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American Coalition for Clean Coal Electricity Comments on EPA's Proposed Rule to Repeal the Clean Power Plan

The American Coalition for Clean Coal Electricity (ACCCE) submits to the Environmental Protection Agency (EPA or Agency) the following comments in strong support of EPA's proposed rule to repeal the Clean Power Plan (CPP)[1] in its entirety.[2]

As discussed below, EPA should repeal the CPP for two important and compelling reasons. First, the CPP is illegal because the rule greatly exceeds EPA's authority to regulate carbon dioxide (CO_2) emissions from fossil-fueled power plants under section 111(d) of the Clean Air Act (CAA or Act). Second, even if for the sake of argument the CPP were determined to be lawful, it would establish bad environmental policy that would have substantial adverse energy and economic repercussions for the nation. These adverse consequences would result from the fact that the CPP would impose massive costs on consumers and businesses without providing any meaningful effect on climate change, cause substantial additional retirements of existing coal-fueled generation that, in turn, will increase risks to the reliability and resilience of the nation's electricity grid, and usurp states' and grid operators' traditional role of determining the appropriate mix of electricity generating resources in each state or region

ACCCE is a non-profit organization that is the only national trade organization whose sole mission is to advocate at the federal and state levels on behalf of the nation's coal fleet. Our members represent every sector of the coal-fueled electricity industry, including electricity generators, coal producers, railroads, barge operators, and equipment manufacturers.[3]

In addition to these comments, ACCCE is a member of the Utility Air Regulatory Group (UARG) and supports and incorporates the UARG comments on the Proposed Rule by reference herein.

I. ACCCE Members have a Substantial Interest in the Repeal of the Clean Power Plan.

ACCCE and its members believe it is critically important to preserve the fleet of existing coal-fired power plants. The importance of the existing coal fleet was recently reaffirmed by the Department of Energy (DOE), the Federal Energy Regulatory Commission (FERC), and the North American Electric Reliability Corporation (NERC). These entities and others have recognized the essential reliability and resiliency attributes the coal fleet provides to the electricity grid.[4]

In the last several years, threats to the resiliency and reliability of the electric grid have increased. More than 111,000 megawatts (MW) of coal-fueled generating capacity have retired or announced plans to retire.[5] This disturbing trend in coal plant retirements would be exacerbated with the implementation of the CPP. EPA has projected that the CPP would cause the retirement of an additional 29,000 MW of coal-fueled generating capacity by 2025.[6]

The pace of coal plant retirements has caused cascading effects throughout the coal industry and industries that support coal, such as railway and barge transportation, not to mention coal-producing communities. Roughly 90% of coal produced in the U.S. is transported by rail or barge.[7] From the peak of U.S. coal transport in 2008 to 2016, U.S. railroads have seen a 45% decrease in carloads of coal.[8] In one year alone, from 2015 to 2016, gross revenues attributable to coal transport fell 25% for Class I railroads.[9]

Workers across the coal industry have been hit hard too. Between 2011 and the second quarter of 2017, 65,484 coal miners lost their jobs, a 45.7% decline.[10] In that same period, nearly 8,000 well-paying jobs have been lost in fossil-fueled electric power generation.[11] Unfortunately, these types of quality jobs are increasingly hard to find in the workers' current regions. Nor are jobs generally available in other energy sectors (such as solar energy development), as such opportunities "vary regionally and often do not correlate well with concurrent job losses in sectors such as coal mining or power plant operations."[12]

EPA's failure to repeal the CPP will do further harm to American workers who depend on the coal industry for their livelihoods. Analysis of lost coal jobs in Southwestern Virginia by the King University School of Business Institute for Regional Economic Studies found that each coal mining job supports 1.27 jobs in other sectors of the region's economy.[13] The loss of 100 coal mining jobs would lead to 127 jobs being lost in all other industries, for a total loss of 227 jobs.[14] Each job in the coal mining industry generates almost $128,000 in earnings paid to households employed in all industries of the region's economy.[15] Therefore, a loss of 100 coal mining jobs would depress the local economy by $12.8 million.[16]

For these reasons, ACCCE and its members have a substantial interest in EPA's Proposal to repeal the CPP in its entirety.

II. The Clean Power Plan Is Illegal and Should Be Repealed.

In the Proposed Rule, EPA has provided a detailed analysis of the Agency's authority to regulate CO_2 emissions from existing electric generating units (EGUs) under section 111(d) of the CAA. This analysis concludes that EPA only has authority to require states to set CO_2 performance standards that satisfy two related statutory requirements. First, the standards must be based on control measures that are determined to be the "best system of emission reduction" (BSER) and second, in making this BSER determination, EPA may consider only control measures "that can be applied at, to or for" an individual stationary source.[17] Based on this reading of the statute, EPA proposes to determine that it does not have authority to establish CO_2 performance standards for existing sources under section 111(d) based on the "beyond-the-fence" methodology used in the CPP rule. That methodology resulted in the establishment of stringent CO_2 emission standards that could not be met by individual coal-fueled power plants and would instead have required generation shifting to natural gas and renewable energy resources.

ACCCE strongly agrees with the Agency's conclusions for the reasons explained below.

A. CAA Section 111 Bars EPA from Requiring States to Establish Generation-Shifting Performance Standards.

Section 111 of the CAA only authorizes the establishment of technology-based performance standards applicable to individual sources within each regulated source category based on the BSER control measures that can be implemented at each individual source. This source-specific and technology-based methodology for establishing performance standards is required by section 111 of the CAA, which expressly requires the setting of performance standards "for" and "applicable … to" individual regulated sources.[18]

Importantly, EPA's role in setting performance standards is limited to establishing a "procedure" for states to submit "plans" that "establish standards of performance *for any existing source*" in accordance with that procedure.[19] State plans in turn must "*apply*[] a standard of performance to any *particular source*."[20] The CAA defines a "stationary source" as "any building, structure, facility, or installation which emits or may emit any air pollutant."[21] Thus, section 111(d) permits EPA to call on states to establish performance standards only for the building, structure, facility, or installation whose emissions are being controlled.

This statutory language unambiguously bars the CPP methodology of establishing performance standards that are based on the shifting of generation to energy resources with reduced or zero CO_2 emissions. Such generation shifting does not entail setting standards that are "for" or "applicable" to affected EGUs (*i.e.*, the building, structure, facility or installation that emits CO_2). Rather, it involves something else entirely, namely, the shifting of generation from coal-fueled EGUs to lower-emitting gas-fueled units or the shifting of generation from fossil-fueled EGUs to zero-emitting renewable energy resources. This is plainly beyond what the CAA permits.

Judicial precedent confirms this interpretation of the CAA. In several cases involving the regulation of emissions under section 111, the courts have ruled that performance standards set under section 111 must apply to individual sources in regulated source categories, rather than to groups of sources or the category as a whole.[22] EPA has ignored this clear and unequivocal legal precedent by setting emissions reductions that are impossible to achieve by any individual coal-fueled EGU but rather are achievable only through shifting of generation to gas-fueled and renewable energy resources across the electricity grid. Requiring an owner or operator of a coal-fueled power plant to construct or purchase generation from other facilities with lower CO_2 emissions (or emissions credits under an emissions trading scheme) is not a standard "for" that individual source at all and therefore is clearly illegal under the CAA.

B. The CPP Is Illegal Because It Violates the Supreme Court's Clear Statement Rule By Seeking To Transform the Power Sector Without A Clear Statement Of Authority From Congress.

In order for the CAA to authorize the CPP's attempt to transform the power sector, EPA must show that the Act contains a clear statement *compelling* the Agency's reading of section 111(d). Because the Act includes no such clear authorization—and in fact, as indicated above, the statute unambiguously forecloses such an interpretation—the CPP violates the clear statement rule established in several recent Supreme Court rulings.

One such ruling is *Utility Air Regulatory Group v. EPA* ("*UARG*").[23] In this case, the Supreme Court ruled that no federal agency (including EPA) can exercise transformative power over matters of economic and political significance unless it has clear congressional authorization to do so. In rejecting EPA's effort to dramatically expand to two CAA permitting programs for regulating greenhouse gas emissions, the Court explained that when an agency seeks to make "decisions of vast 'economic and political significance'" or "bring about enormous and transformative expansion" in its authority under a "long-extant statute," it must point to a "clear[] statement from Congress."[24]

There is no question that the CPP is a transformative rule that would have enormous economic and political impacts on the electricity sector and the nation as a whole. The Obama Administration itself expressly confirmed this fact during the rollout of the CPP when it stated that the objective of CPP was to achieve an "aggressive transformation" of the electricity mix in nearly every state by systematically "decarboniz[ing] power generation" and ushering in a new "clean energy" economy.[25] The transformative nature of the CPP is also confirmed by the fact that the emissions limitations imposed by the CPP would require states to transform their mixes of electricity generation, force the premature closure of coal-fueled plants, and dictate how much electricity each electricity source may generate.

In addition, the Supreme Court has ruled that clear congressional authorization is required when a federal agency intrudes on an "area[] of traditional state responsibility," such as the states' traditional role in structuring their own energy markets and resources.[26] This clear statement rule bars any federal agency from broadly interpreting the CAA in a manner that would invade or encroach upon a traditional state regulatory power unless "unmistakably clear … language" compels the federal agency to do so.[27] In the case of the CPP, there is no language in section 111 or any other provision of the CAA that clearly authorizes EPA to encroach upon traditional powers of states to regulate the generation and use of electricity. Rather, as discussed above, section 111 of the Act contains only a very general authorization to establish technology-based performance standards based on those BSER control measures that can be applied to or for an individual source. This general language is simply not sufficient to satisfy the Supreme Court's clear statement rule and therefore provides an independent legal basis for the repeal of the CPP in its entirety.

C. Prior Agency Practice and the Broader Statutory Context Further Confirm that The Clean Power Plan Is Illegal and Should Be Repealed.

Prior agency practice and the broader statutory context for setting performance standards for stationary sources under other CAA regulatory programs support EPA's proposal to repeal the CPP. These factors further demonstrate that the BSER control measures used for setting CO_2 performance standards under section 111(d) must be measures that can be taken at or applied to each individual power plant itself. The generation-shifting performance standards established by the CPP fail to comply with this requirement and therefore provide an additional legal basis for concluding the CPP is illegal and should be repealed.

1. The CPP Approach is Contrary to Over 45 Years of Prior Agency Practice Under CAA Section 111.

The generation-shifting approach taken in the CPP departs from 45 years of consistent EPA practice, further confirming that this approach is contrary to the requirements of the CAA. Each of the approximately 100 new source performance standards that EPA has set under section 111 for more than 60 source categories has been based on a system of emission reduction that can be achieved with technological and operational measures that the regulated source itself can implement.[28]

In promulgating standards of performance for new and modified refineries, EPA recently reiterated its long-standing view that "[t]he standard that the EPA develops [is] based on the [best system of emission reduction] *achievable at the source*."[29] EPA also took the same well-established approach in promulgating the CO_2 performance standards for new coal- and gas-fueled EGUs under section 111(b) of the CAA. EPA based the standards on its examination of the level of emissions performance these EGUs achieve by using control technologies and operating practices at the EGU facilities themselves, and not based on some CO_2 emission level that could be achieved by shifting some portion of the EGU's generation to new lower- or zero-emitting energy resources. Notably, the Agency issued these performance standards for new EGUs at the same time EPA issued the final CPP rule.

This radical departure from past EPA rulemakings and Agency practice further demonstrates the arbitrariness of EPA's statutory interpretation, and that section 111(d) does not provide EPA with authority to adopt generation-shifting performance standards in the CPP for the first time in the history of the CAA.

2. The Broader Statutory Context Reinforces EPA's Proposed Interpretation.

EPA's proposed interpretation of section 111 is reinforced by the overall statutory context into which section 111 fits. For example, the Prevention of Significant Deterioration (PSD) permit program requires that performance standards be set for each affected source based on the "best available control technology" (BACT). In setting those standards, both the statute[30] and EPA regulations[31] require that the section 111 standards set the "floor" and thereby prohibit the BACT limits from being less stringent than the applicable section 111 emission limits. EPA's approach under the CPP, however, could have the effect of imposing more stringent performance standards under section 111 than can be established as BACT, given that the BACT performance standards must be applied to the source itself and do not include control options that are beyond-the-source, such as generation shifting measures called for under the CPP.[32]

This problem can be corrected by reading the provisions of section 111 in a manner consistent with the PSD requirements noted above for setting BACT performance standards. Under this interpretation, the provisions of section 111 must adhere to the same source-specific standard-setting framework used for establishing BACT limits, a framework that does not rely on generation-shifting measures that cannot be applied at, to, or for a particular source.

Other CAA regulatory programs also require EPA to set performance standards that are focused solely on achieving emission reductions at individual sources. Notable examples include the performance standards based on "lowest achievable emission rate" for criteria air pollutants under the nonattainment new source review (NSR) permit program,[33] those based on "maximum achievable control technology" (MACT) for hazardous air pollutants under the air toxics program,[34] and "best available retrofit technology" for mitigating visibility impairment in Class I areas under the regional haze program.[35]

In contrast, where Congress did authorize emission control measures that go beyond a specific source for the purpose of meeting aggregate emission reduction goals, it spoke clearly and precisely. Notable examples applicable to the power sector include the acid rain emissions trading program specifically established pursuant to Title IV of the CAA and the interstate emission trading programs (such as the Cross-State Air Pollution Rule) authorized by section 110(a)(2)(D) of the Act. In both cases, Congress expressly authorized EPA to pursue a particular air quality objective through the establishment and implementation of emissions trading schemes. In the case of the acid rain program, Title IV of the Act established a detailed regulatory framework for the establishment and implementation of a cap-and-trade program for reducing SO_2 emissions nationwide from all fossil-fueled EGUs. Similarly, Congress expressly authorized the use of "marketable permits" and other types of emission trading mechanisms to achieve emission reductions necessary for addressing interstate transport of air pollution in order to achieve national ambient air quality standards (NAAQS) under section 110 of the CAA.[36]

Viewed in this context, Congress' silence on the use of control measures that can be implemented outside the regulated source in setting the performance standards under section 111(d) reinforces the interpretation that CO_2 standards for existing EGUs cannot be set based on such generation-shifting measures. In particular, this broader statutory context indicates that unintended and illogical consequences would occur by employing the CPP approach. For example, the CPP approach of setting performance standards based on beyond-the-source control measures can result in the imposition of more stringent emission reduction obligations under section 111 than could ever be established for the source-specific performance standards like BACT, LAER and MACT. Such outcomes are at odds with general CAA regulatory framework.

III. The CPP Should Be Repealed In Its Entirety.

EPA should withdraw the CPP in its entirety. There are significant legal and technical errors in the methodology that the Agency used for setting the CO_2 performance standards under the CPP. These errors are so fundamental that the Agency has no choice but to repeal the CPP rule in its entirety.[37]

EPA's proposed legal basis for repealing the CPP in its entirety is that the generation-shifting measures identified under Building Blocks 2 and 3 of the CPP were unlawful for the reasons noted above, while the on-site efficiency measures of Building Block 1 "are not severable and separately implementable."[38] In support of this conclusion, the Agency cites to a prior EPA determination made in the CPP that Building Block 1 efficiency measures "cannot stand on their own" and be separately implemented due to the "rebound effect" that would result from EPA's repeal of Building Blocks 2 and 3. According to EPA's determination in the CPP, the rebound effect would result from the "improved competitiveness and increased generation at the EGUs implementing heat rate improvements" required under Building Block 1 and, consequently, this response "could weaken or potentially even eliminate the ability of Building Block 1 to achieve CO_2 emission reductions."[39]

ACCCE agrees that EPA must withdraw the CPP in its entirety rather than severing and implementing a revised CPP based only on the emission reduction levels achievable under Building Block 1. However, we do not agree that Building Block 1 (*i.e.*, on-site efficiency measures) cannot stand on its own as a section 111 standard due to a lack of "meaningful emission reductions," as claimed by EPA in the CPP. Section 111 is fundamentally different from the other air regulatory provisions, such as those for attaining the NAAQS through state implementation plans under section 110 of the CAA. Unlike these air quality programs, section 111 was not written to achieve specific emission reduction goals or levels that must be achieved by individual sources or from any source category as a whole. Instead, as a technology-based program, section 111 authorizes EPA only to adopt standards of performance that reflect the best system of emission reduction, regardless of the level of emission reductions that are actually achieved individually or collectively by the implementation of the performance standards.

Rather, EPA's legal basis for repealing the CPP in its entirety should be based on a conclusion that Building Blocks 2 and 3 exceed EPA's statutory authority (as noted above), and Building Block 1 is fatally flawed due to major deficiencies in EPA's technical analysis used in determining the reductions achievable by improving power plant efficiency. As documented in our prior comments on the CPP, as well as the comments of UARG that were incorporated into those comments by reference, there were significant methodological errors in EPA's Building Block 1 determination that all coal-fueled EGUs can on average achieve a 4% efficiency (heat rate) improvement. In the CPP, EPA assumed that a 4% improvement can be achieved by "best practices to reduce hourly heat rate variability" as a "best-practices opportunity" based on various technical studies.[40]

However, EPA provided no data showing that an average 4% improvement has been demonstrated to be generally available for all existing coal-fired EGUs covered under the CPP. In addition, many of the coal-fueled units in the United States, particularly those that are still operating after the compliance deadline for the Mercury and Air Toxics Standards (MATS Rule),[41] are likely to have already implemented many of the best practices identified by EPA for improving plant heat rates, thereby limiting the total amount of reductions that could be achieved. Finally, EPA has overlooked the degradation in heat rate that typically results from the application of newly-retrofitted emissions controls to comply with federal and state requirements such as the MATS Rule, intrastate and transport regulations related to NAAQS attainment, and the increase in cycling operations that has been occurring for coal-fueled generation. In other words, heat rate improvements available to coal-fueled power plants are highly unit-specific, will degrade over time, and any analysis that assumes that a 4% improvement is available across-the-board is flawed.

Each of these methodological flaws provides a strong technical basis for determining that the CPP Building Block 1 analysis is fatally flawed and therefore cannot be used in setting CO_2 performance standards for existing EGUs under section 111(d). As a result, EPA has no choice but to repeal the CPP in its entirety due to the fact Building Blocks 2 and 3 are unlawful and Blocks 1 is technically flawed; and the Agency is foreclosed from using the CPP Building Block 1 analysis to set performance standards under any type of CPP replacement rule that EPA elects to adopt.

IV. Policy Reasons Justify Full Repeal of the CPP.

The CPP is bad environmental and energy policy. Compelling policy reasons therefore justify a full CPP repeal even if the CPP were determined to be lawful (which it is not for the legal and technical reasons discussed above). ACCCE urges EPA also to exercise its discretionary authority under the CAA to further justify the repeal of the CPP based on policy reasons, the most compelling of which are briefly summarized below.

Regulation Of Energy Matters Is Beyond EPA's Expertise. The CPP inappropriately seeks to regulate energy matters that are clearly outside the expertise and experience of EPA. While EPA has authority to establish performance standards for existing EGUs under section 111(d) and, in doing so, is required to consider "energy requirements" in setting those standards, this authority does not empower EPA to regulate electricity or determine the appropriate generation mix in meeting future electricity demand. Rather, these types of energy matters have been traditionally left to the Federal Energy Regulatory Commission (FERC) and the states. The Federal Power Act provides FERC with regulatory authority over electric utilities engaged in *interstate* commerce, including wholesale sales, transmission of electricity, and reliability.[42] States, by contrast, have exclusive authority to regulate the *intrastate* generation and transmission of electricity.

The CPP intrudes on this well-established federal-state regime for the regulation of energy by imposing an additional layer of CAA regulation that will have a profound and transformative impact on the electric power sector. Among other things, it would require electricity generators to change their mixes of electricity generation, force the premature closure of coal-fueled plants that generate affordable and reliable electricity, and dictate how much electricity each energy resource may generate. Since the regulation of these types of matters is well beyond EPA's expertise and experience, it would be inappropriate for EPA to use its CAA authority to intrude upon these matters traditionally left to FERC and the states.

Significant Risks Are Posed To The Electric Power Grid. The CPP poses significant risks to ensuring a reliable and resilient supply of electricity for the nation. By its own admission, EPA found that the CPP would result in the premature retirement of additional coal-fired power plants, projecting in its original Regulatory Impact Analysis ("Original RIA") that the CPP would result in the retirement of an additional 29,000 MW of coal-fired electric generating capacity by 2025.[43] DOE, FERC, NERC, and others have already raised concerns about the potential impact of continuing retirements of coal-fueled electric generating capacity on the reliability and resilience of the electric grid.[44] The CPP would exacerbate these risks to grid reliability and resilience.

EPA also did not even attempt to perform a detailed power flow analysis or to project new transmission additions when estimating the potential impacts of the CPP on the electric power sector. Instead, it simply made projections of the total, region-wide capacity for new renewable energy facilities and shifts from coal- to gas-fueled generation that might be available by 2030.[45] Commenters, including entities charged with maintaining the reliability of the nation's electric grid, raised significant issues regarding the basis for these projections and the likelihood that projected capacity would materialize.[46] EPA also found that any realistic appraisal of reliability could not be done until after the rule was implemented by the states.

Enormous Compliance Costs Are Imposed Without Achieving Meaningful Climate Benefits. The CPP would unnecessarily cost consumers and businesses billions of dollars. For example, the Energy Information Agency recently estimated that the CPP would cost $14.4 billion in 2030.[47] In the Regulatory Impact Analysis for the Proposed Repeal Rule ("Current RIA"), EPA estimated that the cost of the CPP to be as much as $33.3 billion per year by 2030.[48] By contrast, EPA has estimated the cost of all power sector regulations through 2010 to be $7 billion per year, with the MATS rule adding $10 billion per year to that total.[49]

Moreover, the CPP would impose these enormous costs on consumers and businesses without achieving a meaningful effect on climate change. Based on EPA's own methodology for estimating climate change effects,[50] the cumulative CO_2 emissions reductions achieved from the power sector under the CPP would only reduce atmospheric CO_2 concentrations by 0.2% by 2050. In turn, this miniscule reduction in atmospheric CO_2 concentrations would only reduce global temperatures by 1/80th degree Celsius by 2100 and decrease sea level rise by just 0.20 millimeter (the thickness of two sheets of paper) by 2050.[51]

The evaluation of costs and benefits in the Current RIA further supports EPA's proposal to repeal the CPP. The RIA demonstrates that the actual costs are much greater than costs initially estimated by EPA, and the Agency's estimated climate-related benefits are much smaller than its original estimates. Repealing the CPP would avoid $33.3 billion in compliance costs by 2030 (using a 7% discount rate), while only forgoing domestic climate benefits of $0.5 billion.[52] ACCCE believes that the repeal of the CPP is justified in light of this cost-benefit analysis that demonstrates substantial compliance costs would be incurred under the CPP while only minimal domestic climate benefits would be lost if the CO_2 reductions from CPP were not achieved.

Executive Order 13783 Requires EPA To Provide Relief from Undue Regulatory Burdens Imposed On the Energy Sector. Executive Order 13783 directs all federal agencies, including EPA, to suspend, revise, or rescind all existing regulations that are determined to "unduly burden the development of domestic energy resources." As noted above and documented in both the Original and Current RIA, the CPP would impose massive costs on the economy, including the power sector and consumers, and create major risks to the electricity grid through the premature retirement of an additional 29,000 MW of coal-fueled generating capacity by 2025. These CPP regulatory burdens are exactly the types of undue regulatory burdens from which Executive Order 13783 directs EPA to provide relief for domestic energy resources.

<u>The CPP Usurps State Regulatory Authority</u>. The CPP is fundamentally inconsistent with the cooperative federalism framework established under the CAA. Notably, section 111(d) gives states the primary responsibility to establish plans for the implementation and enforcement of performance standards for existing sources and limits EPA's role to establishing "a procedure" for the development and submission of those state plans. Instead of following this cooperative federalism framework, EPA has usurped states' regulatory role under section 111(d) by establishing binding national performance standards for all existing power plants under the CPP and imposing those binding standards through federal plans in those cases where states have failed to comply with the requirements of the CPP. Furthermore, these national standards are fixed and may not be varied in light of the remaining useful life of any particular plant or other plant-specific factors, as required by section 111(d)(1) of the CAA.[53]

This usurpation of state authority is another fundamental flaw in the CPP and thereby provides another reason why the CPP should be withdrawn.

V. EPA's Current RIA Provides a Sound Cost-Benefit Evaluation in Support of the Full CPP Repeal.

EPA's analysis of the costs and benefits of the CPP in the Current RIA is greatly improved compared to the approach taken in the Original RIA. EPA notes, importantly, that the new approach in the RIA "underscores the uncertainty associated with any agency action of this magnitude, especially in actions where discretion is afforded to State governments."[54]

A thorough evaluation of the new RIA is contained in a report prepared for ACCCE and the Utility Air Regulatory Group by NERA Economic Consulting entitled "Technical Comments on EPA's Regulatory Impact Analysis for the Proposed Repeal of the Clean Power Plan," which is attached to our comments. The improvements in the current RIA include the following.

