July 1, 2019

Attn: Alaska District Office, U.S. Army Corps of Engineers

Subject: Failure to monetize greenhouse gases in the Pebble Project Draft Environmental Impact Statement

Submitted by: Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Montana Environmental Information Center, Union of Concerned Scientists[1]

The following comments focus on the failure of the U.S. Army Corps of Engineers (the Corps) to monetize climate damages in the Pebble Project Draft Environmental Impact Statement (DEIS).[2] The Pebble Project is located in Southwest Alaska and consists of a copper-gold-molybdenum porphyry deposit surface mine, a 270-megawatt power generating plant, and a 188-mile natural gas pipeline. The Corps quantifies greenhouse gas emissions from construction, operations and closure of the mine, the proposed pipeline, and the compressor station, but fails to provide a monetized estimate of any of the actual, real-world climate damages those emissions will produce.

The Corps uses faulty reasoning to explain why it chose not to monetize the project's climate effects using the IWG's social cost of greenhouse gases metric. In particular, the Corps acknowledges that the DEIS does not cover "the magnitude of the impacts from [the project's] emissions"[3] and claims that there is "no standard methodology" to assess the physical effects of project-specific greenhouse gas emissions.[4] However, the National Environmental Policy Act (NEPA) in fact requires the Corps to address the magnitude of the project's climate impacts, and a methodology exists to do just that. The Corps should use the Interagency Working Group (IWG)'s social cost of greenhouse gases metric to monetize the damages that will result from the Pebble Project's emissions. If the Corps does not provide additional information to contextualize the project's emissions, it will violate its obligations under NEPA.

These comments make the following points:

1. NEPA require a "reasonably thorough discussion" and "necessary contextual information" on real-world climate impacts and their significance; the social cost of greenhouse gases provides such information;
2. NEPA requires agencies to assess the impacts of emissions, including an assessment of their significance, yet the Corps admittedly fails to assess the magnitude of climate impacts from the DEIS. The social cost of greenhouse gases metric is designed to measure marginal additional damages and is therefore an appropriate and available tool to assess the significance of the emissions from a project like the Pebble Project. Monetizing climate damages will directly contextualize the significance of emissions from the DEIS;
3. The Corps monetized a number of other effects of the program, including tax revenue and royalties, and must give climate effects the same consideration. When an agency monetizes a proposed action's potential benefits—as the Corps does here—the potential climate costs

[1] Our organizations may separately and independently submit other comments on other issues raised by the EA.
[2] U.S. Army Corps of Engineers, Pebble Project Draft Environmental Impact Statement, Feb. 2019 [Hereinafter "DEIS"].
[3] Id.
[4] DEIS at 4-20.3.

must be treated with proportional rigor. Additionally, simply because not every effect can be monetized does not mean that monetization is not a useful analytical tool.

4. The Corps must assess the significance of climate damages from not just carbon dioxide emissions but also methane and nitrous oxide emissions, and so the Corps should use the social cost of methane and nitrous oxide metrics as well as the social cost of carbon metrics.

We explain each of these points in turn below.

I. The Corps Must Monetize the Social Cost of Greenhouse Gases in Its EA

The National Environmental Policy Act (NEPA), the statute under which environmental impact statements are required, directs agencies to fully and accurately analyze the environmental, public health, and social welfare differences between proposed alternatives, and to contextualize that information for decision-makers and the public. NEPA requires a more searching analysis than merely disclosing the amount of pollution. Rather, the Corps must examine the "ecological[,]… economic, [and] social" impacts of those emissions, including an assessment of their "significance."[5] By failing to use available tools, such as the social cost of carbon, to analyze the significance of emissions, the Corps has violated NEPA.

Monetizing Climate Damages Fulfills the Obligations and Goals of NEPA

When a project has climate consequences that must be assessed under NEPA, monetizing the climate damages fulfills an agency's legal obligations under NEPA in ways that simple quantification of tons of greenhouse gas emissions cannot. NEPA requires "hard look" consideration of beneficial and adverse effects of each alternative option for major federal government actions. The U.S. Supreme Court has called the disclosure of impacts the "key requirement of NEPA," and held that agencies must "consider and disclose the *actual environmental effects*" of a proposed project in a way that "brings those effects to bear on [the agency's] decisions."[6] Courts have repeatedly concluded that an environmental impact statement must disclose relevant climate effects.[7] NEPA requires "a reasonably thorough discussion of the significant aspects of the probable environmental consequences," to "foster both informed decisionmaking and informed public participation."[8] In particular, "[t]he impact of greenhouse gas emissions on climate change is precisely the kind of cumulative impact analysis that NEPA requires," and it is arbitrary to fail to "provide the necessary contextual information about the cumulative and incremental environmental impacts."[9] Furthermore, the analyses included in environmental assessments and impact statements "cannot be misleading."[10] An agency must provide sufficient

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[5] 40 C.F.R. §§ 1508.8(b), 1502.16(a)-(b).

[6] *Baltimore Gas & Elec. Co. v. Natural Res. Def. Council*, 462 U.S. 87, 96 (1983) (emphasis added); *see also* 40 C.F.R. § 1508.8(b) (requiring assessment of the "ecological," "economic," "social," and "health" "*effects*") (emphasis added).

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

[8] *Ctr. for Biological Diversity*, 538 F.3d at 1194 (citations omitted).

[9] *Id.* at 1217.

[10] *High Country Conservation Advocates v. U.S. Forest Service*, 52 F. Supp. 3d 1174, 1182 (D. Colo. 2014); *accord. Johnston v. Davis*, 698 F.2d 1088, 1094-95 (10th Cir. 1983) (disapproving of "misleading" statements resulting in "an unreasonable comparison of alternatives"); *Hughes River Watershed Conservancy v. Glickman*, 81 F.3d 437, 446 (4th Cir. 1996) ("For an EIS to serve these functions" of taking a hard look and allowing the public to play a role in decisionmaking, "it is essential that the EIS not be based on misleading economic assumptions"); *see also Sierra Club v. Sigler*, 695 F.2d 957, 979 (5th Cir. 1983) (holding that an agency's "skewed cost-benefit analysis" was "deficient under NEPA"); *see generally Bus. Roundtable v. SEC*, 647 F.3d

informational context to ensure that decisionmakers and the public will not misunderstand or overlook the magnitude of a proposed action's climate risks compared to the no action alternative. As this section explains, by only quantifying the volume of greenhouse gas emissions, agencies fail to assess and disclose the actual climate consequences of an action and misleadingly present information in ways that will cause decisionmakers and the public to overlook important climate consequences. Using the social cost of greenhouse gas metrics to monetize climate damages fulfills NEPA's legal obligations in ways that quantification alone cannot.

The Corps Must Assess Actual Incremental Climate Impacts, Not Just the Volume of Emissions

The tons of greenhouse gases emitted by a project are not the "actual environmental effects" under NEPA. Rather, the actual effects and relevant factors are the incremental climate impacts caused by those emissions, including:[11]

- property lost or damaged by sea-level rise, coastal storms, flooding, and other extreme weather events, as well as the cost of protecting vulnerable property and the cost of resettlement following property losses;
- changes in energy demand, from temperature-related changes to the demand for cooling and heating;
- lost productivity and other impacts to agriculture, forestry, and fisheries, due to alterations in temperature, precipitation, CO_2 fertilization, and other climate effects;
- human health impacts, including cardiovascular and respiratory mortality from heat-related illnesses, changing disease vectors like malaria and dengue fever, increased diarrhea, and changes in associated pollution;
- changes in fresh water availability;
- ecosystem service impacts;
- impacts to outdoor recreation and other non-market amenities; and
- catastrophic impacts, including potentially rapid sea-level rise, damages at very high temperatures, or unknown events.

