Institute for Policy Integrity
NEW YORK UNIVERSITY SCHOOL OF LAW

September 15, 2017

VIA ELECTRONIC SUBMISSION

Attn: Office of Budget and Program Analysis, USDA

Re: Identifying Regulatory Reform Initiatives

The Institute for Policy Integrity ("Policy Integrity") at New York University School of Law[1] respectfully submits the following comments to the United States Department of Agriculture ("USDA") regarding its obligation pursuant to Executive Order 13,777, to evaluate existing regulations and identify some for repeal, replacement, or modification.[2] Policy Integrity is a non-partisan think tank dedicated to improving the quality of government decisionmaking through advocacy and scholarship in the fields of administrative law, economics, and public policy.

Executive Order 13,777 directs agencies to identify regulations that "impose costs that exceed benefits" and prioritize "outdated, unnecessary, or ineffective" regulations for repeal, replacement, and modification.[3] It requires agencies to seek input on identifying such regulations from interested persons.[4] Policy Integrity submits these comments to ensure that USDA stays focused on its mandate to identify outdated, unnecessary, ineffective, or net costly regulations for repeal, replacement, or modification and does not instead prioritize recently promulgated and overwhelmingly cost-benefit justified rules identified by industry commenters. Policy Integrity offers two main comments:

- First, retrospective review should prioritize reanalysis of regulations for which actual costs and benefits diverge significantly from predicted costs and benefits because of changing economic circumstances, new technological innovations, or emerging scientific understandings. **Prioritizing retrospective review based purely on the volume of opposition from regulated entities—without consideration of regulatory benefits—is an irrational and inefficient approach**.
- Second, to the extent that other stakeholders suggest repealing rules by attacking cost-benefit methodologies, **USDA should reaffirm that benefit estimates used in recent regulatory impact analyses, including the value of mortality risk**

[1] This document does not purport to present New York University School of Law's views, if any.
[2] Exec. Order No. 13,777, 82 Fed. Reg. 12,285, 12,286 (Feb. 24, 2017).
[3] *Id.* § 3(d),(f).
[4] *Id.* § 3(e).

reduction and the social cost of greenhouse gases, remain the best available estimates.

- Third, USDA should use this as an opportunity to **establish a process to review the performance of any future economically significant rules**.
- Fourth, to the extent that other stakeholders argue for the repeal of regulations by alleging large negative impacts on employment, Policy Integrity urges reliance on well-accepted economic theory and strong evidence: **Regulations have little effect on aggregate employment or unemployment rates**.

Below, we explain each comment in turn.

I. Retrospective review should prioritize reanalysis of regulations for which actual costs and benefits diverge significantly from predicted costs and benefits because of changed circumstances—and should not rehash recent debates over massively cost-benefit justified rules.

Retrospective review is an opportunity to recalibrate regulations to improve efficiency and effectiveness. USDA must approach the review of existing regulations with a plan for identifying appropriate candidates for such modification.

Every President since Carter has sought to identify and address inefficient existing regulations through a process of retrospective review of regulatory costs and benefits. President Trump's Executive Order 13,777 follows this tradition by directing agencies to identify regulations for repeal, replacement, and modification that are "outdated, unnecessary, or ineffective" or that "impose costs that exceed benefits."[5] Executive Order 13,777 embraces past methodologies for identifying such regulations, reaffirming President Obama's Executive Order 13,563,[6] which called on agencies to develop plans "to promote retrospective analysis of rules that are outmoded, ineffective, insufficient, or excessively burdensome" and "to modify, streamline, expand, or repeal them in accordance with what has been learned."[7] It also reaffirms President Clinton's Executive Order 12,866, particularly its call for agencies "to determine whether regulations promulgated by the executive branch of the Federal Government have become unjustified or unnecessary as a result of changed circumstances."[8] Thus, the procedures underlying retrospective review pursuant to Executive Order 13,777 should be consistent with those underlying past efforts.

In other words, agencies should identify net costly or otherwise outdated rules by determining whether, in light of changed circumstances, the actual benefits of the implemented rules no longer justify the actual costs, or the rules as implemented do not maximize net benefits. To prioritize such regulations for modification, USDA must not get diverted by comments from stakeholders complaining about recently promulgated and overwhelmingly cost-benefit justified rules. Retrospective review should strive to enhance net benefits, not just to decrease compliance costs.

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[5] *Id.* § 3(d),(f).
[6] *Id.* § 2(iii).
[7] Exec. Order No. 13,563 § 6(b), 76 Fed. Reg. 3821 (Jan. 21, 2011).
[8] Exec. Order No. 12,866 § 5, 58 Fed. Reg. 51,735 (Oct. 4, 1993).

1. *Retrospective review should prioritize reanalysis of older regulations for which actual costs and benefits diverge significantly from predicted costs and benefits.*

Retrospective review is an opportunity to go back and fix some regulations that have become "outdated, unnecessary, or ineffective" due to changed economic circumstances, new technological innovations, or emerging scientific understandings. When promulgating new rules, agencies make estimates about what the rules' future costs and benefits will likely be. These *ex ante* estimates typically reflect the best available data, scientific models, and economic tools. Nevertheless, *ex ante* estimates are still estimates made in the face of uncertainty. Changing economic conditions, new technological innovations, or emerging scientific understandings can cause a rule's actual costs and benefits to diverge greatly from the agency's *ex ante* estimates. Consequently, after a rule takes effect, *ex post* calculations of actual costs and benefits may reveal that the rule was poorly calibrated. A rational approach to retrospective review would identify such rules and initiate a process to modify them.

New rules are typically not good candidates for retrospective review because, in most cases, regulated entities have not yet fully implemented and adapted to the rules. For such rules, there have been no economic, technological, scientific, or other changed circumstances that shed light on the true costs and benefits of the rules. The cost-benefit analyses conducted before the rules were issued continue to reflect society's best estimates of the costs and benefits of these rules. There is nothing yet to fix; there is only industries' unwillingness to make changes necessary to implement and adapt to the rules. Eliminating such rules under the guise of "retrospective review" would be premature and irrational.

In fact, agencies should be careful not to review existing rules so early as to reduce the ability or incentive for industry to adapt. Adaptation, learning, and innovation by industry in the early years of implementation have often brought down compliance costs.[9] Moreover, these rules are often overwhelmingly cost-benefit justified. Thus, older rules are better candidates for review because technological or other relevant changed circumstances are more likely to have occurred since the rules were issued.

2. *USDA must not rely exclusively on the volume of complaints it receives from stakeholders to prioritize rules for review.*

Although eliminating new rules under the guise of "retrospective review" would be premature and irrational, many stakeholders are likely to encourage USDA to do exactly that. When the Department of Commerce recently sought input from manufacturers on existing regulations, for example, the agency received many comments recommending repeal of recently issued and overwhelming cost-benefit justified rules, at least one of which targeted USDA rules.[10] Many targeted rules had not yet been fully implemented, making them particularly poor candidates for retrospective review for the reasons

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[9] *See* Winston Harrington, Richard D. Morgenstern, & Peter Nelson, On the Accuracy of Regulatory Cost Estimates, Resources for the Future Discussion Paper #99-18 (1999); *see also* OFFICE OF MGMT. & BUDGET, OMB CIRCULAR NO. A-4, REGULATORY ANALYSIS (2003) [hereinafter CIRCULAR NO. A-4].

[10] *See* Department of Commerce, Public Comments on Impact of Federal Regulations on Domestic Manufacturing, *available at* https://www.regulations.gov/docketBrowser?rpp=25&so=DESC&sb=commentDueDate&po=0&dct=PS&D=DOC-2017-0001.

discussed previously. The commenters tended to offer no new information on costs or benefits in their comments to the Department of Commerce; the majority of comments simply rehashed the same arguments and facts presented to and considered by agencies during the initial notice-and-comment rulemaking process.

We suspect that USDA will receive similar kinds of requests from stakeholders. Of course, public comments, including from regulated entities, should play a role in informing regulatory review. But it would waste significant resources if the retrospective review process simply provided another opportunity to rehash prior arguments. Therefore, USDA should resist the urge to review rules solely as a result of intensive lobbying by regulated entities. A high volume of repetitive comments resulting from such lobbying should not by itself weigh in favor of conducting a retrospective review.

Instead, agencies should prioritize rules for reconsideration based on evidence of changed costs or benefits. Public comments are most useful to the extent they offer evidence of circumstances that have changed since the rules were originally promulgated. The agency must remember that the goal of Executive Order 13,777 is not the elimination of cost-benefit justified rules. Moreover, regardless of the goal of the Order, USDA cannot abandon its statutory obligations to create a culture of consistent, efficient service to our customers while easing regulatory burdens to make it easier to invest, produce, and build in rural America in a way that creates jobs and economic prosperity while ensuring the safety of our food supply, and protecting and safeguarding our land, water, and other natural resources for future generations. USDA must keep its objectives—the goals of Executive Order 13,777 and its statutory obligations—in mind as it critically reviews requests from regulated entities.

3. *Retrospective review should include a thorough and balanced review of identified rules' actual impacts, including both costs and benefits.*

As discussed above, USDA should identify rules that are ripe for retrospective review based on changed costs and benefits over time. Once it identifies promising candidates for the review, the review should include a thorough and balanced assessment of a rule's actual impacts, including both costs and benefits and distributional consequences.

Agencies should aim to follow the same best practices in their retrospective analyses as they do when conducting a regulatory impact analysis during the notice-and-comment process.[11] These practices include such factors as choosing an appropriate baseline[12] and identifying the proper scope of the analysis.[13] One of the persistent difficulties in prospective cost-benefit analysis is ensuring that evaluations sufficiently address the unquantified impacts of regulation.[14] Some unquantified benefits and costs may be particularly amenable to retrospective analysis, as they may be easier to identify and measure after implementation of the regulation.

[11] CIRCULAR NO. A-4, *supra* note 9, at 14-42.
[12] *Id.* at 15; *see also* Thomas O. McGarity & Ruth Ruttenberg, *Symposium: What We Know and Do Not Know About the Impact of Civil Justice on the American Economy and Policy: Counting the Cost of Health, Safety and Environmental Regulation*, 80 TEX. L. REV. 1997, 2039 (2002).
[13] CIRCULAR NO. A-4, *supra* note 9, at 15.
[14] *Id.* at 27 ("You should carry out a careful evaluation of non-quantified benefits and costs.").

II. Benefit estimates used in recent regulatory impact analyses, including the value of mortality risk reduction and the social cost of greenhouse gases, remain the best available estimates.

USDA should identify rules that are ripe for retrospective review based on changed costs and benefits over time, where estimates of costs and benefits reflect the best available scientific evidence. USDA should not be diverted by comments arguing for a lower value of statistical life, a lower or no social cost of greenhouse gases, or other changes to cost-benefit methodology that are not supported by best available evidence.

In particular, if USDA considers repeals of energy-efficiency rules or of other rules with greenhouse gas effects, then it should continue to use existing best estimates of the social cost of greenhouse gases in regulatory analyses. Although Executive Order 13,783 withdrew the technical documents prepared by the Interagency Working Group on the Social Cost of Greenhouse Gases,[15] leaving agencies without specific guidance for how to incorporate the social cost of greenhouse gases, the estimates developed by the Interagency Working Group continue to reflect the best available data and methodological choices consistent with Circular A-4, as required by the new Executive Order.[16] As discussed more thoroughly in joint comments recently submitted to the Army Corps of Engineers by Policy Integrity, Environmental Defense Fund, Natural Resources Defense Council, and Union of Concerned Scientists (appended to these comments and available online[17]), a central estimate of about $40 per ton or higher for the value of year 2015 carbon dioxide emissions continues to reflect the best available, peer-reviewed scientific and economic data, models, methodological choices, and literature. No new scientific or economic evidence supports a central estimate lower than $40, a discount rate higher than 3 percent, a different treatment of uncertainty, a shorter time horizon, or ignoring the significant costs and benefits to U.S. citizens accruing from effects beyond our geographic borders. It would be irrational and inconsistent with Circular A-4 to prioritize rules for review based on attacks on the estimates of the social cost of greenhouse gases, the value of mortality risk reduction, or other well-established values used in cost-benefit analysis.

III. Going forward, USDA should create a plan to review the performance of each significant rule[18] it promulgates.

Executive Order 13,777 cites existing initiatives on regulatory reform, including Executive Order 13,563,[19] which states in that a well-functioning regulatory system "must measure, and seek to improve, the actual results of regulatory requirements."[20] Accordingly, rather

[15] Exec. Order. No. 13,783 § 5(b), 82 Fed. Reg. 16,093, 16,095 (Mar. 28, 2017).
[16] *Id.* § 5(c).
[17] *See* Environmental Defense Fund, Policy Integrity, Natural Resources Defense Council, and Union of Concerned Scientists, "Comments on the Use of the Social Cost of Greenhouse Gases in the Draft Environmental Impact Statement for the Proposed Missouri River Recovery Management Plan," http://policyintegrity.org/documents/Joint_Comments_to_Army_Corps_on_SCC_in_EIS.pdf.
[18] "Significance" is defined by Executive Order 12,866 § 3(f), and "economically significant" is usually understood to refer to that definition's first clause: "Any regulatory action that is likely to . . . [h]ave an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities."
[19] Exec. Order No. 13,777, §2(a).
[20] Exec. Order No. 13,563, *supra* note 7 at §1(a).

than waiting until years after a rule has taken effect and circumstances are already changing to look back at the rule's effectiveness, agencies should look ahead when drafting each new rule toward addressing uncertain costs and benefits over time. USDA—and all other executive agencies—should include, in the preamble for each new "economically significant"[21] regulation, a prospective plan to collect sufficient information on the rule's performance under previously defined metrics of success to permit an informed assessment of the rule's effectiveness and design over time.

In particular, for each new economically significant rule, agencies should set a timeline for future retrospective reviews and define the goals, metrics, and milestones against which the rule's success will be evaluated. Agencies should also be rigorous in identifying sources of uncertainty in their new regulatory actions. Agencies should then develop plans to collect information on the rule's performance under the metrics—ideally, the actual, *ex post* costs and benefits of the rule (both quantitative and qualitative)—to permit an informed assessment of the rule's effectiveness and design. After an agency conducts its retrospective review at the pre-determined time, it should issue a reasoned statement on whether the retrospective review warrants any regulatory changes.

These guidelines for retrospective review will place new burdens on agencies' resources. However, the information generated from such retrospective reviews would have the potential to facilitate future regulatory analyses by informing *ex ante* predictions of costs and benefits of other rules, thereby making it easier for agencies to address uncertainty. In fact, this recommendation is one of six consensus recommendations from a roundtable of former OIRA administrators (six from Republican administrations, two from Democratic administrations) convened by Policy Integrity in August 2016.[22]

IV. Regulations have little effect on aggregate employment or unemployment rates.

If commenters submit USDA rules as costly due to alleged "job-killing" effects, note that well-accepted economic theory and strong evidence indicate otherwise. Policy Integrity submits the following findings, detailed in an issue brief (appended to these comments and available online[23]):

(1) Regulations have little effect on aggregate employment or unemployment rates.

(2) While regulatory or deregulatory action may temporarily create labor demand or lead to temporary layoffs, such actions do not typically affect long-term job growth across all sectors and regions.

(3) Job analysis models can easily be manipulated to predict either job losses or gains, and therefore should not be relied upon to prioritize regulatory targets for retrospective review.

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[21] *Supra* note 18.

[22] *See* Jason A. Schwartz & Caroline Cecot, Strengthening Regulatory Review: Recommendations for the Trump Administration from Former OIRA Leaders (2016), *available at* http://policyintegrity.org/publications/detail/strengthening-regulatory-review.

[23] *See* Policy Integrity, "Does Environmental Regulation Kill or Create Jobs?" (2017), http://policyintegrity.org/files/media/Jobs_and_Regulation_Factsheet.pdf.

(4) Blocking or repealing regulations solely based on job effects without consideration of broader benefits and costs is bad economics, bad policy, and bad law.

(5) Regulations are poor tools for addressing the negative impacts from jobs shifting from one sector to another.

Respectfully,

Jason A. Schwartz
Iliana Paul

Institute for Policy Integrity

Attached:

(1) Policy Integrity, “Does Environmental Regulation Kill or Create Jobs?” (2017), http://policyintegrity.org/files/media/Jobs_and_Regulation_Factsheet.pdf.

