February 13, 2023

To: Environmental Protection Agency

Submitted By: Center for Climate and Energy Solutions, Clean Air Task Force, Earthjustice, Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Montana Environmental Information Center, Natural Resources Defense Council, Sierra Club, Union of Concerned Scientists, Western Environmental Law Center

Subject: Comments on the Consideration of the Interagency Working Group's Social Cost of Greenhouse Gases Valuations in Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review (proposed Dec. 6, 2022) (Docket No. EPA–HQ–OAR–2021–0317)

The undersigned organizations respectfully submit the following comments[1] on the Environmental Protection Agency's application of the Interagency Working Group's ("Working Group") social cost of greenhouse gases valuations (namely the social cost of methane) in the above-caption proposed regulation ("Proposed Rule"),[2] and the draft Regulatory Impact Analysis accompanying that proposal ("RIA").[3] These organizations are submitting a separate comment letter to the docket addressing EPA's draft updated valuations to the social cost of greenhouse gases ("Draft Update"),[4] which EPA applies to the Proposed Rule in a sensitivity analysis. In this comment letter, we focus only on EPA's application of the Working Group's climate-damage valuations in its main analysis of the Proposed Rule.

The Proposed Rule appropriately applies the Working Group's social cost estimates and rejects the faulty numbers that EPA applied from 2017 until early 2021. The Working Group developed its social cost estimates through a rigorous and transparent process incorporating the

[1] Our organizations may separately and independently submit other comments to this docket. This document does not purport to represent the views, if any, of New York University School of Law.

[2] 87 Fed. Reg. 74,702 (proposed Dec. 6, 2022).

[3] EPA, Regulatory Impact Analysis of the Supplemental Proposal for the Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review (Nov. 2022) ("RIA").

[4] EPA External Review Draft of Report on the Social Cost of Greenhouse Gases (Sept. 2022) (Docket No. EPA-HQ-OAR-2021-0317) ("Draft Update"). As explained in that separate comment letter, the Draft Update faithfully implements the roadmap laid out in 2017 by the National Academies of Sciences and applies recent advances in the science and economics on the costs of climate change. While the Draft Update reflects an improvement over the Working Group's valuations, those Working Group valuations remain appropriate to apply for now as conservative underestimates. In particular, as explained in this document, criticisms from opponents of sensible climate policy that the Working Group's valuations are inappropriately high are entirely meritless. As reflected in the Draft Update, the precise opposite is true.

best available science available at the time. Those values—though widely agreed to underestimate the full social costs of greenhouse gas emissions,[5] as confirmed by the Draft Update's climate-damage valuations that are significantly higher—are appropriate to use for now as conservative estimates and have been applied in dozens of previous rulemakings[6] and upheld in federal court.[7] In contrast, the estimates that EPA and other federal agencies applied during the Trump administration disregarded the best available science and were rejected by a federal court as arbitrary and capricious.[8]

EPA provides compelling justifications for adopting the Working Group's estimates and can provide additional justifications for its policy choices on this consequential issue. In particular, **further justifications support EPA's decision to adopt a global damages valuation and for the range of discount rates it applies to climate effects**. As detailed herein, there are many additional legal, economic, and policy justifications for such methodological decisions that can further bolster EPA's support for these choices.

These comments are organized into three sections. Section I offers additional justification for adopting a global framework for valuing climate impacts. These include legal justifications based on the Clean Air Act, the National Environmental Policy Act's broad government-wide policy mandates, the Administrative Procedure Act's requirement to consider all important factors, and executive orders and international agreements. EPA can similarly strengthen its economic and policy justifications, such as by **more explicitly concluding that the theory and evidence for international reciprocity justify a focus on the full global values**. Moreover, EPA can offer extensive regulatory precedent for its global approach.

Section II offers additional justification for adopting the range of discount rates endorsed by the Working Group and for rejecting a 7% capital-based discount rate for climate impacts. In particular, **this section provides additional justification for combining climate effects discounted at an appropriate consumption-based rate with other costs and benefits discounted at a capital-based rate**. Besides climate effects presenting special legal, economic, and policy considerations for the discount rate, it is appropriate generally for EPA to focus its analysis of this rule on consumption-based rates given that most costs and benefits are projected to fall to consumption rather than to capital investments.

Finally, Section III offers extensive justification for relying on the Working Group's other methodological choices, including the fact that the Working Group applied a transparent and rigorous process that relied upon the best-available and most widely-cited models for monetizing climate damages. This section also provides detailed **rebuttals to criticisms of the Working Group's methodology** from opponents of climate regulation.

---

[5] Interagency Working Group on the Social Cost of Greenhouse Gases, Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide – Interim Estimates Under Executive Order 13,990 at 4 (2021) [hereinafter "2021 TSD"] (acknowledging that current social cost valuations "likely underestimate societal damages from [greenhouse gas] emissions"). Richard L. Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 NATURE 173 (2014) (explaining that the Working Group's values, though methodically rigorous and highly useful, are very likely underestimates) (co-authored with Nobel Prize-winning economist Kenneth Arrow).

[6] Peter Howard & Jason A. Schwartz, *Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon*, 42 COLUM. J. ENV'T L. 203, 270–84 (2017) (listing all uses through mid-2016).

[7] Zero Zone v. Dept. of Energy, 832 F.3d 654, 679 (7th Cir. 2016).

[8] California v. Bernhardt, 472 F. Supp. 3d 573, 613 (N.D. Cal. 2020).

I. Extensive Justification Supports EPA's Reliance on Global Climate Damage Valuations

In the Proposed Rule, EPA appropriately focuses on a global estimate of climate benefits, continuing its historical approach and once again rejecting its temporary and arbitrary practice during the Trump administration of disregarding all climate effects that occur outside the physical borders of the United States. While EPA offers persuasive justifications for this decision,[9] many additional justifications—some of which EPA itself provides in the Draft Update[10]—further support this approach.[11] In particular, EPA should emphasize the concern for the impacts of U.S. pollution on foreign welfare in the Clean Air Act and other sources of law, further highlight the significance of U.S. strategic interests and reciprocity, further emphasize the importance of extraterritorial impacts and spillovers, and highlight the inconsistency that would occur if the agency considered only domestic benefits while focusing on global costs.

A. Relevant Statutes and Executive Orders Compel, And Certainly Permit, a Global Perspective on Climate Damages

The Clean Air Act, National Environmental Policy Act, Administrative Procedure Act, and other key sources of law not only permit, but in fact require EPA to consider international effects. EPA should highlight these legal requirements as justification for its focus on global climate impacts.

Section 111 of the Clean Air Act, under which EPA issues the Proposed Rule, charges EPA with regulating "air pollution which may reasonably be anticipated to endanger public health or welfare,"[12] where "welfare" is defined to include "effects on . . . weather . . . and climate."[13] When interpreting similar language in Section 202 of the Clean Air Act, the Supreme Court found "there is nothing counterintuitive to the notion that EPA can curtail the emission of substances that are putting the *global* climate out of kilter."[14] And when industry challenged another EPA climate program under Title I of the Clean Air Act by arguing that the statute "was concerned about local, not global effects," the U.S. Court of Appeals for the D.C. Circuit had "little trouble disposing of Industry Petitioners' argument that the [Clean Air Act's prevention of significant deterioration] program is specifically focused solely on localized air pollution," finding instead that the statute was "meant to address a much broader range of harms," including "precisely the types of harms caused by greenhouse gases."[15]

A recent law-review article exhaustively reviewed the legislative history of the Clean Air Act's definition of "welfare" and concluded that "when Congress included the 'effects on . . .

---

[9] RIA at 69–70; *id.* at 76 n.73.

[10] Draft Update, *supra* note 4, at 10–15.

[11] *See generally* Jason A. Schwartz, Inst. for Pol'y Integrity, *Strategically Estimating Climate Pollution Costs in a Global Environment* (2021), https://policyintegrity.org/files/publications/Strategically_Estimating_Climate_Pollution_Costs_in_a_Global_Environment.pdf. *See also* EPA, Revised 2023 and Later Model Year Light Duty Vehicle GHG Emissions Standards: Regulatory Impact Analysis at 3-31 to 3-32 (Dec. 2021).

[12] 42 U.S.C. § 7411(b)(1)(A).

[13] 42 U.S.C. § 7602(h); *Massachusetts v. EPA*, 127 S. Ct. 1438, 1447 (2007).

[14] *Massachusetts,* 127 S. Ct. at 1461 (emphasis added). This case concerned Section 202 of the Clean Air Act, which similarly permits EPA to regulate "any air pollutant . . . which may reasonably be anticipated to endanger public health or welfare." *Id.* at 1454 (quoting 42 U.S.C. § 7521(a)(1)).

[15] Coalition for Responsible Regulation v. EPA, 684 F.3d 102, 137-38 (D.C. Cir. 2012), aff'd in part*, rev'd in part sub nom.* Util. Air Regulatory Grp. v. EPA, 134 S. Ct. 2427 (2014).

climate' language in the statute, it understood that adverse climate effects could occur on a global scale."[16] For instance, Senator Caleb Boggs, a Republican from Delaware and ranking minority member of the Public Works Subcommittee on Air and Water Pollution, which was considering the Clean Air Act in 1970, entered a report into the record stating that air pollution "alters climate and may produce global changes in temperature."[17] Senator Jennings Randolph of West Virginia likewise submitted a statement into the record explaining that U.S. air pollution could "produce unacceptable worldwide climate changes."[18] Congress's clear concern for the effects of domestic pollution on the global climate—many more examples of which are discussed in this law-review article—demonstrates that a global perspective is appropriate, if not required, when EPA regulates under the Clean Air Act.

This interpretation is further compelled by the National Environmental Policy Act ("NEPA"). Though best known for requiring agencies to prepare environmental impact statements before taking certain actions (a requirement that does not apply to Clean Air Act actions),[19] NEPA also much more broadly declares a national environmental policy and requires of all agencies that "to the fullest extent possible[,] the policies, regulations, and public laws of the United States *shall be interpreted and administered* in accordance with the policies set forth in this chapter,"[20] including the need to "recognize the worldwide and long-range character of environmental problems" and to "lend appropriate support" to help "maximize international cooperation."[21] In other words, especially because adopting a global perspective on climate damages will advance U.S. foreign policy goals (see the next subsection), NEPA requires EPA to interpret all of its laws, including the Clean Air Act, in ways that recognize the worldwide character of environmental problems. As EPA recognizes in the Draft Update,[22] using global social cost of greenhouse gas estimates helps fulfill that requirement. Likewise, in a recent guidance document, the Council on Environmental Quality highlighted this very statutory

[16] Richard L. Revesz, Bostock *and the End of the Climate Change Double Standard*, 46 COLUM. J. ENV'T L. 1, 9 (2020).

[17] *Id.* at 32–33.

[18] *Id.* at 33.

[19] While actions taken under the Clean Air Act "shall [not] be deemed a major Federal action significantly affecting the quality of the human environment within the meaning of [42 U.S.C. § 4332(2)(C)]," 15 U.S.C. § 793(c)(1), the other provisions of NEPA—including those quoted and cited in this paragraph—continue to apply.

[20] 42 U.S.C. § 4332(1) (emphasis added).

[21] *Id*. § 4332(2)(F); *see also* EDF v. Massey, 986 F.2d 528, 536 (D.C. Cir. 1993) ("Section 102(2)(F) further supports the conclusion that Congress, when enacting NEPA, was concerned with worldwide as well as domestic problems facing the environment. . . . Compliance with one of the subsections can hardly be construed to relieve the agency from its duty to fulfill the obligations articulated in other subsections."); NRDC v. NRC, 647 F.2d 1345, 1387 (D.C. Cir. 1981) (J. Robinson, concurring; J. Wilkey wrote for the Court, but there was no majority opinion) (concluding that even if a conflict with another statute prevents the agency from conducting an environmental impact statement, that "does not imply that NRC may ignore its other NEPA obligations," including the "provision for multinational cooperation" and the "policy of the United States with respect to the ecological well-being of this planet"; rather, the agency "should remain cognizant of this responsibility"); Greene County Planning Bd. v. Federal Power Comm'n, 455 F.2d 412, 424 (2d Cir. 1972) ("The Commission's 'hands-off' attitude is even more startling in view of the explicit requirement in NEPA that the Commission 'recognize the worldwide and long-range character of environmental problems' and interpret its mandate under the Federal Power Act in accordance with the policies set forth in NEPA.").

[22] Draft Update, *supra* note 4, at 15 n.37.

language to conclude that "it is most appropriate for agencies to focus on [social cost of greenhouse gases] estimates that capture global climate damages."[23]

Other key legal commitments compel this same conclusion. For instance, the United Nations Framework Convention on Climate Change—to which the United States is a party[24]—declares that national "policies and measures to deal with climate change should be cost-effective so as to *ensure global benefits* at the lowest possible cost."[25] The Convention further commits parties to evaluating global climate effects in their policy decisions, by "employ[ing] appropriate methods, for example *impact assessments* . . . with a view to minimizing adverse effects on the economy, on public health and on the quality of the environment, of projects or measures undertaken by them to mitigate or adapt to climate change."[26] The unmistakable implication of the Convention is that parties—including the United States—must account for global economic, public health, and environmental effects in their impact assessments. In 2008, a group of U.S. senators—including then-Senator John Kerry, who helped ratify the framework convention on climate change—agreed with this interpretation of the treaty language, saying that "[u]pon signing this treaty, the United States committed itself to considering the global impacts of its greenhouse gas emissions."[27]

And under the Administrative Procedure Act, it is arbitrary and capricious for agencies to "entirely fail[] to consider an important aspect of the problem"[28]—an obligation that a federal court held requires federal agencies to consider international climate impacts. Specifically, a recent ruling from the U.S. Court for the Northern District of California struck down as arbitrary the Bureau of Land Management's ("BLM") rescission of the Waste Prevention Rule in part because the agency had abandoned the Working Group's peer-reviewed, global estimates of the social cost of greenhouse gases in favor of flawed estimates (the same estimates that EPA applied under the Trump administration) that looked narrowly at effects within the U.S. borders.[29] The court found that the global values developed by the Working Group reflected "the best available science about monetizing the impacts of greenhouse gas emissions,"[30] whereas "focusing solely on domestic effects has been soundly rejected by economists as improper and unsupported by science."[31] The court reminded BLM that relevant executive orders, including Executive Order 12,866, require consideration of "all" costs and benefits, based on the "best

---

[23] Council on Env't Quality, National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change, 88 Fed. Reg. 1196, 1203 (Jan. 9, 2023).