Even in combination with a general, qualitative discussion of climate change, by calculating only the tons of greenhouse gases emitted or a percent comparison to sectoral or national emissions, an agency fails to meaningfully assess the actual incremental impacts to property, human health, productivity, and so

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1144, 1148-49 (D.C. Cir. 2011) (criticizing an agency for "inconsistently and opportunistically fram[ing] the costs and benefits of the rule" and for "fail[ing] adequately to quantify the certain costs or toe explain why those costs could not be quantified").

[11] These impacts are all included to some degree in the three integrated assessment models (IAMs) used by the IWG (namely, the DICE, FUND, and PAGE models), though some impacts are modeled incompletely, and many other important damage categories are currently omitted from these IAMs. *Compare* Interagency Working Group on the Social Cost of Carbon, *Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis* at 6-8, 29-33 (2010), https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/for-agencies/Social-Cost-of-Carbon-for-RIA.pdf [hereinafter 2010 TSD]; *with* Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* (Cost of Carbon Project Report, 2014), http://costofcarbon.org/files/Omitted_Damages_Whats_Missing_From_the_Social_Cost_of_Carbon.pdf. For other lists of actual climate effects, including air quality mortality, extreme temperature mortality, lost labor productivity, harmful algal blooms, spread of west nile virus, damage to roads and other infrastructure, effects on urban drainage, damage to coastal property, electricity demand and supply effects, water supply and quality effects, inland flooding, lost winter recreation, effects on agriculture and fish, lost ecosystem services from coral reefs, and wildfires, *see* EPA, *Multi-Model Framework for Quantitative Sectoral Impacts Analysis: A Technical Report for the Fourth National Climate Assessment* (2017); U.S. Global Change Research Program, *Climate Science Special Report: Fourth National Climate Assessment* (2017); EPA, *Climate Change in the United States: Benefits of Global Action* (2015); Union of Concerned Scientists, *Underwater: Rising Seas, Chronic Floods, and the Implications for U.S. Coastal Real Estate* (2018).

forth.[12] An agency therefore falls short of its legal obligations and statutory objectives by focusing just on volume estimates. Similarly, courts have held that just quantifying the acres of timber to be harvested or the miles of road to be constructed does not constitute a "description of *actual* environmental effects," even when paired with a qualitative "list of environmental concerns such as air quality, water quality, and endangered species," when the agency fails to assess "the degree that each factor will be impacted."[13]

By monetizing climate damages using the social cost of greenhouse gas metrics, the Corps can satisfy the legal obligations and statutory goals to assess the incremental and actual effects bearing on the public interest. The social cost of greenhouse gas methodology calculates how the emission of an additional unit of greenhouse gases affects atmospheric greenhouse concentrations, how that change in atmospheric concentrations changes temperature, and how that change in temperature incrementally contributes to the above list of economic damages, including property damages, energy demand effects, lost agricultural productivity, human mortality and morbidity, lost ecosystem services and non-market amenities, and so forth.[14] The social cost of greenhouse gas tool therefore captures the factors that actually affect public welfare and assesses the degree of impact to each factor, in ways that just estimating the volume of emissions cannot.

Climate Damages Depend on Stock and Flow, But Volume Estimates Only Measure Flow

The climate damage generated by each additional ton of greenhouse gas emissions depends on the background concentration of greenhouse gases in the global atmosphere. Once emitted, greenhouse gases can linger in the atmosphere for centuries, building up the concentration of radiative-forcing pollution and affecting the climate in cumulative, non-linear ways.[15] As physical and economic systems become increasingly stressed by climate change, each marginal additional ton of emissions has a greater, non-linear impact. The climate damages generated by a given amount of greenhouse pollution is therefore a function not just of the pollution's total volume but also the year of emission, and with every passing year an additional ton of emissions inflicts greater damage.[16]

As a result, focusing just on the volume or rate of emissions, as the Corps does here,[17] is insufficient to reveal the incremental effect on the climate. The change in the rate of emissions (flow) must be assessed given the background concentration of emissions (stock). A percent comparison to national emissions is perhaps even more misleading. A project that adds 23 million additional tons per year of carbon dioxide would have contributed to 0.43% of total U.S. carbon dioxide emissions in the year 2012.[18] In the year 2014, that same project with the same carbon pollution would have contributed to

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[12] *See High Country*, 52 F. Supp. 3d at 1190 ("Beyond quantifying the amount of emissions relative to state and national emissions and giving general discussion to the impacts of global climate change, [the agencies] did not discuss the impacts caused by these emissions."); *Mont. Envtl. Info. Ctr. v. U.S. Office of Surface Mining*, 274 F. Supp. 3d 1074, 1096–99 (D. Mont. 2017) (rejecting the argument that the agency "reasonably considered the impact of greenhouse gas emissions by quantifying the emissions which would be released if the [coal] mine expansion is approved, and comparing that amount to the net emissions of the United States").

[13] *Klamath-Siskiyou Wildlands Ctr. v. Bureau of Land Mgmt.*, 387 F.3d 989, 995 (9th Cir. 2004) ("A calculation of the total number of acres to be harvested in the watershed is . . . not a sufficient description of the actual environmental effects that can be expected from logging those acres."); *see also Oregon Natural Res. Council v. Bureau of Land Mgmt.*, 470 F.3d 818 (9th Cir. 2006).

[14] 2010 TSD, *supra* note 11, at 5.

[15] Carbon dioxide also has cumulative effects on ocean acidification, in addition to cumulative radiative-forcing effects.

[16] *See* 2010 TSD, *supra* note 11, at 33 (explaining that the social cost of greenhouse gas estimates grow over time).

[17] DEIS at 4.20-3.

[18] Total U.S. carbon dioxide emissions in 2012 were 5,366.7 million metric tons (for all greenhouse gases, emissions were 6,529 MMT CO2 eq). *See* EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2016* at ES-6, tbl. ES-2 (2018).

just 0.41% of total U.S. carbon dioxide emissions—a seemingly smaller relative effect, since the total amount of U.S. emissions increased from 2012 to 2014.[19] However, because of rising background concentrations of global greenhouse gas stock, and because of growing stresses in physical and economic systems, the marginal climate damages per ton of carbon dioxide (as measured by the social cost of carbon) increased from $33 in 2012 to $35 in 2014 (in 2007$).[20] Consequently, those 23 million additional tons would have caused marginal climate damages costing $759 million in the year 2012, but by 2014 that same 23 million tons would have caused $805 million in climate damages. To summarize: the percent comparison to national emissions misleadingly implied that a project adding 23 million more tons of carbon dioxide would have a relatively less significant effect in 2014 than in 2012, whereas monetizing climate damages would accurately reveal that the emissions in 2014 were much more damaging than the emissions in 2012—almost $50 million more.

Capturing how marginal climate damages change as the background concentration changes is especially important because NEPA requires assessing both present and future impacts.[21] Different project alternatives can have different greenhouse gas consequences over time. Most simply, different alternatives could have different start dates or other consequential changes in timing. Calculating volumes or percentages, especially on an average annual basis, is insufficient to accurately compare the climate damages of project alternatives with varying greenhouse gas emissions over time.

By factoring in projections of the increasing global stock of greenhouse gases as well as increasing stresses to physical and economic systems, the social cost of greenhouse gas metrics enable accurate and transparent comparisons of projects with varying greenhouse gas emissions over time.

Monetization Provides the Required Informational Context that Volume Estimates Lack

NEPA requires sufficient informational context. The Corps admittedly fails to give any context to the project's emissions, conceding it makes no assessment of the "magnitude" of the project's climate impacts.[22] Without proper context, numbers like the 937,865 tons of greenhouse gases per year from operating the mine site, transportation corridor, port, and compressor station[23] will be misinterpreted by people as meaningless, as having zero effect on climate. Indeed, in a country of over 300 million people and over 6.5 billion tons of annual greenhouse gas emissions, it is far too easy to make highly significant effects appear relatively trivial.[24] For example, presenting all weather-related deaths as less than 0.1% of total U.S. deaths makes the risk of death by weather event sound trivial, but in fact that

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[19] Total U.S. carbon dioxide emissions in 2014 were 5,568.8 million metric tons (and for all greenhouse gases, 6,763 MMT CO2 eq.) *Id.*

[20] Interagency Working Group on the Social Cost of Greenhouse Gases, *Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis* at 25 tbl. A1 (2016) (calculating the central estimate at a 3% discount rate), https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/scc_tsd_final_clean_8_26_16.pdf [hereinafter 2016 TSD].