<u>The Current RIA includes an improved presentation of co-benefits</u>. First, the current RIA includes a range of assumptions for predicted fine particulate matter ($PM_{2.5}$) co-benefits resulting from the implementation of the CPP. NERA points out that $PM_{2.5}$ co-benefits from coincidental reductions in emissions of the $PM_{2.5}$ precursors SO_2 and NO_x have been used to justify numerous unrelated air regulations for nearly 20 years. For example, NERA cites a 2011 report in which it found that EPA relied heavily on co-benefit $PM_{2.5}$ reductions in justifying over two dozen air regulations between 1997 and 2011, including the MATS rule.[55] In most of these cases, $PM_{2.5}$ benefits accounted for nearly all of the monetary benefits in the unrelated air regulations. And EPA's inclusion of $PM_{2.5}$ co-benefits in areas *in compliance with* EPA's health-protective $PM_{2.5}$ National Ambient Air

Quality Standards (NAAQS) provided most of the total benefits in these earlier analyses. This was the case in the Original CPP RIA.

The Current RIA greatly improves the treatment of co-benefits. EPA accomplishes this improvement by presenting sensitivity analyses that eliminate or "zero-out" $PM_{2.5}$ co-benefits at (1) levels below the current $PM_{2.5}$ NAAQS and (2) at levels below the "lowest measured level" (LML) of the epidemiological studies underlying the $PM_{2.5}$ risk estimates. These sensitivity cases result in greatly reduced co-benefits. For example, assuming that $PM_{2.5}$ co-benefits fall to zero below the current NAAQS results in 2030 would forego co-benefits of $1.2 billion to $4.5 billion (in the mass-based implementation assumption), compared to foregone co-benefits of $10.6 billion to $28.1 billion (also for the mass-based case) using the original analysis.

These sensitivity analyses should be included because the NAAQS are set at levels designed to protect public health with an adequate margin of safety. Therefore, considering only co-benefits in areas with $PM_{2.5}$ concentrations exceeding the NAAQS (or in areas with $PM_{2.5}$ concentrations exceeding the LMLs from epidemiological studies) is a more appropriate and accurate way to quantify and consider any actual or projected co-benefits that may result from $PM_{2.5}$ emission reductions.

The Current RIA improves critical assumptions used to calculate climate-related benefits. The CPP is intended to address climate change, and the direct forgone benefits of its repeal are therefore climate-related benefits. EPA uses the "social cost of carbon" (SCC) to estimate climate benefits in both the Original RIA and the Current RIA. The previous Administration published several sets of SCC estimates (in 2010, 2013 (two sets), and 2015). ACCCE submitted comments in 2014 when proposed SCC estimates were published for public comment.[56]

The Current RIA alters several critical assumptions used to derive SCC estimates, both in a manner consistent with ACCCE's 2014 recommendations on the SCC estimates. First, the Current RIA compares only *domestic* projected climate damages to CPP compliance costs.[57] The Original RIA performed its cost-benefit analysis based on *global* damages, which included not just domestic damages but also all climate damages projected to occur outside the U.S. Under this approach used for the CPP, the Original RIA compared global damages to domestic compliance costs.

In 2014, ACCCE and others recommended such a change to the derivation of the SCC to focus only on domestic climate damages in 2014 because (1) OMB guidance requires agencies to assess the effects of potential regulations on the domestic economy, and (2) because, as a policy matter, comparing costs imposed on U.S. consumers to benefits assumed to occur everywhere in the world is an apples-to-oranges comparison that exaggerates and distorts domestic benefits derived from regulatory action and relies on U.S. consumers to pay for future worldwide benefits.[58] This is a clear overreach of regulatory authority that must be rectified by repealing the CPP.

In addition, NERA notes in its report that the economic literature supports the principle that "policies that are likely to produce positive net benefits only when including some or all of non-domestic benefits should be avoided." And, as presented in the Current RIA's Table 1-5, the compliance costs of the CPP *exceed* the domestic climate benefits in every case. In other words, avoiding the *domestic* compliance costs of the CPP saves billions of dollars more than the forgone *domestic* climate benefits. For example, in 2030, the projected compliance costs avoided by repealing the CPP are as much as $33.3 billion, while in that year (and for the same discount rate), only $0.5 billion in domestic climate benefits will be forgone. Therefore, on the basis of sound economic analysis alone, the CPP should be withdrawn.

Second, the Current RIA properly considers, in addition to the 3% discount rate in the original RIA, a discount rate of 7%. This is consistent with OMB Guidance and was recommended by ACCCE in 2014.[59] Using a higher discount rate, as ACCCE pointed out, adds a "model risk" premium to the lower discount rates used in the SCCs derived by the previous Administration.

In addition to these changes made in the analysis presented in the RIA, in the attached report NERA recommends several changes in the way both avoided costs and forgone benefits should be presented in any final RIA repealing the CPP. For example, while EPA properly considers sensitivities in which $PM_{2.5}$ co-benefits are reduced at levels below the NAAQS and LMLs, it does not do so for ozone co-benefits. The result is that almost all of the remaining co-benefits are due to ozone concentrations below the ozone NAAQS. NERA strongly recommends that EPA include ozone co-benefit sensitivities in the same manner it included those for $PM_{2.5}$ co-benefits.

And finally, NERA points out that the costs included in the original RIA and the avoided costs presented in the current RIA are missing important components. For example, the RIA does not include an analysis of the potential impact of natural gas price increases on non-electricity consumers, which NERA's analysis for ACCCE in 2014 estimated to range from $15 billion to $144 billion.[60] An analysis of these kinds of cost increases should be included in any final RIA. NERA suggests other additional analyses for any final RIA in its report.

VI. Conclusion

For all of the legal and policy reasons discussed above, ACCCE wholeheartedly supports the repeal of the Clean Power Plan in its entirety.

Sincerely,

Paul Bailey
President and Chief Executive Officer

Attachment: "Technical Comments on EPA's Regulatory Impact Analysis for the Proposed Repeal of the Clean Power Plan," NERA Economic Consulting.

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[1] *See* Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Final Rule, 80 Fed. Reg. 64,662 (Oct. 23, 2015) ("CPP Final Rule").

[2] *Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Proposed Rule*, 82 Fed. Reg. 48,035 (October 16, 2017).

[3] A list of ACCCE members is provided in Appendix 1.

[4] *See* e.g.,, Perry, Rick, "Secretary of Energy's Direction …," Received by Neil Chatterjee, Cheryl LaFleur, and Robert Powelson, September 28, 2017; Federal Energy Regulatory Commission, Department of Energy, "Grid Resiliency Pricing Rule," Notice of Proposed Rulemaking, 82 Fed. Reg. 46940 (October 10, 2017); NERC, "Comments of the North American Electric Reliability Corporation in Response to Notice of Proposed Rulemaking," October 23, 2017; NERC, *2017 Long Term Reliability Assessment*.

[5] ACCCE, Retirement of Coal-Fired Electric Generating Units (October 24, 2017).

[6] EPA, *Regulatory Impact Analysis for the Clean Power Plan Final Rule*, October 23, 2015.

[7] Marianne Mintz, Chris Saricks, and Anant Vyas, Coal-by-Rail: A Business-as-Usual Reference Case 9 (U.S. Department of Energy Argonne National Laboratory 2015).

[8] Association of American Railroads, Railroads and Coal 6 (Association of American Railroads 2017).

[9] Association of American Railroads, Railroads and Coal 7 (Association of American Railroads 2017).

[10] *See* Mine Safety and Health Admin., *Employment/Production Data Set.*

[11] *See* Bureau of Labor Statistics, *Quarterly Census of Employment and Wages, Private, NAICS 221112 Fossil fuel electric power generation, All Counties, 2011* and *2017*.

[12] DOE, *Staff Report to the Secretary on Electricity Markets and Reliability* (August 2017) at 23.

[13] Sam Evans, *Economic Impacts of Job Losses in the Coal Mining Industry*, 7 KIRES Paper 1 (Feb. 2013).

[14] *Id.*

[15] *Id.* at 2.

[16] *Id.* at 2.

[17] 82 Fed. Reg. at 48,039.

[18] CAA §§ 111(a)(2), (b)(1)(B), (d). However, it should be noted that this interpretation does not require individual sources to implement changes in order to comply with the applicable performance standards. Nor does it impose an obligation on states to submit plans that would require a source to install and operate any particular emission control measure under section 111. Rather, EPA would be issuing an emission guideline that States then use to develop and implement performance standards. Affected sources would then comply with the applicable performance standards by using any method capable of achieving that standard—or, if the source's emissions already meet that standard, without taking any affirmative steps at all.

[19] CAA §111(d)(1) (emphasis added).

[20] CAA §111(d)(1) (emphasis added).

[21] CAA §111(a)(3).

[22] One notable example is *ASARCO, Inc. v. EPA*, in which the D.C. Circuit ruled that the CAA "limit[s] the definition of 'stationary source' to one facility" and not a "combination of facilities." 578 F.2d 319, 324, 326 n. 24 (D.C. Cir. 1978). As a result, the court found that EPA has no authority to "change the basic unit to which the [standards] apply from a single building, structure, facility, or installation—the unit prescribed in the statute—to a *combination* of such units." 578 F.2d at 327. Notably, the court in *ASARCO* goes on to state that the objective of section 111 is to require sources "to employ pollution control systems" at the source and that Congress never contemplated setting standards based on reductions that cannot be achieved at the source. 578 F.2d at 327-28. Similarly, the court ruled in *National Southwire Aluminum Company v. EPA* that section 111 performance standards must "specif[y] the maximum rate at which an *individual source* may emit pollution." 838 F.2d 835, 837 n. 3 (6th Cir. 1988).

[23] *Utility Air Regulatory Group v. EPA*, 134 S. Ct. 2427 (2014) (*UARG*).

[24] *UARG*, 134 S. Ct. at 2444 (2014) (quoting *FDA v. Brown & Williamson Tobacco Corp.*, 529 U.S. 120, 160 (2000)). The Supreme Court subsequently confirmed the *UARG* ruling in *King v. Burwell*, holding that courts are not to presume that Congress would implicitly delegate to agencies "question[s] of deep 'economic and political significance'" because, if "Congress wished to assign [such] question[s] to an agency, it surely would have done so expressly." *King v. Burwell*, 135 S. Ct. 2480, 2489 (2015) (citation omitted).

[25] White House Statement (August 5, 2015).

[26] *Bond v. United States*, 134 S. Ct. 2077, 2089 (2014) (noting "well-established principle that it is incumbent upon the federal courts to be certain of Congress' intent before finding that federal law overrides the usual constitutional balance of federal and state powers"). Notably, the Supreme Court has specifically recognized that "the regulation of utilities is one of the most important functions traditionally associated with the police powers of the States" *Arkansas Electric Cooperative Corp. v. Arkansas Public Service Commission*, 461 U.S. 375, 377 (1983).

[27] *American Bar Association v. FTC*, 430 F.3d 457, 471-72 (D.C. Circuit 2005).

[28] *See* 40 C.F.R. Part 60, subparts Cb-OOOO.

[29] 79 Fed. Reg. 36,880, 36,885 (June 30, 2014) (emphasis added).

[30] *See* CAA § 169(3).

[31] 40 C.F.R. §52.51(b)(12).

[32] *See e.g.*, U.S. EPA, PSD and Title V Permitting Guidance for Greenhouse Gases, 24 (March 2011) (indicating that BACT encompasses "all 'available' control options ... that have the potential for practical application to the emissions unit").

[33] *See* CAA §§ 171(3), 173(a)(2); 40 C.F.R. §52.165(a)(1)(xiii).

[34] *See* CAA § 112(d)(2).

[35] *See* CAA §169A(b)(2)(A).

[36] See CAA §110(a)(2)(A) (authorizing states to adopt and include in their state implementation plans "economic incentives such as fees, marketable permits, and auctions of emissions rights").

[37] An entirely new rule is necessary to address the significant legal and technical flaws of the CPP rule if the Agency elects to move forward with a replacement rule that does not mandate generation shifting or other such measures that could force the power sector to re-engineer the electric grid. For the reasons discussed in this section, it is simply not possible for EPA to avoid a repeal of the entire CPP rule by first invalidating generation-shifting measures identified in Building Blocks 2 and 3 as unlawful, and then severing and separately implementing the on-site efficiency improvement measures identified under Building Block 1 of the CPP rule.

[38] 82 Fed. Reg. at 48,039, fn 5. See also *id.* at 48,038.

[39] 80 Fed. Reg. 64,662, 64,758 (October 23, 2015).

[40] EPA originally proposed to require a 6% heat rate improvement for coal-fired EGUs nationwide, representing a 4% heat rate improvement due to implementation of best practices and a 2% heat rate improvement from equipment upgrades. In the final CPP rule, EPA abandoned its proposal to rely on heat rate improvements from equipment upgrades. Although EPA calculated different heat rate improvements for each interconnection region, the final rule relied on the CO_2 performance rate calculated for the Eastern Interconnection with a 4.3% heat rate improvement when setting the CO_2 performance rate for coal-fired EGUs under the Clean Power Plan.

[41] *See* 77 Fed. Reg. 9,304 (Feb. 16, 2012) (codified at 40 C.F.R. pts. 60, 63).

[42] *See* Sections 201-223 of the Federal Power Act.

[43] EPA, *Regulatory Impact Analysis for the Clean Power Plan Final Rule*, October 23, 2015.

[44] *See*, for example, Perry, Rick, "Secretary of Energy's Direction …," Received by Neil Chatterjee, Cheryl LaFleur, and Robert Powelson, September 28, 2017; Federal Energy Regulatory Commission, Department of Energy, "Grid

Resiliency Pricing Rule," Notice of Proposed Rulemaking, 82 Fed. Reg. 46940 (October 10, 2017); NERC, "Comments of the North American Electric Reliability Corporation in Response to Notice of Proposed Rulemaking," October 23, 2017; NERC, *2017 Long Term Reliability Assessment*.

[45] GHG Mitigation Measures TSD (August 2015).

[46] *See, e.g.*, Midcontinent Independent System Operator, Inc. Comments at 3, EPA-HQ-OAR-2013-0602-22547; Southwest Power Pool, SPP's Reliability Impact Assessment of the EPA's Proposed Clean Power Plan, at 3, 5-6 (Oct. 8, 2014), PSA 01-PSA 08; NERC, Potential Reliability Impacts of EPA's Proposed Clean Power Plan, Initial Reliability Review at 19, EPA-HQ-OAR-2013-0602-37006.

[47] EPA, *Regulatory Impact Analysis for the Review of the Clean Power Plan: Proposal*, (October 2017) ("Current RIA") at 18.

[48] Current RIA at 4.

[49] Annual cost of all Clean Air Act rules for the electric power sector promulgated by 2010 from U.S. EPA, *The Benefits and Costs of the Clean Air Act from 1990 to 2020* (2011), Table 3-2. Electric utility direct annual compliance costs were $6.6 billion (2006$) in 2010; this is equivalent to $7.1 billion in 2010$. MATS annual cost from U.S. EPA, *Regulatory Impact Analysis for the Final Mercury and Air Toxics Standards*, December 2011 ($9.6 billion cost in 2006$ is equivalent to $10 billion in 2010$.)

[50] In particular, ACCCE has relied on EPA's assessment of the climate impacts of the proposed greenhouse gas emission standards for light-duty vehicles. See U.S. EPA, *Regulatory Impact Analysis: Final Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards*, August 2012.

[51] ACCCE, "*Climate Effects" of EPA's Final Clean Power Plan*, August 2015. See also Lomborg, Bjorn, *Impact of Current Climate Proposal, Global Policy (2015).*

[52] Current RIA at 4 and 9.

[53] 80 Fed. Reg. at 64,870.

[54] 82 Fed. Reg. at 48,043 note 22.

[55] NERA Economic Consulting, *An Evaluation of the PM2.5 Health Benefits estimates in Regulatory Impact Analyses for Recent Air Regulations* (December 2011).

[56] ACCCE, "Re: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (Nov. 2013)," February 26, 2014. ("ACCCE SCC Comments")

[57] Results using global SCC values are contained in Appendix C of the current RIA.

[58] ACCCE SCC Comments at 6-7.

[59] U.S. Office of Management and Budget, Circular A-4, Regulatory Analysis, September 17, 2003; ACCCE SCC Comments.

[60] NERA Economic Consulting, "Potential Energy Impacts of the EPA Proposed Clean Power Plan," included in comments submitted by ACCCE to EPA-HQ-OAR-2013-0602.

ATTACHMENT

NERA
ECONOMIC CONSULTING

Technical Comments on EPA's Regulatory Impact Analysis for the Proposed Repeal of the Clean Power Plan

Prepared for:

Utility Air Regulatory Group

American Coalition for Clean Coal Electricity

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* The opinions expressed herein do not necessarily represent the views of NERA Economic Consulting or any other NERA consultants.

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Contents

List of Figures and Tables

I. INTRODUCTION AND EXECUTIVE SUMMARY

This report comments on technical aspects of EPA's October 2017 Regulatory Impact Analysis ("RIA") for the proposed repeal of the 2015 Clean Power Plan ("CPP"). The October 2017 RIA is referred to herein as the "CPP Repeal RIA" or "this RIA." Like all RIAs, this RIA is designed to describe the benefits and costs of a proposed regulatory action, provide estimates of those deemed quantifiable, and document the basis for those estimates. In part because the proposed regulatory action at issue is the repeal of a regulation that was promulgated recently but has never been implemented, it relies significantly on the estimated benefits, costs, and modeling presented in the RIA for that underlying rule—the final CPP (which were documented in the RIA that we will refer to herein as the "2015 CPP RIA").

As a preliminary matter, we find that this RIA's analysis methods and its presentation of results create a very useful document for policymakers tasked with determining whether the proposed action is sound public policy, consistent with the intended scope and purpose of RIAs. As such, it serves as a good model for future air regulation RIAs, albeit we recommend several additional elements in our comments herein that we believe will further enhance its utility in policy deliberations. Below is an outline of the full contents of these technical comments on the RIA, while the remainder of this section provides a high level summary of its key findings and our recommendations for further improvement:

- Overview of this RIA's contents and findings, and their relationship to the 2015 CPP RIA's findings (Section II);
- Criteria pollutant co-benefits (Section III);
- Social cost of carbon ("SCC") (Section IV);
- Corrections to estimates of annual compliance costs (Section V.A);
- Annual versus present value comparisons of benefits and costs (Section V.B); and
- Specific suggestions for additional analyses useful to conduct for the final (Section VI).

Because EPA's RIAs for other types of regulations adopted under the Clean Air Act ("CAA") often use similar methodologies, many points in these technical comments will likely be relevant for RIAs for future rulemakings.

A. This RIA Is More Robust, Expansive, Complete, and Transparent

We applaud EPA's efforts in the CPP Repeal RIA to provide transparency and an in-depth analysis and explanation of potential sensitivities that might influence outcomes of the proposed regulatory action. This RIA: (a) provides exceptionally detailed estimates of the potential benefits and costs of the proposed action; (b) provides new types of sensitivity analyses for fine particulate matter ($PM_{2.5}$) co-benefits; (c) provides estimates of potential climate benefits in both domestic and global terms; (d) analyzes the proposed action's potential net benefits using a range of discount rates consistent with RIA guidance; and (e) thoroughly describes the uncertainties associated with the CPP and its proposed repeal. As we will explain in the full body of these comments, each of these is an important component of the desired policy-relevant content of an RIA, and thus helps make it a useful resource document for policymakers and for policy deliberations generally.

The CPP Repeal RIA also provides new types of analyses to comply with Executive Order 13771 signed on January 30, 2017, including the present values of estimates of avoided regulatory compliance costs, forgone benefits, and net benefits. As these comments will further explain, the presentation of present values also expands the decision-relevant content of this RIA, and would be a beneficial addition even if not needed to meet requirements of Executive Order 13771.

In addition to the enhanced information provided in the CPP Repeal RIA, it announces EPA's plan to perform updated modeling using the Integrated Planning Model ("IPM") and also to potentially perform updated full-scale gridded photochemical air quality modeling to support the air quality benefits assessment. Such updated analyses would further expand available relevant information, and we provide suggestions for such modeling in these comments as well.

In summary, by transparently identifying a wide range of potential cost and benefit outcomes, this RIA enables policymakers to develop for themselves a broad as well as nuanced understanding of the issues and uncertainties associated with the proposed regulatory action of repealing the CPP. This will help ensure this complex policy decision is well-informed and substantiated by robust analysis.

B. Key Changes in the CPP Repeal RIA

Consistent with this regulatory proposal being a repeal of the rule for which the 2015 CPP RIA was prepared, comparisons of the two documents are unavoidable. The most salient change is the necessary reversal of labeling of benefits and the costs between the two RIAs. That is, what was a benefit of the CPP is now a forgone benefit in this RIA; what was a cost of the CPP is now an avoided cost in this RIA. This reversal of labeling can be confusing to readers attempting to make a cross-comparison, but ultimately, as we show, it has no substantive impact on the respective net benefit conclusions of the two RIAs under the same assumptions about uncertain outcomes. More important in an RIA is how it serves the objective of providing a range of potential net benefit outcomes that reflect broad uncertainties about the potential benefits and costs of a regulatory action. To that end, this RIA provides substantial disaggregation of its benefit and cost estimates, provides estimates of benefits and costs for many alternative set of assumptions ("sensitivity cases"), and provides extended evaluation of uncertainties in both benefits and costs. The points below summarize key details that this RIA provides, and our key recommendations for improvement.

Avoided Costs

1. The CPP Repeal RIA helpfully disaggregates two different forms of economic impact (*i.e.*, avoided compliance costs and the value of forgone energy efficiency savings) that were presented as one aggregated (*i.e.*, net) cost estimate in the 2015 CPP RIA. By disaggregating these impacts, policymakers can see that there are two large but offsetting phenomena behind what appeared in the 2015 CPP RIA as a relatively small net compliance cost. Given that these two types of dollar impacts are borne by different entities in the economy, and that their estimation is subject to different sources and degrees of uncertainty, such disaggregation better informs policymakers of both distributional and uncertainty aspects of the estimated overall net benefits of the action.

2. We recommend that EPA include additional measures of dollar impacts on consumers beyond just electricity rates and bills, as the ones reported now are incomplete. For example, it would be useful to show total spending on energy services, which would include changes in spending on non-electric sector natural gas and consumer direct spending (non-rebated) on energy efficiency.

Forgone Co-Benefits

1. We recommend that future EPA RIAs, to the extent they estimate co-benefits of reducing criteria pollutants that are not the subject of the proposed action, follow the lead of the CPP Repeal RIA by excluding such estimates from the primary benefit-cost analysis summary tables. Criteria pollutants are already controlled under the stringent legal requirements of CAA Section 109, and keeping the co-benefits estimates separate will enable policymakers to focus on the goals of the proposed regulation in question. Co-benefits can be addressed as sensitivity cases, in the manner done in this RIA.

2. The CPP Repeal RIA provides additional information on the uncertainty of the potential level of co-benefits by including sensitivity analyses showing the effect on forgone $PM_{2.5}$ co-benefits of using different assumptions about the air quality level above which criteria pollutants' risks may benefits occur. Specifically, the RIA now includes information showing the implications of the possibility that there are no forgone co-benefits in locations where air quality levels are 1) already below the current $PM_{2.5}$ National Ambient Air Quality Standard ("NAAQS"), and/or 2) below the lowest measured levels ("LML") of the epidemiological studies on which risk relationship assumptions are based.

3. We recommend that when co-benefits are incorporated into secondary summaries of potential net benefits (such as Table 4-2 of the CPP Repeal RIA), net benefits estimates for all alternative co-benefits sensitivity cases be presented in a single table so that the degree of sensitivity can be more readily understood by a reader.

4. The uncertainty and inconsistency issues that have been raised for $PM_{2.5}$ risk estimates apply equally strongly to those for ozone. We therefore recommend that each co-benefit sensitivity case be revised to include an adjustment to the ozone risk calculation that is directly analogous to the adjustment being made to the $PM_{2.5}$ risk calculation.

5. We note that there is a large change in the confidence associated with the two available estimates that impose a cutpoint 1) at the NAAQS, and 2) at the LML. Given that there is also a large change in the associated forgone co-benefits estimates, an additional sensitivity case between these two cutpoints would provide useful information about whether there is significant non-linearity in the sensitivity over this important interval in potential cutpoint values. We therefore recommend that EPA include at least one more cutpoint sensitivity case for the forgone co-benefits, which would be at a cutpoint that is just slightly below the NAAQS level, such as at 10 $\mu g/m^3$ for $PM_{2.5}$.