[24] S. Treaty Doc. No. 102-38; S. Exec. Rept. No. 102-55.

[25] U.N. Framework Convention on Climate Change art. 3(3), May 9, 1992, 1771 U.N.T.S. 107 (emphasis added); *see also id.* art. 3(1) ("The Parties should protect the climate system for *the benefit of present and future generations of humankind, on the basis of equity* and in accordance with their common but differentiated responsibilities and respective capabilities.") (emphasis added); *id*. art. 4(2)(a) (committing developed countries to adopt policies that account for "the need for equitable and appropriate contributions by each of these Parties to the global effort").

[26] *Id*. art. 4(1)(f) (emphasis added); *see also id.* art. 3(2) (requiring parties to give "full consideration" to those developing countries "particularly vulnerable to the adverse effects of climate change"); *see also* North American Agreement on Environmental Cooperation art. 10(7), Jan. 1, 1994, 32 I.L.M. 1480 (committing the United States to the development of principles for transboundary environmental impact assessments).

[27] Comment Letter from U.S. Sens. Feinstein, Snowe, Nelson, Cantwell, Sanders, Kerry, Durbin, Reed, Boxer, & Cardin to Mary Peters, Sec'y, U.S. Dep't of Transp. on Proposed Rule for Average Fuel Economy Standards, Passenger Cars and Light Trucks; Model Years 2011–2015 (July 1, 2008).

[28] *Motor Vehicle Manufacturers Ass'n v. State Farm Mutual Auto. Ins. Co*., 463 U.S. 29, 41–43 (1983).

[29] *Bernhardt*, 472 F. Supp. 3d at 613.

[30] *Id.* at 611.

[31] *Id.* at 613.

reasonably obtainable scientific, technical, economic, and other information," and concluded that "no[] . . . regulatory rules or orders require exclusion of global impacts."[32]

More recently, Executive Order 13,990 instructed agencies to "tak[e] global damages into account," because "[d]oing so facilitates sound decision-making, recognizes the breadth of climate impacts, and support the international leadership of the United States on climate issues."[33] This language again reinforces the instructions from NEPA that, whenever not precluded by statute from doing so, agencies should account for the environmental impacts of their actions on foreign nations and global commons.

EPA should draw upon these legal authorities in justifying its reliance on global climate-damage valuations.

B. Focusing on Global Climate Damages Furthers U.S. Strategic Interests by Facilitating Reciprocity, Mitigating International Spillover Effects, and Protecting U.S. Extraterritorial Interests

EPA explains in both the regulatory impact analysis[34] and the Draft Update[35] that it is appropriate to value climate damages on a global scale because climate impacts occurring outside U.S. borders can directly and indirectly affect U.S. welfare through spillovers and foreign reciprocity. Indeed, the theory and evidence for reciprocity by itself justifies a focus on the full global values, and additional strategic and practical justifications provide further support for EPA's approach.

1. Use of the Global Values Facilitates International Reciprocity

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. It therefore promotes the strategic interests of the United States to encourage all other countries to think globally in setting their climate policies. The United States can advance this objective by itself adopting the full global social cost of greenhouse gases—as numerous leading climate economists and experts have explained.[36] Indeed, basic economic

---

[32] *Id.* at 611–12 (internal quotation marks omitted).

[33] Exec. Order No. 13,990 § 5(a), 86 Fed. Reg. 7037, 7040 (Jan. 20, 2021).

[34] RIA at 69–70.

[35] Draft Update, *supra* note 4, at 10–15.

[36] Most generally, it is individually rational for a country to fully internalize the global social cost of greenhouse gases "if a country expects a decrease in its own emissions to decrease that of all others in proportion to the ratio of its external cost of emissions to its internal costs." Matthew J. Kotchen, *Which Social Cost of Carbon? A Theoretical Perspective*, 5 J. ASSOC. ENV'T & RES. ECON. 673, 683 (2017). Other economists have justified use of the global social cost estimates on more intuitive grounds. *See, e.g.*, Tamma Carleton & Michael Greenstone, *Updating the United States Government's Social Cost of Carbon* at 26-27 (Becker Friedman Institute Working Paper 2021-04, Jan. 2021), https://perma.cc/H9EU-XWBX ("The global SCC . . . is an ingredient in efforts to procure the necessary international action. . . . Even if policymakers decide that the effects of regulations on U.S. citizens are what matter (in terms of both law and policy), it would make sense to use the global measure, as it would protect U.S. citizens against a range of adverse effects from unmitigated climate change."); William Pizer et al., *Using and Improving the Social Cost of Carbon*, 346 SCIENCE 1189, 1190 (2014) (explaining that the "potential to leverage foreign mitigation," combined with moral, ethical, and security issues, provide "compelling reasons to focus on a global SCC but, more important, to make a strategic choice."); Robert S. Pindyck, Comments on Proposed Rule and Regulatory Impact Analysis on the Delay and Suspension of Certain Requirements for Waste Prevention and Resource Conservation, Nov. 6, 2017, *available at* https://perma.cc/HG8Q-MT6H ("[W]hat treatment of international damages is in the United States' self-interest? . . . The simplest answer is to find the value of the [social

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[37]—likely trillions of dollars in direct benefits from foreign action to combat climate change.[38]

The Biden Administration has made such a strategic choice, to adopt a global valuation of climate damages as part of its diplomatic strategy. Executive Order 13,990 unequivocally states that "[i]t is essential that agencies capture the full costs of greenhouse gas emissions as accurately as possible, including by taking global damages into account . . . [to] support the international leadership of the United States on climate issues."[39] The Order later elaborates: "Our domestic efforts must go hand in hand with U.S. diplomatic engagement. Because most greenhouse gas emissions originate beyond our borders, such engagement is more necessary and urgent than ever. The United States must be in a position to exercise vigorous climate leadership in order to achieve a significant increase in global climate action and put the world on a sustainable climate pathway."[40]

There is already evidence that the U.S. strategy of combining its domestic efforts—including the global valuation of climate damages—with its diplomatic engagement is spurring foreign reciprocity. During the April 2021 "Leaders' Summit on Climate" hosted by the United States, following the announcement of a new U.S. commitment to reduce emissions to 50–52% below 2005 levels by 2030, multiple other countries reciprocally increased the ambition of their own climate targets. Notably, Japan accelerated its reduction goal from 26% to 46–50%; Canada strengthened its target from 30% to 40–45%; South Korea strengthened its target to achieve net zero emissions by 2050; China promised to peak coal use by 2025 and phase down coal consumption after that, and to join the Kigali Amendment to reduce hydrofluorocarbon emissions; Argentina pledged to strengthen its goal by 2.7% and make previously "conditional" targets "unconditional" instead; Brazil committed to a net zero target by 2050 (ten years earlier than its previous 2060 goal) and pledged to end illegal deforestation by 2030; South Africa shifted its emission peak ten years earlier, to 2025; and New Zealand, Bhutan, and Bangladesh all committed to submit more ambitious plans in the near future.[41]

This flurry of activity is just the latest evidence of reciprocity in international climate actions. Some past reciprocity has been explicit. The Kigali Amendment, for example, is the latest internationally negotiated climate treaty, with more than 120 parties so far committing to common but differentiated responsibilities to phase down hydrofluorocarbons.[42] Previously, under the Copenhagen Accord and the Paris Agreement, some parties, including the European Union and Mexico, have at times explicitly made conditional pledges, promising to ratchet up

---

cost of carbon] that maximizes global welfare. . . . I continue to think that the global value is the appropriate provisional value for use as research on this topic continues.").

[37] *See* Kotchen, *supra* note 36, at 678 (providing formulas for the "efficiency argument in support of all countries internalizing the GSCC [global social cost of carbon] for domestic policy").

[38] Inst. for Pol'y Integrity, *Foreign Action, Domestic Windfall: The U.S. Economy Stands to Gain Trillions from Foreign Climate Action* (2015), https://perma.cc/T3WN-H42U.

[39] Exec. Order No 13,990 § 5(a).

[40] *Id*. § 6(d). Though this subsection takes action on the Keystone XL Pipeline permit, its statement of diplomatic goals has much broader relevance.

[41] U.S. Dept. of State, Leaders' Summit on Climate: Day 1, Apr. 22, 2021, https://perma.cc/3X8A-KF4G; Climate Action Tracker, *Warming Projections Global Update: May 2021* at 3 (2021), https://perma.cc/7JYN-N2DU.

[42] *See* U.N., Kigali Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer (2016), https://perma.cc/SEX3-HAQA (last visited June 8, 2021).

their efforts if other countries make comparable reductions.[43] By contrast, when the United States "failed to take action to reduce greenhouse gas emissions during the George W. Bush Administration and during . . . the Trump Administration," as economist Michael Greenstone has testified before the U.S. House of Representatives, "both periods were characterized by little [international] progress, and indeed many instances of backsliding, in reducing emissions globally."[44] By failing to take international climate damages into account, in other words, EPA and other U.S. agencies would incentivize other countries to do the same, which in turn would cause greater greenhouse gas pollution originating in other countries that causes climate damage within the United States.

In January 2021, Trevor Houser and Kate Larsen published a conservative estimate of the number of tons of greenhouse gases that the rest of the world had committed to reduce for each ton that the United States has pledged to reduce: a figure they call the "Climate Reciprocity Ratio."[45] Using only the quantifiable, unconditional pledges that 51 countries had made since 2014 to cut emissions through 2030, Houser and Larsen conservatively estimate that for every ton the United States pledged to reduce, these other countries had collectively pledged to reduce 6.1–6.8 tons in return.[46] While implementation of all these foreign policies is not guaranteed, and while these estimates reflect pledges that may now be outdated, Houser and Larsen cite evidence that several large emitters are on track to meet their goals, and that the ratio should grow over time as the U.S. share of global emissions falls.[47]

In short, both empirical evidence and economic theory strongly support a strategic choice for U.S. agencies to adopt the full global estimates of the social cost of greenhouse gases, as this facilitates international reductions in greenhouse gas pollution that directly benefits the United States. EPA should provide current evidence of foreign reciprocity to further support its focus on the full global valuations of the social cost of greenhouse gases.

2. Use of the Global Values Recognizes Spillover Impacts from Climate Change

As EPA further recognizes, spillover impacts into the United States also support the use of global damage valuations.[48] Significant costs to trade, human health, and security will

---

[43] *See* Eur. Comm'n, Expression of Willingness to Be Associated with the Copenhagen Accord and Submission of the Quantified Economy-Wide Emissions Reduction Targets for 2020 at 2, Jan. 28, 2010, https://perma.cc/77DD-M4LS (committing to a 20% reduction but "reiterat[ing] its conditional offer to move to a 30% reduction by 2020 compared to 1990 levels, provided that other developed countries commit themselves to comparable emission reductions and that developing countries contribute adequately according to their responsibilities and respective capabilities"); Gov't of Mex. Ministry of Env't & Nat. Res., Nationally Determined Contributions: 2020 Update at 22, https://perma.cc/VF4A-K5HK (making an unconditional pledge of 22% reduction of GHGs and 51% of black carbon by 2030; and making a conditional pledge of up to 36% reduction GHGs and 70% black carbon, conditioned on "an international price for carbon trading, adjustment of tariffs for carbon content" as well as technology transfers and financial resources).

[44] Economics of Climate Change: Hearing before the U.S. H. Comm. on Oversight & Reform's Subcomm. on Env't at 6 (Dec. 19, 2019) (testimony of Michael Greenstone), *available at* https://perma.cc/H5JS-V4H6.

[45] Trevor Houser & Kate Larsen, Rhodium Grp., *Calculating the Climate Reciprocity Ratio for the U.S.* (2021), https://perma.cc/7MJ8-DN23 (calling their estimate "deliberately conservative").

[46] The estimate is conservative because it omits any conditional pledges, any pledges that are not readily quantified into specific reductions, any actions from countries that have not formally submitted Nationally Determined Contributions to the United Nations, any reductions occurring after 2030, and any foreign actions already achieved before 2014 that may have motivated U.S. pledges in the first place. *Id.*

[47] *Id.*

[48] RIA at 69; *see also* Draft Update, *supra* note 4, at 11–13.

inevitably "spill over" to the United States as other regions of the planet experience climate change damages.[49] 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. The use of global damage values recognizes these spillover effects, which were ignored under the Trump administration's domestic-only valuation.