[21] NEPA requires agencies to weigh the "relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity," as well as "any irreversible and irretrievable commitments of resources." 42 U.S.C. § 4332(2)(C).

[22] DEIS at 4.20-3.

[23] DEIS at 4.20-6, 4.20-10, 4.20-14, 4.20-17.

[24] California CEQA guidance, "A project's incremental contribution may be cumulatively considerable even if it appears relatively small compared to statewide, national or global emissions." Final Adopted Text for Revisions to the CEQA Guidelines, *available at* https://perma.cc/P4S7-XAMF [http://resources.ca.gov/ceqa/docs/2018_CEQA_FINAL_TEXT_122818.pdf].

figure represents over 2,000 premature deaths per year[25]—hardly an insignificant figure.[26] As the U.S. Court of Appeals for the Fifth Circuit recently observed, even a seemingly "very small portion" of a "gargantuan source of [harmful] pollution" may nevertheless "constitute[ ] a gargantuan source of [harmful] pollution on its own terms."[27] In other words, percentages can be misleading and can be manipulated by the choice of the denominator; what matters is the numerator's actual contribution to total harm.

Economic theory explains why monetization is a much better tool than volume estimates or percent comparisons to provide the necessary contextual information on climate damages. Here, the Corps never even tallies all greenhouse emissions from the project, instead reporting piecemeal estimates: 23 thousand tons here from transportation corridor emissions, 25 thousand tons there from compressor operations.[28] As the Environmental Protection Agency's website explains, "abstract measurements" of so many tons of greenhouse gases can be rather inscrutable for the public, unless "translat[ed] . . . into concrete terms you can understand."[29] Abstract volume estimates fail to give people the required informational context due to another well-documented mental heuristic called "scope neglect." Scope neglect, as explained by Nobel laureate Daniel Kahneman, among others, causes people to ignore the size of a problem when estimating the value of addressing the problem. For example, in one often-cited study, subjects were unable to meaningfully distinguish between the value of saving 2,000 migratory birds from drowning in uncovered oil ponds, as compared to saving 20,000 birds.[30]

By failing to contextualize greenhouse gas emissions in the DEIS, the Corps potentially misleads the reader into believing that there would be no climate effects from the Pebble Project. Scope neglect means many decisionmakers and members of the public would be unable to meaningfully distinguish between the climate risks of 23 thousand tons from one source versus 25 thousand tons from another source. While decisionmakers and the public certainly can discern that one number is higher, without any context it may be difficult to weigh the relative magnitude of the climate risks. In contrast, the different climate risks would have been readily discernible through application of the social cost of greenhouse gas metrics. In this example, while the various sources of operational emission may all individually seem trivial, in fact the total 937,865 tons per year in operational emissions will inflict over $47 million in climate damages each year.[31]

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[25] *Compare* Nat'l Ctr. for Health Stat., Ctrs. for Disease Control & Prevention, *Death Attributed to Heat, Cold, and Other Weather Events in the United States, 2006-2010* at 1 (2014) (reporting about 2000 weather-related deaths per year) *with* Nat'l Ctr. for Health Stat., *Deaths and Mortality*, https://www.cdc.gov/nchs/fastats/deaths.htm (reporting about 2.7 million U.S. deaths per year total).

[26] The public willingness to pay to avoid mortality is typically estimated at around $9.6 million (in 2016$). E.g., 83 Fed. Reg. 12,086, 12,098 (Mar. 19, 2018) (U.S. Coast Guard rule using the Department of Transportation's value of statistical life in a recent analysis of safety regulations). Losing 2,000 lives prematurely to weather-related events is equivalent to a loss of public welfare worth over $19 billion per year.

[27] *Southwestern Elec. Power Co. v. EPA*, No. 15-60821, 2019 WL 1577740 at *22 (5th Cir., Apr. 12, 2019).

[28] DEIS at 4.20-10, 4.20-17.

[29] EPA, *Greenhouse Gas Equivalencies Calculator*. *Available at* https://web.archive.org/web/20180212182940/ https:/www.epa.gov/energy/greenhouse-gas-equivalencies-calculator (last updated Sept. 2017) ("Did you ever wonder what reducing carbon dioxide (CO_2) emissions by 1 million metric tons means in everyday terms? The greenhouse gas equivalencies calculator can help you understand just that, translating abstract measurements into concrete terms you can understand.").

[30] Daniel Kahneman et al., *Economic Preferences or Attitude Expressions? An Analysis of Dollar Responses to Public Issues*, 19 J. Risk & Uncertainty 203, 212-213 (1999).

[31] 2016 TSD (social cost of carbon at $51/metric ton CO_2e).

In general, non-monetized effects are often irrationally treated as worthless.[32] On several occasions, courts have struck down administrative decisions for failing to give weight to non-monetized effects.[33] Most relevantly, in *Center for Biological Diversity v. NHTSA*, the U.S. Court of Appeals for the Ninth Circuit found it arbitrary and capricious to give zero value "to the most significant benefit of more stringent [fuel economy] standards: reduction in carbon emissions."[34] Monetizing climate damages provides the informational context required by NEPA, whereas a simple tally of emissions volume and rote, qualitative, generic description of climate change are misleading and fail to give the public and decisionmakers the required information about the magnitude of discrete climate effects.[35]

Climate Effects Must Be Monetized If Other Costs and Benefits Are Monetized

Though NEPA does not always require a full and formal cost-benefit analysis,[36] agencies' approaches to assessing costs and benefits must be balanced and reasonable. Courts have warned agencies, for example, that "[e]ven though NEPA does not require a cost-benefit analysis," an agency cannot selectively monetize benefits in support of its decision while refusing to monetize the costs of its action.[37]

In *High Country Conservation Advocates v. Forest Service*, the U.S. District Court of Colorado found that it was "arbitrary and capricious to quantify the *benefits* of the lease modifications and then explain that a similar analysis of the *costs* was impossible when such an analysis was in fact possible."[38] The court explained that, to support a decision on coal mining activity, the agencies had "weighed several specific economic benefits—coal recovered, payroll, associated purchases of supplies and services, and royalties," but arbitrarily failed to monetized climate costs using the readily available social cost of carbon protocol.[39] Similarly, in *Montana Environmental Information Center v. Office of Surface Mining* (*MEIC v. OSM*), the U.S. District Court of Montana followed the lead set by *High Country* and likewise held an environmental assessment to be arbitrary and capricious because it quantified the benefits of action (such as employment payroll, tax revenue, and royalties) while failing to use the social cost of carbon to quantify the costs.[40]

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[32] Richard Revesz, *Quantifying Regulatory Benefits*, 102 Cal. L. Rev. 1424, 1434-35, 1442 (2014).

[33] *See id.* at 1428, 1434.

[34] 538 F.3d at 1199.

[35] *See* 42 U.S.C. § 4332(2)(B) (requiring agencies to "identify and develop methods and procedures . . . which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decisionmaking along with economic and technical considerations").

