No. ____

In the Supreme Court of the United States

STATE OF MISSOURI, ET AL.,
Petitioners,

v.

JOSEPH R. BIDEN, JR., IN HIS OFFICIAL CAPACITY AS PRESIDENT OF THE UNITED STATES, ET AL.,
Respondents.

On Petition for Writ of Certiorari to the United States Court of Appeals for the Eighth Circuit

PETITION FOR WRIT OF CERTIORARI

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QUESTION PRESENTED

On January 21, 2021, President Biden issued Executive Order 13990 that re-established the Interagency Working Group on the Social Costs of Greenhouse Gases and ordered them to issue interim estimates on the social costs of greenhouse gases. Executive Order 13990 breaks new ground and generally requires every agency to use those interim "social" costs "when monetizing the value of changes in greenhouse gas emissions resulting from regulations and other relevant agency actions until final values are published." The interim "social costs" were published in February 2021 without any public input and skipping notice-and-comment procedures.

Plaintiff States alleged many different harms and injuries from the interim "social costs" dramatic increase in the costs from emitting greenhouse gases, including harms to proprietary, sovereign, and procedural interests. The Eighth Circuit largely found it too attenuated to infer that federal agencies would propose regulations and follow the President's command to use the interim social costs, and dismissed the case.

The question presented is:

1. Whether the Petitioning States' alleged harms to their proprietary and sovereign interests (as well as a completed procedural injury) are sufficient to supply Article III standing?

PARTIES TO THE PROCEEDING

Petitioners are the States of Missouri, Arkansas, Indiana, Kansas, Montana, Nebraska, Ohio, Oklahoma, South Carolina, Tennessee, and Utah.

The individual Respondents are Joseph R. Biden Jr., Shalanda Young, Jared Bernstein, Arati Prabhakar, Michael Regan, Jennifer Granholm, Willie L. Phillips, om Vilsack, Peter Buttigieg, Debra Haaland, and Tracy Stone-Manning, all in their official capacities. Respondents also include the Department of the Interior, the Bureau of Land Management, the Environmental Protection Agency, the Department of Energy, the Federal Regulatory Commission, the Department of Transportation, the Department of Agriculture, and the Interagency Working Group on Social Costs of Carbon.

STATEMENT OF RELATED PROCEEDINGS

This case arises from the following proceedings:

- *State of Missouri, et al.* v. *Joseph R. Biden, et al.*, No. 21-3013 (8th Cir.) (order denying petition for rehearing and rehearing en banc, issued January 27, 2023), App. 50a;
- *State of Missouri, et al.* v. *Joseph R. Biden, et al*, No. 21-3013 (8th Cir. 2022) (opinion affirming the order of the district court, issued October 21, 2022);
- *State of Missouri, et al.* v. *Joseph R. Biden, et al*, No. 4:21-cv-287-AGF (E.D. Mo.) (order granting motion to dismiss entered on August, 31, 2021); and

- *State of Missouri, et al.* v. *Joseph R. Biden, et al,* No. 22A900 (Apr. 14, 2023) (granting application for extension to file petition for writ of certiorari).

There are no other proceedings in state or federal court or this Court directly related to this case within the meaning of this Court's Rule 14.1(b)(iii).

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OPINIONS BELOW

The district court's opinion granting Respondents' motion to dismiss and denying Petitioners' motion for a preliminary injunction is reported at *Missouri v. Biden,* 558 F. Supp. 3d 754 (E.D. Mo. Aug. 31, 2021), and reprinted at 1a of the Appendix.

The Eighth Circuit's opinion affirming the district court's opinion is reported at *Missouri v. Biden*, and reported at 52 4th 362 (8th Cir. 2022), and reprinted at 34a of the Appendix.

JURISDICTION

The district court had jurisdiction over the case pursuant to 28 U.S.C. §§ 1331, 1346, 1361, and 2201(a). The court of appeals issued its opinion on October 21, 2022, App. 34a, and denied the petition for rehearing and rehearing en banc on January 27, 2023, App. 50a. The time to file a petition for certiorari was extended to June 26, 2023. This Court has jurisdiction under 28 U.S.C. § 1254(1).

CONSTITUTIONAL, STATUTORY, AND REGULATORY PROVISIONS INVOLVED

Article I, § 1 of the United States Constitution provides:

> All legislative Powers herein granted shall be vested in a Congress of the United States, which shall consist of a Senate and House of Representatives.

.Article II, § 1 of the United States Constitution provides:

> The executive Power shall be vested in a President of the United States of America.

Article III, § 2 of the U.S. Constitution provides:

> The judicial Power shall extend to all Cases, in Law and Equity, arising under this Constitution, the Laws of the United States, and Treaties made, or which shall be made, under their Authority;—to all Cases affecting Ambassadors, other public Ministers and Consuls;—to all Cases of admiralty and maritime Jurisdiction;—to Controversies to which the United States shall be a Party;—to Controversies between two or more States;—between a State and Citizens of another State,—between Citizens of different States,—between Citizens of the same State claiming Lands under Grants of different States, and between a State, or the Citizens thereof, and foreign States, Citizens or Subjects.

Executive Order 13990, *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis*, 86 Fed.

Reg. 7037 (January 20, 2021), is reproduced at App. 51a. The Interagency Working Group on Social Cost of Greenhouse Gases, U.S. Government, *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide, Interim Estimates Under Executive Order 13990* (Feb. 26, 2021) is reproduced at App. X.

STATEMENT OF THE CASE

A. Executive Order 13990 Creates an Interagency Working Group to Dictate Binding Values for the Social Costs of Greenhouse Gases.

Carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) are common, naturally occurring gases that are ubiquitous by-products of agriculture, transportation, energy production, industrial production, and many other forms of human economic activity. *See* EPA, *Overview of Greenhouse Gases*, at https://www.epa.gov/ghgemissions/overview-greenhouse-gases. These gases are produced by virtually all agricultural, industrial, energy-producing, and transportation activities. *Id.* The authority to regulate greenhouse gas emissions, therefore, is the power to regulate entire foundational sectors of the U.S. economy.

On January 20, 2021, his first day in office, President Biden issued Executive Order 13990, "Protecting Public Health and the Environment and Restoring Science To Tackle the Climate Crisis." App. 51a, 86 Fed. Reg. 7037 ("EO 13990" or the "Executive Order"). Section 5 of the Order, "Accounting for the Benefits of Reducing Climate Pollution," instructed all federal agencies to "capture the full costs of greenhouse gas emissions as accurately as possible, including by taking global damages into account." App. 59a. The "social cost" of greenhouse gases (SCC, SCN, and SCM; collectively "SCGG")

are "estimates of the monetized damages associated with incremental increases in greenhouse gas emissions." *Id.*

The Executive Order created an "Interagency Working Group" co-chaired by the "Chair of the Council of Economic Advisors, Director of OMB, and Director of the Office of Science and Technology Policy." *Id.* The Working Group includes seven cabinet secretaries and five other high-level executive branch officials. *Id.* at 59a–60a. Section 5(b)(ii)(A) of the Executive Order directed the Working Group to publish interim social costs for carbon dioxide, methane, and nitrous oxide that federal agencies "***shall*** use when monetizing the value of changes in greenhouse gas emissions resulting from regulations and other relevant agency actions until final values are published." *Id.* at 60a (emphasis added). Section 5(b)(ii)(B) directed the Working Group to "publish a final SCC, SCN, and SCM by no later than January 2022," and Section 5(b)(ii)(C)-(E) provided that the Working Group shall provide recommendations regarding the use, updating, and methodology of those numbers. *Id.* at 60a–61a. The Working Group was instructed to consider such intangible factors as "climate risk, environmental justice, and intergenerational equity." *Id.*

The Executive Order directed the Working Group to "solicit public comment; engage with the public and stakeholders; [and] seek the

advice of ethics experts." App. 61a. It also directed the Working Group to "ensure that the SCC, SCN, and SCM reflect the interests of future generations in avoiding threats posed by climate change." *Id.* The Executive Order cited no statutory authority to create the Working Group or to set binding values for "social costs" that "shall" be used by regulatory agencies exercising legislative authority delegated from Congress.

B. The Working Group Promulgates Binding Interim Values for the "Social Costs" of Carbon Dioxide, Methane, and Nitrous Oxide.

On February 26, 2021, the Working Group promulgated its Interim Estimates for the social costs of carbon, methane, and nitrous oxide. App. 67a ("Interim Values" or "2021 TSD"). Although EO 13990 instructed the Working Group to elicit input from the public and stakeholders, the Working Group did not do so before publishing the Interim Values. *See id.* The Interim Values were simply published without any prior notice or opportunity for public comment. *Id.*

The Working Group defined the "social cost of greenhouse gases" or "SCGG" as "the monetary value of the net harm to society associated with adding a small amount of that GHG to the atmosphere in a given year." App. 69a. The Working Group acknowledged that the task of assigning "social costs" to greenhouse gases involves attempting to predict global "changes in net agricultural

productivity, human health effects, property damage from increased flood risk natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services." *Id.* This includes "spillover pathways such as economic and political destabilization and global migration." *Id.* at 71a. In other words, this task involves attempting to predict such unknowable contingencies as the likelihood, frequency, scope, and severity of future international conflicts and human migrations for three centuries into the future. *Id.* The Working Group also admitted that its calculations involve attempting to predict future developments in human technology and innovation for centuries to come, future mitigation strategies performed by the world's 195 nations, and global atmospheric concentrations due to greenhouse gas emissions. *See, e.g.*, *Id.*

The Working Group conceded that "[b]enefit-cost analysis of U.S. Federal regulations have traditionally focused on the benefits and costs that accrue to individuals that reside within the country's national boundaries." App. 92a. But the Interim Values reflect a policy and value judgment to consider in their calculation the anticipated *global* effects of greenhouse gases, not just their anticipated effects within the United States. App. 90a, 92a–97a.

Under the Working Group's approach, one critical factor in calculating the present dollar

value for the "social cost" of a greenhouse gas is the "discount rate." *Id.* at 97a–99a. "In calculating the SC-GHG, the stream of future damages to agriculture, human health, and other market and non-market sectors from an additional unit of emissions are estimated in terms of reduced consumption (or consumption equivalents). Then that stream of future damages is discounted to its present value in the year when the additional unit of emissions was released." *Id.* at 97a. The lower the discount rate, the higher the "social cost" of that gas.

The Working Group acknowledged that "the discount rate has a large influence on the present value of future damages." *Id.* For example, the Working Group calculated the social cost of each gas at four different values using three different discount rates—5%, 3%, and 2.5%, and a 95% probability distribution for the 3% rate. Using these different discount rates, the "social cost" of carbon dioxide ranges from $14 per metric ton to $152 per metric ton, depending on the discount rate selected. App. 114a. The Working Group admits that "the range of discount rates reflects both uncertainty and, at least in part, *different policy or value judgments*." *Id.* at 120a (emphasis added). These include "intergenerational ethical considerations," which must "be accounted for in selecting future discount rates." App. 72a According to the Working Group, "the choice of a discount rate … *raises highly contested and exceedingly difficult questions of science,*

economics, ethics, and law." App. 97a–98a (emphasis added).

The Interim Values calculate that the current "social costs" of carbon, methane, and nitrous oxide, at current rates of emission, are very significant. Among the range of values provided, the Interim Values provide the 3% discount rate as the baseline for agency calculations, but they also invite federal agencies to use smaller discount rates that will increase the calculation of the social cost of gases, including the 2.5% discount rate. App. 98a. Under the Interim Values, the current "social cost" of carbon dioxide in 2020 is $51 per metric ton at the 3% discount rate, $76 per metric ton at the 2.5% discount rate, and $152 per metric ton at the upper probability distribution of the 3% rate. App. 114a. The "social cost of methane" at the 3% rate in 2020 is $1,500 per metric ton, $2,000 per metric ton at 2.5%, and $3,900 at the upper distribution of the 3% rate. App, 115a The "social cost of nitrous oxide" at the 3% discount rate in 2020 is $18,000 per metric ton, $27,000 per metric ton at 2.5%, and $48,000 per metric ton at the upper probability distribution of 3%. App. 116a. All of these values increase significantly over time. App. 114a–116a. The Working Group emphasizes that, on its view, these values "likely underestimate" the actual social costs of those three gases: "It is the IWG's judgment that … the range of four interim SCGG estimates presented in this TSD *likely*

underestimate societal damages from GHG emissions." App, 74a (emphasis added).

Using the 3%, 2.5%, and 95-percentile-of-3% discount rates, the "social cost" of carbon in 2020 was $51, $76, and $152 per metric ton, respectively; the "social cost" of methane was $1500, $2000, and $3900 per metric ton, respectively; and the "social cost" of nitrous oxide was $18,000, $27,000, and $48,000 per metric ton, respectively. App. 114a–116a. In 2019, the United States emitted 5.274 billion metric tons of carbon dioxide, 26.4 million metric tons of methane, and 1.54 million metric tons of nitrous oxide. EPA, *Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2019* 2-6 tbl.2-2 (Feb. 12, 2021). Thus, assuming similar rates of emission between 2019 and 2020, according to the Working Group, the total "social cost" of emissions of all three gases in 2020 at the 3% discount rate was over $336 billion; the total "social cost" at the 2.5% discount rate was over $495 billion; and the total "social cost" at the 95th-percentile distribution was over $978 billion. *Id.*

These enormous "social costs" will lead to comparable increases in regulatory burdens. Even before EO 13990 made the use of SCGG analysis mandatory, there had been "at least eighty-three separate regulatory or planning proceedings conducted by six different federal agencies [that] ha[d] used the SCC or SCM in their analyses" through mid-2016. Howard & Schwartz, *Think Global: International*

Reciprocity as Justification for a Global Social Cost of Carbon, 42:S Colum. J. of Envt'l Law 203, 219–20 & appx. A (2017); *see also* D. Ct. Doc. 6-3. Through mid-2016, the "social cost" of carbon dioxide and methane had been used in federal agency actions related to vending machines, light trucks, dishwashers, dehumidifiers, microwave ovens, kitchen stoves, clothes washers, small electric motors, residential water heaters, ozone standards, residential refrigerators and freezers, sewage guidelines, medium and heavy-duty vehicles, mercury emissions, industrial boilers, solid waste incineration units, fluorescent lamps, residential clothes dryers, room air conditioners, residential furnaces, residential central air conditioners, battery chargers, dishwashers, petroleum refineries, halide lamps, walk-in coolers and freezers, commercial refrigeration units, commercial clothes washers, commercial ice makers, and heat pumps. *Id.*

C. Procedural History.

On March 8, 2021, Plaintiffs-Appellants the States of Missouri, Arizona,[1] Arkansas, Indiana, Kansas, Montana, Nebraska, Ohio, Oklahoma, South Carolina, Tennessee, and Utah ("Plaintiffs" or "the States") filed suit in the Eastern District of Missouri, challenging EO 13990 and the Working Group's Interim

[1] Arizona has determined not to appeal the Eighth Circuit's ruling or join this petition for certiorari.

Values. App. 1a. The lawsuit named as defendants both the members of the Working Group and federal agencies that "shall" use the Interim Values, including EPA, DOE, FERC, DOT, USDA, DOI, and BLM. *State of Missouri, et al.* v. *Joseph R. Biden, et al*, No. 4:21-cv-287-AGF, at Doc. 6 (E.D. Mo. 2021) (D. Ct. Doc.). Plaintiffs filed their First Amended Complaint (adding Alaska as a Plaintiff) on March 26. *Id.* ("Complaint").

The Complaint included nine pages and forty-two paragraphs of allegations regarding injury to the States, based on eight separate theories. *Id.* at 29–38. These included: (1) violation of the principles of federalism that are specifically designed to preserve the independent role of the States, *id.* at 29; (2) injury to the States' sovereign interests from the preemption of state laws and regulations in traditional areas of state authority, *id.* at 29–31; (3) direct injury to the States' sovereignty by dictating how they must administer cooperative-federalism programs, *id.* at 31–34; (4) injury to the States' proprietary interests as purchasers of goods and services whose costs will increase from the Interim Values, *id.* at 34–35; (5) injury to the States' quasi-sovereign interests from the "enormous regulatory costs on the economies and citizens of the States" to be imposed by the Interim Values, *id.* at 36–37; (6) injury to the States' sovereign and proprietary interests in future tax revenues, *id.* at 37; and (8) denial of the opportunity to participate in notice-and-comment when the Working

Group formulated the Interim Values, *id.* at 37–38.

Plaintiffs alleged that EO 13990 and the Working Group's actions were unlawful on four grounds. First, the Complaint alleged that the President and the Working Group violated the separation of powers by exercising quintessential legislative authority without any delegation from Congress. D. Ct. Doc. 6, at 38 Second, the Complaint alleged that the President and the Working Group violated agency statutes that delegated authority to the various agencies, not to the President or the Working Group, to adopt substantive rules in their areas of authority. *Id.* at 38–39. Third, the Complaint alleged that the Working Group violated the Administrative Procedure Act (APA) by issuing the Interim Values without notice and comment. *Id.* at 39–40. Fourth, the Complaint alleged that the Interim Values were both contrary to law and substantively arbitrary and capricious under the APA. *Id.* at 40–41.

On May 3, Plaintiffs filed a motion for preliminary injunction on Counts One and Three of the Complaint. D. Ct. Doc. 18. The Government filed a motion to dismiss on June 4, challenging Plaintiffs' standing to sue and ripeness. D. Ct. Doc. 28. In its briefs in the district court, the Government conceded that the Working Group possessed no delegation of legislative authority: "No statute establishes

it, nor delegates it any legislative authority." *Id.* at 54.

In the district court, the Government also conceded that, under the plain terms of EO 13990, the Working Group's Interim Values are binding on executive agencies, unless a statute forbids their use. D. Ct. Doc. 28, at 36 (admitting that "the Executive Order requires agencies to use the Interim Estimates in some circumstances," because § 6(b)(ii)(A) of EO 13990 "us[es] the word 'shall'"). The Government conceded that "agencies will … rely on the Interim Estimates when they have discretion to do so." *Id.* (italics in original); *see also* D. Ct. Doc. 37, at 26 (admitting that "the Executive Order is binding on agencies" in many circumstances) (emphasis added). The only exception to this rule that the Government acknowledged was when a statute forbids the agency to use the Interim Values. *See id.* In other words, if a federal agency may consider the social cost of greenhouse gases in the exercise of its statutory authority, it must do so under EO 13990, and furthermore, it must use the specific "social cost" values promulgated by the Working Group. *Id.* Further, if a statute requires a federal agency to consider the social cost of greenhouse gases, then that agency may not do its own calculations, but it must use the specific values promulgated by the Working Group. *Id.*

On August 31, 2021, the district court entered its Memorandum and Order granting

the Government's motion to dismiss for lack of standing and ripeness and denying the States' motion for a preliminary injunction. App. 33a. On September 1, 2021, Plaintiffs timely filed their notice of appeal. D. Ct. Doc. 50.

The Eighth Circuit affirmed, concluding that the States' requested injunctive relief, requiring the current administration to follow a previous administration's regulatory policies without a specific agency action to review, was outside the authority of the federal courts under Article III of the Constitution. App. 37a (noting agreement with *Louisiana by & through Landry* v. *Biden*, No. 22-30087, 2022 WL 866282, at *3 (5th Cir. Mar. 16, 2022)). Specifically, the panel viewed the Interagency Working Group as an ordinary advisory group to the President and agencies that "communicate[s] to those agencies the policies the President adopts for his administration." App. 38a. The court acknowledged that the subject matter "raises complex, controversial issues that trigger intense political, economic, and environmental disagreement." *Id.* It summarily found that IWG is a "sensible exercise of the President's executive power" "to communicate his policies to agencies in exercising *their* delegated legislative authority." *Id.* (emphasis in original). In doing so, the panel rejected the States' argument that the "IWG possesses 'no delegation of any legislative authority' by Congress." *Id.*

In its standing analysis, the Eighth Circuit focused on Article III's injury-in-fact requirement. *First,* it dismissed the alleged economic injuries of increased proprietary costs and decreased tax revenues as not "concrete." App. 41a–42a. Agreeing with the district court, it noted that the injury was not "certainly impending" because it required believing that in the future an agency will issue a regulation that relies "in some way upon the Interim Estimates," disregard any objections to the methodology, and that the regulation will harm Plaintiffs in a concrete and particularized way. App. 42a. It agreed with the Government's view that the Interim Values have a limited impact because they only apply "*if* agencies propose future regulations, *if* they conduct cost-benefit analyses for those regulations, and *if* they choose to monetize GHG emissions in those analyses, then the agencies must use the Interim SC-GHG estimates." App. 43a (emphasis in original). The court found this theory of causation too "attenuated" "to show the requisite causation." *Id.*

Second, the panel dismissed any harms to the States' sovereign interests because it found that the Interim Values and EO 13990 do not impose obligations on the States. App. 44a. It reasoned that the causal relationship between any injury and the challenged action was too attenuated because it relied on the decision of "an independent third party"—the federal agencies.

Third, the panel rejected the States' argument that *Bennett* v. *Spear*, 520 U.S. 154 (1997), permits parties to challenge a final agency action that changes the legal regime that is "virtually determinative" another agency action. App. 45a. It concluded that *Bennett* was distinguishable because the Court addressed a concrete dispute over a specific irrigation project and the Interim Values are not "virtually determinative" of agency actions. App. 45a–46a.

Finally, the Eighth Circuit dismissed the procedural harm in failing to provide States (or anyone else) a meaningful opportunity to comment on the Interim Values before they were promulgated. The panel explained that the procedural harm did not have a concrete interest because the Interim Values were not challenged in connection with a specific agency action. App. 47a. It also was unwilling to be the first court to find that an interagency working group was an agency subject to the APA as it would "encourage constant judicial interference with the President's exercise of his executive power." App. 47a.

In sum, the court of appeals concluded that States had failed to plead a "concrete and particularized actual injury in fact that is fairly traceable to defendants' challenged conduct, publication of the interim SC-GHG estimates." App. 48a.

The panel declined to address whether Petitioners had shown that any injury "will be

redressed by a favorable decision." *Id.* (quoting *Lujan* v. *Defenders of Wildlife*, 504 U.S. 555, 561 (1992)).

Petitioner States filed this timely petition for writ of certiorari.

REASONS FOR GRANTING THE PETITION

I. The Eighth Circuit misapplied this Court's precedent as Petitioning States have standing to challenge EO 13990 and the Interim Values.

The Eighth Circuit rejected the States' well-pleaded injuries as relying on a "highly attenuated" chain of causation and rejecting Petitioners' straightforward inferences that are supported by the record and common sense. The court of appeals errors show that it misapplied this Court's precedents in *Bennett*, *Summers v. Earth Island Institute*, 555 U.S. 488 (2009), *Department of Commerce v. New York*, 139 S. Ct. 2551 (2019), and *Ohio Forestry Association, Inc. v. Sierra Club*, 523 U.S. 726 (1998).

A. The Eighth Circuit erred in failing to apply *Bennett v. Spear*.

The court of appeals overlooked a key distinction between the IWG and past working groups: the IWG's binding values are binding on the federal agencies. The binding nature of the Interim Values is what alters the legal landscape under *Bennett* because the subordinate agencies are no longer able to exercise their legislative duties de novo, they must reconcile any difference with the IWG's mandate.

In *Bennett v. Spear*, 520 U.S. 154 (1997), the Court addressed a provision of the

Endangered Species Act that required federal agencies whose projects might adversely impact an endangered species to seek a "biological opinion" from the Fish and Wildlife Service (FWS). *Id.* at 157–58. The FWS's "biological opinion" would assess the likely impact of the project on endangered species and make recommendations to the agency requesting the opinion (the "action agency") on how to mitigate any such impacts. *Id.* at 158. In *Bennett*, the Bureau of Reclamation, which sought a biological opinion from FWS regarding the impact of water levels in the Klamath Project, a series of dams and lakes in Oregon and California. *Id.* at 158–59. FWS issued a biological opinion to the Bureau of Reclamation finding a risk of adverse impact on endangered fish and recommending to the Bureau to mitigate that impact by maintaining certain (higher) water levels in two reservoirs. *Id.* at 159.

In *Bennett*, ranchers who "claim[e]d a competing interest in the water" sued the FWS, challenging its biological opinion, but did not sue the Bureau of Reclamation (the "action agency"). *Id.* at 160. The Government argued that the ranchers' alleged injuries lacked traceability and redressability under Article III because FWS's biological opinion was not binding on the Bureau of Reclamation, and the ranchers would not be harmed by it unless and until the Bureau of Reclamation took a final agency action based on it. *Id.* at 168. In other words, the Government contended that "the proximate

cause of [the ranchers'] harm is an (as yet unidentified) decision by the Bureau regarding the volume of water allocated to petitioners, not the biological opinion itself." *Id.*

The Court unanimously rejected this argument. *Id.* at 168–69. The Court noted that, while the biological opinion was technically "advisory" to the Bureau, "in reality it has a powerful coercive effect" on the second agency, because it "alters the legal regime to which the action agency is subject." *Id.* If the "action agency" (the Bureau) wished to disregard FWS's recommendations in the biological opinion, it was required to articulate its reasons for disagree with FWS's conclusions. *Id.* Agencies seldom did so, and so the biological opinion would "play a central role in the action agency's decisionmaking process." *Id.* Under these circumstances, the Court held that the ranchers were *not* required to wait until the Bureau of Reclamation—the second agency, or "action agency"—had issued a final agency action based on the biological opinion. *Id.* "This wrongly equates injury 'fairly traceable' to the defendant to injury as to which the defendant's actions are the very last step in the chain of causation." *Id.* at 168-69. Because the FWS's biological opinion "alter[ed] the legal regime" under which the Bureau would make its "as yet unidentified" policy, the ranchers had Article III standing to sue FWS to challenge the biological opinion. *Id.* at 169–70.

Bennett should have controlled here, but the court of appeals thought it was factually and legally distinct. The panel determined that *Bennett* could not apply because there was a "concrete dispute about pending agency action affecting a specific irrigation project," and that the Interim Values are not "virtually determinative." App. 45a–46a. But that makes the same error the Court corrected in *Bennett*. It essentially holds that Petitioners could not sue to challenge an "as yet unidentified" agency action using the Interim Values, which means the court of appeals wrongly held that Petitioners could only challenge "the very last step in the chain of causation." *Bennett*, 520 U.S. at 169.

Here, the Interim Values plainly "alter[] the legal regime" under which other agencies conduct rulemakings and other agency actions, because they dictate the outcome of a specific, extremely important aspect of the agency's cost-benefit analysis—just like in *Bennett*. Indeed, Petitioners here have a stronger case for Article III standing, because in *Bennett*, the second agency was "technically free to disregard the Biological Opinion." *Id.* at 170. Here, by contrast, the "action agencies" are *not* "free to disregard" the Interim Values. *Id.* The Interim Values are "binding" on them, D. Ct. Doc. 28, at 36, and the President dictates that they "shall" use them unless a federal statute specifically prohibits it. App. 60a; *see City of Kennett, Missouri v. EPA*, 887 F.3d 424, 431 (8th Cir. 2018) (holding that plaintiffs had standing to

challenge a policy that was "binding" on a future agency action that had not yet been implemented).

Similarly, the conclusion that the Interim Values are not determinative, and therefore insufficient for standing, is implausible and legally incorrect. *Bennett* repeatedly acknowledged that the biological opinion did *not* "mandate" any "particular regulation," *id.*—in fact, the agency could disregard it entirely and make its own findings. But the Supreme Court still held that the ranchers did not need to await the "as yet unidentified" action of the Bureau to challenge FWS's biological opinion. 520 U.S. at 168–69. So even if one of a number of factors, there is still standing to challenge the determination.

Moreover, the Interim Values are meant to be determinative. Unless they are specifically forbidden to do so by statute, agencies *must* monetize the social cost of greenhouse gases when formulating regulations, and in doing so, they *must* use the Working Group's values. As a legal matter, the Interim Values bind the agencies' hands to a specific approach, and specific set of numerical values, on what is typically the most dominant or critical factor in assessing the costs and benefits of agency action. The "social costs" of greenhouse gases are meant to be exorbitant-steadily increasing and measuring the "net harm" of emitting greenhouse gases hundreds of years in the future. As seen in some rulemakings, those "costs" justify billions in real world

regulations. *Light Duty Truck* Rule, 86 Fed. Reg. at 43753 tbl. 4.

This Court's precedent in *Bennett* conclusively supports Petitioners.

B. Petitioning States completed procedural injury is not a procedural right *in vacuo* under *Summers*

EO 13990 also goes beyond previous executive orders by dictating that the Interim Values must be used in formulating substantive policies and rules that directly affect regulated parties. *See* App. 60a (EO 13990); D. Ct. Doc. 28-4, at 3 (OIRA guidance). The Interim Values are to be used "where an agency will take final action in reliance on a benefit-cost analysis that includes estimates of the social cost of greenhouse gas emissions." D. Ct. Doc. 28-4, at 3. Thus, the Interim Values' use purports to be mandatory in formulating final agency actions that bind the regulated public—not just internal regulatory impact statements submitted to OIRA.

The Complaint also alleges, and the Government does not dispute, that "the Working Group did not elicit or receive comments or input from the public or stakeholders before publishing the Interim Values." D. Ct. Doc. 6, at 18; *see also id.* at 24, 25–26. Petitioners alleged that the Working Group "depriv[ed] them of opportunities to provide input and comment prior to adoption

of the Interim Values." *Id.* at 29, 37–38. These injuries were concrete, immediate, and completed on February 26, 2021, when the Working Group published the Interim Values.

The deprivation of the right to participate in notice-and-comment rulemaking is an Article III injury, which is redressable by vacating the agency action and requiring the agency to proceed with notice-and-comment rulemaking. Petitioners are not required to prove that the outcome of the agency's proceeding would have been different if its input had been considered. "The person who has been accorded a procedural right to protect his concrete interests can assert that right without meeting all the normal standards for redressability and immediacy." *Lujan*, 504 U.S. at 572 n.7. "If a petitioner 'is vested with a procedural right, that litigant has standing if there is *some possibility* that the requested relief will prompt the injury-causing party to reconsider the decision that allegedly harmed the litigant." *Iowa League of Cities*, 711 F.3d at 871 (quoting *Massachusetts v. EPA*, 549 U.S. 497, 518 (2007)). Thus, "redressability in this context does not require petitioners to show that the agency would alter its rules upon following the proper procedures." *Id.*; *see also Nat'l Ass'n of Home Builders v. E.P.A.*, 667 F.3d 6, 15 (D.C. Cir. 2011).

Here, there is undoubtedly "some possibility" of a different outcome if the States and other interested parties were allowed to

submit their comments. Calculating a supposed "social cost" of greenhouse gases over a 300-year horizon is wildly speculative and unscientific. D. Ct. Doc. 19, at 5 (Dayaratna Decl.); D. Ct. Doc. 35-2, at 6 (comment to Working Group). Even if the Working Group adhered to its same conclusions in the face of such comments, the chances are excellent that its conclusions would not survive judicial review for arbitrariness and lack of reasoned decisionmaking.

In concluding otherwise, the district court held that the States were merely asserting "a procedural right *in vacuo*." App. 22a (quoting *Summers v. Earth Island Institute*, 555 U.S. 488, 496 (2009)).

The court of appeals misapplied *Summers* by saying that Petitioners had challenged too much, rather than nothing at all. App. 47a. There, a judgment requiring notice-and-comment would have made no difference, because *there was nothing left to comment on*. *Summers*, 555 U.S. at 491. After the Burnt Ridge dispute settled, the remainder of the case merely challenged "the regulation in the abstract," based on "a procedural right *in vacuo*." *Id.* at 494, 496. Here, by contrast, if the Court agrees that the Working Group was required to provide notice-and-comment, there will be a great deal for the States to comment upon. *See* D. Ct. Doc. 35-2 (Dayaratna Decl.). Indeed, because the

President dictates that the Interim Values are *binding* on federal agencies, the only meaningful opportunity to comment on the methodology will be before the Working Group. Comments that attack the methodology or reliability of the Interim Values will carry no weight before a future agency that is bound in advance to accept them. Thus, the Executive Order dramatically tilts the playing field against those opposing the Interim Values in future notice-and-comment proceedings. *See, e.g., City of Los Angeles v. Barr*, 929 F.3d 1163, 1173 (9th Cir. 2019) ("[T]his inability to compete on an even playing field constitutes a concrete and particularized injury.").

But those agencies will be bound by the Interim Values. The States can comment to their hearts' content, but at the end of the day, under EO 13990, those agencies "***shall*** use" the Interim Values "when monetizing the value of changes in greenhouse emissions resulting from regulations and other relevant agency actions…." App. 60a (emphasis added). The district court's ruling effectively permits the Government to evade any notice-and-comment review of the Interim Values.