These spillover effects take many forms. In terms of trade-related impacts, for one, as climate change disrupts the economies of other countries, decreased availability of imported inputs, intermediary goods, and consumption goods will cause supply shocks to the U.S. economy, causing particularly damaging disruptions in sectors such as agriculture and technology. Similarly, the U.S. economy will experience demand shocks as climate-affected countries decrease their demand for U.S. goods. U.S. trade and businesses that rely on foreign-owned infrastructure, services, and resources will suffer.[50] Financial markets will also suffer as foreign countries become less able to loan money to the United States and as the 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.[51]

Climate change is also predicted to exacerbate existing security threats—and possibly catalyze new security threats—to the United States.[52] Besides threats to U.S. military installations and operations at home and abroad from flooding, storms, extreme heat, and wildfires,[53] climate change is also a "source[] of conflict around the world"[54] and a "threat multiplier" that, as recognized by the Department of Defense, 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."[55] Climate change will create and exacerbate new conflicts and humanitarian crises that will require a U.S. response, even as climate change also complicates the logistics of deploying forces and achieving missions.

Climate change will also very directly cause spillover damages across transboundary resources. The United States has already begun to experience increased smoke from Canadian wildfires and drought conditions that spread along the U.S.-Mexico border.[56] The United States shares a maritime border with 21 other countries, shares water resources like the Columbia River

[49] 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 climate spillovers are likely strongly negative, *see* Jody Freeman & Andrew Guzman, *Climate Change and U.S. Interests*, 109 COLUM. L. REV. 1531 (2009).

[50] U.S. Global Change Res. Prog., Fourth National Climate Assessment, Volume II: Impacts, Risks, and Adaptation in the United States, Chapter 16: Climate Effects on U.S. International Interests 608 (2018) [hereinafter "NCA4"].

[51] *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).

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

[53] U.S. Gov't Accountability Off., 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).

[54] U.S. Dep't of Def., Report on Effects of a Changing Climate to the Department of Defense 8 (2019), *available at* https://perma.cc/4WPP-86EN.

[55] U.S. Dep't of Def., Quadrennial Defense Review 2014 at vi, 8 (2014).

[56] NCA4, *supra* note 50, at 607.

with our neighbors, and shares ecosystems—including the oceans through which migratory species with high economic and ecosystem-service values, like the Pacific hake, travel and live.[57]

All of these individual spillover effects can also interact and trigger feedback loops that will propagate additional spillover damages.[58] Economic shocks around the world can make it more difficult for other countries to continue investing in mitigation and abatement, thus hastening the pace of climate change.[59] Conflict and political instability caused by climate change can further reduce the willingness or ability of countries to engage in domestic climate policy or international cooperation.[60] Spillover effects can chain together: if climate change accelerates migration, the attendant economic ripple effects and spread of health risks may cause political instability, which in turn can cause more migration and further economic ripple effects, thus starting the feedback loop again.[61]

Experts on the social cost of greenhouse gases have therefore concluded that, because the integrated assessment models that underlie the Working Group's social cost valuations currently do not capture many of these key inter-regional costs, the use of the global values can be further justified as a proxy for capturing all spillover effects.[62] Though 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. EPA can therefore highlight spillover impacts as further justification for relying on global social cost valuations. In addition to the spillover effects that EPA already mentions,[63] EPA should further argue that transboundary spillovers, feedback loops, information spillovers, and other effects

---

[57] *Id.* at 615.

[58] Peter Howard & Michael Livermore, *Climate-Society Feedback Effects: Be Wary of Unidentified Connections*, INTL. REV. ENV'T & RES. ECON. (forthcoming 2021).

[59] Peter Howard & Michael A. Livermore, *Sociopolitical Feedbacks and Climate Change*, 43 HARV. ENV'T L. REV. 119, 122-23 (2019).

[60] *Id.*

[61] NCA4, *supra* note 50, at 621 (explaining that instability has economic effects, and economic risks create risk of conflict); Freeman & Guzman, *supra* note 49, at 1581–89; *id.* at 1581 (noting that climate-induced pandemics may cause political instability); *id.* at 1564 n.157 (noting that cross-sectoral interactions will "reinforce" international spillovers and create "a costly multiplier effect"). Howard & Livermore, *supra* note 58.

[62] Robert E. Kopp & Bryan K. Mignone, *Circumspection, Reciprocity, and Optimal Carbon Prices*, 120 CLIMATE CHANGE 831, 833 (2013) (2013) (explaining that the principle of "circumspection" can account for spillover effects and can then be used to justify a global SC-GHG value).

Notably, in Katharine Ricke et al., *Country-Level Social Cost of Carbon*, 8 NATURE CLIMATE CHANGE 895 (2018), the authors concede that after factoring in spillovers and other considerations, an individual country's interests may be better reflected in a global valuation than a country-specific valuation, and it may not be appropriate to use a country-specific valuation in setting climate policies:

> Globalization and the many avenues by which the fortunes of countries are linked mean that a high CSCC in one place may result in costs as the global climate changes even in places where the CSCC is nominally negative. For many countries, the effects of climate change may be felt more greatly through transboundary effects, such as trade disruptions, large-scale migration, or liability exposure than through local climate damage. . . . These considerations suggest that country-level interests may be *more closely aligned to global interests than indicated by contemporary country-level contributions* to the SCC. . . . [A] host of other *strategic and ethical considerations* factor into the international relations of climate change mitigation. . . . We make no claim here regarding the utility of the CSCC in setting climate policies. CO_2 emissions are a global externality.

Id. at 899 (emphases added).

[63] RIA at 69 (citing trade, tourism, economic spillovers, political destabilization, and global migration).

justify a focus on the full global values, either independently or in combination with other strategic and ethical considerations.[64]

3. Use of the Global Values Preserves Extraterritorial Interests

The RIA highlights direct and indirect impacts on U.S. citizens and assets located abroad as a justification for a global valuation,[65] but U.S. extraterritorial interests are even more extensive and significant. A domestic-only estimate of the social cost of greenhouse gases 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, including impacts to significant U.S. ownership interests in foreign businesses, properties, and other assets, as well as U.S. consumption abroad including tourism,[66] and even effects to the millions of Americans living abroad.[67] The United States also has military personnel and assets located in almost every nation across the globe, and many if not all installations abroad—including those with high replacement costs or irreplaceable strategic value—face imminent climate risks.[68] Because no methodology for estimating a "domestic-only" value would capture these impacts to extra-territorial interests, focusing on the global values can be further justified in part as a proxy for these important considerations.

The Office of Management and Budget's *Circular A-4* guidance on conducting regulatory impact analysis requires agencies to count all significant costs and benefits, including "use" values as well as "non-use" values like bequest and existence values.[69] *Circular A-4* cautions that "ignoring these values" may cause analyses to "significantly understate the benefits and/or costs" involved.[70] Similarly, *Circular A-4* recognizes that U.S. citizens may have "altruism for the health and welfare of others," and instructs agencies that when "there is evidence of selective altruism, it needs to be considered specifically in both benefits and costs."[71] U.S. citizens will experience costs because of their use values, non-use values, and altruistic values attached to climate effects occurring outside the U.S. borders.

Such non-use and altruistic values take many forms. For one, the United States and its citizens have a willingness to pay—as well as a legal obligation—to protect the global commons of the oceans and Antarctica from climate damage. Furthermore, a quarter of the U.S. population consists of either foreign-born immigrants or second-generation residents,[72] and subsequent

---

[64] *See* Schwartz, *supra* note 11, at 26; *id.* at 12 (on information spillovers).

[65] RIA 69.

[66] "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* 10 (Northwestern Faculty Working Paper 196, 2009), https://perma.cc/EW3B-NKYC.

[67] 2021 TSD, *supra* note 5, at 15 (citing a 2016 figure from Bureau of Consular Affairs, Dept. of State); *see also* Dept. of State, Consular Affairs by the Numbers (2020), https://perma.cc/F3M8-EFSJ.

[68] Ctr. for Climate & Sec., Military Expert Panel Report: Sea Level Rise and the U.S. Military's Mission 7 (2d ed. 2018), https://perma.cc/ZM4R-ED89.

[69] A bequest value captures willingness to pay to preserve a resource for a future generation. Existence value captures willingness to pay to preserve a resource even with no intention to ever use or bequeath the resource. Off. of Mgmt. & Budget, Circular A-4: Regulatory Analysis 22 (2003).

[70] *Id*.

[71] *Id.*

[72] U.S. Census Bureau, Characteristics of the U.S. Population by Generational Status: 2013 at 3 (2016), https://perma.cc/AS3H-BCWK; *see also* Pew Res. Ctr., *First- and second-generation share of the population, 1900-2017*, June 3, 2019, https://perma.cc/Y9WT-75R4 (showing a growing percentage in recent years); *see also* Pew

generations of Americans retain significant familial, cultural, economic, and religious ties to their ancestors' home nations across the world.[73] U.S. citizens and residents have a significant willingness to pay to protect their relatives, ancestral homes, and cultural and religious sites located abroad.[74] Similarly, U.S. citizens value natural resources and plant and animal lives abroad—even if they never see or use those resources—and care about the health and welfare of unrelated foreign citizens[75] and cultural and world heritage sites threatened by climate change.[76] This altruism is "selective altruism," consistent with *Circular A-4*, because the United States is directly responsible for a huge amount of the historic emissions contributing to climate change.[77]

Both strategic considerations and the need to account for spillovers already provide independent justifications for focusing on the full global social cost of greenhouse gas estimates. But the global values can also be at least partly justified as a proxy for these extra-territorial interests that otherwise would be overlooked using a domestic-only damage estimate. EPA can therefore further highlight U.S. extraterritorial interests as additional justification for relying on global social cost valuations, and can specifically call attention to climate-vulnerable U.S. military installations abroad with high replacement costs or irreplaceable strategic value, U.S. willingness to pay to protect relatives, ancestral homes, cultural and religious sites, and natural resources located abroad, and U.S. altruism toward the people, animals, and natural habitats across the globe.

C. Focusing on Global Climate Damages Is Consistent With EPA's Consideration of Global Costs

EPA can further justify its focus on global climate benefits as necessary for consistency with the rest of its analysis. In particular, EPA's analysis implicitly takes a global perspective on compliance costs, and so it would be arbitrary not to similarly take a global perspective on climate effects.

All industry compliance costs ultimately fall on the owners, employees, or customers of regulated and affected firms. Whether the Proposed Rule's compliance costs are passed to consumers or investors, or some combination thereof, a significant portion of the Proposed

---

Res. Ctr., Key Findings About U.S. Immigration, Aug. 20, 2020, https://perma.cc/8JEK-Y88S (showing that 77% of the U.S. foreign-born population are naturalized U.S. citizens or permanent/temporary U.S. residents).

[73] Over $100 billion is sent from the United States to other countries in remittances every year. *See* Pew Res. Ctr., *Remittance Flows Worldwide in 2017*, Apr. 3, 2019, https://perma.cc/D684-7ZA8.

[74] Many cultural sites are located near water because of how civilization developed, Yu Fang & James W. Jawitz, *The evolution of human population distance to water in the USA from 1790 to 2010*, 10 NATURE COMMUNICATIONS 1 (2019), and so such sites may be especially vulnerable to climate change, *see* Lee Bosher et al., *Dealing with multiple hazards and threats on cultural heritage sites: an assessment of 80 case studies*, 29 DISASTER PREVENTION AND MANAGEMENT: AN INTERNATIONAL JOURNAL 109 (2019). More broadly, there are clear cultural costs of climate change, W. Neil Adger et al., *Cultural dimensions of climate change impacts and adaptation*, 3 NATURE CLIMATE CHANGE 112 (2013), and a willingness to pay to protect culture, Ali Ardeshiri et al., *Conservation or Deterioration in Heritage Sites? Estimating Willingness To Pay for Preservation* (Working Paper, 2019).

[75] *See* Arden Rowell, *Foreign Impacts and Climate Change*, 39 HARV. ENV'T L. REV. 371 (2015); Dana, *supra* note 66 (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).

[76] *See* UNESCO, *Climate Change Now Top Threat to Natural World Heritage*, Dec. 2, 2020, https://perma.cc/K9SW-XQDM.

[77] 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).

Rule's alleged compliance costs will ultimately accrue to foreign customers or foreign investors. Regulated manufacturers include major corporations that are headquartered abroad or that are publicly traded with investors across the globe.[78] In general, about 29% of U.S. corporate debt and 14% of equities are foreign-owned,[79] and adding foreign direct investment to portfolio stock ownership suggests that foreigners own about 40% of U.S. corporate equity.[80] These patterns largely hold true for the oil and gas industry.[81] Thus, a significant share of the Proposed Rule's compliance costs are likely to fall on foreign entities, but EPA never distinguishes between those costs that would accrue to foreign entities as opposed to U.S. citizens or U.S. entities. Thus, the agency's calculations of cost implicitly include all global effects. Considering global climate benefits is consistent with that approach.

In a few recent analyses, agencies including EPA have admitted that some portion of the costs or cost savings calculated for publicly-traded corporations will "accru[e] to entities outside U.S. borders" through foreign ownership, employment, or consumption.[82] Yet much like in the Proposed Rule, these analyses do not attempt to separate such effects to foreign interests, nor attempt to exclude such effects from consideration altogether. Indeed, splitting corporate effects into subparts based on ultimate ownership—much like separating climate benefits geographically—could be extremely complicated.[83] Thus, as a practical matter, agencies typically count all costs or benefits to corporations, no matter how those effects may be passed through to foreign owners, foreign employees, or foreign customers.