[36] 40 C.F.R. § 1502.23 ("[T]he weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis."); *but see e.g.*, *Sierra Club v. Sigler*, 695 F.2d 957, 978-79 (5th Cir. 1983) (holding that NEPA "mandates at least a broad, informal cost-benefit analysis," and so agencies must "fully and accurately" and "objectively" assess environmental, economic, and technical costs); *Chelsea Neighborhood Ass'ns v. U.S. Postal Serv.*, 516 F.2d 378, 387 (2d Cir. 1975) ("NEPA, in effect, requires a broadly defined cost-benefit analysis of major federal activities."); *Calvert Cliffs' Coordinating Comm. v. U.S. Atomic Energy Comm'n*, 449 F.2d 1109, 1113 (D.C. Cir. 1971) ("NEPA mandates a rather finely tuned and 'systematic' balancing analysis" of "environmental costs" against "economic and technical benefits"); *Nat'l Wildlife Fed. v. Marsh*, 568 F. Supp. 985, 1000 (D.D.C. 1983) ("The cost-benefit analysis of NEPA is concerned primarily with environmental costs. . . . A court may examine the cost-benefit analysis only as it bears upon the function of insuring that the agency has examined the environmental consequences of a proposed project.").

[37] *High Country Conservation Advocates*, 52 F. Supp. 3d at 1191; *accord. MEIC v. Office of Surface Mining*, 274 F. Supp. 3d at 1094-99 (holding it was arbitrary for the agency to quantify benefits in an EIS while failing to use the social cost of carbon to quantify costs, as well as arbitrary to imply there would be no effects from greenhouse gas emissions).

[38] 52 F. Supp. 3d at 1191.

[39] *Id.*

[40] 274 F. Supp. 3d at 1094-99 (also holding that it was arbitrary to imply that there would be zero effects from greenhouse gas emissions).

High Country and *MEIC v. OSM* were simply the latest applications of a broader line of case law in which courts find it arbitrary and capricious to apply inconsistent protocols for analyzing some effects compared to others, especially when the inconsistency obscures some of the most significant effects.[41] For example, in *Center for Biological Diversity v. National Highway Traffic Safety Administration*, the U.S. Court of Appeals for the Ninth Circuit ruled that, because the agency had monetized other uncertain costs and benefits of its vehicle fuel efficiency standard—like traffic congestion and noise costs—its "decision not to monetize the benefit of carbon emissions reduction was arbitrary and capricious."[42] Specifically, it was arbitrary to "assign[ ] no value to *the most significant benefit* of more stringent [vehicle fuel efficiency] standards: reduction in carbon emissions."[43] When an agency bases a decision on cost-benefit analysis, it is arbitrary to "put a thumb on the scale by undervaluing the benefits and overvaluing the costs."[44] Similarly, the U.S. Court of Appeals for the District of Columbia Circuit has chastised agencies for "inconsistently and opportunistically fram[ing] the costs and benefits of the rule [and] fail[ing] adequately to quantify certain costs or to explain why those costs could not be quantified"[45]; and the U.S. Court of Appeals for the Tenth Circuit has remanded an environmental impact statement because "unrealistic" assumptions "misleading[ly]" skewed comparison of the project's positive and negative effects.[46]

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[41] Other cases from different courts that have declined to rule against failures to use the social cost of carbon in NEPA analyses are all distinguishable by the scale of the action or by whether other effects were quantified and monetized in the analysis. *See League of Wilderness Defenders v. Connaughton*, No. 3:12-cv-02271-HZ (D. Ore., Dec. 9, 2014*); EarthReports v. FERC*, 15-1127, (D.C. Cir. July 15, 2016); *WildEarth Guardians v. Zinke*, 1:16-CV-00605-RJ, at 23-24, (D. N.M. Feb. 16, 2017).

In *WildEarth Guardians v. Zinke*, while the U.S. District Court for the District of Columbia stopped short of requiring BLM to use the social cost of carbon, it issued its holding on very narrow grounds. Specifically, the court declined to side with plaintiffs that "it was arbitrary and capricious for BLM to discuss the economic benefits of oil and gas drilling without quantifying their economic costs" by using the social cost of carbon protocol. No. 16-1724, 2019 WL 1273181, *22 (D.D.C. Mar. 19, 2019). However, the court did *not* hold that BLM's acted consistently in choosing to monetize benefits without monetizing costs; rather, it held that BLM's treatment of economic benefits was so "sparse[]" and "cursory" that the precedent established in *High Country Conservation Advocates v. Forest Service* could be differentiated. *Id*. But several important distinguishing arguments apply. First, the inconsistent treatment of costs and benefits is not the only reason why agencies should use the social cost of greenhouse gases to assess climate damages in NEPA reviews. The court never considered whether using the social cost of greenhouse gases was necessary or appropriate to fulfill the obligations and goals of NEPA: to assess a project's actual real-world impacts, to weigh the intensity and significance of a project's contributions to such impacts, and to give meaningful context to the information presented. Second, the court's consideration was incomplete on the issue of inconsistent treatment of costs and benefits. It is not clear why the paltry size of the lease's economic benefits should excuse BLM from inconsistently treating costs and failing to apply a readily available and easy-to-use tool to monetize the lease's hugely significant climate costs. *High Country*'s ruling turned not on the size of the monetized benefits but on the inconsistent treatment of costs and benefits. Furthermore, the court overlooked other portions of the original EAs and the tiered EISs that monetized and relied on larger economic benefits to much greater extent. Thus, the court's attempts to distinguish *High Country* do not hold up. The D.C. District Court also deferred to BLM's so-called "reasoned explanations," *id.* at *23, yet failed to recognize that in *High Country*, the District of Colorado also considered and dismissed the post-hoc attempt to argue that the social cost of carbon protocol was too imprecise or controversial to use because of the range of estimates. 52 F. Supp. 3d 1174, 1192 (D. Colo. 2014). Finally, the court in *WildEarth v. Zinke* never discussed other important case law, such as *MEIC v. OSM*. Ultimately, the court instructed BLM on remand to "reassess" whether the social cost of greenhouse gas protocol would "contribute to informed decisionmaking" and ensure more accurate analysis as required by NEPA, *id.* at n.31. The court believed that "the protocol may one day soon be a necessary component of NEPA analyses," *id.*—and, indeed, that day has already arrived.

[42] 538 F.3d 1172, 1203 (9th Cir. 2008).

[43] *Id.* at 1199.

[44] *Id.* at 1198.

[45] *Bus. Roundtable v. SCC*, 647 F.3d 1144, 1148-49 (D.C. Cir. 2011)

[46] *Johnston v. Davis*, 698 F.2d 1088, 1094–95 (10th Cir. 1983)

The DEIS monetizes economic benefits similar to those highlighted in *High Country* and *MEIC*, including government revenues, such as taxes and royalties.[47] Moreover, the DEIS characterizes a number of economic effects as "benefits"[48] and as "significant."[49] Touting the project's monetized benefits while failing to assess the project's monetized climate damages is irrational when an accepted tool for monetizing climate damages exists.

II. The Social Cost of Greenhouse Gas Metric Is Appropriate for a Plan with Emissions of this Magnitude

The DEIS claims that "no standard methodology currently exists to assess how a proposed project's GHG emissions would translate into physical effects in the analysis area."[50] The DEIS goes on to state that "while the project's direct GHG emissions are presented for Alternative 1; the magnitude of the impacts from those emissions is not addressed."[51] The Corps only quantifies the emissions.[52] Yet, the social cost of greenhouse gas protocol is exactly such a tool to monetize the incremental climate impacts of specific projects or plans, and to contextualize the magnitude of those impacts. NEPA requires the Corps to use its judgment and available tools, and the agency cannot use uncertainty as a red herring to escape its statutory obligations.

Monetization Is Appropriate and Useful in Any Decision with Significant Climate Impacts, Not Just Regulations

Though the federal Interagency Working Group on the Social Cost of Greenhouse Gases originally developed its estimates of the social cost of greenhouse gases to harmonize the metrics used by agencies in their various regulatory impact analyses, there is nothing in the numbers' development that would limit applications to other decisionmaking contexts. The social cost of greenhouse gases measures the marginal cost of any additional unit of greenhouse gases emitted into the atmosphere. The government action that precipitated that unit of emissions—a regulation, the granting of a permit, or a project approval—is irrelevant to the marginal climate damages caused by the emissions. Whether emitted by a leaking pipeline or the extraction process, whether emitted because of a regulation or a resource management decision, whether emitted in Alaska or Maine, the marginal climate damages per

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[47] DEIS at 4.3-8 to 4.3-9.