C. Under this Court's precedents, the alleged injuries are not too attenuated.

The Court's precedents on causation show that EO 13990 and the Interim Values cause the alleged injuries.

Petitioners alleged a host of injuries that relate to the fact that the Interim Values will inevitably expand the federal regulatory burdens on the States and their citizens in virtually every major sector of American economic life. *See* D. Ct. Doc. 6, at 35. Indeed, the States explained that the increased regulatory burdens caused by the "social costs" would harm their proprietary interests in energy consumption by homes, industries, and farms, their energy production to neighboring states, and the tax revenue that arises from these economic activities used to support the States' activities. D. Ct. Doc. 18, at 51–55. Petitioners have standing based on these injuries as well.

The court of appeals agreed with Respondents and the district court that it was to speculative to infer that the federal government would regulate and use the Interim Values. App. 36a, 17a. The district court dismissed this theory as "speculative," Add. 19a, and characterized it as "a highly attenuated chain of possibilities," App. 17a, but the opposite is true. Each step follows legally and logically—indeed, "inevitably," *id.*—just as Petitioners urged.

First, it is not "speculative" to assume that "at some point in the future, one more agencies will 'inevitably' issue one or more regulations that rely in some way upon the Interim Estimates." App. 17a. Several such rulemakings are already ongoing, in agencies such as EPA, DOT, and FERC, and agencies

are already using SCGG analysis, based on the Interim Values, in formulating rules. One need not "speculate" that this may happen—it is happening. And there will certainly be many more such rulemakings. For one, some courts have held that federal agencies under certain statutes *must* consider the "social cost" of greenhouse gases when conducting cost-benefit analysis in rulemakings. *See, e.g., Center for Biological Diversity v. National Hwy. Traffic Safety Admin.*, 538 F.3d 1172 (9th Cir. 2008). Such agencies, when they do so, are now bound by EO 13990 to use the Working Group's Interim Values. D. Ct. Doc. 6-1, at 5. Even when agencies had complete discretion to do so, federal agencies used SCGG analysis in eighty-three such rulemakings in the Obama Administration. D. Ct. Doc. 6-3. Under EO 13990, any such agency that has discretion under its statutory delegation to consider such "social costs," must consider them—and it must use the Working Group's values.

Second, it is not "speculative" to assume that "such agency will 'inevitably' disregard any objections to the methodology by which the Interim Estimates were calculated." App. 17a. Each such agency has been ordered by the President to do so, App. 60a, and the Government agrees that this direction is "binding" on those agencies, in the absence of a contrary statutory command. D. Ct. Doc. 28, at 36. It is not "speculative" to anticipate that federal agencies will obey a direct order from the President of the United States that

the U.S. Department of Justice says is "binding" on them.

Indeed, this inference is far less speculative than those that have been held to satisfy Article III. In *Department of Commerce v. New York*, for example, the Supreme Court held that plaintiff States demonstrated Article III standing to challenge the inclusion of a question about U.S. citizenship on the 2020 census questionnaire, based on the States' prediction that the citizenship question would induce some unspecified portion of respondents to violate the law by declining to respond to the census, and that this portion would be large enough to affect their federal funding. 139 S. Ct. 2551, 2565–66 (2019). The Government argued that this chain of inferences was too speculative to satisfy Article III, *id.* at 2566, but the Supreme Court held that the plaintiffs had "show[n] that third parties will likely react in predictable ways to the citizenship question, even if they do so unlawfully." *Id.* As in *Dep't of Commerce*, "Respondents' theory of standing does not rest on mere speculation about the decisions of third parties," the Court held, but "it relies instead on the predictable effect of Government action on the decisions of third parties." *Id.*

Third, it is not "speculative" to predict that future "regulation[s] will then harm Plaintiffs in a concrete and particularized way." App. 17a. Justifying such increased regulatory burdens is *the whole point* of the Interim

Values. It is not "speculative" to predict that they will function exactly as designed, and exactly as the President has instructed federal agencies to use them. *See Susan B. Anthony List v. Driehaus*, 573 U.S. 149 (2014) (holding that an injury-in-fact is not conjectural or hypothetical if there is "a 'substantial risk' that the harm will occur"). There is a "substantial risk," *id.*, that federal agencies will use the Interim Values to justify greatly increased regulatory costs, because they have been ordered to do so. The function of "SCGG" analysis in justifying increased regulatory burdens is amply illustrated by the EPA actions regarding light-duty-vehicle emissions discussed above. Petitioners "have met their burden of showing that [federal agencies] will likely react in predictable ways," to the President's Executive Order—again, far more "predictable ways" than speculation about whether aliens will unlawfully decline to respond to the census. *Dep't of Commerce*, 139 S. Ct. at 2566.

Petitioners should not be faulted for alleging that Respondents would act in accordance with EO 13990 and the Interim Values.

D. The Petitioning States theories of sovereign standing also implicate this Court's precedent.

The court of appeals simply refused to provide the special solicitude owed States. The Complaint adequately alleged harms to sovereign interests by describing how EO 13990 and the Interim Values affect how state agencies must conduct their duties in cooperative-federalism programs. D. Ct. Doc. 6, at 31–34, ¶¶ 162–178. As the Complaint alleged, "in their sovereign capacities, the Plaintiff States cooperatively administer many federal programs directly affected by the Working Group's actions, and the Executive Order and the Working Group's Interim Values will directly impact the actions they must take in their participation in these cooperative-federalism programs." *Id.* at 31, ¶ 162. "The President's Executive Order and the Working Group's actions effectively mandate that the Plaintiff States, in their cooperative administration of federal programs, must take actions that they deem unconstitutional, unlawful, and arbitrary and capricious, for the reasons stated herein." *Id.* Because the States participate, not just as regulated parties, but as *regulators* in many federal agency actions, they are directly affected by the unlawful command of EO 13990 and the Interim Values.

The Complaint provides several examples of such injuries. For example, citing 40 C.F.R.

§ 1501.7(b), the Complaint alleges that "[u]nder the Executive Order, the agencies of the Plaintiff States must now employ the Working Group's Interim Values in their NEPA environmental impact statements or face disapproval and rejection by the federal agencies." D. Ct. Doc. 6, at 33. The States also serve as "joint lead" agencies on federally funded transportation projects, and they "regularly engage in federally funded highway projects that require the States to conduct NEPA assessments, which will now have to include the Interim Values or face rejection by the Department of Transportation." *Id.* Further, "Plaintiff State of Missouri is a "no stricter than state' for most emissions standards promulgated by EPA," which "effectively requires Missouri … to enforce through its State Implementation Plans the clean-air standards adopted by EPA, including those standards that incorporate and rely on the Interim Values." *Id.* (citing Mo. Rev. Stat. § 643.055). "Thus, Section 5 of EO 13990 and the Interim Values purport to legally obligate" the Plaintiff States, in their "administration of cooperative-federalism programs…, to enforce illegally and unconstitutionally adopted standards." *Id.*

The court of appeals rejected this theory by noting that the text of EO 13990 explicitly applies to federal agencies. But that misses key context. State administration of cooperative-federalism programs is often dependent on complying with federal

oversight. *See* 42 U.S.C. § 300g-2 (conditions for state primacy in Safe Drinking Water Act). By requiring federal agencies to use the Interim Values, it inflicts immediate and direct injury on state sovereignty, because it directly deprives the States of freedom and discretion that they otherwise would have had in administering these programs without the threat of coercion. *Cf. Printz* v. *United States*, 521 U.S. 898, 916 (1997). This sovereign injury does not depend on the impact of a future agency action, because it immediately affects how States participate in *formulating* agency actions. This injury-in-fact is complete, it is caused by Respondents' unlawful actions, and it is directly redressable. It alone suffices to give the States standing.

Finally, the States' standing draws further support from the "special solicitude" afforded the States in the standing analysis. *Massachusetts v. EPA*, 549 U.S. 497, 520 (2007). Given "the special position and interest" of the States in our federal system, "[i]t is of considerable relevance that the party seeking review here is a sovereign State and not … a private individual." *Id.* at 518. "Such special solicitude has two requirements: (1) the State must have a procedural right to challenge the action in question, and (2) the challenged action must affect one of the State's quasi-sovereign interests." *Texas v. Biden*, 10 F.4th 538, 549 (5th Cir. 2021). Here, where the States are "asserting a procedural right under the APA

to challenge an agency action," *id.*, the first prong is satisfied. *See* D. Ct. Doc. 6, at 40 (Count III). And the States made numerous plausible allegations that the use of "SGCC" analysis will adversely impact their "quasi-sovereign interests in the health and well-being, both physical and economic, of their citizens." *See id.* at 36, ¶ 183. Accordingly, the States are "indeed entitled to special solicitude," which "means redressability is easier to establish for … state litigants than for other litigants." *Texas*, 10 F.4th at 549.

But the States' prediction of injuries from agency action simply claims that federal agencies will obey Executive Order 13990 and use the Working Group's inflated estimates for "social costs of greenhouse gases." D. Ct. Doc. 6-1, at 5. Predicting that federal agencies will obey an Executive Order is a far less "attenuated chain of possibilities" than that which the Supreme Court upheld in *Massachusetts v. EPA* itself, which involved Massachusetts' prediction that a particular EPA regulation of emissions in American vehicles might change the global mix of greenhouse-gas emissions enough to prevent the loss of centimeters of coastline over 100 years. 549 U.S. at 522. Here, by contrast, the States merely predict that federal agencies will follow an Executive Order from the President.

E. The district court's ripeness determination conflict with this Court's precedent.

Though the court of appeals failed to address ripeness, the district court's decision runs afoul of *Ohio Forestry Association, Inc. v. Sierra Club*, 523 U.S. 726 (1998).

First, the district court thought that the case was not ripe, primarily because another case could come along. But "[f]itness rests primarily on whether a case would 'benefit from further factual development,' and therefore cases presenting purely legal questions are more likely to be fit for judicial review." *Iowa League of Cities*, 711 F.3d at 867. Here, three of Plaintiffs' four claims present "purely legal questions." *Id.* Whether the President and the Working Group violated the separation of powers by exercising quintessentially legislative power without a delegation from Congress is a purely legal question. D. Ct. Doc. 6, at 38. Whether the Working Group violated the APA by failing to provide notice-and-comment is a purely legal question. D. Ct. Doc. 6, at 40. And whether the President's directive violates the organic statutes of federal agencies by exercising power delegated to those agencies is a purely legal question. D. Ct. Doc. 6, at 39. "As primarily legal questions, such challenges tend to present questions fit for judicial review." *Iowa League*, 711 F.3d at 867.

In coming to the opposite conclusion, the district court relied heavily on *Ohio Forestry Association, Inc. v. Sierra Club*, 523 U.S. 726 (1998), but that case supports Petitioners. *Ohio Forestry Association* involved a challenge to the Forest Service's logging plan for a national forest that did "not itself authorize the cutting of any trees." 523 U.S. at 729. Thus, there was "considerable legal distance between the adoption of the Plan and the moment when a tree is cut." *Id.* at 730. The Court concluded that it "would benefit from further factual development of the issues presented," *id.* at 733, because the validity and application of the Forest Service's Plan plainly hinged on the Forest Service's future refinement and application of the Plan. *Id.* The Supreme Court emphasized that the Forest Service might well "refine its policies" before any application of them, either "through revision of the Plan" or "through application of the Plan in practice." *Id.* at 735. Here, there is no such prospect that federal agencies will "refine" the Interim Values in future proceedings, because the Values are binding on the agencies. Petitioners claims exclusively address the validity of actions taken by the *Working Group*, not the as-yet-incomplete actions taken by agencies bound by the Working Group's determinations. Because the Working Group's actions in promulgating the Interim Values are complete, Plaintiffs' claims "can never get riper." *Ohio Forestry Ass'n*, 523 U.S. at 737.

Second, the district court also held that "[w]ithholding the Court's consideration at present will not cause Plaintiffs significant hardship." App. 27a. Withholding the Court's consideration will plainly inflict hardship on the States by depriving them of any meaningful opportunity to comment on the Interim Values. The Working Group did not let them do so, and future agencies, even as they accept Plaintiffs' comments, will ultimately be bound by the Working Group's values. This is quintessential hardship, far more than the "minimal" showing required. *Iowa League of Cities*, 711 F.3d at 867; *see also Kennett*, 887 F.3d at 433 ("delaying review of certainly impending regulatory burdens can cause harm").

The district court opined that "Plaintiffs' speculation that their objections will be 'disregarded' or 'receive no meaningful consideration is … not supported by well-pled facts." App. 28a-29a. But the district court cited nothing to support this conclusion, and it ignores the *legally binding* nature of the Interim Values. It is not "speculation" to anticipate that federal agencies will treat the Interim Values as authoritative and binding when the President has directed them to do so and DOJ has affirmed that they are "binding." D. Ct. Doc. 28, at 36.

Again, *Ohio Forestry Association* strongly supports Petitioners here.

Ohio Forestry Association emphasized that "hardship" exists where the challenged

policy "create[s] adverse effects of a strictly legal kind, that is, effects of a sort that traditionally would have qualified as harm." 523 U.S. at 733. Here, many such "adverse effects of a strictly legal kind," *id.*, are discussed above—including the fact that EO 13990 directly commandeers the States' agencies to employ the Interim Values in their administration of cooperative-federalism programs, which the district court wholly disregarded. This Court explained that "hardship" would exist when the challenged policy "command[s] anyone to do anything or to refrain from doing anything," or "create[s] … legal rights or obligations." *Id.* The Interim Values do both—they "command" federal agencies (and cooperating state agencies) to use the Interim Values, and they "create" the "legal … obligation[]" for such agencies to do so. *Id.* Likewise, the States have "pointed to [a] way in which the [Interim Values] could now force [them] to modify [their] behavior," *id.* at 734, because they purport to "force" state agencies to employ the Interim Values in performing NEPA assessments, formulating State Implementation Plans, and conducting other cooperative-federalism tasks.

In the end, the "hardship" prong goes to the heart of the legal and constitutional problems with the Interim Values. They reflect a policy decision with enormous practical consequences for every foundational sector of the American economy. The Government has sought to shield this policy

decision from direct political and judicial accountability by removing from the individual federal agencies who actually have delegated authority in these areas, issue it without any notice-and-comment, and then claim that it is fully insulated from judicial review. The district court's decision insulating them from judicial review at this stage inflicts "hardship" of the very first order.

III. Plaintiff States are likely to succeed on their claims, and thus, any remand should require the expedited consideration of the motion for a preliminary injunction.

Once Plaintiffs' standing is established, this is not a close case. The IWG plainly violated the APA by issuing the Interim Values without notice-and-comment. And the President's attempt to dictate binding numerical values for all federal agencies on a question of enormous policy importance usurps legislative power never delegated to the President, and thus violates the separation of powers.

Although the district court did not reach the motion for a preliminary injunction. App. 31a, the court of appeals stated that it would not find that the IWG is an agency under 5 U.S.C. 551(1), App. 47a. Though this is "a court of review, not of first view," *Cutter* v. *Wilkinson*, 544 U.S. 709, 719 n.7 (2005), it would be proper to vacate that analysis and

remand with instructions to consider the preliminary injunction expeditiously. Otherwise, the district court may see it as binding and deny the warranted relief.

The Working Group is an "agency." First, because it has the authority to make *binding* determinations on a critical policy question to other federal agencies, the Working Group is an "agency" under the APA. "Under the APA, an agency is any 'authority of the Government of the United States, whether or not it is within or subject to review by another agency.'" *Soucie v. David*, 448 F.2d 1067, 1073 (D.C. Cir. 1971) (quoting 5 U.S.C. § 551(1)). The APA "confers agency status on any administrative unit with *substantial independent authority* in the exercise of specific functions." *Id.* (emphasis added). Evaluating other agencies and being able to bind other agencies is critical to determining if the agency has substantial independent authority. *Id.*

In a case earlier relied on by Respondents, *Meyer v. Bush*, 981 F.2d 1288, 1292 (D.C. Cir. 1993), the court of appeals held that an agency exercises "substantial independent authority" when it can "act directly and independently beyond advising and assisting the President." *Id.* Critically, *Meyer* reasoned, an agency like CEQ that had "the power … to issue guidelines to [other] federal agencies," and "the authority to promulgate regulations—*legally binding* on the agencies—implementing the procedural

provisions of the National Environmental Policy Act," was plainly an APA "agency." *Id.* (emphasis added). And that is exactly what the Working Group possesses here.

The Interim Values are a "final agency action." Likewise, because the Interim Values are purportedly binding on federal agencies, they also constitute a "final" agency action. "As a general matter, two conditions must be satisfied for agency action to be 'final': First, the action must mark the 'consummation' of the agency's decisionmaking process—it must not be of a merely tentative or interlocutory nature. And second, the action must be one by which 'rights or obligations have been determined,' or from which 'legal consequences will flow.'" *Bennett*, 520 U.S. at 177–78 (citations omitted). The Interim Values are not "tentative or interlocutory"—they are the official values that must apply to regulatory actions until the "final" values of promulgated in January 2022. And by requiring agencies to exercise their discretion in a specific manner on an important question of legislative policy satisfies the second prong.

The Interim Values are not an "interpretative rule." Because they dictate specific numerical values on a substantive policy question, the Interim Values are not an "interpretative rule" or "general statement of policy" that would be exempt from notice-and-comment. 5 U.S.C. § 553(b)(A). "A rule that turns on a number" is legislative, not

interpretative, unless the number follows clearly and inevitably, by a simple exercise of arithmetic, from the rule or statute. *Hoctor v. U.S. Dep't of Agric.*, 82 F.3d 165, 170 (7th Cir. 1996). "[W]hen an agency wants to state a principle 'in numerical terms,' terms that cannot be derived from a particular record, *the agency is legislating and should act through rulemaking*." *Catholic Health Initiatives v. Sebelius*, 617 F.3d 490, 495 (D.C. Cir. 2010) (quoting Henry J. Friendly, *Watchman, What of the Night?*, *in* Benchmarks 144-45 (1967)) (emphasis added). Here, calculating the Interim Values was not a simple exercise in arithmetic, but involved "different policy or value judgments," and "highly contested and exceedingly difficult questions of science, economics, ethics, and law." App. 97a–98a.

Given the critical importance of these issues and the fact that agency proceedings involving the Interim Values are ongoing, the Court should remand with instructions for the district court to expeditiously issue a ruling on the preliminary injunction.

CONCLUSION

The petition for writ of certiorari should be granted because the Eighth Circuit misapplied this Court's precedents by denying Petitioners standing to challenge the not-so Interim Values is an issue of great importance.

Respectfully submitted,

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UNITED STATES DISTRICT COURT EASTERN DISTRICT OF MISSOURI EASTERN DIVISION

STATE OF MISSOURI, et al.,	)	
Plaintiffs,	)	
v.	)	Case No. 4:21-cv-00287-AGF
JOSPEH R. BIDEN, JR., et al.,	)	

MEMORANDUM AND ORDER

The State of Missouri and 12 other states1 brought this suit against President Joseph R. Biden, Jr. and several other executive branch departments and officials, challenging the President's Executive Order 13990 ("EO 13990"), which, in relevant part, establishes an Interagency Working Group on the Social Cost of Greenhouse Gases (the "Working Group") and directs the Working Group to publish interim—and, by January of 2022, final—values for the "social costs" of greenhouse gas emissions. The Executive Order further provides that agencies "shall use [the Interim Estimates] when monetizing the value of changes in greenhouse gas emissions resulting from regulations and other relevant agency actions until final values are published." 86 Fed. Reg. 7037.

The matter is now before the Court on two motions: (1) Plaintiffs' motion (ECF No. 17) for a "preliminary injunction prohibiting Defendants (excluding the President) from using the social cost of greenhouse gases promulgated in the

February 26, 2021[1] Technical Support Document, [ECF No. 6-2], in any rule making or federal action where there is a statutory command to consider costs or costs are permitted by statute until this case is resolved on appeal"[2] (ECF No. 17 at 1); and (2) Defendants' motion (ECF No. 27) to dismiss the complaint for lack of subject matter jurisdiction and for failure to state a claim.

The Court heard oral argument on both motions on August 25, 2021. Upon review of the entire record and for the reasons set forth below, the Court concludes that Plaintiffs lack standing and that their claims are not ripe for adjudication. Therefore, the Court will grant Defendants' motion to dismiss for lack of subject matter jurisdiction and will dismiss Plaintiffs' motion as moot.

BACKGROUND

On January 20, 2021, President Biden issued EO 13990, titled "Protecting Public Health and the Environment and Restoring Science To Tackle the Climate Crisis." 86 Fed. Reg. 7037. Section 5 of this Order, titled "Accounting for the Benefits of Reducing Climate Pollution," provides in full:

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[1] These are the States of Alaska, Arizona, Arkansas, Indiana, Kansas, Montana, Nebraska, Ohio, Oklahoma, South Carolina, Tennessee, and Utah.

[2] In their supporting brief, Plaintiffs narrow their request, asking only to "preliminarily enjoin all defendants, except for the President, from using the social cost of greenhouse gases promulgated in the February 26, 2021 Technical Support Document as binding values in any agency action." ECF No. 18 at 59.

(a) It is essential that agencies capture the full costs of greenhouse gas emissions as accurately as possible, including by taking global damages into account. Doing so facilitates sound decision-making, recognizes the breadth of climate impacts, and supports the international leadership of the United States on climate issues. The "social cost of carbon" (SCC), "social cost of nitrous oxide" (SCN), and "social cost of methane" (SCM) are estimates of the monetized damages associated with incremental increases in greenhouse gas emissions. They are intended to include changes in net agricultural productivity, human health, property damage from increased flood risk, and the value of ecosystem services. An accurate social cost is essential for agencies to accurately determine the social benefits of reducing greenhouse gas emissions when conducting cost-benefit analyses of regulatory and other actions.

(b) There is hereby established an Interagency Working Group on the Social Cost of Greenhouse Gases (the "Working Group"). The Chair of the Council of Economic Advisers, Director of OMB, and Director of the Office of Science and Technology Policy shall serve as Co-Chairs of the Working Group.

(i) Membership. The Working Group shall also include the following other officers, or their designees: the Secretary of the Treasury; the Secretary of the Interior; the Secretary of

Agriculture; the Secretary of Commerce; the Secretary of Health and Human Services; the Secretary of Transportation; the Secretary of Energy; the Chair of the Council on Environmental Quality; the Administrator of the Environmental Protection Agency; the Assistant to the President and National Climate Advisor; and the Assistant to the President for Economic Policy and Director of the National Economic Council.

(ii) Mission and Work. The Working Group shall, as appropriate and consistent with applicable law:

(A) publish an interim SCC, SCN, and SCM within 30 days of the date of this order, which agencies shall use when monetizing the value of changes in greenhouse gas emissions resulting from regulations and other relevant agency actions until final values are published;

(B) publish a final SCC, SCN, and SCM by no later than January 2022;

(C) provide recommendations to the President, by no later than September 1, 2021, regarding areas of decision-making, budgeting, and procurement by the Federal Government where the SCC, SCN, and SCM should be applied;

(D) provide recommendations, by no later than June 1, 2022, regarding a process for reviewing, and, as appropriate, updating, the SCC, SCN, and SCM to ensure that these costs are based on the best available economics and science; and

(E) provide recommendations, to be published with the final SCC, SCN, and SCM under subparagraph (A) if feasible, and in any event by no later than June 1, 2022, to revise methodologies for calculating the SCC, SCN, and SCM, to the extent that current methodologies do not adequately take account of climate risk, environmental justice, and intergenerational equity.

(iii) Methodology. In carrying out its activities, the Working Group shall consider the recommendations of the National Academies of Science, Engineering, and Medicine as reported in Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide (2017) and other pertinent scientific literature; solicit public comment; engage with the public and stakeholders; seek the advice of ethics experts; and ensure that the SCC, SCN, and SCM reflect the interests of future generations in avoiding threats posed by climate change.

86 Fed. Reg. 7040-41.

Interim Estimates

On February 26, 2021, the Working Group issued a document entitled "Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990" ("Interim Estimates").

These Interim Estimates are purportedly identical to prior estimates developed by another interagency working group under President Barack Obama in 2016, except that they have been adjusted for inflation. See ECF No. 6-2, *Working Group, Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide: Interim Estimates under E.O. 13990* (Feb. 2021), also available at https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.

Plaintiffs argue that the Interim Estimates are faulty for a number of reasons, including that the underlying factual inputs and modeling assumptions are arbitrary and lack a reasonable basis.[3] Plaintiffs rely on a sworn declaration of Kevin D. Dayaratna, a statistician and data scientist at the Heritage Foundation's Center for Data Analysis, in support of their assertions. Because EO 13990 provides that federal agencies "shall" use the Interim Estimates "when monetizing the value of changes in greenhouse gas emissions resulting

[3] For example, Plaintiffs describe in detail why the "discount rate" applied by the Working Group in developing the Interim Estimates was faulty. The discount rate is a "percentage factor designed to calculate the net present value of the future anticipated damages from a marginal increase in emissions of a particular gas." ECF No. 18 at 17. According to Plaintiffs, the discount rates applied by the Working Group were too low, resulting in exaggerated "social costs" of the corresponding greenhouse gases. *See id*.

from regulations and other relevant agency actions until final values are published," 86 Fed. Reg. 7040, Plaintiffs assert that the Interim Estimates "will inevitably be used to justify increased regulation and restrictions in innumerable areas, affecting virtually every aspect of daily life." ECF No. 18 at 19.

In support of this argument, Plaintiffs cite an academic review in 2017, which identified "at least eighty-three separate regulatory or planning proceedings conducted by six different federal agencies [that] have used the SCC or SCM in their analyses" through mid-2016. Am. Compl., ECF No. 6 at ¶¶ 160-61. These included agency actions related to energy, transportation, and agriculture, among other areas, and regulations of everything from ozone standards to household appliances. *Id*.

Complaint

Plaintiffs filed suit on March 8, 2021. In their amended complaint, filed on March 26, 2021, they assert four causes of action: (1) "Violation of the Separation of Powers," (2) "Violation of Agency Statutes,"[4] (3) "Procedural Violation of the Administrative Procedure Act (APA)," and (4) "Substantive Violation of the APA." Plaintiffs seek declaratory and injunctive relief.

Post-Complaint Notice and Guidance from the Executive Office

[4] Specifically, Plaintiffs assert that "Section 5 of EO 13990 and the Working Group's Interim Estimates violate the statutes that confer authority on various federal agencies to conduct cost-benefit analyses in regulatory actions that involve emissions of carbon dioxide, methane, and/or nitrous oxide." ECF No. 6 at 204.

On May 7, 2021, the Office of Management and Budget ("OMB") published a notice in the Federal Register, inviting public comments "on the [Interim Estimates] as well as on how best to incorporate the latest peer-reviewed science and economics literature in order to develop an updated set of SC-GHG estimates." OMB, *Notice of Availability and Request for Comment on ''Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under E.O. 13990*", 86 Fed. Reg. 24669, 24669 (May 7, 2021). Comments were due by June 21, 2021. *Id.*

On June 3, 2021, the Office of Information and Regulatory Affairs ("OIRA") issued a "Frequently Asked Questions" document related to the Interim Estimates. See ECF No. 28-4, OIRA, Social Cost of Greenhouse Gas Emissions: Frequently Asked Questions (FAQs), (June 3, 2021), also available at https://www.whitehouse.gov/wpcontent/uploads/2021/06/Social-Cost-of-Greenhouse-Gas-Emissions.pdf. The document states that agencies should follow EO 13990's requirement to use the Interim Estimates "as they follow other requirements for preparing E.O. 12866 benefit-cost analysis."[5] *Id.* at 1. The document further states that "[d]irectives issued in executive orders and OIRA guidance are always made subject to applicable law. . . . When an agency conducts benefit-cost

[5] EO 12866, issued by President Bill Clinton, directs agencies to follow certain principles, including assessing costs and benefits of available regulatory alternatives and selecting approaches that maximize net benefits, "unless a statute requires another regulatory approach." Exec. Order No. 12866, *Regulatory Planning and Review*, 58 Fed. Reg. 51735 § 1(a) (Sept. 30, 1993). It also establishes a regulatory-review process to be coordinated by OMB and OIRA. *Id.*

analysis pursuant to specific statutory authorities, those authorities must control the agency's development and use of the analysis in taking an agency action the issue." *Id.* at 2.

Motion to Dismiss

Defendants move to dismiss Plaintiffs' amended complaint for lack of subject matter jurisdiction pursuant to Federal Rule of Civil Procedure 12(b)(1) and, alternatively, for failure to state a claim pursuant to Rule 12(b)(6). Defendants assert that Plaintiffs lack standing to pursue their claims because their allegations of injury all stem from hypothetical future regulations that they speculate may be issued in reliance on the Interim Estimates. Defendants further maintain that Plaintiffs' alleged injuries are not redressable by a favorable decision in this lawsuit because, even without EO 13990 or the Interim Estimates, agencies may consider the social costs of greenhouse gases and may arrive at the same—or, from Plaintiffs' perspective, worse—regulations either in light of those costs or in light of the myriad other factors considered by agencies in the rulemaking process.[6]

Regarding Plaintiffs' additional allegations of harm to their sovereign interests or to their ability to participate in the notice-and-comment rulemaking, Defendants contend that these, too, are neither concrete nor particularized enough to demonstrate Article III standing. For similar reasons, Defendants argue that Plaintiffs' claims are not ripe. Rather,

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[6] Defendants argue that a separate redressability problem arises because Plaintiffs' request for relief would necessarily require the Court to enjoin the President's exercise of his official duties, which the Court cannot do. Thus, at a minimum, Defendants ask that the Court dismiss President Biden as a Defendant.

according to Defendants, "[i]f an agency one day relies on the Interim Estimates to justify some action that actually causes Plaintiffs a concrete injury, they can challenge that specific agency action (including its use of the Interim Estimates) at that time." ECF No. 28 at 43.

In any event, Defendants argue that Plaintiffs' claims are meritless. As to Count One, Defendants maintain that there is no basis to imply an equitable cause of action arising from an alleged violation of separation of powers. If there were, Defendants contend that the claim would fail here because EO 13990 is well within the President's Article II authority and is consistent with the longstanding presidential practice of requiring cost-benefit analyses. Defendants note that that, since the Ninth Circuit's decision in *Center for Biological Diversity v. National Highway Traffic Safety Administration*, 538 F.3d 1172 (9th Cir. 2008),[7] federal agencies have specifically employed estimates of the social cost of greenhouse gases prepared by interagency working groups in connection with related cost-benefit analyses.[8]

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[7] In *Center for Biological Diversity*, the Ninth Circuit held that an agency's failure to monetize the benefits of greenhouse gas emissions reduction as part of its cost-benefit analysis before issuing a rule setting fuel economy standards was arbitrary and capricious. 538 F.3d at 1200 (noting that "while the record shows that there is a range of values, the value of carbon emissions reduction is certainly not zero").

[8] In 2017, President Donald J. Trump issued EO 13783, which disbanded the Working Group and withdrew its prior analyses as "no longer representative of the administration's policy." Exec. Order 13783 § 5(b), Promoting Energy Independence and Economic Growth, 82 Fed. Reg. 16093 (Mar. 28, 2017). However, President Trump further ordered that

Regarding Count Two, Defendants contend that no violation of agency statutes could occur because EO 13990 expressly defers to any conflicting federal statute.

As to Plaintiffs' claims under the APA (Counts Three and Four), Defendants maintain that Plaintiffs have not identified a final agency action from which judicial review may be sought; that neither the President nor the Working Group is an agency subject to suit under the APA; and that even if the Interim Estimates were subject to notice-and-comment requirements under the APA, Plaintiffs' claim would still fail under the APA's harmless-error rule.

Motion for Preliminary Injunction

Plaintiffs oppose Defendants' motion to dismiss and affirmatively move to "preliminarily enjoin all defendants, except for the President, from using the social cost of greenhouse gases promulgated in the [Interim Estimates] as binding values in any agency action." ECF No. 18 at 59. Plaintiffs assert that the Court "may decide to remand for the Interim [Estimates] to proceed through notice-and-comment or invalidate them as arbitrary and capricious." ECF No. 35 at

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"when monetizing the value of changes in greenhouse gas emissions resulting from regulations, including with respect to the consideration of domestic versus international impacts and the consideration of appropriate discount rates, agencies shall ensure, to the extent permitted by law, that any such estimates are consistent with the guidance contained in [the Office of Management and Budget] Circular A-4." *Id*. § 5(c). According to Defendants, federal agencies under President Trump continued to estimate the social cost of greenhouse gases in their cost-benefit analysis, albeit applying different models to calculate those costs, such as a higher discount rate.