April 24, 2017

To: U.S. Army Corps of Engineers
ATTN: CENWO-PM-AC—MRRMP-EIS

Subject: Comments on the Use of the Social Cost of Greenhouse Gases in the Draft Environmental Impact Statement for the Proposed Missouri River Recovery Management Plan (MRRMP-EIS)

Submitted by: Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Natural Resources Defense Council, and Union of Concerned Scientists

In the Draft Environmental Impact Statement for the Missouri River Recovery Management Plan, the Army Corps of Engineers appropriately applies an estimate of the social cost of carbon ("SCC") to monetize changes in greenhouse gas emissions resulting from the proposed alternatives.[1] Specifically, the Corps uses an estimate from a range developed by the Interagency Working Group on the Social Cost of Greenhouse Gases.[2] That Interagency Working Group drew on the best available scientific and economic literature and, from 2009 through 2016, developed harmonized, transparent estimates of the social cost of greenhouse gases for all federal agencies to use in their analyses. On March 28, 2017, President Trump's Executive Order 13,783 officially disbanded the Interagency Working Group and withdrew its technical support documents that underpinned the range of estimates.[3] The Order also withdrew the Council on Environmental Quality's guidance on considering greenhouse gas changes in environmental impact statements.[4] Nevertheless, Executive Order 13,783 assumes that federal agencies will continue to "monetiz[e] the value of changes in greenhouse gas emissions" and instructs agencies to ensure such estimates are "consistent with the guidance contained in OMB Circular A-4."[5]

Our organizations respectfully submit these comments encouraging the Corps—and all federal agencies—to continue valuing the social cost of greenhouse gases as thoroughly, accurately, and transparently as possible, drawing from the best available scientific and economic data and methodologies. Our organizations may separately submit other comments regarding other aspects of the draft Environmental Impact Statement. These comments make the following key recommendations:

- First, it is appropriate to **continue estimating the social cost of greenhouse gases in environmental impact statements**, because monetizing such values advances the National Environmental Policy Act's goals of informing decision-makers and the public. More broadly, under legal standards for rational decision-making, agencies must monetize important greenhouse gas effects when their decisions are grounded in cost-benefit analysis.

- Second, OMB's **Circular A-4 requires agencies to coordinate and use the best available data and methodologies to estimate the social cost of greenhouse gases**. Though Executive Order 13,783 withdrew the Interagency Working Group's technical documents, leaving agencies without specific guidance for how to incorporate the social cost of greenhouse gases, the

[1] Some elements of the various alternatives under consideration would decrease hydropower generation, thereby leading to "an increase in thermal power generation to meet the [electricity] demand, which increases carbon dioxide, methane, and nitrous oxide emissions." MRRMP DEIS at 3-335.

[2] The Corps attributes this value to EPA, *id.* ("EPA's social cost of carbon"), but the estimate in fact derives from a range produced by the Interagency Working Group on the Social Cost of Greenhouse Gases.

[3] Exec. Order. No. 13,783 § 5(b), 82 Fed. Reg. 16,093 (Mar. 28, 2017).

[4] *Id.* § 3(c).

[5] *Id.* § 5(c).

estimates developed by the Interagency Working Group continue to reflect the best available data and methodological choices consistent with Circular A-4, as required by the new Executive Order. The estimates of the Interagency Working Group also reflect close collaboration and consistency across agencies. Agencies should avoid relying exclusively on a single model to derive their estimates, and instead should follow the Interagency Working Group's reliance on multiple, peer-reviewed models.

- Third, reliance on a **global estimate of the social cost of greenhouse gases is consistent with Circular A-4**. By comparison, no existing methodology for estimating a "domestic-only" value is reliable, complete, or consistent with Circular A-4. If an agency is required to provide a domestic-only estimate, the existing, deficient methodologies must be supplemented to reflect international spillovers to the United States, U.S. benefits from foreign reciprocal actions, and the extraterritorial interests of U.S. citizens including financial interests and altruism.
- Fourth, reliance on a **3% or lower discount rate for inter-generational effects—or a declining discount rate—is consistent with Circular A-4**. Applying a 7% discount rate to inter-generational effects would be inconsistent with Circular A-4's requirements to distinguish social discount rates from rates based on private returns to capital; to make plausible assumptions; to adequately address uncertainty, especially over long time horizons; and to rely on the best available economic data and literature.
- Fifth, while Circular A-4 requires thorough treatment of uncertainty, including probability distributions, **OMB's guidance also requires plausible assumptions about uncertainty**. Giving disproportionate weight in decision-making to improbably optimistic assessments of future climate impacts (i.e., the low-percentile estimates from a probability distribution) would be inappropriate due to the uncertainties, catastrophic risks, and risk aversion related to climate change. All existing best estimates of the social cost of greenhouse gases are almost certainly underestimates and should be treated as a lower bound.

These comments make several other recommendations about the appropriateness of a 300-year time horizon for measuring climate effects, the requirement to qualitatively describe omitted damages, and the relevance of the Information Quality Act to estimating the social cost of greenhouse gases.

Finally, these comments offer specific advice to the Corps on its future use of the social cost of greenhouse gases, including to monetize methane and nitrous oxide as well as carbon dioxide, and to pay attention to how the estimates increase over time.

1. It Is Appropriate to Estimate the Social Cost of Greenhouse Gases in EISs

To achieve the National Environmental Policy Act (NEPA)'s goals of informing decision-makers and the public, monetizing the costs and benefits of changes in greenhouse gas emissions is appropriate for any environmental impact statement (EIS) with substantial greenhouse gas effects. More broadly, under legal standards for rational decision-making, agencies must monetize important greenhouse gas effects when their decisions are grounded in cost-benefit analysis.

NEPA May Require Monetizing Climate Effects, Especially If Other Costs and Benefits Are Monetized

NEPA requires "hard look" consideration of beneficial and adverse effects of each alternative option for major federal government actions. The U.S. Supreme Court has called the disclosure of impacts the "key requirement of NEPA," and held that agencies must "consider and disclose the actual environmental effects" of a proposed project in a way that "brings those effects to bear on [the agency's] decisions."[6] Courts have repeatedly concluded that an EIS must disclose relevant climate effects.[7] Though NEPA does not require a formal cost-benefit analysis,[8] agencies' approaches to assessing costs and benefits must be balanced and reasonable. Courts have warned agencies, for example, that "[e]ven though NEPA does not require a cost-benefit analysis, it was nonetheless arbitrary and capricious to quantify the *benefits* of [federal action] and then explain that a similar analysis of the *costs* was impossible when such an analysis was in fact possible."[9]

Furthermore, it is arbitrary to exclude a monetized cost or benefit from a final EIS when that monetized value was included in the draft EIS.[10] Because the Corps included in this draft EIS a reasonable estimate of the social cost of carbon based on the best available science and economics, it must likewise include in its final EIS a reasonable estimate based on the best available science and economics.

While often eschewing formal cost-benefit analysis in environmental impact statements, agencies typically include in their NEPA reviews of resource management decisions both quantitative and monetized analyses of the economic benefits and distributional effects of the decision, including estimated tons of recoverable resources per acre and the market value thereof; rental rates per acre and annual royalty rates; temporary and permanent job growth, including annual wages and indirect job effects form local expenditures; construction of infrastructure supporting the project; and other related benefits.[11] This draft EIS, for example, monetizes regional labor income changes, flood risk management benefits, recreational effects, and the value of hydropower generation, among other effects.[12] As the U.S. District Court of Colorado concluded, "[i]t is arbitrary to offer detailed projections of a project's upside while omitting a feasible projection of the project's costs."[13] Thus, to the extent agencies continue to quantify and monetize many of the economic and distributional effects of resource management decisions, agencies must also treat climate effects with proportional analytical rigor.

The recent withdrawal of the Council on Environmental Quality's guidance on greenhouse gas emissions does not change the fact that using the social cost of greenhouse gases is consistent with—and may be required under—NEPA obligations. As CEQ explained in its withdrawal, the "guidance was not a regulation," and "[t]he withdrawal of the guidance does not change any law, regulation, or other legally binding requirement."[14] In other words, when the guidance recommended the appropriate use of the

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[6] Baltimore Gas & Elec. Co. v. Natural Res. Def. Council, 462 U.S. 87, 96 (1983).

[7] As the Ninth Circuit has held: "[T]he fact that climate change is largely a global phenomenon that includes actions that are outside of [the agency's] control . . . does not release the agency from the duty of assessing the effects of its actions on global warming within the context of other actions that also affect global warming." Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin., 538 F.3d 1172, 1217 (9th Cir. 2008); *see also* Border Power Plant Working Grp. v. U.S. Dep't of Energy, 260 F. Supp. 2d 997, 1028-29 (S.D. Cal. 2003) (failure to disclose project's indirect carbon dioxide emissions violates NEPA).

[8] 40 C.F.R. § 1502.23 ("[T]he weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis.").

[9] High Country Conservation Advocates v. Forest Service, 52 F. Supp. 3d 1174, 1191 (D. Colorado, 2014).

[10] *Id.* ("In case there was any doubt about the [social cost of carbon] protocol's potential for inclusion in the Lease Modification EIS, the agencies included it in the draft EIS . . . Even though NEPA does not require a cost-benefit analysis, it was nonetheless arbitrary and capricious to quantify the *benefits* of the lease modifications and then explain that a similar analysis of the *costs* was impossible when such an analysis was in fact possible and was included in an earlier draft EIS.").

[11] *See, e.g.*, Forest Service, Federal Coal Lease Modifications COC-1362 & COC-67232, at pp. 190–91 (Aug. 2012); Forest Service, Pawnee National Grassland Oil and Gas Leasing Final Environmental Impact Statement 317, at 291–98 (Dec. 2014); Bureau of Land Mgmt., Final Environmental Impact Statement for the Wright Area Coal Lease Applications, ES-60-61, 4-130-50 (July 2010).

[12] MRRMP DEIS at 2-79, 2-80.

[13] *High Country*, 52 F. Supp. 3d. at 1195.

[14] 82 Fed. Reg. 16,576, 16,576 (Apr. 5, 2017).

social cost of greenhouse gases in EISs,[15] it was simply explaining that the social cost of greenhouse gases is consistent with longstanding NEPA regulations and case law, all of which are still in effect today.

Numerous federal agencies support using the social cost of greenhouse gases in EISs. EPA has called on agencies to include a monetized estimate of anticipated greenhouse gas effects in their environmental impact statements,[16] and multiple agencies have applied the social cost of carbon in their environmental impact statements, including the Office of Surface Mining Reclamation and Enforcement,[17] the Bureau of Land Management,[18] the National Highway Traffic Safety Administration,[19] and the Forest Service.[20] Clearly there are no legal, conceptual, methodological, or practical barriers to applying the social cost of greenhouse gases in NEPA reviews, and there is much to recommend applying it.

Economic Principles Support Monetizing Climate Effects to Fulfill NEPA's Goals

NEPA's goals are to inform decision-makers and the public by providing a "hard look" at the full range of environmental consequences of the government's proposed action and any feasible alternatives.[21] To inform decision-makers and the public, NEPA reviews should aim to present information in the manner that most easily facilitates comparison across alternatives and that best avoids any information-processing biases that might distort rational decision-making. The economic literature supports monetizing climate effects to achieve these goals.

Monetization provides much-needed context for otherwise abstract consequences of climate change. If the NEPA review for an agency action merely quantifies greenhouse gas emissions by metric ton, or only qualitatively discusses the general effects of global climate change, decision-makers and the public will tend to overly discount that individual action's potential contribution. Without context, it is difficult for many decision-makers and the public to assess the magnitude and climate consequences of, for example, an additional million tons of carbon dioxide. Monetization, on the other hand, allows decision-makers and the public to weigh all costs and benefits of an action—and to compare alternatives—using

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[15] *See* CEQ, *Revised Draft Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* at 16 (Dec. 2014), *available at* https://obamawhitehouse.archives.gov/sites/default/files/docs/nepa_revised_draft_ghg_guidance_searchable.pdf ("When an agency determines it appropriate to monetize costs and benefits, then, although developed specifically for regulatory impact analyses, the Federal social cost of carbon, which multiple Federal agencies have developed and used to assess the costs and benefits of alternatives in rulemakings, offers a harmonized, interagency metric that can provide decisionmakers and the public with some context for meaningful NEPA review. When using the Federal social cost of carbon, the agency should disclose the fact that these estimates vary over time, are associated with different discount rates and risks, and are intended to be updated as scientific and economic understanding improves."); *see also* CEQ, *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* at 33 n.86 (Aug. 2016), *available at* https://obamawhitehouse.archives.gov/sites/whitehouse.gov/files/documents/nepa_final_ghg_guidance.pdf.

[16] Letter from Cynthia Giles, Assistant Adm'r, U.S. Environmental Protection Agency, to Jose W. Fernandez & Dr. Kerri Anne Jones, U.S. Department of State (Apr. 22, 2013), at 2.

[17] *Available at* http://www.wrcc.osmre.gov/initiatives/fourCorners/documents/FinalEIS/Section%204.2%20-%20Climate%20Change.pdf; *see also* http://www.wrcc.osmre.gov/initiatives/fourCorners/documents/FinalEIS/Appendix%20A%20-%20Air%20Quality%20and%20Climate%20Change%20Information.pdf.

[18] Bureau of Land Management, Environmental Assessment DOI-BLM-MT-C020-2014-0091-EA, 76 (May 2014).

[19] *Available at* http://www.nhtsa.gov/staticfiles/rulemaking/pdf/cafe/FINAL_EIS.pdf at 9-77; *see also* http://ntl.bts.gov/lib/55000/55200/55224/Draft_Environmental_Impact_Statement_for_Phase_2_MDHD_Fuel_Efficiency_Standards.pdf.

[20] Forest Service, *Rulemaking for Colorado Roadless Areas: Supplemental Final Environmental Impact Statement* (Nov. 2016), *available at* https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd525072.pdf (using both the social cost of carbon and the social cost of methane).

[21] *See* Robertson v. Methow Valley Citizens Council, 490 U.S. 332 (1989).

the common metric of money. Monetizing climate costs, therefore, better informs the public and helps "brings those effects to bear on [the agency's] decisions."[22]

The tendency to ignore non-monetized effects is the result of common but irrational mental heuristics like probability neglect and base-rate bias. For example, the phenomenon of probability neglect causes people to reduce small probabilities entirely down to zero, resulting in these probabilities playing no role in the decision-making process.[23] This heuristic applies even to events with long-term certainty or with lower-probability but catastrophic consequences, so long as their effects are unlikely to manifest in the immediate future. Weighing the real risks that, decades or centuries from now, climate change will fundamentally and irreversibly disrupt the global economy, destabilize earth's ecosystems, or compromise the planet's ability to sustain human life is challenging; without a tool to contextualize such risks, it is far easier to ignore them. Monetization tools like the social cost of carbon and social cost of methane are designed to solve this problem: by translating long-term costs into present values, instantiating the harms of climate change, and giving due weight to the potential of lower-probability but catastrophic harms.

Agencies and the public might also suffer from base-rate bias, which causes the undervaluation of information that is generally applicable across a range of scenarios.[24] Agencies fall into this trap when their NEPA reviews provide generic narrative descriptions of climate change yet conclude that climate change is too global and general a problem to address in a project-specific environmental impact statement. This approach inappropriately forecloses the possibility of mitigating the effects of climate change. Metrics like the social cost of carbon and social cost of methane encourage agencies to identify such mitigation opportunities by monetizing the effects on climate change from the emission of as little as a single ton of greenhouse gases. In fact, these monetization tools were developed to assess the cost of actions with "marginal" impacts on cumulative global emissions, and so are well suited to projects or rules with even relatively small net changes in greenhouse gas emissions.

Standards of Rationality Requires Attention to and Consistent Treatment of Important Factors

The Supreme Court defined the standard of rationality for agency actions under the Administrative Procedure Act as follows:

> Normally, an agency rule would be arbitrary and capricious if the agency has relied on factors which Congress has not intended it to consider, *entirely failed to consider an important aspect of the problem*, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view of the product of agency expertise.[25]

Furthermore, the Court found that the standard requires agencies to "examine the relevant data and articulate . . . a 'rational connection between the facts found and the choice made."[26]

[22] *See Baltimore Gas & Elec. Co.*, 462 U.S. at 96.

[23] Cass R. Sunstein, *Probability Neglect: Emotions, Worst Cases, and Law* (John M. Olin Law & Economics, Working Paper No. 138, 2001), *available at* http://ssrn.com/abstract=292149.

[24] *See* Fallacy Files, *The Base Rate Fallacy*, http://www.fallacyfiles.org/baserate.html; David B. Graham, Capt. Thomas D. Johns, *The Corporate Emergency Response Plan: A Smart Strategy*, 27 NAT. RESOURCES & ENV'T 3 (2012) (on normalcy bias).

[25] Motor Vehicle Manufacturers Assoc. v. State Farm Mutual Auto. Ins. Co., 463 U.S. 29, 41-43 (1983) (emphasis added); *see also id.* ("[W]e must 'consider whether the decision was based on a consideration of the relevant factors and whether there has been a clear error of judgment.'").