[48] See e.g. DEIS at 4.3-9, discussing right of way acquisition benefits: "These benefits would be certain to occur if the project is permitted and the transportation corridor and pipeline are constructed." *See also id.* (estimating the "magnitude of the [royalty] benefit would be $21 million annually in state royalty payments during the operations phase. The duration of this benefit would be long term; it would be certain to occur if the project is permitted and built.").

[49] *Id.* (calling the "project benefits" from severance taxes a "significant increase in revenue").

[50] DEIS at 4.20-3.

[51] DEIS at 4.20-3.

[52] DEIS at 4.20-5 – 4.20.17.

unit of emissions remain the same. Indeed, the social cost of greenhouse gases has been used by many federal and state agencies in environmental impact reviews[53] and in resource management decisions.[54]

The Social Cost of Greenhouse Gas Metrics Provides a Tool to Assess the Significance of Individual Physical Impacts

The social cost of greenhouse gas methodology is well suited to measure the marginal climate damages of individual projects. These protocols were developed to assess the cost of actions with "marginal" impacts on cumulative global emissions, and the metrics estimate the dollar figure of damages for one extra unit of greenhouse gas emissions. This marginal cost is calculated using integrated assessment models. These models translate emissions into changes in atmospheric greenhouse concentrations, atmospheric concentrations into changes in temperature, and changes in temperature into economic damages. A range of plausible socio-economic and emissions trajectories are used to account for the scope of potential scenarios and circumstances that may actually result in the coming years and decades. The marginal cost is attained by first running the models using a baseline emissions trajectory, and then running the same models again with one additional unit of emissions. The difference in damages between the two runs is the marginal cost of one additional unit. The approach assumes that the marginal damages from increased emissions will remain constant for small emissions increases relative to gross global emissions. In other words, the monetization tools are in fact perfectly suited to measuring the marginal effects of individual projects or other discrete agency actions.

Some of the incremental impacts on the environment that the social cost of greenhouse gas protocol captures—and which the DEIS fails to meaningfully analyze—include property lost or damaged; impacts to agriculture, forestry, and fisheries; impacts to human health; changes in fresh water availability; ecosystem service impacts; impacts to outdoor recreation and other non-market amenities; and some catastrophic impacts, including potentially rapid sea-level rise, damages at very high temperatures, or unknown events.[55] A key advantage of using the social cost of greenhouse gas tool is that each physical

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[53] For example, in August 2017, the Bureau of Ocean Energy Management called the social cost of carbon "a useful measure to assess the benefits of CO2 reductions and inform agency decisions," and applied the metric in an environmental impact statement to monetize the emissions difference of about 5 million metric tons per year between the proposed oil and gas development project and the no-action baseline, *Draft Environmental Impact Statement—Liberty Development Project in the Beaufort Sea, Alaska* at 3-129, 4-50 (2017). More generally, agencies have used IWG's social cost of greenhouse gas estimates not only in scores of rulemakings but also in NEPA analyses for resource management decisions. *See* Peter Howard & Jason Schwartz, *Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon*, 42 Columbia J. Envtl. L. 203, 270-84 (2017) (listing all uses by federal agencies through July 2016).

[54] States have used the social cost of greenhouse gases in decisions about electricity planning. *See* Iliana Paul et al., *The Social Cost of Greenhouse Gases and State Policy: A Frequently Asked Questions Guide* (Policy Integrity Report, 2017), http://policyintegrity.org/files/publications/SCC_State_Guidance.pdf.

[55] These impacts are all included to some degree in the three integrated assessment models (IAMs) used by the IWG (namely, the DICE, FUND, and PAGE models), though some impacts are modeled incompletely, and many other important damage categories are currently omitted from these IAMs. *Compare* Interagency Working Group on the Social Cost of Carbon, *Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis* at 6-8, 29-33 (2010), https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/for-agencies/Social-Cost-of-Carbon-for-RIA.pdf [hereinafter 2010 TSD]; *with* Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* (Cost of Carbon Project Report, 2014), http://costofcarbon.org/files/Omitted_Damages_Whats_Missing_From_the_Social_Cost_of_Carbon.pdf. For other lists of actual climate effects, including air quality mortality, extreme temperature mortality, lost labor productivity, harmful algal blooms, spread of West Nile virus, damage to roads and other infrastructure, effects on urban drainage, damage to coastal property, electricity demand and supply effects, water supply and quality effects, inland flooding, lost winter recreation, effects on agriculture and fish, lost ecosystem services from coral reefs, and wildfires, *see* EPA, *Multi-Model Framework for Quantitative Sectoral Impacts Analysis: A Technical Report for the Fourth National Climate Assessment* (2017); U.S. Global Change Research Program, *Climate Science Special Report: Fourth National Climate Assessment* (2017); EPA, *Climate Change in the United States: Benefits of Global Action* (2015); Union of Concerned Scientists, *Underwater: Rising Seas, Chronic Floods, and the Implications for U.S. Coastal Real Estate* (2018).

impact—such as sea-level rise and increasing temperatures—need not be assessed in isolation. Instead, the social cost of greenhouse gas tool conveniently groups together the multitude of climate impacts and, consistent with NEPA regulations,[56] enables agencies to assess whether all those impacts are cumulatively significant and to then compare those impacts with other impacts or alternatives using a common metric.

The Tons of Greenhouse Gas Emissions at Stake Here Are Clearly Significant

The Corps quantifies greenhouse gas emissions from this project as including hundreds of thousands of metric tons per year from operation.[57] But the Corps refuses to take the straightforward next step of applying the social cost of greenhouse gas values to those quantified tons. Furthermore, the Corps claims that it is unable to determine the effects of the project on climate change[58] and it minimizes the possible significance of the project's emissions by dismissing them as only part of the global concentration of greenhouse gas emissions, further saying that "project GHG emissions will become well mixed in the atmosphere and transported globally without directly causing short-term and local impacts."[59]

While there may not be a bright-line test for significance, the emissions the Corps estimates for this project are significant and warrant monetization. This is especially true since, once emissions have been quantified, the additional step of monetization through application of the Interagency Working Group's 2016 estimates entails a simple arithmetic calculation.[60] It is difficult to understand how NEPA's mandate that an agency take a "hard look" at the environmental impacts of its actions can be satisfied if the Corps fails to analyze the impacts of the greenhouse gas emissions that it quantifies.

In *High Country*, the District Court for the District of Colorado found that it was arbitrary for the Forest Service not to monetize the "1.23 million tons of carbon dioxide equivalent emissions [from methane] the West Elk mine emits annually."[61] The emissions at stake from this project are of comparable size.[62] In *MEIC v. OSM*, the District Court for the District of Montana found it was arbitrary for the Office of Surface Mining not to monetize the 23.16 million metric tons, which constituted "approximately 0.35 percent of the total U.S. emissions."[63] In *Center for Biological Diversity*, the Ninth Circuit found that it was arbitrary for the Department of Transportation not to monetize the 35 million metric ton difference in lifetime emissions from increasing the fuel efficiency of motor vehicles:[64] given the estimated lifetime of vehicles sold in the years 2008-2011 (sometimes estimated at about 15 years on average), this could represent as little 2 million metric tons per year. In a recent environmental impact statement from the Bureau of Ocean Energy Management published in August 2017, the agency explained that the social cost of carbon was "a useful measure" to apply to a NEPA analysis of an action anticipated to have a difference in greenhouse gas emissions compared to the no-action baseline of about 25 million metric

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[56] 40 C.F.R. § 1508.27(b)(7) (explaining that actions can be significant if related to individually insignificant but cumulatively significant impacts).

[57] DEIS at 4.20-5 – 4.20-7.

[58] DEIS at 4.20-3.

[59] DEIS at 4.20-3.