6. We endorse the Agency's stated intention to conduct new co-benefits sensitivity estimates using full photochemical grid modeling. In the event such modeling is not conducted, however, we recommend that EPA continue to use the existing photochemical grid modeling (of the Proposed CPP scenario, which was used to develop cutpoint sensitivities for this RIA) to recompute the benefit-per-ton values to reflect more logically-consistent estimates of forgone co-benefits at the different cutpoints. It is our conclusion that a more logically-consistent incorporation of cutpoints into the benefit-per-ton estimates (in the manner described in detail in Section III.E) will have more quantitative impact than revising the photochemical modeling of the control scenario to more precisely reflect the Final CPP's limits.

7. We recommend that county-level maps of projected SO_2 and NO_x emissions reductions ($PM_{2.5}$ and ozone precursors) and/or projected changes in air quality across the U.S. be presented to provide more information about the distribution of estimated co-benefits. If these are compared to projected baseline concentrations of $PM_{2.5}$ and ozone in the same compliance year, they can provide more insight to readers about why co-benefits are sensitive to cutpoint assumptions.

Forgone Climate Benefits

1. We concur with the decision to report domestic and non-U.S. climate benefits separately and provide additional rationales to support this decision.

2. We provide reasons why a discount rate higher than the consumption rate of interest – which results in lower estimates of potential forgone climate benefits – is reasonable to include in a sensitivity analysis of SCC. Related to this point, we recommend inclusion of an additional sensitivity case using a 5% discount rate.

3. We recommend supplemental ways to address concerns with intergenerational equity that do not require *ad hoc* adjustments to the discount rate, and provide an example of one such supplemental evaluation.

4. We recommend that EPA better communicate the timing of forgone climate benefits using the government's SCC modeling, which shows that most of the benefits are actually projected to occur after 2080.

5. We recommend that sensitivity analyses to additional non-scientific (*i.e.*, "framing") assumptions that strongly affect forgone climate benefits estimates be reconsidered in developing SCC values for use in future RIAs. These include: 1) the effect of choice of time horizon on confidence in the resulting climate impact estimates; and 2) the appropriate choice of baseline future (long-term) emissions projections when valuing near-term incremental emission reduction actions.

C. Despite the Improvements Noted in This RIA, Three of Its Analysis Methods Systematically Understate the Net Benefits of Repealing the CPP

The analysis of and communication about the uncertainties in the calculations of components of net benefits in the CPP Repeal RIA is commendable. Nevertheless, we have also identified three methodological concerns that lead to systematic understatement of the potential net benefits of repealing the CPP. That is, the understatement exists in all of the alternative net benefits estimates that can be derived from information in this RIA. These three aspects of the computations that we recommend be corrected are described below.

1. **The potential net benefits of CPP repeal are understated by several billion dollars in 2020 and 2025 because the RIA improperly understates the avoided costs of energy efficiency improvements in those years under the CPP.** The 2015 CPP RIA's cost analysis assumed that consumers would undertake certain energy efficiency measures to comply with the rule, subsidized by utility co-funding (*e.g.,* rebates). That RIA estimated that regulated utilities would recoup their outlays for those subsidies over a period of 20 years, adjusting electricity rates upwards in 2020 and 2025 by only annualized amounts of the outlays that would actually be expended in those years. In fact, cost recovery for such energy efficiency programs is fully embedded in the next year's electricity rates, and the 2015 CPP RIA should have reported the estimated *actual* dollar expenditures in the 2020 and 2025 compliance years when reporting CPP compliance cost for those years. The RIAs' use of only an *annualized* portion of that spending improperly assumes that society spreads those costs over the investments' useful life, and thereby omits a substantial portion of that actual cost from the calculations of net societal benefits in individual years. The CPP Repeal RIA does not correct this error initiated in the 2015 CPP RIA, and thus it substantially understates the net benefits from repealing the CPP in the years 2020 and 2025 in every alternative net benefit estimate.

2. **The potential net benefits of repeal (when including consideration of co-benefits) are significantly understated because the RIA calculations overstate forgone $PM_{2.5}$ co-benefits in the "cutpoint" sensitivity cases.[1]** When calculating co-benefits estimates for a given assumed cutpoint, EPA simply zeroes out all risks estimated for populations living in areas below that cutpoint concentration. This is intended to indicate the sensitivity of the risk estimates to the possibility that the presumed health effects concentration-response relationship does not continue down to zero, but may cease to exist at some ambient concentration.[2] The various assumed cutpoints are intended to represent alternative possibilities on where the risk relationship might cease, with decreasing confidence attributed to the risk estimates with lower assumed cutpoints. For such sensitivity cases, logical consistency would also suggest that risk would only start to rise above zero as concentrations rise above the cutpoint where the concentration-response relationship is assumed to begin to exist.[3] Thus, estimates of risks for populations living in locations above the assumed cutpoint should also be decreased as a result of a cutpoint assumption (and increasingly so for higher cutpoint assumptions). However, the CPP Repeal RIA's sensitivity cases leave the risks estimated in locations above the assumed cutpoints at exactly the same level as in the zero cutpoint case. This is logically inconsistent with the notion that the concentration-response relationship may not continue below the cutpoint, and results in an overstatement of forgone co-benefits in each of the cutpoint cases (which is particularly large for the higher-confidence co-benefits cases). Hence it also results in understatement of the net benefits of repealing the CPP when including co-benefits in a net benefits calculation.

3. **The RIA further understates the potential net benefits of repeal (when including consideration of co-benefits) by not including ozone risk uncertainties analogous to those for $PM_{2.5}$ in its cutpoint sensitivity cases.** When calculating co-benefits estimates for different cutpoint concentrations (as described in the prior point), EPA makes the adjustment only to the forgone $PM_{2.5}$ co-benefits, even though a substantial portion of the

[1] EPA uses the term "cutpoint" to refer to an ambient pollutant concentration below which the risk models are programmed to assume zero risk to human health. That is, although a non-zero risk is calculated down to zero concentrations using EPA's assumed concentration-response functions, EPA's cutpoint risk calculations then simply zero-out the risks estimated in any locations where baseline concentrations are less than the assumed cutpoint concentration.

[2] This uncertainty regarding whether the concentration-response relationship continues to exist at low ambient concentrations has been a central feature of Administrators' justifications for setting the $PM_{2.5}$ and ozone NAAQS levels through past NAAQS review cycles (CPP Repeal RIA at p. 50; for additional detail, see also Smith, 2016, pp. 1738-1739).

[3] That is, if population-wide health risk is assumed to be zero at and below a given cutpoint concentration, one should not expect population-wide health risk to instantly jump to a non-trivial level when the ambient concentration is only trivially higher than that cutpoint value, yet this is what EPA's cutpoint sensitivity cases assume. A logically-consistent risk model involving a cutpoint would assume public health risks only start to rise above zero as exposures exceed the cutpoint level where risks are assumed to be zero, with the amount of risk elevation being determined by the degree to which the exposure level exceeds that cutpoint concentration (*i.e.*, by the location's ambient concentration *minus* the cutpoint).

reported forgone co-benefits is attributed to ozone. Ambient ozone risk estimates face analogous issues in the confidence with which they are calculated at lower ozone concentrations. By failing to include ozone cutpoints in its co-benefits sensitivity cases, EPA further overstates forgone co-benefits in every one of the cutpoint cases, and thus further understates the net benefits of repealing the CPP when including co-benefits in a net benefits calculation.

D. Next Steps

The CPP Repeal RIA announces EPA's plan to develop additional refinements of its modeling of this regulatory action. We have four suggestions for additional analyses that would further the objective of understanding the impacts of the CPP repeal and the uncertainties regarding those impacts. These are listed below, and discussed in more detail in later sections of this document.

1. To help EPA better quantify the ranges of potential avoided compliance costs and forgone emission reductions, we suggest several new IPM runs. The categories of our recommendations include: 1) general updates (*e.g.*, database of generators, changes in electricity demand projections, natural gas supply/demand fundamentals, coal supply/demand fundamentals, and new technology costs and characteristics); 2) economic and technological change uncertainties (*e.g.*, natural gas supply, new technology costs and characteristics, and electricity demand); and 3) demand-side energy efficiency cost and availability.

2. We recommend evaluating at least one mass-based and one rate-based policy case using a computable general equilibrium model to gain a better understanding of whether the compliance costs based on the IPM model may be understated or overstated.

3. We endorse the Agency's expressed intention to conduct refined co-benefits sensitivity estimates using photochemical grid modeling in future iterations of the CPP Repeal RIA. However, we also note that the corrections to the co-benefits sensitivity cases described in point 2 of the prior section can still be corrected even if one is limited to results from the existing photochemical grid modeling.

4. We also recommend that the photochemical grid modeling outputs (or, more specifically, the air quality grids that are BenMAP inputs) be made available to the public to support comments on that additional work. This recommendation stands whether EPA continues to rely on prior modeling or conducts new model runs.

II. SUMMARY OF KEY CHANGES IN RIA ESTIMATES AND APPROACH

A. Comparing Methods and Results in the 2015 CPP and 2017 CPP Repeal RIAs

Unsurprisingly, the most salient change in the CPP Repeal RIA compared to the 2015 CPP RIA is a reversal of the benefits and costs of the regulatory action, consistent with the idea that the proposed regulatory action is to repeal the 2015 regulatory action. Most of the changes simply redefine what the 2015 CPP RIA characterized as benefits as costs or forgone benefits in the CPP Repeal RIA, and what was characterized as costs in the 2015 CPP RIA as benefits or avoided costs in the CPP Repeal RIA.

To better understand this reversal, we present Table 1, which identifies the key elements of the benefit-cost comparison, and how they are categorized in the two RIAs. The only item for which EPA did not undertake a simple reversal is demand-side energy efficiency ("DSEE"). In the 2015 CPP RIA, the total cost of compliance with the CPP and the value of energy savings from DSEE measures that consumers (with subsidies from utilities) were projected to undertake in response to the CPP were reported as a single aggregate value, leaving it impossible to understand the relative magnitude of either one. Given that DSEE measures were a "negative cost," this aggregation had the further effect of making the total CPP emissions reduction cost seem smaller than its actual estimate. In the CPP Repeal RIA, EPA makes the case that the value of these energy savings from DSEE would have been more properly characterized as a benefit of the CPP rather than as a negative cost, and should have been reported separately from any other cost or benefit component to allow the policymaker to understand the relative magnitudes of each. In the CPP Repeal RIA, EPA thus moves the value of energy savings from DSEE to the benefit side of the ledger from the cost side of ledger. Had this been done in the 2015 CPP RIA, however, the estimated net benefits of the CPP would have remained the same—the total costs of the rule would have been higher (because they would not have been reduced by the DSEE's "negative costs"), but the total benefits would have increased by the same amount. Thus, EPA's decision to recharacterize energy savings from DSEE as a benefit of the CPP rather than as a negative cost does not affect the estimated net benefits of the CPP's repeal (nor of the CPP), but doing so provides policymakers with substantially more insight about the underlying components of benefit-cost comparison.

Since this adjustment has no impact on the net benefits in either the 2015 CPP RIA or the CPP Repeal RIA, we do not give it further attention in these comments. Our view is that it should be calculated and reported as a separate, disaggregated element of the costs and benefits in an RIA. We therefore applaud the CPP Repeal RIA for having provided quantitative information on the magnitude of this element of regulatory impact by estimating it and reporting it as the qualitatively-separate impact category that it is. The improvement in transparency provided by this step is more important than whether the CPP Repeal RIA labels it an avoided cost or a forgone benefit.

Table 1. Labeling of Concepts in the Two RIAs

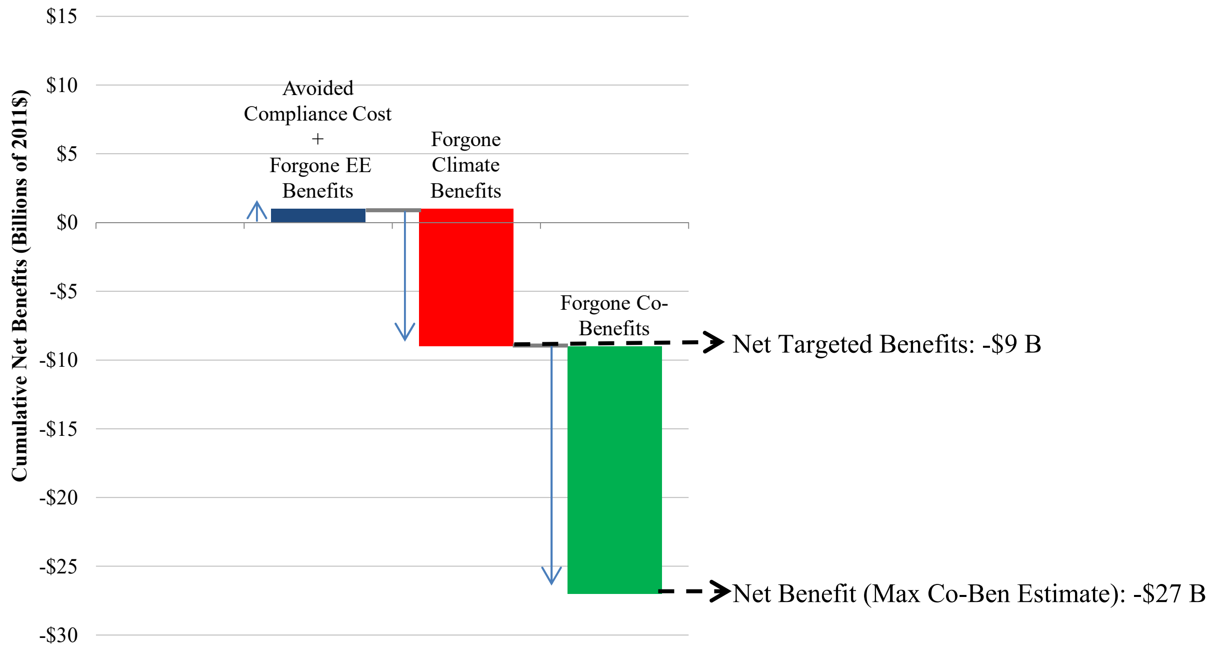
Line Item	2015 CPP RIA	CPP Repeal RIA
Societal Value of Climate Impacts from Changes in CO_2 Emissions	Benefit	Forgone Benefit ("Cost")
Societal Value of Health and Welfare Impacts from Coincidental Changes in Criteria Pollutant Levels	Co-Benefit	Forgone Co-Benefit ("Cost")
Change in Total Power Sector Generating Costs (CPP Policy Case – Base Case)	Cost	Avoided Cost ("Benefit")
Demand-Side EE Expenditures (DSEE)	Cost	Avoided Cost ("Benefit")
Value of Energy Savings from DSEE	Cost (a negative cost)	Nets this item out of 2015 CPP RIA's estimate of Change in Total Power Sector Generating Costs and includes it as a Forgone Benefit
Monitoring, Reporting, and Recordkeeping Costs	Cost	Avoided Cost ("Benefit")

Figure 1 is provided below to graphically illustrate the similarities and differences of the two RIAs' benefit-cost analysis ("BCA") calculations by comparing their component elements which, when added together, translate into net benefits. Figure 1 shows estimates from the rate-based case for 2025. (A comparable figure for the mass-based option in 2025 is provided in Appendix A.) To keep Figure 1 simple for purposes of comparison, the figure presents costs and benefits based on only the 3% discount rate and only the maximal (high) estimate of criteria pollutant co-benefits.

Figure 1(A) presents each of the 2015 CPP RIA's component element estimates exactly as reported in the document, *except* that the sign of each respective estimate has been reversed from that in the 2015 CPP RIA. This allows the estimates to be interpreted from the perspective of repealing rather than promulgating the final CPP and to be compared directly to the estimates in the CPP Repeal RIA, which are shown in Figure 1(B). We do this solely to facilitate the visual comparison of the same component elements in the CPP Repeal RIA.

Figure 1. Cumulative Net Benefits of Repeal as Benefit/Cost Components Are Sequentially Added (Rate-Based Option, 2025 Compliance Year, 3% Discount Rate, Maximum Forgone Co-Benefits)

(A) 2015 CPP RIA (Data Stated in Terms of CPP Repeal)



(B) CPP Repeal RIA

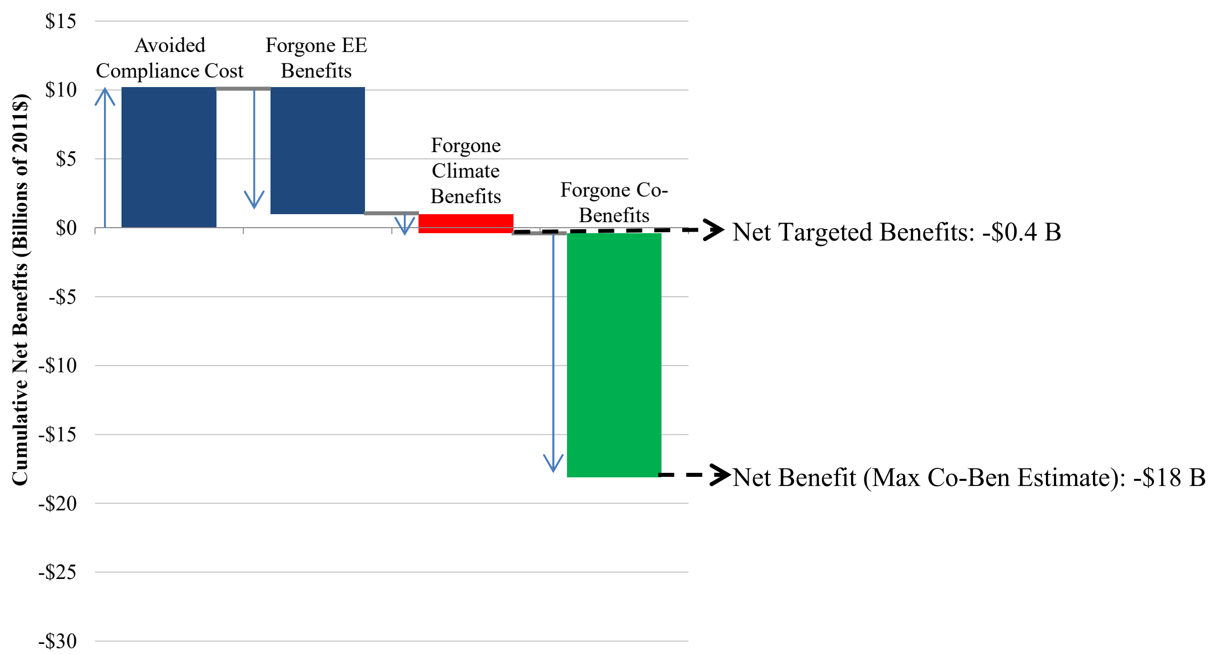


Figure sources: (A) 2015 CPP RIA, Table ES-9; (B) CPP Repeal RIA, Tables 1-1, 1-3, 1-5, and 3-6.

The figure above is called a "waterfall diagram," which shows the cumulative effect on the net benefits of the action when including, sequentially, each of the component elements represented by the bars from left to right. For example, estimated avoided compliance costs (inclusive of forgone EE benefits) are shown in the first bar of Figure 1(A). The estimates of each forgone benefit component (first forgone climate benefits, then forgone co-benefits) are then shown as the vertical lengths of the two subsequent bars, each of which adds to the cumulative net benefit associated with all preceding bars. The net "*targeted*" benefits (*i.e.*, the net benefits of reducing the pollutant targeted by the action, CO_2) can be seen in the figure by looking at the cumulative net benefit just before addition of the bar representing forgone co-benefits of reducing other pollutants that were not targeted by the action (*e.g.*, -$9 billion in the 2015 CPP RIA and -$0.4 billion in the CPP Repeal RIA).

The cumulative net benefit when also including the RIA's maximum forgone co-benefits estimate (which is the same in both RIAs—$17.7 billion for this particular case) is indicated by the bottom of the rightmost bar (*i.e.*, -$27 billion in the 2015 CPP RIA and -$18 billion in the CPP Repeal RIA). In other words, the CPP RIA and the CPP Repeal RIA project identical CPP net avoided costs ($1 billion) and identical maximum net forgone co-benefits from reducing non-targeted criteria pollutants (about $18 billion), while the CPP Repeal RIA projects $8.6 billion less in forgone climate benefits from the CPP than did the 2015 CPP RIA (the difference in the height of the red bars). The only change between the two RIAs that explains the difference of about $9 billion in their targeted net benefits and in their maximal net benefits (including co-benefits), is due to the revised core estimate of forgone climate benefits. (The basis for this revision is discussed in Section IV.)

Thus, comparison of panels A and B in Figure 1 makes apparent the two key changes in this RIA. The first is that the total cost of the CPP in the 2015 CPP RIA has now been disaggregated into its two components (*i.e.*, total spending to comply with the CPP and the value of energy savings from DSEE measures), as discussed above. The second is that the SCC values are estimated differently, which affects the magnitude of the estimated climate benefits. These two changes are discussed individually below. A third change that is not shown in Figure 1 is that this RIA presents several alternative estimates for air quality impacts. This change is also discussed below, along with an enhancement of the figure illustrating how these alternative air quality impact estimates also can be placed on such a figure (see Figure 2).

1. Disaggregation of Total CPP Costs

As noted above, the 2015 CPP RIA presented the total estimated costs of complying with the CPP as an aggregated total that netted the energy savings (*i.e.*, negative costs) from DSEE programs against the estimates of what electric utilities and consumers would have to spend to reduce emissions to comply with the rule. Because of that, it was impossible to discern from the 2015 CPP's RIA how much of the apparently small estimated cost of the CPP (*i.e.*, the first bar, in blue, in Figure 1(A)) is direct spending that was estimated to be necessary to comply with the rule versus what amount was the value of energy savings from the DSEE investments. EPA's decision to disaggregate these two components is a significant analytical refinement of the CPP Repeal RIA that is shown in Figure 1(B).

In Figure 1(B), the total cost that is represented as one dark blue bar in the 2015 CPP RIA is now presented by the first two bars (both also shown in blue). The first bar is avoided direct compliance spending and the second blue bar is the forgone value of energy savings from DSEE. They move in opposite directions, but their net effect is a positive benefit in the CPP Repeal RIA that has the same magnitude as in the 2015 CPP RIA. In other words, using the same underlying data, EPA in its 2017 RIA showed that the costs of complying with the CPP were estimated to be $10.2 billion, and that the estimated benefits of implementing energy efficiency measures were $9.2 billion. The cumulative net benefit after the second bar in Figure 1(B) is thus equal to the small positive amount of the single blue bar in Figure 1(A), or +$1.0 billion.[4]

There are clear merits to this change in how information is presented in the CPP Repeal RIA. It is more transparent, revealing that behind the relatively small estimate of cost in the 2015 CPP RIA is a much larger direct cost offset by a similarly large DSEE-based savings. Given that these are entirely different types of regulatory impacts, it is appropriate to present them separately. It is certainly helpful to see how the components affecting "pocket books" compare to each other, but more importantly, these two offsetting regulatory impacts are borne differently by different groups in the economy. Thus, this information is very helpful for better understanding the distributional implications of the regulation's impacts that almost always lie behind any regulatory net benefit estimate.

Another merit to this additional information lies in the fact that there are different sources and degrees of uncertainty in the estimation of each component. Until they are disaggregated, it is not possible to assess the uncertainty (or perform sensitivity analyses) of the final net benefit estimate. Such sensitivity analyses have not been provided, but would be useful in future RIAs.

There has been some public discussion about the merits of calling DSEE-related energy savings a benefit or a cost. The CPP Repeal RIA justifies its choice of labeling as necessary to be consistent with the accounting conventions used by the Office of Management and Budget ("OMB") as noted by the OMB Guidance for Implementing Executive Order 13771.[5] A comparison of the two panels in Figure 1 should make it apparent the choice of labeling is really not relevant to the net benefit result. Whether one calls it a forgone benefit or an avoided negative cost, it will still function as an offsetting force to the avoided cost of compliance in the CPP Repeal RIA. (The same can be said of its role in offsetting compliance costs in the 2015 CPP RIA.) **The two components of cost impact have been disaggregated in the CPP Repeal RIA, and such disaggregation of fundamentally-different types of financial impacts should**

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[4] 2015 CPP RIA, Table ES-5.

[5] CPP Repeal RIA, p. 33. EPA's rationale, consistent with OMB Guidance, is that DSEE reduces the total electricity that customers would need to purchase, and hence represents a savings to customers.

be emulated in any future RIA that contains such different types of impacts in its cost or benefit modeling.

2. Revisions to Estimates of Climate Impact Value

Another key modification in the CPP Repeal RIA is to the estimate of the CPP's climate benefit (which in this RIA becomes the estimate of forgone climate benefits from repealing the CPP). EPA has not changed its estimate of the CO_2 emission reductions from the CPP, nor has it changed the fact that it calculates estimated climate benefits by multiplying that tonnage estimate by one of several available estimates of the SCC, which is stated as a present value of future climate impacts per ton of incremental change in CO_2 emissions. What EPA has changed in the CPP Repeal RIA is the geographic scope of climate impacts that are accounted for in its core estimate of the SCC value. While retaining the same SCC modeling methods, the CPP Repeal RIA estimates climate benefits by focusing only on the impacts projected to occur in the U.S., rather than including impacts that would occur in other nations, as EPA did in the 2015 CPP RIA. Thus, for any choice of discount rate, the CPP Repeal RIA's domestic SCC value is a subset of (and thus smaller than) the global SCC values used in the 2015 CPP RIA.