[26] *Id.*

Two courts of appeals have already applied arbitrary and capricious review to require the use of the social cost of greenhouse gases in agency decision-making.[27] In *Center for Biological Diversity v. National Highway Traffic Safety Administration*, the U.S. Court of Appeals for the Ninth Circuit ruled that, because the agency had monetized other uncertain costs and benefits of its vehicle fuel efficiency standard, its "decision not to monetize the benefit of carbon emissions reduction was arbitrary and capricious."[28] Specifically, it was arbitrary to "assign[ ] no value to *the most significant benefit* of more stringent [vehicle fuel efficiency] standards: reduction in carbon emissions."[29] When an agency bases a rulemaking on cost-benefit analysis, it is arbitrary to "put a thumb on the scale by undervaluing the benefits and overvaluing the costs."[30]

More recently, in *Zero Zone Inc. v. Department of Energy*, the U.S. Court of Appeals for the Seventh Circuit found that "the expected reduction in environmental costs *needs* to be taken into account" for the Department of Energy "[t]o determine whether an energy conservation measure is appropriate under a cost-benefit analysis."[31] More specifically, in response to petitioners' challenge that the agency's consideration of the global social cost of carbon was arbitrary, the Seventh Circuit responded that the agency "acted reasonably" in monetizing the global climate effects.[32]

In short, agencies must monetize important greenhouse gas effects when their decisions are grounded in cost-benefit analysis.[33]

New Executive Order Encourages Continued Monetization of the Social Cost of Greenhouse Gases

Executive Order 13,783 officially disbanded the Interagency Working Group on the Social Cost of Greenhouse Gases (IWG) and withdrew its technical support documents that underpinned their range of estimates.[34] Nevertheless, Executive Order 13,783 assumes that federal agencies will continue to "monetiz[e] the value of changes in greenhouse gas emissions" and instructs agencies to ensure such estimates are "consistent with the guidance contained in OMB Circular A-4."[35] Consequently, while the Army Corps and other federal agencies no longer have technical guidance directing them to exclusively rely on the IWG's estimates to monetize climate effects, by no means does the new Executive Order imply that agencies should not monetize important effects in their regulatory analyses or environmental impact statements. In fact, Circular A-4 instructs agencies to monetize costs and benefits whenever feasible.[36] The Executive Order does not prohibit agencies from relying on the same choice of models as the IWG, the same inputs and assumptions as the IWG, the same statistical methodologies as the IWG,

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[27] A few courts have also applied arbitrary and capricious review to the use or non-use of the social cost of carbon in environmental impact statements under the National Environmental Policy Act. In *High Country Conservation Advocates v. Forest Service*, the District Court of Colorado found that it was "arbitrary and capricious to quantify the *benefits* of the lease modifications and then explain that a similar analysis of the *costs* was impossible when such an analysis was in fact possible"—specifically, by applying the "social cost of carbon protocol." 52 F. Supp. 3d 1174, 1191 (D. Colo. 2014). The District Court of Oregon declined to follow suit in *League of Wilderness Defenders v. Connaughton*, but only because in this case the Forest Service had not conducted a quantitative analysis of either costs or benefits of climate change but rather addressed climate change qualitatively. No. 3:12-cv-02271-HZ, decided Dec. 9, 2014.

[28] 538 F.3d 1172, 1203 (9th Cir. 2008).

[29] *Id.* at 1199.

[30] *Id.* at 1198.

[31] No. 14-2147, at 40 (Aug. 8, 2016) (emphasis added).

[32] *Id.* at 44.

[33] *See generally* Peter Howard & Jason Schwartz, *Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon*, 42 Columbia J. Envtl. L. 203 (2017) for more on applying standards of rationality to the social cost of carbon.

[34] Exec. Order. No. 13,783 § 5(b), 82 Fed. Reg. 16,093 (Mar. 28, 2017).

[35] *Id.* § 5(c).

[36] OMB, Circular A-4 at 27 (2003) ("You should monetize quantitative estimates whenever possible.").

or the same ultimate values as derived by the IWG. To the contrary, because the Executive Order requires consistency with Circular A-4, as agencies follow the Circular's standards for using the best available data and methodologies, they will necessarily choose similar data, methodologies, and estimates as the IWG, since the IWG's work continues to represent the best available estimates. The Executive Order does not preclude agencies from using the same range of estimates as developed by the IWG, so long as the agency explains that the data and methodology that produced those estimates are consistent with Circular A-4 and, more broadly, with standards for rational decision-making.

Similarly, as explained above, the Executive Order's withdrawal of the CEQ guidance on greenhouse gases does not change agencies' obligations to appropriately monetize climate effects in their EISs. The CEQ guidance had merely summarized and applied longstanding NEPA regulations and case law, all of which are still in effect today. Using the best available estimates of the social cost of greenhouse gases is still consistent with, and may be required by, NEPA.

As the rest of these comments explain, existing best estimates of the social cost of greenhouse gases in fact are already consistent with the Circular A-4. Therefore, the IWG estimates or those of a similar or higher value are appropriate for future use in regulatory analyses and environmental impact statements.

2. Circular A-4 Requires Agencies to Coordinate and Use the Best Available Data and Methodologies to Estimate the Social Cost of Greenhouse Gases

Agencies Should Not Rely on a Single Model, but Should Use Multiple, Peer-Reviewed Models

Circular A-4 requires agencies to use "the best reasonably obtainable scientific, technical, and economic information available. To achieve this, you should rely on peer-reviewed literature, where available."[37]

Since 2010, federal agencies have used estimates of the social cost of greenhouse gases based on the three most cited, most peer-reviewed integrated assessment models (IAMs). These three IAMs—called DICE (the Dynamic Integrated Model of Climate and the Economy[38]), FUND (the Climate Framework for Uncertainty, Negotiation, and Distribution[39]), and PAGE (Policy Analysis of the Greenhouse Effect[40])—draw on the best available scientific and economic data to link physical impacts to the economic damages of each marginal ton of greenhouse gas emissions. Each model translates emissions into changes in atmospheric greenhouse gas concentrations, atmospheric concentrations into temperature changes, and temperature changes into economic damages. These three models have been combined with inputs derived from peer-reviewed literature on climate sensitivity, socio-economic and emissions trajectories, and discount rates. The results of the three models have been given equal weight in federal agencies' estimates and have been run through statistical techniques like Monte Carlo analysis to account for uncertainty.

In a 2017 report, the National Academies of Sciences (NAS) recommended future improvements to this methodology. Specifically, over the next five years the NAS recommends unbundling the four essential steps in the IAMs into four separate "modules": a socio-economic and emissions scenario module, a

[37] *Id.* at 17.

[38] William D. Nordhaus, *Estimates of the social cost of carbon: concepts and results from the DICE-2013R model and alternative approaches*, 1 JOURNAL OF THE ASSOCIATION OF ENVIRONMENTAL AND RESOURCE ECONOMISTS 1 (2014).

[39] David Anthoff & Richard S.J. Tol, THE CLIMATE FRAMEWORK FOR UNCERTAINTY, NEGOTIATION AND DISTRIBUTION (FUND), TECHNICAL DESCRIPTION, VERSION 3.6 (2012), *available at* http://www.fund-model.org/versions.

[40] Chris Hope, *The Marginal Impact of CO_2 from PAGE2002: An Integrated Assessment Model Incorporating the IPCC's Five Reasons for Concern*, 6 INTEGRATED ASSESSMENT J. 19 (2006).

climate change module, an economic damage module, and a discount rate module.[41] Unbundling these four steps into separate modules could allow for easier, more transparent updates to each individual component, to better reflect the best available science and capture the full range of uncertainty in the literature. These four modules could be built from scratch or drawn from the existing IAMs. Either way, the integrated modular framework envisioned by NAS for the future will require significant time and resource commitments from federal agencies. It is likely unrealistic that the Corps could undertake this approach on its own or complete it in time for this EIS process without significant and costly delays.

In the meantime, the NAS has supported the continued near-term use of the existing social cost of greenhouse gas estimates based on the DICE, FUND, and PAGE models, as used by federal agencies to date.[42] In short, DICE, FUND, and PAGE continue to represent the state-of-the-art models. The Government Accountability Office found in 2014 that the estimates derived from these models and used by federal agencies are consensus-based, rely on peer-reviewed academic literature, disclose relevant limitations, and are designed to incorporate new information via public comments and updated research.[43] In fact, the social cost of greenhouse gas estimates used in federal regulatory proposals and EISs have been subject to over 80 distinct public comment periods.[44] The economics literature confirms that estimates based on these three IAMs remain the best available estimates.[45] In 2016, the U.S. Court of Appeals for the Seventh Circuit held the estimates used to date by agencies are "reasonable."[46]

While Executive Order 13,783 withdrew the explicit guidance requiring federal agencies to rely on IWG's technical support documents to estimate the social cost of greenhouse gases, nevertheless, the IWG's choice of DICE, FUND, and PAGE, its use of inputs and assumptions, and its statistical analysis still represent the state-of-the-art approach based on the best available, peer-reviewed literature. This approach satisfies Circular A-4's requirements for information quality and transparency. Therefore, as agencies comply with the Executive Order's instructions to ensure that social cost of greenhouse gases are consistent with Circular A-4, agencies will necessarily have to rely on models like DICE, FUND, and PAGE, to use the same or similar inputs and assumptions as the IWG, and to apply statistical analyses like Monte Carlo.

If agencies choose not to rely directly on the IWG estimates, models should be chosen based on Circular A-4's criteria of quality and transparency. DICE, FUND, and PAGE are still the dominant, most peer-reviewed models,[47] and most estimates in the literature continue to rely on those models.[48] Each of

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[41] Nat'l Acad. Sci., Eng. & Medicine, *Valuing Climate Damages: Updating Estimates of the Social Cost of Carbon Dioxide* 3 (2017) [hereinafter "NAS, Second Report"] (recommending an "integrated modular approach").

[42] Specifically, NAS concluded that a near-term update was not necessary or appropriate and the current estimates should continue to be used while future improvements are developed over time. Nat'l Acad. Sci., Eng. & Medicine, *Assessment of Approaches to Updating the Social Cost of Carbon: Phase 1 Report on a Near-Term Update* 1 (2016) [hereinafter "NAS, First Report"].

[43] Gov't Accountability Office, *Regulatory Impact Analysis: Development of Social Cost of Carbon Estimates* (2014).

[44] Howard & Schwartz, *supra* note 33, at Appendix A.

[45] *E.g.*, Richard G. Newell et al., *Carbon Market Lessons and Global Policy Outlook*, 343 SCIENCE 1316 (2014); Bonnie L. Keeler et al., *The Social Costs of Nitrogen*, 2 SCIENCE ADVANCES e1600219 (2016); Richard L. Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 NATURE 173 (2014) (co-authored with Nobel Laureate Kenneth Arrow, among others).

[46] Zero Zone v. Dept. of Energy, No. 14-2147, at 44 (7th Cir., Aug. 8, 2016) (finding that the agency "acted reasonably" in using global estimates of the social cost of carbon, and that the estimates chosen were not arbitrary or capricious).

[47] *See* Interagency Working Group on the Social Cost of Carbon, *Response to Comments: Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12,866* at 7 (July 2015) ("DICE, FUND, and PAGE are the most widely used and widely cited models in the economic literature that link physical impacts to economic damages for the purposes of estimating the SCC."), *citing* Nat'l Acad. Sci., Eng. & Medicine, *Hidden Cost of Energy: Unpriced Consequences of Energy Production and Use* (2010) ("the most widely used impact assessment models").

these models has been developed over decades of research, and has been subject to rigorous peer review, documented in the published literature. Other models exist but lack DICE, FUND, and PAGE's long history of peer review or exhibit other limitations. For example, the World Bank has created ENVISAGE, which models a more detailed breakdown of market sectors,[49] but unfortunately does not account for non-market impacts and so would omit a large portion of significant climate effects. Models like ENVISAGE are not currently appropriate choices under the criteria of Circular A-4.[50]

An approach based on multiple, peer-reviewed models (like DICE, FUND, and PAGE) is more rigorous and more consistent with Circular A-4 than reliance on a single model or estimate. DICE, FUND, and PAGE each include many of the most significant climate effects, use appropriate discount rates and other assumptions, address uncertainty, are based on peer-reviewed data, and are transparent.[51] However, each IAM also has its own limitations and is sensitive to its own assumptions. No model fully captures all the significant climate effects.[52] By giving weight to multiple models—as the IWG did—agencies can balance out some of these limitations and produce more robust estimates.

Finally, while agencies should be careful not to cherry-pick a single estimate from the literature, it is noteworthy that various estimates in the literature are consistent with the numbers derived from a weighted average of DICE, FUND, and PAGE—namely, with a central estimate of about $40 per ton of carbon dioxide, and a high-percentile estimate of about $120, for year 2015 emissions (in 2016 dollars, at a 3% discount rate). The latest central estimate from DICE's developers is $87 (at a 3% discount rate);[53] from FUND's developers, $12;[54] and from PAGE's developers, $123, with a high-percentile estimate of $332.[55]

In fact, much of the literature suggest that a central estimate of $40 per ton is a very conservative underestimate. A 2013 meta-analysis of the broader literature found a mean estimate of $59 per ton of carbon dioxide,[56] and a soon-to-be-published update by the same author finds a mean estimate of $108 (at a 1% discount rate).[57] A 2015 meta-analysis—which sought out estimates besides just those based on DICE, FUND, and PAGE—found a mean estimate of $83 per ton of carbon dioxide.[58] Various studies

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[48] R.S. Tol, *The Social Cost of Carbon*, 3 Annual Rev. Res. Econ. 419 (2011; T. Havranek et al., *Selective Reporting and the Social Cost of Carbon*, 51 Energy Econ. 394 (2015).

[49] World Bank, *The Environmental Impact and Sustainability Applied General Equilibrium (ENVISAGE) Model* (2008), *available at* http://siteresources.worldbank.org/INTPROSPECTS/Resources/334934-1193838209522/Envisage7b.pdf.

[50] Similarly, Intertemporal Computable Equilibrium System (ICES) does not account for non-market impacts. *See* https://www.cmcc.it/models/ices-intertemporal-computable-equilibrium-system. Other models include CRED, which is worthy of further study for future use. Frank Ackerman, Elizabeth A. Stanton & Ramón Bueno, *CRED: A New Model of Climate and Development*, 85 Ecological Economics 166 (2013). Accounting for omitted impacts more generally, E.A. Stanton, F. Ackerman, R. Bueno, *Reason, Empathy, and Fair Play: The Climate Policy Gap*, (Stockholm Environment Inst. Working Paper 2012-02), find a doubling of the SCC using the CRED model.

[51] While sensitivity analysis can address parametric uncertainty within a model, using multiple models helps address structural uncertainty.

[52] *See* Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* 5 (Cost of Carbon Project Report, 2014), http://costofcarbon.org/.

[53] William Nordhaus, *Revisiting the Social Cost of Carbon*, Proc. Nat'l Acad. Sci. (2017) (estimate a range of $21 to $141).

[54] D. Anthoff & R. Tol, *The Uncertainty about the Social Cost of Carbon: A Decomposition Analysis Using FUND*, 177 Climatic Change 515 (2013).

[55] C. Hope, *The social cost of CO2 from the PAGE09 model*, 39 Economics (2011); C. Hope, *Critical issues for the calculation of the social cost of CO2*, 117 *Climatic Change*, 531 (2013).

[56] R. Tol, *Targets for Global Climate Policy: An Overview*, 37 J. Econ. Dynamics & Control 911 (2013).

[57] R. Tol, *Economic Impacts of Climate Change* (Univ. Sussex Working Paper No. 75-2015, 2015).

[58] S. Nocera et al., *The Economic Impact of Greenhouse Gas Abatement through a Meta-Analysis: Valuation, Consequences and Implications in terms of Transport Policy*. 37 Transport Policy 31 (2015).

relying on expert elicitation[59] from a large body of climate economists and scientists have found mean estimates of $50 per ton of carbon dioxide,[60] $96-$144 per ton of carbon dioxide,[61] and $80-$100 per ton of carbon dioxide.[62] There is a growing consensus in the literature that even the best existing estimates of the social cost of greenhouse gases may severely underestimate the true marginal cost of climate damages.[63] Overall, a central estimate of $40 per ton of carbon dioxide at a 3% discount rate, with a high-percentile estimate of about $120 for year 2015 emissions, is consistent with the best available literature; if anything, the best available literature supports even higher estimates.

Similarly, a comparison of international estimates of the social cost of greenhouse gases suggests that a central estimate of $40 per ton of carbon dioxide is a very conservative value. Sweden places the long-term valuation of carbon dioxide at $168 per ton; Germany calculates a "climate cost" of $167 per ton of carbon dioxide in the year 2030; the United Kingdom's "shadow price of carbon" has a central value of $115 by 2030; Norway's social cost of carbon is valued at $104 per ton for year 2030 emissions; and various corporations have adopted internal shadow prices as high as $80 per ton of carbon dioxide.[64]

Agencies Should Coordinate Efforts and Harmonize Estimates

Without IWG's framework for inter-agency coordination or the instructions in IWG's technical documents for all agencies to use standardized estimates of the social cost of greenhouse gases, agencies have a choice going forward: either each agency could try to select and justify its own estimates, or agencies could continue to coordinate their efforts and harmonize their estimates. The latter is preferred and most consistent with Circular A-4's instructions.