25. Plaintiffs also request a prompt ruling "[d]ue to the finality of any rules being promulgated now and the impending issuance of new social costs of greenhouse gases in January 2022." ECF No. 17 at 1.

In response to Defendants' assertions regarding standing and ripeness, Plaintiffs argue that there is nothing hypothetical about how agencies will use the Interim Estimates. According to Plaintiffs, EO 13990 mandates that federal agencies adopt the Interim Estimates in future rulemaking, regardless of Plaintiffs' objections thereto and without any public input. Plaintiffs contend that their injuries are not speculative because the Interim Estimates are designed to and "will inevitably be used to justify increased regulatory costs in foundational sectors of the American economy, including energy, agriculture, and manufacturing." ECF No. 35 at 9.

Plaintiffs maintain that if they wait to challenge the Interim Estimates until future regulations based on those numbers are issued—either in the notice-and-comment phase or through judicial review—their objections "will be disregarded" and "will receive no meaningful consideration." ECF No. 35 at 9, 11. Plaintiffs likewise maintain that their claims are ripe because the Interim Estimates are a "a self-executing regulation" that will result in immediate injuries to Plaintiffs in the form of "federal regulations using the Interim Values that will encroach on Plaintiff States' authority in areas subject to traditional state regulation." ECF No. 35 at 27.

Next, Plaintiffs argue that all four factors relevant to the preliminary injunction analysis favor them. Plaintiffs argue that they are likely to succeed on the merits of Count

One (Violation of the Separation of Powers) and Count Three (Procedural Violation of the APA) of their amended complaint.[9] Regarding Count One, Plaintiffs argue that "dictating binding values for the social cost of greenhouse gases for use in federal programs is a quintessentially legislative power that lies exclusively with Congress." ECF No. 18 at 22. Thus, Plaintiffs contend that Section 5 of EO 13990 is not a valid exercise of executive power but an exercise of legislative power that requires statutory authority.

Regarding Count Three, Plaintiffs argue that the Working Group is an agency under the APA; that the binding nature of the Interim Estimates render them a final agency action and a substantive rule under the APA; and that the Working Group violated the APA's procedural requirements when it promulgated the Interim Estimates without providing notice to the public and an opportunity to comment.

Plaintiffs further assert that, absent a preliminary injunction, they will suffer irreparable injury in the form of: (i) deprivation of their ability to file comments objecting to the Interim Estimates, (ii) deprivation of their ability to participate meaningfully in future federal agency proceedings, because the Interim Estimates will be essentially shielded from further review; (iii) injury to their sovereign interests in administering

[9] Although Plaintiffs' motion for preliminary injunction does not address the merits of Counts Two and Four, Plaintiffs discuss these counts in their opposition to Defendants' motion to dismiss. There, Plaintiffs assert that Count Two plausibly alleges that the Working Group is acting *ultra vires*, or without statutory authority, and that Count Four plausibly alleges that the Working Group is an agency and the issuance of the Interim Estimates a final agency action.

"cooperative-federalism programs,"[10] because EO 13990 effectively mandates Plaintiffs to employ the Interim Estimates in administering such programs; (iv) injury to Plaintiffs' proprietary interests, because the cost of energy and other regulatory goods that Plaintiffs consume will "necessarily increase under the increased regulation mandated by [EO 13990] and the Interim Estimates" (ECF No. 18 at 51); and (v) the federalism-based injury inherent in any violation of the separation of powers.

Finally, Plaintiffs assert that a preliminary injunction that restores the status quo will impose no cognizable harm on Defendants and will serve the public interest by promoting democratic accountability.

In response, Defendants argue that the Court cannot reach Plaintiffs' motion because the Court lacks subject matter jurisdiction. In any event, Defendants maintain that Plaintiffs would not be entitled to a preliminary injunction because their claims are meritless, they cannot show any imminent or irreparable harm, and an injunction would not serve the public interest.[11]

DISCUSSION

Standing

[10] As one example of a cooperative-federalism program, Plaintiffs cite the permitting of new stationary sources under the Clean Air Act.

[11] In addition to the parties' briefs, the Court has received amicus curiae briefs in support of Plaintiffs' motion for preliminary injunction on behalf of the Texas Public Policy Foundation (ECF No. 26) and the Committee for a Constructive Tomorrow (ECF No. 33).

"The law of Article III standing, which is built on separation-of-powers principles, serves to prevent the judicial process from being used to usurp the powers of the political branches." *Clapper v. Amnesty Int'l USA*, 568 U.S. 398, 408 (2013). "To establish Article III standing, plaintiffs must show (1) an injury in fact, (2) a causal relationship between the injury and the challenged conduct, and (3) that a favorable decision will likely redress the injury." *Animal Legal Def. Fund v. Vaught*, No. 20-1538, 2021 WL 3482998, at *1 (8th Cir. Aug. 9, 2021) (citing *Lujan v. Defs. of Wildlife*, 504 U.S. 555 (1992)). These requirements assure that "there is a real need to exercise the power of judicial review in order to protect the interests of the complaining party." *Summers v. Earth Island Inst.*, 555 U.S. 488, 493 (2009) (internal citations omitted).

"The plaintiffs bear the burden of establishing these elements, and must support each element in the same way as any other matter on which they bear the burden of proof." *Vaught*, 2021 WL 3482998, at *1 (citing *Lujan*, 504 U.S. at 561). "On a motion to dismiss, therefore, the plaintiffs must allege sufficient facts to support a reasonable inference that they can satisfy the elements of standing." *Vaught*, 2021 WL 3482998, at *1. "The plaintiff must assert facts that affirmatively and plausibly suggest that the pleader has the right he claims (here, the right to jurisdiction), rather than facts that are merely consistent with such a right." *In re Polaris Mktg., Sales Pracs., & Prod. Liab. Litig.*, No. 20-2518, 2021 WL 3612758, at *2 (8th Cir. Aug. 16, 2021) (citation omitted).

Injury in fact is "'an invasion of a legally protected interest' that is 'concrete and particularized' and 'actual or

imminent, not conjectural or hypothetical.'" *Spokeo, Inc. v. Robins*, 578 U.S. 856, 136 S. Ct. 1540, 1548, as revised (May 24, 2016) (quoting *Lujan,* 504 U.S. at 560)). "A 'concrete' injury must be 'de facto'; that is, it must actually exist" in reality, rather than in the abstract." *Spokeo*, 136 S. Ct. at1548. "For an injury to be 'particularized,' it must affect the plaintiff in a personal and individual way." Id.

"Although imminence is concededly a somewhat elastic concept, it cannot be stretched beyond its purpose, which is to ensure that the alleged injury is not too speculative for Article III purposes—that the injury is certainly impending." *Clapper*, 568 U.S. at 409 (emphasis in original and citations omitted). "[A]llegations of possible future injury are not sufficient." *Id.* (emphasis in original).

"For causation to exist, the injury has to be fairly traceable to the challenged action of the defendant, and not the result of the independent action of some third party not before the court." *Agred Found. v. U.S. Army Corps of Eng'g,* 3 F.4th 1069, 1073 (8th Cir. 2021) (citation omitted). This "requires the plaintiff to show a sufficiently direct causal connection between the challenged action and the identified harm. That connection cannot be overly attenuated." Id.

"[W]hen the plaintiff is not himself the object of the government action or inaction he challenges, standing is not precluded, but it is ordinarily substantially more difficult to establish." *Lujan*, 504 U.S. at 562. "To satisfy that burden, the plaintiff must show at the least that third parties will likely react in predictable ways." *California v. Texas*, 141 S. Ct. 2104, 2117 (2021) (citing *Dep't of Commerce v. New York*, 139 S. Ct. 2551, 2566 (2019)).

Redressability, the third element of standing, requires plaintiff to show that "it is likely, as opposed to merely speculative, that the injury will be redressed by a favorable decision." *Lujan*, 504 U.S. at 561. In assessing redressability, the court must "consider the relationship between the judicial relief requested and the injury suffered." California v. Texas, 141 S. Ct. 2104, 2115 (2021).

Plaintiffs have failed to establish any of these three elements.

Injury in Fact

Plaintiffs ask the Court to assume that at some point in the future, one or more agencies will "inevitably" issue one or more regulations that rely in some way upon the Interim Estimates; that such agency will "inevitably" disregard any objections to the methodology by which the Interim Estimates were calculated; and that this yet-to-be identified regulation will then harm Plaintiffs in a concrete and particularized way. This "theory of standing, which relies on a highly attenuated chain of possibilities, does not satisfy the requirement that threatened injury must be certainly impending." See *Clapper*, 568 U.S. at 410.

Summers v. *Earth Island Institute*, 555 U.S. 488 (2009) is instructive. There, the Supreme Court held that environmental organizations lacked standing to challenge regulations that exempted a salvage sale of timber on the ground that they failed to demonstrate injury in fact. In so reasoning, the Supreme Court explained that the regulations at issue "neither require[d] nor forb[ade] any action on the part of the [organizations]" but instead merely prescribed "standards and procedures" that governed "the conduct of

Forest Service officials engaged in project planning." 555 U.S. at 493; *see also Clapper*, 568 U.S. at 401 (holding that the respondents' theory that there was "an objectively reasonable likelihood that their communications will be acquired under [challenged statute permitting electronic surveillance] at some point in the future [was] . . . too speculative to satisfy the well-established requirement that threatened injury must be 'certainly impending'").

Likewise here, EO 13990 neither requires nor forbids any action on the part of Plaintiffs but instead merely prescribes standards and procedures governing the conduct of federal agencies engaged in rulemaking and other agency actions when monetizing the value of changes in greenhouse gas emissions. In such cases, standing is "substantially more difficult to establish." *Lujan*, 504 U.S. at 562.

Plaintiffs argue that cases like *Summers* and *Clapper* do not apply "because instead of merely authorizing the injury, . . . the Executive Order mandates the Interim [Estimates]."[12]

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[12] Plaintiffs also argue that "*Summers* merely stands for the unremarkable proposition that a plaintiff lacks an injury to challenge procedural regulations after settling the substantive claim causing the injury." ECF No. 35 at 16. The environmental organizations in *Summers* challenged Forest Service regulations in general and as they applied to a particular project (the Burnt Ridge project). See *Summers*, 555 U.S. at 490- 91. The Supreme Court noted that the organizations would have established standing with respect to the Burnt Ridge project, but by the time the case reached the Supreme Court, the parties had settled their dispute over that project. *Id.* at 494. Thus, the only challenge remaining was a challenge to "the regulation in the abstract . . . , apart from any concrete application that threaten[ed] imminent harm to [the organizations'] interests." *Id.* That procedural challenge in the abstract is the one that Plaintiffs here

ECF No. 35 at 21. But Interim Estimates, alone, do not injure Plaintiffs. *Cf. City of Kennett, Mo. v. Env't Prot. Agency*, 887 F.3d 424, 431–32 (8th Cir. 2018) (holding that a city had standing to challenge a "total maximum daily load" standard for pollutants in a particular ditch where the standard directly injured the city in the form of compliance costs). The injury that Plaintiffs fear is from hypothetical future regulation possibly derived from these Estimates. That injury is not concrete and therefore insufficient for standing. See *Nat'l Ass'n of Home Builders v. E.P.A.*, 667 F.3d 6, 13 (D.C. Cir. 2011) (rejecting theory of standing based on only the "possibility of [harmful] regulation" by federal agency) (emphasis in original).

Causation and Redressability

For similar reasons, Plaintiffs have failed to establish causation or redressability. In light of the inherently speculative nature of Plaintiffs' alleged harm, it is unknowable in advance whether that harm caused by possible future regulations would have any causal connection to EO 13990 or the Interim Estimates. The causal chain, supported by a number of bare assumptions, is too weak for standing.

It is true, as Plaintiffs assert, that, "Article III requires no more than de facto causality," which may be satisfied by showing "the predictable effect of Government action on the decisions of third parties." *Dep't of Commerce*, 139 S. Ct. at

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raise. And the Supreme Court was clear that plaintiffs lack standing to pursue such a challenge in the absence of concrete, imminent harm. *Id.* The Court observed that, to hold otherwise, "would fly in the face of Article III's injury-in-fact requirement." *Id.*

2566. But the actions of the third parties here are far from predictable.

In support of their argument otherwise, Plaintiffs rely heavily on *Bennett v. Spear*, 520 U.S. 154 (1997), in which the Supreme Court held that a group of ranchers and irrigation districts had standing to challenge a Fish and Wildlife Service biological opinion that had the effect of requiring minimum water levels in particular reservoirs. The government in that case conceded that, although the biological opinion purported to be "advisory," the relevant "statutory scheme presuppose[d] that the biological opinion [would] play a central role in the action agency's decisionmaking process," such that the opinion "alter[ed] the legal regime to which the agency [was] subject" and had a "*virtually determinative effect*" on the agency's resulting water level restrictions. Id. at 169-70 (emphasis added). In other words, the biological opinion prescribed a particular action (imposition of water level restrictions) which the agency was required to take or face significant consequences, and that particular action posed imminent injury to petitioners in the form of reduced irrigation water. *See id.* at 170-71. The Supreme Court thus concluded the petitioners' injury was fairly traceable to the biological opinion. *Id.* at 171.

Unlike the biological opinion in *Bennett*, neither EO 13990 nor the Interim Estimates mandate agencies issue the particular regulations that Plaintiffs fear will harm them. As noted above, the mandate in EO 13990 on which Plaintiffs focus is limited to one of innumerable other factors in the cost-benefit analysis conducted by a wide range of agencies in an even wider range of regulatory contexts, and only to the extent

consistent with applicable law. It is implausible to suggest that the Interim Estimates alters the legal regime to which agencies are subject.

Indeed, when asked at oral argument to explain how exactly the Interim Estimates would apply in future agency actions, Plaintiffs could not. Because they do not yet know. Neither does this Court. There is simply no way to predict how the Interim Estimates will affect an agency's analysis, if at all, without resorting to sheer speculation.

For similar reasons, Plaintiffs fail to demonstrate redressability. Redressability may be shown "where a favorable decision avoids, or at least delays, a regulatory burden." *City of Kennett*, 887 F.33d at 432 (citations omitted). Plaintiffs' requested relief in this case would do neither. Even if the Court were to declare the Interim Estimates non-binding, agencies would be free to—and may be required to, s*ee Center for Biological Diversity*, 538 F.3d at 1200—consider the social costs of greenhouse gas emissions. And agencies may arrive at the same or even more costly regulations at the same speed or even more quickly than Plaintiffs currently predict.

In short, Plaintiffs are attempting to do what the Supreme Court cautioned against in *Lujan*, 497 U.S. 871. "Instead of attacking the separate [rules or regulations] allegedly causing them harm, [Plaintiffs] chose to challenge a more generalized level of Government action." 504 U.S. at 568. "This programmatic approach has obvious practical advantages, but also obvious difficulties insofar as proof of causation or redressability is concerned" and is "rarely if ever appropriate for federal-court adjudication." Id. Rather, a "case-by-case approach . . . [while] understandably

frustrating" to Plaintiffs, "is the traditional, and remains the normal, mode of operation of the courts." *Lujan v. Nat'l Wildlife Fed'n*, 497 U.S. 871, 894 (1990).

Relaxed Requirements for Procedural Injuries or for State Plaintiffs

Plaintiffs argue that the standing requirements are somewhat relaxed in this case for two reasons: (1) because they have suffered a "procedural injury" in that they have been denied the ability to file comments on the Interim Estimates, and (2) because states in general are "entitled to special solicitude in the Court's standing analysis," *Massachusetts v. EPA*, 549 U.S. 497, 520 (2007). Both arguments are without merit.

The Supreme Court has made clear that "deprivation of a procedural right without some concrete interest that is affected by the deprivation—a procedural right *in vacuo*— is insufficient to create Article III standing." *Summers*, 555 U.S. at 496; *see also Spokeo*, 136 S. Ct. at 1549 ("[A plaintiff] could not, for example, allege a bare procedural violation, divorced from any concrete harm, and satisfy the injury-in-fact requirement of Article III."). Put simply, an allegation of "'procedural' standing to challenge the . . . failure to provide notice and an opportunity to submit comments pursuant to the APA" is destined to fail where "no imminent injury in fact has been alleged." *Nat'l Ass'n of Home Builders v. E.P.A.*, 667 F.3d 6, 15–16 (D.C. Cir. 2011); see also *Summers*, 555 U.S. at 497 ("Unlike redressability, . . . the requirement of injury in fact is a hard floor of Article III jurisdiction that cannot be removed by statute."). As explained above, Plaintiffs have not alleged imminent injury in fact. Therefore, they lack standing.

Neither are Article III's requirements excused merely because a state sues in its sovereign capacity. In Massachusetts v. EPA, a group of states sued the EPA, alleging that the agency's failure to regulate greenhouse gas emissions violated the Clean Air Act and caused them injury in the form of harm to their states' environments. *Massachusetts*, 549 U.S. at 504. The Supreme Court held that because one of the plaintiff states, Massachusetts, "own[ed] a substantial portion of the state's coastal property, . . . it ha[d] alleged a particularized injury in its capacity as a landowner." *Id.* at 522. In so holding, the Court rejected the EPA's argument that, because the harm from climate change is "widely shared," it is the sort of "generalized harm" that is insufficient to establish Article III jurisdiction. *Id.* at 516-23. Rather, the Court held that "States are not normal litigants for the purposes of invoking federal jurisdiction," because of their unique "desire to preserve [their] sovereign territory." *Id.* at 518-19. As such, the Court accorded Massachusetts "special solicitude in [the] standing analysis." *Id.* at 520.

"Lower courts have lamented the 'lack of guidance on how they are to apply the special solicitude doctrine to standing questions.'"[13] *California v. Trump*, No. CV 19- 960

[13] The Fifth Circuit recently described the doctrine has having "two requirements: (1) the State must have a procedural right to challenge the action in question, and (2) the challenged action must affect one of the State's quasi-sovereign interests." *State v. Biden*, No. 21-10806, 2021 WL 3674780, at *5 (5th Cir. Aug. 19, 2021). Like the Supreme Court in Massachusetts v. EPA, the Fifth Circuit in Biden found that at least one state litigant (Texas) had shown actual and imminent injuries that directly flowed from—and could be redressed by enjoining—the agency's

(RDM), 2020 WL 1643858, at *6 (D.D.C. Apr. 2, 2020) (quoting *Wyoming v. U.S. Dep't of Interior*, 674 F.3d 1220, 1238 (10th Cir. 2012)). But whatever the exact meaning, it is at least clear that "[t]his special solicitude does not eliminate the state petitioner's obligation to establish a concrete injury." *Wyoming*, 674 F.3d at 1238 (emphasis in original).

Massachusetts established such a concrete and particularized injury to its coastal property. See *Massachusetts*, 549 U.S. at 522. Plaintiffs here have not. Their injuries are merely speculative, which is insufficient for standing. *See California*, 2020 WL 1643858, at *7 ("[T]he special-solitude and procedural-injury doctrines do not—and cannot—alter the irreducible constitutional minimum of standing reflected in the elements of injury in fact, causation, and redressability.").

Ripeness

Besides standing, Plaintiffs face another, closely related jurisdictional barrier. Their claims are not ripe. "Ripeness is a justiciability doctrine designed to prevent the courts, through avoidance of premature adjudication, from entangling themselves in abstract disagreements over administrative policies, and also to protect the agencies from

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immigration-related action in that case. 2021 WL 3674780, at *4. But to "remove any lingering doubt" as to redressability, the Fifth Circuit noted that the special solicitude doctrine made this prong of standing "easier to establish for certain state litigants than for other litigants." 2021 WL 3674780, at *6. Here, even giving Plaintiffs the benefit of doubt that the solicitude doctrine may afford, Plaintiffs cannot establish redressability or any of the other Article III requirements.

judicial interference until an administrative decision has been formalized and its effects felt in a concrete way by the challenging parties." *Nat'l Park Hosp. Ass'n v. Dep't of Interior*, 538 U.S. 803, 807–08, (2003). "The touchstone of a ripeness inquiry is whether the harm asserted has matured enough to warrant judicial intervention." *Parrish v. Dayton*, 761 F.3d 873, 875 (8th Cir. 2014) (citation omitted). The doctrine "is drawn both from Article III limitations on judicial power and from prudential reasons for refusing to exercise jurisdiction." *Nat'l Park Hosp. Ass'n*, 538 U.S. at 808.

"Determining whether administrative action is ripe for judicial review requires us to evaluate (1) the fitness of the issues for judicial decision and (2) the hardship to the parties of withholding court consideration." Id. "Both of these factors are weighed on a sliding scale, but each must be satisfied to at least a minimal degree." *City of Kennett*, 887 F.3d at 432. "Absent a statutory provision providing for immediate judicial review, a regulation is not ordinarily considered the type of agency action 'ripe' for judicial review under the . . . APA . . . until the scope of the controversy has been reduced to more manageable proportions, and its factual components fleshed out, by some concrete action applying the regulation to the claimant's situation in a fashion that harms or threatens to harm him." *Nat'l Park Hosp. Ass'n*, 538 U.S. at 808.

Plaintiffs' claims are not ripe for judicial review because any impact of EO 13990 and the Interim Estimates cannot "be said to be felt immediately" by Plaintiffs (if at all) "in conducting their day-to-day affairs," and because "no irremediably adverse consequences flow[] from requiring a later challenge." *See id.* at 810 (citation omitted); *see also*

State v. Yellen, No. 4:21CV376 HEA, 2021 WL 1889867, at *5 (E.D. Mo. May 11, 2021) (dismissing Missouri's challenge to the American Rescue Plan Act on both standing and ripeness grounds where "Missouri asked the Court to determine the scope of the ARPA's Offset Restriction well in advance of any adverse effect and in a wholly, non-actionable hypothetical context").

In *Ohio Forestry Association, Inc. v. Sierra Club*, 523 U.S. 72 (1998), the Supreme Court held that a challenge to a Forest Service plan alleging excess logging was not ripe for judicial review because "[a]lthough the Plan set[] logging goals, select[ed] the areas of the forest that [were] suited to timber production, . . . and determine[d] which probable methods of timber harvest [were] appropriate, . . . it [did] not itself authorize the cutting of any trees." 523 U.S. at 729. Before the logging could take place, the Forest Service had to "(a) propose a specific area in which logging will take place and the harvesting methods to be used . . . ; (b) ensure that the project is consistent with the Plan . . . ; (c) provide those affected by proposed logging notice and an opportunity to be heard . . . ; (d) conduct an environmental analysis . . . ; and (e) subsequently make a final decision to permit logging, which affected persons may challenge in an administrative appeals process and in court . . . ." *Id.* at 729-30.

Likewise here, there is "considerable legal distance" between the adoption of the Interim Estimates and the moment—if one occurs—when a harmful regulation is issued. *See id.* at 730. Withholding the Court's consideration at present will not cause Plaintiffs significant hardship. The time or expense of having to pursue numerous challenges to each

allegedly harmful regulation, rather than cutting the regulatory process off prematurely, is not the type of harm sufficient to justify immediate review. *See id*. at 734-35 (holding that the fact that it would "be easier, and certainly cheaper, to mount one legal challenge against the Plan now, than to pursue many challenges to each site-specific logging decision to which the Plan might eventually lead [is not] . . . sufficient by itself to justify review in a case that would otherwise be unripe").

The Court does not mean to disregard Plaintiffs' fears of future economic harm. But Plaintiffs will have ample opportunity to bring legal challenges to particular regulations if those regulations pose imminent, concrete, and particularized injury. For example, in *Zero Zone, Inc. v. United States Department of Energy*, the Seventh Circuit considered a challenge to a Department of Energy (DOE) regulation of the type Plaintiffs here fear—namely, a rule establishing new energy efficiency standards for commercial refrigeration equipment. That rule was developed after the agency conducted a cost benefit analysis that considered, among other factors, "an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year, known as the Social Cost of Carbon ('SCC')." 832 F.3d 654, 677 (7th Cir. 2016).

The petitioners contended that the relevant statutory authority did not permit the DOE to consider environmental factors and that the DOE's analysis of the SCC was itself arbitrary and capricious. *Id.* at 677. Like the Plaintiffs here, the petitioners contended that the calculation of the SCC was "irredeemably flawed" for a number of reasons and that the DOE acted arbitrarily by accounting for indirect global

benefits to the environment while ignoring indirect costs such as the effects on displaced workers. *Id.* at 678. The Seventh Circuit considered the petitioners' arguments and held that the DOE adequately responded to the petitioners' concerns during its notice-and-comment period and that the DOE's analysis was not arbitrary or capricious. Id.

In other words, the petitioners in *Zero Zone*, like many others with similar concerns,[14] had a full and fair opportunity to address their objections to the SCC through the normal review process under the APA—first, before the agency itself and later, through judicial review. So, too, would Plaintiffs here.[15] Plaintiffs' speculation that their objections will be

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[14] Indeed, as Defendants note, several courts have considered challenges to specific agency actions on the theory that an agency inappropriately accounted for the social costs of greenhouse gases. See, e.g., Ctr. for Biological Diversity, 538 F.3d at 1203; *Wyoming v. Dep't of the Interior*, 493 F. Supp. 3d 1046, 1080 (D. Wyo. 2020).

[15] Plaintiffs suggest—cautiously, so as not to foreclose anticipated future lawsuits— that the Supreme Court's decision in *Dep't of Homeland Sec. v. Regents of the Univ. of Cal.*, 140 S. Ct. 1891, 1910 (2020) "cast doubt" on the notion that Plaintiffs could challenge the Interim Estimates as part of a later complaint regarding agency action. See ECF No. 35 at 10. *Regents* involved a challenge to the Department of Homeland Security's (DHS) recission of the Deferred Action for Childhood Arrivals (DACA) program. 140 S. Ct. at 1891. In rescinding DACA, DHS acted on the Attorney General's advice. *Id*. The Court noted that the Immigration and Nationality Act (INA) bound DHS to the Attorney General's legal conclusions and, therefore, raised the question of whether a suit challenging DHS's decision was the "proper vehicle" for attacking the Attorney General's underlying legal conclusions. *Id*. at 1910. But because the parties had not addressed that question in their briefs, the Court did not resolve it. *Id*. In other words, *Regents* did not involve an executive order at all, raised a question

"disregarded" or "receive no meaningful consideration" (ECF No. 35, at 9, 11) is just that; it is not supported by well-pled facts.

In fact, the evidence suggests the opposite. In their motion for a preliminary injunction, Plaintiffs describe a recent proceeding before the Federal Energy Regulatory Commission (FERC), in which FERC "request[ed] comments on whether 'the [Natural Gas Act], [National Environmental Policy Act], or other federal statute[s] authorize[d] or mandate[d] the use of Social Cost of Carbon (SCC) analysis by [FERC] in its consideration of certificate applications.'" ECF No. 18 at 35 (quoting Notice of Inquiry, Certification of New Interstate Natural Gas Facilities, 86 Fed. Reg. 11,268-72 (Feb. 24, 2021)). FERC also "ask[ed] for comment on how the SCC could be 'used to determine whether a proposed project is required by public convenience and necessity,' because that is the statutory language that Congress requires FERC to meet when certifying a new pipeline." Id. at 26.

Plaintiffs state that they "took advantage of this process and commented."[16] *Id*. at 35 n.7; *see also* ECF No. 35

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involving a unique provision of the INA not relevant here, and, in any event, did not answer the question. *Regents* is thus inapposite. Plaintiffs have not cited, and the Court has not found, any legal authority that would preclude Plaintiffs from challenging the Interim Estimates as part of a later challenge to agency action. To the contrary, such claims are regularly heard by federal courts. *E.g.*, *Zero Zone*, 832 F.3d at 677.

[16] At oral argument, Plaintiffs also described a newly proposed EPA rule regarding emissions standards for light duty vehicles that allegedly relies on the Interim Estimates. Plaintiffs stated that they intended to participate

at 16 n.1 (noting that their comments "explain[ed] that the Interim Values are arbitrary, outdated, and the process lacks transparency"). Plaintiffs have not suggested that FERC disregarded their comments. But if that happens, and if FERC then takes some action that harms Plaintiffs in a concrete and particularized way, Plaintiffs may seek relief in the appropriate court, after exhausting any applicable administrative remedies and complying with any applicable statutory authority.[17] *See, e.g.*, 15 U.S.C. § 717r(b) (setting forth the procedures for seeking review of FERC orders under the Natural Gas Act); *N.J. Conservation Found. v. Fed. Energy Regul. Comm'n*, 353 F. Supp. 3d 289, 295 (D.N.J. 2018) ("[T]he courts of appeals have exclusive jurisdiction to review all matters inhering in natural gas pipelines certificate proceedings before FERC.").

In short, the Court agrees with Defendants' assessment:

> A court's determination of the legality of an agency's reliance on the Interim Estimates will necessarily be informed by the specific statutory directives that Congress has provided to guide the agency's actions. The Court cannot meaningfully engage with Plaintiffs' arguments *en masse*, divorced from the context

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in the notice-and-comment proceedings with respect to this rule and, if appropriate, seek judicial relief in the proper forum.

[17] As Defendants correctly note, the fact that governing statutes may vest jurisdiction to challenge particular regulations or orders exclusively in certain courts, such as the federal courts of appeal, makes premature review by this Court particularly inappropriate.

> of particular agencies operating under specific statutory delegations of authority.

ECF No. 28 at 50. That is to say, "further factual development would significantly advance [the court's] ability to deal with the legal issues presented and would aid . . . in their resolution." *Ohio Forestry Ass'n*, 523 U.S. at 737.

For all of these reasons, the Court will grant Defendants' motion to dismiss for lack of subject matter jurisdiction. Doing so properly responds to the separation-of powers concerns raised by Plaintiffs by respecting the limits of judicial power.

Remaining Motions and Arguments

Because the Court lacks jurisdiction, it must dismiss this lawsuit without prejudice and without reaching the merits of Plaintiffs' claims or Plaintiffs' motion for preliminary injunction.

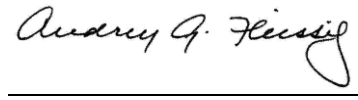
CONCLUSION

Accordingly,

IT IS HEREBY ORDERED that Defendants' motion to dismiss for lack of subject matter jurisdiction is GRANTED. ECF No. 27.

IT IS FURTHER ORDERED that Plaintiffs' motion for a preliminary injunction is DISMISSED as moot. ECF No. 17.

A separate Order of Dismissal will accompany this Memorandum and Order.



AUDREY G. FLEISSIG
UNITED STATES DISTRICT JUDGE

Dated this 31st day of August, 2021.

UNITED STATES DISTRICT COURT EASTERN DISTRICT OF MISSOURI EASTERN DIVISION

STATE OF MISSOURI, et al.,	)	
	)	
Plaintiffs,	)	
	)	
v.	)	Case No. 4:21-cv-00287-AGF
	)	
JOSPEH R. BIDEN, JR., et al.,	)	

ORDER OF DISMISSAL

Pursuant to the Memorandum and Order issued herein on this day,

IT IS HEREBY ORDERED, ADJUDGED, and DECREED that this case is DISMISSED without prejudice.

Audrey G. Fleissig

AUDREY G. FLEISSIG
UNITED STATES DISTRICT JUDGE

Dated this 31st day of August, 2021.

United States Court of Appeals

For the Eighth Circuit

No. 21-3013

State of Missouri, et al.

Plaintiffs - Appellants

v.

Joseph R. Biden, Jr., in his official capacity as the President of the United States of America, et al.

Defendants - Appellees

Committee for a Constructive Tomorrow

Amicus on Behalf of Appellants

Appeal from United States District Court for the Eastern District of Missouri - St. Louis

Submitted: June 16, 2022

Filed: October 21, 2022

Before LOKEN and KELLY, Circuit Judges, and MENENDEZ, District Judge.*

*The Honorable Katherine M. Menendez, United States District Judge for the District of Minnesota, sitting by designation.

LOKEN, Circuit Judge.

Upon taking office, President Joseph Biden issued Executive Order 13990 ("E.O. 13990"), entitled "Protecting Public Health and the Environment and Restoring Science To Tackle the Climate Crisis," and invoking "the authority vested in me as President by the Constitution and the laws of the United States of America." 86 Fed. Reg. 7037 (Jan. 20, 2021). E.O. 13990 expressly revoked or suspended numerous Executive Orders issued by his predecessor, President Donald Trump. See id. at 7041-42. The revoked orders included Executive Order 13783 ("E.O. 13783"), in which President Trump disbanded an Interagency Working Group on the Social Cost of Greenhouse Gases ("IWG") established by President Barack Obama. 82 Fed. Reg. 16093, 16095-96 (Mar. 28, 2017). E.O. 13990 re-established the IWG with members from multiple cabinet-level and executive branch agencies,[1] directed the IWG to publish interim and then final estimates of the social costs of greenhouse gas emissions (hereafter, "interim SC-GHG estimates"), and required federal agencies to use these estimates when monetizing the costs and benefits of future agency actions and regulations. 86 Fed. Reg. at 7040-41.