The merits of using a domestic rather than global SCC value in an RIA for a U.S. regulatory decision are discussed in detail in Section IV of these comments. The implications of this choice for the net benefits of the proposed CPP repeal can be seen by comparing the red bars for climate impacts in the two panels of the figure. Climate impacts have much less overall role in determining net benefits in the CPP Repeal RIA (Figure 1(B)) than they did in the 2015 CPP RIA (Figure 1(A)).

While the CPP Repeal RIA uses a domestic SCC for its core net benefits estimates, it also reports net benefits using the global SCC values as a sensitivity case, consistent with the new general approach of providing more information for policymakers. The 2015 CPP RIA, in contrast, presented net benefits using only the global SCC value.

3. Air Quality Impacts

In the CPP Repeal RIA, EPA does not change the way it estimates the CPP's maximal potential co-benefits of reducing non-CO_2 emissions. The base estimate of air quality impacts (forgone health co-benefits) is the same as the estimate of air quality co-benefits in the 2015 CPP RIA, and thus the heights of the (maximal) air quality impacts bars are the same in panels A and B of Figure 1. However, this RIA provides additional information by including several sensitivity analyses that estimate benefits of reducing fine particulate matter ("$PM_{2.5}$") below the lowest measured levels ("LMLs")[6] and below the level of the annual $PM_{2.5}$ NAAQS.

[6] Each epidemiological study used to estimate association between pollutant concentrations and health risk relies on observations of how health risk varies as pollutant concentrations vary over a range of values. The lowest concentration observed in a given study is its LML. Any association detected in such a study can only be said to

In both sensitivity cases, EPA assumes that the benefits fall to zero when $PM_{2.5}$ levels fall below the LML and the NAAQS, respectively. In the LML case, this is because there is no evidence at all that the association continues to exist below the LML. In the NAAQS case, this is because the NAAQS by law is set at a level that is protective of public health and thus reducing emissions below that level by law should not yield public health benefits.[7] These sensitivity cases, which are illustrated in Figure 2, indicate the degree of uncertainty in net benefits associated with these co-benefit uncertainties.[8]

As seen in Figure 2, with the additional information included in the CPP Repeal RIA, one can now evaluate cumulative net benefits in three additional ways: 1) including only co-benefits estimated for populations living in areas where $PM_{2.5}$ is above NAAQS, and 2) also including co-benefits estimated for populations with exposures below the NAAQS but above the LML, and 3) also including the lowest-confidence category of co-benefits, which are those estimated in populations whose ambient $PM_{2.5}$ exposures are already below even the lowest level measured in any of the epidemiological studies. The last of these was the only net benefits case provided in the 2015 CPP RIA. The merit of providing net benefits estimates under a range of co-benefit sensitivity cases is discussed in more detail in Section III of these comments, and some suggestions are provided for improving the RIA's presentation of those uncertainties.

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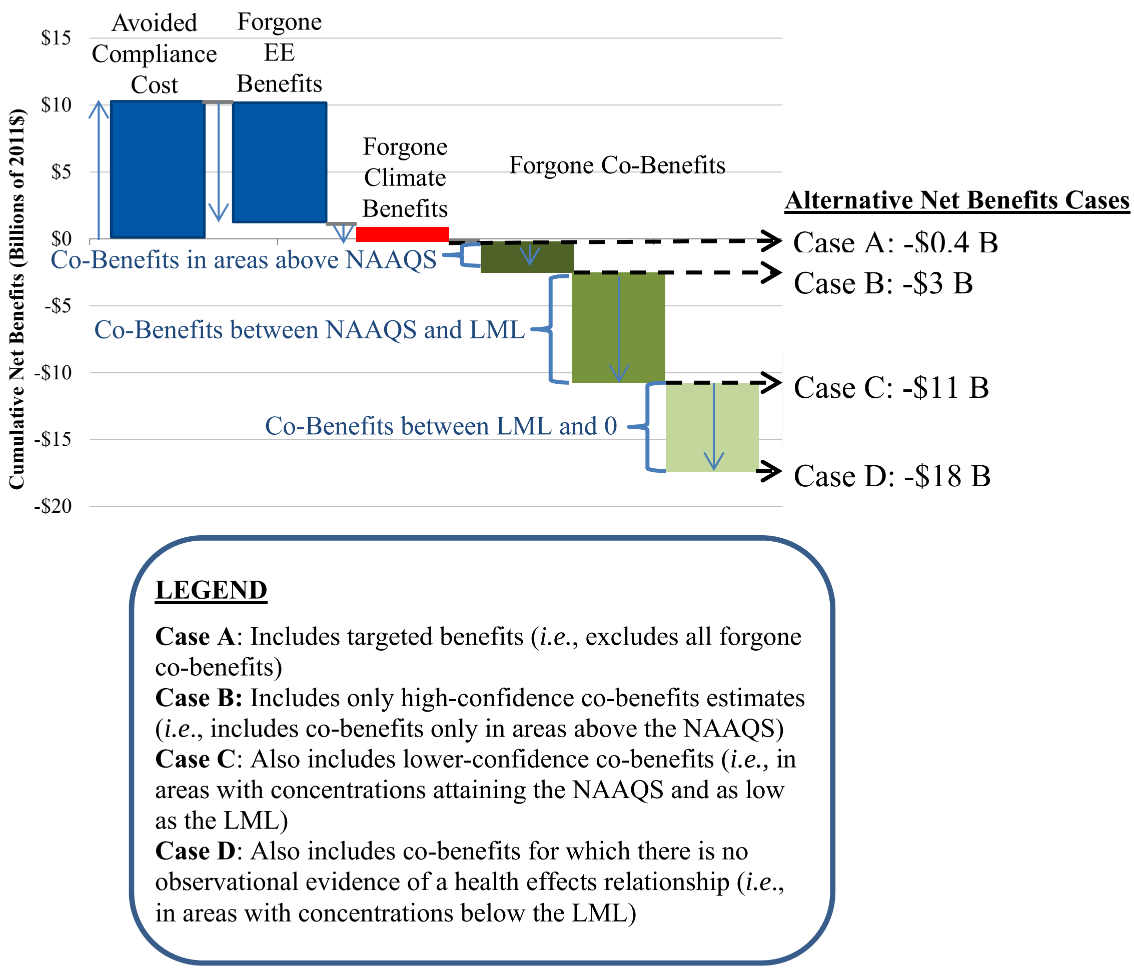
apply to concentrations within that observed range, and continuation of the association below a study's LML is unknown.

[7] The NAAQS are not set as low as the LMLs because uncertainty about the continuation of the observed association becomes a concern somewhere between the central mass of the observations (which are near their mean or average) and the 10^{th} to 25^{th} percentile of the observed data, which are above the LML, or 0^{th} percentile of the observations (78 *Federal Register* 3086, January 15, 2013 at 3159).

[8] The comparable figure for the mass-based option is provided in Appendix A.

Figure 2. Alternative Potential Estimates of Net Benefits of Repeal for CPP Repeal RIA's Co-Benefit Sensitivity Cases (Rate-Based Option, 2025 Compliance Year, 3% Discount Rate)



B. Merits of CPP Repeal RIA in Context of Objectives for RIAs Generally

To summarize from the prior section, the difference in the ranges of absolute net benefits shown in panels (A) and (B) of Figure 1 are due entirely to showing the climate impacts by using a domestic SCC value instead of a global one.[9] The main difference is thus in a judgment about the policy-relevance of U.S. versus non-U.S. impacts of a U.S. regulation, and thus which estimates to emphasize in net benefits summaries, rather than any computational differences in the method of calculating the value of climate impacts. A sensitivity case that computes climate impacts in the same manner as in the 2015 CPP RIA is provided in Appendix C of the CPP

[9] While attention has been given in public discussion of this RIA to the change in how one *qualitatively* describes a certain regulatory impact (*i.e.*, value of DSEE savings), the prior section has shown it to be irrelevant to the ultimate question of the numerical net benefits of either the final CPP or the proposed repeal of the CPP.

Repeal RIA (starting at p. 168) for 2020 and 2030, and these too could be incorporated into illustrations of net benefits sensitivities.[10]

Technical or theoretical arguments in favor of some of the alternative emphases are discussed in Sections III through V below, along with comments about how the RIA's estimates and their communication can be further improved. First, however, we comment on how the CPP Repeal RIA's methods of presenting alternative possible cost and benefit estimates helps meet the objectives for RIAs generally.

Executive branch agencies have been required to complete RIAs for regulatory proposals and final rules since 1981, though the primary currently-applicable requirements date to Executive Order 12866, adopted in 1993. Throughout the history of RIAs, their most basic objective has been to inform policymakers about positive and negative implications of a regulatory decision. A central, but not sole, feature of RIAs is BCA, which leads to evaluation of whether a regulation will have positive net benefits. Discussion of the distributional impacts of the component elements of benefits and costs, economic impacts, and other concerns such as employment and small business impacts is also expected in a thorough RIA.

Pursuant to Executive Order 12866, OMB in 2003 developed guidance for agencies preparing RIAs in what is referred to as Circular A-4.[11] EPA has prepared its own guidance, generally following that of OMB, but with more detail about methodologies that are most relevant to environmental policy issues (EPA, 2010). These guidelines, and other papers and articles about the RIA requirements (see, for example, Dudley *et al*., 2017 and NERA, 2011) all concur that a sound RIA must present the relevant information in a transparent and balanced manner so that readers (which include policy makers and the interested public or stakeholders) can understand how estimates were derived and the uncertainties associated with those estimates. The objective of an RIA is not to resolve uncertainties, but instead to highlight the role of uncertainties in the overall conclusions about the potential merits of a new regulation.

The CPP Repeal RIA's provision of multiple alternative BCA comparisons enhances the degree of transparency in how uncertainties of CPP-related impacts (both costs and benefits) are communicated. The CPP Repeal RIA strives to reflect the range and sensitivities to key uncertainties that were known, but not reported or discussed in a quantitative manner in the 2015 CPP RIA. The CPP Repeal RIA highlights these uncertainties with respect to forgone climate benefits and also forgone air quality co-benefits by presenting sensitivity analysis results for each. For the forgone climate benefits, the CPP Repeal RIA presents these values based on a domestic SCC and a global SCC; for the forgone air quality co-benefits, the CPP Repeal RIA presents these values based on three different levels where $PM_{2.5}$ benefits would fall to zero

[10] Appendix C of the CPP Repeal RIA does not report global values for 2025 specifically (it does so only for 2020 and 2030, which bound 2025), but if it had presented the 2025 global impacts estimates as well, they would match the global value of forgone climate impacts reflected in the red bar of Figure 1(A).

[11] See https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A4/a-4.pdf.

(which are 1) only at zero a $PM_{2.5}$ concentration, 2) when $PM_{2.5}$ concentrations are lower than the LML, and 3) when $PM_{2.5}$ concentrations are below the annual $PM_{2.5}$ NAAQS level, or "in attainment").[12] In contrast, the 2015 CPP RIA made certain preferred assumptions, and left readers no information about how much those assumptions affect the cost, benefit, or net benefit estimates. While it was possible for a technically-sophisticated reviewer to conduct her or his own sensitivity analyses to alternative assumptions, a good RIA should not leave that exercise to the reader.

Although the CPP Repeal RIA has filled in many of those blanks, it does (necessarily) make judgments about which assumptions to treat as core assumptions rather than as sensitivity analyses. When doing so, however, it directly provides alternative estimates so that others who might disagree with those judgments can emphasize the alternatives instead. In other words, the CPP Repeal RIA does not attempt to resolve uncertainties, but instead it seeks to enable readers to see the full range of net benefit estimates that result from those uncertainties.

It is difficult to imagine a rational case for providing less information on quantitative impacts of key sources of uncertainties. At best, one might argue that extensive new information can be difficult to assimilate. This, however, would be an argument for better communication and synthesis of the results, not for fewer sensitivity cases. In later sections of these comments, we suggest ways to summarize those many alternative net benefit estimates that might be useful for policymakers.

Prior comments on RIAs such as NERA (2011) have argued that the common method of RIAs to compare costs and benefits at single points in time (such as for a first compliance year) should be replaced by comparisons of the present values of a projected multi-year stream of costs and benefits. The CPP Repeal RIA also opens the door to this possibility by reporting present values. Although the present value analysis is provided ostensibly to meet a new requirement under Executive Order 13771, we recommend that this analysis become more central to the BCA portion of the RIA as well. Additionally, in conducting a present value analysis, one should present timelines of cost accrual and benefit accrual, allowing readers to understand the extent to which costs may precede benefits (or vice versa), and the likely payback period associated with each new regulation. This issue becomes particularly relevant for regulations addressing greenhouse gas emissions, as is discussed in more detail in Section IV.C of this document. The CPP Repeal RIA has taken the first analytical steps necessary to consider net benefits on a present value basis, and to provide associated timelines. **We recommend that if EPA finalizes the proposed repeal of the CPP, the RIA for that final action should implement characterization of the timeline of net benefits more fully, as we discuss in more detail in later sections of these comments.**

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[12] Although it could have, the CPP Repeal RIA has not included analogous cutpoint assumptions for ozone-related co-benefits. In these comments, we recommend that EPA incorporate ozone co-benefits into its cutpoint sensitivity cases in the next RIA.

The key message a reader likely inferred from the presentation of costs and benefits in the 2015 CPP RIA was that the net benefits of implementing the final CPP would have almost certainly been positive (*i.e*., benefits would have exceeded compliance costs). Stated in terms of a repeal of that rule, this would mean that the net benefits of repeal of the CPP would almost certainly be negative. Although negative net benefits from CPP repeal are among the potential outcomes estimated in the CPP Repeal RIA, such a result is not the only possibility, which can be understood better in light of this RIA's provision of new information on the impacts of important uncertainties, and other enhancements we identified above. Having access to this more nuanced understanding of the uncertainty in an RIA's net benefits estimates is an important step towards achieving the balance and transparency that are desired traits in an RIA that can provide sound guidance to complex policy decisions.

III. CO-BENEFITS FROM REDUCED EMISSIONS OF CRITERIA POLLUTANTS

The CPP Repeal RIA estimates forgone health co-benefits associated with forgone reductions of the criteria pollutants ("CPs") $PM_{2.5}$ and ozone that are projected to occur in achieving compliance with the CPP. The method by which these forgone benefits are calculated is identical to that in the 2015 CPP RIA, using a "benefits-per-ton" ("BPT") shortcut approach. However, these co-benefits are presented in a different manner in the CPP Repeal RIA – one that helps readers understand the degree to which the original estimates are subject to uncertainties that go beyond statistical variance, and which relate to lack of confidence in the continued existence of the concentration-response ("C-R") functions at lower and lower baseline ambient concentrations.

Specifically, the forgone co-benefits estimates are presented for a full range of potential scientific realities: no attenuation in risk down to zero ambient concentration (which is the method used for the 2015 CPP RIA's only set of co-benefits estimates); counting only those $PM_{2.5}$ co-benefits that occur in areas where $PM_{2.5}$ is above the LMLs of the epidemiological studies underlying the risk estimates; and counting only those $PM_{2.5}$ co-benefits that occur in areas where $PM_{2.5}$ is above the current annual $PM_{2.5}$ NAAQS of 12 $\mu g/m^3$. Additionally, the CPP Repeal RIA presents results in a manner that is forthcoming regarding the degree to which co-benefits, rather than benefits from the pollutant targeted by the rule, drive the prospects for the proposed action to have a positive net benefit outcome.[13]

The Agency seeks comments on its selected method of presenting forgone co-benefits in this way (p. 51), on its approach for characterizing these uncertainties (p. 94), and on how best to use empirical data to characterize the increasing uncertainty in a quantitative manner (p. 8).

The way these sensitivities are used to provide information about scientific uncertainties is a very helpful step in the direction of greater transparency and should be continued, for the reasons outlined below. We also provide several suggestions for developing the alternative sensitivity estimates of co-benefits in a more robust manner. In addition, we provide suggestions for clearer synthesis and communication about the sensitivity in RIA results.

A. Background on Use of Criteria Pollutant Co-Benefits

The growing use by EPA of co-benefits from coincidental reductions of CPs associated with projected compliance with non-CP regulations was first documented and discussed at length in NERA (2011), focusing specifically on $PM_{2.5}$ co-benefits. The 2011 NERA study conducted a review of air RIAs dating back to the time of the first $PM_{2.5}$ risk analysis in 1997 (which was

[13] In the case of the CPP Repeal RIA, the target pollutant is CO_2, and a "positive net targeted benefit" would occur if the estimated avoided cost of rescinding the CPP is less than the estimated forgone benefits from reductions of CO_2 without any consideration of CP co-benefits that are not targeted by the action.

applied for the first $PM_{2.5}$ NAAQS rulemaking) and found that $PM_{2.5}$ co-benefits had become an increasingly important component justifying findings of benefits greater than costs in RIAs for all sorts of non-$PM_{2.5}$ regulations. Indeed, $PM_{2.5}$ co-benefits accounted for more than half of the non-$PM_{2.5}$ RIA's regulatory benefits in almost all RIAs reviewed over the entire period, and after 2009, $PM_{2.5}$ co-benefits usually accounted for all, or more than 99%, of total benefits in those RIAs.

In effect, the ease with which $PM_{2.5}$ co-benefits could overwhelm estimated costs of most non-$PM_{2.5}$ regulations appeared to be undermining the Agency's motivation to develop methods for quantifying the health and welfare impacts of other air pollutants, particularly those regulated under CAA Section 112 as air toxics. This fact alone suggested a detrimental impact on one of the important roles of RIAs, which is to provide a well-documented analysis of the merits of each new regulation – which surely should be focused primarily on the effects of the pollutant being regulated, rather than on the co-benefits of another pollutant that is already subject to its own, quite stringent, regulatory framework.

NERA (2011) also made a number of other observations regarding EPA's reliance on $PM_{2.5}$ co-benefits. It described how the Agency had changed its assumptions for estimating such co-benefits in a manner that greatly increased its estimates of population-wide risk from current levels of ambient $PM_{2.5}$ at approximately the same time co-benefits started to become the central form of benefit reported in most non-$PM_{2.5}$ RIAs. That is, in about 2009 EPA started to assign mortality risk due to $PM_{2.5}$ down to zero concentration, instead of to the LML in the underlying epidemiological studies. (This is the calculation that the CPP Repeal RIA calls "full range of ambient $PM_{2.5}$ concentrations" and which produces the highest estimate of forgone co-benefits.) As NERA (2011) showed, this single change in the co-benefit calculation more than tripled the quantity of annual deaths "attributable to $PM_{2.5}$" associated with then-current ambient concentrations – a reservoir of potential co-benefits that each new regulation that might coincidentally reduce a $PM_{2.5}$ precursor could tap.

The CPP Repeal RIA's approach for presenting a series of alternative estimates of $PM_{2.5}$ co-benefits is a very positive development because it provides information enabling readers to see the impact of this assumption, and also to estimate net benefits using alternative assumptions in which they have greater confidence. The CPP Repeal RIA does this in a balanced manner that does not give particular emphasis to any one of the assumptions.[14]

B. Reasons to Exclude Criteria Pollutant Co-Benefits Altogether

The CPP Repeal RIA notes (at p. 47, footnote 28) that inclusion of co-benefits is consistent with RIA guidance from OMB (2003) and EPA (2014), and does not question the appropriateness of including $PM_{2.5}$ and ozone co-benefits in non-CP RIAs. However, NERA (2011) provides a theoretical analysis demonstrating that the inclusion of co-benefits from already-regulated

[14] In later sections, we provide recommendations for how to make these insights more accessible to readers.

pollutants (particularly those regulated as CPs) in a benefit-cost optimization for another targeted pollutant can lead to overregulation of the targeted pollutant from an overall societal BCA perspective. Furthermore, if CPs are truly regulated under CAA Section 109 to the point where there is no confidence that the C-R relationship continues to exist at lower concentrations than the selected NAAQS level, then the *expected value* of co-benefits from incremental reductions of those CPs below their NAAQS level will be close to zero, if not exactly zero.[15] The latter assumption is consistent with the forgone co-benefits sensitivity case that the CPP Repeal RIA labels "$PM_{2.5}$ benefits fall to zero below NAAQS," in which co-benefits are only counted if they occur in locations with $PM_{2.5}$ concentrations above the NAAQS.[16]

For these reasons, **the OMB and EPA guidance to include co-benefits in RIAs should be reconsidered for the specific case of CP co-benefits**: a strong case can be made to exclude estimates of co-benefits associated with CPs based on the stringent legal requirements under which they are already controlled under CAA Section 109. The stringency of NAAQS levels is reinforced by the requirement that NAAQS be reviewed every five years and updated as appropriate to address the latest scientific evidence, and by the detailed implementation requirements and timelines for CPs. At the same time, it remains appropriate to include ancillary benefits from co-reductions of other pollutants or other environmental conditions that are not already regulated, or that face regulatory constraints that, in contrast to the NAAQS, are far less stringent from the perspective of permissible remaining public health risk.

Although we present a strong case for eliminating CP co-benefits from non-CP RIAs altogether in the future, we consider it a very good first step to separate the assessment of co-benefits from the main BCA summary table, such as in Table 4-1 (p. 71 in the CPP Repeal RIA). We recommend, for purposes of improved clarity, that when co-benefits are then incorporated into the summary of net benefits (as is done in the format of Table 4-2, p. 73, in the CPP Repeal

[15] From the perspective of legal interpretation of CAA Section 109, its requirement that NAAQS be set at a level that is "requisite" to protect the public health with an adequate margin of safety does not imply that NAAQS literally achieve "zero risk." EPA Administrators have based their determinations of "requisite" on identifying a concentration level at which their confidence in the continuation of the C-R relationships (which provide the evidence of risk to the public health) below that level becomes too low to warrant a yet-lower level for the NAAQS. This use of subjective confidence allows one to reconcile the statement that a NAAQS is not a "zero risk" standard with the statement that it is requisitely protective of the public health; the use of subjective confidence is also consistent with the notion that the expected value of incremental risk is exceedingly low, if not zero, even though application of the C-R functions below that NAAQS level – as if one does has 100% confidence in their continuation -- will obviously produce positive estimates of incremental risk. Whether the expected value of incremental co-benefits below the NAAQS is zero or merely *de minimis* from a public health perspective, it is much lower than the values that are calculated using the C-R functions that have been used in the current and earlier RIAs.

[16] The fact that the co-benefits in the RIA for this sensitivity case are not very close to zero (see Table 3-11, p. 52) is because EPA has not applied a similar assumption of zero benefits below the NAAQS for the calculation of ozone co-benefits. Our replication of EPA's sensitivity analysis calculations in that table shows that the $PM_{2.5}$ co-benefits are reduced from the "full range" estimate by about 99.6%, and almost all of the reported forgone co-benefits in the "$PM_{2.5}$ benefits fall to zero below the NAAQS" sensitivity case are therefore due to ozone co-benefits, even though the ozone risk calculations face analogous uncertainties to those of $PM_{2.5}$. We therefore recommend that EPA include comparable cutpoints for ozone as for $PM_{2.5}$ in its forgone co-benefits sensitivity cases in the final rule RIA.

RIA), that the results be presented for each of the alternative co-benefits computations, from omitting co-benefits entirely (*i.e.*, the net benefit values in Table 4-1), through "zero below NAAQS," to "zero below LML," to "full range." This will help a reader understand the implications of the sensitivity cases in terms of the very large uncertainty about net benefits when co-benefits are given consideration. If this had been done in the RIA for the MATS rule, there would have been a much better and more transparent communication to the public and policymakers that could have reduced the risk of performing the kind of "end run around" that Chief Justice Roberts identified when he noted the "disproportionate nature" of the $PM_{2.5}$ co-benefits in that rulemaking.[17]

C. Reasons for Assigning Low Confidence to Many of the Co-Benefit Estimates

The approach used to characterize co-benefits uncertainties addresses another concern with $PM_{2.5}$ benefits and co-benefits calculations that has been identified in the literature. Smith (2016) compared the rationales used by the Administrator in choosing NAAQS levels for $PM_{2.5}$ and ozone with the assumptions being made in the RIAs associated with those decisions and noted that the two were inconsistent. While the rationales indicated that the levels of the NAAQS had been set where uncertainty in continued public health risk was deemed too great to warrant a tighter standard, the RIAs have been assuming that estimates of risks below the standard were every bit as certain as those for exposures above the standard. Smith (2016) calls for the risk estimates to be broken into their components of decreasing confidence levels rather than to present them as a single combined risk estimate. This recommendation focused on the use of CP risk estimates even when they are the targeted benefit of an RIA, such as in RIAs for new NAAQS decisions, but would also apply to CP co-benefits estimates (if they are to continue to be used in non-CP RIAs).