Since EPA analyzes the Proposed Rule's costs globally—without distinguishing between U.S. and foreign effects—it would be inconsistent and arbitrary for the agency to attempt to separate and disregard climate benefits that occur abroad, as doing so would "put a thumb on the scale" by treating costs globally but benefits domestically.[84] EPA can therefore highlight its consistent treatment of costs and benefits as further justification for assessing climate damages from a global perspective.

---

[78] For instance, BP is based in the United Kingdom. Shell Oil is a subsidiary of Royal Dutch Shell, which is headquartered in the Netherlands and incorporated in the United Kingdom. Yet in the Proposed Rule, EPA does not distinguish between compliance costs that would fall upon British investors, Dutch investors, or American investors.

[79] Dept. of Treasury et al., *Foreign Portfolio Holdings of U.S. Securities* at B-3 (2020), https://perma.cc/6VP6-PPG6.

[80] Steve Rosenthal & Theo Burke, *Who's Left to Tax? U.S. Taxation of Corporations and Their Shareholders* at 2 (Urban-Brookings Tax Policy Center Working Paper, 2020), https://perma.cc/YMR2-XREM.

[81] *See* Energy Info. Admin., Foreign Investors Play Large Role in U.S. Shale Industry, https://www.eia.gov/todayinenergy/detail.php?id=10711 (Apr. 8, 2013) ("Since 2008, foreign companies have entered into 21 joint ventures with U.S. acreage holders and operators, investing more than $26 billion in tight oil and shale gas plays.").

[82] *See, e.g.*, EPA, Regulatory Impact Analysis for the Proposed Reconsideration of the Oil and Natural Gas Sector Emission Standards for New, Reconstructed, and Modified Sources at 3-13 (2018); EPA, Regulatory Impact Analysis for the Proposed Revised Cross-State Air Pollution Rule (CSAPR) Update for the 2008 Ozone NAAQS at 5-5 (2020).

[83] *See, e.g.*, EPA, Draft Guidelines for Preparing Economic Analyses: Review Copy prepare for EPA's Science Advisory Board at 5-2 (2020), *available at* https://perma.cc/3K86-M7AH ("Limiting standing to citizens and residents of the United States can be complicated to operationalize in practical terms (e.g., how should multi-national firms with plants in the United States but shareholders elsewhere be treated?).").

[84] *Ctr. for Biological Diversity*, 538 F.3d at 1198.

D. Considering Extraterritorial Climate Effects Is Consistent With Administrative Precedent Outside the Climate Context

While EPA offers extensive justification for its focus on global damage estimates, it can provide additional regulatory precedent supporting that approach. Agencies often consider the extraterritorial effects of their actions—including effects on international reciprocity, international cooperation, and transboundary spillovers—when administering their statutory authority. And on numerous occasions, courts have endorsed this practice. To bolster its justification for its global perspective, EPA should highlight these regulatory precedents.

For one, as noted above, the National Environmental Policy Act (NEPA) requires agencies to administer and interpret the nation's law to "recognize the worldwide and long-range character of environmental problems" and to "lend appropriate support" to help "maximize international cooperation."[85] Numerous court decisions—including one from the U.S. Court of Appeals for the D.C. Circuit—have held that reasonably foreseeable transboundary effects must appear in NEPA analyses.[86] And consistent with those decisions, agencies have assessed transboundary impacts under NEPA for over forty years under Executive Order 12,114, which instructs agencies to "take into consideration in making decisions" effects of their actions on the "environment of a foreign nation" and "the global commons."[87] In other words, EPA's consideration of extraterritorial environmental impacts is consistent with decades of agency practice.

Beyond NEPA, and outside the climate context, agencies have considered key effects on international reciprocity in their regulatory cost-benefit analyses and decisionmaking. Perhaps the best antecedent on this front is EPA's 1988 regulations to protect stratospheric ozone—another global pollutant that, like greenhouse gases, requires international cooperation to effectively mitigate. In issuing those regulations, EPA recognized that it could "consider other countries' willingness to take regulatory action" in "deciding whether and how to regulate."[88] EPA also took "[c]onsideration of the international ramifications of United States action" into account when "analyzing the cost and feasibility of controls."[89] And in its regulatory impact analysis, EPA modeled alternative regulatory stringency levels based on potential international participation rates and the influence that EPA regulation would have on reciprocal international actions.[90] By adopting a global approach to the social cost of greenhouse gases, EPA therefore draws upon the approach that it took for stratospheric ozone under the Reagan administration.

On several prior occasions—again outside the context of climate change—courts have upheld EPA's authority to consider effects on international reciprocity and cooperation due to domestic pollution standards. In one case, for instance, the D.C. Circuit upheld EPA's decision to set an interim tolerance of 30 ppb for the chemical ethylene dibromide under the Food, Drug, and Cosmetic Act (FDCA)—rather than ban the chemical altogether—after EPA concluded that

---

[85] 42 U.S.C. § 4332(2)(F) (*cited at* Draft Update, *supra* note 4, at 15 n.37).

[86] *E.g.* Env't Def. Fund, Inc. v. Massey, 986 F.2d 528 (D.C. Cir. 1993); Gov't of Man. v. Salazar, 691 F. Supp. 2d 37, 51 (D.D.C. 2010).

[87] See Exec. Order No. 12,114 § 2–3, 44 Fed. Reg. 1957 (Jan. 4, 1979).

[88] Protection of Stratospheric Ozone, 53 Fed. Reg. 30,566, 30,569 (Aug. 12, 1988).

[89] *Id.* ("Certainly other nations' ozone-depleting emissions or control of emissions affect the cost of United States' controls, and the need for other nations to limit their emissions may make appropriate United States action that encourages, or does not discourage, other nations to agree to such limits.").

[90] Env't Prot. Agency, *Regulatory Impact Analysis for the Protection of Stratospheric Ozone* (1988).

a ban "could damage cooperative [food-safety] efforts," reasoning that "[s]ince effective enforcement of food safety laws depends upon such cooperation, a ban might increase the risk that fruit and vegetables would enter the U.S. treated with unsafe levels of pesticides or infested with pests or diseases."[91] The D.C. Circuit similarly upheld EPA's consideration of international harmonization in setting NO_x emissions standards for commercial aircraft gas turbine engines, after EPA issued a standard under the Clean Air Act to align U.S. standards with international standards.[92]

In addition to EPA's consideration of international reciprocity and cooperation in prior rulemakings, agencies have also considered transboundary spillover effects in making key decisions. As one example, when considering the "public interest" in the certification of natural gas exports under the Natural Gas Act,[93] the Department of Energy routinely "consider[s] international trade policy, foreign policy, and national security interests."[94] As another example, the Food and Drug Administration also frequently considers international effects as part of its regulatory decisionmaking, and has recognized that such costs are particularly relevant because "a portion of foreign costs could be passed on to domestic consumers."[95]

Courts have confirmed that agencies may—and, in some cases, must—take into account international spillover effects. In 2020, the U.S. Court of Appeals for the Ninth Circuit rejected a Bureau of Ocean Energy Management approval of an offshore oil drilling and production facility after the agency concluded that domestic extraction would not affect international fossil-fuel supply and consumption.[96] As the court explained, because domestic production causes "foreign consumers [to] buy and consume more oil"—and because that consumption "can be translated into estimates of greenhouse gas emissions" that harms the United States—the agency had an obligation to consider those increased foreign emissions resulting from domestic action.[97] Two subsequent district court opinions similarly faulted Department of Interior analyses for omitting the effects of domestic production on foreign demand and consumption.[98] The fact that courts have required agencies to consider the spillover impacts from foreign greenhouse gas emissions provides strong support for EPA's consideration of spillovers from domestic emissions.

As all of these examples illustrate, EPA's consideration of climate damages on a global scale is consistent with how EPA and other agencies have exercised regulatory authority in numerous contexts. EPA should highlight these antecedents as further support for its global approach.

---

[91] National Coalition Against the Misuse of Pesticides v. Thomas, 815 F.2d 1579, 1582 (D.C. Cir. 1987).

[92] National Ass'n of Clean Air Agencies v. EPA, 489 F.3d 1221 (D.C. Cir. 2007).

[93] 15 U.S.C. § 717b(a).

[94] New Policy Guidelines and Delegation Orders from Secretary of Energy to Economic Regulatory Administration and Federal Energy Regulatory Commission Relating to the Regulation of Imported Natural Gas, 49 Fed. Reg. 6,684 6,688 (Feb. 22, 1984).

[95] Requirements for Additional Traceability Records for Certain Foods, 87 Fed. Reg. 70,910, 71,071 tbl.2 (Nov. 21, 2022).

[96] Ctr. for Biological Diversity v. Bernhardt, 982 F.3d 723, 738 (9th Cir. 2020).

[97] *Id.*

[98] Sovereign Iñupiat for a Living Arctic v. Bureau of Land Mgmt., 555 F. Supp. 3d 739, 764–67 (D. Alaska 2021); citing Friends of the Earth v. Haaland, No. CV 21-2317 (RC), 2022 WL 254526, at *14–15 (D.D.C. Jan. 27, 2022).

II. Extensive Justification Supports EPA's Decisions to Omit a 7% Discount Rate and To Discount Long-Term Climate Impacts at Lower Rates than the Rule's Shorter-Term Impacts

EPA applies the social cost of greenhouse gas estimates calculated at discount rates of 2.5%, 3%, and 5%,[99] consistent with the Working Group's current recommendations, and justifies its decision to return to its prior conclusion that a 7% capital-based discount rate is inappropriate for climate effects. EPA's return to a reasonable range of discount rates to assess climate impacts is well supported—in fact, as recognized by both the Working Group in its 2021 update[100] and EPA in the Draft Update,[101] discount rates of 2% or lower are appropriate for valuing climate damages. Nonetheless, in anticipation of specious legal challenges, EPA should consider providing additional justifications for its discounting choices.[102]

The RIA cites the Working Group's arguments that, for long-term policies with intergenerational effects, uncertainty and ethical considerations make a 7% capital-based discount rate inappropriate.[103] Though these arguments provide sufficient reason for EPA's approach to discount rates, additional justifications support EPA's focus on consumption-based rates and its approach to discounting climate effects as compared to other costs and benefits.

A. The 7% Discount Rate Is Inappropriate for Climate Effects, as Considerable Evidence Points to Substantially Lower Discount Rates in Intergenerational Settings

Although *Circular A-4* provides discount rates of 3% and 7% as a default assumption, it also requires agency analysts to do more than rigidly apply default assumptions.[104] As such, analysis must be "based on the best reasonably obtainable scientific, technical, and economic information available,"[105] and agencies must "*[u]se sound and defensible values* or procedures to monetize benefits and costs, and ensure that key analytical assumptions are defensible."[106] Rather than assume that 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.[107] Based

[99] Note that just as there is growing evidence that the discount rate should be below 2%, there is growing evidence that 5% is much too high a discount rate. The values at 5% should be considered a very conservative lower bound.

[100] 2021 TSD, *supra* note 5, at 16–22 (offering extensive evidence for the use of lower discount rates and recommending that agencies "consider discount rates below 2.5 percent" for valuing the social cost of greenhouse gases). *See also id.* at 4 ("Consistent with the guidance in E.O. 13990 for the IWG to ensure that the SC-GHG reflect the interests of future generations, the latest scientific and economic understanding of discount rates discussed in this TSD, and the recommendation from OMB's Circular A-4 to include sensitivity analysis with lower discount rates when a rule has important intergenerational benefits or costs, agencies may consider conducting additional sensitivity analysis using discount rates below 2.5 percent.").

[101] In the Draft Update, EPA applies a central near-term discount rate of 2%, with additional valuations using near-term discount rates of 1.5% and 2.5%. The discount rates in the Draft Update also decline over time. *See* Draft Update, *supra* note 4, at 3 tbl.ES-1; *id.* at 52–61 (explaining discounting module).

[102] *See generally* Peter Howard & Jason A. Schwartz, *About Time: Recalibrating the Discount Rate for the Social Cost of Greenhouse Gases* (Policy Integrity Report 2021), https://policyintegrity.org/files/publications/About_Time.pdf.

[103] RIA at 21–22.

[104] Circular A-4, *supra* note 69, at 3 ("You cannot conduct a good regulatory analysis according to a formula. Conducting high-quality analysis requires competent professional judgment.").

[105] *Id.* at 17.

[106] *Id.* at 27 (emphasis added).

[107] *Id.* at 3 ("[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.") (emphasis added).

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—and that discount rates of 3% or lower are appropriate.

First, basing the discount rate on the consumption rate of interest (which the 3% rate represents) is the correct framework for the analysis of climate effects, whereas a discount rate based on the private return to capital (which the 7% rate represents) is inappropriate. While *Circular A-4* suggests that 7% should be a "default position" that reflects regulations that primarily displace capital investments, it also explains that "[w]hen regulation primarily and directly affects private consumption . . . *a lower discount rate is appropriate*."[108] The 7% discount rate is based on a private sector rate of return on capital, as private market participants typically have short time horizons. By contrast, climate change concerns the public well-being broadly rather than market participants narrowly. Rather than evaluating an optimal outcome from the narrow perspective of investors alone, economic theory requires analysts to make optimal choices based on societal preferences and social discount rates.

Moreover, because climate change is expected to mostly affect large-scale consumption, as opposed to capital investment,[109] a 7% rate is inappropriate. Crucially, as the Working Group recognizes, the social cost of greenhouse gas estimates present climate damages in consumption-equivalent units, and therefore, *Circular A-4*'s guidance in fact dictates the application of consumption-based discount rates.[110] The National Academies of Sciences has agreed that a capital-based rate would be inappropriate for use with the social cost of greenhouse gases, given that climate damages are estimated in consumption-equivalent units.[111] There is also strong consensus through the economic literature that a capital discount rate like 7% is inappropriate for climate change.[112]

---

[108] *Id.* at 33.

