includes their home burning down without compensation.

The climate models and related research find that high-impact outcomes are plausible and that their costs are significantly higher than the cost of the average outcome. Although the original Interagency Group analysis did not formally account for risk aversion, it did recognize that people are generally risk averse and reported the 95th percentile value: EPA should not have deviated from this practice

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<sup>79</sup> See, e.g., Joint Comments at 28; Responses to ACE Comments at 7-43, 7-44.

and should have considered separately the distribution of potential climate damages, including severely negative climate outcomes.

In sum, EPA's refusal to justify why it changed its policy for considering the costs of severe climate outcomes in formulating a rule aimed at achieving climate benefits was arbitrary in light of the evidence before the agency.

### CONCLUSION

For the foregoing reasons, the Court should find that EPA acted arbitrarily and capriciously in its use of its concocted and unjustified Social Cost of Carbon to analyze the climate benefits of the ACE Rule. This Court should not permit EPA to promulgate a regulation intended to reduce emissions of CO<sub>2</sub> based upon a fundamentally flawed analysis of the benefits of those reductions.

Respectfully submitted,

Dated: April 24, 2020

/s/ Mark Norman Templeton  
Mark Norman Templeton  
(supervising attorney)  
Robert Adam Weinstock  
Alexander Valdes (clinical law  
student)  
Benjamin Nickerson (clinical law  
student)  
Abrams Environmental Law Clinic  
*Counsel for Amicus Curiae*  
*Professor Michael Greenstone*



## CERTIFICATE OF COMPLIANCE

Pursuant to Fed. R. App. P. 32(g), I hereby certify that this brief complies with the type-volume limitation of Fed. R. App. P. 32(a)(7)(B) and the Court's order of January 31, 2020 (Doc. No. 1826621). According to the count of Microsoft Word, this brief contains 6,466 words, excluding the parts of the brief exempted by Fed. R. App. P. 32(f) and Circuit Rule 32(e)(1).

I further certify that this brief complies with the typeface and type-style requirements of Fed. R. App. P. 32(a)(5) and (6) because it has been prepared in 14-point Times New Roman, a proportionally spaced font.

Dated: April 24, 2020

/s/ Mark Norman Templeton  
Mark Norman Templeton

**CERTIFICATE OF SERVICE**

I hereby certify that on this 24th day of April, 2020, the foregoing Brief of Professor Michael Greenstone as Amicus Curiae in Support of State and Municipal, Public Health and Environmental, Power Company, and Clean Energy Trade Association Petitioners has been served on all registered counsel through the Court's electronic filing system.

Dated: April 24, 2020

/s/ Mark Norman Templeton  
Mark Norman Templeton