[1] The IWG is co-chaired by the Chair of the Council of Economic Advisers, the Director of the Office of Management and Budget (OMB), and the Director of the Office of Science and Technology Policy. It includes the Secretaries of the Treasury, the Interior, Agriculture, Commerce, Health and Human Services, Transportation, and Energy; the Chair of the Council on Environmental Quality; the Administrator of the Environmental Protection Agency; the Assistant to the President and National Climate Advisor; and the Assistant to the President for Economic Policy and Director of the National Economic Council, or their designees. 86 Fed. Reg. at 7040.

The IWG published interim SC-GHG estimates in February 2021; final estimates have not yet been published. The State of Missouri and twelve other States[2] then filed this action against President Biden, the IWG, numerous federal officials, departments, and agencies. In their March 26, 2021, First Amended Complaint, the States requested injunctive and declaratory relief, asserting four causes of action: (1) "Violation of the Separation of Powers;" (2) "Violation of Agency Statutes;" (3) "Procedural Violation of the APA"; and (4) "Substantive Violation of the APA." The States moved for a preliminary injunction prohibiting "defendants, except for the President, from using the [interim SC-GHG estimates] as binding values in any agency action." The Defendants moved to dismiss for lack of subject matter jurisdiction under Federal Rule of Civil Procedure 12(b)(1), and for failure to state a claim under Rule 12(b)(6), arguing that the States lack Article III standing, and that their challenges to the interim SC-GHG estimates are not ripe for adjudication and are meritless. The district court[3] concluded the States lack Article III standing and their claims are not ripe for adjudication, granted Defendants' motion to dismiss for lack of subject matter jurisdiction, and denied Plaintiffs' motion for a preliminary injunction as moot. *Missouri v. Biden*, 558 F. Supp. 3d 754 (E.D. Mo. 2021).[4]

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[2] Alaska, Arizona, Arkansas, Indiana, Kansas, Montana, Nebraska, Ohio, Oklahoma, South Carolina, Tennessee, and Utah.

[3] The Honorable Audrey G. Fleissig, United States District Judge for the Eastern District of Missouri.

[4] The district court did not reach Defendants' contention that the States' claims are without merit, and neither do we. With respect to future challenges to the merits of the SC-GHG estimates, the dismissal is without

The Plaintiff States appeal, arguing they have Article III standing, their claims are ripe for adjudication, and we should remand with directions to enter the requested preliminary injunction. We review the issues of Article III standing and ripeness de novo. Missouri v. Yellen, 39 F.4th 1063, 1067 (8th Cir. 2022). We conclude that the States are requesting a federal court to grant injunctive relief that directs "the current administration to comply with prior administrations' policies on regulatory analysis [without] a specific agency action to review," a request that is "outside the authority of the federal courts" under Article III of the Constitution. Louisiana by & through Landry v. Biden, No. 22-30087, 2022 WL 866282, at *3 (5th Cir. Mar. 16), appeal to vacate denied, 142 S. Ct. 2750 (May 26, 2022). Accordingly, we affirm.

I. Background

Dating back at least to President Richard Nixon's administration, Presidents have instituted procedures coordinating federal agency actions, and, of particular relevance here, requiring agencies to engage in quantified cost-benefit analyses before imposing or adjusting regulatory burdens. Article II, Section 1 of the Constitution vests "executive Power" in the President. It is not a shared power. The President and his White House staff have a "basic need . . . to monitor the consistency of executive agency regulations with Administration policy." Subject of course to statutory limits and directives, this need demands the creation of interagency working groups or teams whose purposes are to

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prejudice, like the Rule 12(b)(1) dismissal in Yeransian v. B. Riley FBR, Inc., 984 F.3d 633, 636 (8th Cir. 2021).

advise the President on policy questions that affect numerous agencies, and to communicate to those agencies the policies the President adopts for his administration. See, e.g., Sierra Club v. Costle, 657 F.2d 298, 405-06 & n.524 (D.C. Cir. 1981). Thus, we reject the States' broad contention that the IWG's SC-GHG estimates are invalid because the IWG possesses "no delegation of any legislative authority" by Congress. The IWG was formed by the President to communicate his policies to agencies in exercising *their* delegated legislative authority. We may not prohibit this sensible exercise of the President's executive power. The policies here at issue affect the manner in which agencies engage in quantified cost-benefit analysis before adopting regulations or implementing agency actions, an analysis that is now universally recognized as critical to the proper exercise of executive power. See, e.g., Meyer v. Bush, 981 F.2d 1288, 1298 (D.C. Cir. 1993) (President Reagan's Task Force on Regulatory Relief); Exec. Order No. 12866, 58 Fed. Reg. 51,735 (Sept. 30, 1993); Off. of Mgmt. & Budget ("OMB"), Exec. Off. of the President, OMB Circular A-4, at 1, 27 (Sept. 17, 2003). As the history of EO 13990 makes clear, this type of analysis raises complex, controversial issues that trigger intense political, economic, and environmental disagreement. But absent a specific controversy that falls within the judiciary's Article III power to decide Cases and Controversies, these policy disagreements are for the people to decide through their elected representatives in the legislative and executive branches of government. See TransUnion LLC v. Ramirez, 141 S. Ct. 2190, 2203 (2021).

As the focus on climate change intensified in recent decades, Executive Branch cost-benefit analyses began incorporating the direct and indirect effects of greenhouse gas emissions caused by agency actions. To ensure interagency consistency, President Obama in 2010 established the first IWG to define a standard estimate for the social cost of carbon. See IWG, Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (Feb. 2010). The initial estimates were revised and republished after an Administrative Procedure Act ("APA") notice and comment period. See IWG, Response to Comments: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (July 2015). Estimates for methane and nitrous oxide were added in 2016.[5]

In E.O. 13783, President Trump disbanded the IWG and set aside its SC-GHG estimates. E.O. 13783 allowed agencies to continue to use their own SC-GHG estimates in a manner consistent with general processes for agency cost-benefit analysis. See 82 Fed. Reg. at 16095-96. In E.O. 13990, President Biden established a reconstituted IWG and directed it to publish interim and final SC-CHG estimates "as appropriate and consistent with applicable law." The IWG's interim SC-GHG estimates, published on February 26, 2021, were the same as the Obama IWG's estimates, adjusted for inflation. See IWG, Technical Support Document: Social Cost

[5] See IWG, 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 (Aug. 2016).

of Carbon, Methane, and Nitrous Oxide Interim SC-GHG estimates under Executive Order 13990 (Feb. 2021).

After this suit was filed but before the district court ruled on the parties' cross motions, the OMB opened a notice and comment period on the interim SC-GHG estimates and on strategies for incorporating contemporary science and economics research in defining the final estimates. OMB, Notice of Availability and Request for Comment on "Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim SC-GHG estimates Under E.O. 13990", 86 Fed. Reg. 24669 (May 7, 2021). In June 2021, the Office of Information and Regulatory Affairs ("OIRA") published a document clarifying that agencies must use the IWG's interim SC-GHG estimates in complying with the general cost-benefit analysis principles adopted in Executive Order 12866 and applicable statutes. OIRA, Social Cost of Greenhouse Gas Emissions: Frequently Asked Questions (FAQs) (June 3, 2021).

II. The Plaintiff States Lack Article III Standing

"Standing to sue is a doctrine rooted in the traditional understanding of a case or controversy." Spokeo, Inc. v. Robins, 578 U.S. 330, 338 (2016). It "serves to prevent the judicial process from being used to usurp the powers of the political branches." Clapper v. Amnesty Int'l USA, 568 U.S. 398, 408 (2013). The "irreducible constitutional minimum of standing" requires plaintiffs to show they "(1) suffered an injury in fact, (2) that is fairly traceable to the challenged conduct of the defendant, and (3) that is likely to be redressed by a favorable judicial decision." Spokeo, 578 U.S. at 338 (quotation and citations omitted). To avoid dismissal for lack

of standing, the States, like private plaintiffs, "must allege sufficient facts to support a reasonable inference that they can satisfy the elements of standing." Yellen, 39 F.4th at 1068 (quotation omitted). The "standing inquiry [is] especially rigorous when reaching the merits of the dispute would force us to decide whether an action taken by one of the other two branches of the Federal Government was unconstitutional." Clapper, 568 U.S. at 408 (quotation omitted).

"To establish injury in fact, a plaintiff must show that he or she suffered an invasion of a legally protected interest that is concrete and particularized and actual or imminent, not conjectural or hypothetical." Spokeo, 578 U.S. at 339 (quotations omitted). The Supreme Court has "repeatedly reiterated that threatened injury must be certainly impending to constitute injury in fact, and that allegations of possible future injury are not sufficient." Clapper, 568 U.S. at 409 (emphasis in original) (cleaned up). In their First Amended Complaint, the States allege a host of economic, sovereign, and procedural injuries.

(1) Although their principal focus is elsewhere, the States allege that direct monetary injury will result from federal agencies' future use of the interim SC-GHG estimates. They argue the estimates' emphasis on the "social benefits" of increased restriction of greenhouse gas emissions will result in "costs to states as purchasers of more heavily regulated goods and services," and "loss of future tax revenues" from more heavily regulated economic activity. Economic injury to a State from increased proprietary costs or reduced tax revenues can certainly be sufficiently "concrete and particularized" to give the State standing to sue, provided the threatened injury

is "certainly impending" and "fairly traceable" to the challenged conduct. Cf. Dep't. of Commerce v. New York, 139 S. Ct. 2551, 2565 (2019). So why do these alleged injuries not suffice to avoid a motion to dismiss for lack of standing in this case?

The problem with this contention, as the district court explained, is that the alleged economic injuries are "concrete" only if we "assume that at some point in the future, one or more agencies will 'inevitably' issue one or more regulations that rely in some way upon the Interim Estimates; that such agency will 'inevitably' disregard any objections to the methodology by which the Interim SC-GHG estimates were calculated; and that this yet-to-be-identified regulation will then harm Plaintiffs in a concrete and particularized way." 558 F. Supp. 3d at 765. This theory of injury in fact "does not satisfy the requirement that threatened injury must be certainly impending" because it "relies on a highly attenuated chain of possibilities." Clapper, 568 U.S. at 410, citing Summers v. Earth Island Inst., 555 U.S. 488, 496 (2009).

In Summers, the Court dismissed for lack of standing plaintiffs' challenge to the United States Forest Service's exemption of certain timber sales from notice and comment rule-making. Without injury allegations tied to a specific logging project, the Court concluded, the mere statistical likelihood that the regulations would harm the plaintiffs in the future was insufficient. 555 U.S. at 498. The challenged Forest Service procedures "neither require nor forbid any action on the part of respondents. . . . [They] govern only the conduct of Forest Service officials engaged in project planning." Id. at 493. Similarly here, even if E.O. 13990 makes their use

mandatory, the interim SC-GHG estimates only establish a consistent standard for one factor federal agencies may use when conducting cost-benefit analyses they are obligated to complete under executive branch regulations and statutory directives. We agree with the district court that the "Interim SC-GHG estimates, alone, do not injure Plaintiffs. . . . The njury that Plaintiffs fear is from hypothetical future regulation possibly derived from these Estimates." 558 F. Supp. 3d at 766.

The government's brief aptly summarizes the estimates' limited impact: *"if* agencies propose future regulations, *if* they conduct cost-benefit analyses for those regulations, and *if* they choose to monetize GHG emissions in those analyses, then the agencies must use the Interim SC-GHG estimates." This highly attenuated theory of injury does not satisfy the States' burden to show the requisite causation. "For causation to exist, the injury has to be fairly traceable to the challenged action of the defendant, and not the result of the independent action of some third party not before the court." Agred Found. v. U.S. Army Corps of Engr's, 3 F.4th 1069, 1073 (8th Cir. 2021) (quotation omitted). In these circumstances, even if the States plausibly allege concrete injury, they fail to show the alleged injuries are caused by the interim SCGHG estimates.

(2) On appeal, the States argue the district court also erred by failing to take into account the past and ongoing *sovereign* injury caused by the interim SC-GHG estimates' intrusion into the States' role as regulators in cooperative federalism programs such as those mandated by the National Environmental Policy Act (NEPA), Clean Air Act state

implementation plans, and federal highway administration actions. They argue this injury -- "depriv[ing] the States of freedom and discretion that they otherwise would have had in administering these programs" -- "does not depend on the impact of a future agency action, because it immediately affects how States participate in formulating agency actions."

Whether and when alleged sovereign injuries can constitute the concrete and particularized injury in fact required for Article III standing is a controversial, unsettled question, as the Supreme Court's 5 to 4 decision in Massachusetts v. EPA, 549 U.S. 497 (2007), makes clear. However, even if the States as sovereigns are entitled to some undefined "special solicitude" in the standing analysis, they still must satisfy the basic requirements of Article III standing. Yellen, 39 F.4th at 1070 n.7, citing Massachusetts v. EPA, 549 U.S. at 521-23.

E.O. 13990 explicitly states that the interim SC-GHG estimates apply only to federal "executive departments and agencies." 86 Fed. Reg. at 7037. "[W]here a causal relation between injury and challenged action depends on the decision of an independent third party [here, future regulatory decisions of other federal agencies] standing is not precluded but it is ordinarily substantially more difficult to establish." California v. Texas, 141 S. Ct. 2104, 2117 (2021) (cleaned up). Here, neither the interim SC-GHG estimates nor EO 13990 impose obligations on the States. Even when States are conducting cost-benefit analyses as part of their participation in cooperative federalism programs, they are not bound to use the interim SC-GHG estimates. The States would prefer that their federal agency partners not use these estimates in future

program planning or decision-making. But that is not concrete harm to the States. "No concrete harm, no standing." Transunion, 141 S. Ct. at 2200.

(3) The States further argue the district court erred in concluding "that Article III standing could never exist until a future agency action based on the [interim SCGHG estimates] is finalized." They cite Bennett v. Spear, 520 U.S. 154 (1997), as controlling contrary authority. In Bennett, ranchers and irrigation districts challenged a Fish and Wildlife Service "biological opinion" issued under the Endangered Species Act. The Supreme Court reversed the dismissal of their action for lack of standing. Though plaintiffs' threatened injury -- allocation of less water under the Klamath Irrigation Project -- would be caused by a third party, the Bureau of Reclamation, the Court held that plaintiffs met their "relatively modest" burden of alleging injury that is "fairly traceable" to the biological opinion because that opinion "has a powerful coercive effect on the action agency," "alters the legal regime to which the action agency is subject," and has a "virtually determinative effect" on agency action that will result in concrete and particularized harm to the plaintiffs. Id. at 169-71. The district court distinguished Bennett because "neither EO 13990 nor the Interim SCGHG estimates mandate agencies issue the particular regulations that Plaintiffs fear will harm them." 558 F. Supp. 3d at 767. We agree.

The facts alleged here are materially different than in Bennett. The States seek injunctive relief against all future uses of the interim SC-GHG estimates; the Court in Bennett addressed a concrete dispute about a pending agency action affecting a specific irrigation project. Moreover, unlike the

biological opinion's "virtually determinative effect" on specific agency action in Bennett, the interim SC-GHG estimates are only "one of innumerable other factors in the cost-benefit analysis conducted by a wide range of agencies in an even wider range of regulatory contexts, and only to the extent consistent with applicable law." 558 F. Supp. 3d at 767. We agree with the Fifth Circuit that these alleged future increased regulatory costs are not traceable to the interim SC-GHG estimates "because agencies consider a great number of other factors in determining when, what, and how to regulate or take agency action (and the Plaintiff States do not challenge a specific regulation or action)." Louisiana v. Biden, 2022 WL 866282, at *2 (emphasis in original).

(4) Finally, the States argue they suffered procedural harm when the IWG published initial estimates without APA notice and comment procedures. They assert this injury alone gives them Article III standing, pointing to our decision in Iowa League of Cities v. EPA, 711 F.3d 844, 870-71 (8th Cir. 2013). We reject this contention for two independent reasons.

First, the Supreme Court has held that the "deprivation of a procedural right without some concrete interest that is affected by the deprivation -- a procedural right in vacuo -- is insufficient to create Article III standing." Summers, 555 U.S. at 496. In Iowa League of Cities, we held that we had subject matter jurisdiction to review an APA procedural challenge to agency "guidance letters" responding to a Senator's inquiries because the letters were binding policy promulgations that threatened the plaintiffs's concrete interest "in avoiding regulatory obligations above and beyond those that can be statutorily imposed upon them." 711 F.3d at 871. Here, the

alleged procedural harm is untethered to any specific harm. By challenging all uses of the interim SC-GHG estimates, rather than their use in a specific agency action, the States are asserting only "a procedural right *in vacuo*."

Second, the States assert that the IWG is an "agency" subject to APA notice and comment requirements. But in support, they cite only Soucie v. David, 448 F.2d 1067, 1075 (D.C. Cir. 1971), a case holding that the Office of Science and Technology, an entity within the Executive Office of the President, was an "agency" subject to the disclosure requirements of the Freedom of Information Act (FOIA), which is part of the APA. Congress approved this decision when it amended the definition of "agency" in the section of the APA that imposes FOIA requirements to include "the Executive Office of the President." 5 U.S.C. § 552(f)(1) (formerly § 552(e)); see Meyer, 981 F.2d at 1291-92. But the APA's rule-making requirements, 5 U.S.C. § 553, apply to an "agency" as generally defined in 5 U.S.C. § 551(1) -- "each authority of the Government of the United States." The Supreme Court has never held that the President's interagency working groups are § 551(1) "agencies" and therefore their "actions" are subject to APA notice and comment requirements. We doubt it would do so, because such a ruling would encourage constant judicial interference with the President's exercise of his executive power. Cf. Kissinger v. Reporters Comm., 445 U.S. 136, 155-58 (1980). We certainly will not be the first to make this extraordinary leap. For this reason, too, the States have failed to allege plausible procedural injury in fact.

The States failed to allege plausible injury in fact fairly traceable to the interim SC-GHG estimates. Thus, their complaint was properly dismissed for lack of subject matter jurisdiction, specifically, lack of Article III standing. We need not consider the third indispensable element of Article III standing, that it be "likely, as opposed to merely speculative, that the injury will be redressed by a favorable decision." Lujan v. Defenders of Wildlife, 504 U.S. 555, 561 (1992) (quotations omitted).

III. Conclusion

The Plaintiff States failed to plausibly allege the "irreducible constitutional minimum" of Article III standing -- concrete and particularized actual injury in fact that is fairly traceable to defendants' challenged conduct, publication of the interim SC-GHG estimates. The Plaintiff States disagree with the President's policies reflected in the interim SC-GHG estimates, but it is not our role to "exercise general legal oversight of the Legislative and Executive Branches." TransUnion, 141 S. Ct. at 2203. When executive agencies or officials take or propose to take specific actions based on reliance on the interim SC-GHG estimates, E.O. 13990 does not exempt them from complying with statutory duties imposed by the APA, including providing opportunities for notice and comment. And if the States believe that specific agency actions justified by the interim SC-GHG estimates inflict concrete and particularized injury, they may challenge the actions, and the interim SC-GHG estimates themselves, in federal court. See 5 U.S.C. § 706. But the States' "generalized grievance of how the current administration is considering SC-

GHG. . . . fails to meet the standards of Article III standing." Louisiana v. Biden, 2022 WL 866282, at *2.

The judgment of the district court is affirmed.

UNITED STATES COURT OF APPEALS
FOR THE EIGHTH CIRCUIT

No: 21-3013

State of Missouri, et al.

Appellants

v.

Joseph R. Biden, Jr., in his official capacity as the President of the United States of America, et al.

Appellees

Committee for a Constructive Tomorrow

Amicus on Behalf of Appellant(s)

Appeal from U.S. District Court for the Eastern District of Missouri - St. Louis
(4:21-cv-00287-AGF)

ORDER

The petition for rehearing en banc is denied. The petition for rehearing by the panel is also denied.

January 27, 2023

Order Entered at the Direction of the Court:
Clerk, U.S. Court of Appeals, Eighth Circuit.
/s/ Michael E. Gans

Presidential Documents

Executive Order 13990 of January 20, 2021

Protecting Public Health and the Environment and Restoring Science To Tackle the Climate Crisis

By the authority vested in me as President by the Constitution and the laws of the United States of America, it is hereby ordered as follows:

Section 1. *Policy*. Our Nation has an abiding commitment to empower our workers and communities; promote and protect our public health and the environment; and conserve our national treasures and monuments, places that secure our national memory. Where the Federal Government has failed to meet that commitment in the past, it must advance environmental justice. In carrying out this charge, the Federal Government must be guided by the best science and be protected by processes that ensure the integrity of Federal decision-making. It is, therefore, the policy of my Administration to listen to the science; to improve public health and protect our environment; to ensure access to clean air and water; to limit exposure to dangerous chemicals and pesticides; to hold polluters accountable, including those who disproportionately harm communities of color and low-income communities; to reduce greenhouse gas emissions; to bolster resilience to the impacts of climate change; to restore and expand our national treasures and

monuments; and to prioritize both environmental justice and the creation of the well-paying union jobs necessary to deliver on these goals.

To that end, this order directs all executive departments and agencies (agencies) to immediately review and, as appropriate and consistent with applicable law, take action to address the promulgation of Federal regulations and other actions during the last 4 years that conflict with these important national objectives, and to immediately commence work to confront the climate crisis.

Sec. 2. *Immediate Review of Agency Actions Taken Between January 20, 2017, and January 20, 2021*. (a) The heads of all agencies shall immediately review all existing regulations, orders, guidance documents, policies, and any other similar agency actions (agency actions) promulgated, issued, or adopted between January 20, 2017, and January 20, 2021, that are or may be inconsistent with, or present obstacles to, the policy set forth in section 1 of this order. For any such actions identified by the agencies, the heads of agencies shall, as appropriate and consistent with applicable law, consider suspending, revising, or rescinding the agency actions. In addition, for the agency actions in the 4 categories set forth in subsections (i) through (iv) of this section, the head of the relevant agency, as appropriate and consistent with applicable law, shall consider publishing for notice and comment a proposed rule suspending, revising, or rescinding the agency action within the time frame

specified.

(i) Reducing Methane Emissions in the Oil and Gas Sector: "Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources Reconsideration," 85 FR 57398 (September 15, 2020), by September 2021.

(ii) Establishing Ambitious, Job-Creating Fuel Economy Standards: "The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part One: One National Program," 84 FR 51310 (September 27, 2019), by April 2021; and "The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks," 85 FR 24174 (April 30, 2020), by July 2021. In considering whether to propose suspending, revising, or rescinding the latter rule, the agency should consider the views of representatives from labor unions, States, and industry.

(iii) Job-Creating Appliance- and Building-Efficiency Standards: "Energy Conservation Program for Appliance Standards: Procedures for Use in New or Revised Energy Conservation Standards and Test Procedures for Consumer Products and Commercial/Industrial Equipment," 85 FR 8626 (February 14, 2020), with major revisions proposed by March 2021 and any remaining revisions proposed by June 2021; "Energy Conservation Program for Appliance Standards: Procedures for Evaluating Statutory Factors for Use in New or Revised Energy Conservation Standards," 85 FR 50937 (August 19, 2020), with major revisions proposed by March 2021

and any remaining revisions proposed by June 2021; "Final Determination Regarding Energy Efficiency Improvements in the 2018 International Energy Conservation Code (IECC)," 84 FR 67435 (December 10, 2019), by May 2021; "Final Determination Regarding Energy Efficiency Improvements in ANSI/ASHRAE/IES Standard 90.1-2016: Energy Standard for Buildings, Except Low-Rise Residential Buildings," 83 FR 8463 (February 27, 2018), by May 2021.

(iv) Protecting Our Air from Harmful Pollution: "National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units— Reconsideration of Supplemental Finding and Residual Risk and Technology Review," 85 FR 31286 (May 22, 2020), by August 2021; "Increasing Consistency and Transparency in Considering Benefits and Costs in the Clean Air Act Rulemaking Process," 85 FR 84130 (December 23, 2020), as soon as possible; "Strengthening Transparency in Pivotal Science Underlying Significant Regulatory Actions and Influential Scientific Information," 86 FR 469 (January 6, 2021), as soon as possible.

(b) Within 30 days of the date of this order, heads of agencies shall submit to the Director of the Office of Management and Budget (OMB) a preliminary list of any actions being considered pursuant to section (2)(a) of this order that would be completed by December 31, 2021, and that would be subject to OMB review. Within 90 days of the date of this order, heads of agencies shall submit to the Director of

OMB an updated list of any actions being considered pursuant to section (2)(a) of this order that would be completed by December 31, 2025, and that would be subject to OMB review. At the time of submission to the Director of OMB, heads of agencies shall also send each list to the National Climate Advisor. In addition, and at the same time, heads of agencies shall send to the National Climate Advisor a list of additional actions being considered pursuant to section (2)(a) of this order that would not be subject to OMB review.

(c) Heads of agencies shall, as appropriate and consistent with applicable law, consider whether to take any additional agency actions to fully enforce the policy set forth in section 1 of this order. With respect to the Administrator of the Environmental Protection Agency, the following specific actions should be considered:

(i) proposing new regulations to establish comprehensive standards of performance and emission guidelines for methane and volatile organic compound emissions from existing operations in the oil and gas sector, including the exploration and production, transmission, processing, and storage segments, by September 2021; and

(ii) proposing a Federal Implementation Plan in accordance with the Environmental Protection Agency's "Findings of Failure To Submit State Implementation Plan Revisions in Response to the 2016 Oil and Natural Gas Industry Control Techniques Guidelines for the 2008 Ozone National Ambient Air Quality Standards (NAAQS) and for States in the Ozone Transport Region," 85 FR 72963 (November 16, 2020), for

California, Connecticut, New York, Pennsylvania, and Texas by January 2022.

(d) The Attorney General may, as appropriate and consistent with applicable law, provide notice of this order and any actions taken pursuant to section 2(a) of this order to any court with jurisdiction over pending litigation related to those agency actions identified pursuant to section (2)(a) of this order, and may, in his discretion, request that the court stay or otherwise dispose of litigation, or seek other appropriate relief consistent with this order, until the completion of the processes described in this order.

(e) In carrying out the actions directed in this section, heads of agencies shall seek input from the public and stakeholders, including State local, Tribal, and territorial officials, scientists, labor unions, environmental advocates, and environmental justice organizations.

Sec. 3. *Restoring National Monuments.* (a) The Secretary of the Interior, as appropriate and consistent with applicable law, including the Antiquities Act, 54 U.S.C. 320301 *et seq.*, shall, in consultation with the Attorney General, the Secretaries of Agriculture and Commerce, the Chair of the Council on Environmental Quality, and Tribal governments, conduct a review of the monument boundaries and conditions that were established by Proclamation 9681 of December 4, 2017 (Modifying the Bears Ears National Monument); Proclamation 9682 of December 4, 2017 (Modifying the Grand Staircase-Escalante National Monument); and Proclamation 10049 of June 5, 2020 (Modifying the Northeast Canyons and

Seamounts Marine National Monument), to determine whether restoration of the monument boundaries and conditions that existed as of January 20, 2017, would be appropriate.

(b) Within 60 days of the date of this order, the Secretary of the Interior shall submit a report to the President summarizing the findings of the review conducted pursuant to subsection (a), which shall include recommendations for such Presidential actions or other actions consistent with law as the Secretary may consider appropriate to carry out the policy set forth in section 1 of this order.

(c) The Attorney General may, as appropriate and consistent with applicable law, provide notice of this order to any court with jurisdiction over pending litigation related to the Grand Staircase-Escalante, Bears Ears, and Northeast Canyons and Seamounts Marine National Monuments, and may, in his discretion, request that the court stay the litigation or otherwise delay further litigation, or seek other appropriate relief consistent with this order, pending the completion of the actions described in subsection (a) of this section.

Sec. 4. *Arctic Refuge.* (a) In light of the alleged legal deficiencies underlying the program, including the inadequacy of the environmental review required by the National Environmental Policy Act, the Secretary of the Interior shall, as appropriate and consistent with applicable law, place a temporary moratorium on all activities of the Federal Government relating to the implementation of the Coastal Plain Oil and Gas Leasing Program, as established by the Record of Decision signed

August 17, 2020, in the Arctic National Wildlife Refuge. The Secretary shall review the program and, as appropriate and consistent with applicable law, conduct a new, comprehensive analysis of the potential environmental impacts of the oil and gas program.

(b) In Executive Order 13754 of December 9, 2016 (Northern Bering Sea Climate Resilience), and in the Presidential Memorandum of December 20, 2016 (Withdrawal of Certain Portions of the United States Arctic Outer Continental Shelf From Mineral Leasing), President Obama withdrew areas in Arctic waters and the Bering Sea from oil and gas drilling and established the Northern Bering Sea Climate Resilience Area. Subsequently, the order was revoked and the memorandum was amended in Executive Order 13795 of April 28, 2017 (Implementing an America-First Offshore Energy Strategy). Pursuant to section 12(a) of the Outer Continental Shelf Lands Act, 43 U.S.C. 1341(a), Executive Order 13754 and the Presidential Memorandum of December 20, 2016, are hereby reinstated in their original form, thereby restoring the original withdrawal of certain offshore areas in Arctic waters and the Bering Sea from oil and gas drilling.

(c) The Attorney General may, as appropriate and consistent with applicable law, provide notice of this order to any court with jurisdiction over pending litigation related to the Coastal Plain Oil and Gas Leasing Program in the Arctic National Wildlife Refuge and other related programs, and may, in his discretion, request that the court stay the litigation or otherwise delay further litigation, or seek other appropriate relief consistent with this order, pending the completion of the

actions described in subsection (a) of this section.

Sec. 5. *Accounting for the Benefits of Reducing Climate Pollution.* (a) It is essential that agencies capture the full costs of greenhouse gas emissions as accurately as possible, including by taking global damages into account. Doing so facilitates sound decision-making, recognizes the breadth of climate impacts, and supports the international leadership of the United States on climate issues. The "social cost of carbon" (SCC), "social cost of nitrous oxide" (SCN), and "social cost of methane" (SCM) are estimates of the monetized damages associated with incremental increases in greenhouse gas emissions. They are intended to include changes in net agricultural productivity, human health, property damage from increased flood risk, and the value of ecosystem services. An accurate social cost is essential for agencies to accurately determine the social benefits of reducing greenhouse gas emissions when conducting cost-benefit analyses of regulatory and other actions.

(b) There is hereby established an Interagency Working Group on the Social Cost of Greenhouse Gases (the "Working Group"). The Chair of the Council of Economic Advisers, Director of OMB, and Director of the Office of Science and Technology Policy shall serve as Co-Chairs of the Working Group.

(i) Membership. The Working Group shall also include the following other officers, or their designees: the Secretary of the Treasury; the Secretary of the Interior; the Secretary of Agriculture; the Secretary of

Commerce; the Secretary of Health and Human Services; the Secretary of Transportation; the Secretary of Energy; the Chair of the Council on Environmental Quality; the Administrator of the Environmental Protection Agency; the Assistant to the President and National Climate Advisor; and the Assistant to the President for Economic Policy and Director of the National Economic Council.

(ii) Mission and Work. The Working Group shall, as appropriate and consistent with applicable law:

(A) publish an interim SCC, SCN, and SCM within 30 days of the date of this order, which agencies shall use when monetizing the value of changes in greenhouse gas emissions resulting from regulations and other relevant agency actions until final values are published;

(B) publish a final SCC, SCN, and SCM by no later than January 2022;

(C) provide recommendations to the President, by no later than September 1, 2021, regarding areas of decision-making, budgeting, and procurement by the Federal Government where the SCC, SCN, and SCM should be applied;

(D) provide recommendations, by no later than June 1, 2022, regarding a process for reviewing, and, as appropriate, updating, the SCC, SCN, and SCM to ensure that these costs are based on the best available economics and science; and

(E) provide recommendations, to be published with the final SCC, SCN, and SCM under

subparagraph (A) if feasible, and in any event by no later than June 1, 2022, to revise methodologies for calculating the SCC, SCN, and SCM, to the extent that current methodologies do not adequately take account of climate risk, environmental justice, and intergenerational equity.

(iii) Methodology. In carrying out its activities, the Working Group shall consider the recommendations of the National Academies of Science, Engineering, and Medicine as reported in Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide (2017) and other pertinent scientific literature; solicit public comment; engage with the public and stakeholders; seek the advice of ethics experts; and ensure that the SCC, SCN, and SCM reflect the interests of future generations in avoiding threats posed by climate change.