Circular A-4 directs agencies to "keep in mind the larger objective of analytical consistency in estimating benefits and costs across regulations and agencies. . . Failure to maintain such consistency may prevent achievement of the most risk reduction for a given level of resource expenditure."[65] By sharing resources, information, and expertise, agencies can save time and money and ultimately produce better estimates. Harmonized values for the social cost of greenhouse gases will increase predictability and transparency for regulated entities, the U.S. public, and international actors looking to U.S. actions to develop their own reciprocal approaches (see *infra* for more on reciprocal foreign actions). Though the

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[59] Circular A-4, at 41, supports use of expert elicitation as a valuable tool to fill gaps in knowledge.

[60] Scott Holladay & Jason Schwartz, *Economists and Climate Change* 43 (Inst. Policy Integrity Brief, 2009 (directly surveying experts about the SCC).

[61] Peter Howard & Derek Sylvan, *The Economic Climate: Establishing Expert Consensus on the Economics of Climate Change* (Inst. Policy Integrity Working Paper 2015/1) (using survey results to calibrate the DICE-2013R damage function).

[62] R. Pindyck, *The Social Cost of Carbon Revisited* (Nat'l Bureau of Econ. Res. No. w22807, 2016) ($80-$100 is the trimmed range of estimates at a 4% discount rate; without trimming of outlier responses, the estimate is $200).

[63] *E.g.,* Howard & Sylvan, *supra* note 61; Pindyck, *supra* note 62. The underestimation results from a variety of factors, including omitted and outdated climate impacts (including ignoring impacts to economic growth and tipping points), simplified utility functions (including ignoring relative prices), and applying constant instead of a declining discount rate. *See* Howard, *supra* note 52; Revesz et al., *supra* note 45; J.C. Van Den Bergh & W.J. Botzen, A Lower Bound to the Social Cost of CO2 Emissions, 4 Nature Climate Change 253 (2014) (proposing $125 per metric ton of carbon dioxide in 1995 dollars, or about $200 in today's dollars, as the lower bound estimate). *See also* F.C. Moore & D.B. Diaz, *Temperature Impacts on Economic Growth Warrant Stringent Mitigation Policy*, 5 Nature Climate Change 127 (2015) (concluding the SCC may be six times higher after accounting for potential growth impacts of climate change). Accounting for both potential impacts of climate change on economic growth and other omitted impacts, S. Dietz and N. Stern find a two- to seven-fold increase in the SCC. *Endogenous growth, convexity of damage and climate risk: how Nordhaus' framework supports deep cuts in carbon emissions*. 125 *The Economic Journal* 574 (2015).

[64] *See* Howard & Schwartz, *supra* note 33, at Appendix B.

[65] Circular A-4 at 9-10.

recent Executive Order officially disbanded the IWG, agencies can and should continue to coordinate their efforts.

3. **Reliance on a Global Estimate Is Consistent with Circular A-4**

Not only is it consistent with Circular A-4 and best economic practices to estimate the global damages of U.S. greenhouse gas emissions in regulatory analyses and environmental impact statements, but no existing methodology for estimating a "domestic-only" value is reliable, complete, or consistent with Circular A-4. If an agency is required to provide a domestic-only estimate, the existing, deficient methodologies must be supplemented to reflect international spillovers to the United States, U.S. benefits from foreign reciprocal actions, and the extraterritorial interests of U.S. citizens including financial interests and altruism.

Circular A-4 Requires "Different Emphases . . . Depending on the Nature" of the Regulatory Issue

From 2010 through 2016, federal agencies based their regulatory decision and NEPA reviews on global estimates of the social cost of greenhouse gases. Though agencies often also disclosed a "highly speculative" range that tried to capture exclusively U.S. climate costs, emphasis on a global value was recognized as more accurate given the science and economics of climate change, as more consistent with best economic practices, and as crucial to advancing U.S. strategic goals.[66]

Opponents of climate regulation challenged the global number in court and other forums, and often attempted to use Circular A-4 as support.[67] Specifically, opponents have seized on Circular A-4's instructions to "focus" on effects to "citizens and residents of the United States," while any significant effects occurring "beyond the borders of the United States . . . should be reported separately."[68] Importantly, despite this language and such challenges, the U.S. Court of Appeals for the Seventh Circuit had no trouble concluding that a global focus for the social cost of greenhouse gases was reasonable:

> AHRI and Zero Zone [the industry petitioners] next contend that DOE [the Department of Energy] arbitrarily considered the global benefits to the environment but only considered the national costs. They emphasize that the [statute] only concerns "national energy and water conservation." In the New Standards Rule, DOE did not let this submission go unanswered. It explained that climate change "involves a global externality," meaning that carbon released in the United States affects the climate of the entire world. According to DOE, national energy conservation has global effects, and, therefore, those global effects are an appropriate consideration when looking at a national policy. Further, AHRI and Zero Zone point to no global costs that should have been considered alongside these benefits. Therefore, DOE acted reasonably when it compared global benefits to national costs.[69]

Circular A-4's reference to effects "beyond the borders" confirms that it is appropriate for agencies to consider the global effects of U.S. greenhouse gas emissions. While Circular A-4 may suggest that most

[66] *See generally* Howard & Schwartz, *supra* note 33.

[67] Ted Gayer & W. Kip Viscusi, *Determining the Proper Scope of Climate Change Policy Benefits in U.S. Regulatory Analyses: Domestic versus Global Approaches*, 10 Rev. Envtl. Econ. & Pol'y 245 (2016) (citing Circular A-4 to argue against a global perspective on the social cost of carbon); *see also, e.g.*, Petitioners Brief on Procedural and Record-Based Issues at 70, in *West Virginia v. EPA*, case 15-1363, D.C. Cir. (filed February 19, 2016) (challenging EPA's use of the global social cost of carbon).

[68] Circular A-4 at 15. Note that A-4 slightly conflates "accrue to citizens" with "borders of the United States": U.S. citizens have financial and other interests tied to effects beyond the borders of the United States, as discussed further below.

[69] Zero Zone v. Dept. of Energy, No. 14-2147, at 44 (7th Cir., Aug. 8, 2016).

typical decisions should focus on U.S. effects, the Circular cautions agencies that special cases call for different emphases:

> [Y]ou cannot conduct a good regulatory analysis according to a formula. Conducting high-quality analysis requires competent professional judgment. ***Different regulations may call for different emphases*** in the analysis, ***depending on the nature and complexity*** of the regulatory issues and the sensitivity of the benefit and cost estimates to the key assumptions.[70]

In fact, Circular A-4 elsewhere assumes that agencies' analyses will not always be conducted from purely the perspective of the United States, as one of its instructions only applies "as long as the analysis is conducted from the United States perspective,"[71] suggesting sometimes the perspective may instead be global. For example, the Environmental Protection Agency and the Department of Transportation have adopted a global perspective on the analysis of potential monopsony benefits to U.S. consumers resulting from the reduced price of foreign oil imports following energy efficiency increases, and the Environmental Protection Agency assesses the global potential for leakage of greenhouse gas emissions owing to U.S. regulation.[72]

The nature of the issue of climate change requires such a "different emphasis" from the default domestic-only assumption. To avoid a global "tragedy of the commons" that could irreparably damage all countries, including the United States, every nation should ideally set policy according to the global social cost of greenhouse gases.[73] Climate and clean air are global common resources, meaning they are freely available to all countries, but any one country's use—i.e., pollution—imposes harms on the polluting country as well as the rest of the world. Because greenhouse pollution does not stay within geographic borders but rather mixes in the atmosphere and affects climate worldwide, each ton emitted by the United States not only creates domestic harms, but also imposes large externalities on the rest of the world. Conversely, each ton of greenhouse gases abated in another country benefits the United States along with the rest of the world.

If all countries set their greenhouse emission levels based on only domestic costs and benefits, ignoring the large global externalities, the aggregate result would be substantially sub-optimal climate protections and significantly increased risks of severe harms to all nations, including the United States. Thus, basic economic principles demonstrate that the United States stands to benefit greatly if all countries apply global social cost of greenhouse gas values in their regulatory decisions and project reviews. Indeed, the United States stands to gain hundreds of billions or even trillions of dollars in direct benefits from efficient foreign action on climate change.[74]

Therefore, a rational tactical option in the effort to secure that economically efficient outcome is for the United States to continue using global social cost of greenhouse gas values itself.[75] The United States is engaged in a repeated strategic dynamic with several significant players—including the United Kingdom, Germany, Sweden, and others—that have already adopted a global framework for valuing the social

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[70] Circular A-4 at 3.

[71] *Id.* at 38 (counting international transfers as costs and benefits "as long as the analysis is conducted from the United States perspective").

[72] *See* Howard & Schwartz, *supra* note 33, at 268-69.

[73] *See* Garrett Hardin, *The Tragedy of the Commons*, 162 Science 1243 (1968) ("[E]ach pursuing [only its] own best interest . . . in a commons brings ruin to all.").

[74] Policy Integrity, *Foreign Action, Domestic Windfall: The U.S. Economy Stands to Gain Trillions from Foreign Climate Action* (2015), http://policyintegrity.org/files/publications/ForeignActionDomesticWindfall.pdf

[75] *See* Robert Axelrod, *The Evolution of Cooperation* 10-11 (1984) (on repeated prisoner's dilemma games).

cost of greenhouse gases.[76] For example, Canada and Mexico have explicitly borrowed the U.S. estimates of a global Social Cost of Carbon to set their own fuel efficiency standards.[77] For the United States to now depart from this collaborative dynamic by reverting to a domestic-only estimate could undermine the country's long-term interests and could jeopardize emissions reductions underway in other countries, which are already benefiting the United States.

For these and other reasons, federal agencies have, since 2009, properly relied on global estimates of the social cost of greenhouse gases to justify their decisions. At the same time, agencies have often disclosed a "highly speculative" estimate of the domestic-only effects of climate change. In particular, the Department of Energy always includes a chapter on a domestic-only value of carbon emissions in the economic analyses supporting its energy efficiency standards; the Environmental Protection Agency has also often disclosed similar estimates.[78] Such an approach is consistent with Circular A-4's suggestion that agencies should usually disclose domestic effects separately from global effects. However, as explored more below, reliance on a domestic-only methodology would be inconsistent with the standards of Circular A-4, and existing estimates of domestic-only effects are severe underestimates. Consequently, it is appropriate under Circular A-4 for agencies to continue to rely on global estimates of the social cost of greenhouses to justify their regulatory decisions or their choice of alternatives under NEPA.

For more details on the justification for a global value of the social cost of greenhouse gases, please see Peter Howard & Jason Schwartz, *Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon*, 42 Columbia J. Envtl. L. 203 (2017). Another strong defense of the global valuation as consistent with best economic practices appears in a letter published in the latest issue of *The Review of Environmental Economics and Policy*, co-authored by Nobel laureate Kenneth Arrow.[79]

No Current Methodology for Estimating a "Domestic-Only" Value Is Consistent with Circular A-4

OMB, the National Academies of Sciences, and the economic literature all agree that existing methodologies for calculating a "domestic-only" value of the social cost of greenhouse gases are deeply flawed and result in severe and misleading underestimates.

The Interagency Working Group had offered some domestic estimates. Using the results of one economic model (FUND) as well as the U.S. share of global gross domestic product ("GDP"), the group generated an "approximate, provisional, and ***highly speculative***" range of 7–23% of the global social cost of carbon as an estimate of the purely direct climate effects to the United States.[80] Yet, as the interagency group acknowledged—and as discussed more thoroughly in the next subsection of these comments—this range is almost certainly an underestimate because it ignores significant, indirect costs to trade, human health, and security that are likely to "spill over" into the United States as other regions experience climate change damages, among other effects.

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[76] *See* Howard & Schwartz, *supra* note 33, at Appendix B.

[77] *See* Heavy-Duty Vehicle and Engine Greenhouse Gas Emission Regulations, SOR/2013-24, 147 Can. Gazette pt. II, 450, 544 (Can.), *available at* http://canadagazette.gc.ca/rp-pr/p2/2013/2013-03-13/html/sor-dors24-eng.html ("The values used by Environment Canada are based on the extensive work of the U.S. Interagency Working Group on the Social Cost of Carbon."); Jason Furman & Brian Deese, *The Economic Benefits of a 50 Percent Target for Clean Energy Generation by 2025*, White House Blog, June 29, 2016 (summarizing the North American Leader's Summit announcement that U.S., Canada, and Mexico would "align" their SCC estimates).

[78] Howard & Schwartz, *supra* note 33, at 220-21.

[79] Richard Revesz, Kenneth Arrow et al., *The Social Cost of Carbon: A Global Imperative*, 11 REEP 172 (2017).

[80] INTERAGENCY WORKING GROUP ON SOCIAL COST OF CARBON, TECHNICAL SUPPORT DOCUMENT: SOCIAL COST OF CARBON FOR REGULATORY IMPACT ANALYSIS UNDER EXECUTIVE ORDER 12,866 at 11 (2010).

Neither the existing IAMs nor a share of global GDP are appropriate bases for calculating a domestic-only estimate. FUND, like other IAMS, includes some simplifying assumptions: of relevance, FUND and the other IAMs are not able to capture the adverse effects that the impacts of climate change in other countries will have on the United States through trade linkages, national security, migration, and other forces. This is why the IWG characterized the domestic-only estimate from FUND as a "highly speculative" underestimate. Similarly, a domestic-only estimate based on some rigid conception of geographic borders or U.S. share of world GDP will fail to capture all the climate-related costs and benefits that matter to U.S. citizens.[81] U.S. citizens have economic and other interests abroad that are not fully reflected in the U.S. share of global GDP. GDP is a "monetary value of final goods and services—that is, those that are bought by the final user—produced in a country in a given period of time."[82] GDP therefore does not reflect significant U.S. ownership interests in foreign businesses, properties, and other assets, as well as consumption abroad including tourism,[83] or even the 8 million Americans living abroad.[84] At the same time, GDP is also over-inclusive, counting productive operations in the United States that are owned by foreigners. Gross National Income ("GNI"), by contrast, defines its scope not by location but by ownership interests.[85] However, not only has GNI fallen out of favor as a metric used in international economic policy,[86] but using a domestic-only SCC based on GNI would make the SCC metrics incommensurable with other costs in regulatory impact analyses, since most regulatory costs are calculated by U.S. agencies regardless of whether they fall to U.S.-owned entities or to foreign-owned entities operating in the United States.[87] The artificial constraints of both metrics counsel against a rigid split based on either U.S. GDP or U.S. GNI.[88]

In 2015, OMB concluded, along with several other agencies, that "good methodologies for estimating domestic damages do not currently exist."[89] Similarly, the National Academies of Sciences recently concluded that current IAMs cannot accurately estimate the domestic social cost of greenhouse gases, and that estimates based on U.S. share of global GDP would be likewise insufficient.[90] William Nordhaus,

[81] A domestic-only SCC would fail to "provide to the public and to OMB a careful and transparent analysis of the anticipated consequences of economically significant regulatory actions." Office of Information and Regulatory Affairs, *Regulatory Impact Analysis: A Primer* 2 (2011).

[82] Tim Callen, *Gross Domestic Product: An Economy's All*, IMF, http://www.imf.org/external/pubs/ft/fandd/basics/gdp.htm (last updated Mar. 28, 2012).

[83] "U.S. residents spend millions each year on foreign travel, including travel to places that are at substantial risk from climate change, such as European cities like Venice and tropical destinations like the Caribbean islands." David A. Dana, *Valuing Foreign Lives and Civilizations in Cost-Benefit Analysis: The Case of the United States and Climate Change Policy* (Northwestern Faculty Working Paper 196, 2009), http://scholarlycommons.law.northwestern.edu/cgi/viewcontent.cgi?article=1195&context=facultyworkingpapers.

[84] Assoc. of Americans Resident Oversees, https://www.aaro.org/about-aaro/6m-americans-abroad. Admittedly 8 million is only 0.1% of the total population living outside the United States.

[85] *GNI, Atlas Method (Current US$)*, THE WORLD BANK, http://data.worldbank.org/indicator/NY.GNP.ATLS.CD.

[86] *Id*.

[87] U.S. Office of Management and Budget & Secretariat General of the European Commission, *Review of Application of EU and US Regulatory Impact Assessment Guidelines on the Analysis of Impacts on International Trade and Development* 13 (2008).