Bloomberg (2016) pointed out that the overall confidence level in CP co-benefits estimates will continue to decline over time due to ever-declining ambient concentration levels across the U.S. Thus, the confidence level associated with total co-benefits reported in an RIA for a rule such as the CPP, which was to be implemented in the mid-2020s, would be even lower than the co-benefits reported in an RIA such as for the MATS rule, which was implemented in the mid-2010s, when U.S. ambient $PM_{2.5}$ and ozone concentrations were projected to be generally higher.

The range of sensitivity assumptions of $PM_{2.5}$ co-benefits estimates spans from estimates that can be viewed as having "highest confidence" (because they are associated with concentrations above the NAAQS) down to those with "lowest confidence" (because they assume C-R relationships continue to exist to the lowest concentrations modeled, even below the LMLs of the associated studies). However, **we recommend that EPA also include at least one more sensitivity case, which would be at a cutpoint that is just slightly below the NAAQS level**, such as at 10 $\mu g/m^3$ for annual $PM_{2.5}$. We recommend this additional sensitivity case because

[17] See oral arguments in *Michigan v. EPA*, pages 61-62, transcript available at: https://www.supremecourt.gov/oral_arguments/argument_transcripts/2014/14-46_1b5p.pdf.

there is a large change in the confidence associated with the sensitivity cases that impose a cutpoint at the NAAQS (at 12 μg/m^3) versus at the LML (as low as 5 μg/m^3). There is also a very large change in estimated $PM_{2.5}$ co-benefits between these two sensitivity cases.[18] An additional sensitivity case that is slightly below the NAAQS level would provide helpful insight about whether the very small co-benefits in the "highest confidence" (NAAQS cutpoint) estimate rise quickly to the larger co-benefits estimates in the "lower-confidence" (LML cutpoint) case or whether those co-benefits start to rise only after the cutpoint has been reduced far below the NAAQS level.

D. A Comparable Sensitivity Analysis Should Be Applied to the RIA's Ozone Co-Benefits Estimates

The CPP Repeal RIA's approach for calculating and presenting co-benefits estimates goes far in the direction of revealing the declining confidence levels of different components of the co-benefits. In particular, the co-benefits in the "zero below NAAQS" case should be viewed as being the estimate for which there is good confidence (*i.e.*, are calculated in a manner consistent with the Administrator's more recent judgment about the scientific evidence on health effects). One concern with the manner in which EPA has implemented this approach in the CPP Repeal RIA is that it has re-calculated *only the* $PM_{2.5}$ co-benefits for alternative confidence levels. This has resulted in almost all of the remaining co-benefit estimate being due to ozone co-benefits,[19] because the ozone co-benefits have not been similarly revised. However, the uncertainty and inconsistency issues that have been raised for $PM_{2.5}$ benefits estimates apply equally strongly to those for ozone.

Thus, **we strongly recommend that when EPA refines its analysis for future RIAs, a parallel adjustment be made to the ozone co-benefits as is made to the $PM_{2.5}$ co-benefits for each sensitivity case.**

E. Correction Needed in Computation of Co-Benefits Under Alternative Cutpoint Levels

Although the CPP Repeal RIA has made good progress in the decision to present a range of co-benefits estimates for different cutpoints in the continuation of the C-R function, there is a logical inconsistency in how these alternative calculations are being made for risks above the assumed cutpoint. Specifically, the sensitivity cases are simply estimating the fraction of risks

[18] The $PM_{2.5}$ co-benefits estimate in the NAAQS cutpoint case is far smaller than one may guess from the results presented in the CPP Repeal RIA, which combine ozone with $PM_{2.5}$ co-benefits. If these were presented in a disaggregated manner by type of pollutant, it would become apparent that the $PM_{2.5}$ co-benefits are nearly zero in the NAAQS cutpoint case, and almost all of the co-benefit value reported for that sensitivity case is due to ozone. We recommend that ozone be included in the sensitivity cases too (see Section III.D).

[19] We have replicated most of this RIA's co-benefit calculations for the sensitivity cases, and we find that 98% to 99% of the co-benefits in the "zero below the NAAQS" case are ozone co-benefits, which have not had any adjustment relative to their "full range" values.

that are occurring in populations residing in areas with concentrations below the selected cutpoint, and zeroing out that subset of the population-wide risk estimate. However, if the cutpoint is to be viewed as the point at which one loses confidence that the C-R function continues to yet-lower concentrations, then the relative risk per unit of pollutant would only start to accrue *from that cutpoint*.

The logically-consistent way to calculate the risk if the C-R relationship is assumed not to continue below some cutpoint is not to only zero-out the estimated portion of the risk that occurs below that cutpoint, but to also recalibrate the relative risk that exists for populations that reside in areas with concentrations above that cutpoint. For example, if the C-R relationship is assumed to end at an LML of 8 $\mu g/m^3$, then 8 $\mu g/m^3$ becomes the starting point from which incremental exposure creates incremental (relative) risk. Thus, exposures at 10 $\mu g/m^3$ would be subjected to the increase in risk associated in an incremental exposure of 10 minus 8, or 2 $\mu g/m^3$ rather than 10 $\mu g/m^3$. This means that current estimates of the $PM_{2.5}$ co-benefits in each sensitivity case in the CPP Repeal RIA are overstated—and greatly so for the highest cutpoint case. The higher the cutpoint assumption, the more the relative risk for exposures above that cutpoint is reduced, and hence the higher the overstatement.

This may seem like a minor detail but it will in fact have a very large impact on the sensitivity of co-benefits that are currently presented. This point was made in UARG's comments to the docket for the proposed ozone NAAQS, based on the technical report of Smith and Glasgow (2015). In that proposed rule, a similar cutpoint analysis was presented for ozone risks associated with different NAAQS levels. Smith and Glasgow (2015) demonstrated how the sensitivity was much more pronounced when risk above the cutpoint level was recalibrated to start relative to the cutpoint level.[20] Appendix B of these comments provides a copy of the relevant sections of Smith and Glasgow (2015).

Thus, **we strongly recommend that every one of the co-benefits sensitivity calculations be revised to compute incremental risk <u>relative to the cutpoint point</u> rather than by simply zeroing out those risks that are calculated below the cutpoint point.**

When cutpoints are applied to the ozone co-benefits estimates as well, the method of recalibration of risk relative to the selected cutpoint should also be applied to those sensitivity cases.

F. Avoiding Limitations of Benefit-per-Ton Approach

The BPT approach for estimating $PM_{2.5}$ and ozone benefits was developed to make it exceptionally easy for the Agency to produce co-benefits estimates. Whatever its merits may be, this device instantly created a barrier for the Agency and for public commenters to develop

[20] This calculation of relative risk starting from the cutpoint is also the method used in the sensitivity analysis of $PM_{2.5}$ benefits at different confidence levels that appears in Smith (2016).

estimates of the sensitivity of co-benefits to alternative assumptions about where the C-R relationship might end. This is a particularly problematic situation given that uncertainty on this specific matter has routinely been used by the Administrator to justify the choice of NAAQS level for these two pollutants.[21] NERA identified this problematic aspect of the BPT approach in its report on the proposed CPP RIA co-benefits prepared for the Virginia Legislature (NERA, 2015). Using a cutpoint of 10 $\mu g/m^3$ (a level substantially more stringent than the current NAAQS), NERA (2015) performed a very rough approximation of the geographical relationship of projected $PM_{2.5}$ and ozone precursor emission reductions and areas in attainment with the current $PM_{2.5}$ and ozone standards to estimate that only about 2% of the overall $PM_{2.5}$ co-benefits were likely to be in counties with $PM_{2.5}$ above 10 $\mu g/m^3$. We note that this is stated in terms of counties rather than population, and the roughness of the estimation approach reflects our lack of access to the underlying data on which the BPT estimates were originally calculated.[22]

In preparing the CPP Repeal RIA, the Agency has also identified this problem and developed some rough approximations for working around it for its sensitivity cases. In doing so, the Agency has had the advantage of being able to return to the modeling data that it used for its CPP BPT estimates in 2015. From these data, EPA has obtained direct estimates of the percentage of the modeled avoided premature mortalities in its CPP Option 1 case that resided in areas above the relevant LMLs and NAAQS. It then reduced each respective BPT estimate by that fraction (see footnote 36 on p. 51, and Table 5-2 on p. 95 of the CPP Repeal RIA) to calculate the reduced $PM_{2.5}$ mortality and co-benefits for its two sensitivity cases. With this approach, EPA reports that 0.4% of the avoided premature mortalities upon which the BPT estimates were calculated were in areas projected to be exceeding the annual $PM_{2.5}$ NAAQS of 12 $\mu g/m^3$. The Agency seeks comment on how best to use the available empirical data to develop such sensitivity estimates (p. 8), and we provide our responses below.

First, just as we have applauded the effort to provide sensitivity estimates in the CPP Repeal RIA, **we also endorse the Agency's expressed intention to conduct refined co-benefits sensitivity estimates using photochemical modeling in future iterations of the CPP Repeal RIA. We also recommend that the photochemical modeling outputs (or, more specifically, the air quality grids that are BenMAP inputs) be made available to the public to develop comments on that additional work.**

However, even if new photochemical modeling is not conducted, we have several recommendations for refining the sensitivity calculations already prepared:

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[21] See footnote 2, and discussion regarding points made in Smith (2016) in Section III.C regarding this.

[22] NERA (2015) also provides a detailed explanation of how the BPT approach relates to the standard health risk calculation of BenMAP, and why this eliminates the ability to tailor BPT-based benefits estimates to account for location-specific differences in relative risk from pollutant concentrations. We recommend pp. 7-13 of that report to readers who would like more explanation of this BPT issue than is provided in the CPP Repeal RIA.

- As stated above, the same types of cutpoints that are applied to $PM_{2.5}$ should also be applied for ozone. For example, in the "zero below NAAQS" case, ozone co-benefits should be included only to the extent they occur above the current ozone NAAQS. At present the significant sensitivity of $PM_{2.5}$ co-benefits in this case is masked by the fact that ozone co-benefits remain at their "full range" value, and become almost all of the co-benefits estimate reported for that case. LML levels can also be defined for ozone for the "zero below LML" calculations.

- The error in the computation of sensitivity to alternative "cutpoints" described in Section III.E can be roughly corrected even without full new photochemical modeling. This can be done using the existing projection for the proposed CPP Option 1 and Baseline air quality projections to recompute BPT in the original manner, after first subtracting the cutpoint value (either the LML or the NAAQS, depending on the sensitivity case) from the projected air concentration in each location in the modeling domain.

G. Suggestions for Improving Synthesis and Communication of Impacts on Net Benefits of Sensitivity Cases

We note that a valuable aspect of EPA's present approach is that the Agency does not make any attempt to resolve the question of which sensitivity case is more valid. A "best estimate" is inappropriate for purposes of educating the public about the implications of including co-benefits in the net benefit calculation, and for communicating how much the associated uncertainty can affect results, if one does wish to incorporate co-benefits at all. Transparency and an unbiased presentation are best served by simply providing the alternative estimates, explaining what they represent, and letting each reader draw his or her own conclusion about what to emphasize. Public discussion can thus also proceed without the ability of one party or another to dodge the issue of what assumptions they are giving greatest weight to.

In the interests of doing this, **we recommend the adaptation of Tables 4-1 through 4-4 in the CPP Repeal RIA to a more condensed format such as our Table 2 below.**[23] For the Rate-Based Option, Table 2 summarizes the net benefits in the CPP Repeal RIA under all of the combinations of discount rate and co-benefits sensitivity cases.[24]

Each row within a cell of Table 2 shows the effect of incrementally adding more and more of the uncertain forgone co-benefits from $PM_{2.5}$ (as previously noted, the CPP Repeal RIA does not address the uncertainty in the ozone co-benefits, but should). The first row in each cell, labeled "No Co-Benefits," shows net targeted benefits (by year and discount rate, as indicated in row and column headers). This estimate provides an appropriate BCA evaluation for regulatory action if one decides that $PM_{2.5}$ and ozone co-benefits are inappropriate to include given that they are

[23] It would be perhaps even more helpful to find a way to represent these sensitivity ranges in a graphical format to supplement the tabular format provided here.

[24] The comparable table for the Mass-Based Option is provided in Appendix A (see Table 8).

already stringently regulated under the CAA. The remaining three entries in each cell below that reflect the impact of allowing for consideration of co-benefits, but showing the implications of allowing co-benefits estimates that have varying degrees of perceived credibility (or "confidence" in the words of the EPA Administrator).

The second row in each cell (labeled "Cutpoint at NAAQS") shows the effect on net benefits when including only co-benefits of the highest confidence level (*i.e.*, those associated with exposures above the NAAQS level). The third row includes co-benefits estimated for populations facing even very low current $PM_{2.5}$ exposures, as low as the LML observed in the associated epidemiological study data set. The Administrator has declared such low confidence in risk estimates based on exposures within this range as to not warrant setting the NAAQS at any level within this range. The fourth row within each cell (labeled "No cutpoint") includes risk estimates for all populations, including those living in locations that have cleaner air than any that were observed in the associated epidemiological studies. The resulting net benefits estimates on this last row of each cell thus have the lowest confidence levels of all.

Naturally, the estimates of the net benefits of repeal become increasingly smaller (increasingly negative in some cases) as less and less credible estimates of co-benefits are included in the calculation. A table such as this is useful for summarizing the sensitivity of the net benefits of the rule to the inclusion of co-benefits, and to alternative limits that are placed on the credibility of co-benefits estimates, if they are to be considered at all.

With the net benefits estimates for all the sensitivity cases (in Tables 4-1 through 4-4 in the CPP Repeal RIA) consolidated into this single table, one can more readily infer the extent to which the acceptance of co-benefits estimates in the policy evaluation affects one's view of its potential to be net beneficial.[25] When either discount rate is used, net benefits can become negative, but generally only when co-benefits are both included in the evaluation, and are based on the lower-confidence assumptions about the continuation of the C-R function to levels far below the NAAQS. As one would expect, the potential that net benefits will be negative is somewhat larger for the 3% discount rate than for the 7% discount rate cases.

The important insight made clearer by providing a condensed summary such as the above is that whether the repeal of the CPP will result in net benefits is not a certainty, and depends heavily not just on whether one believes CP co-benefits are appropriate to include in a climate RIA, but also on how willing one is to believe in the unabated continuation of the $PM_{2.5}$ and ozone C-R relationships to levels far below their respective NAAQS levels.

[25] We reiterate that the co-benefits sensitivity cases should be revised to include analogous cutpoints for ozone, which will reinforce this statement. If the cutpoint sensitivities for both are computed to calculate risk relative to the cutpoint, these results will also be reinforced.

Table 2. Sensitivity of Net Benefits of CPP Repeal to Inclusion of Increasingly Uncertain Forgone Co-Benefits (Rate-Based Option)

		Discount rate case[26]	
		3%	**7%**
2020	No co-benefits Cutpoint at NAAQS Cutpoint at LML No cutpoint	\$2.1 \$1.5 to \$2.0 \$0.9 to \$1.5 \$0.3 to \$1.4	\$2.9 \$2.4 to \$2.8 \$1.8 to \$2.3 \$1.2 to \$2.3
2025	No co-benefits Cutpoint at NAAQS Cutpoint at LML No cutpoint	(\$0.4) (\$3.1) to (\$1.1) (\$10.5) to (\$7.3) (\$18.1) to (\$7.8)	\$4.7 \$2.1 to \$4.0 (\$4.6) to (\$1.6) (\$11.5) to (\$2.0)
2030	No co-benefits Cutpoint at NAAQS Cutpoint at LML No cutpoint	\$5.7 \$0.7 to \$4.2 (\$13.5) to (\$7.6) (\$28.3) to (\$8.6)	\$14.0 \$9.2 to \$12.7 (\$3.6) to \$2.0 (\$16.9) to \$1.1

The temporal aspect of the potential for negative net benefits revealed in the above tables is of some interest, because, as the CPP Repeal RIA notes (at p. 11), there is an issue of what regulations take place first in terms of the net benefits of the next regulation. Given that the co-benefits come from pollutants that are subject to NAAQS, and may be more stringently regulated by the later dates, some of those forgone co-benefits may occur "anyway" as a result of direct regulation of those CPs that would occur even without the CPP. Indeed, the lower the cutpoint considered reasonable (which is what drives up the forgone co-benefits), the more likely it is that those $PM_{2.5}$ reductions will occur anyway by the years 2025 and 2030 – and thus should not even be considered as forgone co-benefits for the CPP.

H. Suggestions for Providing Insight About Geographical Distribution of Co-Benefits

As the results of the cutpoint sensitivity analyses show, many of the $PM_{2.5}$ co-benefits are apparently occurring in areas that have low $PM_{2.5}$ concentrations from the start. Clearly the best way to demonstrate this would be to perform full photochemical air modeling and graph both baseline $PM_{2.5}$ and estimated mortality reductions as overlays. However, some geographical

[26] The discount rate affects both the forgone climate benefits and the avoided compliance cost estimates (as can be seen in CPP Repeal RIA Table 4-1

insight can be gained even from the current outputs of IPM model runs, as illustrated with the figures below.

NERA obtained the detailed IPM model output files from the IPM model runs that were used to estimate compliance costs and associated emissions reductions. (These are the same for both the original and CPP Repeal RIA.) These files identify the generating units that are projected to have SO_2 and NO_x reductions as a result of CPP implementation, the total of which is used to calculate the RIAs' co-benefits using the BPT approach.[27] We assigned each unit to its county, and mapped the projected reductions across the U.S. at the county level. Figure 3 maps the counties in which the SO_2 tons of reduction associated with the mass-based option are projected to occur. Figure 4 does the same for the associated NO_x tons reduced.

These files tell us where IPM has projected the reductions in generation will occur– which itself injects an unknown amount of uncertainty into the total tons of reduction, given that the reduction in SO_2 and NO_x per unit of reduced CO_2 will vary depending on which units are projected to reduce their generation to comply with the CPP. Whatever may be the uncertainty in total tons, it is unsurprising that there is a fair amount of overlap in where SO_2 and NO_x reductions occur, given that compliance with the CPP is mostly achieved by reduction of utilization of certain electricity generating units rather than reduction in those specific pollutants.

Another interesting feature is that some counties are projected to experience an increase rather than decrease in emissions. This reflects the fact that as some plants close down, others in other locations may generate more. Thus, the maps tell us that estimated co-benefits of the CPP were not necessarily positive for all people in all parts of the U.S. These distributional differences in where co-benefits are likely to be concentrated, and possibly also negative, would be useful to report in interests of transparency.

We recognize that the location of emissions reductions are not the same as the locations of air concentration changes, given that $PM_{2.5}$ and ozone are formed as the result of secondary chemical reactions in the atmosphere following emission of their precursors such as SO_2 and NO_x. Nevertheless, a rough first approximation of where the concentration changes will occur may be possible to infer from these maps of where the emissions reductions are projected to occur. **We therefore recommend that such maps be presented in the co-benefits section of the RIA, particularly if photochemical modeling of these specific emissions reductions has not been done. In the latter case, the better alternative would be to provide the maps of the projected changes in air quality results.**[28]

[27] The two files for 2025, EPA (2015f) and EPA (2015g), were submitted by EPA to the CPP Docket, EPA-HQ-OAR-2013-0602.

[28] It would appear that EPA could do this with current results, as it seems that its analysis of the BPT for the 2015 CPP RIA was based on 2015 modeling of the predicted changes in tons from the proposed CPP's Option 1 case. While those reductions are not going to be identical to the results of the final CPP's compliance projections, they will nevertheless be very informative about the general geographic pattern of where the air quality changes are

Figure 3. Location of 2025 IPM-Projected SO_2 Reductions (Mass-Based Option)

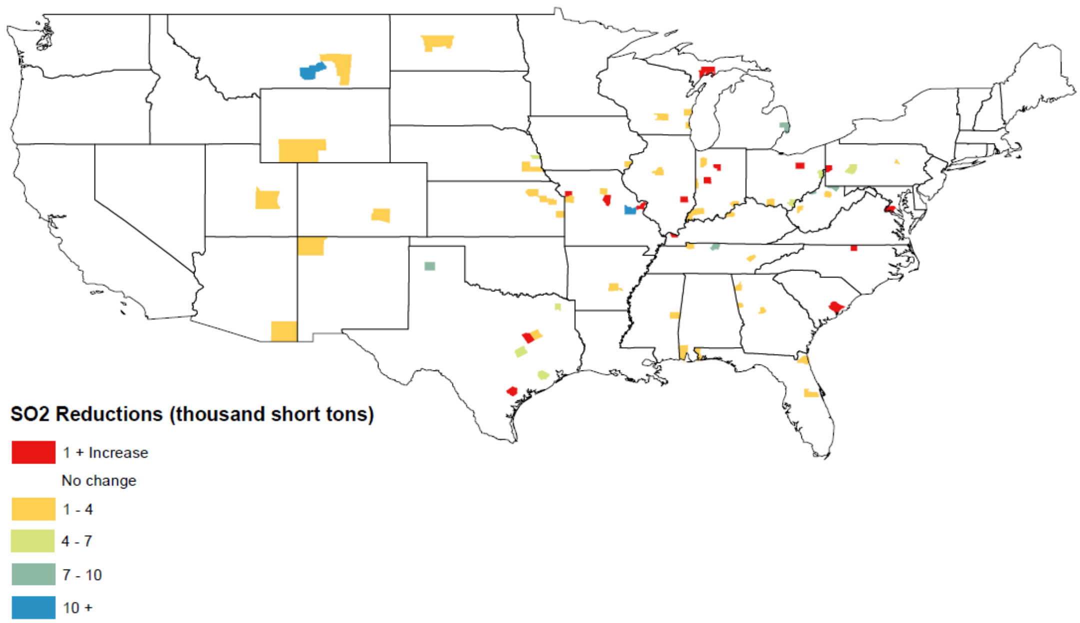
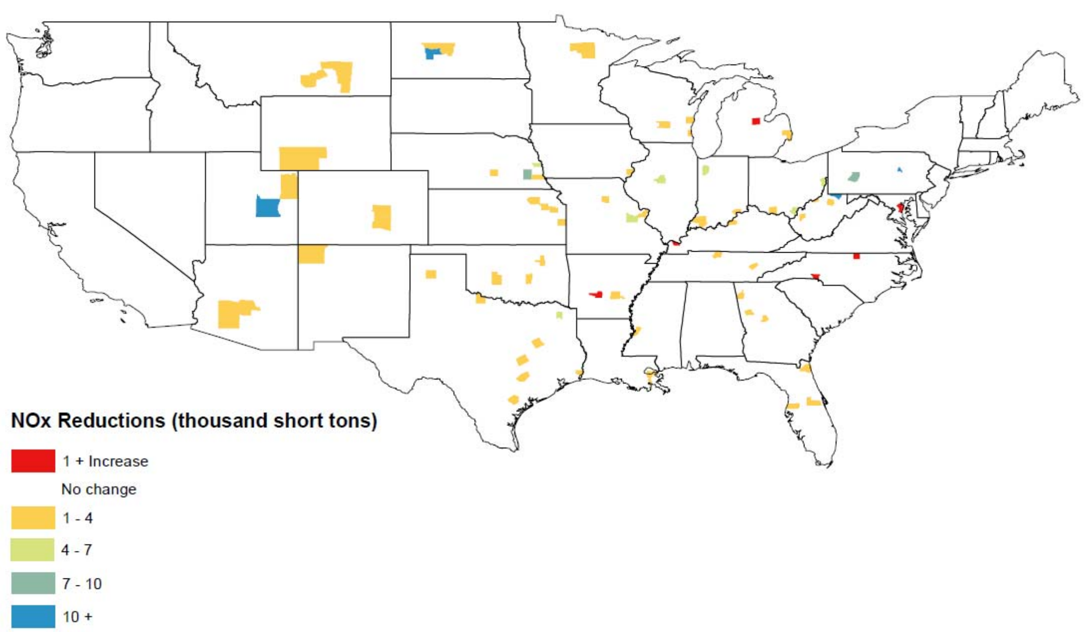


Figure 4. Location of 2025 IPM-Projected NO_X Reductions (Mass-Based Option)



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occurring, and should be provided if EPA does not proceed with its intention of conducting more specific air quality modeling.

Finally, it would be useful if the RIA were to provide maps showing the distribution of baseline $PM_{2.5}$ and ozone levels in each of the modeled years. An ability to compare the projected locations of the emissions changes (or better, the air quality changes) from CPP compliance with baseline projection of concentrations in each compliance year analyzed would help readers gain insight on why co-benefits are so sensitive to using a cutpoint in the co-benefit calculations. This would also help readers understand what is inside the BPT approach's black box.