Sec. 6. *Revoking the March 2019 Permit for the Keystone XL Pipeline.* (a) On March 29, 2019, the President granted to TransCanada Keystone Pipeline, L.P. a Presidential permit (the "Permit") to construct, connect, operate, and maintain pipeline facilities at the international border of the United States and Canada (the "Keystone XL pipeline"), subject to express conditions and potential revocation in the President's sole discretion. The Permit is hereby revoked in accordance with Article 1(1) of the Permit.

(b) In 2015, following an exhaustive review, the Department of State and the President determined that

approving the proposed Keystone XL pipeline would not serve the U.S. national interest. That analysis, in addition to concluding that the significance of the proposed pipeline for our energy security and economy is limited, stressed that the United States must prioritize the development of a clean energy economy, which will in turn create good jobs. The analysis further concluded that approval of the proposed pipeline would undermine U.S. climate leadership by undercutting the credibility and influence of the United States in urging other countries to take ambitious climate action.

(c) Climate change has had a growing effect on the U.S. economy, with climate-related costs increasing over the last 4 years. Extreme weather events and other climate-related effects have harmed the health, safety, and security of the American people and have increased the urgency for combatting climate change and accelerating the transition toward a clean energy economy. The world must be put on a sustainable climate pathway to protect Americans and the domestic economy from harmful climate impacts, and to create well-paying union jobs as part of the climate solution.

(d) The Keystone XL pipeline disserves the U.S. national interest. The United States and the world face a climate crisis. That crisis must be met with action on a scale and at a speed commensurate with the need to avoid setting the world on a dangerous, potentially catastrophic, climate trajectory. At home, we will combat the crisis with an ambitious plan to build back better, designed to both reduce harmful emissions and create good clean-energy jobs. 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. Leaving the Keystone XL pipeline permit in place would not be consistent with my Administration's economic and climate imperatives.

Sec. 7. *Other Revocations.* (a) Executive Order 13766 of January 24, 2017 (Expediting Environmental Reviews and Approvals For High Priority Infrastructure Projects), Executive Order 13778 of February 28, 2017 (Restoring the Rule of Law, Federalism, and Economic Growth by Reviewing the "Waters of the United States" Rule), Executive Order 13783 of March 28, 2017 (Promoting Energy Independence and Economic Growth), Executive Order 13792 of April 26, 2017 (Review of Designations Under the Antiquities Act), Executive Order 13795 of April 28, 2017 (Implementing an America-First Offshore Energy Strategy), Executive Order 13868 of April 10, 2019 (Promoting Energy Infrastructure and Economic Growth), and Executive Order 13927 of June 4, 2020 (Accelerating the Nation's Economic Recovery from the COVID-19 Emergency by Expediting Infrastructure Investments and Other Activities), are hereby revoked. Executive Order 13834 of May 17, 2018 (Efficient Federal Operations), is hereby revoked except for sections 6, 7, and 11.

(b) Executive Order 13807 of August 15, 2017 (Establishing Discipline and Accountability in the

Environmental Review and Permitting Process for Infrastructure Projects), is hereby revoked. The Director of OMB and the Chair of the Council on Environmental Quality shall jointly consider whether to recommend that a replacement order be issued.

(c) Executive Order 13920 of May 1, 2020 (Securing the United States Bulk-Power System), is hereby suspended for 90 days. The Secretary of Energy and the Director of OMB shall jointly consider whether to recommend that a replacement order be issued.

(d) The Presidential Memorandum of April 12, 2018 (Promoting Domestic Manufacturing and Job Creation Policies and Procedures Relating to Implementation of Air Quality Standards), the Presidential Memorandum of October 19, 2018 (Promoting the Reliable Supply and Delivery of Water in the West), and the Presidential Memorandum of February 19, 2020 (Developing and Delivering More Water Supplies in California), are hereby revoked.

(e) The Council on Environmental Quality shall rescind its draft guidance entitled, "Draft National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions," 84 FR 30097 (June 26, 2019). The Council, as appropriate and consistent with applicable law, shall review, revise, and update its final guidance entitled, "Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews," 81 FR 51866 (August 5, 2016).

(f) The Director of OMB and the heads of agencies shall promptly take steps to rescind any orders, rules,

regulations, guidelines, or policies, or portions thereof, including, if necessary, by proposing such rescissions through notice-and- comment rulemaking, implementing or enforcing the Executive Orders, Presidential Memoranda, and draft guidance identified in this section, as appropriate and consistent with applicable law.

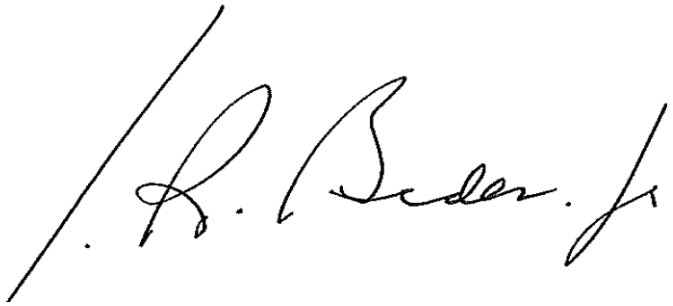
Sec. 8. *General Provisions.* (a) Nothing in this order shall be construed to impair or otherwise affect:

(i) the authority granted by law to an executive department or agency, or the head thereof; or

(ii) the functions of the Director of the Office of Management and Budget relating to budgetary, administrative, or legislative proposals.

(b) This order shall be implemented in a manner consistent with applicable law and subject to the availability of appropriations.

(c) This order is not intended to, and does not, create any right or benefit, substantive or procedural, enforceable at law or in equity by any party against the United States, its departments, agencies, or entities, its officers, employees, or agents, or any other person.



THE WHITE HOUSE, January 20, 2021. Filed 1-22-21; 11:15 am]

Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide
Interim Estimates under Executive Order 13990

Interagency Working Group on Social Cost of Greenhouse Gases, United States Government With participation by

Council of Economic Advisers Council on Environmental Quality Department of Agriculture Department of Commerce Department of Energy
Department of Health and Human Services Department of the Interior
Department of Transportation Department of the Treasury Environmental Protection Agency National Climate Advisor National Economic Council
Office of Management and Budget Office of Science and Technology Policy

February 2021

Preface

The Interagency Working Group (IWG) on the Social Cost of Greenhouse Gases is committed to ensuring that the estimates agencies use when monetizing the value of changes in greenhouse gas emissions resulting from regulations and other relevant agency actions continue to reflect the best available science and methodologies. This Technical Support Document (TSD) presents interim estimates of the social cost of carbon, methane, and nitrous oxide developed under Executive Order 13990. These interim values are the same as those developed by the IWG in 2013 and 2016. The current IWG will take comment on recent developments in the science and economics for use in a more comprehensive update, to be issued by January 2022, which will more fully address the recommendations of the National Academies of Sciences, Engineering, and Medicine as reported in Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide (2017) and other pertinent scientific literature. As a part of that request for comment, the IWG will seek comment on the discussion of advances in science and methodology included in this TSD and how those advances can best be incorporated into the revised final estimates.

Executive Summary

A robust and scientifically founded assessment of the positive and negative impacts that an action can be expected to have on society provides important insights in the policy-making process. The estimates of the social cost of carbon (SC-CO_2), social cost of methane (SC-CH_4), and social cost of nitrous oxide (SC- N_2O) presented here allow

agencies to understand the social benefits of reducing emissions of each of these greenhouse gases, or the social costs of increasing such emissions, in the policy making process. Collectively, these values are referenced as the "social cost of greenhouse gases" (SC-GHG) in this document. The SC-GHG is the monetary value of the net harm to society associated with adding a small amount of that GHG to the atmosphere in a given year. In principle, it includes the value of all climate change impacts, including (but not limited to) changes in net agricultural productivity, human health effects, property damage from increased flood risk natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services. The SC-GHG, therefore, should reflect the societal value of reducing emissions of the gas in question by one metric ton. The marginal estimate of social costs will differ by the type of greenhouse gas (such as carbon dioxide, methane, and nitrous oxide) and by the year in which the emissions change occurs. The SC-GHGs are the theoretically appropriate values to use in conducting benefit-cost analyses of policies that affect GHG emissions.

Federal agencies began regularly incorporating social cost of carbon (SC-CO2) estimates in benefit-cost analyses conducted under Executive Order (E.O.) 12866[1] in 2008,

[1] Under E.O. 12866, agencies are required, to the extent permitted by law and where applicable, "to assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs." As indicated in the discussion above, many statutes also require agencies to conduct at least some of the same analyses required under E.O. 12866, such as the Energy Policy and Conservation Act which mandates the setting of fuel economy regulations.

following a court ruling in which an agency was ordered to consider the value of reducing CO2 emissions in a rulemaking process. The U.S. Ninth Circuit Court of Appeals remanded a fuel economy rule to DOT for failing to monetize CO2 emission reductions, stating that "whole the record shows that there is a range of values, the value of carbon emissions reduction is certainly not zero."[2] In 2009, an interagency working group (IWG) was established to ensure that agencies were using the best available science and to promote consistency in the values used across agencies. The IWG published SC-CO2 estimates in 2010 that were developed from an ensemble of three widely cited integrated assessment models (IAMs) that estimate global climate damages using highly aggregated representations of climate processes and the global economy combined into a single modeling framework. The three IAMs were run using a common set of input assumptions in each model for future population, economic, and GHG emissions growth, as well as equilibrium climate sensitivity (ECS) – a measure of the globally averaged temperature response to increased atmospheric CO2 concentrations. These estimates were updated in 2013 based on new versions of each IAM. In August 2016 the IWG published estimates of the social cost of methane (SC-CH4) and nitrous oxide (SC-N2O) using methodologies that are consistent with the methodology underlying the SC-CO2 estimates. In January 2017, the National Academies of Sciences, Engineering, and Medicine issued recommendations for an updating process to ensure the estimates continue to reflect the best

[2] *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1200 (9th Cir. 2008).

available science. In March 2017, Executive Order 13783 disbanded the IWG and instructed agencies when monetizing the value of changes in greenhouse gas emissions resulting from regulations to follow the Office of Management and Budget's (OMB) Circular A-4.

On January 20, 2021, President Biden issued E.O. 13990 which re-established the IWG and directed it to ensure that SC-GHG estimates used by the U.S. Government (USG) reflect the best available science and the recommendations of the National Academies (2017) and work towards approaches that take account of climate risk, environmental justice, and intergenerational equity. The IWG was tasked with first reviewing the SC-GHG estimates currently used by the USG and publishing interim estimates within 30 days of the E.O. that reflect the full impact of GHG emissions, including taking global damages into account. In this initial review, the IWG finds that the SC-GHG estimates used since E.O. 13783 fail to reflect the full impact of GHG emissions in multiple ways. First, the IWG found previously and is restating here that a global perspective is essential for SC-GHG estimates because climate impacts occurring outside U.S. borders can directly and indirectly affect the welfare of U.S. citizens and residents. Thus, U.S. interests are affected by the climate impacts that occur outside U.S. borders. Examples of affected interests include: direct effects on U.S. citizens and assets located abroad, international trade, tourism, and spillover pathways such as economic and political destabilization and global migration. In addition, assessing the benefits of U.S. GHG mitigation activities requires consideration of how those actions may affect mitigation activities by other countries, as those international mitigation actions will provide a benefit to U.S. citizens and residents by mitigating climate impacts that affect U.S. citizens and residents. Second, the IWG found previously and is restating here that the use of the social rate of return

on capital to discount the future benefits of reducing GHG emissions inappropriately underestimates the impacts of climate change for the purposes of estimating the SC-GHG (see Section 3.1). Consistent with the findings of the National Academies (2017) and the economic literature, the IWG continues to conclude that the consumption rate of interest is the theoretically appropriate discount rate in an intergenerational context (IWG 2010, 2013, 2016). The IWG recommends that discount rate uncertainty and relevant aspects of intergenerational ethical considerations be accounted for in selecting future discount rates.

While the IWG works to assess how best to incorporate the latest, peer reviewed science to develop an updated set of SC-GHG estimates, it is setting interim estimates to be the most recent estimates developed by the IWG prior to the group being disbanded in 2017. The IWG concludes that these interim estimates represent the most appropriate estimate of the SC-GHG until the revised estimates have been developed. This update reflects the immediate need to have an operational SC-GHG for use in regulatory benefit-cost analyses and other applications that was developed using a transparent process, peer- reviewed methodologies, and the science available at the time of that process. Those estimates were subject to public comment in the context of dozens of proposed rulemakings as well as in a dedicated public comment period in 2013.

At the same time, consistent with its continuing commitment to a transparent process and a desire to move quickly to update SC-GHG estimates to better reflect the recent science, the IWG will be taking comment on how to incorporate the recommendations of the National Academies (2017) and other recent science , including the advances discussed in this Technical Support Document

(TSD), both during the development of the fully updated SC-GHG estimates to be released by January of 2022 and in subsequent updates. The IWG will soon issue a Federal Register notice with a detailed set of requests for public comments on the new information presented in this TSD, as well as other topics and issues the IWG will address as we develop the next set of updates.

This TSD presents the IWG's interim findings and provides interim estimates of the SC-CO2, SC-CH4, and SC-N2O that should be used by agencies until a comprehensive review and update is developed in line with the requirements in E.O. 13990. The TSD maintains the same methodological approach as has been used for global USG SC-GHG estimation to date. The estimates rely on the same models and harmonized inputs and are calculated using a range of discount rates. At this time, the IWG has determined that it is appropriate for agencies to revert to the same set of four values drawn from the SC-GHG distributions based on three discount rates (2.5 percent, 3 percent, and 5 percent) as were used in regulatory analyses between 2010 and 2016 and subject to public comment. However, as described below, based on the IWG's initial review, new data and evidence strongly suggests that the discount rate regarded as appropriate for intergenerational analysis is lower.

Tables ES-1, ES-2, and ES-3 summarize the interim SC-CO2, SC-CH4, and SC-N2O estimates, respectively, for the years 2020 through 2050. These estimates are reported in 2020 dollars but are otherwise identical to those presented in the previous version of the TSD and its Addendum, released in August 2016. For purposes of capturing

uncertainty around the SC-GHG estimates in analyses, the IWG emphasized previously and reemphasizes here the importance of considering all four of the SC-GHG values. In particular, this TSD discusses how the understanding of discounting approaches suggests discount rates appropriate for intergenerational analysis in the context of climate change that are lower than 3 percent. Consistent with the guidance in E.O. 13990 for the IWG to ensure that the SC-GHG reflect the interests of future generations, the latest scientific and economic understanding of discount rates discussed in this TSD, and the recommendation from OMB's Circular A-4 to include sensitivity analysis with lower discount rates when a rule has important intergenerational benefits or costs, agencies may consider conducting additional sensitivity analysis using discount rates below 2.5 percent. Furthermore, the IAMs used to produce these interim estimates do not include all of the important physical, ecological, and economic impacts of climate change recognized in the climate change literature. For these same impacts, the science underlying their "damage functions" – i.e., the core parts of the IAMs that map global mean temperature changes and other physical impacts of climate change into economic (both market and nonmarket) damages – lags behind the most recent research. Likewise, the assumptions regarding equilibrium climate sensitivity and socioeconomic and emissions scenarios used as inputs to the model runs in this TSD will need to be updated. It is the IWG's judgment that, taken together, these limitations suggest that the range of four interim SC-GHG estimates presented in this TSD likely underestimate societal damages from GHG emissions.

Table ES-1: Social Cost of CO2, 2020 – 2050 (in 2020 dollars per metric ton of CO2)[3]

Discount Rate and Statistic

Emissions Year	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020	14	51	76	152
2025	17	56	83	169
2030	19	62	89	187
2035	22	67	96	206
2040	25	73	103	225
2045	28	79	110	242
2050	32	85	116	260

[3] The values reported in this TSD are identical to those reported in the 2016 TSD adjusted for inflation to 2020 dollars using the annual GDP Implicit Price Deflator values in the U.S. Bureau of Economic Analysis' (BEA) NIPA Table 1.1.9: 113.626 (2020)/ 92.486 (2007) = 1.228575 (U.S. BEA 2021). Values are the average across models and socioeconomic emissions scenarios for each of three discount rates (2.5%, 3%, and 5%), plus a fourth value, selected as the 95th percentile of estimates based on a 3 percent discount rate. Values of SC-CO2 are rounded to the nearest dollar; SC-CH4 and SC-N2O are rounded to two significant figures. The annual unrounded estimates are available on OMB's website for use in regulatory and other analyses: https://www.whitehouse.gov/omb/information-regulatory- affairs/regulatory-matters/#scghg

Table ES-2: Social Cost of CH4, 2020 – 2050 (in 2020 dollars per metric ton of CH4)

	Discount Rate and Statistic			
Emissions Year	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020	670	1500	2000	3900
2025	800	1700	2200	4500
2030	940	2000	2500	5200
2035	1100	2200	2800	6000
2040	1300	2500	3100	6700
2045	1500	2800	3500	7500
2050	1700	3100	3800	8200

Table ES-3: Social Cost of N2O, 2020 – 2050 (in 2020 dollars per metric ton of N2O)

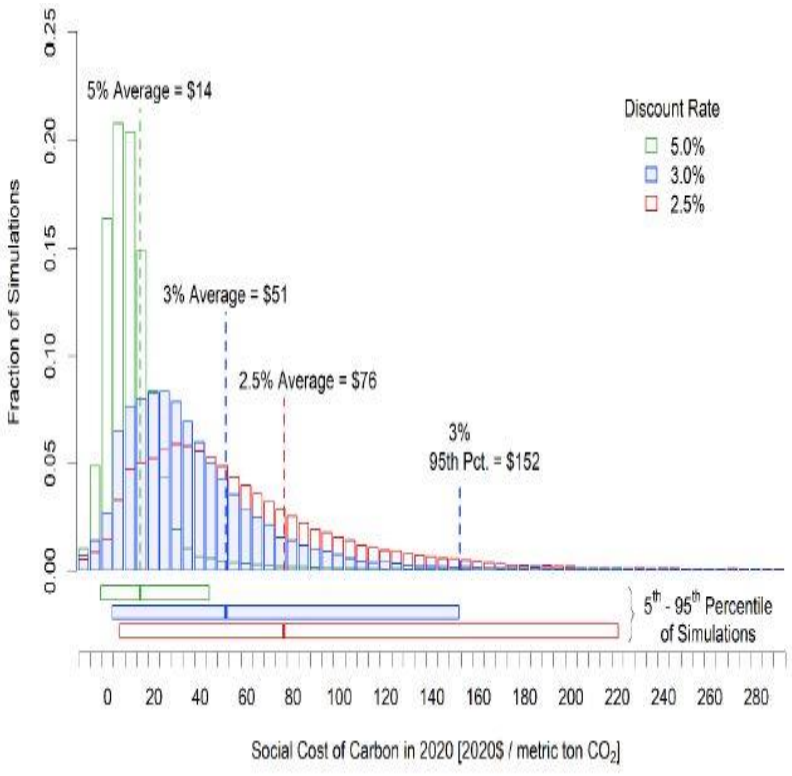
	Discount Rate and Statistic			
Emissions Year	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020	5800	18000	27000	48000
2025	6800	21000	30000	54000
2030	7800	23000	33000	60000
2035	9000	25000	36000	67000
2040	10000	28000	39000	74000
2045	12000	30000	42000	81000
2050	13000	33000	45000	88000

While point estimates are important for providing analysts with a tractable approach for regulatory analysis, they do not fully quantify uncertainty associated with the SC-GHG estimates. Figures ES-1 through ES-3 present the quantified sources of uncertainty in the form of frequency distributions for the SC-GHG estimates for emissions in 2020. The distributions of SC-GHG estimates reflect uncertainty in key model parameters chosen by the IWG such as the equilibrium climate sensitivity, as well as uncertainty in other parameters set by the original model developers. To highlight the difference between the impact of the discount rate and other quantified sources of uncertainty, the bars below the frequency distributions provide a symmetric representation of quantified variability in the SC-GHG estimates for each discount rate. There are other sources of uncertainty that have not yet been quantified and are thus not reflected in these estimates. When an agency determines that it is appropriate to conduct additional quantitative uncertainty analysis, it should follow best practices for probabilistic analysis.[4] The full set of information that underlies the frequency distributions in Figures ES-1 through ES-3 is available on OMB's website[5].

[4] See e.g. OMB's Circular A-4, section on Treatment of Uncertainty. Available at: https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A4/a-4.pdf.atory- affairs/regulatory- matters/#scghgs

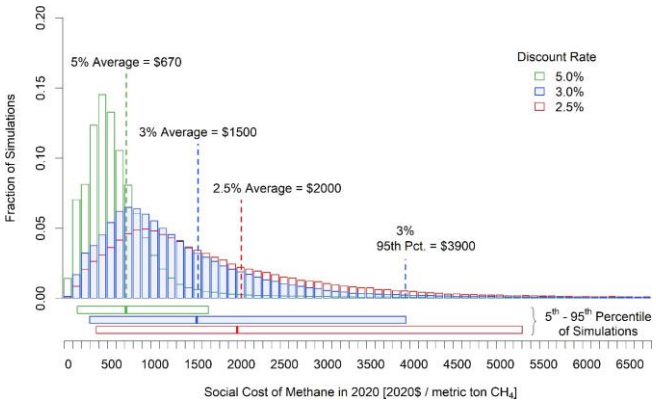
[5] Available at https://www.whitehouse.gov/omb/information-regulatory-affairs/regulatory- matters/#scghgs

Figure ES-1 Frequency Distribution of SC-CO_2 Estimates for 2020[6]

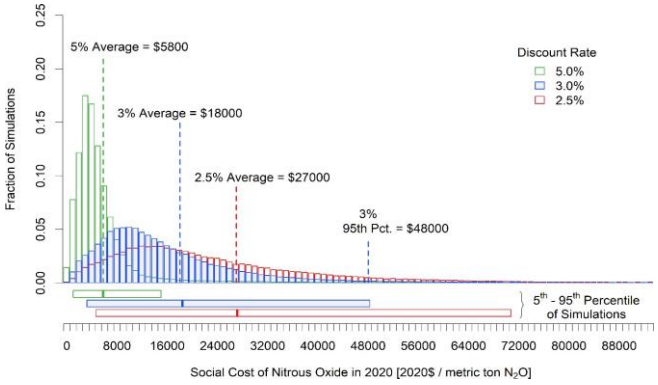


[6] Although the distributions and numbers in Figures ES-1, ES-2, and ES-3 are based on the full set of model results (150,000 estimates for each discount rate and gas), for display purposes the horizontal axis is truncated with 0.02 to 0.68 percent of the estimates falling below the lowest bin displayed and 0.12 to 3.11 percent of the estimates falling above the highest bin displayed, depending on the discount rate and GHG.

Figure ES-2: Frequency Distribution of SC-CH_4 Estimates for 2020



F igure ES-3: Frequency Distribution of SC-N_2O Estimates for 2020



1 Background

The estimates of the social cost of carbon (SC-CO2), social cost of methane (SC-CH4), and social cost of nitrous oxide (SC-N2O) presented here allow agencies to incorporate the social benefits of reducing emissions of each of these greenhouse gases, or the social costs of increasing such emissions, in decision making. Collectively, these values are referenced as the "social cost of greenhouse gases" (SC-GHG) in this document. The SC-GHG is the monetary value of the net harm to society associated with adding a small amount of that GHG to the atmosphere in a given year. In principle, it includes the value of all climate change impacts, including (but not limited to) changes in net agricultural productivity, human health effects, property damage from increased flood risk natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services. The SC-GHG, therefore, should reflect the societal value of reducing emissions of the gas in question by one ton. The marginal estimate of social costs will differ by the type of greenhouse gas (such as carbon dioxide, methane, and nitrous oxide) and by the year in which the emissions change occurs. The SC-GHGs are calculated along a baseline path and provide a measure of the marginal benefit of GHG abatement. Thus, they are the theoretically appropriate values to use when conducting benefit-cost analyses of policies that affect GHG emissions.[7]

[7]These estimates of social damages should not be confused with estimates of the costs of attaining a specific emissions or warming limit. Specifically, there is another strand of research that investigates the costs of setting a specific climate target (e.g., capping emissions or temperature increases to a certain level). If total emissions are capped, IAM models can estimate the

1.1 Overview of U.S. Government SC-GHG Estimates to Date

Estimates of the social cost of carbon and other greenhouse gases have been published in the academic literature for many years. Meta-reviews of SC-CO_2 estimates were available as early as 2002 (Clarkson and Deyes 2002). Federal agencies began regularly incorporating SC-CO_2 estimates in regulatory impact analyses in 2008, following a court ruling in which an agency was ordered to consider the SC-CO_2 in the rulemaking process. The U.S. Ninth Circuit Court of Appeals remanded a fuel economy rule to the Department of Transportation (DOT) for failing to consider the value of reducing CO_2 emissions, stating that "whole the record shows that there is a range of values, the

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costs of limiting emissions or temperature increase to that cap. Similarly, other models simulate market trading in a cap and trade system. The price of a permit to emit one ton of carbon provides a measure of the marginal cost of GHG abatement, which can be useful in evaluating policy cost-effectiveness but is not an alternative way to value damages from GHG emissions in benefit-cost analysis. Moreover, a policy that specifies an environmental target implicitly requires a valuation of damages when setting the constraint even though it is not explicitly modeled or estimated. For example, a target set to keep temperature increases below a certain threshold implicitly places value on damages incurred beyond that threshold. For more on how these concepts (e.g., a predetermined target-based approach and a damage (SC-GHG) based approach) can be used when designing climate policy see, for example, Hansel et al. (2020) and Stern and Stiglitz (2021).

8 Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin., 538 F.3d 1172, 1200 (9th Cir. 2008).

value of carbon emissions reduction is certainly not zero."[8]

In 2009, an interagency process was launched, under the leadership of the Office of Management and Budget (OMB) and the Council of Economic Advisers (CEA), that sought to harmonize a range of different SC-CO2 values being used across multiple Federal agencies. The purpose of this process was to ensure that agencies were using the best available information and to promote consistency in the way agencies quantify the benefits of reducing CO2 emissions in regulatory impact analyses. This included the establishment of an IWG which represented perspectives and technical expertise from many federal agencies and a commitment to following the peer-reviewed literature. In 2010, the IWG finalized a set of four SC-CO2 values for use in regulatory analyses and presented them in a TSD that also provided guidance for agencies on using the estimates (IWG 2010). Three of these values were based on the average SC-CO2 from three widely cited integrated assessment models (IAMs) in the peer-reviewed literature – DICE, PAGE, and FUND[9] – at discount rates of 2.5, 3,

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[8] *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1200 (9th Cir. 2008).

[9] The DICE (Dynamic Integrated Climate and Economy) model by William Nordhaus evolved from a series of energy models and was first presented in 1990 (Nordhaus and Boyer 2000, Nordhaus 2008). The PAGE (Policy Analysis of the Greenhouse Effect) model was developed by Chris Hope in 1991 for use by European decision-makers in assessing the marginal impact of carbon emissions (Hope 2006, Hope 2008). The FUND (Climate Framework for Uncertainty, Negotiation, and Distribution) model, developed by Richard Tol in the early 1990s, originally to study international capital transfers in climate policy was widely used to study climate impacts (e.g., Tol 2002a, Tol 2002b, Anthoff et al. 2009, Tol 2009).

and 5 percent. The fourth value was included to represent higher-than-expected economic impacts from climate change further out in the tails of the SC-CO2 distribution. For this purpose, it used the SC-CO2 value for the 95th percentile at a 3 percent discount rate.

In May of 2013, the IWG provided an update of the SC-CO2 estimates to incorporate new versions of the IAMs used in the peer-reviewed literature (IWG 2013). The 2013 update did not revisit other IWG modeling decisions (i.e., the discount rates or harmonized inputs for socioeconomic and emission scenarios and equilibrium climate sensitivity). Improvements in the way damages are modeled were confined to those that had been incorporated into the latest versions of the models by the developers themselves in the peer-reviewed literature.[10] In August of 2016, the IWG published estimates of the social cost of methane (SC-CH4) and nitrous oxide (SC-N2O) that are consistent with the methodology underlying the SC-CO2 estimates (IWG 2016a, 2016b).

Over the course of developing and updating the USG SC-GHG, through both the IWG and individual agencies, there were extensive opportunities for public input on the estimates and underlying methodologies. There was a public comment process associated with each proposed rulemaking that used the estimates, and OMB initiated a separate comment process on the IWG TSD in 2013. Commenters offered a wide range of perspectives on all

[10]The IWG subsequently provided additional minor technical revisions in November of 2013 and July of 2015, as explained in Appendix B of the 2016 TSD (IWG 2016a).

aspects of process, methodology, and final estimates and diverse suggestions for improvements. The U.S. Government Accountability Office (GAO) also reviewed the development of the USG SC-CO_2 estimates and concluded that the IWG processes and methods reflected three principles: consensus-based decision making, reliance on existing academic literature and models, and disclosure of limitations and incorporation of new information (U.S. GAO 2014).

In 2015, as part of the IWG response to the public comments received in the 2013 solicitation, the IWG announced a National Academies of Sciences, Engineering, and Medicine review of the IWG estimates (IWG 2015). Specifically, the IWG asked the National Academies to conduct a multi-discipline, two-phase assessment of the IWG estimates and to offer advice on how to approach future updates to ensure that the estimates continue to reflect the best available science and methodologies. The National Academies' interim (Phase 1) report (National Academies 2016a) recommended against a near term update of the SC- CO_2 estimates within the existing modeling framework. For future revisions, the National Academies recommended the IWG move efforts towards a broader update of the climate system module consistent with the most recent, best available science and offered recommendations for how to enhance the discussion and presentation of uncertainty in the SC-CO_2 estimates. In addition to publishing estimates of SC-CH_4 and SC-N_2O, the IWG's 2016 TSD revision responded to the National Academies' Phase 1 report recommendations regarding presentation of uncertainty. The revisions included: an expanded presentation of the SC-GHG estimates that

highlights a symmetric range of uncertainty around estimates for each discount rate; new sections that provide a unified discussion of the methodology used to incorporate sources of uncertainty; detailed explanation of the uncertain parameters in both the FUND and PAGE models; and making the full set of SC-CO2 estimates easily accessible to the public on OMB's website.

In January 2017, the National Academies released their final report, *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide*, and recommended specific criteria for future updates to the SC-CO2 estimates, a modeling framework to satisfy the specified criteria, and both near-term updates and longer-term research needs pertaining to various components of the estimation process (National Academies 2017). A description of the National Academies' recommendations for near-term updates are described in Section 1.2 of this document. Shortly thereafter, in March 2017, President Trump issued Executive Order (E.O.) 13783 which called for the rescission and review of several climate-related Presidential and regulatory actions as well as for a review of the SC-GHG estimates used for regulatory impact analysis. E.O. 13783 disbanded the IWG, withdrew the previous TSDs, and directed agencies to ensure SC-GHG estimates used in regulatory analyses are consistent with the guidance contained in OMB's Circular A-4, "including with respect to the consideration of domestic versus international impacts and the consideration of appropriate discount rates" (E.O. 13783, Section 5(c)). Benefit-cost analyses following E.O. 13783 used SC-GHG estimates that attempted to focus on the domestic impacts of climate change as estimated by the models to occur within U.S.

borders and were calculated using two discount rates recommended by OMB's Circular A-4, 3 percent and 7 percent.[11] All other methodological decisions and model versions used in SC-GHG calculations remained the same as those used by the IWG in 2010 and 2013, respectively.

On January 20, 2021, President Biden issued E.O. 13990, which re-established the IWG and directed it to ensure that USG SC-GHG estimates reflect the best available science and the recommendations of the National Academies (2017). The IWG was tasked with first reviewing the SC-GHG estimates currently used by the USG and publishing interim estimates within 30 days of the E.O. that reflect the full impact of GHG emissions, including by taking global damages into account. The E.O. instructs the IWG to develop final SC-GHG estimates by January 2022. Section 1.3 describes requirements established by E.O. 13990 in greater detail. In addition, the E.O. instructs the IWG to provide recommendations to the President by September 2021, regarding areas of decision-making, budgeting, and procurement by the Federal Government where the SC-GHG should be applied. The SC-GHG has been used previously in non- regulatory Federal analysis, such as in federal procurement,[12] grant programs,[13] and National

[11] OMB Circular A-4 (2003) indicates that sensitivity analysis using lower discount rates than 3 percent and 7 percent may be appropriate where intergenerational effects are important. See Section 3 for further discussion.

[12] For example, SC-CO2 estimates have been used in Domestic Delivery Services contracts for USG parcel shipping (https://westcoastclimateforum.com/sites/westcoastclimateforum/files/related_documents/FedGSA_DDS3_green_features_fact_sheet.pdf).