[88] Advanced Notice of Proposed Rulemaking on Regulating Greenhouse Gas Emissions Under the Clean Air Act, 73 Fed. Reg. 44,354, 44,415 (July 30, 2008) ("Furthermore, international effects of climate change may also affect domestic benefits directly and indirectly to the extent U.S. citizens value international impacts (e.g., for tourism reasons, concerns for the existence of ecosystems, and/or concern for others); U.S. international interests are affected (e.g., risks to U.S. national security, or the U.S. economy from potential disruptions in other nations).").

[89] In November 2013, OMB requested public comments on the social cost of carbon. In 2015, OMB along with the rest of the Interagency Working Group issued a formal response to those comments. Interagency Working Group on the Social Cost of Carbon, *Response to Comments: Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12,866* at 36 (July 2015) [hereinafter, OMB 2015 Response to Comments].

[90] NAS Second Report, at 12.

the developer of the DICE model, cautioned earlier this year that "regional damage estimates are both incomplete and poorly understood," and "there is little agreement on the distribution of the SCC by region."[91] In short, any domestic-only estimate will be inaccurate, misleading, and out of step with the best available economic literature, in violation of Circular A-4's standards for information quality.

Benefits and Costs that "Accrue to U.S. Citizens" Are Much Broader Than Effects "within U.S. Borders"

To the extent agencies are required to distinguish a portion of the global social cost of greenhouse gases that "accrue[s] to U.S. citizens" alone, agencies will need to analyze a much broader range of climate effects than those occurring "within U.S. borders." Circular A-4 instructs to estimate *all* important "opportunity costs," meaning "what individuals are willing to forgo to enjoy a particular benefit."[92] U.S. individuals are willing to forgo money to enjoy benefits or avoid costs from climate effects that occur beyond U.S. borders, and all such significant effects must be captured.[93]

International Spillovers: First, agencies may not ignore significant, indirect costs to trade, human health, and security likely to "spill over" to the United States as other regions experience climate change damages.[94] Due to its unique place among countries—both as the largest economy with trade- and investment-dependent links throughout the world, and as a military superpower—the United States is particularly vulnerable to effects that will spill over from other regions of the world. Spillover scenarios could entail a variety of serious costs to the United States as unchecked climate change devastates other countries. Correspondingly, mitigation or adaptation efforts that avoid climate damages to foreign countries will radiate benefits back to the United States as well.[95] While the current IAMs provide reliable but conservative estimates of global damages, they currently cannot calculate reliable region-specific estimates, in part because they do not model such spillovers.

As climate change disrupts the economies of other countries, decreased availability of imported inputs, intermediary goods, and consumption goods may cause supply shocks to the U.S. economy. Shocks to the supply of energy, technological, and agricultural goods could be especially damaging. For example, when Thailand—the world's second-largest producer of hard-drives—experienced flooding in 2011, U.S. consumers faced higher prices for many electronic goods, from computers to cameras.[96] A recent economic study explored how heat stress-induced reductions in productivity worldwide will ripple through the interconnected global supply network.[97] Similarly, the U.S. economy could experience demand shocks as climate-affected countries decrease their demand for U.S. goods. Financial markets may also suffer as foreign countries become less able to loan money to the United States and as the

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[91] William Nordhaus, *Revisiting the Social Cost of Carbon*, 114 PNAS 1518, 1522 (2017).

[92] Circular A-4 at 18.

[93] This section draws heavily from Howard & Schwartz (2017), *supra* note 33, and includes passages taken directly from that article (which was written by co-authors of these comments).

[94] Indeed, the integrated assessment models used to develop the global SCC estimates largely ignore inter-regional costs entirely. *See* Howard, *supra* note 52. Though some positive spillover effects are also possible, such as technology spillovers that reduce the cost of mitigation or adaptation, *see* S. Rao et al., *Importance of Technological Change and Spillovers in Long-Term Climate Policy*, 27 ENERGY J. 123-39 (2006), overall spillovers likely mean that the U.S. share of the global SCC is underestimated, *see* Jody Freeman & Andrew Guzman, *Climate Change and U.S. Interests*, 109 COLUMBIA L. REV. 1531 (2009).

[95] *See* Freeman & Guzman, *supra* note 94, at 1563-93.

[96] *See* Charles Arthur, *Thailand's Devastating Floods Are Hitting PC Hard Drive Supplies*, THE GUARDIAN, Oct. 25, 2011.

[97] Leonie Wenz & Anders Levermann, *Enhanced Economic Connectivity to Foster Heat Stress-Related Losses*, SCIENCE ADVANCES (June 10, 2016).

value of U.S. firms declines with shrinking foreign profits. As seen historically, economic disruptions in one country can cause financial crises that reverberate globally at a breakneck pace.[98]

The human dimension of climate spillovers includes migration and health effects. Water and food scarcity, flooding or extreme weather events, violent conflicts, economic collapses, and a number of other climate damages could precipitate mass migration to the United States from regions worldwide, especially, perhaps, from Latin America. For example, a 10% decline in crop yields could trigger the emigration of 2% of the entire Mexican population to other regions, mostly to the United States.[99] Such an influx could strain the U.S. economy and will likely lead to increased U.S. expenditures on migration prevention. Infectious disease could also spill across the U.S. borders, exacerbated by ecological collapses, the breakdown of public infrastructure in poorer nations, declining resources available for prevention, shifting habitats for disease vectors, and mass migration.

Finally, climate change is predicted to exacerbate existing security threats—and possibly catalyze new security threats—to the United States.[100] Besides threats to U.S. military installations and operations at home and abroad from flooding, storms, extreme heat, and wildfires,[101] Secretary of Defense Mattis has explained that "Climate change is impacting stability in areas of the world where our troops are operating today."[102] The Department of Defense's 2014 Defense Review declared that climate effects "are threat multipliers that will aggravate stressors abroad such as poverty, environmental degradation, political instability, and social tensions—conditions that can enable terrorist activity and other forms of violence," and as a result "climate change may increase the frequency, scale, and complexity of future missions, including defense support to civil authorities, while at the same time undermining the capacity of our domestic installations to support training activities."[103] As an example of the climate-security-migration nexus, prolonged drought in Syria likely exacerbated the social and political tensions that erupted into an ongoing civil war,[104] which has triggered an international migration and humanitarian crisis.[105]

Because of these interconnections, attempts to artificially segregate a U.S.-only portion of climate damages will inevitably result in misleading underestimates. Some experts on the social cost of carbon have concluded that, given that integrated assessment models currently do not capture many of these

[98] *See* Steven L. Schwarcz, *Systemic Risk*, 97 GEO. L.J. 193, 249 (2008) (observing that financial collapse in one country is inevitably felt beyond that country's borders).

[99] Shuaizhang Feng, Alan B. Krueger & Michael Oppenheimer, *Linkages Among Climate Change, Crop Yields and Mexico-U.S. Cross-Border Migration*, 107 PROC. NAT'L ACAD. SCI. 14,257 (2010).

[100] *See* CNA Military Advisory Board, *National Security and the Accelerating Risks of Climate Change* (2014).

[101] U.S. Gov't Accountability Office, GAO-14-446 *Climate Change Adaptation: DOD Can Improve Infrastructure Planning and Processes to Better Account for Potential Impacts* (2014); Union of Concerned Scientists, *The U.S. Military on the Front Lines of Rising Seas* (2016).

[102] Andrew Revkin, *Trump's Defense Secretary Cites Climate Change as National Security Challenge*, ProPublica, Mar. 14, 2017.

[103] U.S. Dep't of Defense, *Quadrennial Defense Review 2014* vi, 8 (2014).; see also U.S. Dep't of Defense, *Report to Congress: National Security Implications of Climate-Related Risks and a Changing Climate* (2015), *available at* http://archive.defense.gov/pubs/150724-congressional-report-on-national-implications-of-climate-change.pdf?source=govdelivery ("Global climate change will have wide-ranging implications for U.S. national security interests over the foreseeable future because it will aggravate existing problems—such as poverty, social tensions, environmental degradation, ineffectual leadership, and weak political institutions—that threaten domestic stability in a number of countries.")

[104] *See* Center for American Progress et al., *The Arab Spring and Climate Change: A Climate and Security Correlations Series* (2013); Colin P. Kelley et al., *Climate Change in the Fertile Crescent and Implications of the Recent Syrian Drought*, 112 PROC. NAT'L ACAD. SCI. 3241 (2014); Peter H. Gleick, *Water, Drought, Climate Change, and Conflict in Syria*, 6 WEATHER, CLIMATE & SOCIETY, 331 (2014).

[105] *See, e.g.*, *Ending Syria War Key to Migrant Crisis, Says U.S. General*, BBC.COM (Sept. 14, 2015).

key inter-regional costs, use of the global SCC may be further justified as a proxy to capturing all spillover effects.[106] Though surely not all climate damages will spill back to affect the United States, many will, and together with other justifications, the likelihood of significant spillovers makes a global valuation the better, more transparent accounting of the full range of costs and benefits that matter to U.S. policymakers and the public.

Reciprocal Foreign Actions: Second, an indirect consequence of the United States using a global social cost of greenhouse gas to justify actions that protect against climate damages is that foreign countries take reciprocal actions that benefit the United States. Circular A-4 requires that the "same standards of information and analysis quality that apply to direct benefits and costs should be applied to ancillary benefits and countervailing risks."[107] Consequently, any attempt to estimate a domestic-only value of the social cost of greenhouse gas must include indirect effects from reciprocal foreign actions.

As detailed more in Howard & Schwartz (2017), because the world's climate is a single interconnected system, the United States benefits greatly when foreign countries consider the global externalities of their greenhouse gas pollution and cut emissions accordingly. Game theory predicts that one viable strategy for the United States to encourage other countries to think globally in setting their climate policies is for the United States to do the same, in a tit-for-tat, lead-by-example, or coalition-building dynamic. In fact, most other countries with climate policies already use a global social cost of carbon or set their carbon taxes or allowances at prices above their domestic-only costs, consistent with the global perspective used to date by U.S. agencies to value the cost of greenhouse gases. Both Republican and Democratic administrations have recognized that the analytical and regulatory choices of U.S. agencies can affect the actions of foreign countries, which in turn affect U.S. citizens.[108]

According to one study, over the next fifteen years, direct U.S. benefits from global climate policies already in effect could reach over $2 trillion.[109] Any attempt to estimate a domestic-only value of the social cost of greenhouse gases must include such indirect effects from reciprocal foreign actions.

Extraterritorial Interests: Circular A-4 requires agencies to count all significant costs and benefits, and specifically explains the importance of including "non-use" values like "bequest and existence values": "ignoring these values in your regulatory analysis may significantly understate the benefits and/or costs of regulatory action."[110] Similarly, while Circular A-4 distinguishes altruism from non-use values, the guidance instructs agencies that "if there is evidence of selective altruism, it needs to be considered specifically in both benefits and costs."[111] Many costs and benefits accrue to U.S. citizens from use values, non-use values, and altruism attached to climate effects occurring outside the U.S. borders.

U.S. citizens have economic and other interests abroad that are not fully reflected in the U.S. share of global GDP. As explained above, GDP does not reflect significant U.S. ownership interests in foreign businesses, properties, and other assets, as well as consumption abroad including tourism, or even the 8 million Americans living abroad.

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[106] *See* Robert E. Kopp & Bryan K. Mignone, Circumspection, Reciprocity, and Optimal Carbon Prices, 120 CLIMATE CHANGE 831, 833 (2013).

[107] Circular A-4 at 26.

[108] Howard & Schwartz, *supra* note 33, at 232-37 (citing acknowledgement of this phenomenon by both the Bush administration and the Obama administration).

[109] Policy Integrity, *Foreign Action, Domestic Windfall: The U.S. Economy Stands to Gain Trillions from Foreign Climate Action* 11 (2015), http://policyintegrity.org/files/publications/ForeignActionDomesticWindfall.pdf

[110] Circular A-4 at 22.

[111] *Id.*

The United States also has a willingness to pay—as well as a legal obligation—to protect the global commons of the oceans and Antarctica from climate damages. For example, the Madrid Protocol on Environmental Protection to the Antarctic Treaty commits the United States and other parties to the "comprehensive protection of the Antarctic environment," including "regular and effective monitoring" of "effects of activities carried on both within and outside the Antarctic Treaty area on the Antarctic environment."[112] The share of climate damages for which the United States is responsible is not limited to our geographic borders.

Similarly, U.S. citizens value natural resources and plant and animal lives abroad, even if they never use those resources or see those plants or animals. For example, the "existence value" of restoring the Prince William Sound after the 1989 Exxon Valdez oil tanker disaster—that is, the benefits derived by Americans who would never visit Alaska but nevertheless felt strongly about preserving the existence of this pristine environment—was estimated in the billions of dollars.[113] Though the methodologies for calculating existence value remain controversial,[114] U.S. citizens certainly have a non-zero willingness to pay to protect rainforests, charismatic megafauna like pandas, and other life and environments existing in foreign countries. U.S. citizens also have an altruistic willingness to pay to protect foreign citizens' health and welfare.[115] This altruism is "selective altruism," consistent with Circular A-4, because the United States is directly responsible for most of the historic emissions contributing to climate change.[116]

NEPA Requires a Global Perspective

Circular A-4 cannot change agencies' statutory obligations. The National Environmental Policy Act contains a provision on "International and National Coordination of Efforts" that broadly requires that "all agencies of the Federal Government *shall* . . . recognize the worldwide and long-range character of environmental problems."[117] Using a global social cost of greenhouse gases to analyze and set policy fulfills these instructions. Furthermore, the Act requires agencies to, "where consistent with the foreign policy of the United States, lend appropriate support to initiatives, resolutions, and programs designed to maximize international cooperation in anticipating and preventing a decline in the quality of mankind's world environment."[118] By continuing to use the global social cost of greenhouse gases to spur reciprocal foreign actions, federal agencies "lend appropriate support" to the National Environmental Policy Act's goal of "maximize[ing] international cooperation" to protect "mankind's world environment."

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[112] Madrid Protocol on Environmental Protection to the Antarctic Treaty (1991), http://www.ats.aq/documents/recatt/Att006_e.pdf

[113] Richard Revesz & Michael Livermore, *Retaking Rationality* 121 (2008).

[114] *Id.* at 129.

[115] *See* Arden Rowell, *Foreign Impacts and Climate Change*, 39 Harvard Environmental Law Rev. 371 (2015); Dana, *supra* note 83 (discussing U.S. charitable giving abroad and foreign aid, and how those metrics likely severely underestimate true U.S. willingness to pay to protect foreign welfare).

[116] Datablog, *A History of CO_2 Emissions*, THE GUARDIAN (Sept. 2, 2009) (from 1900-2004, the United States emitted 314,772.1 million metric tons of carbon dioxide; Russia and China follow, with only around 89,000 million metric tons each).

[117] 42 U.S.C. § 4332(2)(f) (emphasis added).

[118] *Id.*; *see also Environmental Defense Fund v. Massey*, 986 F.2d 528, 535 (D.C. Cir. 1993) (confirming that Subsection F is mandatory); Natural Resources Defense Council v. NRC, 647 F.2d 1345, 1357 (D.C. Cir. 1981) ("This NEPA prescription, I find, looks toward cooperation, not unilateral action, in a manner consistent with our foreign policy."); *cf.* COUNCIL ON ENVIRONMENTAL QUALITY, GUIDANCE ON NEPA ANALYSIS FOR TRANSBOUNDARY IMPACTS (1997), *available at* http://www.gc.noaa.gov/documents/transguide.pdf; Exec. Order No. 12,114, *Environmental Effects Abroad of Major Federal Actions*, 44 Fed. Reg. 1957 §§ 1-1, 2-1 (Jan. 4, 1979) (applying to "major Federal actions . . . having significant effects on the environment outside the geographical borders of the United States," and enabling agency officials "to be informed of pertinent environmental considerations and to take such considerations into account . . . in making decisions regarding such actions").

Also of note, Circular A-4 implements Executive Order 12,866, but that Order has been supplemented by additional Orders. Executive Order 13,609, which remains in effect, recognizes that significant regulations can have "significant international impacts,"[119] and it calls on federal agencies to work toward "best practices for international regulatory cooperation with respect to regulatory development."[120] Therefore, for federal policies and actions with significant international effects, a global perspective on costs and benefits is appropriate and may be required.

4. Reliance on a 3% or Lower Discount Rate for Intergenerational Effects—or a Declining Discount Rate—Is Consistent with Circular A-4

In 2015, OMB explained that "Circular A-4 is a ***living document***. . . . [T]he use of ***7 percent is <u>not</u> considered appropriate*** for intergenerational discounting. There is wide support for this view in the academic literature, and it is recognized in Circular A-4 itself. "[121] While Circular A-4 tells agencies generally to use a 7% discount rate in addition to lower rates for typical rules,[122] the guidance does not intend for default assumptions to produce analyses inconsistent with best economic practices. Circular A-4 clearly supports using lower rates to the exclusion of a 7% rate for the costs and benefits occurring over the extremely long, 300-year time horizon of climate effects.