IV. SOCIAL COST OF CARBON

The pollutant targeted by the CPP was CO_2, and therefore, the targeted benefits of that rule were those associated with the impact to climate change. RIAs for rules that target greenhouse gases have often relied on a concept known as the SCC to estimate the net economic value of climate impacts associated with each incremental ton of CO_2 emitted.[29] While the use of SCC to assess climate benefits in RIAs dates back about a decade, the U.S. government's quantitative SCC estimates have varied over time as both climate assessment models and philosophies regarding the appropriate non-scientific ("framing") assumptions to apply when running those models have evolved.[30] Both assumptions about scientific phenomena and analysis framing assumptions have been shown to have extremely large impacts on the SCC estimates, and this has made every attempt to develop an SCC value for use in policy evaluations highly controversial.

The CPP Repeal RIA focuses on SCC estimates that have been calculated with a wider range of alternative values considered for two of at least four important framing assumptions that were adopted during the previous Administration (and included in the 2015 CPP RIA). Given the high degree of sensitivity of SCC estimates to alternative values for these two framing assumptions, and the complete absence of such estimates in the 2015 CPP RIA, the range of potential net benefits is substantially altered in the more recent RIA. The two framing assumptions that are treated differently are:

1. *The geographic scope of climate impacts that is considered relevant for comparison to compliance costs*. The 2015 CPP RIA assumed that the CPP's U.S. compliance costs should be compared to the rule's estimated impacts of global damages, including those projected to occur outside of the U.S. (2015 CPP RIA, p. 4-4), and it did not report the U.S.-specific component of the global impact at all. The CPP Repeal RIA gives primary emphasis to U.S.-specific impacts, while still providing estimates of global impacts separately.

[29] Like the estimates of criteria pollutant co-benefits discussed in Section III, the SCC is a dollar per ton estimate. The U.S. government's SCC estimates are stated in dollars per metric ton of CO_2 emitted and vary with the year in which the ton is emitted.

[30] Framing assumptions are assumptions that have no objective or testable basis, and which instead reflect ethical and other value judgments of the decision maker that are unavoidable in the analysis of the impacts of a particular decision. Examples of framing assumptions in the SCC are the choice of geographical and temporal scope to incorporate into the climate damage calculations, the baseline conditions projected to occur in the far future, and the relative weight to assign to future vs near-term impacts. None of these judgments are fixed in the climate models that are used, but all have significant impact on the estimates that any given climate model will produce. There is no single correct way to set such framing assumptions. Decision analysis practice suggests that such judgments should be tailored to the context of the decision that is being informed, including the relative balance deemed acceptable between estimates based on assumptions that have strong empirical support vs. those that involve significant extrapolation beyond the available data. As a result, completely different SCC values may be appropriate for different decisions and for different decision makers.

2. *The discount rate that is used to apply different relative weight to consumption changes that occur in the future versus now*. The 2015 CPP RIA used discount rates from 2.5% to 5%. The CPP Repeal RIA continues to use the 2.5% and 3.0% discount rates, and expands the range to include 7%, while giving primary emphasis to results for discount rates of 3% and 7%.[31]

The CPP Repeal RIA notes that both of these framing assumption changes have been made to comply with the requirements of Executive Order 13783, which withdraws the prior Administration's SCC technical support documents (*i.e.*, IWG, 2010, 2013a, 2013b, 2015) and requires that future SCC values adhere to guidance about framing assumptions expressed in OMB's Circular A-4 (OMB, 2003, pp. 42-43). The bases for both of the above framing assumption choices are discussed in more detail in Sections IV.A and IV.B below, respectively. Although we will not discuss them in as much detail, **we also note here that there are yet other important framing assumptions implicit in RIAs' climate benefits estimates that we recommend also be reconsidered in developing SCC values for use in future RIAs**. Two important ones include:

- ***The choice of time horizon over which impact estimates are made which affects the confidence one can place in the resulting SCC estimates***. At present the models give equal credence to an estimate of economic impact that occurs in 2250 as it does to an estimated impact that occurs in 2050. While discounting diminishes the relative effect of a later impacts, it does not (and should not be used to) assign lower confidence to outcomes projected in the far future. The enormous uncertainty in climate impact estimates, particularly those that SCCs ascribe to the far future, is discussed and characterized quantitatively in many studies, including NERA (2014a), Smith (2014), and Smith (2015). (The effect of longer time horizons on confidence in the SCC results is not dissimilar to the effect that assuming lower cutpoints on $PM_{2.5}$ risk impacts has on resulting co-benefits estimates.)

- ***The choice of baseline future emissions against which to value the impact of an incremental ton in the near term***. The estimate of the SCC of a ton emitted in a given year, such as 2025, is affected by the total amount of baseline greenhouse gases assumed to be emitted *after* that year until the end of the time horizon. The government's current method of calculating its SCC values averages SCC estimates from five alternative baseline projections of future emissions that are assumed by the SCC-estimating models to be invariant to any emissions control decisions made as a result of the resulting SCC

[31] In its reporting of estimated climate benefits, the 2015 CPP RIA included estimates using the 95th percentile of damages using a 3% discount rate. From a decision analysis perspective, a comparison of "worst case" benefits to "best case" costs without also considering the other ends of both distributions is not an appropriate method for accommodating risk aversion into an evaluation. The CPP Repeal RIA has dropped this SCC estimate without discussion. We would recommend that the next RIA give a more explicit discussion of the reasons for excluding this type of net benefit calculation.

estimate.[32] Four of these five baseline projections assume no long-term emissions reduction efforts, even if the resulting elevation in estimated near term SCC values associated with those no-future-control assumptions do motivate actions to decrease emissions now (and in the future). A more logically-coherent approach for estimating SCC values to guide near-term reduction decisions would assume that future (long-term) emissions would also be reduced consistent with continued use of the SCC through the end of the model horizon. Doing so would imply lower baseline emissions in at least four of the five baseline projections now used by the U.S. government, which, in turn, would imply lower average estimates of SCC than those currently adopted.[33]

Finally, in Section IV.C we make a recommendation for how the RIA can improve its communication and transparency about the temporal nature of the climate impact estimates, which have a uniquely long-term dimension relative to the estimated costs or other estimates to which they are being compared. This recommendation would not alter any SCC calculation *per se*, but would alter their presentation. The recommendation is consistent with Circular A-4 guidance calling for transparency in communications of results (p. 17, Section E.4).

A. Geographic Scope of Climate Impact Estimates

The SCC estimates developed by the previous Administration (IWG, 2010, 2013a, 2013b, 2015) embodied a judgment that all climate impacts experienced worldwide should be included when evaluating costs and benefits of U.S. policies affecting U.S. CO_2 emissions. This was deemed the appropriate perspective even if the policy measures were unilateral and would impose costs only on the U.S. economy. Consistent with that perspective, the 2015 CPP RIA compared estimates of global climate impacts to estimates of the costs of complying with the CPP in the U.S. That RIA did not provide any information on the portion of global impacts that might be expected to accrue domestically in the U.S.

For the CPP Repeal RIA, additional SCC estimates have been calculated reflecting domestic climate impacts alone. Because these were computed in the same manner and with the same assumptions as the global SCC estimates calculated by the prior Administration (p. 162 of the Current RIA), they indicate the portion of the 2015 CPP RIA's climate impact estimates that

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[32] Each baseline projection also assumes future levels of gross domestic product ("GDP"), and population. The government adopts the simple average of all the alternative SCC estimates for a given discount rate as "the" SCC value for that discount rate.

[33] One of the five baselines used in current SCC estimation process (called the "Fifth Scenario") assumes future emissions levels low enough to stabilize global atmospheric concentrations at 550 ppm. This one baseline is not inconsistent with the notion of using SCC estimates to motivate control measures today. Notably, it also produces lower SCC estimates than any of the other four baselines. Until the U.S. government adopts SCC-estimating models that endogenously adjust future emissions levels to be consistent with near-term SCC-based reduction efforts, a case might be made to use SCC values based solely on that "Fifth Scenario" baseline, rather than continuing the present practice of giving it only 20% weight, compared to the 80% weight assigned to SCC estimates are based on internally-inconsistent future emissions baselines.

could have been attributed to impact on the U.S. The primary results reported in the various net benefits summary tables in Sections 1 and 4 of the CPP Repeal RIA reflect only domestic impacts, but quantitative results using the respective global SCC values are reported in Appendix C of the RIA. Thus, unlike the 2015 CPP RIA, the CPP Repeal RIA provides estimates for both domestic and global forgone climate benefits.

The CPP Repeal RIA points to OMB guidance in Circular A-4 as the justification for its emphasis on domestic benefits (pp. 42-43). There are sound reasons for OMB's guidance to have called for non-U.S. benefit (or forgone damage) estimates to be reported separately from U.S. damages. This fact is briefly noted in a footnote in Appendix C (CPP Repeal RIA, fn. 83, p. 168), which merits greater prominence:

> *While Circular A-4 does not elaborate on this guidance, the basic argument for adopting a domestic only perspective for the central benefit-cost analysis of domestic policies is based on the fact that the authority to regulate only extends to a nation's own residents who have consented to adhere to the same set of rules and values for collective decision-making, as well as the assumption that most domestic policies will have negligible effects on the welfare of other countries' residents (EPA 2010; Kopp et al. 1997; Whittington et al. 1986). In the context of policies that are expected to result in substantial effects outside of U.S. borders, an active literature has emerged discussing how to appropriately treat these impacts for purposes of domestic policymaking (e.g., Gayer and Viscusi 2016, 2017; Anthoff and Tol, 2010; Fraas et al. 2016; Revesz et al. 2017). This discourse has been primarily focused on the regulation of greenhouse gases (GHGs), for which domestic policies may result in impacts outside of U.S. borders due to the global nature of the pollutants.*

The points that are made in the papers cited in this quotation deserve a more thorough discussion in the final RIA, possibly in the form of a technical support document to accompany that RIA. We recommend that such an extended discussion be developed. In its absence, we briefly expand below on the key elements of the justification for emphasis on domestic benefits in the case of a global externality such as climate change.

A common thread in the literature supporting emphasis on domestic benefits in a policy that is known to have non-domestic spillover effects is tied to the concept of legal standing. This in turn is tied to the fact that standing has usually been granted only in the presence of reciprocal effort on the part of the other nations. Reciprocal effort is important because it implies something akin to a joint optimization. Without joint optimization, results of a unilateral benefit-cost policy optimization that considers the other nations' benefits leads to outcomes that are detrimental to the individual nation's interests. Thus, the societal rationality that BCA promises is lost.

Another way of explaining the theoretical reasons for considering only domestic benefits in a BCA is noted in some of the papers cited in the CPP Repeal RIA's footnote 83 (p. 168). The conclusion that a BCA will lead to societal welfare enhancement is founded on a principle called the Kaldor-Hicks "potential compensation principle" ("PCP"). The PCP addresses concerns with distributional effects of a policy (*i.e.*, the potential that the costs of the policy may be distributed more heavily on some citizens than their share of its benefits). According to the PCP, a policy can be treated as welfare-enhancing as long as the value of its benefits can be redistributed by that society in such a way that all those absorbing its costs will be individually compensated. The policy need not actually achieve this compensation, but only identify that the society making the decision to implement that policy be able, potentially, to do so through other policy mechanisms available to it. The PCP is the basis for the conclusion that a policy that is estimated to have positive net benefits will enhance societal welfare.

The difficulty with including non-domestic benefits in a net benefit calculation for a unilateral national policy decision is that national authority for potentially redistributing benefits does not extend to the benefits accruing outside of that nation. If the non-domestic benefits are necessary for net benefits to be positive, then the PCP fails, and that net benefits estimate cannot be viewed as necessarily welfare-enhancing. In other words, the underlying social welfare properties of BCA are lost when non-domestic benefits are automatically included in the calculation, and thus it is important to *separate* estimates of non-domestic benefits from domestic benefits. It is acceptable to include non-domestic benefits as additional justification supporting a policy, but a first principle remains that the domestic-only net benefit calculation be positive. Policies that are likely to produce positive net benefits only when including some or all non-domestic benefits should be avoided or otherwise demand much stronger evaluation of off-setting considerations such as the existence of reciprocity.

A common counterargument to the above arguments is that the U.S. needs to account for global impacts in order for its assessments of climate policies to be consistent with a global optimization of climate risk management. A related argument is that the U.S. needs to do this to demonstrate leadership in global climate policy development, thus encouraging other countries to undertake similarly aggressive action. It would be appropriate to include global damages in valuations of U.S. policies that are to be part of a global policy package (*i.e.*, when actions in other major-emitting nations are also being set to be optimal with respect to the same global damage estimates). However, that is a different decision context than the one-by-one consideration of unilateral U.S. policies that are not part of a global optimization package. Even if the CPP were to be viewed as part of a U.S. commitment under the Paris Agreement, it is not correct to view it, or the other countries' national commitments under the Paris Agreement, as consistent with a global climate control optimization. A fundamental concept underlying that Agreement is the voluntary nature of the commitments that each country is willing to contribute when considering its own domestic conditions. As a result, each nation's commitment reflects what it considers the best it can contribute within the time frame of concern – a set of domestically-affordable actions rather than a set of actions possible within each nation that would have global benefits greater than their domestic costs.

Thus, even if the U.S. ultimately remains a party to the Paris Agreement, it would not be inconsistent for the U.S. to focus primarily on the domestic benefits of its own domestic policy decisions, while leaving room in the analysis results to give some recognition (for altruistic purposes) to the additional incremental benefits that other nations may accrue as a result of the U.S.'s domestic spending. This is the basis for the Circular A-4 guidance to report domestic benefits separately from non-domestic benefits. The amount of recognition to decide to grant to non-domestic benefits in a final policy judgment could be tied to the amount of reciprocal consideration of global benefits that appears to be entering into other nations' levels of "ambition" in reducing their own carbon emissions.

B. Discounting Far-Future Climate Impact Estimates

The SCC estimates used in the 2015 CPP RIA were based on discount rates of 2.5%, 3% and 5% per year. Citing the requirement of Executive Order 13783 to rely on guidance of Circular A-4 for updated estimates of the SCC, the CPP Repeal RIA provides additional climate impact estimates based on new SCC calculations using a 7% discount rate. The primary net benefit estimates include a 3% and 7% discount rate estimate. Appendix C of the CPP Repeal RIA reports the comparable climate benefits estimates for 2.5%, reflecting Circular A-4 guidance to also consider estimates with a lower discount rate in cases involving very long time horizons, such as climate change. No specific estimates are provided in the CPP Repeal RIA for the 5% discount rate, possibly because a discount rate between 3% and 7% is not mentioned in Circular A-4. However, it is clear that estimates for that discount rate would lie within the range provided in the primary tables.

The CPP Repeal RIA notes that the 3% discount rate is intended by Circular A-4 to reflect the consumption rate of interest while the 7% rate is intended to reflect the capital rate of interest (p. 166). Circular A-4 requires that both discount rates be used in RIAs, and does not suggest that some types of regulations could be evaluated using only one or the other of the rates.[34] The argument for omitting an estimate based on 7% provided by developers of the initial ranges of SCC estimates[35] is that the models being used to estimate the monetary value of climate damages have already converted all damages into consumption-equivalent units, and therefore only the consumption rate of interest should be used in converting far future climate damages into a present value. The reason SCC estimates based on 5% were provided rather than just 3%, as advised by Circular A-4, was that it reflected the IWG's view on uncertainty regarding the consumption rate of interest. They described this range as generally being 3% to 5%, while a lower rate of 2.5% could be justified by concerns about growth rate uncertainty and/or ethical issues (IWG, 2010, p. 23).

[34] Circular A-4 also allows for a sensitivity analysis using an unspecified lower (but positive) discount rate for regulatory actions that would have "important" intergenerational cost or benefit impacts (OMB, 2003, p. 36).

[35] This group is often referred to as the Interagency Working Group ("IWG").

1. Reasons to Consider a Discount Rate Higher Than the Consumption Rate of Interest for Discounting the IWG's SCC Results

Certainly the order to follow Circular A-4 guidance on discount rates provides a direct reason to provide sensitivity analyses based on 7%. On a more directly theoretical basis, if one accepts the IWG's view that the consumption rate of interest may be as high as 5% (as did the IWG), an argument for considering the sensitivity of the SCC to discount rates that exceed 5% is the following:

- The SCC calculations being used by the U.S. government are conducted in the absence of any consideration of costs to achieve the incremental tons of reduction that are simulated. That is, the consumption impacts of an incremental change in emissions are estimated by the models that the U.S. government has adopted, while those models do not include any accounting for the consumption impacts of the investment that would be required to achieve that incremental emissions change.

- The present value of benefits from a ton of carbon reduction is thus estimated in a vacuum that ignores any opportunity cost associated with achieving that reduction. Instead, that SCC estimate is compared to a separately-derived estimate of the cost of carbon-reducing action(s) to determine whether to mandate such control measure(s). If, as a result of this *ex post* SCC-to-control cost comparison, a control action is required, the cost of that control action will have its own incremental impact on future consumption levels, which will be in the opposite direction of the improved future consumption reflected in the SCC estimate. That offsetting incremental reduction in future consumption levels is not accounted for in the U.S. government's method of estimating SCC. In other words, any control actions motivated by use of an SCC estimate will cause an endogenous adjustment of the future consumption levels that are an important determinant of the value of the SCC in the first place, and that adjustment is not accounted for by any of the SCC models that have been used by the U.S. government.

- The dollars spent on the incremental ton of emission reduction in a given year will have an opportunity cost thereafter that is equal to the real rate of return on capital, which is recognized to be higher than the consumption rate of interest. While it would require a complex analysis to directly incorporate that opportunity cost of capital into the U.S. government's SCC estimates, the effect of doing so would be equivalent to a slight reduction in the baseline future consumption path upon which the SCC's consumption impacts are computed. It would thus reduce the SCC value, and would do so in a manner that is mathematically similar to a slight increase in the consumption rate of interest (whatever it may be assumed to be for a given SCC calculation).

In summary, it is appropriate that the SCC be estimated using a range of discount rates that reflects the range in the estimated consumption rate of interest plus some adder to reflect the long-run opportunity cost of the control cost on the long-run consumption path that is independent of how climate impacts also reduce it. If the consumption rate of interest does lie in the range of 3% to 5%, the appropriate discount rates to use for estimating present values from the U.S. government's versions of SCC-estimating models should be somewhat above 3% to somewhat above 5%. For this reason, **we recommend that the RIA also present estimates of forgone climate benefits based on 5**%, as well as the 3% and 7% mandated by Circular A-4.

The concept of an endogenous opportunity cost of capital is more properly captured in the standard version of the DICE model, rather than the version adapted by the IWG for its own SCC estimation process. That standard version does not estimate damages in a vacuum independent of the cost of control, but rather includes both costs and climate benefits to determine the socially-optimal level of investment in climate control (Nordhaus, 2017).[36] An optimal real rate of increase in the price of carbon is generated by the standard DICE model. Professor Nordhaus notes that the goods discount rate is endogenously determined, and model parameters for assumptions such as intergenerational discounting (which are unobservable) should be calibrated to produce near-term savings rates and rates of return on capital (which are observable) that are consistent with those actually observed (Nordhaus, 2007, 2017). Based on this logic, Nordhaus's preferred discount rate in a model that estimates an optimal SCC by balancing the consumption impacts of spending to control emissions against those of resulting climate outcomes is between 4% and 5% (Nordhaus, 2017, Table 3). In earlier analyses, he calibrated to consumption discount rates of over 5%, and showed how this discount rate could be reconciled with an assumed rate of time preference across generations as low as 0.1% (Nordhaus, 2007, p. 698-700).

The sensitivity of net benefits estimates to the discount rate assumption is greatly reduced when domestic benefits are applied (see for example, CPP Repeal RIA Table 1-5, plus the sensitivity results reported on p. 167 for a 2.5% discount rate). However, it remains a significant source of sensitivity if non-domestic benefits are to be given any weight in decision making (as can be seen by replacing the domestic climate benefits in Table 1-5 with the global climate benefits estimated for 3% and 7% that are reported on p. 168).[37] For this reason, absent any easy empirical resolution to the appropriate discount rate range to use, it is useful to consider from first principles one of the key elements of the debate about discount rates in the context of climate change benefits estimates, which we discuss in the next section.

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[36] To perform its own "DICE" calculations that it considered "harmonized" with FUND and PAGE model runs, the IWG has removed this optimization feature from the versions of DICE that it has used (IWG, 2010, p.7, fn.3).

[37] At 3%, global benefits reverse the finding of positive net benefits from repealing the CPP, whereas at 7% they do not.

2. Reasons Not to Consider Discount Rates Lower Than the Consumption Rate of Interest for Discounting the IWG's SCC Results

The most commonly-articulated argument in favor of discount rates as low as or lower than 3% for far-future climate impact estimates is a concern that the present generation will make decisions that unethically ignore the implications of their current consumption on that available to future generations. Circular A-4 acknowledges this concern and that a sensitivity analysis with a rate of interest lower than 3% would be permissible as a sensitivity case, reflecting some views that this concern might be addressed by lowering the discount rate below empirically observed levels. However, Circular A-4 also suggests that one possible way to address concerns with intergenerational equity would be:

> *… to follow the same discounting techniques described above*[38] *and supplement the analysis with an explicit discussion of the intergenerational concerns (how future generations will be affected by the regulatory decision). Policymakers would be provided with this additional information without changing the general approach to discounting.* (OMB, 2003)

In other words, rather than using a discount rate lower than 3% to "adjust for" concerns with intergenerational equity, one might perform the present value analysis using 3% and 7%, then directly report on the degree of inequity that is implicit in the analysis. In this section, we provide an example of how this can be done using the same model results that produce the SCC values used in U.S. government RIAs.[39]

The principle that the consumption ("welfare") of future generations should be given fair consideration when society makes decisions today that may have very long-term consequences is not controversial. However, the prescription that the way to accomplish this is to use a discount rate that is lower than, and inconsistent with, empirical evidence of current societies' consumption rate of interest is not the only approach that economists/philosophers have suggested for ethically accounting for future generations.

Mishan (1977) analyzes intergenerational welfare and growth models, as well as theories of intragenerational welfare, to assess economic criteria for intergenerational comparisons. The paper shows that any number of possible intergenerational distributions can be derived from the models, but also makes the case that "no economic criterion can produce acceptable answers to the distribution problem – whether at a point of time or over time – since the problem is basically an ethical one." (Mishan, 1977, p. 304). Recognizing the ethical issue is one of personal opinion, Mishan suggests he believes most people would agree on one premise with respect to intergenerational ethics:

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[38] In the context of this quote, the techniques "above" are to estimate net benefits using 3% and 7% discount rates.

[39] This example and discussion is taken from Smith (2015).

> *For whatever be our view of the fundamental factors explaining differences in existing incomes, we are likely to agree that an equal per capita real consumption for all generations is an eminently fair arrangement …In sum, the ethical appeal of equality of per capita consumption over generational time is independent of a belief in the justice of an equal division of the product in any existing society, and is far more compelling.* (Mishan, pp. 300-301).[40]

In brief, economic analysis offers no way to sort among prescriptive formulas. It is thus false to view the common prescription of adjusting the discount rate to lower levels than is descriptive of existing society's consumption rate of time preference as the only ethical way to handle the question of fairness to future generations. In fact, studies have shown that the approach of addressing this concern through lowered discount rates creates analytic problems. Two such problems were noted by Farrow and Viscusi (2011): time inconsistency and infinite benefits. Nordhaus (2007) further demonstrates that an overly low discount rate in an SCC-estimating integrated assessment model ("IAM") produces nonsensical implications for savings rates. (Nordhaus, 2007, p. 700)

The quote from Mishan suggests alternative ways to give consideration to the welfare of future generations than titrating the empirically-observed consumption rate of interest to a normatively-prescribed lower level. If Mishan is correct that most would agree that we should manage existing societal decisions so that future generations will have at least our level of real consumption, then we can look to the consumption projected by the IWG's IAM model runs to determine how well different emissions regulations meet that objective. Table 3 presents the real per capita consumption in each of the five IWG baseline scenarios using the IWG's version of the DICE model for current time (2020), and then in 2100, 2200, and 2300. These consumption paths are the endogenous ones that DICE calculates, given the climate impacts associated with each scenario's respective projection of emissions.[41] Table 3 shows that even after absorbing the impacts of temperature change, all of the IWG scenarios are projecting that future generations will be far wealthier and have far higher real consumption than is the case in the present. In fact, by 2100, real consumption is projected to be three to five times higher than real global consumption today. By 2300, when the largest amount of climate impact (with unreduced baseline emissions) is projected to occur, real consumption is projected to be between 7 and 25 times higher than we have today. Thus, the scenarios that the IWG has used to compute the SCC of a ton of emission today are also implying that any cost we incur today will reduce our generation's lower consumption in order to add to the much higher projected baseline consumption ("welfare") of future generations.