[13] For example, in 2016 DOT's Transportation Investment Generating Economic Recovery (TIGER) discretionary grant program required a demonstration that benefits justify costs for proposed projects, and the

Environmental Policy Act (NEPA) analysis,[14] as well as in state level applications; the latter is discussed further in Section 5.

1.2 Recommendations from the National Academies of Sciences, Engineering, and Medicine

In 2015, the IWG requested that the National Academies of Sciences, Engineering, and Medicine review and recommend potential approaches for improving its SC-CO2 estimation methodology. In response, the National Academies convened a multidisciplinary committee, the Committee on Assessing Approaches to Updating the Social Cost of Carbon. In addition to evaluating the IWG's overall approach to SC-CO2 estimation, the committee reviewed its choices of IAMs and damage functions, climate science assumptions, future baseline socioeconomic and emission projections, presentation of uncertainty, and discount rates.

In its final report (National Academies 2017), the National Academies committee recommended that the IWG pursue an integrated modular approach to the key components of SC-CO2 estimation to allow for independent updating and review and to draw more readily on expertise from the wide range of scientific disciplines relevant to SC-CO2 estimation. Under this approach, each step in SC-CO2

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guidance DOT provides to applicants for how to conduct such an analysis specified that they should use the USG SC-CO2 estimates https://www.transportation.gov/sites/dot.gov/files/docs/BCARG2016March.pdf).

[14] See Howard and Schwartz (2019) for examples of the use of SC-CO2 estimates in NEPA analyses.

estimation is developed as a module—socioeconomic projections, climate science, economic damages, and discounting—that reflects the state of scientific knowledge in the current, peer-reviewed literature. In the longer-term, it recommended that the IWG also fund research on ways to better capture interactions and feedbacks between these components. In addition, the committee noted that, while the IWG harmonized assumptions across the IAMs for socioeconomic and emission projections, climate sensitivity, and discount rates when estimating the SC-CO2, using a single climate module in the nearer-term (2-3 years) and eventually transitioning to a single IAM framework will enhance transparency, improve consistency with the underlying science, and allow for more explicit representation of uncertainty. It recommended these three criteria also be used to judge the value of other updates to the methodology. In addition, it recommended that the IWG update SC-CO2 estimates at regular intervals, suggesting a five-year cycle.

Regarding the key components of the SC-CO2, the committee recommended the following improvements in the nearer-term:

- Socioeconomic and emissions projections: Use accepted statistical methods and elicit expert judgment to project probability distributions of future annual growth rates of per-capita GDP and population, bearing in mind potential correlation between economic and population projections. Then using expert elicitation, guided by information on historical trends and emissions consistent with different climate outcomes, project emissions for each forcing agent of interest conditional on population and income scenarios.

Additional recommendations were offered for improving the socioeconomic module centered on four broad criteria: time horizon, future policies, disaggregation, and feedbacks.

- Climate science: Adopt or develop a simple Earth system model (such as the Finite Amplitude Impulse Response (FaIR) model) to capture relationships between CO2 emissions, atmospheric CO2 concentrations, and global mean surface temperature change over time while accounting for non-CO2 forcing and allowing for the evaluation of uncertainty. It also recommended the IWG adopt or develop a sea level rise component in the climate module that: (1) accounts for uncertainty in the translation of global mean temperature to global mean sea level rise and (2) is consistent with sea level rise projections available in the literature for similar forcing and temperature pathways. It also noted the importance of generating spatially and temporally disaggregated climate information as inputs into damage estimation. It recommended the use of linear pattern scaling (which estimates linear relationships between global mean temperature and local climate variables) to achieve this goal in the near-term.
- Economic damages: Improve and update existing formulations of individual sectoral damage functions when feasible; characterize damage function calibrations quantitatively and transparently; present spatially disaggregated damage projections and discuss how they scale with temperature, income, and population; and recognize any correlations between formulations when multiple damage functions are used.
- Discounting: Account for the relationship between economic growth and discounting; explicitly recognize

uncertainty surrounding discount rates over long time horizons using a Ramsey-like approach; select parameters to implement this approach that are consistent with theory and evidence to produce certainty-equivalent discount rates consistent with near-term consumption rates of interest; use three sets of Ramsey parameters to generate a low, central, and high certainty-equivalent near-term discount rate, and three means and ranges of SC-CO2 estimates; discuss how the SC-CO2 estimates should be combined with other cost and benefit estimates that may use different discount rates in regulatory analysis.

Additional details on each of these recommendations as well as longer term research needs are provided in the National Academies' final report (National Academies 2017).

1.3 Executive Order 13990

On January 20, 2021, President Biden issued E.O. 13990, "Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis." Echoing one of the general principles of E.O. 12866 that an Agency "shall base its decisions on the best reasonably obtainable scientific, technical, economic, and other information", E.O. 13990 states that it is essential for Agencies to account for the benefits of reducing GHG emissions as accurately as possible. It emphasizes that a full global accounting of the costs of GHG emissions "facilitates sound decision-making, recognizes the breadth of climate impacts, and supports the international leadership of the United States on climate issues" (E.O. 13990 2021). Specifically, E.O. 13990 reinstates the IWG as the Interagency Working

Group on the Social Cost of Greenhouse Gases, names the Chair of the CEA, Director of OMB, and Director of the Office of Science and Technology Policy (OSTP) as co-chairs of the IWG, and specifies the membership of the IWG to include the following officials, or their designees: the Secretary of the Treasury; the Secretary of the Interior; the Secretary of Agriculture; the Secretary of Commerce; the Secretary of Health and Human Services; the Secretary of Transportation; the Secretary of Energy; the Chair of the Council on Environmental Quality; the Administrator of the Environmental Protection Agency; the Assistant to the President and National Climate Advisor; and the Assistant to the President for Economic Policy and Director of the National Economic Council.

E.O. 13990 tasks the reinstated IWG with the following:

(1) publish an interim update to the SC-GHG (SC-CO2, SC-CH4, and SC-N2O) estimates by February 19, 2021, for agencies to use when monetizing the value of changes in greenhouse gas emissions resulting from regulations and other relevant agency actions until final values are published;

(2) publish a final update to the SC-GHG estimates by no later than January 2022;

(3) provide recommendations, by no later than September 1, 2021, regarding areas of decision- making, budgeting, and procurement by the Federal Government where the SC-GHG estimates should be applied;

(4) provide recommendations, by no later than June 1, 2022, regarding a process for reviewing and, as appropriate, updating the SC-GHG estimates to ensure that these estimates are based on the best available economics and

science; and

(4) provide recommendations, to be published with the interim SC-GHG estimates if feasible and by no later than June 1, 2022, to revise methodologies for SC-GHG calculations to the extent that current methodologies do not adequately take account of climate risk, environmental justice, and intergenerational equity.

Finally, the E.O. specifies that in carrying out its activities, the IWG shall consider the recommendations of the National Academies (2017) and other pertinent scientific literature; solicit public comment; engage with the public and stakeholders; seek the advice of ethics experts; and ensure that the SC-GHG estimates reflect the interests of future generations in avoiding threats posed by climate change.

This TSD presents the interim SC-GHG estimates called for in the first of these tasks. It also provides preliminary discussion of how at least one component of SC-GHG estimation, discounting, warrants reconsideration in the more comprehensive update by January 2022 to reflect the advice of the National Academies (2017) and other recent scientific literature.

2 The Importance of Accounting for Global Damages

Benefit-cost analyses of U.S. Federal regulations have traditionally focused on the benefits and costs that accrue to individuals that reside within the country's national boundaries. This is a natural result of the fact that most regulations have a limited impact on individuals residing outside of the United States and do not reflect any other scientific, legal, or other rationale. According to OMB's

Circular A-4 (2003), an "analysis should focus on benefits and costs that accrue to citizens and residents of the United States."[15] While Circular A-4 does not elaborate, this guidance towards a focus on U.S. populations in domestic policy analysis is broadly consistent with the fact that the authority to regulate only extends to a nation's own residents who have consented to adhere to the same set of rules and values for collective decision- making (EPA 2010; Kopp et al. 1997; Whittington and MacRae 1986). However, guidance towards a focus on impacts to U.S. citizens and residents is different than recommending that analysis be limited to the impacts that occur within the borders of the U.S. Furthermore, OMB Circular A-4 states that when a regulation is likely to have international effects that "these effects should be reported" though the guidance recommends this be done separately. There are many reasons, as summarized in this TSD, why it is appropriate for agencies to use the global value of damages in making decisions that affect, or may be affected by, GHG emissions. Courts have upheld the use of global damages in estimating the social cost of GHGs, in part in recognition of the diverse ways in which U.S. interests, businesses, and residents may be impacted by climate change beyond U.S. borders.[16]

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[15] OMB's Circular A-4 provides guidance to Federal agencies on the development of regulatory analysis conducted pursuant to Executive Order 12866.

[16] *Zero Zone, Inc. v. Dep't of Energy*, 832 F.3d 654, 678-79 (7th Cir. 2016) (rejecting a petitioner's challenge to DOE's use of a global (rather than domestic) social cost of carbon in setting an efficiency standard under the Energy Policy and Conservation Act, holding that DOE had reasonably identified carbon pollution as "a global externality" and concluding that, because "national energy conservation has global effects, ...those global effects are an appropriate consideration when looking at national policy.

Unlike many environmental problems where the causes and impacts are distributed more locally, climate change is a true global challenge making GHG emissions a global externality. GHG emissions contribute to damages around the world regardless of where they are emitted. The global nature of GHGs means that U.S. interests, and therefore the benefits to the U.S. population of GHG mitigation, cannot be defined solely by the climate impacts that occur within U.S. borders. Impacts that occur outside U.S. borders as a result of U.S. actions can directly and indirectly affect the welfare of U.S. citizens and residents through a multitude of pathways. Over 9 million U.S. citizens lived abroad as of 2016[17] and U.S. direct investment positions abroad totaled nearly $6 trillion in 2019.[18] Climate impacts occurring outside of U.S. borders will have a direct impact on these U.S. citizens and the investment returns on those assets owned by U.S. citizens and residents. The U.S. economy is also inextricably linked to the rest of the world. The U.S. exports over $2 trillion worth of goods and services a year and imports around $3 trillion.[19] Climate impacts that occur outside U.S. borders can thus impact the welfare of individuals and firms that reside in the United States through their effect on international markets, trade, tourism, and other activities. Furthermore, additional spillovers can occur through pathways such as economic and political destabilization and global migration that can lead to adverse impacts on U.S. national security, public

[17] U.S. Department of State's Bureau of Consular Affairs.

[18] BEA Direct Investment by Country and Industry 2019, https://www.bea.gov/data/intl-trade-investment/directinvestment-country-and-industry

[19] BEA National Income and Product Accounts Table 1.1.5.

health, and humanitarian concerns (DoD 2014, CCS 2018). As described by the National Academies (2017), to correctly assess the total damages to U.S. citizens and residents, one must account for these spillover effects on the United States.

As an empirical matter, the development of a domestic SC-GHG is greatly complicated by the relatively few region- or country-specific estimates of the SC-CO_2 in the literature. At present, the only quantitative characterization of domestic damages from GHG emissions, as represented by the domestic SC-GHG, is based on the share of damages arising from climate impacts occurring within U.S. borders as represented in current IAMs. This is both incomplete and an underestimate of the share of total damages that accrue to the citizens and residents of the U.S. because these models do not capture the regional interactions and spillovers discussed above. A 2020 U.S. GAO study observed that "[a]ccording to the National Academies, the integrated assessment models were not premised or calibrated to provide estimates of the social cost of carbon based on domestic damages, and more research would be required to update the models to do so. The National Academies stated it is important to consider what constitutes a domestic impact in the case of a global pollutant that could have international implications that affect the United States" (U.S. GAO 2020).

The global nature of GHGs means that damages caused by a ton of emissions in the U.S. are felt globally and that a ton emitted in any other country harms those in the U.S. Therefore, assessing the benefits of U.S. GHG mitigation activities will require consideration of how those actions

may affect mitigation activities by other countries since those international actions will provide a benefit to U.S. citizens and residents. A wide range of scientific and economic experts have emphasized the issue of reciprocity as support for considering global damages of GHG emissions (e.g., Kopp and Mignone 2013, Pizer et al. 2014, Howard and Schwartz 2019, Pindyck 2017, Revesz et al. 2017, Carleton and Greenstone 2021). Carleton and Greenstone (2021) discuss examples of how historic use of a global SC-CO2 may have plausibly contributed to additional international action. Houser and Larson (2021) estimate that under the Paris Agreement, other countries pledged to reduce 6.1 to 6.8 tons for every ton pledged by the U.S. Kotchen (2018) offers a theoretical perspective showing that non-Nash game theoretic behavior can lead countries to optimally chose a social cost of carbon higher than their domestic value to encourage additional reductions from other countries. Using a global estimate of damages in U.S. analyses of regulatory and other actions allows the U.S. to continue to actively encourage other nations, including emerging major economies, to take significant steps to reduce emissions.

The IWG found previously and is restating here that because of the distinctive global nature of climate change that analysis of Federal regulatory and other actions should center on a global measure of SC- GHG. This approach is the same as that taken in regulatory analyses over 2009 through 2016. In the 2015 response to comments, the IWG noted that the only way to achieve an efficient allocation of resources for emissions reduction on a global basis is for all countries to base their policies on global estimates of

damages (IWG 2015). Therefore, the IWG continues to recommend the use of global SC-GHG estimates in analysis of Federal regulatory and other actions. The IWG also continues to review developments in the literature, including more robust methodologies for estimating SC-GHG values based on purely domestic damages, and explore ways to better inform the public of the full range of carbon impacts, both global and domestic.

3 Discounting in Intergenerational Analyses

GHG emissions are stock pollutants, where damages are associated with what has accumulated in the atmosphere over time, and they are long lived such that subsequent damages resulting from emissions today occur over many decades or centuries depending on the specific greenhouse gas under consideration.[20] In calculating the SC-GHG, the stream of future damages to agriculture, human health, and other market and non-market sectors from an additional unit of emissions are estimated in terms of reduced consumption (or consumption equivalents). Then that stream of future damages is discounted to its present value in the year when the additional unit of emissions was released. Given the long time horizon over which the damages are expected to occur, the discount rate has a large influence on the present value of future damages. However, the choice of a discount rate also raises highly contested

[20] "GHGs, for example, CO2, methane, and nitrous oxide, are chemically stable and persist in the atmosphere over time scales of a decade to centuries or longer, so that their emission has a long-term influence on climate. Because these gases are long lived, they become well mixed throughout the atmosphere" (IPCC 2007).

and exceedingly difficult questions of science, economics, ethics, and law.

In 2010, in light of disagreements in the literature on the appropriate discount rate to use in this context, and uncertainty about how rates may change over time, the IWG elected to use three discount rates to span a plausible range of certainty-equivalent constant consumption discount rates: 2.5, 3, and 5 percent per year. The IWG at that time determined that these three rates reflected reasonable judgments under both descriptive and prescriptive approaches to selecting the discount rate.

The 3 percent value was included as consistent with estimates provided in OMB's Circular A-4 (OMB 2003) guidance for the consumption rate of interest. The IWG found that the consumption rate of interest is the correct discounting concept to use when future damages from elevated temperatures are estimated in consumption-equivalent units as is done in the IAMs used to estimate the SC-GHG (National Academies 2017). The upper value of 5 percent was included to represent the possibility that climate-related damages are positively correlated with market returns, which would imply a certainty equivalent value higher than the consumption rate of interest. The low value, 2.5 percent, was included to incorporate the concern that interest rates are highly uncertain over time. It represents the average certainty-equivalent rate using the mean-reverting and random walk approaches from Newell and Pizer (2003) starting at a discount rate of 3 percent. Using this approach, the certainty equivalent is about 2.2 percent using the random walk model and 2.8 percent using the mean reverting approach. Without giving preference to a particular model, the average of the two rates is 2.5 percent. Additionally, a rate below the consumption rate of interest

would also be justified if the return to investments in climate mitigation are negatively correlated with the overall market rate of return. Use of this lower value was also deemed responsive to certain judgments based on the prescriptive or normative approach for selecting a discount rate and to related ethical objections that have been raised about rates of 3 percent or higher. Further details about the process for selecting these rates is presented in the 2010 TSD (IWG 2010). Finally, it is important to note that, while the consumption discount rate is the conceptually correct rate for discounting the SC- GHG, and the three rates originally selected were based on this concept, the latest data as well as recent discussion in the economics literature indicates that the 3 percent discount rate used by the IWG to develop its range of discount rates is likely an overestimate of the appropriate discount rate and warrants reconsideration in future updates of the SC-GHG.

This section discusses three issues related to the selected discount rates: (1) why the social rate of return to capital, estimated to be 7 percent in OMB's Circular A-4, is not appropriate for use in calculating the SC-GHG, (2) new evidence on the consumption rate of interest, which may inform the future updates to the SC-GHG, and (3) analytic consistency across discounting within an analysis.

3.1 Social Rate of Return on Capital and Intergenerational Analyses

When analyzing policies and programs that result in GHG emission reductions, it is important to account for the difference between the social and private rate of return on any capital investment affected by the action. Society is not

indifferent between a regulation that displaces consumption versus investment in equal amounts. Market distortions, in large part taxes on capital income, cause private returns on capital investments to be different from the social returns. In well-functioning capital markets, arbitrage opportunities will be dissipated, and the cost of investments will equal the present value of future private returns on those investments. Therefore, an individual forgoing consumption or investment of equal amounts as the result of a regulation will face an equal private burden. However, because the social rate of return on the investment is greater than the private rate of return, the overall social burden will be greater in the case where investment is displaced.

OMB's Circular A-4 points out that "the analytically preferred method of handling temporal differences between benefits and costs is to adjust all the benefits and costs to reflect their value in equivalent units of consumption and to discount them at the rate consumers and savers would normally use in discounting future consumption benefits" (OMB 2003). The damage estimates developed for use in the SC-GHG are estimated in consumption-equivalent terms. An application of OMB Circular A-4's guidance for regulatory analysis would then use the consumption discount rate to calculate the SC-GHG, while also developing a more complete estimate of social cost to account for the difference in private and social rates of return on capital for any investment displaced as a result of the regulation. This more complete estimate of social costs can be developed using either the shadow price of capital approach or by estimating costs in a general equilibrium framework, for example by using a computable general equilibrium model. In both cases, displaced investment

would be converted into a flow of consumption equivalents.

In cases where the costs are not adjusted to be in consumption-equivalent terms, OMB's Circular A-4 recommends that analysts provide a range of estimates for net benefits based on two approaches. The first approach is based on using the consumption rate of interest to discount all costs and benefits. This approach is consistent with the case where costs are primarily borne as reduced consumption. The second approach, the social opportunity cost of capital (SOC) approach, focuses on the case where the main effect of a regulation is to displace or alter the use of capital in the private sector (OMB 2003). When interpreting the SOC approach from the point of view of whether to invest in a single government project, it is asking whether the benefits from the project would at least match the returns from investing the same resources in the private sector. Interpreting the approach from the standpoint of a benefit-cost analysis of regulation, the approach focuses on adjusting estimates of benefits downward by discounting at a higher rate to offset additional social costs not reflected in the private value of displaced investment.

Harberger (1972) derived a more general version of the social opportunity cost of capital approach, recognizing that policies will most likely displace a mix of consumption and investment and therefore a blended discount rate would be needed to adjust the benefits to account for the omitted costs. In his partial equilibrium approach, the blended discount rate is a weighted average of the consumption interest rate and social rate of return on capital, where the weights are the share of a policy's costs borne by consumption versus investment. This general result has been extended to the general equilibrium context by

Sandmo and Drèze (1971) and Drèze (1974) and can be extended to account for changes in foreign direct investment (CEA 2017). This highlights that using the social rate of return for benefits and costs is at best creating a lower bound on the estimate of net benefits that would only be met in an extreme case where regulatory costs fully displace investment. If the beneficial impacts of the regulation induce private investment whose social returns have not been quantified and fully converted to consumption equivalents, then the net benefits calculated using the social rate of return on capital is not even a lower bound.[21] Li and Pizer (2021) further generalize the SOC framework and demonstrate that temporal pattern of benefits is important and that when benefits occur far in the future discounting using the social rate of return on capital again is not even a lower bound on net benefits.

For regulations whose benefits and costs occur over a relatively short time frame, the range of net benefits computed using the two discounting approaches will be relatively narrow. Therefore, there is less risk in maintaining an uninformed prior over the share of regulatory costs that will displace investment and using the potential bounding cases for net benefits. However, for cases where the costs are borne early in the time horizon

[21]The SOC approach as outlined on OMB's Circular A-4 is most applicable to cases where the benefits are represented as consumption equivalents and costs may not be. If the benefits of the policy include the inducement of new private investment, discounting both benefits and costs at the social rate of return for capital is no longer appropriate. The results of Bradford (1975) show that in a case where regulatory costs are primarily borne through reduced consumption and the beneficial impacts of the policy may induce private investment the appropriate rate under the SOC approach could be below the consumption interest rate.

and benefits occur for decades or even centuries, such as with GHG mitigation, the two estimates of net benefits will differ significantly. In this case, the risk to society of maintaining an uninformed prior over the share of regulatory costs borne by investment is significantly higher. In turn, the preferred approach is to discount benefits using the consumption rate of interest and strive to provide a more complete measure of costs, accounting for displacement of investment whose social rate of return exceeds the private rate of return, either by using a shadow price of capital approach or a general equilibrium framework, like a computable general equilibrium model.

It is important to note that even if an appropriately specified blended SOC rate could be calculated based on the share of regulatory costs that are expected to displace investment that would not obviate the need to carefully consider issues of uncertainty and ethics when discounting in an intergenerational context, pointing to a lower rate.

For these reasons, the IWG is returning to the approach of calculating the SC-GHG based on the consumption rate of interest, consistent with the findings of the National Academies (2017) [22]

3.2 New Evidence on the Consumption Discount Rate

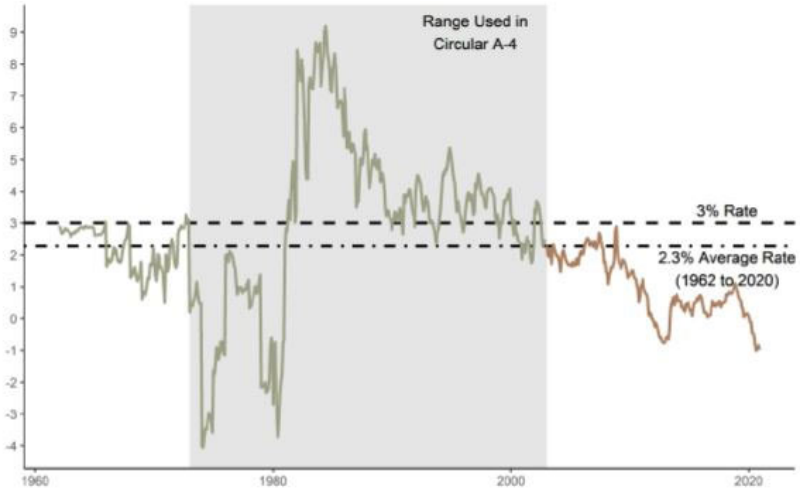
The three discount rates selected by the IWG in 2010 are centered around the 3 percent estimate of the consumption interest rate published in OMB's Circular A-4 in 2003. That

[22] NAS (2017) stated "The estimates that result from the SC-IAMs are measured in consumption- equivalent units: thus, a discount rate that reflects how individuals trade off current and future consumption is defensible in this setting" (p. 236-7).

guidance was based on the real rate of return on 10-year Treasury Securities from the prior 30 years (1973 through 2002), which averaged 3.1 percent. Over the past four decades there has been a substantial and persistent decline in real interest rates (see Figure 1). Recent research has found that this decline has been driven by decreases in the equilibrium real interest rate (Bauer and Rudebusch 2020).

Re-estimating the consumption rate of interest following the same approach applied in Circular A-4, including using data from the most recent 30 years, yields a substantially lower result. The average rate of return on inflation adjusted 10-year Treasury Securities over the last 30 years (1991-2020) is 2.0 percent. These rates are not without historic precedent, such that over the last 60 years the inflation adjusted 10-year Treasury Securities is 2.3 percent. Current real rates of returns below 2 percent are expected to persist. The U.S. Congressional Budget Office (CBO) in its September 2020 Long Term Budget Outlook forecasts real rates of return on 10-Year Treasury Securities to average 1.2 percent over the next 30 years (U.S. CBO 2020). This new information suggests that the consumption rate of interest is notably lower than 3 percent. CEA (2017) examined additional forecasts of 10-Year Treasury Securities and data on futures contracts, reaching the conclusion that the appropriate consumption discount rate should be at most 2 percent.

Figure 1: Monthly 10-Year Treasury Security Rates, Inflation-Adjusted[23]



Several surveys have been conducted in recent years to elicit experts' views on the appropriate discount rates to use in an intergenerational context (e.g., Drupp et al. 2018; Howard and Sylvan 2020). For example, Drupp et al.

[23] Monthly 10-Year Treasury Security returns, adjusted for inflation. Real interest rates prior to 2003 (green line) are calculated by subtracting the annual rate of inflation as measured by the CPI-U from the nominal rate of return on 10-Year constant maturity Treasury Securities. Interest rates from 2003 onwards (brown line) are based on the 10-Year Treasury Inflation-Protected Securities.

(2018) offers confirming evidence that the economics profession generally agrees that the appropriate social discount rate is below 3 percent as reflected in the recent trends in data. They surveyed over 200 experts and found a "surprising degree of consensus among experts, with more than three-quarters finding the median risk-free social discount rate of 2 percent acceptable" (Drupp et al. 2018).[24]

It is important to note that the new information pointing to a lower consumption rate of interest, lower than 3 percent, does not obviate the need to carefully consider issues of uncertainty and ethics when discounting in an intergenerational context.[25] If 2 percent was used as the consumption interest rate and adjusted for uncertainty using the results of Newell and Pizer (2003) as was done in the 2010 TSD, the process would yield a discount rate lower than 2 percent. Therefore, a consideration of discount rates below 3 percent, including 2 percent and lower, are warranted when discounting intergenerational impacts.

This is consistent with the 2003 recommendation in OMB's Circular A-4 that noted "[a]lthough most people demonstrate time preference in their own consumption behavior, it may not be appropriate for society to demonstrate a similar preference when deciding between the well-being of current and future generations" and found that certainty equivalent discount rates as low as 1 percent

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[24] For a detailed explanation of discounting concepts and terminology see EPA's *Guidelines for Preparing Economic Analysis* (2010). https://www.epa.gov/environmental-economics/guidelines-preparing-economic-analyses

[25] For a more detailed explanation of ethical and uncertainty considerations around discounting see National Academies (2017) and the 2010 TSD (IWG 2010).

could be appropriate for intergenerational problems (OMB 2003). Similarly, if implementing a declining discount rate schedule to account for uncertainty (see next section), an updated consumption rate of interest, based on additional data presented above, may be a starting point for an update.

In light of the evidence and discussion on discount rates presented in this TSD and elsewhere, the recommendation from OMB's Circular A-4 to include further sensitivity analysis with lower discount rates when a rule has important intergenerational benefits or costs, and the direction to the IWG in E.O. 13990 to ensure that the SC-GHG reflect the interest of future generations, the IWG finds it appropriate as an interim recommendation that agencies may consider conducting additional sensitivity analysis using discount rates below 2.5%.

3.3 Analytic Consistency and Declining Discount Rates

While the consumption rate of interest is an important driver of the benefits estimate, it is uncertain over time, as may be observed in Figure 1. Weitzman (1998, 2001) showed theoretically and Newell and Pizer (2003) and Groom et al. (2005) confirmed empirically that discount rate uncertainty can have a large effect on net present values. A main result from these studies is that if there is a persistent element to the uncertainty in the discount rate (e.g., the rate follows a random walk), then it will result in an effective (or certainty-equivalent) discount rate that declines over time. This is because lower discount rates tend to dominate over the very long term (see Weitzman 1998, 1999, 2001; Newell and Pizer 2003; Groom et al.

2005; Gollier 2009; Summers and Zeckhauser 2008; Gollier and Weitzman 2010; Arrow et al. 2013; Cropper et al. 2014; and Arrow et al. 2014).

The proper way to specify a declining discount rate schedule remains an active area of research. One approach is to develop a stochastic model of interest rates that is empirically estimated and used to calculate the certainty equivalent declining discount rate schedule (e.g., Newell and Pizer 2003; Groom et al. 2007). An alternative approach is to use the Ramsey equation based on a forecast of consumption growth rates that accounts for uncertainty (e.g., Cropper et al. 2014; Arrow et al. 2013). If the shocks to consumption growth are positively correlated over time then the result of the Ramsey equation will be a certainty-equivalent discount rate schedule that declines over time (Goiller 2014). Others have argued for a less structural approach to specify a declining discount rate schedule (e.g., Weitzman 2001, the United Kingdom's "Green Book" for regulatory analysis (HM Treasury 2020), the declining discount schedule in France (Lebègue 2005) and varying the discount rate based on the time period in Germany (Schwermer 2012, U.S. GAO 2020)). This approach uses a higher discount rate initially, like the current estimate of the consumption interest rate, but applies a graduated scale of lower discount rates further out in time.[26]

Instead of explicitly specifying a declining discount rate schedule, the IWG in 2010 elected to use a constant but

[26] For instance, the United Kingdom applies a discount rate of 3.5 percent to the first 30 years; 3 percent for years 31 - 75; 2.5 percent for years 76 - 125; 2 percent for years 126 - 200; 1.5 percent for years 201 - 300; and 1 percent after 300 years. As a sensitivity, it recommends a discount rate of 3 percent for the first 30 years, also decreasing over time.

lower discount rate to capture the directional effect of the literature on discounting under uncertainty. Specifically, the IWG considered two declining discount rate schedules based on the mean- reverting and random walk models from Newell and Pizer (2003) starting at a discount rate of 3 percent. The 2.5 percent discount rate selected by the IWG in 2010 reflected the midpoint between the average certainty equivalent discount rates of both models. The approach of using a lower, but constant, discount rate to capture the effect of uncertainty has led to inconsistency in regulatory analyses, where impacts occurring in a given year are discounted at different rates depending on whether they are related to climate change (Arrow et al. 2014). The National Academies (2017) and EPA's Science Advisory Board (2021) have recommended that the U.S. Government establish an explicit declining discount rate schedule that is applied to all regulatory impacts in an analysis to capture the effect of uncertainty on long-term discount rates, while also maintaining consistency across impact categories in the analysis. The IWG will consider the literature on declining discount rates and the recommendations of the National Academies (2017) and EPA's Science Advisory Board (2021) as it develops future updates to the SC-GHG. In the interim, the IWG is returning to the use of the 2.5, 3, and 5 percent discount rates in calculating the SC- GHG but recommends that agencies describe potential limitations in their analyses to ensure transparency. As noted above, agencies may also consider discount rates below 2.5 percent as part of a sensitivity analysis.

4 Interim Estimates of SC-CO_2, SC-CH_4, SC-N_2O

The interim SC-GHG estimates presented in this TSD rely on the same models and harmonized inputs for the socioeconomic emissions scenarios and equilibrium climate sensitivity distribution used for USG SC- GHG estimates since 2013. Specifically, the SC-GHG estimates rely on an ensemble of three IAMs: Dynamic Integrated Climate and Economy (DICE) 2010 (Nordhaus 2010); Climate Framework for Uncertainty, Negotiation, and Distribution (FUND) 3.8 (Anthoff and Tol 2013a, 2013b); and Policy Analysis of the Greenhouse Gas Effect (PAGE) 2009 (Hope 2013). IAMs are useful because they combine climate processes, economic growth, and feedback between the climate and the global economy into a single modeling framework. They gain this advantage at the expense of a more detailed representation of underlying climatic and economic systems. DICE, PAGE, and FUND all take stylized, reduced-form approaches and have been widely used in the economic and scientific literature since the 1990s. They are periodically updated by the model developers, but as discussed further in Section 5, the versions of the three models used in the 2013 and 2016 TSDs do not reflect the tremendous increase in the scientific and economic understanding of climate-related damages that has occurred in the past decade. The three IAMs were run using a common set of assumptions in each model for future population, economic, and GHG emissions growth, as well as equilibrium climate sensitivity (ECS) – a measure of the globally averaged temperature response to increased atmospheric CO_2 concentrations. The socioeconomic and emission projections included five

reference scenarios based on the Stanford Energy Modeling Forum EMF-22 modeling exercise (Clarke, et al. 2009; Fawcett, et al. 2009). The models were run using a probability distribution for ECS, calibrated to the Intergovernmental Panel on Climate Change's (IPCC) Fourth Assessment Report findings using the Roe and Baker (2007) distribution. Details on these versions of the IAMs and the harmonized inputs are presented in the 2016 TSD and Addendum and 2010 TSD. (IWG 2010, 2016a, 2016b). The 2016 Addendum also describes the methodology used to calculate the SC-CH4 and SC- N2O estimates in greater detail.[27] Finally, for the reasons set forth in Section 3 above, the interim estimates were based on three constant discount rates of 2.5, 3, and 5 percent.