[109] Maureen Cropper, *How Should Benefits and Costs Be Discounted in an Intergenerational Context?*, 183 RESOURCES 30, 33 (2013) ("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."); *see also* Richard G. Newell & William A. Pizer, Uncertain Discount Rates in Climate Policy Analysis, 32 ENERGY POL'Y 519, 521 (2004) ("Because climate policy decisions ultimately concern the future welfare of people—not firms—the consumption interest rate is more appropriate.").

[110] *See* 2021 TSD, *supra* note 5, at 17.

[111] Nat'l Acad. Sci., Engineering & Med., *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide* 28 (2017), https://www.nap.edu/read/24651/chapter/1 [hereinafter "NAS 2017 Report"]; *see also* Kenneth Arrow et al., *Is There a Role for Benefit-Cost Analysis in Environmental, Health, and Safety Regulation?*, 272 SCIENCE 221 (1996) (explaining that a consumption-based discount rate is appropriate for climate change).

[112] *See, e.g.*, Richard Newell, *Unpacking the Administration's Revised Social Cost of Carbon* (Oct. 10, 2017), http://www.rff.org/blog/2017/unpacking-administration-s-revised-social-cost-carbon; Comments from Robert Pindyck, to BLM, on the Social Cost of Methane in the Proposed Suspension of the Waste Prevention Rule (submitted Nov. 5, 2017).

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.[113] By contrast, greenhouse gas emissions generate effects stretching out across approximately 300 years. As *Circular A-4* notes, "[p]rivate 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."[114] *Circular A-4* discusses how uncertainty over long time horizons drives the discount rate lower.[115] It cites the work of renowned economist Martin Weitzman and concludes that the "certainty-equivalent discount factor . . . corresponds to *the minimum discount rate having any substantial positive probability*."[116] The National Academies of Sciences makes the same point about discount rates and uncertainty.[117]

Third, a 7% discount rate also ignores catastrophic risks and the welfare of future generations. As EPA showed in a recent cost-benefit analysis, the 7% rate truncates the long right-hand tail of social costs relative to the 3% rate's distribution.[118] The long right-hand tail represents the possibility of catastrophic damages. Thus, the 7% discount rate effectively assumes that present-day Americans are barely willing to pay anything at all to prevent medium- to long-term catastrophes. Given that Congress expressed its overall goal for the Clean Air Act Amendments of 1977 to "[e]nsure the protection of the public health and the environment, both of this *and future generations*, while at the same time considering the energy and economic needs of this Nation," it would not be reasonable for EPA to discount climate impacts at such a high rate as to effectively ignore the welfare of future generations.[119] Moreover, as noted above, NEPA requires agencies to consider the "long-range character of environmental problems,"[120] and citing this statutory requirement, the Council on Environmental Quality has advised agencies to apply climate-damage valuations that "discount future effects at rates that consider future generations."[121]

Fourth, long-term time horizons in general counsel strongly against applying a capital-based rate. The Working Group's latest guidance cites Li and Pizer's work on how the capital-based rate is generally inappropriate in many longer-term contexts.[122] Specifically, Li and Pizer

---

[113] Circular A-4, note 69, at 34; *see also* Interagency Working Group on the Social Cost of Carbon, Response to Comments: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 at 21 (2015), https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/scc-response-to-comments-final-july-2015.pdf [hereinafter "Response to Comments"] (noting that "most regulatory impact analysis is conducted over a time frame in the range of 20 to 50 years," and thus do not fully implicate "special ethical considerations [that] arise when comparing benefits and costs across generations").

[114] Circular A-4, note 69, at 36.

[115] *Id*. (explaining that "the longer the horizon for the analysis," the greater the "uncertainty about the appropriate value of the discount rate," which supports a lower rate).

[116] *Id.*; *see also* Council of Econ. Advisers, *Discounting for Public Policy: Theory and Recent Evidence on the Merits of Updating the Discount Rate* at 9 [hereinafter "CEA Issue Brief"], *available at* https://obamawhitehouse.archives.gov/sites/default/files/ page/files/201701_cea_discounting_issue_brief.pdf.

[117] NAS 2017 Report, *supra* note 111, at 27.

[118] EPA, Benefit and Cost Analysis for Revisions to Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category, at I-4 fig. I-1 (showing the 7% discount rate distribution).

[119] H.R. Rep. No. 95-294, 34, 1977 U.S.C.C.A.N. 1077, 1112.

[120] 42 U.S.C. 4332(2)(F).

[121] Council on Env't Quality, National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change, 88 Fed. Reg. 1196, 1203 (Jan. 9, 2023).

[122] 2021 TSD, *supra* note 5, at 19.

find that, given their best estimate of the shadow price of capital, the appropriate social discount rate collapses to the consumption-based rate relatively quickly, in just several decades.[123] Given the long time horizon that analysis of climate policies demands, the capital-based rate is simply inapplicable.

Fifth, several standard justifications for capital-based discount rates break down given the particular threats of climate change. For example, one argument for capital-based discount rates is that spending capital on climate-abatement policies has opportunity costs and so, in policy analysis, future costs and benefits should be discounted at the rate of return to capital. However, the irreversible, uncertain, and catastrophic risks of climate change may disrupt this "opportunity cost" rationale: while it may seem, for instance, that future, wealthier generations might have better opportunities to address climate change for themselves, irreversible or catastrophic damages could arise that make future mitigation efforts more expensive or impossible.[124] Similarly, if climate damages are "non-marginal," such that climate change significantly affects the very natural resources needed to drive economic growth, growth could plummet or even turn negative.[125]

Sixth, a 7% discount rate is inappropriate 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."[126] Yet *Circular A-4*'s own default assumption of a 7% discount rate was published twenty years ago and was based on data from even earlier.[127] *Circular A-4*'s guidance on discount rates needs an update, as the Council of Economic Advisers (CEA) detailed recently after reviewing the best available economic data and theory.[128] CEA gave two reasons to revise the 7% rate, both of which are generally applicable but may have particular force in the context of climate change. The first argument is that the market data clearly shows that the long-term interest rates used to derive the consumption-based discount rates have fallen, such that the 3% consumption-based rate instead "should be at most 2 percent."[129] Because of the relationship between long-term, tax-free interest rates and rates of return on capital (i.e., the divergence between those rates is caused largely by taxation), a 1% drop in the consumption-based discount rate strongly suggests a corresponding drop in the capital-based rate.[130] This may be especially true for longer-term context like climate change, because of the lack of reliable market data to measure expected rates of return on assets held inter-generationally.[131]

---

[123] Qingran Li & William A. Pizer, Use of the Consumption Discount Rate for Public Policy over the Distant Future, 107 J. ENV'T ECON. & MGMT. 102,428 (2021).

[124] Richard L. Revesz & Matthew R. Shahabian, *Climate Change and Future Generations*, 84 S. CAL. L. REV. 1097, 1149-52 (2011).

[125] *Id.* at 1153 & n.246 (citing Heal's observation that estimates of productivity growth based on historical records omit depletion of natural resources, and thus bias discount rates upwards).

[126] Circular A-4, *supra* note 69, at 17.

[127] The 7% rate was based on a 1992 report; the 3% rate was based on data from the 30 years preceding the publication of Circular A-4 in 2003. *Id.* at 33–34.

[128] CEA Issue Brief, *supra* note 116, at 1; *see also 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.").

[129] *Id.* at 1.

[130] *Id.* at 12.

[131] *See id.*

The second argument why the 7% rate is too high is that market rates of return are artificially increased by returns associated with unpriced externalities, rents associated with market power, and private (as opposed to social) risk premiums.[132] For example, a market return on an oil and gas investment is increased because the oil and gas operation can externalize some of the costs of its pollution onto society. Yet especially when crafting long-term climate policies, it would be inappropriate to discount future welfare based on the fact that the current generation of investors prefers the high market returns that are now available partly because of such externalities.[133] As such, the 7% capital-based rate is not only out of date and too high, but especially inappropriate for climate policy.

Finally, *Circular A-4* recognizes that intergenerational contexts raise unique ethical issues that further counsel for lower discount rates. Specifically, it recognizes that "[i]t may not be appropriate for society to demonstrate a similar preference when deciding between the well-being of current and future generations" as it does in the intragenerational setting." [134] *Circular A-4* thus recommends that agencies conduct additional analysis "using a lower [than 3%] but positive discount rate" for impacts with important intergenerational effects.[135] Most market data reflects at best individual's current preferences for their own welfare over time and so simply does not capture society's preferences toward or ethical obligations to future generations. Basing a discount rate solely on market data ignores such important inter-generational considerations.

Executive Order 13,990 instructs agencies to ensure that the social cost of greenhouse gas values adequately account for "intergenerational equity."[136] A 7% rate ignores much of future generations' welfare and so would be inconsistent with that mandate. Notably, even when using high discount rates for climate damages in 2020, EPA explained that the 7% capital rate did not adequately account for "tradeoffs between improving the welfare of current and future generations."[137]

B. Extensive Justification Supports EPA's Distinct Approach to Discounting Climate Effects Relative to Other Costs and Benefits

As explained above, EPA's choice to use the social cost of greenhouse gases values calculated with consumption-based discount rates is fully justified. But this choice also means EPA is calculating the present value of reduced greenhouse gas emissions differently than the present value of other costs and benefits (which, per *Circular A-4*'s default recommendations, it calculates using 3% and 7% discount rates). Extensive justification supports this distinct treatment of climate impacts relative to other costs and benefits, which EPA can draw upon in explaining its discounting approach.

In particular, EPA should consider two approaches: (1) explaining why a general focus on discounting all costs and benefits at consumption-based rates, rather than at a 7% capital-based rate, is appropriate in this particular rulemaking; and (2) further explaining why special

---

[132] *Id.* at 12-13.
[133] *See* Howard & Schwartz, *supra* note 102, at 5–6 (arguing for a decrease in the capital-based rate).
[134] Circular A-4, *supra* note 69, at 35–36.
[135] *Id.*
[136] Exec. Order § 13,990 5(b)(ii)(E).
[137] 85 Fed. Reg. at 24,735 (explaining that the central analysis focused on a 3% rate, and the 7% rate was used only for sensitivity analysis).

legal, economic, and policy considerations justify a different approach to discounting climate effects as distinct from other costs and benefits.

To begin, EPA can explain that given the nature of the Proposed Rule's costs and benefits, it is more appropriate to discount all effects using consumption-based rates, and so the present value calculations that include some costs and benefits discounted at a 7% rate can be viewed as lower-bound sensitivity analyses. The capital-based discount rate theoretically assesses whether the net benefits from government action will exceed the returns that society could earn by instead investing the same resources in the private sector. But this framework for discounting and comparing benefits and costs makes sense only under the "extreme" assumption that all the costs of government action would "fully displace" (i.e., crowd out) private investment.[138] In this way, the capital-based rate "at best creat[es] a lower bound on the estimate of net benefits," by applying a maximum discount rate that reflects an extreme case not likely to apply to many government actions.[139] As Li and Pizer explain, a capital-based approach does not provide "a suitable discount rate" for regulatory cost-benefit analysis, in large part because the benefits of regulation—and not just the costs—may fall on capital as well.[140]

In general, there is less of a chance now that U.S. government actions will crowd out private investments than there was in 1992 when OMB first set its 7% capital-based discount rate, because the U.S. economy is relatively more open now.[141] Additionally, the magnitude of the costs and benefits involved in many agency actions will be relatively small compared to the overall U.S. debt, again making it unlikely that agency actions will significantly crowd out private U.S. investment.[142] Some agency actions may also induce more private investment than they displace.[143] And if the costs of agency actions will be more borne through displaced consumption rather than displaced investment, the crowding-out theory for a capital-based discount rate further breaks down. Because of the nature of the rule, the theory for a capital-based discount rate has a tenuous application at best. EPA therefore would be justified in arguing for a focus on cost-benefit comparisons using consumption-based rates, with the application of a 7% rate treated like a lower-bound sensitivity analysis.

Separately, EPA would also be justified in taking a distinct approach to discounting climate effects, and EPA should further elaborate upon the special legal, economic, and policy considerations. While effects like compliance costs will play out over the next several decades, the climate effects of this rule are undeniably much longer term, affecting the welfare of future generations over centuries. Therefore, the arguments in favor of lower consumption-based discount rates—based on long-term uncertainty, ethics, declining economic growth, inapplicable market data, and other considerations—apply much more strongly to climate effects than to other costs and benefits. And because a high capital-based rate, like 7%, will effectively ignore the welfare of future generations (e.g., over the course of just 80 years, a 7% rate discounts away

[138] 2021 TSD, *supra* note 5, at 18-19.
[139] *Id.*
[140] Qingran Li & William A. Pizer, *Discounting for Public Benefit-Cost Analysis*, RES. FOR THE FUTURE 3 (July 2021), https://www.rff.org/publications/issue-briefs/discounting-for-public-benefit-cost-analysis/.
[141] *See* EPA, Guidelines for Economic Analysis, at 6-11.
[142] *Id.*
[143] 2021 TSD, *supra* note 5, at 19 (noting that if the social returns to induced investments have not been quantified, using a capital-based discount rate "is not even a lower bound"); *see also* Li & Pizer, *supra* note 140.