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[40] This philosophical stance originates with Rawls (1971).

[41] In other words, the damage function in the model decreases the raw IWG projections of GDP in light of the emissions projected and their projected impact on temperature. These calculations used the median value of the equilibrium climate sensitivity input assumption (*i.e.*, 3).

Table 3. Real Undiscounted Consumption per Capita Over Time IAM Scenarios (Baseline Emissions)

	IMAGE	MERGE	MESSAGE	MiniCAM	5th scenario
Real global consumption per capita					
2020	$ 9,194	$ 7,427	$ 8,595	$ 7,613	$ 8,171
2100	$ 37,133	$ 22,892	$ 26,912	$ 36,671	$ 31,106
2200	$ 125,365	$ 43,798	$ 53,759	$ 134,827	$ 90,555
2300	$ 169,660	$ 49,239	$ 63,872	$ 187,494	$ 122,001
Consumption relative to 2020 consumption					
2100 relative to 2020	4	3	3	5	4
2200 relative to 2020	14	6	6	18	11
2300 relative to 2020	18	7	7	25	15

Source: NERA runs of DICE model using median equilibrium climate sensitivity (ECS=3)

Table 4 considers the impact on future consumption of eliminating emissions. In these analyses, NERA set all manmade emissions after 2010 to zero in each of the same five respective IWG socioeconomic scenarios. The result is that future generations' real consumption does rise; relative to 2020 real consumption, future generations will be even better off than we are. In other words, the projected inequitable distribution of wealth over time – which favors future generations – is exacerbated by reductions in emissions. Furthermore, as discussed earlier in this subsection, the costs of those emissions controls are not included in these projected consumption levels; to the extent that they are more heavily borne in the near term than in the far future, inclusion of the costs of attaining the welfare of future generations shown in the table below may further tilt the balance in favor of future generations.

Table 4. Real Undiscounted Consumption per Capita over Time in IAM Scenarios (Zero Manmade Emissions from 2015 Onwards)

	IMAGE	MERGE	MESSAGE	MiniCAM	5th scenario
Real global consumption per capita					
2020	$ 9,202	$ 7,433	$ 8,603	$ 7,620	$ 8,177
2100	$ 38,466	$ 23,954	$ 27,726	$ 38,072	$ 31,458
2200	$ 140,133	$ 51,271	$ 58,024	$ 151,673	$ 92,610
2300	$ 202,420	$ 63,738	$ 71,653	$ 224,995	$ 126,239
Consumption relative to 2020 consumption					
2100 relative to 2020	4	3	3	5	4
2200 relative to 2020	15	7	7	20	11
2300 relative to 2020	22	9	8	30	15

Source: NERA runs of DICE model using median equilibrium climate sensitivity (ECS=3), and with manmade emissions set to zero in 2015 and all years thereafter.

In conclusion, it is possible to use the IAM models with reasonable estimates of discount rates based on empirical (behavioral) evidence on the consumption rate of interest, and to separately check that this does not result in unfair welfare outcomes of future generations. This can be done as long as the real consumption levels projected for the far future by the same model runs that estimate SCC do not fall relative to what those models assume is the real consumption level for current generations. This supplemental analysis more directly addresses the issue of intergeneration equity than *ad hoc* reductions of the discount rate to some level lower than empirical estimates of the consumption rate of interest.

If one were to contend that the IAM models do not properly account for the welfare of future generations by consideration of just their projected real consumption, then this would be an admission that any estimate of SCC from those models is also invalid. The welfare calculations implicit in each SCC estimate are based on nothing other than projections of changes in real consumption, now and in the far future.

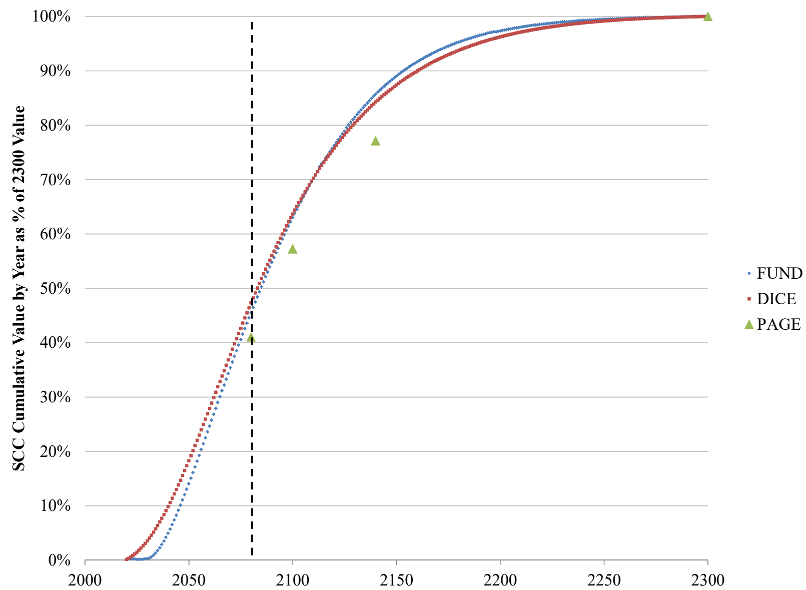
C. Communicating the Temporal Dimension of Net Benefit Estimates That Have a Large SCC-Based Component

When considering net benefits estimates that have a large SCC-based component, such as those in the CPP Repeal RIA, we recommend that EPA better communicate the timing of those SCC-based benefits. NERA has performed additional analysis and model runs of the IAMs (FUND, PAGE, and DICE) that EPA has used to set the SCC values to better understand the timing of the SCC benefits. Our estimates of what fraction of the total SCC value will have accrued cumulatively from the time of emission to 2300 are shown in Figure 5 (for the domestic SCC estimate) and in Figure 6 (for the global SCC estimate). In both cases, this is based on the SCC values using a 3% discount rate. As these figures show, about 50% of the domestic climate benefits would be realized by 2080, and less than 50% of the global SCC estimates.[42]

Evaluating the net benefits associated with the targeted pollutant (Table 1-5, p. 12 in the CPP Repeal RIA), there is only one combination of CPP implementation, year, and discount rate where the net benefits (for the targeted pollutant) of repealing the CPP are negative (*i.e.*, for rate-based implementation, 2025, and a 3% discount rate, which has an estimated net benefit of negative $0.4 billion in 2011 dollars). Using this worst case net benefits outcome, one can infer the net benefits would be highly unlikely to turn negative until after 2080. That is, if only 50% of the forgone climate benefit in that case ($1.4 billion, per Table 1-5) would be realized by 2080, this would imply only $0.7 billion in climate benefits by 2080. Assuming all the other costs and forgone benefits in that net benefit calculation are incurred before 2080, the net benefits by 2080 for that case would be positive $0.3 billion. Since all other cases in Table 1-5 have positive net benefits even through 2300, this adjustment would only reinforce those positive net benefit results.

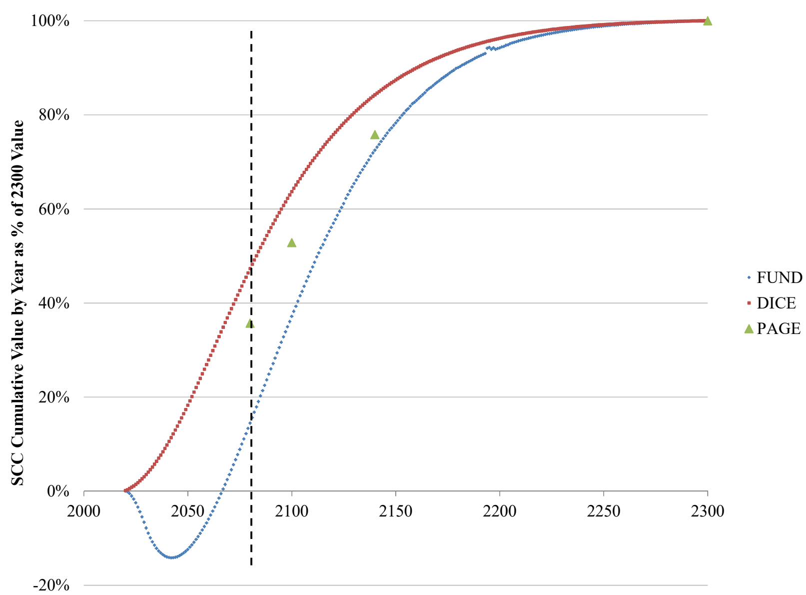
[42] NERA computed values to determine the SCC values over time using the three standard IAMs used by the EPA. For the FUND model, the values are standard outputs by year, averaged across 10,000 iterations and averaged across five baselines (MERGE, MESSAGE, IMAGE, MiniCAM, and 5th Scenario); for the PAGE model, values are averaged across 10,000 iterations and five baselines for separate model runs with terminal years of 2080, 2100, 2140, and 2300; and for the DICE model, values by year are averages across five baselines for a fixed climate sensitivity value of 3.

Figure 5. Cumulative Value of Domestic SCC through 2300 (2007$/metric ton, 2020 emission year)



Sources and notes: NERA analysis using IWG's versions of FUND, DICE, and PAGE models. Values from PAGE model are based on separate model runs with terminal years of 2080, 2100, 2140, and 2300.

Figure 6. Cumulative Value of Global SCC through 2300 (2007$/metric ton, 2020 emission year)



Sources and notes: NERA analysis using IWG's versions of FUND, DICE, and PAGE models. Values from PAGE model are based on separate model runs with terminal years of 2080, 2100, 2140, and 2300.

If one were relying on global, instead of domestic, climate benefits, the communication of the timing of the realization of benefits would become even more important. Based on the analysis contained in the CPP Repeal RIA (Table 1-5 and forgone global climate benefits on p. 168), the net benefits associated with the target pollutant would be negative in 2020 for a 3% discount rate (negative $0.3 billion for rate-based and negative $1.9 billion for mass-based). However, in both instances, less than 50% (and possibly significantly less) of the forgone global climate benefits of $2.8 billion and $3.3 billion, respectively, would be realized by 2080. Thus, by 2080, both the rate-based and mass-based implementations would still be registering positive net benefits. Another way to think about this is that the compliance costs associated with the CPP would not be "paid back" even by *global* climate benefits until after 2080—more than 60 years after those costs would have been incurred.

V. COSTS OF PROPOSED CPP REPEAL

Section II described how the benefits/avoided costs in the CPP Repeal RIA are based on the cost estimates in the 2015 CPP RIA. The CPP Repeal RIA also has additional observations based on a comparison of results with and without an implementation of the CPP included by the U.S. Energy Information Administration ("EIA") in its *Annual Energy Outlook 2017 ("AEO 2017")*. This additional comparison is discussed in Appendix C of these comments.

Table 5 contains a summary of the detailed annual avoided compliance costs presented in the CPP Repeal RIA, with DSEE costs presented for both 3% and 7% discount rates.[43] The total avoided compliance costs (3% discount rate) in 2025 for the mass-based policy are the same as those presented in Figure 1 (B) in Section II.A.

Table 5. Avoided CPP Compliance Costs from CPP Repeal RIA (Billions of 2011$)

	2020	2025	2030
Rate-Based			
Avoided power sector generating costs	$0.3	($15.7)	($18.0)
Avoided DSEE costs (3%)	$2.1	$16.7	$26.3
Avoided DSEE costs (7%)	$2.6	$20.6	$32.5
Additional generation costs absent demand reductions from EE	$1.2	$9.2	$18.8
Monitoring, reporting, recordkeeping	$0.07	$0.01	$0.01
Total avoided compliance cost (3%)	$3.7	$10.2	$27.2
Total avoided compliance cost (7%)	$4.2	$14.1	$33.3
Mass-Based			
Avoided in power sector generating costs	($0.8)	($13.7)	($21.2)
Avoided DSEE costs (3%)	$2.1	$16.7	$26.3
Avoided DSEE costs (7%)	$2.6	$20.6	$32.5
Additional generation costs absent demand reductions from EE	$1.2	$10.0	$19.3
Monitoring, reporting, recordkeeping	$0.07	$0.01	$0.01
Total avoided compliance cost (3%)	$2.6	$13.0	$24.5
Total avoided compliance cost (7%)	$3.1	$16.9	$30.6

Source and notes: CPP Repeal RIA, Tables 3-1, 3-2, 3-3, and 3-6, pp. 34-35, 41. Negative values denote avoided costs.

[43] We note that the so-called annual avoided DSEE costs are actually annualized costs, rather than first-year costs that we contend should be used instead. This issue is discussed further in Section V.A.2.

A. Presented Avoided Costs Are Not the Full Avoided Costs

The costs presented in the 2015 CPP RIA and the avoided costs in the CPP Repeal RIA both are missing some important information to allow individuals to understand how these costs will impact electricity consumers and industry participants. The market impacts, which do show economic impacts on electricity consumers and industry participants, still do not represent a full picture of the costs of the Final CPP (or the avoided costs of the proposed repeal of the CPP).

1. Market Impacts

Table 3-14 in the CPP Repeal RIA (Tables ES-11 and 3-22 in the 2015 CPP RIA) shows the changes in retail electricity prices and average electricity bills (relative to a case with the Final CPP). However, neither of these measures reflects the spending by electricity consumers on electricity services, which would also include consumers' direct (non-rebated) spending on DSEE. To take this example to an extreme, if electricity consumers could undertake sufficient DSEE projects to completely eliminate their electricity demand then their electricity bill would be $0, but their cost for electricity services would be exceptionally high because of their direct costs of DSEE undertaken to avoid having an electricity bill.

In addition, Table 3-14 in the CPP Repeal RIA (Table 3-18 in the 2015 CPP RIA) shows the change in the price of the Henry Hub natural gas spot price (relative to a case with the Final CPP), but this is not translated into a cost for consumers. Natural gas is purchased by households, commercial businesses and industry, and any avoided increase in the price of that fuel would also be an avoided cost of repealing the CPP that can be calculated by multiplying the change in the price by the quantity of natural gas purchased.[44] In NERA (2014b), NERA estimated this cost of non-electricity natural gas purchases (for the proposed CPP rather than the final CPP), which ranged from $15 billion to $144 billion (present value from 2017 through 2031, taken in 2014 using a 5% real discount rate, in 2013$).[45] This avoided cost is a direct impact of the repeal of the CPP, and should be included in any analysis to provide a more complete picture of the costs avoided by repealing the CPP. **We recommend that EPA include broader measures of economic impacts on consumers beyond just electricity rates and bills, as these are incomplete and potentially misleading.**

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[44] The quantity of natural gas purchased would likely decrease (increase) somewhat given an increase (decrease) in the natural gas price, but a first order approximation of the economic impact can be estimated based on quantities purchased absent the policy. An analysis using a computable general equilibrium ("CGE") model of the entire U.S. economy, as EPA mentioned they are considering, could provide a more refined estimate of this cost because the non-electric sector natural gas demand in a policy scenario would be at equilibrium given changes in electric sector natural gas demand and natural gas prices.

[45] NERA Report, "Potential Energy Impacts of the EPA Proposed Clean Power Plan," included in comment submitted by Paul Bailey, Senior Vice President Federal Affairs and Policy, American Coalition for Clean Coal Electricity at https://www.regulations.gov/document?D=EPA-HQ-OAR-2013-0602-25764. Full NERA Report available at:
http://www.nera.com/content/dam/nera/publications/2014/NERA_ACCCE_CPP_Final_10.17.2014.pdf.

2. Under-Reporting of Demand-Side Energy Efficiency Costs

The reported avoided compliance costs of achieving DSEE (Tables 3-1, 3-2, and 3-3 in the CPP Repeal RIA) are $2.1 billion, $16.7 billion, and $26.3 billion for 2020, 2025, and 2030, respectively (with a 3% discount rate). These are the same costs in the 2015 CPP RIA (Table 3-3). However, these are not the full costs of the DSEE measures undertaken in those years.

The avoided costs/costs for DSEE reported in the CPP Repeal RIA and the 2015 CPP RIA are not the actual ("upfront") spending associated with the level of DSEE adopted in the reported year, but instead are annualized costs. In both the Original and CPP Repeal RIAs, EPA calculated costs of achieving DSEE improvements in two ways: 1) Annual first-year costs, and 2) Annualized costs.[46] DSEE is typically associated with an upfront cost, with benefits realized in the future over a number of years (EPA assumes an average life of 10.2 years). EPA properly reflected these as upfront costs when calculating the impact of DSEE costs on retail rates, but did not have the same treatment of these costs when presenting its avoided compliance costs in the CPP Repeal RIA (or compliance costs in the 2015 CPP RIA).

EPA has properly represented how benefits from DSEE accrue over time (based on its assumed EE expiration schedule), but it has not properly represented the avoided costs/costs of DSEE. Table 6 shows the DSEE costs for the two ways in which EPA has calculated such costs, and then shows that the approach used for determining avoided costs in the CPP Repeal RIA leads to a very large understatement of such avoided costs in 2020 and 2025 (with a small overstatement of costs in 2030).

Table 6. Comparison of Reported and Correct Timing of Avoided Costs of Achieving DSEE Improvements (Billions of 2011$)

	2020	2025	2030
Reported (Annualized)	$2.1	$16.7	$26.3
Correct (First-Year)	$18.1	$25.4	$25.3
Under (Over) Reporting	$16.0	$8.7	($1.0)

Such changes do not affect any other avoided costs or forgone benefits in the CPP Repeal RIA, so these understatements of avoided costs (and small overstatement in 2030) would directly translate to higher net benefits of repeal of the CPP in 2020 and 2025 (and slightly lower net benefits in 2030) if EPA had used the proper first-year DSEE costs instead of the annualized costs. (We also note that the analysis of avoided compliance costs using *AEO 2017* presents the DSEE costs as expenditures, equivalent to first-year costs.[47]) **We recommend that EPA properly report DSEE costs as first-year costs to accurately reflect the timing of when these**

[46] See EPA (2015b), Tables 32 and 33 (Total Rows).

[47] See further discussion of avoided costs from *AEO 2017* in Appendix B. Cost details for *AEO 2017* are included in: https://www.regulations.gov/document?D=EPA-HQ-OAR-2017-0355-0010.

costs will be incurred. This will greatly increase the net benefits of repeal estimated for 2020 and 2025.

B. Present Value vs. Annual Value

The CPP Repeal RIA purports to present avoided compliance costs and forgone benefits on an annual basis for 2020, 2025, and 2030 (*e.g.*, Tables 3-6 and 3-8). However, these comparisons of annual avoided compliance costs and forgone benefits in 2020, 2025, and 2030 are false comparisons because neither the avoided costs nor the forgone benefits are actually annual values for the stated years.

As was detailed in the previous section, the avoided costs of DSEE that are reported in 2020, 2025, and 2030 are not the actual costs that would be incurred in those years. The avoided costs in 2020 and 2025 are significantly understated (the reported avoided costs in 2030 are very similar to the avoided costs that would be incurred in that year).

As previously described in Section IV, the forgone domestic climate benefits are based on SCC values that do not represent avoided damages that actually occur in 2020, 2025, or 2030. Instead, the avoided U.S. CO_2 emissions in the individual years presented are multiplied by the *present value* of estimated avoided damages from that year through 2300. In fact, the estimated avoided damages in the year of the reduced CO_2 emissions are miniscule, with the highest incremental domestic SCC value in any year being less than $0.02/metric ton (2007$) in the FUND model.[48] Thus, the forgone climate benefits reported in 2020, 2025, and 2030 are likely to be misinterpreted by readers if more is not done to explain that they are present values, and to communicate about the timeline over which the forgone climate benefits would accrue. (More details of this timeline and how to estimate it for inclusion in the RIA are provided in Section IV.C).

Section 6 of the CPP Repeal RIA provides a present value analysis, something that was not provided in the 2015 CPP RIA. According to EPA, the present value analysis was done to comply with Executive Order 13771. The present value analysis included in the CPP Repeal RIA is for the years 2020 through 2033, with values presented from the perspective of 2016.

The exact manner in which the present value avoided costs were calculated in the CPP Repeal RIA (Table 6-1 in the CPP Repeal RIA) is unclear, particularly for DSEE and the approximate cost of additional generation required in the absence of the DSEE.[49] What is clear, however, is

[48] Incremental values are readily available for all years from the FUND model, but not from the PAGE model. Incremental values are also available from the DICE model, with the domestic SCC values assumed to be 10% of the global value. The highest incremental domestic SCC value in any year from DICE is less than $0.04/metric ton (2007$).

[49] It is unclear if the RIA uses the year-by-year DSEE costs that were included in spreadsheets for 3% and 7% discount rates (see EPA, 2015c and 2015d). It is also unclear if (and how) EPA might have recalculated the cost of additional generation required in the absence of DSEE, particularly if the year-by-year DSEE quantity and costs were included.

that the present value of avoided costs for DSEE for 2020 through 2033 is understated, as shown in Table 7, because of EPA's incorrect use of annualized costs. If the proper first-year costs had been used (as previously discussed), then the present value of avoided DSEE costs would have been approximately $75 billion higher.

Table 7. Annual Values for Avoided Demand-Side Energy Efficiency (2020-2033) and Present Value (Billions of 2011$)

Year	Annualized (EPA)	First-Year (Correct)
2020	$2.1	$18.1
2021	$4.7	$21.5
2022	$7.5	$24.3
2023	$10.6	$26.0
2024	$13.8	$27.3
2025	$16.7	$25.4
2026	$19.3	$25.3
2027	$21.5	$25.3
2028	$23.5	$25.3
2029	$25.2	$25.3
2030	$26.3	$25.3
2031	$27.4	$25.4
2032	$28.4	$25.5
2033	$29.4	$25.6
Present Value	***$175.9***	***$250.0***

While the CPP Repeal RIA did not show present values for the forgone benefits, if it had, those results may have suffered from similar issues of timing as was discussed in Section IV regarding the SCC.

VI. RECOMMENDATIONS FOR MODELING NEXT STEPS

The prior sections have detailed several adjustments that we recommend EPA implement, including:

- Refining health co-benefits analysis in the absence of air quality modeling,
- Presenting U.S. climate benefits and how they accrue over time,
- Suggesting additional sensitivities in calculating the SCC, and
- Reporting all spending for achieving DSEE improvements in the years where the spending actually occurs.

In this section we highlight our recommendations for next steps as they relate to modeling, with a particular focus on updated IPM runs of the U.S. electricity sector, consideration of using a CGE model to better capture secondary market impacts, and new air quality modeling that would allow for improved estimation of health co-benefits.

A. Updated IPM Runs

As previously described, the avoided power sector compliance costs in the CPP Repeal RIA are based on 2015 simulations of the IPM model including and excluding the CPP (separate evaluations of rate-based and mass-based implementations). The CPP Repeal RIA states:

> *EPA plans to do updated modeling using the Integrated Planning Model (IPM), which will be made available for public comment before any action that relates to the CPP is finalized. We plan to provide updated analysis of avoided costs, forgone benefits, and impacts.*[50]

EPA later specified five key uncertainties, two of which are directly applicable to IPM analysis – 1) economic and technological change, and 2) approaches that states would have taken to comply with the 2015 CPP.[51] To help EPA better quantify the ranges of potential avoided compliance costs and forgone emission reductions, we suggest several different IPM runs. These runs, and the potential clarity that they can provide, are detailed below.

B. General Updates

Given the elapsed time since the 2015 IPM model runs used in the 2015 CPP RIA, EPA will need to make general updates to the existing conditions in the U.S. (and interconnected international) electricity markets, and fuel markets. These changes will apply to the Base Case and Policy Cases evaluated against this updated Base Case. Such changes will include updating the database of existing generators, planned (under construction) new generators, and announced retirements. EPA should also make updates if it determines that there are significant changes in

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[50] CPP Repeal RIA, p.3

[51] 2015 CPP RIA, p. 79.

electricity demand projections, natural gas supply/demand fundamentals, and coal supply/demand fundamentals. Other areas warranting updates include new technology costs and characteristics and new/updated policies (*e.g.*, CSAPR Update Rule).

C. Economic and Technological Change Uncertainty

To address important economic and technological change uncertainties, EPA will need to model both Base Case and Policy Cases using different sets of assumptions on several key inputs. These inputs include natural gas supply (paired with non-electric sector natural gas demand), new technology costs, and electricity demand.

1. Natural Gas Supply

In past analyses, EPA has frequently only considered a single natural gas price outlook. This approach ignores the significant impact that a different outlook can have on the Base Case emissions and the costs to comply with the 2015 CPP. We suggest evaluating a range of natural gas prices (based on different outlooks on natural gas supply and non-electric sector natural gas demand). An outlook with lower natural gas prices would, *ceteris paribus*, lower Base Case CO_2 emissions in the power sector thereby requiring fewer emission reductions to meet the 2015 CPP. Further, to the extent that coal to natural gas switching is deemed to be a cost-effective compliance action, lower natural gas prices would lower the costs to comply with the 2015 CPP. Conversely, higher natural gas prices would have the opposite effect – likely increasing Base Case CO_2 emissions, increasing the required emission reductions, and increasing compliance costs. One potential source of lower and higher natural gas price outlooks is EIA's *AEO 2018*. *AEO 2018* includes side cases for "High oil and gas resource and technology" (low natural gas price) and "Low oil and gas resource and technology" (high natural gas price). We note that both of these side cases also have been evaluated with and without an implementation of the CPP.