The combination of three models and five scenarios produced 15 separate frequency distributions of SC- GHG estimates for each discount rate in a given year, with each distribution consisting of 10,000 estimates based on draws from the standardized ECS distribution (as well as distributions of parameters treated as uncertain in two of the models (FUND and PAGE)). For each discount rate, the IWG combined the distributions across models and socioeconomic emissions scenarios (applying equal weight

[27] The IWG calculated the SC-CH4 and SC-N2O estimates following the approach used in Marten et al. (2015). In order to develop SC-CH4 and SC-N2O estimates consistent with the methodology underlying the SC-CO2 estimates, Marten et al. (2015) needed to augment the IWG modeling framework in two respects: (1) augment the climate model of two of the IAMs to explicitly consider the path of additional radiative forcing from a CH4 or N2O perturbation, and (2) add more specificity to the assumptions regarding post-2100 baseline CH4 and N2O emissions. See IWG (2016b) for more discussion of these two modeling modifications and the peer review and public comment processes accompanying their development.

to each) and then selected a set of four values for use in benefit-cost analyses: an average value resulting from the model runs for each of three discount rates (2.5%, 3%, and 5%), plus a fourth value, selected as the 95th percentile of estimates based on a 3 percent discount rate. The fourth value was included to provide information on potentially higher-than-expected economic impacts from climate change, conditional on the 3% estimate of the discount rate. For this purpose, the SC-GHG value for the 95th percentile at a 3 percent discount rate was presented.[28] For the purposes of capturing the uncertainties involved in analyses, the IWG emphasized previously and emphasizes in this TSD the importance and value of including all four SC-GHG values. In particular, values based on lower discount rates are consistent with the latest scientific and economic understanding of discounting approaches relevant for intergenerational analysis (described in Section 3).

Tables 1-3 show the four selected values for SC-CO2, SC-CH4, and SC-N2O, respectively, in five-year increments from 2020 to 2050. These estimates are reported in 2020 dollars but are otherwise identical to those presented in the previous version of the TSD and its Addendum, released in August 2016.[29] The full set of annual SC-GHG values

[28] A detailed set of percentiles by model and scenario combination and additional summary statistics for the 2020 values is available in the 2016 TSD and Addendum (IWG 2016a, 2016b).

[29] The values in Tables 1-3 are the same as those reported in the 2016 TSD and Addendum adjusted for inflation to 2020 dollars using the annual GDP Implicit Price Deflator values in U.S. Bureau of Economic Analysis (BEA) NIPA Table 1.1.9: 113.626 (2020)/ 92.486 (2007) = 1.228575 (U.S. BEA 2021). Values of SC-CO2 presented in this TSD are rounded to the nearest dollar; SC-CH4 and SC-N2O are rounded to two significant figures. The

between 2020 and 2050, calculated using linear interpolation between the numbers shown in Tables 1-3, is reported in the Appendix and the full set of model results are available on the OMB website.[30] The SC-GHG estimates increase over time within the models – i.e., the societal harm from one metric ton emitted in 2030 is higher than the harm caused by one metric ton emitted in 2025 – because future emissions produce larger incremental damages as physical and economic systems become more stressed in response to greater climatic change, and because GDP is growing over time and many damage categories are modeled as proportional to GDP.

annual unrounded estimates are available □n OMB's website for use in regulatory and other analyses:
https://www.whitehouse.gov/omb/information-regulatory-affairs/regulatory-matters/#scghgs.

[30] https://www.whitehouse.gov/omb/information-regulatory-affairs/regulatory-matters/#scghgs

Table 1: Social Cost of CO_2, 2020 – 2050 (in 2020 dollars per metric ton of CO2)[31]

Emissions Year	Discount Rate and Statistic: 5% Average	3% Average	2.5% Average	3% 95th Percentile
2020	14	51	76	152
2025	17	56	83	169
2030	19	62	89	187
2035	22	67	96	206
2040	25	73	103	225
2045	28	79	110	242
2050	32	85	116	260

[31] The values reported in this TSD are identical to those reported in the 2016 TSD adjusted for inflation to 2020 dollars using the annual GDP Implicit Price Deflator values in the U.S. Bureau of Economic Analysis' (BEA) NIPA Table 1.1.9: 113.626 (2020)/ 92.486 (2007) = 1.228575 (U.S. BEA 2021). The IWG combined the distributions across models and socioeconomic emissions scenarios for each of three discount rates (2.5%, 3%, and 5%), plus a fourth value, selected as the 95th percentile of estimates based on a 3 percent discount rate. Values of SC-CO2 are rounded to the nearest dollar; SC-CH4 and SC-N2O are rounded to two significant figures. The annual unrounded estimates are available □n OMB's website for use in regulatory and other analyses: https://www.whitehouse.gov/omb/information-regulatory-affairs/regulatory-matters/#scghgs.

Table 2: Social Cost of CH_4, 2020 – 2050 (in 2020 dollars per metric ton of CH_4)

Emissions Year	Discount Rate and Statistic: 5% Average	3% Average	2.5% Average	3% 95th Percentile
2020	670	1500	2000	3900
2025	800	1700	2200	4500
2030	940	2000	2500	5200
2035	1100	2200	2800	6000
2040	1300	2500	3100	6700
2045	1500	2800	3500	7500
2050	1700	3100	3800	8200

Table 3: Social Cost of N_2O, 2020 – 2050 (in 2020 dollars per metric ton of N_2O)

	Discount Rate and Statistic			
Emissions Year	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020	5800	18000	27000	48000
2025	6800	21000	30000	54000
2030	7800	23000	33000	60000
2035	9000	25000	36000	67000
2040	10000	28000	39000	74000
2045	12000	30000	42000	81000
2050	13000	33000	45000	88000

Multiplying the SC-GHG in year *t* by the change in emissions in year *t* yields the monetized value of future emission changes from a year *t* perspective. This value must then be discounted to the present before being included in an analysis. For this purpose, the 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.

As noted above, to correctly assess the total climate damages to U.S. citizens and residents, an analysis must account for both the impacts that occur within U.S. borders and spillover effects from climate action elsewhere. For the reasons discussed in Section 2 above, estimates focusing on the climate impacts occurring within U.S. borders are an underestimate of the benefits of GHG mitigation accruing

to U.S. citizens and residents and, therefore, are not equivalent to a domestic estimate of the SC-GHG. (Section 2 also discusses why analyses should center their attention on a global measure of the SC-GHG). Additionally, models differ in their treatment of regional damages[32] with one of the model developers recently noting that regional damages are "both incomplete and poorly understand" (Nordhaus 2017). The IWG further notes that the domestic focused SC-GHG estimates used under E.O. 13783[33] did not benefit

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[32]Both the PAGE and FUND model contain a U.S. region and so the damages for this region are reported directly for those models. The DICE 2010 model does not explicitly include a separate U.S. region in the model. For the domestic focused SC-GHG estimates used under E.O. 13783, the DICE model damages occurring within U.S. borders were approximated as 10 percent of the global estimate from the DICE model runs, based on the results from a regionalized version of the model (RICE 2010) reported in Table 2 of Nordhaus (2017). Although the regional shares reported in Nordhaus (2017) are specific to SC-CO2, they were also used in approximating the share of marginal damages from CH4 and N2O emissions occurring within U.S. borders. Direct transfer of the U.S. share from the SCCO2 likely understate the U.S. share of the IWG global SC-CH4 estimates based on DICE due to the combination of three factors: a) regional damage estimates are known to be highly correlated with output shares (Nordhaus 2017, 2014), b) the U.S. share of global output decreases over time in all five EMF-22 based socioeconomic scenarios used for the model runs, and c) the bulk of the temperature anomaly (and hence, resulting damages) from a perturbation in emissions in a given year will be experienced earlier for CH4 than CO2 due to the shorter lifetime of CH4 relative to CO2.

[33] For emissions occurring in 2020, the average estimates of marginal damages occurring within the U.S. borders for CO2, CH4, and N2O emissions across all model runs that were used in 2017-2020 regulatory analyses were $7/mtCO2, $190/mtCH4, and $2,300/mtN2O (in 2020 dollars), respectively, using a 3 percent discount rate, and $1/mtCO2, $59/mtCH4, and $380/mtN2O (in 2020 dollars) using a 7 percent discount rate. These values increased over time; for 2050 emissions, the average estimates of marginal damages occurring within the U.S. borders are $11/mtCO2, $380/mtCH4, and $4,000/mtN2O (in 2020 dollars) using a 3% discount rate and $3/mtCO2, $160/mtCH4, and

from a consensus-based IWG process, were not documented in a dedicated TSD, subjected to a SC-GHG specific notice and comment period, or considered by National Academies in their 2017 review. The IWG will request public comments on the new information presented in this TSD, as well as other topics and issues the IWG will address as we develop the next set of updates (see Section 6).

4.1 Treatment of Uncertainty

Uncertainty about the value of the SC-GHGs is in part inherent, as with any analysis that looks into the future, but it is also driven by current data gaps associated with the complex physical, economic, and behavioral processes that link GHG emissions to human health and well-being. Some sources of uncertainty pertain to aspects of the natural world, such as quantifying the physical effects of greenhouse gas emissions on Earth systems. Other sources of uncertainty are associated with current and future human behavior and well-being, such as population and economic growth, GHG emissions, the translation of Earth system changes to economic damages, and the potential extent and costs of adaptation. It is important to note that even in the presence of uncertainty, scientific and economic analysis can provide valuable information to the public and decision

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$1,000/mtN2O (in 2020 dollars) using a 7% discount rate. Using the same approach with a 2.5 percent discount rate, the average estimates of marginal damages occurring within the U.S. borders of CO2, CH4, and N2O for emissions in 2020 are $10/mtCO2, $240/mtCH4, and $3,300/mtN2O (in 2020 dollars), respectively; for 2050 emissions, these values increase to $15/mtCO2, $450/mtCH4, and $5,300/mtN2O (in 2020 dollars).

makers. Such uncertainty should, however, be acknowledged, communicated as clearly as possible, and taken into account in the analysis whenever possible.

The 2016 TSD and the 2017 National Academies report provide detailed discussions of the ways in which the modeling underlying the development of the SC-GHG estimates addressed quantified sources of uncertainty.

In developing the SC-CO2 estimates, the IWG considered various sources of uncertainty through a combination of a multi-model ensemble, probabilistic analysis, and scenario analysis. For example, the three IAMs used collectively span a wide range of Earth system and economic outcomes to help reflect the uncertainty in the literature and in the underlying dynamics being modeled. The use of an ensemble of three different models is also intended to, at least partially, address the fact that no single model includes all of the quantified economic damages. It also helps to reflect structural uncertainty across the models, which is uncertainty in the underlying relationships between GHG emissions, Earth systems, and economic damages that are included in the models. Bearing in mind the different limitations of each model (discussed in the 2010 TSD) and lacking an objective basis upon which to differentially weight the models, the three IAMs were given equal weight in the analysis.

The IWG used Monte Carlo techniques to run the IAMs a large number of times. In each simulation the uncertain parameters are represented by random draws from their defined probability distributions. In all three models the equilibrium climate sensitivity is treated probabilistically based on the probability distribution described in the 2010

TSD. The equilibrium climate sensitivity is a key parameter in this analysis because it helps define the strength of the climate response to increasing GHG concentrations in the atmosphere. In addition, the FUND and PAGE models define many of their parameters with probability distributions instead of point estimates. For these two models, the model developers' default probability distributions are maintained for all parameters other than those superseded by the IWG's harmonized inputs (i.e., equilibrium climate sensitivity, socioeconomic and emissions scenarios, and discount rates). More information on the uncertain parameters in PAGE and FUND is presented in Appendix C of the 2016 TSD (IWG 2016a).

Finally, based on the review of the literature, the IWG chose discount rates that reflect reasonable judgements under both prescriptive and descriptive approaches to intergenerational discounting. As discussed in the 2010 TSD, in light of disagreement in the literature on the appropriate discount rate to use in this context and uncertainty about how rates may change over time, the IWG selected three certainty-equivalent constant discount rates to span a plausible range: 2.5, 3, and 5 percent per year. However, unlike the approach taken for consolidating results across models and socioeconomic and emissions scenarios, the SC-GHG estimates are not pooled across different discount rates because the range of discount rates reflects both uncertainty and, at least in part, different policy or value judgements.

The outcome of accounting for various sources of uncertainty using the approaches described above is a frequency distribution of the SC-CO2 estimates for emissions occurring in a given year for each of the three

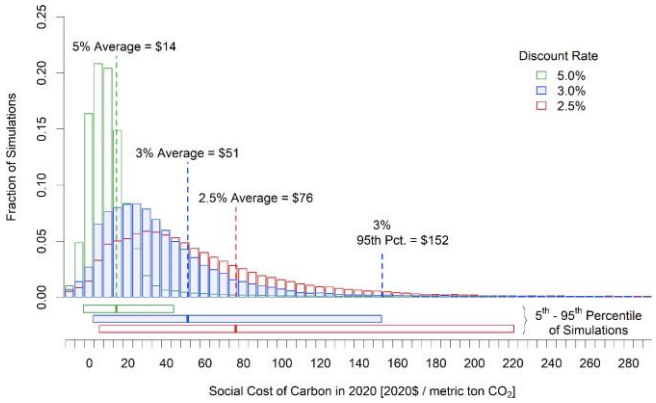
discount rates. These frequency distributions reflect the uncertainty around the input parameters for which probability distributions were defined, as well as from the multi-model ensemble and socioeconomic and emissions scenarios where probabilities were implied by the equal weighting assumption. It is important to note that the probability distribution for the SC-GHG calculated using the modeling approach outlined above does not fully characterize uncertainty about the SC-GHG due to impact categories omitted from the models and sources of uncertainty that have not been fully characterized due to data limitations. To name just one example of many known GHG-induced damages omitted in the three IAMs, none of the models include damages associated with ocean acidification, and, therefore, naturally the models do not reflect uncertainty as to the potential severity of those damages.

Figures Figure ***2*** through Figure ***4*** present the frequency distribution of the interim SC-CO2, SC-CH4, and SC-N2O estimates, respectively, for emissions in 2020 and for each discount rate. Each distribution represents 150,000 estimates based on 10,000 simulations for each combination of the three models and five socioeconomic and emissions scenarios. In general, the distributions are skewed to the right and have long right tails, which tend to be longer for lower discount rates. To highlight the difference between the impact of the discount rate on the SC-GHG and other quantified sources of uncertainty, the bars below the frequency distributions provide a symmetric representation of quantified variability in the SC-GHG estimates conditioned on each discount rate. The full set of SC-GHG results through 2050 is available on OMB's

website.

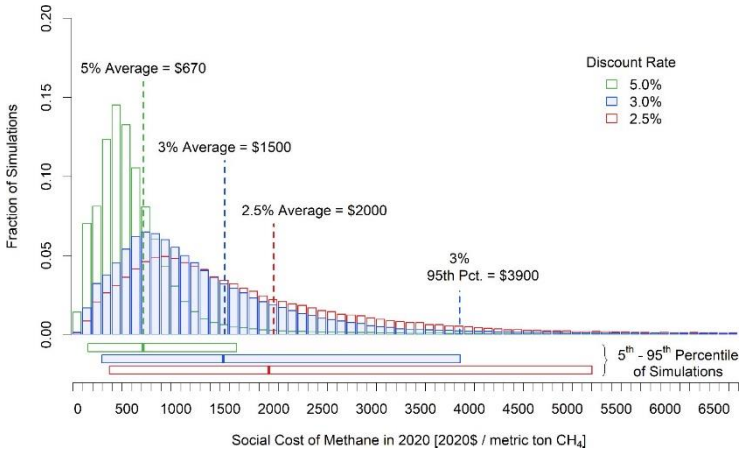
As illustrated by the frequency distributions in Figures Figure ***2*** through Figure ***4***, the assumed discount rate plays a critical role in the ultimate estimate of the SC-GHG. As explained in Section 3, this is because GHG emissions today continue to impact society far out into the future, so with a higher discount rate, costs that accrue to future generations are weighted less, resulting in a lower estimate. As discussed in Section 3.1, new data and evidence strongly suggest that the consumption interest rate is likely to be less than 3, near 2 percent or lower.

Figure 2: Frequency Distribution of SC-CO_2 Estimates for 2020[34]



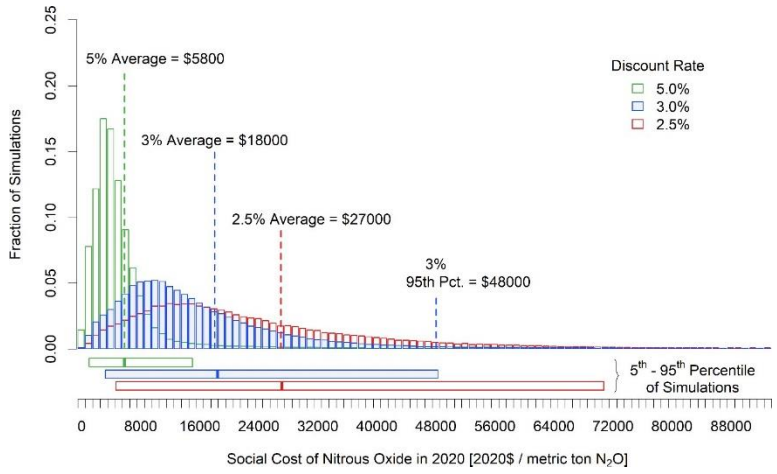
[34] Although the distributions and numbers in Figure 2 are based on the full set of model results (150,000 estimates for each discount rate), for display purposes the horizontal axis is truncated with 0.81 percent of the estimates falling below the lowest bin displayed and 3.56 percent of the estimates falling above the highest bin displayed.

Figure 3: Frequency Distribution of SC-CH4 Estimates for 2020[35]



[35] Although the distributions and numbers in Figure 3 are based on the full set of model results (150,000 estimates for each discount rate), for display purposes the horizontal axis is truncated with 0.12 percent of the estimates falling below the lowest bin displayed and 2.84 percent of the estimates falling above the highest bin displayed.

Figure 4: Frequency Distribution of SC-N2O Estimates for 2020[36]



While the figures above reflect the uncertainties that are explicitly considered in a quantitative manner, there are other areas of uncertainty that are not quantitatively reflected in the interim SC-GHG estimates. The scientific and economics literature has further explored known sources of uncertainty related to estimates of the SC-GHG. For example, published studies explore the sensitivity of IAMs and the resulting SC-GHG estimates to different assumptions embedded in the models (see, e.g., Hope 2013, Anthoff and Tol 2013a, and Nordhaus 2014). However, there remain additional sources of uncertainty that have not been fully characterized and explored due to data

[36]Although the distributions and numbers in Figure 4 are based on the full set of model results (150,000 estimates for each discount rate), for display purposes the horizontal axis is truncated with 0.1 percent of the estimates falling below the lowest bin displayed and 2.85 percent of the estimates falling above the highest bin displayed.

limitations and lack of consensus in the scientific or economic literature about how to represent them. Additional research is needed to expand the quantification of various sources of uncertainty in estimates of the SC-GHG (e.g., developing explicit probability distributions for more inputs pertaining to climate impacts and their valuation).

4.2 Other Modeling Limitations

The interim SC-GHG estimates presented in this TSD have a number of limitations, as would be expected for any modeling exercise that covers such a broad scope of scientific and economic issues across the complex global landscape. These include the incomplete treatment of catastrophic and non-catastrophic impacts in the IAMs, their incomplete treatment of adaptation and technological change, the incomplete way in which inter-regional and intersectoral linkages are modeled, uncertainty in the extrapolation of damages to high temperatures, and inadequate representation of the relationship between the discount rate and uncertainty in economic growth over long time horizons.

There are newer versions available of each of the IAMs used to calculate the interim SC-GHG estimates in this TSD that offer improvements in some of these areas beyond the version of the models used for the interim estimates. For example, the latest version of the PAGE model, PAGE-ICE (Yumashev et al. 2019, Yumashev 2020), extends PAGE09 (Hope 2013) with representation of two nonlinear Arctic feedbacks (permafrost carbon feedback and surface albedo feedback) on the global climate system and economy,

among other changes. The newest version of the DICE model, DICE2016-R3 (Nordhaus 2017), includes numerous updates, including changes to the carbon cycle (to better simulate the long-run behavior of larger models with full ocean chemistry) and updated methods for estimating economic activity.[37] At comparable discount rates, DICE2016-R3 would result in SC-CO2 estimates roughly twice that of the interim estimates presented in this TSD. For example, using a 3% constant discount rate and other IWG modeling assumptions, DICE2016-R3 yields an average SC-CO2 of $104 (2018 international dollars) for 2020 emissions (Nordhaus 2019a). However, even DICE2016 and PAGE-ICE do not include all of the important physical, ecological, and economic impacts of climate change recognized in the climate change literature and the science underlying their damage functions lags behind the most recent research. Likewise, the socioeconomic and emissions scenarios used as inputs to the models in this TSD do not reflect new information from the last decade of scenario generation or the full range of projections.

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[37] Relative to the previous version of DICE, DICE2013, the DICE2016 updates to the carbon cycle and the methods for estimating economic activity had the greatest impact on the SC-CO2. Based □n Archer et al. (2009), DICE2016's three-box carbon cycle model aims to better simulate the long-run behavior of larger models with full ocean chemistry. In measuring economic activity, one of the important changes in DICE2016 was to move from market exchange rates to measures adjusted for purchasing power parity when comparing monetary values across countries. See Nordhaus (2017, 2019a) for more discussion of these and other updates included in DICE2016-R3. Nordhaus has also recently explored side extensions of DICE2016. For example, DICE-GIS extends DICE2016 to include representation of sea level rise from melting of the Greenland Ice Sheet (Nordhaus 2019b, Pizer 2019).

The modeling limitations discussed above do not all work in the same direction in terms of their influence on the SC-GHG estimates. However, it is the IWG's judgment that, taken together, the limitations suggest that the interim SC-GHG estimates presented in this TSD likely underestimate the damages from GHG emissions. In particular, the IPCC's Fourth Assessment Report (IPCC 2007), which was the most current IPCC assessment available at the time when the IWG decision over the ECS input was made, concluded that SC-CO2 estimates "very likely…underestimate the damage costs" due to omitted impacts. Since then, the peer-reviewed literature has continued to support this conclusion, as noted in the IPCC's Fifth Assessment report (IPCC 2014) and other recent scientific assessments (e.g., IPCC 2018, 2019a, 2019b; U.S. Global Change Research Program (USGCRP) 2016, 2018; and National Academies 2016b, 2019). These assessments confirm and strengthen the science, updating projections of future climate change and documenting and attributing ongoing changes. For example, sea level rise projections from the IPCC's Fourth Assessment report ranged from 18 to 59 centimeters by the 2090s relative to 1980-1999, while excluding any dynamic changes in ice sheets due to the limited understanding of those processes at the time (IPCC 2007). A decade later, the Fourth National Climate Assessment projected a substantially larger sea level rise of 30 to 130 centimeters by the end of the century relative to 2000, while not ruling out even more extreme outcomes (USGCRP 2018). Section 5 briefly previews some of the recent advances in the scientific and economic literature that the IWG is actively following and that could provide guidance on, or methodologies for, addressing some of the limitations with the interim SC-

GHG estimates.

5 Scientific and Economic Advances

The research community has made considerable progress in developing new data and methods that will provide a path forward for bringing the USG SC-GHG estimates closer to the current frontier of climate science and economics and could address many of the National Academies' (2017) recommendations. This research since 2010/2013 has advanced knowledge regarding each key component in the process of estimating the SC-GHG. This TSD does not intend to provide a detailed review of all these advancements, but this section does highlight some of the key research and new information that the IWG will be reviewing as it works to improve the SC-GHG estimates. As part of the process for updating the SC-GHG estimates by January 2022, the IWG will survey the scientific literature, including the economic literature, to identify advances to address the National Academies (2017) recommendations.

Climate system representation. There have been advancements in climate science since the publication of the IPCC's Fourth Assessment Synthesis report (IPCC 2007), which was the basis for the IWG decision on what equilibrium climate sensitivity (ECS) input to use in the IAM model runs. The conclusions of recent scientific assessments, e.g., from the IPCC (2014, 2018, 2019a, 2019b), the USGCRP (2016, 2018), and the National Academies (2016b, 2019), confirm and strengthen the science, updating projections of future climate change and documenting and attributing ongoing changes. In addition,

there are reduced complexity climate models that could offer meaningful improvement over current representation of climate dynamics in existing IAMs (Nicholls et al. 2020). For example, the National Academies (2017) stated that the FAIR model (Smith et al., 2018) satisfies all of the criteria set by National Academies (2017) recommendations related to the representation of climate system dynamics, generates projections of future warming consistent with more complex, state of the art models, can be used to accurately characterize current best understanding of uncertainty, and can be easily implemented and transparently documented. Reduced complexity sea level rise models are also being developed that can provide projections for damage functions that require sea level estimates, including the contributions of thermal expansion and glacial and ice sheet melting based on recent scientific research (e.g., Wong et al. 2017).

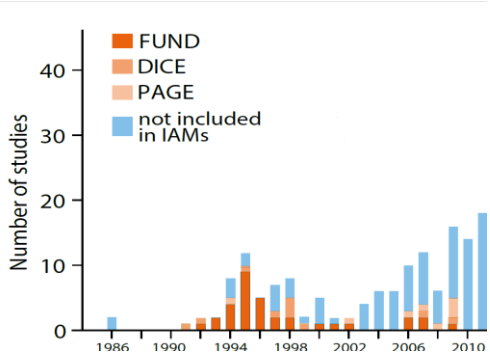
***Damage functions*.** At the core of IAMs are "damage functions" that map global mean temperature changes and other physical impacts of climate change into economic (both market[38] and nonmarket[39]) damages. Relative to how much progress has been made in modeling and improving our understanding of climate system dynamics and the physical impacts resulting from temperature change, efforts involved in, and the public resources targeted at, understanding how these physical changes translate into economic impacts have been significantly smaller (Auffhammer 2018). Even so, as illustrated in Figure 5, in

[38] Examples of market damages include changes in net agricultural productivity, energy use, and property damage from increased flood risk.

[39] Examples of nonmarket damages include services that natural ecosystems provide to society.

the time since the versions of the IAMs used in this TSD were published, there has been an explosion of research on climate impacts and damages.

Figure 5. New Research on Climate Impacts[40]



Source: Greenstone (2016).

Several efforts are underway to draw on recent literature for improving damage functions and to generate new damage estimates. In particular, the Climate Impact Lab is undertaking an effort to quantify and monetize damages at a fine spatial scale, relying on rigorous empirical methods

[40] In many cases, the three IAMs used different studies for calibration. This is particularly true of FUND, which used studies relating to different subsectors of the model, whereas DICE and PAGE did not have as detailed a sectoral breakdown. That means that summing across these different models is likely valid in all but a few isolated cases. The blue bars include studies uncovered from a comprehensive literature review in the economics literature (and a few others in public health or relevant disciplines) by the Climate Impact Lab (CIL) through early 2016. Each of the studies counted in blue was determined by CIL to have employed a research design that allowed for the causal interpretation of results (Greenstone 2016).

to develop plausibly causal estimates for several sectors, including health (Carleton et al. 2020), energy (Rode et al. 2021), labor productivity (Rode et al. 2020), agriculture, conflict, and sea level rise.[41] Other research efforts have sought to update the damage function for one sector in an existing IAM based on an updated review of the empirical literature on climate impacts pertaining to that sector (e.g., Moore et al. (2017) for agriculture damages in the FUND model). Damage functions specific to impacts within the U.S. have also been developed and improved for a number of sectors, such as impacts on coastal property, mortality due to extreme temperatures, transportation infrastructure, electricity supply and demand, water quality, recreation, and allergies (Neumann et al. 2020) and impacts of climate change on air quality and human health (Fann et al. 2021). There is also an emerging literature focused on incorporating interactions among regions and impacts. For example, biodiversity loss (e.g., animal pollinators) as a result of climate-driven ecosystem stress could amplify impacts of climate change on agriculture. See National Academies (2017) for more discussion of recent research addressing these and other types of interactions.

Related to the development of damage functions, damages from climate change are uncertain and hence pose additional risks. Reductions in GHG emissions reduce not only expected damages, but also reduce the uncertainty and

[41] The Climate Impact Lab is a multidisciplinary collaboration of climate scientists, economists, computational experts, researchers, analysts, and students working to build empirically derived, local-level estimates of climate change damages and an empirically based SC-CO2. More information on the Climate Impact Lab can be found at: http://www.impactlab.org/.

risks of catastrophic events. Evaluating the damages using the mean outcome does not account for the benefits of reducing uncertainty. Some researchers have raised the need to include this consideration in the SC-GHG (e.g., Carleton and Greenstone 2021) consistent with the observation that individuals are regularly willing to pay for insurance against bad outcomes.

Furthermore, E.O. 13990 instructs the IWG to consider how best to reflect environmental justice and intergenerational equity concerns in assessing climate damages. In the context of climate policy, equity considerations are discussed by economists, ethicists, and others in several ways: distributional effects within a specific country, effects across countries, and intergenerational equity impacts. Economists, ethicists, and others have proposed potential ways to incorporate equity into the SC-GHG. For example, IAM developers have introduced the use of equity weights potentially incorporate these concerns (e.g., Hope 2008; Anthoff and Emmerling 2019).

Socioeconomic and Emissions Projections. The socioeconomic and emissions projections underlying current USG SC-GHG estimates were developed around 2007. Since that time, there have been efforts to develop updated baseline scenarios. Several researchers have started using deterministic scenarios available as part of the IPCC's Fifth Assessment Report Working Group 3 database and the Shared Socioeconomic Pathways (SSPs) linked with the Representative Concentration Pathway (RCP) emissions scenarios (Riahi et al. 2017 and Moss et al. 2010) as benchmark scenarios. Resources for the Future (RFF) has engaged in a research effort to implement each

of the National Academies' (2017) recommendations, in collaboration with research partners.[42] One part of this effort is focused on developing probability distributions for future paths of population, GDP, and emissions via using econometrics and expert elicitation techniques. For example, economic growth projections are being built off the results of a formal expert elicitation of leading growth economists together with recent research by Muller, Stock and Watson (2020), who have refined a foundational statistical methodology for generating long-run projections of economic growth at the country level. RFF plans to make these probabilistic scenarios easily usable on Mimi.jl, an open-source modular computing platform used for creating, running, and performing analyses on IAMs.[43]

Discounting. Another area of active research relates to discounting, including the best available evidence on the consumption rate of interest and the application of discount rates to regulations in which some costs and benefits accrue intra-generationally while others accrue inter-generationally. As described in Section 3.2, new empirical evidence suggests that consumption interest rates are now below the previous estimate of 3 percent presented in OMB's Circular A-4. This empirical evidence is also consistent with long-term forecasts by the Congressional

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[42] For more information on RFF's Social Cost of Carbon Initiative, see: https://www.rff.org/topics/scc/.

[43] Mimi.jl was developed by a team of researchers at UC Berkeley led by David Anthoff in response to a core recommendation from the National Academies (2017) to create an integrated modular approach to draw more readily on expertise from the wide range of scientific disciplines relevant to SC-CO2 estimation. Mimi.jl provides an interface for defining components and building models in a modularized, transparent way (mimiframework.org).

Budget Office, suggesting these lower rates will persist (U.S. CBO 2020). Future updates to the SC-GHGs estimates will need to reflect the best available evidence from the time series of risk-free rate data and expectations of these rates into the future.

As described in Section 3.3 uncertainty in the discount rate over time yields a declining certainty- equivalent discount rate schedule and can have a dramatic effect on the size of the SC-GHG. While this is not a new theoretical result, new literature has proposed methods for how to incorporate discount rate uncertainty (e.g., Arrow et al., 2013; Cropper et al., 2014) and other nations have implemented declining discount rate schedules for policy analysis (e.g., United Kingdom, France, and Germany). Recent recommendations by the National Academies (2017) and EPA's Science Advisory Board (2021) have encouraged the development and use of a declining certainty-equivalent discount rate schedule as theoretically appropriate and as a method of introducing consistency into analyses that have both near- term and long-term impacts.

