June 6, 2022

To: Office of Energy Efficiency and Renewable Energy, Department of Energy

Submitted By: Center for Climate and Energy Solutions, Institute for Policy Integrity at New York University School of Law, Natural Resources Defense Council, Sierra Club, Union of Concerned Scientists

Subject: Monetizing Greenhouse Gas Emissions in Energy Conservation Program: Energy Conservation Standards for Room Air Conditioners (EERE-2014-BT-STD-0059) (proposed April 7, 2022)

The undersigned organizations respectfully submit the following comments[1] on the Department of Energy's application of the social cost of greenhouse gases in its notice of proposed rulemaking for room air conditioners ("Proposed Rule"),[2] and in the associated technical support document ("TSD").[3]

Even though the Proposed Rule would be cost-benefit justified without the consideration of climate effects,[4] DOE appropriately applies the social cost estimates developed by the Interagency Working Group on the Social Cost of Greenhouse Gases ("Working Group") for carbon dioxide, methane, and nitrous oxide, to its analysis of emissions reduction benefits generated by the Proposed Rule.[5] DOE correctly recognizes that the social cost estimates, though likely underestimates, represent the federal government's best available valuation of the social benefits from reducing greenhouse gas emissions.[6] The Working Group developed its social cost estimates through a rigorous and transparent process incorporating the best available science. Those values—though widely agreed to underestimate

[11] 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] Energy Conservation Program: Energy Conservation Standards for Room Air Conditioners, 87 Fed. Reg. 20,608 (proposed Apr. 7, 2022).

[3] Dep't of Energy, Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Room Air Conditioners (Mar. 2022) [hereinafter "TSD"]..

[4] See 87 Fed. Reg. at 20,613 (showing net benefits between $9 billion and $17 billion, of which climate benefits are only $2.39 billion).

[5] 87 Fed. Reg. at 20,643.

[6] See, e.g., *id.* at 20,670 ("DOE agrees with the IWG that these estimates most likely underestimate the climate benefits of greenhouse gas reductions."); see also *id.* at 20,643 ("DOE exercises its own judgment in presenting monetized climate benefits as recommended by applicable Executive orders and guidance, and DOE would reach the same conclusion presented in this proposed rulemaking in the absence of the social cost of greenhouse gases.").

the full social costs of greenhouse gas emissions[7]—are appropriate to use as conservative estimates and have been applied in dozens of previous rulemakings[8] and upheld in federal court.[9]

DOE provides compelling justifications for readopting the Working Group's estimates[10] that it briefly abandoned under the Trump administration.[11] As detailed herein, there are many additional legal, economic, and policy justifications that can further bolster DOE's adoption of those valuations. Accordingly, **DOE should expand upon its rationale for adopting a global damages valuation and for the range of discount rates it applies to climate effects**. As detailed herein, there are additional legal, economic, and policy reasons for such methodological decisions that can further bolster DOE's support for these choices. DOE should also strongly consider conducting supplemental sensitivity analyses to assess the Proposed Rule's climate benefits at lower discount rates, per the recommendation of the Working Group.

These comments are organized into four sections. First, Section I recommends that DOE provide additional support for adopting a global framework for valuing climate impacts. These include legal justifications based on the Energy Policy and Conservation Act, Energy Independence and Security Act of 2007, 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. DOE can similarly strengthen its economic and policy justifications, such as by **explicitly concluding that the theory and evidence for international reciprocity justify a focus on the full global values**. Section I also recommends that DOE consider including a discussion of domestic-only estimates. While DOE should not use the flawed domestic-only values developed under the now-revoked Executive Order 13,783, which it applied in a similar rulemaking in 2020, **it should consider conducting sensitivity analysis using a sounder domestic-only estimate as a backstop, and should explicitly conclude that the rule is cost-benefit justified even using a domestic-only valuation that may still undercount climate benefits**.

Section II offers additional justification for adopting the range of discount rates endorsed by the Working Group and for appropriately deciding not to apply a 7% capital-based discount rate to climate impacts. In particular, **DOE should provide 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, DOE should also argue that it is appropriate generally 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. We also urge DOE to consider providing additional

[7] 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 "IWG, 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) (note that co-author Kenneth Arrow was a Nobel Prize-winning economist).

[8] 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).

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

[10] *See* 87 Fed. Reg. at 20,643-45; *see also* Proposal TSD at 14-1 to 14-4.

[11] *See, e.g.*, Dep't of Energy, Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Room Air Conditions 14-1 (June 2020) (applying the flawed domestic-only interim estimates developed pursuant to Executive Order 13,783.) [hereinafter "2020 Air Conditioners TSD"].

sensitivity analysis using discount rates of 2% or lower for climate impacts, as recently suggested by the Working Group.

Section III offers further 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 common criticisms of the Working Group's methodology** from opponents of energy, consumer-rights, and climate regulation.

Finally, Section IV recommends that DOE clearly state that any criticisms of the social cost of greenhouse gases are moot in this rulemaking because the Proposed Rule is easily cost-justified without any climate benefits.

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I. DOE Should Provide Additional Justification for Its Reliance on Global Climate Damage Valuations, While Considering Additional Analysis of Domestic Effects

In the Proposed Rule and TSD, DOE appropriately focuses on a global estimate of climate benefits,[12] returning to its longstanding historical approach and correcting its temporary and arbitrary practice of disregarding all climate effects that occur outside the physical borders of the United States.[13] While DOE offers persuasive justifications for this decision,[14] it should provide additional analysis on this front.[15] In particular, DOE should emphasize the concern for the impacts of U.S. pollution on foreign welfare in the Energy Policy and Conservation Act and other sources of law, further highlight the significance of U.S. strategic interests and reciprocity, discuss 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. At the same time, DOE may wish to conduct additional sensitivity analysis using a reasonable domestic-only valuation.

a. Relevant Statutes and Executive Orders Permit, if Not Compel, a Global Perspective on Climate Damages

The Energy Policy and Conservation Act ("EPCA"), Energy Independence and Security Act of 2007 ("EISA"), National Environmental Policy Act, Administrative Procedure Act, and other key sources of law permit, if not require, DOE to consider the effects of U.S. pollution on foreign nations. DOE should highlight these legal requirements as justification for its focus on global climate impacts.

EPCA requires that amended or new energy conservation standards promulgated by DOE be "economically justified," meaning that "the benefits of the standard exceed its burdens."[16] In making this cost-benefit assessment, DOE is instructed to consider any "relevant" "factors" to "the greatest extent practicable," including the "need for national energy and water conservation."[17] Such relevant factors include the global climate damages that result from greenhouse gas emissions. For decades, courts have affirmed that this language does not bar, but in fact compels agencies to consider the environmental implications of energy conservation, including effects on climate change.[18]

Nowhere does EPCA restrict consideration of climate impacts to those effects that occur within the nation's borders, as confirmed in a 2016 case from the U.S. Court of Appeals for the Seventh Circuit. In that case, industry groups challenged a Department of Energy efficiency standard that was promulgated under EPCA, specifically objecting to the alleged "mismatch in the [social cost of carbon] analysis looking to global benefits." According to the petitioners, "EPCA authorizes [the agency] to conduct only a national analysis. There are no references to global impacts in the statute."[19] However, the Seventh Circuit rejected that argument, holding that DOE "acted reasonably" in considering the "global benefits" of its EPCA standards.[20] The Court further held that DOE had reasonably identified

[12] 87 Fed. Reg. at 20,643–46; TSD at 14-1 to 14-6.