A 7% Discount Rate Is Not "Sound and Defensible" or "Appropriate" for Climate Effects

As quoted previously, Circular A-4 clearly requires agency analysts to do more than rigidly apply default assumptions: "You cannot conduct a good regulatory analysis according to a formula. Conducting high-quality analysis requires competent professional judgment."[123] Analysis must be "based on the best reasonably obtainable scientific, technical, and economic information available,"[124] and agencies must "***Use sound and defensible values*** or procedures to monetize benefits and costs, and ensure that key analytical assumptions are defensible."[125] Rather than assume a 7% discount rate should be applied automatically to every analysis, Circular A-4 requires agencies to justify the choice of discount rates for each analysis: "[S]tate in your report what assumptions were used, *such as . . . the discount rates* applied to future benefits and costs," and explain "clearly how you arrived at your estimates."[126] Based on Circular A-4's criteria, there are numerous reasons why applying a 7% discount rate to climate effects that occur over a 300-year time horizon would be unjustifiable.

First, basing the discount rate on the **<u>consumption rate of interest</u>** is the correct framework for analysis of climate effects; a discount rate based on the private return to capital is inappropriate. Circular A-4 does suggest that 7% should be a "default position" that reflects regulations that primarily displace capital investments; however, the Circular explains that "When regulation primarily and directly affects private consumption . . . *a lower discount rate is appropriate*."[127] The 7% discount rate is based on a private sector rate of return on capital, but private market participants typically have short time horizons. By contrast, climate change concerns the public well-being broadly. Rather than evaluating an

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[119] 77 Fed. Reg. at 26,414, § 3(b).

[120] *Id*. at 26,413, § 2(a)(ii)(B) (defining the goals of the regulatory working group).

[121] OMB 2015 Response to Comments, at 36.

[122] Circular A-4 at 36 ("For regulatory analysis, you should provide estimates of net benefits using both 3 percent and 7 percent….If your rule will have important intergenerational benefits or costs you might consider a further sensitivity analysis using a lower but positive discount rate in addition to calculating net benefits using discount rates of 3 and 7 percent.").

[123] *Id.* at 3.

[124] *Id.* at 17.

[125] *Id.* at 27.

[126] *Id.* at 3.

[127] *Id.* at 33.

optimal outcome from the narrow perspective of investors alone, economic theory requires analysts to make the optimal choices based on societal preferences and social discount rates. Moreover, because climate change is expected to largely affect consumption,[128] a 7% rate is inappropriate.

In 2013, OMB called for public comments on the social cost of greenhouse gases; in the 2015 Response to Comment document,[129] OMB (together with the other agencies from the IWG) explained that:

> [T]he consumption rate of interest is the correct concept to use . . . as the impacts of climate change are measured in consumption-equivalent units in the three IAMs used to estimate the SCC. This is consistent with OMB guidance in Circular A-4, which states that when a regulation is expected to primarily affect private consumption—for instance, via higher prices for goods and services—it is appropriate to use the consumption rate of interest to reflect how private individuals trade-off current and future consumption.[130]

The Council of Economic Advisers similarly interprets Circular A-4 as requiring agencies to choose the appropriate discount rate based on the nature of the regulation: "[I]n Circular A-4 by the Office of Management and Budget (OMB) the appropriate discount rate to use in evaluating the net costs or benefits of a regulation depends on whether the regulation primarily and directly affects private consumption or private capital."[131] The National Academies of Sciences also explained that a consumption rate of interest is the appropriate basis for a discount rate for climate effects.[132] In short, 7% is an inappropriate choice of discount rate for the impacts of climate change.

Second, **uncertainty over the long time horizon** of climate effects should drive analysts to select a lower discount rate. As an example of when a 7% discount rate is appropriate, Circular A-4 identifies an EPA rule with a 30-year timeframe of costs and benefits.[133] By contrast, greenhouse gas emissions generate effects stretching out across 300 years. As Circular A-4 notes, while "Private market rates provide a reliable reference for determining how society values time within a generation, but for extremely long time periods no comparable private rates exist."[134]

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[128] "There are two rationales for discounting future benefits—one based on consumption and the other on investment. The consumption rate of discount reflects the rate at which society is willing to trade consumption in the future for consumption today. Basically, we discount the consumption of future generations because we assume future generations will be wealthier than we are and that the utility people receive from consumption declines as their level of consumption increases. . . . The investment approach says that, as long as the rate of return to investment is positive, we need to invest less than a dollar today to obtain a dollar of benefits in the future. Under the investment approach, the discount rate is the rate of return on investment. If there were no distortions or inefficiencies in markets, the consumption rate of discount would equal the rate of return on investment. There are, however, many reasons why the two may differ. As a result, using a consumption rather than investment approach will often lead to very different discount rates." Maureen Cropper, *How Should Benefits and Costs Be Discounted in an Intergenerational Context?*, 183 RESOURCES 30, 33.

[129] Note that this document was not withdrawn by Executive Order 13,783.

[130] OMB 2015 Response to Comments, at 22.

[131] Council of Econ. Advisers, *Discounting for Public Policy: Theory and Recent Evidence on the Merits of Updating the Discount Rate* at 1 (CEA Issue Brief, 2017), *available at* https://obamawhitehouse.archives.gov/sites/default/files/page/files/201701_cea_discounting_issue_brief.pdf. In theory, the two rates would be the same, but "given distortions in the economy from taxation, imperfect capital markets, externalities, and other sources, the SRTP and the marginal product of capital need not coincide, and analysts face a choice between the appropriate opportunity cost of a project and the appropriate discount rate for its benefits." *Id.* at 9. The correct discount rate for climate change is the social return to capital (i.e., returns minus the costs of externalities), not the private return to capital (which measures solely the returns).

[132] NAS Second Report at 28.

[133] Circular A-4 at 34. See also OMB 2015 Response to Comments at 21 ("While most regulatory impact analysis is conducted over a time frame in the range of 20 to 50 years").

[134] Circular A-4 at 36.

Circular A-4 discusses how uncertainty over long time horizons drives the discount rate lower: "the longer the horizon for the analysis," the greater the "uncertainty about the appropriate value of the discount rate," which supports a lower rate.[135] Circular A-4 cites the work of respected economist Weitzman and concludes that the "certainty-equivalent discount factor corresponds to ***the minimum discount rate having any substantial positive probability***."[136] The National Academies of Sciences makes the same point about discount rates and uncertainty.[137]

Third, a 7% percent discount rate would be inappropriate for climate change because it is based on **outdated data and diverges from the current economic consensus**. Circular A-4 requires that assumptions—including discount rate choices—are "based on the best reasonably obtainable scientific, technical, and economic information available."[138] Yet Circular A-4's own default assumption of a 7% discount rate was published 14 years ago and was based on data from decades ago.[139] Circular A-4's guidance on discount rates is in need of an update, as the Council of Economic Advisers detailed earlier this year after reviewing the best available economic data and theory:

> The discount rate guidance for Federal policies and projects was last revised in 2003. Since then a general reduction in interest rates along with a reduction in the forecast of long-run interest rates, warrants serious consideration for a reduction in the discount rates used for benefit-cost analysis.[140]

In addition to recommending a value below 7% as the discount factor based on private capital returns, the Council of Economic Advisers further explains that, because long-term interest rates have fallen, a discount rate based on the consumption rate of interest "should be at most 2 percent,"[141] which further confirms that applying a 7% rate to a context like climate change would be wildly out of step with the latest data and theory. Similarly, recent expert elicitations—a technique supported by Circular A-4 for filling in gaps in knowledge[142]—indicate that a growing consensus among experts in climate economics for a discount rate between 2% and 3%; 5% represents the upper range of values recommended by experts, and few to no experts support discount rates greater than 5% being applied to the costs and

[135] Circular A-4 at 36.

[136] *Id.*; *see also* CEA, *supra* note 131, at 9: "Weitzman (1998, 2001) showed theoretically and Newell and Pizer (2003) and Groom et al. (2007) confirm empirically that discount rate uncertainty can have a large effect on net present values. A main result from these studies is that if there is a persistent element to the uncertainty in the discount rate (e.g., the rate follows a random walk), then it will result in an effective (or certainty-equivalent) discount rate that declines over time. Consequently, lower discount rates tend to dominate over the very long term, regardless of whether the estimated investment effects are predominantly measured in private capital or consumption terms (see Weitzman 1998, 2001; Newell and Pizer 2003; Groom et al. 2005, 2007; Gollier 2008; Summers and Zeckhauser 2008; and Gollier and Weitzman 2010)."

[137] NAS Second Report at 27.

[138] CEQ regulations implementing NEPA similarly require that information in NEPA documents be "of high quality" and states that "[a]ccurate scientific analysis . . . [is] essential to implementing NEPA." 40 C.F.R. § 1500.1(b).

[139] The 7% rate was based on a 1992 report; the 3% rate was based on data from the thirty years preceding the publication of Circular A-4 in 2003. Circular A-4 at 33.

[140] CEA, *supra* note 131, at 1; *id.* at 3 ("In general the evidence supports lowering these discount rates, with a plausible best guess based on the available information being that the lower discount rate should be at most 2 percent while the upper discount rate should also likely be reduced."); *id.* at 6 ("The Congressional Budget Office, the Blue Chip consensus forecasts, and the Administration forecasts all place the ten year treasury yield at less than 4 percent in the future, while at the same time forecasting CPI inflation of 2.3 or 2.4 percent per year. The implied real ten year Treasury yield is thus below 2 percent in all these forecasts.").

[141] *Id.* at 1.

[142] Circular A-4 at 41.

benefits of climate change.[143] Based on current economic data and theory, the most appropriate discount rate for climate change is 3% or lower.

Fourth, Circular A-4 requires more of analysts than giving all possible assumptions and scenarios equal attention in a sensitivity analysis; if alternate assumptions would fundamentally change the decision, Circular A-4 requires analysts to select the **most appropriate assumptions from the sensitivity analysis**.

Circular A-4 indicates that significant intergenerational effects will warrant a special sensitivity analysis:

> Special ethical considerations arise when comparing benefits and costs across generations. . . It may not be appropriate for society to demonstrate a similar preference when deciding between the well-being of current and future generations. . . If your rule will have important intergenerational benefits or costs you might consider a further sensitivity analysis using a lower but positive discount rate in addition to calculating net benefits using discount rates of 3 and 7 percent.[144]

Elsewhere in Circular A-4, OMB clarifies that sensitivity analysis should not result in a rigid application of all available assumptions regardless of plausibility. Circular A-4 instructs agencies to depart from default assumptions when special issues "call for different emphases" depending on "the sensitivity of the benefit and cost estimates to the key assumptions."[145] More specifically:

> If benefit or cost estimates depend heavily on certain assumptions, you should make those assumptions explicit and carry out *sensitivity analyses using plausible alternative assumptions*. If the value of net benefits changes from positive to negative (or vice versa) or if the relative ranking of regulatory options changes with alternative plausible assumptions, you should conduct further analysis to determine ***which of the alternative assumptions is more appropriate***.[146]

In other words, if using a 7% discount rate would fundamentally change the agency's decision compared to using a 3% or lower discount rate, the agency must evaluate which assumption is most appropriate. Since OMB, the Council of Economic Advisers, the National Academies of Sciences, and the economic literature all conclude that a 7% rate is inappropriate for climate change, agencies should select a 3% or lower rate. Applying a 7% rate to climate effects cannot be justified "based on the best reasonably obtainable scientific, technical, and economic information available" and is inconsistent with the proper treatment of uncertainty over long time horizons.

Alternatively, Use a Declining Discount Rate

Circular A-4 contemplates the use of declining discount rates in its reference to the work of Weitzman.[147] As the Council of Economic Advisers explained earlier this year, Weitzman and others developed the foundation for a declining discount rate approach, wherein rates start relatively higher for near-term costs and benefits but steadily decline over time according to a predetermined schedule

[143] Howard and Sylvan, *supra* note 61; M.A. Drupp, et al., *Discounting Disentangled: An Expert Survey on the Determinants of the Long-Term Social Discount Rate* (London School of Economics and Political Science Working Paper, May 2015) (finding consensus on social discount rates between 1-3%).

[144] Circular A-4 at 35-36.

[145] *Id.* at 3.

[146] *Id.* at 42.

[147] Circular A-4, at page 36, cites to Weitzman's chapter in Portney & Weyant, eds. (1999); that chapter, at page 29, recommends a declining discount rate approach: "a sliding-scale social discounting strategy" with the rate at 3-4% through year 25; then around 2% until year 75; then around 1% until year 300; and then 0% after year 300.

until, in the very long-term, very low rates dominate due to uncertainty.[148] The National Academies of Sciences' report also strongly endorses a declining discount rate approach.[149]

One possible schedule of declining discount rates was proposed by Weitzman.[150] It is derived from a broad survey of top economists and other climate experts and explicitly incorporates arguments around interest rate uncertainty. Work by Arrow *et al*, Cropper *et al*, and Gollier and Weitzman, among others, similarly argue for a declining interest rate schedule and lay out the fundamental logic.[151] Another schedule of declining discount rates has been adopted by the United Kingdom.[152]

However, as the Council of Economic Advisers notes, "there are technical difficulties with the declining discount rate approach that have yet to be fully addressed by economists."[153] OMB has similarly cautioned that there is not yet a consensus around which schedule to adopt for declining discount rates.[154] The Council of Economic Advisers therefore suggests that, in lieu of a declining discount rate, it is still appropriate "to pick a flat but somewhat lower discount-rate schedule for projects involving distant costs and benefits."[155]

If agencies are not yet confident that the economic literature supports a specific schedule for a declining discount rate, applying a 3% or lower rate to long-term climate effects remains the best practice.

5. **Circular A-4 requires plausible assumptions about uncertainty, which support higher estimates of the social cost of greenhouse gases.**

Circular A-4 requires thorough treatment of uncertainty around both values and outcomes,[156] and for especially large or complex matters it recommends a formal probabilistic analysis.[157] Generally, Circular

[148] CEA, *supra* note 131, at 9 ("[A]nother way to incorporate uncertainty when discounting the benefits and costs of policies and projects that accrue in the far future—applying discount rates that decline over time. This approach uses a higher discount rate initially, but then applies a graduated schedule of lower discount rates further out in time. The first argument is based on the application of the Ramsey framework in a stochastic setting (Gollier 2013), and the second is based on Weitzman's 'expected net present value' approach (Weitzman 1998, Gollier and Weitzman 2010). In light of these arguments, the governments of the United Kingdom and France apply declining discount rates to their official public project evaluations.").

[149] NAS Second Report at 242.

[150] Martin L. Weitzman, *Gamma Discounting*, 91 AM. ECON. REV. 260, 270 (2001). Weitzman's schedule is as follows:

1-5 years	6-25 years	26-75 years	76-300 years	300+ years
4%	3%	2%	1%	0%

[151] Kenneth J. Arrow et al., *Determining Benefits and Costs for Future Generations*, 341 SCIENCE 349 (2013); Kenneth J. Arrow et al., *Should Governments Use a Declining Discount Rate in Project Analysis?*, REV ENVIRON ECON POLICY 8 (2014); Maureen L. Cropper et al., *Declining Discount Rates*, AMERICAN ECONOMIC REVIEW: PAPERS AND PROCEEDINGS (2014); Christian Gollier & Martin L. Weitzman, *How Should the Distant Future Be Discounted When Discount Rates Are Uncertain?* 107 ECONOMICS LETTERS 3 (2010).

[152] Joseph Lowe, H.M. Treasury, U.K., Intergenerational Wealth Transfers and Social Discounting: Supplementary Green Book Guidance 5 (2008), *available at* http://www.hm-treasury.gov.uk/d/4(5).pdf. The U.K. declining discount rate schedule that subtracts out a time preference value is as follows:

0-30 years	31-75 years	76-125 years	126-200 years	201-300 years	301+ years
3.00%	2.57%	2.14%	1.71%	1.29%	0.86%

[153] CEA, *supra* note 131, at 9.

[154] OMB 2015 Response to Comments at 23.

[155] CEA, *supra* note 131, at 9.

[156] Circular A-4, at 42, requires probability distributions for "values as well for each of the outcomes"; the social cost of greenhouse gases is a value with a probability distribution.

[157] *Id.* at 41.