2. New Technology Costs and Characteristics

Another important uncertainty relates to the costs and operating characteristics of new generating technologies within the electric sector. There has been considerable debate regarding the current and projected costs of newer generating technologies such as wind and solar photovoltaic, but there is also uncertainty around existing technologies such as natural gas combined cycle and coal. Other technologies such as nuclear, biomass, energy storage, and geothermal also have uncertainties associated with their costs and characteristics, but are unlikely to be added in sufficient quantities to significantly alter the power sector compliance costs by 2030. When considering cases with alternate technology costs and characteristics it is important to consider factors beyond the capital cost. For example, for wind and solar photovoltaic uncertainties also exist regarding the quantity and timing of their output; for fossil technologies there are uncertainties on their heat rates. We suggest that EPA evaluate optimistic and pessimistic technology cases. In an optimistic case, technology advances would likely lead to a more rapid turnover of the existing fleet of generators, thereby reducing wholesale electricity prices and emissions (the converse would likely be true for a pessimistic case).

3. Electricity Demand

Recent growth rates in annual on-grid electricity demand are lower than they have historically been. This has likely been due to lower economic growth, increased DSEE, and increases in distributed electricity generation, among other factors. The outlook for on-grid electricity demand may continue on the current path, or there could be increased electrification of other sectors (*e.g.*, transportation) that could spur higher rates of growth. We suggest a sensitivity case with higher rates of growth in annual on-grid electricity demand. Such a case would likely lead to higher CO_2 emissions and thereby require greater CO_2 emission reductions under the CPP. The power sector compliance costs to meet the CPP would also likely increase. A case with a lower growth rate for annual on-grid electricity demand is likely not necessary as such a policy case would already be simulated with reduction in electricity demand from DSEE (the demand-side EE is not part of the IPM run, but instead electricity demand is changed exogenously and costs for demand-side EE are added outside of the model run).[52]

D. Demand-Side Energy Efficiency Cost and Availability

Uncertainties concerning the cost and availability of DSEE add to the uncertainty of the costs of complying with the 2015 CPP. There have been many different approaches to estimating the costs of DSEE, and these reflect a fairly wide range of assumptions.[53] Sensitivities of the cost of achieving DSEE improvements can be evaluated outside of the IPM model runs (with some minor exceptions) because DSEE is not endogenously considered in the model.[54]

Analyses of sensitivities of the availability (or the quantity) of DSEE are appropriate for consideration within EPA's planned IPM runs. The assumed quantity is translated to reduced demand for electricity sales and reduced quantities of electricity generation. To date, EPA has only included such reductions in Policy Cases, but should also consider sensitivities that include additional DSEE in Base Cases. There is significant uncertainty about the quantities of DSEE that EPA assumed possible in its 2015 CPP analysis because these would reflect significant increases above historical levels and would likely go beyond the most common actions taken to date.

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[52] This would be true for simulating a mass-based implementation of the CPP, but would not be true for a rate-based implementation. It might be necessary to do a Base Case with lower electricity demand growth, but we also recommend evaluating a Base Case with DSEE, which would serve this purpose.

[53] See for example, EPA (2015b), Section 4.3.2, and NERA (2014b), p. 12.

[54] DSEE costs could increase up to the level where customers would no longer find it cost effective. This level is roughly equal to double the customers' electricity rate given an assumption of a 50/50 split of the costs between customers and utilities.

To provide a full range of the impacts of the assumption on the feasible quantity of DSEE improvement, we recommend evaluating the Policy Cases without any DSEE (beyond what is currently embedded in the Base Case electricity demand forecast). Evaluating a case with no DSEE would also provide EPA with precise numbers on the increased sector costs from not undertaking DSEE measures that were assumed by EPA in its analyses for the 2015 CPP (and CPP Repeal) RIA. If EPA determines that adoption of DSEE measures at rates higher than those that were used in its 2015 CPP analysis are feasible, then EPA can also consider higher quantities as an upper bound range.

EPA's approach in the 2015 CPP RIA of continuing to add DSEE measures after 2030 and of presenting the resulting total costs in annualized form creates unnecessary challenges to developing an estimate of the present value of net benefits of this regulatory action because the costs and the benefits from DSEE activities extend beyond the modeling horizon used for all the other components of the BCA. It is not necessary to include these post-2030 investments in the analysis, and therefore, we recommend that EPA eliminate them. By not adding incremental DSEE after 2030, EPA could calculate a present value of both the full costs and the full benefits of the DSEE added between 2020 and 2030.[55] This recommendation is in addition to our recommendations above for considering sensitivities about the cost and availability of DSEE.

E. Use of a Computable General Equilibrium Model

In its evaluation of the CPP, EPA did not use a CGE model. The benefits of a CGE model include the ability to evaluate secondary market impacts because the entire economy is evaluated, as EPA noted in the CPP Repeal RIA at page 59. Thus, to the extent that there is fuel switching within the electricity sector to natural gas, this is likely to increase natural gas prices, which could impact the non-electricity sectors' consumption of natural gas. Higher electricity prices would likely lead to lower electricity demand and potentially higher costs of producing other goods and services. These types of impacts are not available from IPM. When EPA has previously evaluated economy-wide CO_2 reduction legislation it used CGE models, like the ADAGE model.[56]

We recommend evaluating at least one mass-based and one rate-based Policy Case using a CGE model to gain a better understanding of whether the compliance costs based on IPM are potentially understated or overstated. We also caution that when using a CGE model, the full costs of compliance will extend beyond the electricity sector and reflect potentially higher/lower costs in other sectors and potential lost/gained economic output due to changing prices of production and services.

[55] EPA assumes that more than 99% of DSEE added in 2030 would be expired by 2050, the last year included in EPA's IPM modeling.

[56] For example, EPA (2009) used the ADAGE model as part of its evaluation of H.R. 2454.

F. New Full-Scale Air Quality Modeling

The RIA states that EPA, "to the extent feasible," plans to perform full-scale photochemical air quality modeling. As discussed in Section III, we endorse the Agency's expressed intention to conduct refined co-benefits sensitivity estimates using photochemical modeling in future iterations of the CPP Repeal RIA. We also recommend that the photochemical modeling outputs (or, more specifically, the air quality grids that are BenMAP inputs) be made available to the public to develop comments on that additional work. The performance of updated full-scale photochemical air quality modeling would allow the EPA to move away from the BPT approach, and allow the Agency to develop estimates of the sensitivity of co-benefits to alternative assumptions about where the C-R relationship might end.

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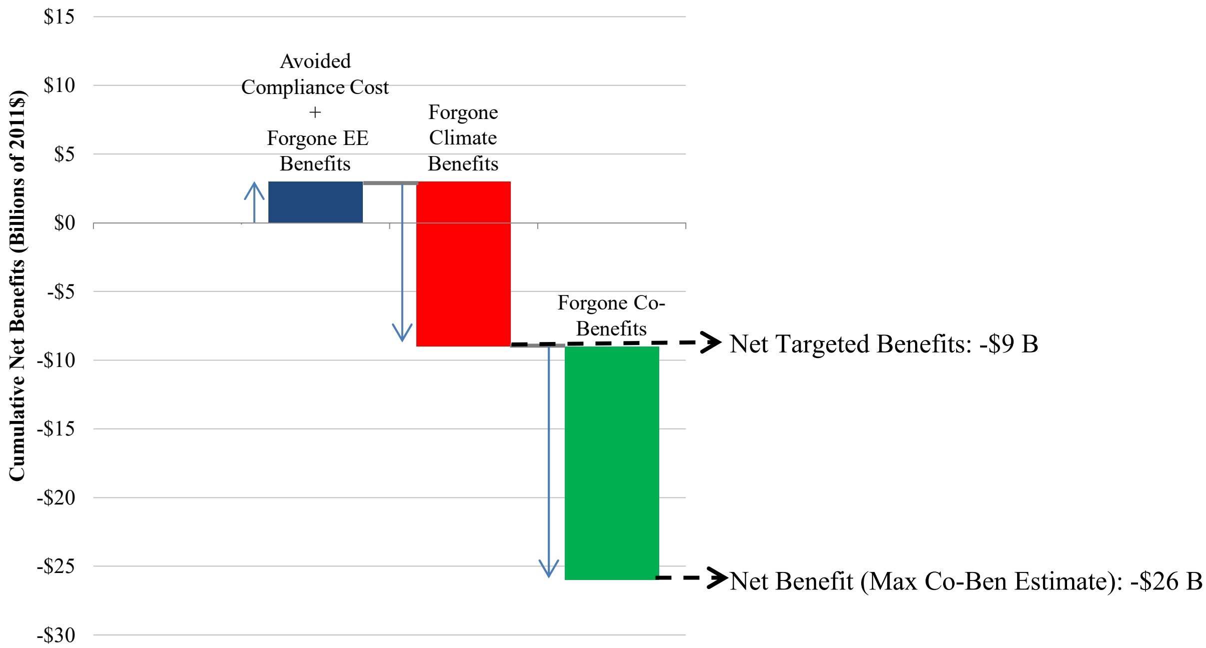
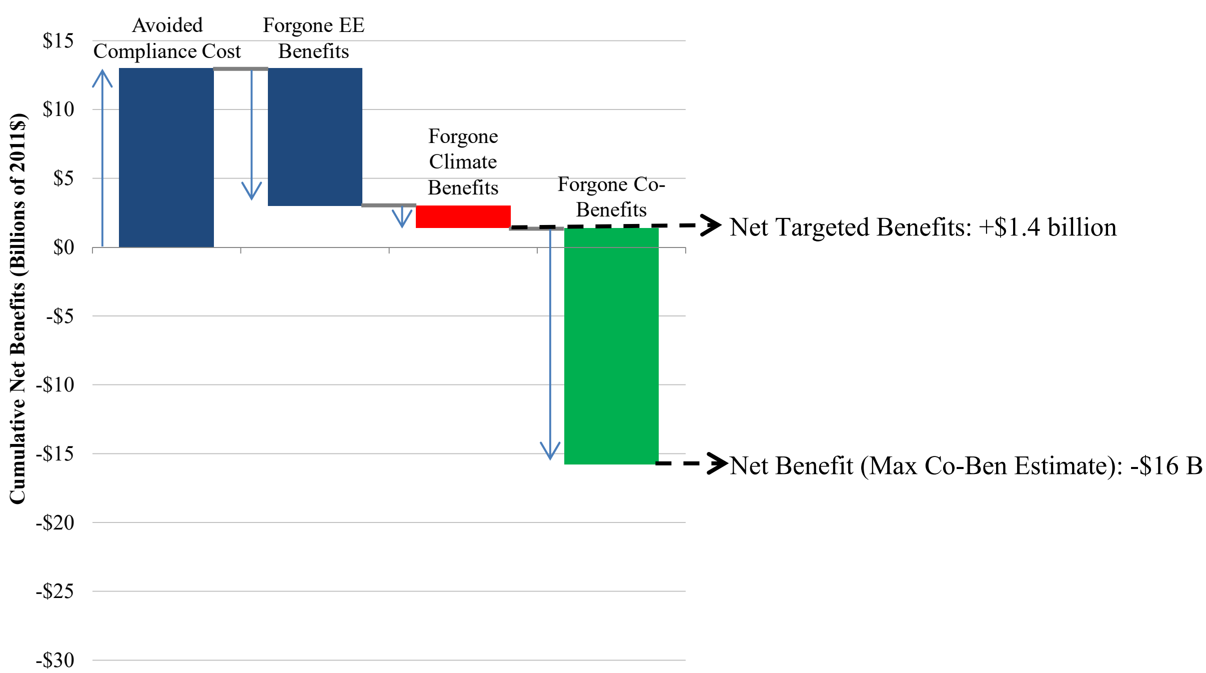
APPENDIX A.

Figure 7. Cumulative 2025 Net Benefits of Repeal as Benefit/Cost Components Are Sequentially Added – Mass-Based (3% Discount Rate)

(A) 2015 CPP RIA (Data Stated in Terms of Repeal)

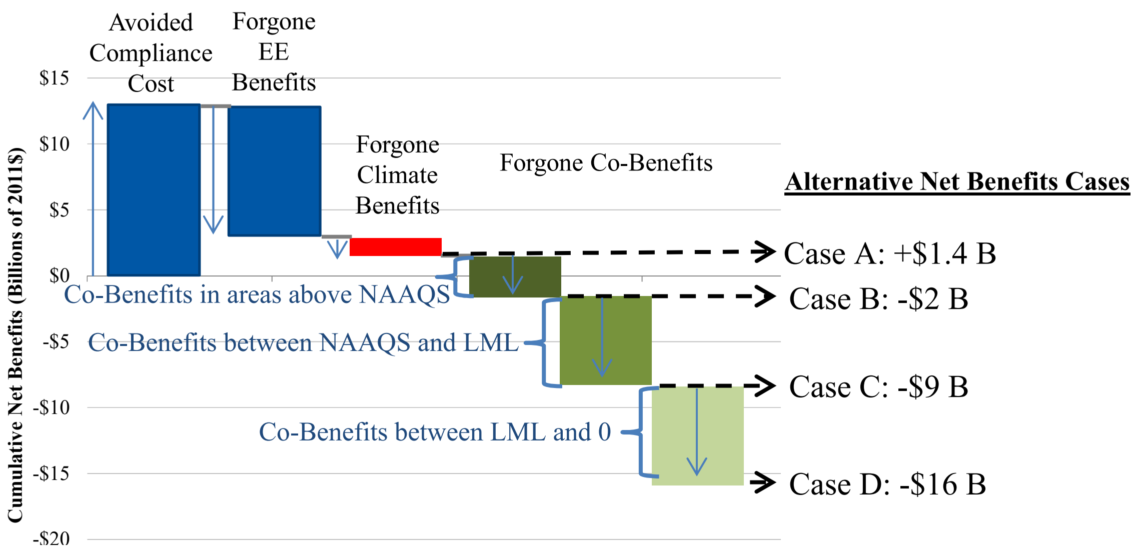


(B) CPP Repeal RIA



Sources and notes: (A) 2015 CPP RIA, Table ES-10; (B) CPP Repeal RIA, Tables 1-1, 1-3, 1-5, and 3-6.

Figure 8. Alternative Potential Estimates of Net Benefits of Repeal for CPP Repeal RIA's Co-Benefit Sensitivity Cases (Mass-Based Option, 2025 Compliance Year, 3% Discount Rate)



LEGEND

Case A: Includes targeted benefits (*i.e.*, excludes all forgone co-benefits)
Case B: Includes only high-confidence co-benefits estimates (*i.e.*, includes co-benefits only in areas above the NAAQS)
Case C: Also includes lower-confidence co-benefits (*i.e.,* in areas with concentrations attaining the NAAQS and as low as the LML)
Case D: Also includes co-benefits for which there is no observational evidence of a health effects relationship (*i.e.*, in areas with concentrations below the LML)

Table 8. Sensitivity of Net Benefits of CPP Repeal to Inclusion of Increasing Uncertain Forgone Co-Benefits (for Mass-Based Option)

		Discount rate case	
		3%	**7%**
2020	No co-benefits Cutpoint at NAAQS Cutpoint at LML No cutpoint	\$1.0 \$0.2 to \$0.8 (\$1.8) to (\$0.9) (\$3.8) to (\$1.0)	\$1.8 \$1.1 to \$1.7 (\$0.7) to \$0.2 (\$2.5) to \$0.0
2025	No co-benefits Cutpoint at NAAQS Cutpoint at LML No cutpoint	\$1.4 (\$1.6) to \$0.6 (\$8.5) to (\$5.2) (\$15.8) to (\$5.7)	\$6.6 \$3.7 to \$5.9 (\$2.5) to \$0.7 (\$9.1) to (\$0.2)
2030	No co-benefits Cutpoint at NAAQS Cutpoint at LML No cutpoint	\$2.5 (\$2.1) to \$1.2 (\$13.7) to (\$8.4) (\$25.7) to (\$9.3)	\$10.8 \$6.4 to \$9.6 (\$4.0) to \$0.9 (\$14.8) to \$0.2

APPENDIX B. EXCERPTS FROM SMITH AND GLASGOW (2015)

Excerpt from Smith and Glasgow (2015), pages 13 through 15, attached to UARG Comments on 2015 Ozone Proposed Rule noting the overstatement when simple cutpoints are used rather than recalculating risk relative to alternative assumed ending point of the ozone C-R relationship.

Quantitative Sensitivity of Short-Term Mortality Risks to Potential Thresholds

The Proposed Rule notes that there is uncertainty in the shape of the concentration-response functions for short-term mortality and morbidity as well, but these epidemiological studies do not provide precise evidence to narrowly define an appropriate threshold assumption, as is possible for the long-term mortality study described above. Section II of these comments has explained in more detail the reason for the Proposed Rule to have noted this weakness in the epidemiological evidence. However, in attempting to characterize the sensitivity of the short-term mortality risks to potential alternative thresholds by summarizing information in the HREA, the Proposed Rule makes a conceptual error that greatly understates that sensitivity.

Table 3 of the Proposed Rule (copied as Figure 3 below) reports the fractions of the total estimated short-term mortality (the sum of estimated deaths in all 12 urban study areas) that is attributable to ozone above certain levels (20 ppb, 40 ppb, and 60 ppb). This table is based on data in the HREA, but has been derived specifically for the Proposed Rule, by aggregating data presented in the HREA in a different format. While the data in the table can be replicated from various tables in the HREA, the Proposed Rule incorrectly interprets those data. The Proposed Rule suggests that this table can be used to infer the sensitivity in the HREA's total short-term mortality estimates if the concentration-response function were not to continue to apply all the way to zero below each of the levels in the column headers. For example, in reference to use of its Table 3, the Proposed Rule states:

> *A focus on estimates of total risks would place greater weight on the possibility that concentration-response relationships are linear over the entire distribution of ambient O_3 concentrations, and thus on the potential for morbidity and mortality to be affected by changes in relatively low O_3 concentrations. A focus on risks associated with O_3 concentrations in the upper portions of the ambient distribution would place greater weight on the uncertainty associated with the shapes of concentration-response curves for O_3 concentrations in the lower portions of the distribution.*[32]

[32] 79 *Fed. Reg.* 75234, December 17, 2014, at 75276.

In other words, the Proposed Rule is interpreting the alternative estimates in Table 3 as if they were showing the implications of the possibility that the concentration-response relationship used is *not* "linear over the entire distribution" of ozone, which is what is meant by a threshold. This is an incorrect interpretation of what Table 3 reports; this table only reports how much of the total daily no-threshold risk estimate in the first column (which is the sum of risks calculated for each day in a season) remains if risks on some of those days (*i.e.*, days when ozone is lower than the ppb level identified in the other column headers) are excluded from the summation. For each of the other columns, the risks estimated for the days above its listed ppb level are exactly the same as in the original "total O_3" calculation. In other words, all of the numbers in each row of the Proposed Rule's Table 3 are based on a single risk model run, using the same concentration-response function. This is not how a threshold affects risk estimation. A threshold affects the "shape of the concentration-response" function, which changes the risk level for days at *every* ppb level, whether above or below the threshold.[33] Thus, estimating the sensitivity to alternative possible threshold levels requires re-estimating the total seasonal risk on every day of the season being assessed, and then summing them – not simply dropping some days from the summation based on a single (no-threshold) risk model run.

Table 1 provides the total short-term mortality risk estimates that the HREA would have reported if it had actually performed a sensitivity analysis to potential thresholds by re-running its risk model (called BenMAP) with thresholds specified at 20 ppb, 40 ppb, and 60 ppb. As can be seen by comparing the estimates in Table 1 to those in Figure 3, the short-term mortality risk estimates are much more sensitive to potential thresholds than the Proposed Rule currently recognizes. As Table 2 shows, the short-term mortality risk estimates would be reduced by essentially 100% if a threshold exists at 60 ppb. Even if a threshold were to exist at 40 ppb, the short-term mortality risk estimates at the current standard of 75 ppb would be 87% and 88% lower than the HREA has estimated (for 2007 and 2009 ozone, respectively). This is a very substantial degree of sensitivity associated with remaining uncertainties in the shape of the concentration-response functions, which echoes the sensitivity reported in the HREA for long-term respiratory mortality risk estimates.

[33] Days that fall below the threshold are assigned zero risk, as Table 3 is doing, while days above the threshold are assigned a risk that is based on the level of its concentration *relative* to the threshold. (This is what the BenMAP model that EPA has used for its HREA and RIA calculations does if its user chooses to specify a threshold.)

Figure 3. Copy of Table 3 from the Proposed Rule

TABLE 3—ESTIMATES OF O_3-ASSOCIATED DEATHS ATTRIBUTABLE TO THE FULL DISTRIBUTION OF 8-HOUR AREA-WIDE O_3 CONCENTRATIONS AND TO CONCENTRATIONS AT OR ABOVE 20, 40, OR 60 PPB O_3

[Deaths summed across urban case study areas][83]

Standard level	Number of O_3-associated deaths summed across urban case study areas			
	Total O_3	20+ ppb	40+ ppb	60+ ppb
2007				
75 ppb	7,500	7,500	5,400	500
70 ppb	7,200	7,200	4,900	240
65 ppb	6,500	6,500	2,800	90
60 ppb [84]	6,400	6,400	2,300	10
2009				
75 ppb	7,000	7,000	4,700	270
70 ppb	6,900	6,900	4,300	80
65 ppb	6,400	6,400	2,600	40
60 ppb	6,300	6,300	2,100	10

Table 1. Proposed Rule's Table 3 Calculated with Correct Threshold Logic: Estimates of Total O_3-Associated Deaths Using Various Alternative Assumptions on Level of Potential Threshold in the Short-Term Mortality Association

Standard level	Number of O_3-associated deaths summed across urban case study areas			
	Total O_3 - No Threshold	Total O_3 - Threshold at 20 ppb	Total O3 - Threshold at 40 ppb	Total O3 - Threshold at 60 ppb
2007				
75 ppb	7,500	4,100	1,000	0
70 ppb	7,200	3,800	700	0
65 ppb	6,500	3,100	400	0
60 ppb	6,400	2,900	300	0
2009				
75 ppb	7,000	3,700	830	0
70 ppb	6,900	3,500	640	0
65 ppb	6,400	3,000	350	0
60 ppb	6,300	2,900	230	0

Table 2. Percentage Reduction in Total Short-Term Mortality Relative to the Zero-Threshold Calculations Used in the HREA under Alternative Assumptions of Level of Potential Threshold

Standard level	Number of O_3-associated deaths summed across urban case study areas			
	Total O_3 - No Threshold	Total O_3 - Threshold at 20 ppb	Total O3 - Threshold at 40 ppb	Total O3 - Threshold at 60 ppb
2007				
75 ppb	0%	45%	87%	100%
70 ppb	0%	47%	90%	100%
65 ppb	0%	52%	94%	100%
60 ppb	0%	55%	95%	100%
2009				
75 ppb	0%	47%	88%	100%
70 ppb	0%	49%	91%	100%
65 ppb	0%	53%	95%	100%
60 ppb	0%	54%	96%	100%

APPENDIX C. ESTIMATING AVOIDED COSTS FROM AEO 2017

The *AEO 2017* included reference cases with and without the CPP. The CPP Repeal RIA uses a comparison of these two cases to provide a more recent analysis of the avoided costs and forgone benefits associated with repeal of the CPP. The CPP analysis included in *AEO 2017* is a mass-based implementation, with regional caps (as opposed to state-based caps). Comparing the costs of the reference case without the CPP to that with the CPP provides the avoided compliance costs (Table 9). The CPP Repeal RIA does note that the avoided compliance costs based on *AEO 2017* are "not directly comparable" to the avoided compliance costs based on the 2015 CPP RIA.[57]

Table 9. Avoided Compliance Costs of CPP from *AEO 2017* (Billions of 2011$)

	2020	2025	2030
Total avoided compliance cost	-$0.3	$14.5	$14.4

Source and notes: CPP Repeal RIA, Table 1-9, p. 18. Negative values denote avoided credits.

Since the comment period on the CPP Repeal RIA was opened, the EIA has released *AEO 2018*. The reference and sensitivity cases modeled have been evaluated with and without an implementation of the CPP, but it is unclear if the EIA has produced tables to evaluate the avoided compliance costs of the CPP as was included in the CPP Repeal RIA since these are not standard tables that are created and publicly-released.

[57] CPP Repeal RIA, p. 18. EPA was not able to estimate the value of reduced electricity demand associated with DSEE, as was done for the avoided compliance costs based on the 2015 CPP RIA. Also, the DSEE costs from *AEO 2017* are expenditures ("first-year costs" in EPA's language describing DSEE costs).

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