[13] *See* 2020 Air Conditioners TSD, *supra* note 11, at 14-1.

[14] 87 Fed. Reg. at 20,643–46; TSD at 14-1 to 14-6.

[15] *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.

[16] 42 U.S.C. § 6295(o)(2)(B)(i).

[17] *Id.* § 6295(o)(2)(B)(i)(VI)–(VII).

[18] *See Pub. Citizen v. Nat'l Highway Traffic Safety Admin.*, 848 F.2d 256, 263 n.27 (D.C. Cir. 1988).

[19] Brief for Petitioners at 28–30, *Zero Zone v. Dep't of Energy*, 832 F.3d 654 (7th Cir. 2016).

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

carbon pollution as "a global externality" and appropriately concluded that, because "national energy conservation has global effects, . . . those global effects are an appropriate consideration when looking at a national policy."[21] Thus, the court rejected industry petitioners' argument that EPCA prohibited consideration of global climate externalities, affirming as reasonable DOE's connection between global climate damages and national policy interests.[22]

An analysis performed under EISA[23] is likewise not restricted to domestic climate impacts. For instance, while EISA charges DOE with "mov[ing] the United States toward greater energy independence and security,"[24] the Seventh Circuit held that a similar charge in EPCA includes environmental benefits and does not preclude the agency from considering global climate impacts.[25] Indeed, EISA specifically charges DOE with facilitating "greenhouse gas capture and storage options,"[26] indicating that Congress intended the agency to consider impacts on "*global* warming" that the statute also emphasizes.[27] Focusing narrowly on domestic climate impacts would not be consistent with that charge.

This interpretation that DOE is authorized to consider global climate impacts is further supported by the National Environmental Policy Act ("NEPA"). Though best known for requiring agencies to prepare environmental impact statements before taking certain actions,[28] 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,"[29] including the need to "recognize the worldwide and long-range character of environmental problems" and to "lend appropriate support" to help "maximize international cooperation."[30] In other words, especially because adopting a global perspective on climate damages will advance U.S. foreign policy goals (see subsection II.B.), NEPA requires DOE to interpret all of its laws in ways that recognize the worldwide character of

[21] *Id.*

[22] *Id.*

[23] 87 Fed. Reg. at 20,617 (discussing relevance of EISA to this rulemaking).

[24] Energy Independence and Security Act of 2007, Pub. L. No. 110-140, 121 Stat. 1492, 1492 (Jan. 4, 2007).

[25] *Zero Zone*, 832 F.3d at 677.

[26] Energy Independence and Security Act of 2007, Pub. L. No. 110-140, 121 Stat. 1492, 1492 (Jan. 4, 2007).

[27] 42 U.S.C. § 7545(o)(1)(G) (emphasis added).

[28] DOE asserts that the Proposed Rule falls under a categorial exclusion to NEPA. 87 Fed. Reg. at 20,683. However, this does not affect the application of 42 U.S.C. § 4332's requirement that agencies interpret their laws to "recognize the worldwide and long-range character of environmental problems." *See infra* notes 29–30 and accompanying text.

[29] 42 U.S.C. § 4332(1) (emphasis added).

[30] *Id.* § 4332(2)(F); *see also EDF v. Massey*, 986 F.2d 528, 536 (D.C. Cir. 1993) (finding that agency must consider transboundary impacts of its actions under NEPA, pointing to Section 102(2)(F) to "support[] the conclusion that Congress, when enacting NEPA, was concerned with worldwide as well as domestic problems facing the environment."); *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.").

environmental problems.[31] Using global social cost of greenhouse gas estimates helps fulfill that requirement.

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[32]—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."[33] 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."[34] The unmistakable implication of the Convention is that parties—including the United States, which ratified the Convention in 1992[35]—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."[36]

And under the Administrative Procedure Act, it is arbitrary and capricious for agencies to "entirely fail[] to consider an important aspect of the problem"[37]—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 DOE previously applied in at least one instance) that looked only at effects within the U.S. borders.[38] 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,"[39] whereas "focusing solely on domestic effects has been soundly rejected by economists as improper and unsupported by science."[40]

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[31] For over forty years, agencies have assessed transboundary impacts under NEPA. See Exec. Order No. 12,114 § 2–3, 44 Fed. Reg. 1957 (Jan. 4, 1979) (instructing agencies to "take into consideration in making decisions" effects of their actions on the environment of foreign nations and global commons).

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

[33] 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").

[34] *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).

[35] Treaty Doc. 102-38, S. Exec. Rept. 102-55 (1992).

[36] 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).

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

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

[39] *Id.* at 611.

[40] *Id.* at 613.

The court reminded BLM that relevant executive orders, including Executive Order 12,866, require consideration of "all" costs and benefits, based on the "best reasonably obtainable scientific, technical, economic, and other information," and concluded that "no[] . . . regulatory rules or orders require exclusion of global impacts."[41] 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."[42] 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.

DOE should draw upon these legal authorities in further explaining 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

While DOE offers clear and robust support for its decision to readopt a global perspective for climate impacts, there are additional economic and policy justifications that its discussion does not include. This section fully explains the theory and evidence for relying on global damage valuations. It recognizes that the theory and evidence for reciprocity by itself justifies a focus on the full global values, and that additional strategic and practical justifications provide further support.

i. 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.[43] Indeed, basic economic principles demonstrate that the United States stands to benefit greatly if all countries apply global social cost of greenhouse gas values in their

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

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

[43] 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 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.").

regulatory decisions and project reviews[44]—likely trillions of dollars in direct benefits from foreign action to combat climate change.[45]

The Biden Administration has clearly 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."[46] 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."[47]

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%; the European Union set a target of at least 55%; the United Kingdom set a new target for the year 2035; 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.[48]

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 130 parties so far committing to common but differentiated responsibilities to phase down hydrofluorocarbons.[49] 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 their efforts if other countries make comparable reductions.[50] By contrast, when the United States "failed to take action to reduce greenhouse

[44] *See* Kotchen, *supra* note 43, at 678 (providing formulas for the "efficiency argument in support of all countries internalizing the GSCC [global social cost of carbon] for domestic policy").

[45] 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.

[46] Exec. Order No 13,990 § 5(a).

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

[48] 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.

[49] *See* .N., Kigali Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer (2016), https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=XXVII-2-f&chapter=27&clang=_en (last visited May 17, 2022).

[50] *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

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."[51] By failing to take international climate damages into account, in other words, DOE 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 has committed to reduce for each ton that the United States has pledged to reduce: a figure they call the "Climate Reciprocity Ratio."[52] Using only the quantifiable, unconditional pledges that 51 countries have 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 have pledged 6.1–6.8 tons in return.[53] While implementation of all these foreign policies is not guaranteed, 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.[54]

DOE also recognizes the importance of U.S. leadership on climate policy. In the Proposed Rule, DOE notes that the U.S. recently rejoined the Paris Agreement and so "will exert leadership in confronting the climate crisis. These actions have placed an increased emphasis on the importance of energy savings that reduce greenhouse gas emissions and help mitigate the climate crisis."[55] The agency explicitly connects this rulemaking to the U.S.' place among other countries in combating the climate crisis, so it follows that DOE should value greenhouse gas emissions from a global perspective in light of the reciprocity dynamic.