99.5% of a future effect's value[144]) legal requirements to consider the welfare of future generations caution much more strongly against the application of a 7% rate to long-term climate effects than to other costs and benefits. Notably, the Clean Air Act Amendments of 1977 expressed the congressional goal to "[e]nsure the protection of the public health and the environment, both of this *and future generations*,"[145] and NEPA broadly instructs[146] all agencies to interpret all their laws to the fullest extent possible to advance the national environmental policies,[147] including to "fulfill the responsibilities of each generation as trustee of the environment for succeeding generations."[148] Multiple Executive Orders, including Executive Order 13,563 and 13,990, also call for agencies to appropriately and accurately weigh the interests of future generations.[149]

Consequently, as the National Academies of Sciences has recognized, some differences in the application of discount rates may be warranted "when only some categories [of costs and benefits] have an intergenerational component."[150] The National Academies has offered recommendations for how agencies can best apply different annualized discount rates to climate impacts versus other costs and benefits,[151] and EPA can rely on the National Academies' guidance to support its approach to discounting here. Likewise, as noted above, *Circular A-4* also recognizes that intergenerational effects merit lower discount rates than intragenerational costs and benefits.[152]

Case law on the social cost of greenhouse gases also offers support for EPA's discounting approach. Specifically, in *Zero Zone v. Department of Energy*, the plaintiffs argued that the Department of Energy had arbitrarily considered hundreds of years of climate benefits while limiting its assessment of employment impacts and other effects to just a thirty-year time horizon. The court upheld the regulatory analysis, concluding that the difference in time horizons was justified because the rule "would have long-term effects on the environment but . . . would not have long-term effects on employment."[153] The choice of time horizons is related to the choice of discount rate: any cost or benefit occurring beyond the end of the analytical time horizon is effectively discounted at an infinitely high (or 100 percent) rate.[154] Analogizing from this precedent, a court may similarly defer to an agency's finding that the long time horizon of climate change justifies a lower discount rate than the rate applied to shorter-term costs and

---

[144] The discount factor is $\frac{1}{(1+r)^t}$; $\frac{1}{(1+0.07)^{80}} = 0.0045 = 0.45\%$.

[145] H.R. Rep. No. 95-294, 34, 1977 U.S.C.C.A.N. 1077, 1112; *see also* Howard & Schwartz, *supra* note 102, at 32 (summarizing the Clean Air Act's legislative history and references to future generations).

[146] Note again that these NEPA provisions apply outside the context of conducting environmental impact statements for major actions, and so EPA's exclusion under the Clean Air Act does not apply.

[147] 42 U.S.C. § 4332(1).

[148] 42 U.S.C. § 4331(b)(1).

[149] Exec. Order No. 13,563 at 1(c) ("[U]se the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible."); Exec. Order No. 13,990 at 5(b)(ii)(E) & (iii) ("adequately take account of…intergenerational equity," "to reflect the interests of future generations in avoiding threats posed by climate change").

[150] NAS 2017 Report, *supra* note 111, at 182.

[151] *Id.*

[152] Circular A-4, *supra* note 69, at 35–36.

[153] *Zero Zone*, 832 F.3d at 679.

[154] *See* Arden Rowell, *Time in Cost-Benefit Analysis*, 4 U.C. IRVINE L. REV. 1215, 1237-38 (2014) (noting time inconsistencies in different regulatory analyses and advising agencies to identify a temporal break-even point by which a proposed policy will pay for itself).

benefits. EPA should explain the special economic, legal, and ethical considerations that justify selecting a different annual discount rate for climate effects than for other costs and benefits.

At the same time, EPA may wish to perform sensitivity analysis using consistent discount rates across all costs and benefits, to further demonstrate that the regulation is not sensitive to any discounting inconsistency. Already, EPA concludes that the rule is cost-justified when all costs and benefits (including climate benefits) are discounted at a constant 3% rate.[155] To take this a step further, EPA could perform an additional sensitivity analysis in which it discounts all costs and benefits using the declining discount rates that it applies in the Draft Update.

III. EPA Should Defend Against Common Criticisms of the Working Group's Methodology

While the Working Group developed its social cost valuations through a rigorous process that incorporated the best scientific and economic modeling available at the time, its assumptions have sometimes been criticized by opponents of climate regulation. Such objections lack merit and do not supply bases for EPA to reject the Working Group's expert valuations. Nonetheless, EPA should provide additional defense of the Working Group's process and modeling assumptions, and be prepared to respond to common criticisms of its work. This section offers responses to criticisms from opponents of sensible climate policy.

A. EPA Is Required to Value Climate Damages, and Doing So Provides Balance to EPA's Cost-Benefit Analysis

One objection to agency usage of the Working Group's estimates is that Congress, not the executive branch, should set policy with respect to climate change. But EPA has broad authority to assess climate impacts, and judicial precedent suggests that it must value climate-change impacts as part of its regulatory impact analysis. In fact, assessing climate damages as part of its regulatory impact analysis provides rationality and balance to EPA's approach—and does not, as critics have suggested, inappropriately skew the analysis.

1. EPA Must Monetize Climate Impacts as Part of Its Analysis

It is widely established that federal agencies may—and often must—consider effects on climate change when those effects flow from the agency's actions. With EPA, this is especially well-established. Perhaps most relevant here, in *Massachusetts v. EPA*, the Supreme Court held that greenhouse gas emissions qualify as an "air pollutant" for regulation under the Clean Air Act.[156] Because the purpose of the Proposed Rule is to regulate greenhouse gas pollution as an "air pollutant" under Section 111 of the Clean Air Act—following the *Massachusetts* precedent—EPA should naturally and obviously consider impacts on climate when deciding upon the stringency of its regulation.

Since EPA must account for climate impacts when setting the stringency of its standard, the only relevant question is how it should account for those impacts. Monetizing climate impacts is the best available option. Indeed, it is well accepted in regulatory practice and precedent that agencies should monetize regulatory impacts to the extent feasible, to compare costs and benefits along a common metric and select the alternative that maximizes net

[155] *See, e.g.*, RIA at 12 tbl.1-4 (reporting costs and benefits using 3% discount rate).
[156] *Massachusetts v. EPA*, 127 S. Ct. 1438 (2007).

benefits.[157] And EPA monetized climate damages in methane regulations promulgated under both the Obama and Trump administrations.[158]

Monetizing climate impacts may also be legally required. In 2007, the U.S. Court of Appeals for the Ninth Circuit held that the federal government must monetize climate impacts when it conducts a cost-benefit analysis. In *Center for Biological Diversity v. National Highway Traffic Safety Administration*, the Ninth Circuit remanded a fuel economy rule to the Department of Transportation ("DOT") for failing to monetize the benefits of carbon dioxide reductions in its regulatory analysis.[159] The Court recognized the presence of uncertainty in the valuation of climate damages, but explained that "the value of carbon emissions reduction is certainly not zero."[160] By failing to value the benefit of greenhouse gas emission reductions in its analysis, the Court continued, DOT effectively ignored the adverse impacts of greenhouse gas emissions and thus "put a thumb on the scale by undervaluing the benefits and overvaluing the costs of more stringent standards."[161]

2. Monetizing Climate Benefits Does Not Skew the Analysis, but Rather Provides Balance Since EPA Also Monetizes Costs

Another objection to the use of the social cost of greenhouse gases from critics of climate action is that these valuations account only for the damages from climate change, but do not take account of the economic benefits from fossil-fuel production and usage, such as economic development and employment. But this argument is unpersuasive for two key reasons.

First, the economic benefits of fossil-fuel extraction are far more limited than its proponents suggest, since the broader benefits that society derives from power and electricity are attributable to energy production in general and are not unique to fossil fuels.[162] Accordingly, controls on fossil fuels will have limited net economic impacts.[163] Second, while there are of

---

[157] Circular A-4, *supra* note 69, at 2 ("Benefit-cost analysis is a primary tool used for regulatory analysis.2 Where all benefits and costs can be quantified and expressed in monetary units, benefit-cost analysis provides decision makers with a clear indication of the most efficient alternative, that is, the alternative that generates the largest net benefits to society (ignoring distributional effects).").

[158] *See, e.g.*, Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources Review, 85 Fed. Reg. 57,018, 57,066 (describing Trump administration's approach to monetizing climate damages resulting from methane emissions).

[159] *Ctr. for Biological Diversity*, 538 F.3d at 1198–1203 (9th Cir. 2008).

[160] *Id.* at 1200.

[161] *Id.* at 1198.

[162] Renewable energy, like fossil fuels, generates revenue, supports jobs, and vitalizes local economies. *See, e.g.*, Katie Siegner et al., Rocky Mtn. Inst., *Seeds of Opportunity: How Rural America Is Reaping Economic Development Benefits from the Growth of Renewables* 6–16 (2021), *available at* https://perma.cc/DWH9-D4L7.

[163] Environmental regulation typically has limited impacts on total employment or other macroeconomic indicators, but rather shifts production from one sector to another. *See* Inst. for Pol'y Integrity, *Does Environmental Regulation Kill or Create Jobs* (2017), *available at* https://policyintegrity.org/files/media/Jobs_and_Regulation_Factsheet.pdf. Meanwhile, the sharp decline in the cost renewable energy is already expected to crowd out the demand for gas-fuel electricity in the coming years and decades. *See, e.g.* Energy Info. Admin., *Annual Energy Outlook 2021 Narrative* 18 tbl. 11 (projecting doubling of renewables as a share of domestic energy consumption—from 21% to 42%—by 2050 under reference case, while share of coal and natural gas declines); Charles Teplin et al., ROCKY MTN. INST., *The Growing Market for Clean Energy Portfolios* 8 fig. ES-2 (2019), *available at* https://perma.cc/P5YJ-WARJ (showing precipitous decline in cost of clean energy to being cheaper than fossil fuels).

course some economic impacts from reductions in fossil-fuel production and usage, including effects on revenues and jobs, those impacts should not be included in any calculation of climate damages, but rather considered separately by regulators on the costs side of the ledger in individual determinations.

In the Proposed Rule, EPA monetizes not only the expected benefits of the proposal but also the expected compliance costs from industry. EPA then compares quantified cost and benefit estimates in determining whether and how to regulate, as instructed by federal guidance and executive order.[164] Capturing climate benefits is thus essential to ensuring a balanced analysis. As the Ninth Circuit has recognized, "failure to monetize the most significant benefit of more stringent standards: reduction in carbon emissions"—while continuing to value estimated compliance costs—would "put a thumb on the scale by undervaluing the benefits and overvaluing the costs of more stringent standards."[165]

B. Other Common Criticisms of the Working Group's Methodology from Opponents of Climate Policy Lack Merit

EPA should also provide detailed responses to any objections lobbed against the Working Group's methodology and valuations during this comment period. The Working Group, of course, has already responded to criticisms of its methodology that were offered during the public comment period that it held in 2013,[166] and EPA should draw from that document where relevant in responding to objections offered through this notice-and-comment process. But some objections are now being raised that were not offered during the 2013 comment period, while some of the responses that the Working Group provided can be supplemented with more recent information. Below, we provide brief responses to common objections that are now being presented by opponents of climate reforms.

1. The Social Cost Valuations Are Not Too Uncertain to Apply

While critics argue that there is too much uncertainty to rely on the Working Group's social cost valuations, this argument is incorrect on multiple levels. As a legal matter, the presence of some uncertainty in the social cost valuations should not preclude agencies from using the best numbers available. And as a factual matter, the Working Group rigorously considered uncertainty and accounted for it in numerous ways. Moreover, the presence of continued uncertainty suggests that the social cost valuations should be higher than presently valued—not that climate damages should be ignored. This is confirmed by EPA's Draft Update, which incorporates the latest available research and produces substantially higher climate-damage valuations than those the Working Group previously developed.

Federal courts have repeatedly recognized that agency analysis necessitates making predictive judgments under uncertain conditions, explaining that "[r]egulators by nature work under conditions of serious uncertainty" [167] and "are often called upon to confront difficult administrative problems armed with imperfect data."[168] As the Ninth Circuit has explained, "the

[164] Exec. Order No. 12,866 § 1(a), 58 Fed. Reg. 51,735 (Oct. 4, 1993) (directing that "in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits").
[165] *Ctr. for Biological Diversity*, 538 F.3d at 1198–99.
[166] Response to Comments, *supra* note 113.
[167] Pub. Citizen v. Fed. Motor Carrier Safety Admin., 374 F.3d 1209, 1221 (D.C. Cir. 2004).
[168] Mont. Wilderness Ass'n v. McAllister, 666 F.3d 549, 559 (9th Cir. 2011).

proper response" to the problem of uncertain information is not for the agency to ignore the issue but rather "for the [agency] to do the best it can with the data it has."[169] Courts generally grant broad deference to agencies' analytical methodologies and predictive judgments so long as they are reasonable, and do not require agencies to act with complete certainty.[170]

The Working Group rigorously considered various sources of long-term uncertainty "through a combination of a multi-model ensemble, probabilistic analysis, and scenario analysis."[171] As the Working Group explained, the three reduced-form integrated assessment models (IAMs) account for uncertainty themselves by spanning a range of economic and ecological outcomes.[172] Additionally, the use of three separate models—all developed by different experts spanning a range of views—accounts for uncertainty by integrating a diversity of viewpoints and structural and analytical considerations.[173]

In addition to the use of three distinct damage models with different inputs and assumptions, the Working Group integrated various sources of uncertainty into its damage valuations. For instance, the Working Group applied an equilibrium climate sensitivity—that is, an estimate of how much an increase in atmospheric greenhouse gas concentrations affects global temperatures—that reflects a broad distribution of possible outcomes.[174] The Working Group also applied five different socioeconomic and emissions trajectories from the published literature reflecting a range of possible outcomes for future population growth, global gross domestic product, and greenhouse gas emission baselines—all important inputs that affect long-term climate damage estimates.[175] The Working Group ran each integrated assessment model 10,000 times per scenario (and per greenhouse gas) for a total of 150,000 draws per greenhouse gas, and then averaged across those results to develop its recommended estimates.[176] In addition to reporting the average valuations, the Working Group published the results of each model run under each scenario.[177]

Moreover, experts broadly agree—and EPA's Draft Update confirms—that the presence of uncertainty in the social cost valuations counsels for more stringent climate regulation, not less.[178] This is due to various factors including risk aversion, the informational value of delaying climate change impacts, and the possibility of irreversible climate tipping points that cause

---

[169] *Id.*

[170] *See* Wis. Pub. Power, Inc. v. FERC*,* 493 F.3d 239, 260 (D.C.Cir.2007) ("It is well established that an agency's predictive judgments about areas that are within the agency's field of discretion and expertise are entitled to particularly deferential review, so long as they are reasonable.").