A-4 encourages agencies to disclose the full probability distribution of potential consequences, including both upper and lower bound estimates in addition to central estimates.[158]

However, this guidance comes with some caveats. First, this approach to central estimates and the probability distribution "is appropriate as long as society is 'risk neutral' with respect to the regulatory alternatives."[159] But if society is risk averse—as is the case with climate change[160]—different considerations need to be taken into account. Second, in 2011, the Office of Information and Regulatory Affairs interpreted Circular A-4's goal as "not to characterize the full range of *possible* outcomes . . . but rather the range of *plausible* outcomes."[161] Agency analysts must exercise judgment. Finally, as with all elements of agencies' economic analyses, Circular A-4 stresses that "Your analysis should be credible, objective, realistic, and scientifically balanced."[162]

Consequently, while it may be appropriate to disclose the full probability distribution of an uncertainty analysis, it is not appropriate under Circular A-4 to give a low-percentile estimate of the social cost of greenhouse gases equal weight in decision-making with the central and upper-percentile estimates. Giving equal attention to a low-percentile estimate is not "credible, objective, realistic, and scientifically balanced," does not reflect "plausible" scenarios, and would undermine consideration of risk aversion. Instead, a proper and plausible treatment of uncertainty in the context of climate change will support higher estimates of the social cost of greenhouse gases.

The estimates of the social cost of greenhouse gases used to date by federal agencies are a range of four estimates: three central or mean-average estimates at a 2.5%, 3%, and 5% discount rate respectively, and a 95th percentile value at the 3% discount rate. The Interagency Working Group's technical support documents did disclose fuller probabilities distributions, but those four estimates were chosen by agencies to be the focus for decision-making. In particular, application of the 95th percentile value was not part of an effort to show the probability distribution around the 3% discount rate; rather, the 95th percentile value serves as a methodological shortcut to approximate the uncertainties around low-probability but high-damage, catastrophic, or irreversible outcomes that are currently omitted or undercounted in the economic models.

The shape of the distribution of climate risks and damages includes a long tail of lower-probability, high-damage, irreversible outcomes, due to "tipping points" in planetary systems, inter-sectoral interactions, and other deep uncertainties. Climate damages are not normally distributed around a central estimate, but rather feature a significant right skew toward catastrophic outcomes. In fact, a 2015 survey of economic experts concludes that catastrophic outcomes increasingly seem likely to occur.[163] The integrated assessment models used to calculate the social cost of greenhouse gases are unable to

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[158] Circular A-4 at 18, 40; *id.* at 45 ("When you provide only upper and lower bounds (in addition to best estimates), you should, if possible, *use the 95 and 5 percent* confidence bounds.").

[159] *Id.* at 42.

[160] *See* Interagency Working Group on Social Cost of Carbon, Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12,866 at 11 (2010).

[161] Office of Information and Regulatory Affairs, *Regulatory Impact Analysis: A Primer* 2 (2011). This is best understood as drawing the line at insignificant or scientifically unsupported outcomes. By contrast, the low-probability but catastrophic potential outcomes of climate change are highly significant and the scientific literature demands giving them due attention.

[162] Circular A-4 at 39.

[163] Policy Integrity, *Expert Consensus on the Economics of Climate Change* 2 (2015), *available at* http://policyintegrity.org/files/publications/ExpertConsensusReport.pdf ("Experts believe that there is greater than a 20% likelihood that this same climate scenario would lead to a 'catastrophic' economic impact (defined as a global GDP loss of 25% or more)."). *See also* Pindyck, R. S. (2016). *The Social Cost of Carbon Revisited* (No. w22807). National Bureau of Economic Research.

systematically account for these potential catastrophic outcomes, and so a 95th percentile value is typically used instead to account for such uncertainty. There are no similarly systematic biases pointing in the other direction which might warrant giving weight to a low-percentile estimate.

Additionally, the 95th percentile value addresses the strong possibility of widespread risk aversion with respect to climate change. The integrated assessment models do not reflect that individuals likely have a higher willingness to pay to reduce low-probability, high-impact damages than they do to reduce the likelihood of higher-probability but lower impact damages with the same expected cost. Beyond individual members of society, governments also have reasons to exercise some degree of risk aversion to irreversible outcomes like climate change.

In short, the 95th percentile estimate attempts to capture risk aversion and uncertainties around lower-probability, high-damage, irreversible outcomes that are currently omitted or undercounted by the models. There is no need to balance out this estimate with a low-percentile value, because the reverse assumptions are not reasonable:

- There is no reason to believe the public or the government will be systematically risk seeking with respect to climate change.[164]
- The consequences of overestimating the risk of climate damages (i.e., spending more than we need to on mitigation and adaptation) are not nearly as irreversible as the consequences of underestimating the risk of climate damage (i.e., failing to prevent catastrophic outcomes).
- Though some uncertainties might point in the direction of lower social cost of greenhouse gas values, such as those around the development of breakthrough adaptation technologies, the models already account for such uncertainties around adaptation; on balance, most uncertainties strongly point toward higher, not lower, social cost of greenhouse gas estimates.[165]
- There is no empirical basis for any "long tail" of potential benefits that would counteract the potential for extreme harm associated with climate change.

Furthermore, emphasis on low-percentile values would have no support in the community of experts on climate economics. The existing estimates based on the 5% discount rate already provides a lower-bound; indeed, if anything the 5% discount rate is already far too conservative as a lower-bound. A recent survey of 365 experts on the economics of climate change found that 90% of experts believe a 3% discount rate or lower is appropriate for climate change; a 5% discount rate falls on the extremely high end of what experts would recommend.[166] Only 8% of the experts surveyed believe that the central estimate of the social cost of carbon is below $40, and 69% of experts believed the value should be at or

[164] As a 2009 survey revealed, the vast majority of economic experts support the idea that "uncertainty associated with the environmental and economic effects of greenhouse gas emissions increases the value of emission controls, assuming some level of risk-aversion." *See Expert Consensus, supra* note 163, at 3 (citing 2009 survey).

[165] *See* Richard L. Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 NATURE 173 (2014). R. Tol, *The Social Cost of Carbon*, 3 Annual Rev. Res. Econ. 419 (2011) ("[U]ndesirable surprises seem more likely than desirable surprises. Although it is relatively easy to imagine a disaster scenario for climate change—for example, involving massive sea level rise or monsoon failure that could even lead to mass migration and violent conflict—it is not at all easy to imagine that climate change will be a huge boost to human welfare.").

[166] *Expert Consensus, supra* note 163, at 21; *see also* Drupp, M.A., et al. *Discounting Disentangled: An Expert Survey on the Determinants of the Long-Term Social Discount Rate* (London School of Economics and Political Science Working Paper, May 2015) (finding consensus on social discount rates between 1-3%).

above the central estimate of $40.[167] Moreover, even the best existing estimates of the social cost of greenhouse gases are likely underestimated because the models currently omit many significant categories of damages—such as economic growth, pests, pathogens, erosion, air pollution, fire, energy supply, health costs, political conflict, and ocean acidification—and because of other methodological choices.[168] There is little to no support among economic experts to give weight to any estimate lower than the 5% discount rate estimate.

The National Academies of Sciences did recommend that the Interagency Working Group document its full treatment of uncertainty in an appendix and disclose low-probability as well as high-probability estimates of the social cost of greenhouse gases.[169] However, that does not mean it would be appropriate for individual agencies to rely on low-percentile estimates to justify decisions. While disclosing low-percentile estimates as a sensitivity analysis may promote transparency, relying on such an estimate for decision-making—in the face of contrary guidance from the best available science and economics on uncertainty and risk—would not be a "credible, objective, realistic, and scientifically balanced" approach to uncertainty.

More generally, agencies should remember that uncertainty is not a reason to abandon the social cost of greenhouse gas methodologies; rather uncertainty supports a higher estimates of the social cost of greenhouse gases, because most uncertainties about climate change entail tipping points, catastrophic risks, and unknown unknown about the damages of climate change.

6. Circular A-4 Requires Analyzing the Full 300-Year Time Horizon of Climate Effects

Circular A-4 instructs that the timeframe for agencies' analyses "should cover a period long enough to encompass all the important benefits and costs likely to result from the rule."[170] A-4 further explains that "[b]enefits and costs do not always take place in the same time period."[171] Importantly, the "ending point" for economic analysis should be set "far enough in the future to encompass all the significant benefits and costs likely to result from the rule."[172]

Opponents of climate regulation have complained in court that it is inconsistent to analyze 300 years' worth of climate effects when an agency's regulatory analysis looks at perhaps only 30 years' worth of compliance costs. In fact, there is no inconsistency with such an approach. For example, when the Department of Energy has set energy efficiency standards, it has analyzed all the consequences resulting from implementation over roughly a 30-year period (a typical expected life of appliances): all the compliance efforts over 30 years, all the consumer savings over 30 years, and all the greenhouse gas emissions over 30 years.[173] However, because greenhouse gases persists in the atmosphere for centuries, the climate benefits from reducing emissions over those 30 years will continue to accrue far beyond that time frame into the future. The U.S. Court of Appeals for the Seventh Circuit recently

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[167] *Expert Consensus, supra* note 163, at 18.

[168] *See* Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 NATURE 173 (2014); Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* (Cost of Carbon Project Report, 2014); Frances C. Moore & Delavane B. Diaz, *Temperature Impacts on Economic Growth Warrant Stringent Mitigation Policy*, 5 NATURE CLIMATE CHANGE 127 (2015) (demonstrating SCC may be biased downward by more than a factor of six by failing to include the climate's effect on economic growth).

[169] NAS First Report at 49 ("[T]he IWG could identify a high percentile (e.g., 90th, 95th) and corresponding low percentile (e.g., 10th, 5th) of the SCC frequency distributions on each graph.").

[170] Circular A-4 at 15.

[171] *Id.* at 31.

[172] *Id.*

[173] E.g., 79 Fed. Reg. at 17,779.

upheld the Department of Energy's approach that captured all the effects from 30 years of regulatory implementation, including the 300 years of climate costs and benefits that will accrue from those 30 years of emission changes.[174]

One state-level administrative judge (from Minnesota) reviewing the social cost of carbon expressed concern about the multiplying risk of calculation errors associated with very long time frames.[175] On the other hand, the Minnesota judge acknowledged that "a ton of CO2 released into the atmosphere will not be fully absorbed into the land or the oceans for a minimum of two hundred years," and noted that "a preponderance of the evidence demonstrates that CO2 will continue to have a cumulative impact on the climate for as long as it remains in the atmosphere."[176] Ultimately, the Minnesota judge recommended a 200-year time frame. However, more recent analysis by the highly respected National Academies of Sciences concludes that the effects of climate change over a 300-year period are well established in the scientific literature.

In 2017, NAS issued a report stressing the importance of a longer time horizon for calculating the social cost of greenhouse gases. The report states that, "[i]n the context of the socioeconomic, damage, and discounting assumptions, the time horizon needs to be long enough to capture the vast majority of the present value of damages."[177] The report goes on to note that the length of the time horizon is dependent "on the rate at which undiscounted damages grow over time and on the rate at which they are discounted. Longer time horizons allow for representation and evaluation of longer-run geophysical system dynamics, such as sea level change and the carbon cycle."[178] In other words, after selecting the appropriate discount rate based on theory and data (in this case, 3% or below), analysts should determine the time horizon necessary to capture all costs and benefits that will have important net present values at the discount rate. Therefore, a 3% or lower discount rate for climate change implies the need for a 300-year horizon to capture all significant values. NAS reviewed the best available, peer-reviewed scientific literature and concluded that the effects of greenhouse gas emissions over a 300-year period are sufficiently well established and reliable as to merit consideration in estimates of the social cost of greenhouse gases.[179]

The best available science and economics, as required by Circular A-4, thus supports a 300-year time horizon for climate effects.

7. Circular A-4 requires qualitative description of all omitted damages

Experts widely acknowledge that even the best existing estimates of the social cost of greenhouse gases are almost certainly underestimates of true global damages—perhaps severe underestimates.[180] Using

[174] Zero Zone v. Dept. of Energy, No. 14-2147, at 44 (7th Cir., Aug. 8, 2016).

[175] In the Matter of the Further Investigation into Environmental and Socioeconomic Costs Under Minnesota Statutes Section 216B.2422, Subdivision 3, VI.35. ("[w]hile the evidentiary underpinning is no greater for this extrapolation than it would be to extend the model to the year 2300, this approach [of using the 100-year time horizon] lessens the danger of multiplication of errors within the extrapolation while providing a response to the strong evidence of damage from CO_2."). The administrative judge also found that the IWG's prediction of damages beyond 2100 did not meet the same standard of reliability as the predictions from present to 2100. *Id.* at VI.32.

[176] *Id.* at VI.30-31

[177] NAS Second Report at 78.

[178] *Id.*

[179] NAS First Report at 32

[180] *See* Richard L. Revesz, Peter H. Howard, Kenneth Arrow, Lawrence H. Goulder, Robert E. Kopp, Michael A. Livermore, Michael Oppenheimer & Thomas Sterner, *Global Warming: Improve Economic Models of Climate Change*, 508 NATURE 173 (2014).

different discount rates; selecting different models; applying different treatments to uncertainty, climate sensitivity, and the potential for catastrophic damages; and making other reasonable assumptions could yield very different, and much larger estimates.[181] For example, a 2014 report found current social cost of carbon estimates omit or poorly quantify damages to the following sectors:

> agriculture, forestry, and fisheries (including pests, pathogens, and weeds, erosion, fires, and ocean acidification); ecosystem services (including biodiversity and habitat loss); health impacts (including Lyme disease and respiratory illness from increased ozone pollution, pollen, and wildfire smoke); inter-regional damages (including migration of human and economic capital); inter-sector damages (including the combined surge effects of stronger storms and rising sea levels); exacerbation of existing non-climate stresses (including the combined effect of the over pumping of groundwater and climate-driven reductions in regional water supplies); socially contingent damages (including increases in violence and other social conflict); decreasing growth rates (including decreases in labor productivity and increases in capital depreciation); weather variability (including increased drought and inland flooding); and catastrophic impacts (including unknown unknowns on the scale of the rapid melting of Arctic permafrost or ice sheets).[182]

Circular A-4 requires that "When there are important non-monetary values at stake, you should also identify them in your analysis."[183] Specifically, agencies must "Include a summary table that lists all the unquantified benefits and costs, and use your professional judgment to highlight (e.g., with categories or rank ordering) those that you believe are most important."[184] Agencies should therefore fully disclose the limitations of their social cost of greenhouse gas estimates and include detailed charts of any important, unquantified climate effects.

8. **The Information Quality Act Further Requires Agencies to Use the Best Available Data**

The Information Quality Act (IQA), also known as the Data Quality Act, was enacted in 2001, and further supports all the recommendations of these comments about basing estimates of the social cost of greenhouse gases on the best available science and economics.

The text of the IQA itself is brief; it calls upon the Office of Management and Budget (OMB) to prepare guidance for "ensuring and maximizing the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by Federal agencies," in fulfillment of the provisions of the Paperwork Reduction Act (35 U.S.C chapter 44).[185] It also requires that each agency create its own information quality guidelines to those ends.[186]

Like all other federal agencies, the Army Corps of Engineers, a component of the Department of Defense, is required to abide by the IQA. As described in further detail below, the IQA—as well as the agency-specific guidelines to which the Corps must adhere—requires the Corps to use the best available data, meaning data that is objective, accurate, complete, and reliable.

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[181] *Id.*; *see also* Joint Comments from Institute for Policy Integrity et al., to Office of Information and Regulatory Affairs, on the Technical Update of the Social Cost of Carbon, OMB-2013-0007-0085, Feb. 26, 2014.

[182] Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* 5 (Cost of Carbon Project Report, 2014), http://costofcarbon.org/.

[183] Circular A-4 at 3.

[184] *Id.* at 27.

[185] Consolidated Appropriations Act of 2001 § 515 (a).