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.

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

Significant costs to trade, human health, and security will inevitably "spill over" to the United States as other regions of the planet experience climate change damages.[56] Due to its unique place

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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. and 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).

[51] 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.

[52] Trevor Houser & Kate Larsen, *Calculating the Climate Reciprocity Ratio for the U.S.*, Rhodium Group, Jan. 21, 2021 (calling their estimate "deliberately conservative").

[53] 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.*

[54] *Id.*

[55] 87 Fed. Reg. at 20,619–20.

[56] 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

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. 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.[57] 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.[58]

Climate change is also predicted to exacerbate existing security threats—and possibly catalyze new security threats—to the United States.[59] Besides threats to U.S. military installations and operations at home and abroad from flooding, storms, extreme heat, and wildfires,[60] climate change is also a "source[] of conflict around the world"[61] 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."[62] 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.[63]

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.[64] The United States shares a maritime border with 21 other countries, shares water resources like the Columbia River with our neighbors, and

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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).

[57] 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"].

[58] *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).

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

[60] 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).

[61] 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.

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

[63] U.S. Dep't of Def., Climate Adaptation Plan 3 (2021) ("Extreme weather events are already costing the Department billions of dollars and are degrading mission capabilities. These effects and costs are likely to increase as climate change accelerates. Not adapting to climate change will be even more consequential with failure measured in terms of lost military capability, weakened alliances, enfeebled international stature, degraded infrastructure, and missed opportunities for technical innovation and economic growth.").

[64] NCA4, *supra* note 57, at 607.

shares ecosystems—including the oceans through which migratory species with high economic and ecosystem-service values, like the Pacific hake, travel and live.[65]

All of these individual spillover effects can also interact and trigger feedback loops that will propagate additional spillover damages.[66] 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.[67] 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.[68] 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.[69]

Some 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, use of the global values can be further justified as a proxy for capturing all spillover effects.[70] 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. DOE can therefore elaborate on spillover impacts, arguing that transboundary spillovers, feedback loops, information spillovers, and other effects justify a focus on the full global values, either independently or in combination with other strategic and ethical considerations.[71]

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[65] *Id.* at 615.

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

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

[68] *Id.*

[69] NCA4, *supra* note 57, at 621 (explaining that instability has economic effects, and economic risks create risk of conflict); Freeman & Guzman, *supra* note 56, 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 66.

[70] 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 SCC 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).

[71] *See* Schwartz, *supra* note 15, at 26.

iii. Use of the Global Values Preserves Extraterritorial Interests

The Proposed Rule mentions direct and indirect impacts to U.S. citizens and assets located abroad as a justification for a global valuation,[72] 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,[73] and even effects to the millions of Americans living abroad.[74] 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.[75] 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.[76] *Circular A-4* cautions that "ignoring these values" may cause analyses to "significantly understate the benefits and/or costs" involved.[77] 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."[78] 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 damages. Furthermore, a quarter of the U.S. population consists of either foreign-born immigrants or second-generation residents,[79] and subsequent generations of Americans retain significant familial, cultural, economic, and religious ties to their ancestors' home nations across the world.[80] U.S. citizens and residents have a significant willingness to pay to protect their relatives,

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[72] 87 Fed. Reg. at 20,644.

[73] "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.

[74] IWG, 2021 TSD, *supra* note 7, 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.

[75] 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.

[76] 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).

[77] *Id.*

[78] *Id.*

[79] 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 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).

[80] 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.

ancestral homes, and cultural and religious sites located abroad.[81] 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[82] and cultural and world heritage sites threatened by climate change.[83] 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.[84]

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. DOE can further highlight U.S. extraterritorial interests as justification for relying on global social cost valuations, and should specifically call attention to climate-vulnerable U.S. military instillations 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 DOE's Consideration of Global Costs

DOE can further justify its focus on global climate benefits as necessary for consistency with the rest of its analysis. In particular, DOE'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 Rule's alleged compliance costs will ultimately accrue to foreign customers or foreign investors. In general, about 29% of U.S. corporate debt and 14% of equities are foreign-owned,[85] and adding foreign direct investment to portfolio stock ownership suggests that foreigners own about 40% of U.S. corporate equity.[86] Thus, a significant share of the Proposed Rule's compliance costs are likely to fall on foreign entities, but DOE

[81] 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).

[82] *See* Arden Rowell, *Foreign Impacts and Climate Change*, 39 HARV. ENV'T L. REV. 371 (2015); Dana, *supra* note 73 (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).

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

[84] 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).

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

[86] 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.

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 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.[87] Yet much like in the Proposed Rule, these analyses do not attempt to separate out 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.[88] 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 DOE 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 out and disregard climate benefits that occur abroad, as doing so would "put a thumb on the scale" by treating costs globally but benefits domestically.[89] DOE can therefore highlight its consistent treatment of costs and benefits as further justification for relying on global social cost of greenhouse gas valuations.

d. DOE Should Consider a Sensitivity Analysis Using Defensible Domestic-Specific Values as a Backstop to Minimize Legal Risks

DOE correctly relies on global social cost of greenhouse gases values to assess the proposal's benefits, and as the U.S. Court of Appeals for the Seventh Circuit has held, it would be reasonable for DOE to continue to do so without any attempt to calculate a domestic-only share of climate benefits. The integrated assessment models ("IAMs") used to calculate the social cost of greenhouse gases are not designed to accurately estimate costs to individual regions, as they do not reflect, for example, spillover effects from one region to another.[90] As such, any attempt to estimate a domestic-only share could prove to be a misleading underestimate.

However, DOE has conducted sensitivity analyses using domestic-only estimates in the past,[91] and so DOE should consider once again conducting sensitivity analysis using a defensible domestic-only estimate—not the interim estimates developed under Executive Order 13,783, which were riddled with

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[87] *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).

[88] *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?).").

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

[90] *See, e.g.*, William Nordhaus, *Revisiting the Social Cost of Carbon*, 114 PNAS 1518, 1522 (2017) (cautioning that "regional damage estimates are both incomplete and poorly understood," and "there is little agreement on the distribution of the [social cost of greenhouse gases] by region."); see *also* 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"] (concluding that current integrated assessment models cannot accurately estimate the domestic social cost of greenhouse gases, and that estimates based on U.S. share of global GDP would be likewise insufficient).

[91] Dep't of Energy, Technical Support Document for the U.S. Department of Energy's Notice of Proposed Rulemaking Establishing Energy Conservation Standards for Manufactured Housing at 14.101 (June 2016), https://perma.cc/KAV5-XVFR.

fatal flaws.[92] DOE's judgment that domestic-only estimates developed under the Trump administration are indefensible is correct; however, DOE should consider conducting a sensitivity analysis using a more reasonable domestic-only valuation. DOE correctly recognizes that the values used under Executive Order 13,783 "fail to reflect the full impact of GHG emissions in multiple ways,"[93] explaining that these numbers do not consider spillover and reciprocity. Indeed, those valuations have been ruled by a federal court to be illegally arbitrary values inconsistent with the best available science and economics.[94]

The Working Group may in the future release guidance on an appropriate range for such a valuation, and considerable evidence suggests that—after weighing strategic benefits, spillover effects, and extraterritorial interests—any reasonable attempt to estimate the U.S. share of climate benefits would be quite a high proportion of global benefits.[95] In the meantime, however, the best existing guidance available to DOE for a domestic-only estimate is *not* the arbitrary values calculated under the now-revoked Executive Order 13,783, which DOE USED as recently as 2020.[96] Rather, DOE should look to the Working Group's past technical support documents for guidance.