[60] Agencies simply need to multiply their estimate of tons in each year by the IWG's 2016 values for the corresponding year of emissions (adjusted for inflation to current dollars). If the emissions change occurs in the future, agencies would then discount the products back to present value.

[61] 52 F. Supp. 3d at 1191 (quoting an e-mail comment on the draft statement for the quantification of tons).

[62] See EA at 4.20-5 – 4.20 – 17. Operational emissions alone are expected to be approximately 940,000 tons of CO_2e annually.

[63] *MEIC v. Office of Surface Mining* at 36-37.

[64] 538 F.3d at 1187.

tons over a 5-year period,[65] or about 5 million metric tons per year. The Corps estimates of emissions from this project are comparable to other projects and cases where monetization of emissions has been found useful or legally required.

Under any reasonable application of the social cost of greenhouse gas metrics, the direct operational emissions from the Pebble Project will cause almost $50 million dollars in climate damages, while construction-induced emissions will cause an additional $11 million in damages. Tellingly, the Corps had no problem concluding that it was appropriate to monetize, for example, $21 million in revenue annually from state royalty payments.[66] A potential climate cost of tens of millions of dollars is also clearly significant, particularly in the context of a document the very purpose of which is to evaluate a project's *environmental* impacts.[67]

Monetizing Climate Damages Is Appropriate and Useful Regardless of Whether Every Effect Can Be Monetized in a Full Cost-Benefit Analysis

The Corps should use the social cost of greenhouse gases because NEPA requires agencies to use readily available tools to better contextualize environmental effects, just as the Corps has monetized certain economic impacts like labor income and royalties to contextualize the project's alleged upsides.

Monetizing one key impact still provides useful information for decisonmakers and the public even when monetizing other impacts is not feasible. The social cost of greenhouse gases enables a more accurate and transparent comparison of alternatives along the dimension of climate impacts even if other costs and benefits cannot be quantified, and "breakeven analysis" could provide a framework for making decisions when some effects but not others are monetized. Climate damages can and should be monetized even if other costs and benefits are harder to quantify or monetize and so must be discussed qualitatively. Many effects can readily be quantified and monetized, and agencies should generally do so when feasible; other effects, like water quality, are notoriously difficult to quantify and monetize, due to the geographically idiosyncratic nature of individual water bodies. Greenhouse gases, by comparison, have the same impact on climate change no matter where they are emitted, and those impacts are readily monetized using the social cost of greenhouse methodology. Regardless of whether all other effects can be monetized, using the social cost of greenhouse gases provides useful and necessary information to the public and decisionmakers. In particular, whether or not other effects are monetized, using the social cost of greenhouse gases will facilitate comparison between alternative options along the dimension of climate change. As discussed above, different alternatives could have varying greenhouse gas consequences over time, and monetization provides the best means of comparing project alternatives along the dimension of climate change.

Moreover, analytical frameworks exist to weigh qualitative effects alongside monetized effects. NEPA regulations, for example, first state that if there are "important qualitative considerations," then the ultimate "weighing of the merits and drawbacks of the various alternatives" should not be displayed exclusively as a "monetary cost-benefit analysis." Nevertheless, NEPA regulations further acknowledge that when monetization of costs and benefits is "relevant to the choice among environmentally different alternatives," "that analysis" can be presented alongside "any analyses of unquantified environmental

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[65] BOEM, *Liberty Development and Production Plan Draft EIS* at 3-129, 4,50 (2017) (89,940,000 minus 64,570,000 is about 25 million).

[66] DEIS at 4.3-8 – 4.3-9.

[67] See California CEQ guidance ("economic and social effects of a physical change may be used to determine that the physical change is a significant effect on the environment.").

impacts, values, and amenities."[68] In other words, the monetization of some impacts does not require the monetization of all impacts.

The Office of Management and Budget's *Circular A-4*[69] guidance to agencies on conducting economic analysis also provides a framework for weighing monetized and qualitative costs and benefits, called break-even analysis:

> It will not always be possible to express in monetary units all of the important benefits and costs. When it is not, the most efficient alternative will not necessarily be the one with the largest quantified and monetized net-benefit estimate. In such cases, you should exercise professional judgment in determining how important the non-quantified benefits or costs may be in the context of the overall analysis. If the non-quantified benefits and costs are likely to be important, you should carry out a "threshold" analysis to evaluate their significance. Threshold or "break-even" analysis answers the question, "How small could the value of the non-quantified benefits be (or how large would the value of the non-quantified costs need to be) before the rule would yield zero net benefits?" In addition to threshold analysis you should indicate, where possible, which non-quantified effects are most important and why.[70]

Even without using something as formal as a break-even analysis, it is clear that monetizing climate damages provides useful information whether or not every effect can be monetized in a full cost-benefit analysis.

III. The Corps Should Use the Interagency Working Group's 2016 Estimates of the Social Cost of Carbon and the Social Cost of Methane

In 2016, the IWG published updated central estimates for the social cost of greenhouse gases: $50 per ton of carbon dioxide, $1440 per ton of methane, and $18,000 per ton of nitrous oxide (in 2017 dollars for year 2020 emissions).[71] Agencies must continue to use estimates of a similar or higher[72] value in their analyses and decisionmaking. A recent Executive Order disbanding the IWG does not change the fact that the IWG estimates still reflect the best available data and methodologies.

IWG's Methodology Is Rigorous, Transparent, and Based on Best Available Data

Beginning in 2009, the IWG assembled experts from a dozen federal agencies and White House offices to "estimate the monetized damages associated with an incremental increase in carbon emissions in a given year" based on "a defensible set of input assumptions that are grounded in the existing scientific and economic literature."[73] IWG's methods combined three frequently used models built to predict the

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[68] 40 C.F.R. § 1502.23.

[69] Though *Circular A-4* focus on agencies' regulatory analyses under Executive Order 12,866, the document nevertheless more generally has distilled best practices on economic analysis and is a useful guide to all agencies undertaking an assessment of costs and benefits.

[70] OMB, CIRCULAR A-4 at 2 (2003).

[71] U.S. Interagency Working Group on the Social Cost of Greenhouse Gases, "Technical support document: Technical update of the social cost of carbon for regulatory impact analysis under executive order 12866 & Addendum: Application of the methodology to estimate the social cost of methane and the social cost of nitrous oxide" (2016), available at https://obamawhitehouse.archives.gov/omb/oira/social-cost-of-carbon.

[72] See, e.g., Richard L. Revesz et al., Global Warming: Improve Economic Models of Climate Change, 508 NATURE 173 (2014) (explaining that current estimates omit key damage categories and, therefore, are very likely underestimates).

[73] IWG, *Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866* (2010) ("2010 TSD"). *Available at* https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/for-agencies/Social-Cost-of-Carbon-for-RIA.pdf.

economic costs of the physical impacts of each additional ton of carbon.[74] The models together incorporate such damage categories as: agricultural and forestry impacts, coastal impacts due to sea level rise, impacts from extreme weather events, impacts to vulnerable market sectors, human health impacts including malaria and pollution, outdoor recreation impacts and other non-market amenities, impacts to human settlements and ecosystems, and some catastrophic impacts.[75] IWG ran these models using a baseline scenario including inputs and assumptions drawn from the peer-reviewed literature, and then ran the models again with an additional unit of carbon emissions to determine the increased economic damages.[76] IWG's social cost of carbon estimates were first issued in 2010 and have been updated several times to reflect the latest and best scientific and economic data.[77]

Following the development of estimates for carbon dioxide, the same basic methodology was used in 2016 to develop the social cost of methane and social cost of nitrous oxide—estimates that captures the distinct heating potential of methane and nitrous oxide emissions.[78] These additional metrics used the same economic models, the same treatment of uncertainty, and the same methodological assumptions that IWG applied to the social cost of carbon, and these new estimates underwent rigorous peer-review.[79]

IWG's methodology has been repeatedly endorsed by reviewers. In 2014, the U.S. Government Accountability Office concluded that IWG had followed a "consensus-based" approach, relied on peer-reviewed academic literature, disclosed relevant limitations, and adequately planned to incorporate new information through public comments and updated research.[80] In 2016 and 2017, the National Academies of Sciences issued two reports that, while recommending future improvements to the methodology, supported the continued use of the existing IWG estimates.[81] And in 2016, the U.S. Court of Appeals for the Seventh Circuit held that the Department of Energy's reliance on IWG's social cost of carbon was reasonable.[82] It is, therefore, unsurprising that leading economists and climate policy experts have endorsed the Working Group's values as the best available estimates.[83]

Furthermore, uncertainty over the values or range of values included in the IWG's social costs of greenhouse gases metric is not a reason to abandon the social cost of greenhouse gas methodologies;[84] quite the contrary, uncertainty supports higher estimates of the social cost of greenhouse gases,

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[74] *Id.* at 5. These models are DICE (the Dynamic Integrated Model of Climate and the Economy), FUND (the Climate Framework for Uncertainty, Negotiation, and Distribution), and PAGE (Policy Analysis of the Greenhouse Effect).