[171] 2021 TSD, *supra* note 5, at 26.

[172] *See id.*

[173] *See id.*

[174] *Id.* at 13 tbl.1 (showing 5th-95th probability range of distributions in the chosen Roe & Baker model from 1.72°C from a doubling of atmospheric greenhouse gas concentrations to 7.14°C(.

[175] *Id.* at 15–17 & tbl.2.

[176] *Id.* at 28; *see also* 2021 TSD, *supra* note 5, at 26–27 (providing additional detail).

[177] Interagency Working Group, *Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis* 26 tbl.3 (2010) ["2010 TSD"].

[178] *See, e.g.*, Alexander Golub et al., *Uncertainty in Integrated Assessment Models of Climate Change: Alternative Analytical Approaches*, 19 ENV'T MODELING & ASSESSMENT 99 (2014) ("The most important general policy implication from the literature is that despite a wide variety of analytical approaches addressing different types of climate change uncertainty, none of those studies supports the argument that no action against climate change should be taken until uncertainty is resolved. On the contrary, uncertainty despite its resolution in the future is often found to favor a stricter policy.").

catastrophic damage.[179] In fact, as discussed above and emphasized in EPA's Draft Update, uncertainty is a factor justifying lowering the discount rate, particularly in intergenerational settings.[180] Furthermore, current omission of key features of the climate problem such as catastrophic damages and certain cross-regional spillover effects further suggests that the true social cost values are likely higher than the Working Group's current estimates.[181]

2. The Working Group Did Not Bias Its Estimates by Ignoring Positive Impacts of Climate Change

Critics further claim that the Working Group's social cost values ignore important positive impacts of a warming climate. Examples that have been offered to support this argument include alleged agricultural benefits from higher temperatures and decreased wintertime mortality. But these arguments are legally and factually dubious, and miss the forest for the trees.

Mere omission of some impacts does not counsel for abandoning the social cost estimates, particularly since independent experts—and EPA's Draft Update—widely agree that those estimates likely undervalue true climate damages because they omit far more negative effects than positive ones. For instance, the Working Group has explained that several of the underlying economic models omit certain major damage categories such as catastrophic damages and certain cross-regional spillover effects.[182] These effects can be massive: One paper, for instance, finds that the inclusion of tipping points doubles the social cost estimates, [183] with another paper concluding that the effect is even greater and thus the Working Group's existing values "may be significantly underestimating the needs for controlling climate change."[184] The current consensus of experts puts damages for a 3°C increase at roughly 5% to 10% of gross domestic product,[185] which is substantially higher than the damages estimated by the IAMs.[186] And as the Ninth Circuit has explained, the presence of some omitted damages does not provide a legal basis to ignore established methodologies to monetize climate damages, since while "there is a range of [plausible] values, the value of carbon emissions reduction is certainly not zero."[187]

---

[179] The undersigned organizations have filed comments in numerous regulatory proceedings highlighting the various forms of uncertainty that increase the social cost of greenhouse gases, and providing numerous references. *See, e.g.*, Environmental Defense Fund et al., *Improper Valuation of Climate Effects in the Proposed Revised Cross-State Air Pollution Rule Update for the 2008 Ozone NAAQS*, Technical App'x: Uncertainty (Dec. 14, 2020), https://policyintegrity.org/documents/Joint_SCC_comments_EPA_revised_CSAPR_Ozone_NAAQS_2020.12.14.pdf.

[180] *See* Howard & Schwartz, *supra* note 102, at 13–25.

[181] Interagency Working Group, *Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis* 21 (2016) ["2016 TSD"] (recognizing that "these limitations suggest that the [social cost of greenhouse gases] estimates are likely conservative").

[182] 2010 TSD, *supra* note 177, at 26, 32.

[183] Derek Lemoine & Christian P. Traeger, *Economics of Tipping the Climate Dominoes*. 6 NATURE CLIMATE CHANGE 514 (2016).

[184] Yongyang Cai et al., *Environmental Tipping Points Significantly Affect the Cost-Benefit Assessment of Climate Policies*, 112 PROCS. NAT'L ACADS. SCIS. 4606 (2015).

[185] *See, e.g.*, Peter Howard & Derek Sylvan, Inst. for Pol'y Integrity, *Gauging Economic Consensus on Climate Change* 25 (2021) (reporting mean estimate of 8.5% GPD loss and median estimate of 5% loss, based on elicitation of over 700 climate-policy experts).

[186] 2010 TSD, *supra* note 177, at 9 fig.1A (showing range of GDP loss below 5% for 3°C temperature increase).

[187] *Ctr. for Biological Diversity*, 38 F.3d at 1200.

In addition to its legal shortcomings, arguments about the impact of positive externalities are also factually suspect. For instance, while agricultural benefits have become a flashpoint in this debate, the IAMs in fact do account for the potential agricultural benefits of carbon dioxide fertilization from a warming planet.[188] And evidence suggests that, if anything, these models likely overvalue agricultural benefits from a warming planet—and thus undervalue the social cost of greenhouse gases.[189] One paper, for instance, concludes that estimates of net agricultural impacts produced an undervaluation of the social cost values by more than 50%, explaining that "new damage functions reveal far more adverse agricultural impacts than currently represented" in the IAMs used by the Working Group.[190] And a comprehensive investigation of the impacts of climate change on agriculture has rejected the hypothesis "that agricultural damages over the next century will be minimal and indeed that a few degrees Celsius of global warming would be beneficial for world agriculture," concluding that climate change "will have at least a modest negative impact on global agriculture in the aggregate."[191] This conclusion is confirmed by the Draft Update, which finds that climate change on net will harm, not benefit, the agricultural sector.[192]

Other arguments focusing on omitted positive impacts are equally misguided. For example, while some critics of the Working Group's methodology misleadingly point out that one of the models, DICE, focuses on increased heat-related mortality and does not account for reductions in wintertime mortality, consideration of the many damages omitted from the IAMs (such as particulate matter from wildfires, deaths from flooding, Lyme and other tick-based diseases), including certain mortality effects, consistently point toward a higher social cost value.[193] One recent study concludes that the IAMs, on net, undervalue mortality from climate change.[194] Focusing on the omission of reductions in wintertime mortality thus misses the forest for the trees, and does not supply a basis to disregard the Working Group's valuations.

---

[188] *See* Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* 6 (2014), *available at* https://policyintegrity.org/files/publications/Omitted_Damages_Whats_Missing_From_the_Social_Cost_of_Carbon.pdf. *See also* Inst. for Pol'y Integrity, *A Lower Bound: Why the Social Cost of Carbon Does Not Capture Critical Climate Damages and What That Means for Policymakers* 5 (2019), *available at* https://policyintegrity.org/files/publications/Lower_Bound_Issue_Brief.pdf; *Climate Impacts Reflected in the SCC Estimates*, Cost of Carbon Project, https://costofcarbon.org/scc-climate-impacts.

[189] *See, e.g.*, Frances C. Moore et al., *Economic Impacts of Climate Change on Agriculture: A Comparison of Process-Based and Statistical Yield Models*, 12 ENV'T RES. LTRS., 65008 ("[W]e find little evidence for differences in the yield response to warming. The magnitude of CO_2 fertilization is instead a much larger source of uncertainty. Based on this set of impact results, we find a very limited potential for on-farm adaptation to reduce yield impacts.").

[190] Frances C. Moore et al., *New Science of Climate Change Impacts on Agriculture Implies Higher Social Cost of Carbon*, 8 NATURE COMMUNS. 1607 (2017).

[191] WILLIAM R. CLINE, GLOBAL WARMING AND AGRICULTURE: IMPACT ESTIMATES BY COUNTRY 1–2 (2007).

[192] Draft Update, *supra* note 4, at 70 tbl.3.1.4 (breaking down damage estimates by sector/category).

[193] *See, e.g.,* Howard, *supra* note 188. *See also* 2016 TSD, *supra* note 181, at 21.

[194] *See* Tamma A. Carleton et al., *Valuing the Global Mortality Consequences of Climate Change Accounting for Adaptation Costs and Benefits* (U. Chicago, Becker Friedman Inst. for Econ. Working Paper No. 2018-51) (Jul. 31, 2019), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3224365 (finding that new empirical estimates suggest that the increase in morality risk from climate change is valued at approximately 3.2% of global GDP in 2100).

3. The Working Group Did Not Overstate the Pace of Climate Change

Critics further allege that the chosen Equilibrium Climate Sensitivity ("ECS") distribution—that is, the amount of warming that is expected to result from a doubling of the atmospheric carbon dioxide concentration—is outdated and fails to account for recent evidence showing that sensitivity to be lower than previously believed. But these arguments rely on cherry-picked data and ignore the scientific consensus.

In 2016, the National Academies of Sciences dedicated an entire report to whether the Working Group should update the social cost metrics to reflect more recent science on the ECS. The National Academies decided that such an update was unnecessary, "recommend[ing] against a near-term change in the distributional form of the ECS" and explaining that any reasonable revisions on this front would "have a minimal impact on estimates of the [social cost of greenhouse gases]."[195]

On top of the National Academies' rejection of this argument, there is little support for the claim that the Working Group overstated the pace of climate change. The most recent estimate from the Intergovernmental Panel on Climate Change ("IPCC")—which reflects consensus estimates from the worldwide scientific community—projects an ECS range from 2.5°C to 4°C, with 3°C as a "best estimate."[196] This is consistent with the range applied by the Working Group—based off of Roe & Baker—which uses 3°C as its median and 3.5 °C as its mean ECS value.[197] In evaluating the ECS, the Working Group assessed estimates from a wide range of experts and selected consensus values. In fact, as the Working Group acknowledged, some ECS estimate ranges go as high as 10º C, making its selected ECS distribution substantially lower than these high-end estimates and a reasonable middle range.[198] The Draft Update confirms this approach by applying a similar ECS value using the FaIR model.[199]

In previous dockets, opponents of the Working Group's estimates have cited Lewis & Curry (2015)—which estimates a median ECS of 1.64 ºC with an uncertainty range (5–95%) of 1.05–4.05 ºC—to suggest that the Working Group applied an inappropriately high ECS range.[200] But in light of the consensus estimates discussed above, that paper is a severe outlier. Since its publication, Lewis & Curry (2015) has been criticized by other climate scientists for methodological deficiencies that cause it to underestimate the ECS.[201] And as noted above, the

[195] Nat'l Acad. Scis., Eng'g & Med., *Assessment of Approaches to Updating the Social Cost of Carbon: Phase 1 Report on a Near-Term Update* 34, 46 (2016), *available at* https://perma.cc/TJM6-XE65 [hereinafter "NAS 2016 Report"].

[196] IPCC, *AR6 Synthesis Report* SPM-14 (2021).

[197] 2010 TSD, *supra* note 177, at 13 tbl.1.

[198] *Id.* at 14 fig.2.

[199] Draft Update, *supra* note 4, at 28–29 & 29 tbl.2.2.1.

[200] Nicholas Lewis & Judith A. Curry, *The Implications for Climate Sensitivity of AR5 Forcing and Heat Uptake Estimates*, 45 Climate Dynamics 1009 (2015).

[201] *See, e.g.*, Kate Marvel et al., *Internal Variability and Disequilibrium Confound Estimates of Climate Sensitivity from Observations*, 45 GEOPHYS. RES. LTRS. 1595 (2018) ("[A] range of recent work … suggests that [Lewis & Curry (2015)] may underestimate equilibrium warming."); Timothy Andrews et al., *Accounting for Temperature Patterns Increases Historical Estimates of Climate Sensitivity*, 45 GEOPHYS. RES. LTRS. 8490 (2018) (explaining that Lewis and Curry disregard "the impact from non-CO_2 forcings and unforced climate variability that could have had a significant impact on the pattern of historical temperature change").

National Academies did not think that Lewis & Curry (2015) merited an update to the Working Group's valuations to revise the ECS estimates.[202]

Critics further argue that the ECS distribution applied by the Working Group inappropriately skews rightward, meaning that its mean ECS value exceeds the median value of 3º C that the IPCC has indicated. But that decision is a feature, not a bug. As the National Academies explained, the IPCC has found that there is a "positively skewed distributional form for [the ECS] parameter" similar to the ECS distribution applied by the Working Group.[203] (This too is confirmed in EPA's Draft Update.[204]) In other words, the mean ECS value should be higher than the median ECS value, and the Working Group applied an appropriate distribution. Criticisms to the contrary are meritless.