In 2010, the Working Group provided an "approximate, provisional, and highly speculative" range of up to 23% of the global value as a domestic-only estimate, but admitted even that was likely a significant underestimate.[97] Though an imprecise and gross underestimate, those values at least have the virtue of some regulatory precedent, as DOE has repeatedly used them in sensitivity analyses.[98] DOE should therefore consider 23% of the global value to be the absolute minimum used for a domestic-only sensitivity analysis. DOE should emphasize that such values are still gross underestimates, as they disregard most of the domestic impacts discussed above including international reciprocity, spillover impacts, and extraterritorial interests. DOE should also note that the integrated assessment models used to estimate the social cost of greenhouse gases were not designed for such localized, non-global estimates. DOE could alternately look to the literature and consider conducting a sensitivity analysis with peer-reviewed domestic only values such as those published by Yale University economics professor Matthew J. Kotchen, which are approximately 73% of the global social cost figures.[99] Those values too, however, are likely underestimates because they do not include inter-regional spillover impacts or extraterritorial interests.

However DOE assesses domestic climate benefits, the agency should clearly explain that the rule is cost-justified even based on a consideration of only domestic climate benefits, and therefore the decision to focus on global climate benefits is in no way dispositive. In fact, as the Proposed Rule and

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[92] *California v. Bernhardt*, 472 F. Supp. 3d 573, 613 (N.D. Cal. 2020) (recognizing that the Trump-era estimates of domestic climate damages "ignores impacts on 8 million United States citizens living abroad, including thousands of United States military personnel; billions of dollars of physical assets owned by United States companies abroad; United States companies impacted by their trading partners and suppliers abroad; and global migration and geopolitical security").

[93] TSD at 14-3.

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

[95] *See* Schwartz, *supra* note 15, at 39-40 (recommending that a value over 75% could be justified).

[96] 2020 Air Conditioners TSD, *supra* note 11, at 14-1.

[97] Working Group, *Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis* 11 (2010), https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/for-agencies/Social-Cost-of-Carbon-for-RIA.pdf ["IWG, 2010 TSD"].

[98] *See, e.g.*, Dept. of Energy, Technical Support Document: Energy Efficiency Program for Consumer Products: Residential Central Air Conditioners and Heat Pumps at 14-3 & n.b, 14-6 to 14-7 (2016) (giving preference to calculations based on the global social cost of greenhouse gases, but also including a domestic valuation in sensitivity analysis).

[99] Kotchen, *supra* note 43, at 690.

TSD show, the rule is easily cost-justified without any monetization of climate benefits.[100] At the same time, however, DOE should maintain that the global perspective is the correct focus for its main analysis, for all the reasons detailed above.

II. DOE Should Provide Additional Explanation for Its Discount Rate Choices and Conduct Sensitivity Analysis Using Lower Rates

DOE applies the social cost of greenhouse gas estimates calculated at discount rates of 2.5%, 3%, and 5%,as well as the 95th percentile estimate based on a 3% discount rate,[101] consistent with the Working Group's current recommendations, and explains its decision to return to its prior conclusion that a 7% capital-based discount rate is inappropriate for climate effects.[102] DOE's use of a reasonable range of discount rates to assess climate impacts is well supported.[103] Per the Working Group's recommendation, DOE should strongly consider providing additional sensitivity analysis around discount rates lower than 2.5%—such as a 2% discount rate.

a. DOE Should Provide Additional Justifications for Its Discount Rate Range

DOE adopts and endorses 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.[104] Though these arguments provide sufficient reason for DOE's approach to discount rates, this section provides additional justifications for its focus on consumption-based rates and its approach to discounting climate effects as compared to other costs and benefits.

i. A 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.[105] As such, analysis must be "based on the best reasonably obtainable scientific, technical, and economic information available,"[106] and agencies must "*[u]se sound and defensible values* or procedures to monetize benefits and costs, and ensure that key analytical assumptions are defensible."[107] 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.[108] Based on *Circular A-4*'s criteria, there are numerous reasons why applying a 7% discount rate to climate effects that occur over a 300-year time horizon would be unjustifiable—and that discount rates of 3% or lower are appropriate.

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[100] *See* 87 Fed. Reg. at 20,613.

[101] 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.

[102] 87 Fed. Reg. at 20,644; TSD at 14-3.

[103] *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

[104] 87 Fed. Reg. at 20,644; TSD at 14-3.

[105] Circular A-4, *supra* note 76, at 3 ("You cannot conduct a good regulatory analysis according to a formula. Conducting high-quality analysis requires competent professional judgment.").

[106] *Id.* at 17.

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

[108] *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).

First, basing the discount rate on the consumption rate of interest (which the 3% rate represents) is the correct framework for 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*."[109] 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 the 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,[110] 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 application of consumption-based discount rates.[111] 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.[112] There is also strong consensus through the economic literature that a capital discount rate like 7% is inappropriate for climate change.[113]

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 a U.S. Environmental Protection Agency rule with a 30-year timeframe of costs and benefits.[114] 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

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[109] *Id.* at 33.

[110] 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.").

[111] *See* IWG, 2021 TSD, *supra* note 7, at 17.

[112] Nat'l Acads. Scis., Eng'g & Med., Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide (2017) ("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).

[113] *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).

[114] Circular A-4, note 76, 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").

values time within a generation, but for extremely long time periods no comparable private rates exist."[115] *Circular A-4* discusses how uncertainty over long time horizons drives the discount rate lower.[116] *Circular A-4* 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*."[117] The National Academies of Sciences makes the same point about discount rates and uncertainty.[118]

Third, a 7% discount rate also ignores catastrophic risks and the welfare of future generations. As the U.S. Environmental Protection Agency 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.[119] The long right-hand tail represents the possibility of catastrophic damages.[120] 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 NEPA's mandate that agencies "recognize the worldwide and long-range character of environmental problems,"[121] it would not be reasonable for DOE to discount climate impacts at such a high rate as to effectively ignore the welfare of future generations.[122]

Fourth, long-term time horizons in general counsel strongly against application of 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.[123] Specifically, Li and Pizer 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 the span of just several decades.[124] 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.[125] Similarly, if climate damages are "non-marginal,"

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[115] Circular A-4, note 76, at 36.

[116] *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).

[117] *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.

[118] NAS 2017 Report, *supra* note 112, at 27.

[119] 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).

[120] IWG, 2021 TSD at 10 ("The [95th percentile] value was included to represent higher-than-expected economic impacts from climate change further out in the tails of the SC-CO2 distribution.").

[121] *See supra* note 44 and accompanying text.

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

[123] IWG, 2021 TSD, *supra* note 7, at 19.

[124] 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).