[75] *Id.* at 6-8.

[76] *Id.* at 24-25.

[77] IWG, *Technical Update of the Social Cost of Carbon* at 5–29 (2016). *Available at* https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/ scc_tsd_final_clean_8_26_16.pdf.

[78] *See* 2016 IWG Addendum at 2.

[79] *Id.* at 3.

[80] Gov't Accountability Office, *Regulatory Impact Analysis: Development of Social Cost of Carbon Estimates* 12-19 (2014). Available at http://www.gao.gov/assets/670/665016.pdf.

[81] Nat'l Acad. Sci., Engineering & Med., *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide* 3 (2017), https://www.nap.edu/read/24651/chapter/1; Nat'l Acad. Sci., Engineering & Med., *Assessment of Approaches to Updating the Social Cost of Carbon: Phase 1 Report on a Near-Term Update* 1–2 (2016); https://www.nap.edu/read/21898/chapter/1.

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

[83] See, e.g., Richard Revesz et al., *Best Cost Estimate of Greenhouse Gases*, 357 Science 655 (2017); Michael Greenstone et al., *Developing a Social Cost of Carbon for U.S. Regulatory Analysis: A Methodology and Interpretation*, 7 Rev. Envtl. Econ. & Pol'y 23, 42 (2013); Richard L. Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 Nature 173 (2014) (co-authored with Nobel Laureate Kenneth Arrow, among others).

[84] *Center for Biological Diversity v. NHTSA*, 538 F.3d 1172, 1200 (9th Cir. 2008) ("[W]hile the record shows that there is a range of values, the value of carbon emissions reductions is certainly not zero.").

because most uncertainties regarding climate change entail tipping points, catastrophic risks, and unknown unknowns about the damages of climate change. Because the key uncertainties of climate change include the risk of irreversible catastrophes, applying an options value framework to the regulatory context strengthens the case for ambitious regulatory action to reduce greenhouse gas emissions. Not only was justifying omitted climate damages due to uncertainty rejected by the Ninth Circuit in *Center for Biological Diversity*—"while . . . there is a range of values, the value of carbon emissions reduction is certainly not zero"[85]—but the range of values recommended by the Interagency Working Group[86] and endorsed by the National Academies of Sciences[87] is rather manageable. In 2016, the IWG recommended values at discount rates from 2.5% to 5%, calculated as between $12 and $62 for year 2020 emissions.[88] Numerous federal agencies have had no difficulty either applying this range in their environmental impact statements or else focusing on the central estimate at a 3% discount rate.[89] Most recently, in ugust 2017, the Bureau of Ocean Energy Management applied the IWG's range of estimates calculated at three discount rates (2.5%, 3%, and 5%) to its environmental impact statement for an offshore oil development plan,[90] and called this range of estimates "a useful measure to assess the benefits of CO_2 reductions and inform agency decisions."[91]

A Recent Executive Order Does Not Change the Requirements to Monetize Climate Damages

In March 2017, President Trump disbanded the IWG and withdrew their technical support documents.[92] Nevertheless, Executive Order 13,783 assumes that federal agencies will continue to "monetiz[e] the value of changes in greenhouse gas emissions" and instructs agencies to ensure such estimates are "consistent with the guidance contained in OMB Circular A-4."[93] Consequently, while federal agencies no longer benefit from ongoing technical support from the IWG on use of the social cost of greenhouse gases, by no means does the new Executive Order imply that agencies should not monetize important effects in their environmental impact statements. The Executive Order does not prohibit agencies from relying on the same choice of models as the IWG, the same inputs and assumptions as the IWG, the same statistical methodologies as the IWG, or the same ultimate values as derived by the IWG. To the contrary, because the Executive Order requires consistency with Circular A-4, as agencies follow the Circular's standards for using the best available data and methodologies, they will necessarily choose similar data, methodologies, and estimates as the IWG, since the IWG's work continues to represent the

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[85] 538 F.3d at 1200.

[86] *See* Interagency Working Group on the Social Cost of Greenhouse Gases, *Technical Update* (2016) (hereinafter 2016 TSD).

[87] *See* National Academies of Sciences, *Assessment of Approaches to Updating the Social Cost of Carbon* (2016) (hereinafter First NAS Report) (endorsing continued near-term use of the IWG numbers; in 2017, the NAS recommended moving to a declining discount rate, *see* National Academies of Sciences, *Valuing Climate Damages* (2017) (hereinafter Second NAS Report).

[88] 2016 TSD. The values given here are in 2007$. The IWG also recommended a 95th percentile value of $123.

[89] BLM, *Envtl. Assessment—Waste Prevention, Prod. Subject to Royalties, and Res. Conservation* at 52 (2016); BLM, *Final Envtl. Assessment: Little Willow Creek Protective Oil and Gas Lease*, DOI-BLM-ID-B010-2014-0036-EA, at 82 (2015); Office of Surface Mining, *Final Envtl. Impact Statement—Four Corners Power Plant and Navajo Mine Energy Project* at 4.2-26 to 4.2-27 (2015) (explaining the social cost of greenhouse gases "provide[s] further context and enhance[s] the discussion of climate change impacts in the NEPA analysis."); U.S. Army Corps of Engineers, *Draft Envtl. Impact Statement for the Missouri River Recovery Mgmt. Project* at 3-335 (2016); U.S. Forest Serv., *Rulemaking for Colorado Roadless Areas: Supplemental Final Envtl. Impact Statement* at 120-123 (Nov. 2016) (using both the social cost of carbon and social cost of methane relating to coal leases); NHTSA EIS, *Available at* http://www.nhtsa.gov/staticfiles/rulemaking/pdf/cafe/FINAL_EIS.pdf at 9-77.

[90] BOEM, *Liberty Development Project: Draft Environmental Impact Statement*, at 4-247 (2017).

[91] *Id.* at 3-129.

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

[93] *Id.* § 5(c).

best available estimates.[94] The Executive Order does not preclude agencies from using the same range of estimates as developed by the IWG, so long as the agency explains that the data and methodology that produced those estimates are consistent with Circular A-4 and, more broadly, with standards for rational decisionmaking.

Similarly, the Executive Order's withdrawal of the Council on Environmental Quality's guidance on greenhouse gases,[95] does not—and legally cannot—remove agencies' statutory requirement to fully disclose the environmental impacts of greenhouse gas emissions. As the Council on Environmental Quality explained in its withdrawal, the "guidance was not a regulation," and "[t]he withdrawal of the guidance does not change any law, regulation, or other legally binding requirement."[96] In other words, when the guidance originally recommended the appropriate use of the social cost of greenhouse gases in environmental impact statements,[97] it was simply explaining that the social cost of greenhouse gases is consistent with longstanding NEPA regulations and case law, all of which are still in effect today.