[186] *Id.*

It is important to note that IQA guidelines are independently applicable as well as incorporated into Circular A-4, which says that agencies must "assure compliance with the Information Quality Guidelines for your agency."[187] Circular A-4 further goes on to say that "[t]he data and analysis that you use to support your rule must meet these agency and OMB [information] quality standards."[188]

The Corps follows the Department of Defense's guidelines, which are substantially similar to those issued by the OMB.[189] According to the agency's guidelines, the Corps must use information that "meets a basic level of quality."[190] The guidelines state that quality is comprised of three substantive conditions, information's "utility," "objectivity," and "integrity."[191]

Utility "[r]efers to the relevance and timeliness of information to its intended users." The guidelines also mandate that agency components, like the Corps, need "to consider the uses of the information not only from the perspective of the component but also from the perspective of the public" in assessing information.[192] Finally, the guidelines tell agency components that they must consider the "usefulness" of the information for its reasonable and expected application.[193]

The guidelines state that objectivity "[i]nvolves two distinct elements, presentation and substance."[194] That means that information has objectivity if it is "presented in an accurate, clear, complete and unbiased manner," as well as presented in the proper context.[195] In a scientific, financial, or statistical context, objectivity means that "the original and supporting data shall be generated, and the analytical results shall be developed, using sound statistical research methods,"[196] subject to "formal, independent, external peer review."[197] Moreover, "influential" scientific, financial, or statistical information must have "a high degree of transparency of data and methods...to facilitate the reproducibility of such information by qualified third parties."[198]

Finally, integrity of information "[r]efers to the security of information," which the guidelines define as whether the information is protected "from unauthorized access or revision, to ensure that the information is not compromised through corruption or falsification."[199]

For any analysis or risks to public health, safety or the environment, the Department of Defense guidelines also require the Corps and other agency components to adopt or adapt, as appropriate, the quality principles of the Safe Water Drinking Act of 1996.[200] The Safe Water Drinking Act principles state that, "to the degree that an Agency action is based on science," the agency shall use "the best available, peer-reviewed sciences and supporting studies conducted in accordance with sound and objective scientific practices," and "data collected by...best available methods."[201] For analysis of public health

[187] Circular A-4 at 17.
[188] *Id* at 43.
[189] 67 Fed. Reg. 8,452 et seq.
[190] Dept. of Defense, Ensuring the Quality of Information Disseminated to the Public by the Department of Defense, Policy and Procedural Guidance, 3.1.1.2.
[191] *Id*. at 3.2.2
[192] *Id.*, at definitions.
[193] *Id.* at 3.2.2
[194] *Id.* at 8.
[195] *Id.* at 8.1.
[196] *Id.* at 8.2.
[197] *Id.* at 8.2.1.
[198] *Id.* at 8.2.2.
[199] *Id.* at Definitions, 6.
[200] *Id.* at 3.2.3.3.
[201] 42 U.S.C. § 300g-1(b)(3)(A).

effects, information must be "comprehensive, informative, and understandable."[202] Furthermore, the agency must specify, to the extent practicable, "the expected risk or central estimate of risk for the specific populations; each appropriate upper-bound or lower-bound estimate of risk; [and] each significant uncertainty identified in the process of the assessment of public health effects and studies that would assist in resolving the uncertainty."[203]

Continuing to estimate the social cost of greenhouse gases using peer-reviewed models, a global perspective, a 3% or lower discount rate, and a 300-year time horizon will meet the Corps' requirements set forth in the IQA.

9. The Corps Should Monetize Methane as well as Carbon and Adjust for Yearly Increases

The Corps' use of an estimate of the social cost of carbon in its draft EIS is commendable. However, currently the Corps does not appear to be using the social cost of methane or the social cost of nitrous oxide. Additionally, the Corps seems to be using only a single estimate of the social cost of carbon, without considering how that estimate will grow over time or giving weight to higher estimates that better capture uncertainty, catastrophe, and risk aversion.

For example, Alternative 2 identified in the EIS would increase carbon dioxide emissions by over 121 million pounds annually (about 55,000 metric tons), as well as several thousands of pounds more in methane and nitrous oxide emissions; by comparison, Alternative 3 (the option preferred by the Corps) would decrease carbon dioxide emissions by 8 million pounds annually (about 3600 metric tons).[204] The Corps applied an estimate of the Social Cost of Carbon to partially monetize these effects, choosing the central estimate for present-year emissions at a 3% discount rate, or about $38 per metric ton of carbon dioxide.[205] Applying this metric to the Plan Alternatives' greenhouse gas effects, the Corps calculates that Alternative 2 would lead to climate costs totally over $2 million annually, while its preferred Alternative 3 would save about $138,000 in climate benefits annually.[206]

Monetize Methane and Nitrous Oxide Emissions

Based on the above calculations, it seems the Corps has only monetized the carbon dioxide emissions. However, estimates of the social cost of methane and the social cost of nitrous oxide also exist in the literature[207] and have been used by agencies.[208] All the reasons discussed above for applying the social cost of greenhouse gases generally also counsel in favor of monetizing non-carbon emissions. Since the Corps has already quantified the emissions of methane and nitrous oxide, monetization can be accomplished by simple multiplication.

[202] Id, § 300g-1(b)(3)(B).
[203] Id, § 300g-1(b)(3)(B)(ii, iii, iv).
[204] MRRMP DEIS at 3-336.
[205] *Id.* at 3-335.
[206] *Id.* at 3-336, 3-341.
[207] Marten, A.L., Kopits, E.A., Griffiths, C.W., Newbold, S.C., and A. Wolverton. 2015. Incremental CH4 and N2O Mitigation Benefits Consistent with the U.S. Government's SC-CO2 Estimates. Climate Policy. 15(2): 272-298.
[208] Emission Guidelines, Compliance Times, and Standards of Performance for Municipal Solid Waste Landfills, 80 Fed. Reg. 52,100 (proposed Aug. 27, 2015); Standards of Performance for Municipal Solid Waste Landfills, 80 Fed. Reg. 52,162 (Aug. 27, 2015); Oil and Natural Gas Sector: Emission Standards for New and Modified Sources, 80 Fed. Reg. 56,593 (Sept. 18, 2015); EPA, *Valuing Methane Emissions Changes in Regulatory Benefit-Cost Analysis, Peer Review Charge Questions, and Responses* (2015), http://www3.epa.gov/climatechange/pdfs/social%20cost%20methane%20white%20paper%20application%20and%20peer%20review.pdf.

Move Beyond a Single Estimate, to Account for Growing Damages over Time and Uncertainty

The same calculations discussed above further suggest that these climate effects would occur on an annual basis. However, the Corps has chosen only a single estimate of the social cost of greenhouse gases: based on the calculations, the Corps has chosen an estimate appropriate for roughly present-year emissions. The social cost of greenhouse gases in fact increases every year. Because carbon dioxide accumulates in the atmosphere over time and climate damages escalate as temperature rises, a ton of carbon dioxide emitted next year is marginally more damaging than one emitted today, and so the social cost estimates rise over time. Even if it not feasible for the Corps to calculate the entire future stream of greenhouse gas effects over the years, discounted back to net present value, the Corps should acknowledge that it is only monetizing greenhouse gases for a single year, and that increased emissions would be more costly and reductions would be more beneficial in future years.

Finally, the Corps should acknowledge that there is a range of social cost of greenhouse gas estimates, including a 95^{th}-percentile value that captures uncertainty, risk aversion, and the potential of catastrophic outcomes.

Sincerely,

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Does Environmental Regulation Kill or Create Jobs?

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Government regulation and deregulation are often framed as extensions of employment policy. Advocates of all stripes portray environmental regulation either as "killing" jobs or as the primary driver behind "green job" growth. This misleading framing is not supported by economic theory or evidence, and it distracts from policies that could actually create economic security for workers in the U.S. economy. Job impact models provide limited economic context and are easily manipulated; these limitations should be considered in any debates about regulation and jobs.

Regulations have little effect on aggregate employment or unemployment rates.

There is no consistent evidence that regulations contribute to long-term changes in the unemployment rate.[1] While some regulations could shift jobs from one sector to another, these sectoral or regional layoffs are often accompanied by hiring in other areas.[2] "Deregulation" presents the same issue: while some may claim extreme growth in jobs from removing regulations, any job growth in that named sector will likely be paired with job losses in another sector or region.

The best predictions by agencies estimate that regulations have very little effect on jobs. And any job effects tend to be dwarfed by the overall effects on public welfare. For example, EPA finalized a rule in 2011 to curb upwind sources from impairing air quality in downwind states. The agency estimated a onetime increase of +2,230 compliance-related job-years, equivalent to creating 2,230 one-year positions or 1,115 two-year positions. The annual net effect on the regulated industry was estimated at −1,000 to +3,000 jobs, with a central estimate of +700. By comparison, EPA estimated the rule would generate between $120 and $280 billion in annual net benefits, including up to 34,000 premature deaths avoided per year.[3] Note that this estimation includes short-term employment (compliance-related job-years) and longer-term employment.

While a regulatory or deregulatory action may create labor demand temporarily, it often does not affect long-term job growth.

For instance, the State Department estimated that construction of the Keystone XL pipeline would create 10,000 temporary jobs lasting only 4-8 months each,[4] and only 35 permanent jobs;[5] the project would not have a significant impact on long-term employment. Some advocates of the pipeline insist that 42,100 jobs would result from the project,[6] but provide no clarification on how many would be permanent, lasting jobs that would create economic security for workers. Similarly, President Trump recently claimed that 28,000 jobs would result from the project, without mention of how many of these jobs would be permanent.[7]

Job analysis models can easily be manipulated to predict either job losses or gains.

Economists use several types of models to estimate job impacts, and **most models rely on assumptions that drastically affect the results.** Input-output models use a number of simplifying assumptions to allow researchers to focus on employment results in particular sectors or regions. **Ideally, data going into these models would be collected from detailed surveys of manufacturers,[8] but in fact such data is often built around shortcuts that can undermine their reliability.[9] This type of modeling tends to overstate employment effects,[10]** as it assumes prices are constant and does not reflect long-term, structural changes to the economy like globalization and industrialization.[11]

Computable General Equilibrium models (CGEs) use the same data as input-output models, with all the attendant reliability issues. Unlike input-output models, CGEs allow for price changes and more complex interactions among economic sectors.[12] This complexity, while depicting a more accurate picture of the economy, also makes the model less transparent to a lay or policy audience. Since CGEs often do not explicitly define all their assumptions, the models are frequently characterized as "black boxes."[13] **Small tweaks to these often undisclosed assumptions can have large effects on results, allowing advocates to cherry-pick a set of assumptions in order to produce a result they want.**

In an advocacy context, job impact analyses using these models can tell very different stories, often depending on the narrator. **In one revealing example, the American Coalition for Clean Coal Electricity estimated that two EPA rules on power plant emissions would trigger a 1.4 million job *loss*; meanwhile, using a different model and different assumptions, the Political Economy Research Institute predicted the same two rules would generate a 1.4 million job *gain*.[14]** EPA estimated the total job impact of the two rules to be relatively small: a combined total of fewer than 50,000 one-time job gains and fewer than 9,000 jobs created annually.[15]

Both of these studies looked at limited parts of our dynamic economy. **Modeling layoffs or hiring in a particular sector cannot accurately capture the dynamic, economy-wide effects of a policy on aggregate employment levels.**

Because overall employment responds to large, macroeconomic factors like inflation and monetary policy, **individual environmental regulations will rarely have lasting effects on aggregate employment.**[16]

Models can tell us some information about redistribution in the workforce.

Environmental regulations are more likely to influence the geographic or sectoral distribution of employment opportunities, rather than national employment levels. Current employment models are better suited to measuring these effects than forecasting economy-wide consequences.[17] Even if aggregate, economy-wide demand for labor is not affected by a rule, a policy could expand employment opportunities in specific markets and have particularly significant benefits for workers—especially in areas in which the regional or local economy is depressed. Models can also show the specific sectors and regions experiencing layoffs due to economic shifts, helping identify where additional policy is needed to support those workers.[18] Such considerations need to be properly incorporated into the broader, existing mandates for regulatory impact analysis.[19]

Blocking regulation solely based upon job effects is bad economics, bad policy, and bad law.

Effects on employment are often small compared to the net social benefits of regulation. Well-designed rules can save the public money by preventing negative impacts before they happen, rather than mitigating expensive impacts after they happen. **The health benefits of an environmental rule, such as avoiding early mortality, are normally much larger than either the costs for industries to comply with the rule or the potential job impacts.**[20] For example, EPA proposed controls for hazardous air pollutants, such as mercury, from industrial boilers in 2010. EPA estimated the rule would generate between $25.2 and $65.5 billion in annual net benefits, including up to 8,000 premature deaths avoided per year. By comparison, the agency estimated a cumulative, net employment effect on the regulated industry of between −4,000 and +8,300 jobs, with a central estimate of +2,100.[21]

Even in cases like these, job impacts are important for the individuals affected and should be given appropriate weight in the decisionmaking process. Avoiding discussion of the public benefits of a regulation does not help these individuals, who also must bear the burden of under-regulation.

Regulations are poor tools for addressing the negative impacts from jobs shifting from one sector to another.

Other policies, like supporting technical job training for growing areas of the economy and tax policy that promotes economic growth, are tools that can help address distributional effects.[22] Repealing or blocking regulation solely based on potential job effects and ignoring their massive benefits to the public will neither save taxpayers money nor help U.S. workers.

Laws require agencies to evaluate a range of regulatory advantages and disadvantages, and not focus disproportionately on a single factor like layoffs and hirings. Agencies are required by various statutes to create rules advancing their policy missions. Some of these statutes require extensive cost-benefit analysis. Some statutes prohibit consideration of costs. Other statutes and judicial rulings encourage agencies to roughly weigh advantages and disadvantages. No statute, however, instructs agencies to avoid issuing even massively benefit-justified new regulations to prevent shifting any jobs from one sector to another.

When presented with claims about how regulation affects jobs, Congress and the media must ask these questions to understand the context of the claims.

What are the inputs and assumptions used in the model?

All models make simplifying assumptions. Changing the underlying assumptions of a model can dramatically change model results. **Any analysis that does not make its modeling choices public should be questioned**, and a request for that information should be made.

Do small changes in the above assumptions create large differences in outcomes?

One way to communicate the uncertainty associated with job impact analyses is to determine how sensitive model results are to any change in the model structure. A good analysis will show how model results change when the structure or underlying assumptions of a model change. This helps determine how robust (or reliable) the results of the model are, which aspects of the model are most strongly driving results, and what errors may exist in the model. **If sensitivity analysis is not conducted or is incomplete, this calls into question the results reported by the model.**

Does the model distinguish between the impacts of short-term and long-term unemployment?

When a worker quickly finds a new position after a layoff, it creates different stress than if the worker remains unemployed for a long time. Models determining the economic costs of layoffs should account for this difference between short-term and long-term unemployment. Short-term unemployment may create relatively minor costs for job search, relocation, and retraining. Long-term unemployment, by contrast, may entail more substantive costs, such as more intense retraining, long-term income and productivity effects, and negative health consequences. **Conflating these two distinct types of consequences in a job impact analysis leads to incorrect cost calculations and misleading rhetoric.**

Does the model clarify if new jobs are long-term or temporary?

Advocates may justify a project by declaring it will create several thousand jobs. **As in the Keystone Pipeline example, those several thousand jobs may last only a few months each and provide little economic security for workers.** If a job estimate is presented in “job years”, remember that this number presents an aggregate amount of labor demand, and likely temporary labor, rather than a number that can be linked to longer-term economic security for a set number of workers.

Has the model gone through independent review?

Ideally, analyses are peer reviewed or are at least replicable. Reports that have undergone peer review are usually more reliable than those that have not, if only because their assumptions and underlying data are likely to have been made available and tested. Requests to view the underlying information that goes into job analyses should be made in all cases.

What are the regulation's broader costs and benefits?

Environmental protection has a wide range of economic costs and benefits, including public health improvements and expenditures on pollution control technology. Regulation can also induce hiring and cause layoffs. These effects should be considered within the context of a complete cost-benefit analysis of a proposed rule. **In many cases, effects on employment are likely to be relatively small compared to both public health benefits and compliance costs.**

Endnotes

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10 Berck & Hoffman, *supra* note 8, 144-45.

11 Red Herring, *supra* note 2 at 12.

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13 Arvind Panagariya & Rupa Duttagupta, *The 'Gains' from Preferential Trade Liberalization in the CGE Model: Where Do They Come From?* 3 (Working Paper, 2001), *available at* http://www.columbia.edu/~ap2231/technical%20papers/cge-critique.pdf (noting that in the context of trade liberalization, "Unearthing the features of CGE models that drive [their results] is often a time-consuming exercise. This

is because their sheer size, facilitated by recent advances in computer technology, makes it difficult to pinpoint the precise source of a particular result. They often remain a black box. Indeed, frequently, authors are themselves unable to explain their results intuitively and, when pressed, resort to uninformative answers.")

14 James Heintz et al., Pol. Econ. Res. Inst. & Ceres, *New Jobs—Cleaner Air: Employment Effects under Planned Changes to the EPA's Air Pollution Rules* (2011); NERA Econ. Consulting & Am. Coalition for Clean Coal Electricity, *Proposed CATR + MACT* (2011).

15 Combining estimates for EPA's Interstate Transport Rule (gains of 2,200 one-time jobs and 700 annual jobs) and Utility Mercury and Air Toxics Rule (gains of 46,000 one-time jobs and 8,000 annual jobs). *See* EPA, Regulatory Impact Analysis of the Proposed Toxics Rule: Final Report (2011), *available at* http://www.epa.gov/ttn/atw/utility/ria_toxics_rule.pdf and Office of Air and Radiation, EPA, Regulatory Impact Analysis for the Federal Implementation Plans to Reduce Interstate Transport of Fine Particulate Matter and Ozone in 27 States (2011).

16 Red Herring *supra* note 2 at 11.

17 Red Herring *supra* note 2 at 11.

18 Red Herring *supra* note 2 at 9.

19 Red Herring *supra* note 2 at 6.

20 Jobs and Regulation, *supra* note 3 at 241.

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22 Jobs and Regulation, *supra* note 3 at 251.

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