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

such that climate change significantly affects the very natural resources needed to drive economic growth, growth could plummet or even turn negative.[126]

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—be "based on the best reasonably obtainable scientific, technical, and economic information available."[127] Yet *Circular A-4*'s own default assumption of a 7% discount rate was published 19 years ago and was based on data from even earlier.[128] *Circular A-4*'s guidance on discount rates is in need of an update, as the Council of Economic Advisers (CEA) detailed recently after reviewing the best available economic data and theory.[129] 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."[130] 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.[131] 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.[132]

The second argument the CEA presented for 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.[133] 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.[134] 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."[135] *Circular A-4* thus recommends that agencies conduct additional analysis at "using a lower [than 3%] but positive discount rate" for impacts with important intergenerational effects.[136] Most market data reflects at best individuals' current preferences for their own welfare over time and so simply does not capture society's preferences toward or ethical

[126] *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).

[127] Circular A-4, *supra* note 76, at 17.

[128] 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.

[129] CEA Issue Brief, *supra* note 117, 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.").

[130] *Id.* at 1.

[131] *Id.* at 12.

[132] *See id.*

[133] *Id.* at 12-13.

[134] *See* Howard & Schwartz, *supra* note 103, at 5-6 (arguing for a decrease in the capital-based rate).

[135] Circular A-4, *supra* note 76, at 35–36.

[136] *Id.*

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."[137] A 7% rate ignores much of future generations' welfare and so would be inconsistent with that mandate.

However, while the above arguments are more than sufficient to justify rejecting a 7% discount rate in the context of the social cost of greenhouse gases, DOE should again note that the Proposed Rule would be cost-benefit justified even if the social cost of greenhouse gases were hypothetically zero—and, *ipso facto*, if it were calculated using a 7% discount rate.

ii. DOE Should Further Explain Its Distinct Approach to Discounting Climate Effects

As explained above, DOE's choice to use the social cost of greenhouse gas values calculated with consumption-based discount rates is fully justified. Two additional discounting choices then arise: how to discount back to present value the application of a future social cost of greenhouse gas value to monetize the climate benefits of future emissions reductions (e.g., bringing the $85 per ton of carbon dioxide in climate benefits generated by an emissions reduction in the year 2050 back to present value in 2021), and then how to compare those discounted climate effects to other costs and benefits.

DOE has chosen to ensure that all climate benefits are discounted in an internally consistent way, by applying the same discount rate used to estimate the underlying social cost values (e.g., 2.5%, 3%, or 5%) to calculate the present values of future climate benefits.[138] That approach is consistent with the Working Group's guidance.[139] But it also means DOE is calculating the present value of reduced greenhouse gas emissions differently than the present value of other costs and benefits (which mostly use 3% and 7% discount rates).[140]

If the opportunity presents itself, DOE should consider working with OMB and the Working Group to move toward a declining discount rate framework that can straightforwardly resolve all these issues of consistent discounting, by adopting a single schedule of applicable discount rates that steadily declines over time.[141] In the meantime, DOE should expand on its rationale to its current approach to discounting. DOE should consider two non-exclusive 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) explaining why special legal, economic, and policy considerations justify a different approach to discounting climate effects as distinct from other costs and benefits.

To begin, DOE can explain that given the nature of the proposed standards' 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

[137] Exec. Order § 13,990 5(b)(ii)(E).

[138] *See* 87 Fed. Reg. 20,670–72 tbls. V.50-55.

[139] IWG, 2021 TSD, *supra* note 7, at 25 ("[T]he monetized value of future emission changes should be discounted at the same rate used to calculate the initial SC-GHG to ensure internal consistency—i.e., future damages from climate change using the SC-GHG at 2.5 percent should be discounted to the base year of the analysis using the same 2.5 percent rate.").

[140] 87 Fed. Reg. at 20,613 tbl. 1.3 .

[141] *See* Howard & Schwartz, *supra* note 103, at 41 (recommending a declining discount rate framework).

makes sense only under the "extreme" assumption that all the costs of government action would "fully displace" (i.e., crowd out) private investment.[142] 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.[143]

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.[144] 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.[145] Some agency actions may also induce more private investment than they displace.[146] 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. In this rulemaking, the upfront technology costs and long-term energy savings will be felt primarily by individual consumers; other effects, like climate benefits, will be felt by society as a whole. In other words, because of the nature of the rule, the theory for a capital-based discount rate has a tenuous application at best. DOE 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, DOE would also be justified in taking a distinct approach to discounting climate effects, and DOE should elaborate on the special legal, economic, and policy considerations justifying that approach. While effects like consumer operating cost savings will play out over the course of 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 99.5% of a future effect's value[147]) 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, NEPA broadly instructs all agencies to interpret all their laws to the fullest extent possible to advance the national environmental policies,[148] including to "fulfill the responsibilities of each generation as trustee of the environment for succeeding generations."[149] 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.[150]

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[142] IWG, 2021 TSD, *supra* note 7, at 18-19.

[143] *Id.*

[144] *See* EPA, Guidelines for Economic Analysis, at 6-11.

[145] *Id.*

[146] IWG, 2021 TSD, *supra* note 7, 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").

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

[148] 42 U.S.C. § 4332(1).

[149] 42 U.S.C. § 4331(b)(1).

[150] 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").

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."[151] The National Academies has offered recommendations for how agencies can best apply different annualized discount rates to climate impacts versus other costs and benefits,[152] and DOE can rely on the National Academies' guidance to support its approach to discounting here.

Beyond the dozens of rulemakings (including prior DOE rules) in which agencies discounted climate impacts using consumption-based rates even when discounting other regulatory impacts using capital-based rates, there is regulatory precedent outside the context of climate change for applying lower discount rates to long-term regulatory impacts. In 1999, the U.S. Department of Housing and Urban Development ("HUD") finalized rules for lead-based paint hazards in certain residences.[153] While OMB at that time recommended using only a 7% discount rate, HUD discounted the lifetime earnings benefits for young children who avoid lead exposure at both 3% and 7%. As HUD explained, a special "intergenerational discount rate" was applied to the lifetime earnings benefits only because "lifetime earnings benefits will be realized by the children and grandchildren of the[] adult taxpayers" bearing the rule's costs.[154] HUD also discussed why the 7% discount rate may be less appropriate because the rule's costs, which would fall mostly on federally-assisted housing, would be funded not by private investments but by federal expenditures, and so would tend to increase federal borrowing rather than displace private capital.[155] Notably, HUD's analysis applied different annualized discount rates to different impacts depending on their nature and time horizon—demonstrating that DOE is justified here in taking a similar approach.

Case law on the social cost of greenhouse gases also offers support for DOE discounting approach. Specifically, in *Zero Zone,* the plaintiffs argued that the DOE 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."[156] 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.[157] Analogizing from this precedent, a court may similarly defer to DOE's finding that the long time horizon of climate change justifies a lower discount rate than the rate applied to shorter-term costs and benefits is similarly justified. DOE should explain the special economic, legal, and ethical considerations that support selecting a different annual discount rate for climate effects than for other costs and benefits.

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[151] NAS 2017 Report, *supra* note 90, at 182.

[152] *Id.*

[153] 64 Fed. Reg. 50,140 (Sept. 15, 1999).

[154] *Id.* at 50,186.

[155] *Id.* at 50,187 (also considering a 4-5% discount rate, consistent with nominal costs of government borrowing).