Notably, some agencies under the Trump administration have continued to use the IWG estimates even following the Executive Order. For example, in August 2017, the Bureau of Ocean Energy Management called the social cost of carbon "a useful measure" and applied it to analyze the consequences of offshore oil and gas drilling.[98] And in July 2017, the Department of Energy used the IWG's estimates for carbon and methane emissions to analyze energy efficiency regulation, describing the social cost of methane as having "undergone multiple stages of peer review."[99]

Two agencies have developed new "interim" values of the social cost of greenhouse gases following the Executive Order. Relying on faulty economic theory, these "interim" estimates drop the social cost of carbon from $50 per ton in year 2020 down to as little as $1 per ton, and drop the social cost of methane from $1420 per ton in year 2020 down to $58. These "interim" estimates are inconsistent with accepted science and economics; the IWG's 2016 estimates remain the best available estimates. The IWG's methodology and estimates have been repeatedly endorsed by reviewers as transparent, consensus-based, and firmly grounded in the academic literature. By contrast, the "interim" estimates ignore the interconnected, global nature of our climate-vulnerable economy, and obscure the devastating effects that climate change will have on younger and future generations. The Corps should not use the "interim" social cost of greenhouse gas estimates because of their methodological flaws.

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[94] *See* Richard L. Revesz et al., *Best Cost Estimate of Greenhouse Gases*, 357 SCIENCE 6352 (2017) (explaining that, even after Trump's Executive Order, the social cost of greenhouse gas estimate of around $50 per ton of carbon dioxide is still the best estimate).

[95] Exec. Order 13,783 § 3(c)

[96] 82 Fed. Reg. 16,576, 16,576 (Apr. 5, 2017).

[97] *See* CEQ, *Revised Draft Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* at 16 (Dec. 2014), *available at* https://obamawhitehouse.archives.gov/sites/default/files/docs/nepa_revised_draft_ghg_guidance_searchable.pdf ("[A]lthough developed specifically for regulatory impact analyses, the Federal social cost of carbon, which multiple Federal agencies have developed and used to assess the costs and benefits of alternatives in rulemakings, offers a harmonized, interagency metric that can provide decisionmakers and the public with some context for meaningful NEPA review.").

[98] *Draft Environmental Impact Statement—Liberty Development Project in the Beaufort Sea, Alaska* at 3-129.

[99] Energy Conservation Program: Energy Conservation Standards for Walk-In Cooler and Freezer Refrigeration Systems, 82 Fed. Reg. 31,808, 31,811, 31,857 (July 10, 2017).

Uncertainty Supports Higher Social Cost of Greenhouse Gas Estimates, and Is Never a Reason to Abandon the Metric

Generally, uncertainty is *not* a reason to abandon the social cost of greenhouse gas methodologies;[100] quite the contrary, uncertainty supports higher estimates of the social cost of greenhouse gases, because most uncertainties regarding climate change entail tipping points, catastrophic risks, and unknown unknowns about the damages of climate change. Because the key uncertainties of climate change include the risk of irreversible catastrophes, applying an options value framework to the regulatory context strengthens the case for ambitious regulatory action to reduce greenhouse gas emissions.

There are numerous well-established, rigorous analytical tools available to help agencies characterize and quantitatively assess uncertainty, such as Monte Carlo simulations, and the IWG's social cost of greenhouse gas protocol incorporates those tools. To further deal with uncertainty, the IWG recommended to agencies a range of four estimates: three central or mean-average estimates at a 2.5%, 3%, and 5% discount rate respectively, and a 95th percentile value at the 3% discount rate. While the IWG's technical support documents disclosed fuller probabilities distributions, these four estimates were chosen by agencies to be the focus for decisionmaking. In particular, application of the 95th percentile value was not part of an effort to show the probability distribution around the 3% discount rate; rather, the 95th percentile value serves as a methodological shortcut to approximate the uncertainties around low-probability but high-damage, catastrophic, or irreversible outcomes that are currently omitted or undercounted in the economic models.

The shape of the distribution of climate risks and damages includes a long tail of lower-probability, high-damage, irreversible outcomes due to "tipping points" in planetary systems, inter-sectoral interactions, and other deep uncertainties. Climate damages are not normally distributed around a central estimate, but rather feature a significant right skew toward catastrophic outcomes. In fact, a 2015 survey of economic experts concludes that catastrophic outcomes are increasingly likely to occur.[101] Because the three integrated assessment models that the IWG's methodology relied on are unable to systematically account for these potential catastrophic outcomes, a 95th percentile value was selected instead to account for such uncertainty. There are no similarly systematic biases pointing in the other direction which might warrant giving weight to a low-percentile estimate.

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

The National Academies of Sciences did recommend that the IWG document its full treatment of uncertainty in an appendix and disclose low-probability as well as high-probability estimates of the social cost of greenhouse gases.[102] However, that does not mean it would be appropriate for individual

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[100] *Center for Biological Diversity v. NHTSA*, 538 F.3d 1172, 1200 (9th Cir. 2008) ("[W]hile the record shows that there is a range of values, the value of carbon emissions reductions is certainly not zero.").

[101] Howard and Sylvan 2015, *supra* note **Error! Bookmark not defined.**, at 2. ("Experts believe that there is greater than a 20% likelihood that this same climate scenario would lead to a 'catastrophic' economic impact (defined as a global GDP loss of 25% or more)."). *See also* Pindyck 2016.

[102] Nat'l Acad. Of Sci., *Assessment of Approaches to Updating the Social Cost of Carbon* 49 (2016) ("[T]he IWG could identify a high percentile (e.g., 90th, 95th) and corresponding low percentile (e.g., 10th, 5th) of the SCC frequency distributions on each graph.").

agencies to rely on low-percentile estimates to justify decisions. While disclosing low-percentile estimates as a sensitivity analysis may promote transparency, relying on such an estimate for decisionmaking—in the face of contrary guidance from the best available science and economics on uncertainty and risk—would not be a "credible, objective, realistic, and scientifically balanced" approach to uncertainty, as required by Circular A-4.[103]

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

- There is no reason to believe the public or the government will be systematically risk seeking with respect to climate change.[104]
- The consequences of overestimating the risk of climate damages (i.e., spending more than we need to on mitigation and adaptation) are not nearly as irreversible as the consequences of underestimating the risk of climate damage (i.e., failing to prevent catastrophic outcomes).
- Though some uncertainties might point in the direction of lower social cost of greenhouse gas values, such as those related to the development of breakthrough adaptation technologies, the models already account for such uncertainties around adaptation; on balance, most uncertainties strongly point toward higher, not lower, social cost of greenhouse gas estimates.[105]
- There is no empirical basis for any "long tail" of potential benefits that would counteract the potential for extreme harm associated with climate change.

Moreover, even the best existing estimates of the social cost of greenhouse gases are likely underestimated because the models currently omit many significant categories of damages—such as depressed economic growth, pests, pathogens, erosion, air pollution, fire, dwindling energy supply, health costs, political conflict, and ocean acidification, as well as tipping points, catastrophic risks, and unknown unknowns—and because of other methodological choices.[106]

Consequently, uncertainty suggests an even higher social cost of greenhouse gases and so is not a reason to abandon the metric, which would misleadingly suggest that climate damages are worthless.

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[103] CIRCULAR A-4 at 39.

[104] As a 2009 survey revealed, the vast majority of economic experts support the idea that "uncertainty associated with the environmental and economic effects of greenhouse gas emissions increases the value of emission controls, assuming some level of risk-aversion." *See Expert Consensus, supra* note 101, at 3 (citing 2009 survey).

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

[106] *See* Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, *supra* note 105; Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* (Cost of Carbon Project Report, 2014); Frances C. Moore & Delavane B. Diaz, *Temperature Impacts on Economic Growth Warrant Stringent Mitigation Policy*, 5 NATURE CLIMATE CHANGE 127 (2015) (demonstrating SCC may be biased downward by more than a factor of six by failing to include the climate's effect on economic growth).

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