In light of new science and evidence, including many of those highlighted in the paragraphs above, other jurisdictions are already considering or have implemented some of the scientific and economic advances discussed above. For example, some states that use SC-GHG estimates in policy analysis have recently updated their approach to discounting based on the increasing evidence that a 3% discount rate is too high for intergenerational analysis. In December 2020, New York issued guidance recommending state agencies use SC-GHG estimates based the same IWG modeling and input decisions as presented

in this TSD but with lower discount rates: 2 percent in central scenarios ($125/mtCO2 for 2020 emissions (2020 dollars), along with sensitivity analysis at 1 percent and 3 percent (New York Department of Environmental Conservation 2020). Similarly, in Washington state an April 2019 law required utilities to use estimates based on the IWG methodology with a 2.5% discount rate when developing "lowest-cost analyses" for its integrated resource planning and clean energy plans.[44]

Canada is also in the process of updating the SC-GHG estimates used in their regulatory analyses. While the update is underway, they are continuing to use the estimates they adopted in 2016 (which are an adaptation of the IWG global SC-GHG estimates presented in this TSD) as well as a side analysis based on more recent estimates from the academic literature. Based on their review of the literature and latest climatological and economic evidence, they present their current estimates as a "likely underestimate [of] climate-related damages to society" and the side analysis as a way "to illustrate a range of plausible values if the Department were to update its [social cost of carbon] estimate based on new versions of the models currently used."[45] Specifically, the side analysis includes SC-CO2 estimates based on DICE2016 and PAGE- ICE ($135 and $440/mtCO2 for

[44] Wash. Sen. Bill. 5116 (signed by Gov. Inslee on May 7, 2019). More information on Washington and other states' use of SC-GHG estimates is compiled by the Institute for Policy Integrity at NYU School of Law (see http://www.costofcarbon.org/states) and discussed in U.S. GAO (2020).

[45] Proposed Clean Fuel Regulations (published for public comment on 12/20/20) http://www.gazette.gc.ca/rp-pr/p1/2020/2020-12-19/pdf/g1-15451.pdf.

2020 emissions (2019 Canadian dollars)).[46]

The IWG will consider the new science and evidence as it works towards a more comprehensive update, including the new research and information described in this section.

6 Path Forward

E.O. 13990 reaffirms that "[a]n accurate social cost is essential for agencies to accurately determine the social benefits of reducing greenhouse gas emissions when conducting cost-benefit analyses of regulatory and other actions" (E.O. 13990 2021). The E.O. instructs the IWG to publish interim SC-CO2, SC-CH4, and SC-N2O estimates (collectively, SC-GHG estimates) within 30 days and to publish a set of final estimates by no later than January 2022.[47] In doing so, the E.O. instructs the IWG to consider the recommendations of the National Academies of Science, Engineering, and Medicine as reported in Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide (2017) and other pertinent scientific literature; solicit public comment; engage with the public and stakeholders; seek the advice of ethics experts; and ensure that the SC-GHG estimates reflect the interests of future generations in avoiding threats posed by climate change.

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[46] Proposed Clean Fuel Regulations (published for public comment on 12/20/20)
http://www.gazette.gc.ca/rp-pr/p1/2020/2020-12-19/pdf/g1-15451.pdf.

[47] The Executive Order also requests that the IWG assess the application of the SC-GHG to inform government decision making beyond regulations, in addition to recommending a robust long-term structure for ensuring the SCGHGs continue to reflect the best available science and economic and that long-term research needs are met.

In developing the SC-GHG estimates in 2010, 2013, and 2016 the IWG used consensus-based decision making, relied on peer-reviewed literature and models, and took steps to disclose limitations and incorporate new information by considering public comments and revising the estimates as updated research became available (U.S. GAO 2014). Going forward the IWG commits to maintaining a consensus driven process for making evidence-based decisions that are guided by the best available science and input from the public, stakeholders, and peer reviewers.

While the IWG assesses the current state of the science in each component of the SC-GHG modeling exercise, the IWG is beginning by asking for public comment on how best to incorporate the latest, peer reviewed science to develop an updated set of SC-GHG estimates. The IWG will soon issue a Federal Register notice with a detailed set of requests for public comments on the new information presented in this TSD, as well as other topics and issues the IWG will address as we develop the next set of updates. Among other things, the IWG will ask for public comment on how to incorporate the best available science in the updated SC-GHG estimates, due to be published by January 2022, and how to incorporate the recommendations of the National Academies (2017).

References

Anthoff, D., and J. Emmerling. 2019. Inequality and the Social Cost of Carbon. *Journal of the Association of Environmental and Resource Economists* 6(2): 243-273.

Anthoff D, C. Hepburn, and R. Tol. 2009. Equity Weighting and the Marginal Damage Costs of Climate Change. *Ecological Economics* 68:836-849.

Anthoff, D., and Tol, R.S.J. 2010. On International Equity Weights and National Decisions Making on Climate Change. *Journal of Environmental Economics and Management* 60(1): 14-20.

Anthoff, D. and Tol, R.S.J. 2013a. The uncertainty about the social cost of carbon: a decomposition analysis using FUND. *Climatic Change* 117: 515–530.

Anthoff, D. and Tol, R.S.J. 2013b. Erratum to: The uncertainty about the social cost of carbon: A decomposition analysis using FUND. *Climatic Change* 121(2): 413.

Anthoff, D., R. Tol, and G. Yohe. 2009. Risk aversion, time preference, and the social cost of carbon.

Environmental Research Letters 4: 024002 (7pp).

Arrow, K., Cropper, M., Gollier, C., Groom, B., Heal, G., Newell, R., Nordhaus, W., Pindyck, R., Pizer, W., and Portney, P. 2013. Determining Benefits and Costs for Future Generations. *Science* 341(6144): 349- 350

Arrow, K., Cropper, M., Gollier, C., Groom, B., Heal, G., Newell, R., Nordhaus, W., Pindyck, R., Pizer, W., and Portney, P. 2014. Should Governments Use a Declining Discount Rate in Project Analysis? *Review of*

Environmental Economics and Policy 8(2): 145–163.

Auffhammer, M. 2018. Quantifying Economic Damages from Climate Change. *Journal of Economic Perspectives* 32(4): 33–52.

Bradford, D.F. 1975. Constraints on government investment opportunities and the choice of discount rate. *American Economic Review* 65(5): 887-899.

Bauer, M. and Rudebusch, G.D. 2020. The Rising Cost of Climate Change: Evidence from the Bond Market. Federal Reserve Bank of San Francisco Working Paper 2020-25. Available at: https://doi.org/10.24148/wp2020-25 (accessed February 5, 2021).

Carleton, T. and Greenstone, M. 2021. Updating the United States Government's Social Cost of Carbon. University of Chicago, Becker Friedman Institute for Economics Working Paper, (2021-04). Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3764255 (accessed February 5, 2021).

Center for Biological Diversity v. National Highway Traffic Safety Administration, 538 F.3d 1172 (9th Cir.). Available at: https://casetext.com/case/center-for-biological-v-nhtsa (accessed February 5, 2021).

Center for Climate and Security, The. 2018. Military Expert Panel Report Sea Level Rise and the U.S. Military's Mission. Available at: https://climateandsecurity.files.wordpress.com/2018/02/military- expert-panel-report_sea-level-rise-and-the-us-militarys-mission_2nd-edition_02_2018.pdf (accessed February 5, 2021)

Clarke, L., Edmonds, J., Krey, V., Richels, R., Rose, S., and

Tavoni, M. 2009. International climate policy architectures: Overview of the EMF 22 International Scenarios. *Energy Economics* 31: S64-S81.

Clarkson, R. and Deyes, K. 2002. Estimating the social cost of carbon emissions. London: HM Treasury.

Council of Economic Advisers (CEA). 2017. Discounting for public policy: Theory and recent evidence on the merits of updating the discount rate. Issue Brief. Executive Office of the President. Available at: https://obamawhitehouse.archives.gov/sites/default/files/page/files/201701_cea_discounting_issue_brief.pdf (accessed February 5, 2021).

Cropper, Maureen L., Mark C. Freeman, Ben Groom, and William A. Pizer. 2014. Declining Discount Rates. *American Economic Review*, 104 (5): 538-43.

Dreze, J.H. 1974. Investment under private ownership: optimality, equilibrium and stability. In *Allocation under uncertainty: equilibrium and optimality* (pp. 129-166). Palgrave Macmillan, London.

Department of Defense. 2014. Climate Change Adaptation Roadmap. Available at: https://www.acq.osd.mil/eie/downloads/CCARprint_wForward_e.pdf (accessed February 5, 2021).

Drupp, M., M. Freeman, B. Groom, and F. Nesje. 2018. Discounting Disentangled. *American Economic Journal: Economic Policy* 10 (4): 109-34.

Executive Order (E.O.) 12866. Regulatory Planning and Review, Section 1(a), October 4, 1993. Available at: https://www.archives.gov/files/federal-register/executive-orders/pdf/12866.pdf (accessed February 5, 2021).

Executive Order (E.O.) 13783. Promoting Energy Independence and Economic Growth March 28, 2017. Available at: https://www.federalregister.gov/documents/2017/03/31/2017-06576/promoting-energy- independence-and-economic-growth (accessed February 5, 2021).

Executive Order (E.O.) 13990. Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis. January 20, 2021. Available at: https://www.federalregister.gov/documents/2021/01/25/2021-01765/protecting-public-health-and- the-environment-and-restoring-science-to-tackle-the-climate-crisis (accessed February 5, 2021).

Fankhauser, S., Tol, R.S.J., and Pearce, D. 1997. The Aggregation of Climate Change Damages: A Welfare Theoretic Approach. *Environmental and Resource Economics* 10: 249-266.

Fann N.L., Nolte C.G., Sarofim M.C., Martinich J., Nassikas N.J. 2021. Associations between simulated future changes in climate, air quality, and human health. *JAMA Netw Open*. 4(1).

Fawcett, A., Calvin, K., de la Chesnaye, F., Reilly, J., and Weyant, J. 2009. Overview of EMF 22 U.S. transition scenarios. *Energy Economics* 31: S198-S211.

Gollier, C. 2009. Expected Net Present Value, Expected Net Future Value, and the Ramsey Rule. *Journal of Environmental Economics and Management,* 59(2): 142-148.

Gollier, C. 2014. Discounting and growth. *American Economic Review,* 104(5): 534-537.

Gollier, C. and Weitzman, M. 2010. How should the distant future be discounted when discount rates are uncertain? *Economics Letters*, 107(3): 350-353.

Goulder, L. 2007. Benefit-Cost Analysis, Individual Differences, and Third Parties. In *Research in Law and Economics, Vol. 23*. Zerbe, R.O. (Ed.) Emerald Group Publishing Limited, Bingley.

Greenstone, Michael. 2016 (May). A New Path Forward for an Empirical Social Cost of Carbon. Presented at The National Academies of Sciences, Engineering, and Medicine, *Assessing Approaches to Updating the Social Cost of Carbon*. Available at: https://sites.nationalacademies.org/cs/groups/dbassesite/documents/webpage/dbasse_172599.pdf (Accessed February 5, 2021).

Groom, B., C. Hepburn, P. Koundouri, and D. Pearce. 2005. Declining Discount Rates: The Long and the Short of It. *Environmental and Resource Economics*, 32: 445-493.

Groom, B., P. Koundouri, E. Panopoulou, and T. Pantelidis. 2007. Discounting the Distant Future: How Much Does Model Selection Affect the Certainty Equivalent Rate? *Journal of Applied Econometrics*, 22(3): 641-656.

Harberger, A.C. 1972. On measuring the social opportunity cost of public funds. In *Project Evaluation* (pp. 94-122). Palgrave Macmillan, London.

Hänsel, M.C., Drupp, M.A., Johansson, D.J., Nesje, F., Azar, C., Freeman, M.C., Groom, B. and Sterner, T., 2020. Climate economics support for the UN climate targets. *Nature Climate Change*, 10(8), pp.781-789.

HM Treasury. 2020. The Green Book: Central Government

Guidance on Appraisal and Evaluation. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/938046/The_Green_Book_2020.pdf

Hope C. 2006. The marginal impact of CO2 from PAGE2002: an integrated assessment model incorporating the IPCC's five reasons for concern. *The Integrated Assessment Journal* 6(1):19-56.

Hope, C. 2008. Discount Rates, Equity Weights and the Social Cost of Carbon. *Energy Economics,* 30(3): 1011-1019.

Hope C. 2008. Optimal carbon emissions and the social cost of carbon under uncertainty. *The Integrated Assessment Journal* 8(1):107-122.

Hope, C. 2013. Critical issues for the calculation of the social cost of CO2: why the estimates from PAGE09 are higher than those from PAGE2002. *Climatic Change,* 117: 531–543.

Houser and Larson. 2021. Calculating the Climate Reciprocity Ratio for the US. Available at: https://rhg.com/research/climate-reciprocity-ratio (accessed February 5th, 2021).

Howard, P., and Schwartz, J. 2019. Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon. *Columbia Journal of Environmental Law,* 42(S): 203-294.

Howard, P.H., Sylvan, D. 2020. Wisdom of the experts: Using survey responses to address positive and normative uncertainties in climate-economic models. *Climatic Change,* 162: 213–232.

Interagency Working Group on Social Cost of Carbon (IWG). 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866. February. United States Government. Available at: https://www.whitehouse.gov/omb/information-regulatory-affairs/regulatory-matters/#scghgs.

Interagency Working Group on Social Cost of Carbon (IWG). 2013. Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. May. United States Government. Available at: https://www.whitehouse.gov/omb/information- regulatory-affairs/regulatory-matters/#scghgs.

Interagency Working Group on Social Cost of Carbon (IWG). 2015. Response to Comments: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. July. United States Government. Available at: https://www.whitehouse.gov/omb/information-regulatory-affairs/regulatory- matters/#scghgs

Interagency Working Group on Social Cost of Greenhouse Gases (IWG). 2016a. Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. August. United States Government. Available at: https://www.whitehouse.gov/omb/information-regulatory-affairs/regulatory-matters/#scghgs

Interagency Working Group on the Social Cost of Greenhouse Gases (IWG). 2016b. 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. August. United Stated Government. Available at: https://www.whitehouse.gov/omb/information-regulatory-affairs/regulatory-matters/#scghgs.

Intergovernmental Panel on Climate Change (IPCC). 2007. Core Writing Team; Pachauri, R.K; and Reisinger, A. (ed.), Climate Change 2007: Synthesis Report, Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, IPCC, ISBN 92-9169- 122-4.

Intergovernmental Panel on Climate Change (IPCC). 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

Intergovernmental Panel on Climate Change (IPCC). 2018. Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. P□rtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)].

Intergovernmental Panel on Climate Change (IPCC). 2019a. Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. P□rtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)].

Intergovernmental Panel on Climate Change (IPCC). 2019b. IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Portner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor,

E. Poloczanska, K. Mintenbeck, A. Alegria, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)].

Kopp, R., A. Krupnick, and M. Toman. 1997. *Cost-Benefit Analysis and Regulatory Reform: An Assessment of the Science and the Art*. Report to the Commission on Risk Assessment and Risk Management.

Kopp, R.E. and Mignone, B.K. 2013. Circumspection, reciprocity, and optimal carbon prices. *Climatic Change* 120(4): 831-843.

Kotchen, M. 2018. Which Social Cost of Carbon? A Theoretical Perspective. *Journal of the Association of Environmental and Resource Economists,* 5(3): 673-694.

Lebègue, Daniel. 2005. Révision du Taux d'Actualisation des Investissements Publics. Rapport du Gr□upe d'Experts, Commisariat Général du Plan.

Li, Q., and W.A. Pizer. 2021. Use of the consumption

discount rate for public policy over the distant future. *Journal of Environmental Economics and Management* doi: https://doi.org/10.1016/j.jeem.2021.102428.

Marten, A.L., and S.C. Newbold. 2012. Estimating the social cost of non-CO2 GHG emissions: methane and nitrous oxide. *Energy Policy,* 51: 957-972.

Marten, A.L., Kopits, E.A., Griffiths, C.W., Newbold, S.C., and A. Wolverton. 2015. Incremental CH4 and N2O Mitigation Benefits Consistent with the U.S. Government's SC-CO2 Estimates. *Climate Policy* 15(2): 272-298.

Moore, Frances C., Uris Baldos, Thomas Hertel, and Delavane Diaz. 2017. New Science of Climate Change Impacts on Agriculture Implies Higher Social Cost of Carbon. *Nature Communications,* 8(1): 1-9.

Moss, R.H., J.A. Edmonds, K.A. Hibbard, M.R. Manning, S.K. Rose, D.P. Van Vuuren, T.R. Carter, S. Emori,

M. Kainuma, T. Kram, G.A. Meehl, J.F.B. Mitchell, N. Nakicenovic, K. Riahi, S.J. Smith, R.J. Stouffer, A.M. Thomson, J.P. Weyant, and T.J. Wilbanks. 2010. The next generation of scenarios for climate change research and assessment. *Nature,* 463: 747-756.

Muller, U.K., J.H. Stock and M.W. Watson. 2020. An Econometric Model of International Growth Dynamics for Long-Horizon Forecasting. *The Review of Economics and Statistics* 0 0:ja, 1-47. https://doi.org/10.1162/rest_a_00997.

National Academies of Sciences, Engineering, and Medicine (National Academies). 2016a. *Assessment of*

Approaches to Updating the Social Cost of Carbon: Phase 1 Report on a Near-Term Update. Washington, D.C.: National Academies Press.

National Academies of Sciences, Engineering, and Medicine (National Academies). 2016b. *Attribution of Extreme Weather Events in the Context of Climate Change*. Washington, DC: The National Academies Press. https://dio.org/10.17226/21852.

National Academies of Sciences, Engineering, and Medicine (National Academies). 2017. *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide*. Washington, D.C.: National Academies Press.

National Academies of Sciences, Engineering, and Medicine (National Academies). 2019. *Climate Change and Ecosystems*. Washington, DC: The National Academies Press. https://doi.org/10.17226/25504.

Neumann, James E., Jacqueline Willwerth, Jeremy Martinich, James McFarland, Marcus C. Sarofim, and Gary Yohe. 2020. Climate Damage Functions for Estimating the Economic Impacts of Climate Change in the United States. *Review of Environmental Economics and Policy*, 14(1): 5-43.

Newell, R., and Pizer, W. 2003. Discounting the distant future: how much do uncertain rates increase valuations? *Journal of Environmental Economics and Management*, 46: 52-71.

New York Department of Environmental Conservation. 2020. Establishing a Value of Carbon: Guidelines for Use

by State Agencies. https://www.dec.ny.gov/docs/administration_pdf/vocfguid.pdf.

Nicholls, Z. R. J., Meinshausen, M., Lewis, J., Gieseke, R., Dommenget, D., Dorheim, K., Fan, C.-S., Fuglestvedt, J. S., Gasser, T., Gol□ke, U., Goodwin, P., Hartin, C., Hope, A. P., Kriegler, E., Leach, N. J., Marchegiani, D., McBride, L. A., Quilcaille, Y., Rogelj, J., Salawitch, R. J., Samset, B. H., Sandstad, M., Shiklomanov, A. N., Skeie, R. B., Smith, C. J., Smith, S., Tanaka, K., Tsutsui, J., and Xie, Z. 2020. Reduced Complexity Model Intercomparison Project Phase 1: introduction and evaluation of global-mean temperature response, Geosci. Model Dev., 13, 5175–5190, https://doi.org/10.5194/gmd-13-5175- 2020.

Nordhaus W. 2008. A Question of Balance: Weighing the Options on Global Warming Policies. New Haven, CT: Yale University Press.

Nordhaus, W. 2010. Economic aspects of global warming in a post-Copenhagen environment.

Proceedings of the National Academy of Sciences, 107(26): 11721-11726.

Nordhaus, W. 2014. Estimates of the Social Cost of Carbon: Concepts and Results from the DICE-2013R Model and Alternative Approaches. *Journal of the Association of Environmental and Resource Economists* 1(1/2): 273-312.

Nordhaus, W.D., 2017. Revisiting the social cost of carbon. *Proceedings of the National Academy of Sciences*, *114*(7), pp.1518-1523.

Nordhaus, W. 2019a. Climate Change: The Ultimate

Challenge for Economics. *American Economic Review* 109(6): 1991–2014.

Nordhaus, W. 2019b. Economics of the Disintegration of the Greenland Ice Sheet. *PNAS* 116(25): 12261– 12269.

Nordhaus W., and Boyer J. 2000. Warming the World: Economic Models of Global Warming. Cambridge, MA: MIT Press.

Office of Management and Budget (OMB). 2003. Circular A-4, Regulatory Analysis, September 17. Available at: http://www.whitehouse.gov/omb/circulars_a004_a-4/ (accessed February 5, 2021).

Pindyck, R. 2017. Comments from Robert Pindyck, to BLM, on the Social Cost of Methane in the Proposed Suspension of the Waste Prevention Rule (submitted Nov. 6, 2017).

Pizer, W. 2019. Valuing the Greenland ice sheet and other complex geophysical phenomena. *PNAS*

116(25): 12134–12135.

Pizer, W., M. Adler, J. Aldy, D. Anthoff, M. Cropper, K. Gillingham, M. Greenstone, B. Murray, R. Newell,

R. Richels, A. Rowell, S. Waldhoff, and J. Wiener. 2014. Using and Improving the Social Cost of Carbon.

Science 346: 1181–82.

Revesz, R., Greenstone, M., Hanemann, M., Livermore, M., Sterner, T., Grab, D., Howard, P. and Schwartz, J. 2017. Best cost estimate of greenhouse gases. *Science*, 357(6352): 655.

Riahi, Keywan, Detlef P. van Vuuren, Elmar Kriegler, Jae Edm□nds, Brian C. O'Neill, Shinichiro Fujimori, Nico

Bauer, Katherine Calvin, Rob Dellink, Oliver Fricko, Wolfgang Lutz, Alexander Popp, Jesus Crespo Cuaresma, Samir KC, Marian Leimbach, Leiwen Jiang, Tom Kram, Shilpa Rao, Johannes Emmerling, Kristie Ebi, Tomoko Hasegawa, Petr Havlik, Florian Humpen□der, Lara Aleluia Da Silva, Steve Smith, Elke, Stehfest, Valentina Bosetti, Jiyong Eom, David Gernaat, Toshihiko Masui, Joeri Rogelj, Jessica Strefler, Laurent Drouet, Volker Krey, Gunnar Luderer, Mathijs Harmsen, Kiyoshi Takahashi, Lavinia Baumstark, Jonathan C. Doelman, Mikiko Kainuma, Zbigniew Klimont, Giacomo Marangoni, Hermann Lotze-Campen, Michael Obersteiner, Andrzej Tabeau, and Massimo Tavoni. 2017. The Shared Socioeconomic Pathways and their energy, land use, and greenhouse gas emissions implications: An overview. *Global Environmental Change,* 42: 153-168.

Rode, A., R. Baker, T. Carleton, A. D'Agostino, M. Delgado, T. Foreman, M. Greenstone, T. Houser, S. Hsiang, A. Hultgren, A. Jina, R. Kopp, K. McCusker, I. Nath, M. Pecenco, J. Rising, and J. Yuan. 2020. Labor Disutility in a Warmer World: The Impact of Climate Change on the Global Workforce.

Rode, A., T. Carleton, M. Delgado, M. Greenstone, T. Houser, S. Hsiang, A. Hultgren, A. Jina, R. Kopp, K. McCusker, I. Nath, J. Rising, and J. Yuan. 2021. Estimating a Social Cost of Carbon for Global Energy Consumption.

Roe, G.H. and Baker, M.B. 2007. Why is climate sensitivity so unpredictable? *Science* 318(5850): 629- 632.

Sandmo, A. and Dreze, J.H. 1971. Discount rates for public investment in closed and open economies. *Economica*

38(152): 395-412.

Schwermer, S., 2012. Economic Valuation of Environmental Damage—Methodolocical Convention 2.0 for Estimates of Environmental Costs. German Federal Environment Agency (UBA): Berlin, Germany.

Smith, C. J., Forster, P. M., Allen, M., Leach, N., Millar, R. J., Passerello, G. A., and Regayre, L. A. 2018. FAIR v1.3: a simple emissions-based impulse response and carbon cycle model. *Geosci. Model Dev.*, 11: 2273- 2297, https://doi.org/10.5194/gmd-11-2273-2018.

Stern, N., and J. Stiglitz. 2021. The Social Cost of Carbon, Risk, Distribution, Market Failures: An Alternative Approach. National Bureau of Economic Research Working Paper Series: No. 28472.

Summers, L. and Zeckhauser, R. 2008. Policymaking for posterity. *Journal of Risk and Uncertainty,* 37(2): 115-140.

Tol, R. 2002a. "Esitmates of the damage costs of climate change. Part I: benchmark estimates."

Environmental and Resource Economics 21:47-73.

Tol, R. 2002b. "Estimates of the damage costs of climate change. Part II: dynamic estimates."

Environmental and Resource Economics 21:135-160.

Tol, R. 2009. "An analysis of mitigation as a response to climate change." Copenhagen Consensus on Climate. Discussion Paper.

U.S. Bureau of Economic Analysis (BEA). Implicit Price Deflators for Gross Domestic Product, Table 1.1.9. https://apps.bea.gov/iTable/index_nipa.cfm (accessed February 10, 2021).

U.S. Congressional Budget Office. 2020. Long Term Budget Outlook. September. https://www.cbo.gov/publication/56516.

U.S. EPA. 2010. Guidelines for Preparing Economic Analyses. EPA-240-R-10-001. Office of the Administrator. December.

U.S. EPA. 2016. Technical Guidance for Assessing Environmental Justice in Regulatory Analysis. Available at: https://www.epa.gov/sites/production/files/2016-06/documents/ejtg_5_6_16_v5.1.pdf

U.S. EPA Science Advisory Board. 2021. SAB Peer Review of the EPA's Revised Guidelines for Preparing Economic Analysis. January 6. Available at: https://yosemite.epa.gov/sab/sabproduct.nsf/LookupWebProjectsCurrentBOARD/61C74C0E14BD5956852586550071E058/$File/EPA-SAB-21-002.pdf .

U.S. Government Accountability Office (GAO). 2014. Regulatory Impact Analysis: Development of Social Cost of Carbon Estimates. GAO-14-663. July. Available at: https://www.gao.gov/products/GAO-14-663 (accessed February 5, 2021).

U.S. Government Accountability Office (GAO). 2020. Social Cost of Carbon: Identifying a Federal Entity to Address the National Academies' Recommendations Could Strengthen Regulatory Analysis. GAO-20-254. Available at: https://www.gao.gov/assets/710/707776.pdf.

U.S. Global Change Research Program (USGCRP). 2016. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J.

Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim,

J. Trtanj, and L. Ziska, Eds. U.S. Global Change Research Program, Washington, DC, 312 pp. https://dx.dio.org/10.7930/J0R49NQX.

U.S. Global Change Research Program (USGCRP). 2018. Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 1515 pp. doi: 10.7930/NCA4.2018.

Weitzman, M.L. 1998. Why the Far-Distant Future Should Be Discounted at Its Lowest Possible Rate.

Journal of Environmental Economics and Management, 36(3): 201-208.

Weitzman, M.L. 1999. Just keep discounting, but. In *Discounting and Intergenerational Equity,* Portney,

P.R. and Weyant, J.P. (Ed.) Resources for the Future, New York.

Weitzman, M.L. 2001. Gamma Discounting. *American Economic Review* 91(1): 260-271.

Whittington and MacRae. 1986. The Issue of Standing in Cost-Benefit Analysis. *Journal of Policy Analysis and Management,* 5(4): 665-682.

Wong, T. E., Bakker, A. M. R., Ruckert, K., Applegate, P., Slangen, A. B. A., and Keller, K. 2017. BRICK v0.2, a simple, accessible, and transparent model framework for

climate and regional sea-level projections. *Geosci. Model Dev.*, 10: 2741–2760, https://doi.org/10.5194/gmd-10-2741-2017.

Yumashev, D., Hope, C., Schaefer, K. et al. 2019. Climate policy implications of nonlinear decline of Arctic land permafrost and other cryosphere elements. *Nat Commun* 10, 1900.

Yumashev, D. 2020. PAGE-ICE Integrated Assessment Model. https://www.researchgate.net/publication/342396462_PAGE-ICE_Integrated_Assessment_Model.

Zero Zone, Inc. v. U.S. Dep't of Energy, 832 F.3d 654 (7th Cir. 2016). Available at: https://casetext.com/case/zero-zone-inc-v-us-dept-of-energy-1 (accessed February 5, 2021).

Appendix – Annual SC-CO2, SC-CH4, and SC-N2O Values, 2020-2050

The values in Tables A-1 through A-3 are the same as those reported in the 2016 TSD and Addendum adjusted for inflation to 2020 dollars using the annual GDP Implicit Price Deflator values in U.S. Bureau of Economic Analysis (BEA) NIPA Table 1.1.9: 113.626 (2020)/ 92.486 (2007) = 1.228575 (U.S. BEA 2021).

Values of SC-CO2 presented in this TSD are rounded to the nearest dollar; SC-CH4 and SC-N2O are rounded to two significant figures. The annual unrounded estimates are available □n OMB's website for use in regulatory and other analyses: https://www.whitehouse.gov/omb/information-regulatory- affairs/regulatory-matters/#scghgs.

Table A-1: Annual SC-CO_2, 2020 – 2050 (in 2020 dollars per metric ton of CO_2)

Emissions Year	Discount Rate and Statistic			
	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020	14	51	76	152
2021	15	52	78	155
2022	15	53	79	159
2023	16	54	80	162
2024	16	55	82	166
2025	17	56	83	169
2026	17	57	84	173
2027	18	59	86	176
2028	18	60	87	180
2029	19	61	88	183
2030	19	62	89	187
2031	20	63	91	191
2032	21	64	92	194
2033	21	65	94	198
2034	22	66	95	202
2035	22	67	96	206
2036	23	69	98	210
2037	23	70	99	213
2038	24	71	100	217
2039	25	72	102	221
2040	25	73	103	225
2041	26	74	104	228
2042	26	75	106	232
2043	27	77	107	235
2044	28	78	108	239
2045	28	79	110	242
2046	29	80	111	246
2047	30	81	112	249
2048	30	82	114	253
2049	31	84	115	256
2050	32	85	116	260

Table A-2: Annual SC-CH_4, 2020 – 2050 (in 2020 dollars per metric ton of CH_4)

Emissions Year	Discount Rate and Statistic			
	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020	670	1500	2000	3900
2021	690	1500	2000	4000
2022	720	1600	2100	4200
2023	750	1600	2100	4300
2024	770	1700	2200	4400
2025	800	1700	2200	4500
2026	830	1800	2300	4700
2027	860	1800	2300	4800
2028	880	1900	2400	4900
2029	910	1900	2500	5100
2030	940	2000	2500	5200
2031	970	2000	2600	5300
2032	1000	2100	2600	5500
2033	1000	2100	2700	5700
2034	1100	2200	2800	5800
2035	1100	2200	2800	6000
2036	1100	2300	2900	6100
2037	1200	2300	3000	6300
2038	1200	2400	3000	6400
2039	1200	2500	3100	6600
2040	1300	2500	3100	6700
2041	1300	2600	3200	6900
2042	1400	2600	3300	7000
2043	1400	2700	3300	7200
2044	1400	2700	3400	7300
2045	1500	2800	3500	7500
2046	1500	2800	3500	7600
2047	1500	2900	3600	7700
2048	1600	3000	3700	7900
2049	1600	3000	3700	8000
2050	1700	3100	3800	8200

Table A-3: Annual SC-N_2O, 2020 – 2050 (in 2020 dollars per metric ton of N_2O)

	Discount Rate and Statistic			
Emissions Year	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020	5800	18000	27000	48000
2021	6000	19000	28000	49000
2022	6200	19000	28000	51000
2023	6400	20000	29000	52000
2024	6600	20000	29000	53000
2025	6800	21000	30000	54000
2026	7000	21000	30000	56000
2027	7200	21000	31000	57000
2028	7400	22000	32000	58000
2029	7600	22000	32000	59000
2030	7800	23000	33000	60000
2031	8000	23000	33000	62000
2032	8300	24000	34000	63000
2033	8500	24000	35000	64000
2034	8800	25000	35000	66000
2035	9000	25000	36000	67000
2036	9300	26000	36000	68000
2037	9500	26000	37000	70000
2038	9800	27000	38000	71000
2039	10000	27000	38000	73000
2040	10000	28000	39000	74000
2041	11000	28000	39000	75000
2042	11000	29000	40000	77000
2043	11000	29000	41000	78000
2044	11000	30000	41000	80000
2045	12000	30000	42000	81000
2046	12000	31000	43000	82000
2047	12000	31000	43000	84000
2048	13000	32000	44000	85000
2049	13000	32000	45000	87000
2050	13000	33000	45000	88000