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

[157] *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).

b. DOE Should Conduct Additional Sensitivity Analysis Around Lower Discount Rates for Climate Impacts

In the Proposed Rule and TSD, DOE assesses climate benefits using discount rates of 2.5%, 3%, and 5 % for the social cost of greenhouse gases. In its most recent Working Group technical support document, however, the Group suggested that agencies "conduct[] additional sensitivity analysis using discount rates below 2.5 percent."[158] Just as DOE should include a sensitivity analysis with a robust domestic-only estimate, it should also prepare a sensitivity analysis based on a run using a 2% or lower discount rate for the social cost of greenhouse gases.

As the Working Group explained in its February 2021 technical support document, there is considerable evidence from market data that the default estimate of the consumption-based discount rate should be revised down from 3% to 2%. In the context of long-term, intergenerational effects like climate damages, the case for a lower discount rate is even stronger, in light of ethical considerations and other factors.[159] Multiple expert elicitations show a growing consensus around a discount rate below 2%,[160] and factors like uncertainty, negative economic growth correlations, risk aversion, and the scarcity and non-substitutability of environmental goods all point strongly toward even lower discount rates.[161]

For this reason, among others, the Working Group acknowledged in its latest technical support document that its social cost valuations—presented at discount rates of 2.5%, 3%, and 5%—"likely underestimate societal damages from [greenhouse gas] emissions."[162] The Working Group will evaluate the discount rate (among other issues) as it performs a full assessment of its social cost valuations to reflect the latest scientific and economic research. In the meantime, the Working Group has recommended that agencies apply additional sensitivity analysis around lower discount rates.[163]

To do so, DOE could look to the "value of carbon" estimates from the New York State Department of Environmental Conservation (DEC), which applied a 2% discount rate as its central value.[164] Pursuant to DEC's estimates, at a discount rate of 2% social cost valuations for year 2020 emissions equal $125 per ton of carbon dioxide, $2,782 per ton of methane, and $44,727 per ton of

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[158] IWG, 2021 TSD, *supra* note 7, at 4.

[159] *Id.* at 16–21 (surveying literature).

[160] Peter Howard & Derek Sylvan, *The Economic Climate: Establishing Expert Consensus on the Economics of Climate Change*, INST. POLICY INTEGRITY WORKING PAPER 33–34 (2015); M.A. Drupp, et al., *Discounting Disentangled: An Expert Survey on the Determinants of the Long-Term Social Discount Rate* (London School of Economics and Political Science Working Paper, May 2015) (finding consensus on social discount rates between 1-3%). Pindyck, in a survey of 534 experts on climate change, finds a mean discount rate of 2.9% in the climate change context and this rate drops to 2.6% when he omits individuals that lack confidence in their knowledge. Robert S. Pindyck, *The Social Cost of Carbon Revisited* (National Bureau of Economic Research, 2016). Unlike Howard and Sylvan (2015), Pindyck (2016) combines economists and natural scientists in his survey, though the mean constant discount rate drops to 2.7% when including only economists. Again, this further supports the finding that the appropriate discount rate is below 3%.

[161] *See, e.g.*, Howard & Schwartz, *supra* note 103, at 10 (reporting such research and concluding that "the best empirical estimate of the discount rate based on long-term interest rates in the current period is under 1%—and is likely to remain under 2% or less for the foreseeable future"); *See also* 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).

[162] IWG, 2021 TSD, *supra* note 7, at 4.

[163] IWG, 2021 TSD, *supra* note 7, at 4.

[164] N.Y. Dep't of Env't. Conserv., Establishing a Value of Carbon: Guidelines for Use by State Agencies 16–18 (2020), *available at* https://www.dec.ny.gov/docs/administration_pdf/vocguidrev.pdf.

nitrous oxide.[165] DEC also recommended using a 1% discount rate for climate impacts, and provided annual social cost values for doing so.[166] Because these valuations are based off of the Working Group's methodology, and differ only through the discount rate, DOE can apply these valuations if it applies additional sensitivity analysis around lower discount rates.

III. DOE Should Be Prepared To 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 legal merit, and do not supply bases for DOE to reject the Working Group's expert valuations.[167] Nonetheless, in order to minimize legal risk, DOE 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 a defense of the Working Group's process and methodology, and offers responses to common criticisms that have been offered by opponents of sensible climate policy.

a. The Working Group's Methodology Is Rigorous, Transparent, and Based on a Range of Assumptions Reflecting the Best Available Data

Although the term "social cost of greenhouse gases" is often used synonymously with the valuations developed by the federal Working Group, economic research and modeling on the social cost of greenhouse gases predate federal efforts to monetize incremental climate damages. Several of the most celebrated economic models of climate damages—such as models by William Nordhaus[168] and Chris Hope[169] that have since been integrated into the federal government's damage valuations—were first released in the early 1990s.

Owing to the availability of these damage models, 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.[170] The Court recognized the presence of uncertainty in the valuation of climate damages, but explained that "the value of carbon

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[165] N.Y. Dep't of Env't. Conserv., Appendix: Value of Carbon (2020), https://www.dec.ny.gov/docs/administration_pdf/vocapprev.pdf.

[166] *Id.*

[167] *See* Iliana Paul & Max Sarinsky, Inst. for Pol'y Integrity, *Playing With Fire: Responding to Criticism of the Social Cost of Greenhouse Gases* (2021), https://policyintegrity.org/publications/detail/playing-with-fire (rebutting substantive arguments presented in litigation); *see also* Brief of Amicus Curiae Institute for Policy Integrity, *Louisiana v. Biden*, No. 22-30087 (5th Cir. May 10, 2022).

[168] The earliest versions of Nordhaus's DICE model were published starting in 1992. *See* William Nordhaus, *An Optimal Transition Path for Controlling Greenhouse Gas Emissions*, 258 SCIENCE 1315 (1992).

[169] Chris Hope first released his PAGE model in 1991. *See* Memorandum by Dr Chris Hope, Judge Institute of Management, University of Cambridge, ¶1 (Jan. 14, 2005), https://publications.parliament.uk/pa/ld200506/ldselect/ldeconaf/12/5011805.htm (document describing the development and results of the PAGE model submitted to the Select Committee on Economic Affairs of the U.K. House of Lords).

[170] *Ctr. for Biological Diversity v. NHTSA*, 538 F.3d 1172, 1198–1203 (9th Cir. 2008) (original opinion at 508 F.3d 508 (9th Cir. 2007)).

emissions reduction is certainly not zero."[171] 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."[172]

Following this decision, federal agencies began applying different valuations of the social cost of greenhouse gases in their regulatory analyses.[173] Though methodologies differed across agencies, the Environmental Protection Agency under the George W. Bush administration endorsed global valuations and discount rates of 2–3%.[174]

To harmonize those damage valuations across agencies, the Obama administration convened an interagency working group comprised of members of twelve federal agencies and departments, including DOE, the Environmental Protection Agency, CEA, the Office of Management and Budget, and others.[175] The Working Group released its first estimates of the social cost of carbon (i.e. carbon dioxide) in 2010,[176] which it updated in both 2013[177] and 2016[178] to incorporate more recent scientific and economic data. Following its 2013 update, the Working Group also solicited comments on its social cost estimates,[179] resulting in a 44-page document with detailed responses to the comments received.[180] The Working Group also released damage estimates for two other greenhouse gases—methane and nitrous oxide—in 2016.[181] These additional metrics used the same economic models, the same treatment of uncertainty, and the same methodological assumptions that the Working Group applied to the social cost of carbon, and underwent peer review.[182]

b. DOE Is Required to Value Climate Damages, and Doing So Provides Balance to DOE'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 DOE has broad authority to

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[171] *Id.* at 1200.