4. The Working Group Applied a Reasonable Range of Emission Baselines

Critics further argue that the Working Group's valuations are an overestimate because they apply outdated emission scenarios that exaggerate the baseline level of atmospheric greenhouse gas levels. Using a higher baseline level of emissions raises the social cost estimates because the harm from an additional unit of emissions increases with the baseline atmospheric emissions level. However, the Working Group used a reasonable emissions baseline that reflects different possible mitigation scenarios.

While the Working Group assumed a baseline emissions range of 13–118 gigatons of carbon dioxide emitted per year by 2100,[205] recent projections from the Climate Action Tracker indicate that baseline emissions will reach between 14–175 gigatons of carbon dioxide by 2100 under a range of scenarios reflecting different levels of mitigation.[206] Thus, the baselines used by the Working Group potentially understate baseline emissions rather than overvalue them as opponents argue. Several of the Working Group's supposedly "business-as-usual" scenarios are actually more consistent with baseline estimates reflecting policy projections.[207] Accordingly, the criticism that the Working Group overestimated future greenhouse gas concentrations in the atmosphere falls flat.

Moreover, this choice does not particularly affect the social cost valuations. In comparison to the Working Group's central social cost of carbon estimate in 2020 of $51 per ton, the average social cost of carbon under the Working Group's supposed business-as-usual emissions scenarios is $53 per ton and $41 per ton under the emissions scenario that is consistent with sustained and widespread mitigatory action.[208] While relying less on the Working Group's supposed business-as-usual scenarios would therefore modestly decrease the interim social cost valuations in a vacuum, more holistic updates to the metrics as recommended by the National

---

[202] NAS 2016 Report, *supra* note 195.

[203] *Id.* at 25.

[204] Draft Update, *supra* note 4, 29 tbl.2.2.1 (reporting mean ECS of 3.18 °C and median of 2.95 °C).

[205] 2010 TSD, *supra* note 177, at 16 tbl.2.

[206] Climate Action Tracker, *Global Emissions Time Series* (Dec. 1, 2020), *available at* https://perma.cc/B4X2-RAWA.

[207] *Compare id.* (projecting 35-48 gigatons of emissions in 2100 under "current policy projections" scenarios and 83-175 gigatons under business-as-usual scenario) *with* 2010 TSD, *supra* note 177, at 16 tbl.2 (incorporating supposedly business-as-usual scenarios of 42.7 and 60.1 gigatons in 2100).

[208] *See* Peter Howard et al., *Option Value and the Social Cost of Carbon: What Are We Waiting For?* (Inst. for Pol'y Integrity Working Paper No. 2020/1) at 16 tbl.1 (2020), *available at* https://policyintegrity.org/files/publications/Working_paper_06.22.20.pdf.

Academies of Sciences would very likely increase the social cost valuations overall—as confirmed by EPA's Draft Update—due to the omitted damages discussed above and recent evidence regarding intergenerational discount rates.[209] At best, therefore, this argument makes a mountain out of a molehill.

5. The Working Group Applied Scientifically-Based Damage Models

Critics further claim that the IAMs—the damage functions for translating climate impacts into economic losses—are flawed and arbitrary. While newer data has enabled the development of updated damage models that EPA applies in the Draft Update, the Working Group's damage functions nonetheless are based on reasonable assumptions made by a range of experts.[210] They have also withstood scientific scrutiny, and while opponents of climate reform frequently highlight criticism of the damage functions by a notable economist, they take this criticism out of context.

The Working Group selected three models of climate damages that, when the Working Group selected them in 2010, were the most widely used and cited models in the economics literature linking physical climate impacts to economic damages[211]: the DICE, FUND, and PAGE models.[212] These models were developed by outside experts, published in peer-reviewed economic literature,[213] and were the product of extensive scholarship and expertise. One of the models, DICE, was developed by William Nordhaus, an economics professor and former provost of Yale University who won a Nobel Memorial Prize in Economic Sciences for developing the model. And PAGE's developer, Chris Hope, was a lead author and review editor for the Third and Fourth Assessment Reports of the IPCC, which shared the Nobel Peace Prize in 2007 with former U.S. Vice President Al Gore.[214]

The three models reflect a wide diversity of methodological assumptions about a range of key parameters and inputs.[215] This reflects, in part, different judgments about the experts who developed the models. For instance, Richard Tol, who developed the FUND model, has stated that "[t]he impact of climate change is relatively small," and dismissed much of the research behind climate change as "scaremongering" rather than "sound science."[216] Unsurprisingly, his model produces the lowest damage estimates of the three models incorporated by the Working Group.[217] William Nordhaus, who developed the DICE model, is widely credited with

---

[209] *See* 2021 TSD, *supra* note 5, at 4 (Working Group acknowledging that its current social cost valuations "likely underestimate societal damages from [greenhouse gas] emissions").

[210] Response to Comments, *supra* note 113, at 8 ("While the development of the DICE, FUND and PAGE models necessarily involved assumptions and judgments on the part of the modelers, the damage functions are not simply arbitrary representations of the modelers' opinions about climate damages.").

[211] Response to Comments, *supra* note 113, at 4 (stating the models "remain the most widely cited"), 8 (quoting the National Academies of Sciences for recognizing that the chosen models represent "the most widely used impact assessment models" available).

[212] 2010 TSD, *supra* note 177, at 5.

[213] Response to Comments, *supra* note *supra* note 113, at 4.

[214] *See* Chris Hope faculty bio page, University of Cambridge Judge Business School, https://www.jbs.cam.ac.uk/faculty-research/research-teaching-staff/chris-hope/.

[215] *See* 2010 TSD, *supra* note 177, at 6 (discussing how "[t]he parameters and assumptions embedded in the three models vary widely").

[216] Richard S.J. Tol, *Why Worry About Climate Change?*, ESRI Research Bulletin 2009/1/1, at 3, 5 (2009).

[217] *See* 2010 TSD, *supra* note 177, at 50 tbl.A5 (reporting that FUND model has the lowest mean estimate of the three models at all discount rates, including a negative social cost of carbon estimate at a 5% discount rate).

popularizing the goal that global temperatures increase no more than 2° Celsius (or 3.6° Fahrenheit) below pre-industrial levels[218]—a goal now considered conservative by the global community.[219] His model produces higher damage estimates that are close to the Working Group's average damage valuations.[220]

Opponents of climate mitigation policy frequently point to criticisms from Robert S. Pindyck, a noted climate economist who has been critical of the Working Group's choice of damage functions. But as Professor Pindyck has himself stated, his "writings continue to be taken out of context by some to unfairly attack the Interagency Working Group's methodology and its interim estimates."[221] While Professor Pindyck has questioned the shape of the models' damage functions,[222] he has acknowledged that the damage functions reflect "common beliefs" about the effects of two or three degrees of warming.

And Pindyck states that uncertainty about the social cost estimates, including the damage functions, "does not imply that [their] value should be set to zero until the uncertainty is resolved."[223] In fact, he actually advocates for an even higher social cost value than that produced by the Working Group,[224] and has emphatically declared that "the federal government should continue to use the [Working Group's] interim estimates . . . as lower bound estimates."[225]

In other words, the best critic of the Working Group's methodology that opponents could find *supports* the continued use of the Working Group's estimates and considers them to be conservative underestimates of the true cost to society of greenhouse gas emissions. His conclusion is supported by EPA's Draft Update, which provides conclusive evidence that the Working Group's climate-damage valuations are underestimates. Accordingly, criticisms of the Working Group's valuations from opponents of sensible climate policy are groundless.

---

[218] The 2° C Limit on Global Warming, The Economist (Dec. 6, 2015), https://www.economist.com/the-economist-explains/2015/12/06/the-2degc-limit-on-global-warming.

[219] For instance, the Paris Agreement calls for governments to "hold[] the increase in the global average temperature to well below 2°C above pre-industrial levels and pursu[e] efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change." Paris Agreement to the United Nations Framework Convention on Climate Change, Art. 2(1)(a), Dec. 12, 2015, T.I.A.S. No. 16-1104.

[220] *Compare* 2010 TSD, *supra* note 177, at 50 tbl.A5 *with id.* at 1.

[221] Robert S. Pindyck, Comments on "Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990" at 1 (June 15, 2021), *available at* https://www.regulations.gov/comment/OMB-2021-0006-0012.

[222] Robert S. Pindyck, *Climate Change Policy: What do the Models Tell Us? (*N*at'l Bureau of Econ. Research, Working Paper No. 19244)* 16 (2013), *available at* https://perma.cc/G25M-MA7W.

[223] Robert S. Pindyck, Comments to Ms. Catherine Cook, Bureau of Land Management, on Proposed Rule and Regulatory Impact Analysis on Delay and Suspension of Certain Requirements for Waste Prevention and Resource Conservation 3 (Nov. 6, 2017), *available at* https://perma.cc/8MY5-58P5; *see also* Pindyck, *supra* note 222, at 16 (My criticism of IAMs should not be taken to imply that because we know so little, nothing should be done about climate change right now, and instead we should wait until we learn more. Quite the contrary.").

[224] Pindyck, *supra* note 221, at 1 ("My work instead strongly suggests that the estimates of the social cost of greenhouse gases should be higher than the February 2021 interim estimates[.]") In 2019, Pindyck's own estimate of the average social cost of carbon dioxide was between $80 to $100, with plausible values going up to $200. Robert S. Pindyck, *The Social Cost of Carbon Revisited*, 94 J. ENV'T ECON. & MGMT. 140, 140, 154–55 (2019). This is far higher than the Working Group's current central estimate of $51.

[225] Pindyck, *supra* note 221, at 1.

Conclusion

For the foregoing reasons, it is appropriate for EPA to continue to rely on the Working Group's valuations of the social cost of greenhouse gases in the Proposed Rule as conservative underestimates. To bolster the legal justification for that reliance as it finalizes its regulation, EPA should provide additional explanation for its methodological choices and conduct additional sensitivity analysis around different social cost values.

Sincerely,

Natasha Brunstein, Legal Fellow, Institute for Policy Integrity at NYU School of Law
Mohit Chhabra, Senior Scientist, Natural Resources Defense Council
Rachel Cleetus, Ph.D., Policy Director, Union of Concerned Scientists
Stephanie Gagnon, Associate Policy Fellow, Center for Climate and Energy Solutions
Anne Hedges, Director of Policy and Leg. Affairs, Montana Environmental Information Center
Melissa Hornbein, Senior Attorney, Western Environmental Law Center
Peter Howard, Ph.D., Economics Director, Institute for Policy Integrity at NYU School of Law
Nat Keohane, Ph.D., President, Center for Climate and Energy Solutions
Andres Restrepo, Senior Attorney, Sierra Club
Max Sarinsky, Senior Attorney, Institute for Policy Integrity at NYU School of Law
Grace Smith, Attorney, Environmental Defense Fund
Hana Vizcarra, Senior Attorney, Earthjustice
Ann Brewster Weeks, Senior Counsel and Legal Director, Clean Air Task Force
Rosalie Winn, Director & Senior Attorney, Environmental Defense Fund

For any questions regarding these comments, please contact:

Max Sarinsky, Senior Attorney | max.sarinsky@nyu.edu
Institute for Policy Integrity at NYU School of Law
139 MacDougal Street, 3rd Floor, New York, NY 10012

Attachments:

1) Council of Econ. Advisers, *Discounting for Public Policy: Theory and Recent Evidence on the Merits of Updating the Discount Rate* (CEA Issue Brief, 2017)
2) Moritz 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)
3) Moritz Drupp et al., Comments on Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990 (June 20, 2021)
4) Trevor Houser & Kate Larsen, *Calculating the Climate Reciprocity Ratio for the U.S.*, Rhodium Group (Jan. 21, 2021)

5) Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon,* COST OF CARBON PROJECT REPORT (2014)
6) Peter Howard & Jason A. Schwartz, *About Time: Recalibrating the Discount Rate for the Social Cost of Greenhouse Gases* (2021)
7) Peter Howard & Jason Schwartz, *Foreign Action, Domestic Windfall* (2015)
8) Peter Howard & Jason Schwartz, *Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon*, 42 COLUMBIA J. ENV'T L. 203 (2017)
9) Peter Howard & Derek Sylvan, *Gauging Economic Consensus on Climate Change* (2021)
10) Interagency Working Group on the Social Cost of Greenhouse Gases, Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide – Interim Estimates Under Executive Order 13,990 (2021)
11) Matthew J. Kotchen, *Which Social Cost of Carbon? A Theoretical Perspective*, 5 J. ASSOC. ENV'T & RES. ECON. 673 (2017)
12) Qingran Li & William A. Pizer, *Use of the Consumption Discount Rate for Public Policy over the Distant Future*, 107 J. ENV'T ECON. & MGMT. 102,428 (2021)
13) National Academies of Sciences, *Assessment of Approaches to Updating the Social Cost of Carbon: Phase 1 Report on a Near-Term Update* (2016)
14) Iliana Paul & Max Sarinsky, *Playing with Fire: Responding to Criticism of the Social Cost of Greenhouse Gases* (2021)
15) Robert S. Pindyck, Comments on "Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990" (June 15, 2021)
16) Richard L. Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 NATURE 173–175 (2014).
17) Richard L. Revesz & Matthew R. Shahabian, *Climate Change and Future Generations*, 84 S. CAL. L. REV. 1097 (2011)
18) Jason A. Schwartz, *Strategically Estimating Climate Pollution Costs in a Global Environment* (2021)