[172] *Id.* at 1198.

[173] IWG, 2010 TSD, *supra* note 97, at 3–4.

[174] *Id*. at 3 (citing Regulating Greenhouse Gas Emissions Under the Clean Air Act, 73 Fed. Reg. 44,354, 44,446 (July 30, 2008)).

[175] *Id.* (cover page).

[176] *Id.*

[177] Interagency Working Group on the Social Cost of Carbon, *Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866* (2013), https://obamawhitehouse.archives.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf.

[178] Interagency Working Group on the Social Cost of Greenhouse Gases, *Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866* (2016), https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/scc_tsd_final_clean_8_26_16.pdf [hereinafter "IWG, 2016 TSD"].

[179] Request for Comment, 78 Fed. Reg. 70,586 (Nov. 26, 2013).

[180] Response to Comments, *supra* note 114.

[181] Interagency Working Group on the Social Cost of Greenhouse Gases, *Addendum to Technical Support Document on Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866: Application of the Methodology to Estimate the Social Cost of Methane and the Social Cost of Nitrous Oxide* (2016), https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/august_2016_sc_ch4_sc_n2o_addendum_final_8_26_16.pdf.

[182] *Id.* at 3.

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 DOE's approach—and does not, as critics have suggested, inappropriately skew the analysis.

i. DOE 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 DOE, this especially well-established. In *Zero Zone*, for example, the Seventh Circuit held that DOE appropriately used the social cost metric in promulgating energy conservation standards, specifically rejecting industry petitioners' claims that "EPCA does not allow DOE to consider environmental factors."[183] As the Court explained, "[t]o determine whether an energy conservation measure is appropriate under a cost-benefit analysis, the expected reduction in environmental costs needs to be taken into account. We have no doubt that Congress intended that DOE have the authority under the EPCA to consider the reduction in [the social cost of carbon]."[184] As the Proposed Rule would set energy conservation standards that are promulgated under EPCA, DOE is correct to consider climate impacts as part of the seven factors it needs to evaluate "in determining whether a potential energy conservation standard is economically justified."[185]

Since DOE should account climate impacts, therefore, 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, in order to compare costs and benefits along a common metric and select the alternative that maximizes net benefits.[186] In a decision that sparked the federal government to develop consensus valuations of climate damages in the first place—the *Center for Biological Diversity* case discussed above—the Ninth Circuit held that the Department of Transportation acted arbitrarily and capriciously by failing to monetize potential climate benefits when assessing the costs and benefits of various alternative fuel-economy standards for new automobiles.[187] And DOE monetized climate damages in numerous past energy conservation standards rulemakings.[188]

ii. Monetizing Climate Benefits Does Not Skew the Analysis, but Rather Provides Balance Since DOE 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.

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[183] *Zero Zone*, 832 F.3d at 677.

[184] *Id.*

[185] 87 Fed. Reg. at 20,620.

[186] Circular A-4, *supra* note 76, 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).").

[187] *Ctr. for Biological Diversity v. NHTSA*, 538 F.3d 1172, 1198–1203 (9th Cir. 2008) (original opinion at 508 F.3d 508 (9th Cir. 2007)).

[188] E.g., 85 Fed. Reg. 1504 (Jan. 10, 2020); 85 Fed. Reg. 1592 (Jan. 10, 2020); 85 Fed. Reg. 1378 (Jan. 10, 2020); 85 Fed. Reg. 1447 (Jan. 10, 2020).

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.[189] Accordingly, controls on fossil fuels will hasten a transition to a greener economy, and so have limited net economic impacts.[190] Second, while there are of 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, DOE monetizes not only the expected benefits of the proposal—including, but not limited to, climate benefits—but also the expected incremental costs to industry from energy efficiency measures, as well as other costs of the rule such consumer incremental product costs. DOE then compares quantified cost and benefit estimates in determining whether and how to regulate, as instructed by federal guidance and executive order.[191] Capturing climate benefits is thus essential to ensuring a balanced analysis. As the Ninth Circuit has held, "failure to monetize the most significant benefit of more stringent [vehicle-emission] 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."[192]

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

DOE 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,[193] and DOE 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

[189] 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.

[190] 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).

[191] 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").

[192] *Ctr. for Biological Diversity*, 538 F.3d at 1198–99.

[193] Response to Comments, *supra* note 114.

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.

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

While critics argue that there it 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. If anything, the presence of continued uncertainty suggests that the social cost valuations should be higher than presently valued—not that climate damages should be ignored.

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" [194] and "are often called upon to confront difficult administrative problems armed with imperfect data."[195] As the Ninth Circuit has explained, "the 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."[196] 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.[197]

Use of the Working Group's social cost estimates is precisely the type of reasonable analysis of uncertain information that courts endorse. The Working Group rigorously considered various sources of long-term uncertainty "through a combination of a multi-model ensemble, probabilistic analysis, and scenario analysis."[198] As the Working Group explained, the three integrated assessment models (IAMs) account for uncertainty themselves by spanning a range of economic and ecological outcomes.[199] 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.[200]

In addition to the use of three distinct damage models with differing 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.[201] 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.[202] The Working Group ran each

[194] *Pub. Citizen v. Fed. Motor Carrier Safety Admin.*, 374 F.3d 1209, 1221 (D.C. Cir. 2004).
[195] *Mont. Wilderness Ass'n v. McAllister*, 666 F.3d 549, 559 (9th Cir. 2011).
[196] *Id.*
[197] *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.").
[198] IWG, 2021 TSD, *supra* note 7, at 26.
[199] *See id.*
[200] *See id.*
[201] *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.
[202] *Id.* at 15–17 & tbl.2.

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.[203] In addition to reporting the average valuations, the Working Group published the results of each model run under each scenario.[204]

Moreover, experts broadly agree that the presence of uncertainty in the social cost valuations counsels for more stringent climate regulation, not less.[205] 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 catastrophic damage.[206] In fact, as discussed above, uncertainty is a factor justifying lowering the discount rate, particularly in intergenerational settings.[207] 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.[208]

ii. 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 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.[209] These effects can be massive: One paper, for instance, finds that the inclusion of tipping points would significantly increase, potentially doubling, the social cost estimates,[210] with another paper concluding that the effect is even greater and thus the Working Group's existing values "may be significantly underestimating the

[203] *Id.* at 28; *see also* IWG, 2021 TSD, *supra* note 7, at 26–27 (providing additional detail).

[204] IWG, 2010 TSD, *supra* note 97, at 26 tbl.3.

[205] *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.").

[206] 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.

[207] *See* Howard & Schwartz, *supra* note 103, at 13–25.

[208] *See* IWG, 2016 TSD, *supra* note 178, at 21 (recognizing that "these limitations suggest that the [social cost of greenhouse gases] estimates are likely conservative").

[209] IWG, 2010 TSD, *supra* note 97, at 26, 32.

[210] Derek Lemoine & Christian P. Traeger, *Economics of Tipping the Climate Dominoes*. 6 NATURE CLIMATE CHANGE 514 (2016). While this paper calculates the optimal carbon tax rather than the social cost of greenhouse gases, the two figures are closely related.

needs for controlling climate change."[211] The current consensus of experts puts damages for a 3°C increase at roughly 5% to 10% of gross domestic product,[212] which is substantially higher than the damages estimated by the IAMs.[213] 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."[214]

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.[215] And evidence suggests that, if anything, these models overvalue agricultural benefits from a warming planet—and thus undervalue the social cost of greenhouse gases.[216] One paper, for instance, concludes that estimates of net agricultural impacts produced an undervaluation of the social cost of carbon 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.[217] 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."[218]

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.[219] One recent study, in fact, concludes that the

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

[212] *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).

[213] IWG, 2010 TSD, *supra* note 97, at 9 fig.1A (showing range of GDP loss below 5% for 3°C temperature increase).

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

[215] *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. .

[216] *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.").

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

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

[219] *See, e.g.*, Howard, *supra* note 215. *See also* IWG, 2016 TSD, *supra* note 178, at 21.

IAMs, on net, undervalue mortality from climate change.[220] 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.

iii. 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]."[221]

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."[222] 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.[223] 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.[224]

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.[225] 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.

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[220] *See* Tamma A. Carleton et al., *Valuing the Global Mortality Consequences of Climate Change Accounting for Adaptation Costs and Benefits* (U. Chicago, Becker Friedman Institute for Economics 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).

[221] 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"].

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

[223] IWG, 2010 TSD, *supra* note 97, at 13 tbl.1.

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

[225] NAS 2016 Report, *supra* note 221, at 25.

iv. 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,[226] 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.[227] Thus, the baselines used by the Working Group potentially understate baseline emissions rather than overvalue them as opponents argue. In fact, several of the Working Group's supposedly "business-as-usual" scenarios are actually more consistent with baseline estimates reflecting policy projections.[228] 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.[229] 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 Academies of Sciences would very likely increase the social cost valuations overall due to the omitted damages discussed above and recent evidence regarding intergenerational discount rates.[230] At best, therefore, this argument makes a mountain out of a molehill.

v. 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. In reality, however, the damage functions are based on reasonable assumptions made by a range of experts.[231] They have also withstood scientific scrutiny, and while opponents of sensible climate policies frequently highlight criticism of the damage functions by a notable economist, they take this criticism out of context.

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[226] IWG, 2010 TSD, *supra* note 97, at 16 tbl.2.

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

[228] *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* IWG, 2010 TSD, *supra* note 97, at 16 tbl.2 (incorporating supposedly business-as-usual scenarios of 42.7 and 60.1 gigatons in 2100).

[229] *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.

[230] *See* IWG, 2021 TSD, *supra* note 7, at 4 (Working Group acknowledging that its current social cost valuations "likely underestimate societal damages from [greenhouse gas] emissions").

[231] Response to Comments, *supra* note 114, 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.").

The Working Group selected three models of climate damages that were the most widely used and cited models in the economics literature linking physical climate impacts to economic damages[232]: the DICE, FUND, and PAGE models.[233] These models were developed by outside experts, published in peer-reviewed economic literature,[234] 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 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.[235]

The three models reflect a wide diversity of methodological assumptions about a range of key parameters and inputs.[236] 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."[237] Unsurprisingly, his model produces the lowest damage estimates of the three models incorporated by the Working Group.[238] William Nordhaus, who developed the DICE model, is widely credited with popularizing the goal that global temperatures increase no more than 2° Celsius (or 3.6° Fahrenheit) below pre-industrial levels[239]—a goal now considered conservative by the global community.[240] His model produces higher damage estimates that are close to the Working Group's average damage valuations.[241]

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."[242] While Professor Pindyck has questioned the shape of the models' damage functions,[243] he has acknowledged

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[232] Response to Comments, *supra* note 114, 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).

[233] IWG, 2010 TSD, *supra* note 97, at 5.

[234] Response to Comments, *supra* note *supra* note 114, at 4.

[235] *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/ (last visited Sept. 24, 2021).

[236] *See* IWG, 2010 TSD, *supra* note 97, at 6 (discussing how "[t]he parameters and assumptions embedded in the three models vary widely").

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

[238] *See* IWG, 2010 TSD, *supra* note 97, 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).

[239] 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.

[240] 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.

[241] *Compare* IWG, 2010 TSD, *supra* note 97, at 50 tbl.A5 *with id.* at 1.

[242] 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.

[243] 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.

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."[244] In fact, he actually advocates for an even higher social cost value than that produced by the Working Group,[245] and has emphatically declared that "the federal government should continue to use the [Working Group's] interim estimates . . . as lower bound estimates."[246] In other words, the best critic of the Working Group's methodology that opponents could find *supports* 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.

IV. DOE Should Emphasize that Any Criticisms of the Social Cost of Greenhouse Gases Are Moot in This Rulemaking Because the Proposed Rule Is Cost-Justified Even Absent Climate Effects

DOE's analysis for the Proposed Rule establishes that its carries substantial net benefits, totaling between $9.05 billion and $17.1 billion.[247] And certain factors discussed above—including that the Working Group's social cost estimates omit major categories of climate damages[248] and that its recommended range of discount rates is higher than supported by current research[249]—suggest that the Proposed Rule's true net benefits are likely considerably higher than reported. Moreover, DOE should explicitly observe that the Proposed Rule would carry substantial net benefits without even considering climate benefits.[250] To be sure, DOE should continue to emphasize that, for all the reasons outlined above, it endorses the Working Group's social cost estimates as conservative values and that critiques suggesting that these estimates are in any way inflated, or that they should reflect domestic-only considerations, are meritless. However, DOE should also explicitly note that the standard is cost-benefit justified no matter how it estimates climate impacts. Thus, even if any critiques of the social cost figures hypothetically did have merit, such critiques are moot.

Conclusion

[244] 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 243, 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.").

[245] Pindyck, *supra* note 242, 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.

[246] Pindyck, *supra* note 242, at 1.

[247] *See* 87 Fed. Reg. at 20,613 tbl.I.3.

[248] *See* 87 Fed. Reg. at 20,670.

[249] *See supra* Section II.B.

[250] *See* 87 Fed. Reg. at 20,613 tbl.I.3 (showing consumer cost savings of $13.87 billion compared to total costs of $3.31 billion, at a 3 percent discount rate. At a 7% discount rate, consumer cost savings once again exceed total cost).

For the foregoing reasons, it is appropriate for DOE to continue to rely on the Working Group's valuations of the social cost of greenhouse gases as conservative estimates when it finalizes the room air conditioner energy conservation standards.

Sincerely,

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*No part of this document purports to represent the views, if any, of New York University School of Law.

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, Mark Freeman, Ben Groom, & Frikk Nesje, 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) N.Y. Dep't of Env't. Conserv., Establishing a Value of Carbon: Guidelines for Use by State Agencies (2020)
15) Iliana Paul & Max Sarinsky, *Playing with Fire: Responding to Criticism of the Social Cost of Greenhouse Gases* (2021)
16) 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)
17) Richard L. Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 NATURE 173–175 (2014).
18) Richard L. Revesz & Matthew R. Shahabian, *Climate Change and Future Generations*, 84 S. CAL. L. REV. 1097 (2011)
19) Jason A. Schwartz, *Strategically Estimating Climate Pollution Costs in a Global Environment* (2021)