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Office of Information and Regulatory Affairs
Office of Management and Budget
Attn: Darcel D. Gayle
NEOB, Room 10202
725 17th Street N.W.
Washington, D.C. 20503

Re: **Draft 2010 Report to Congress on the Benefits and Costs of Federal Regulations (Docket ID OMB-2010-0008)**

Dear Sir/Madam:

These comments are submitted by Professor Amy Sinden[1], a Member of the Board of Directors of the Center for Progressive Reform (CPR); Professor Sid Shapiro[2], a Member of the Board of Directors of CPR; Professor Rena Steinzor[3], President of CPR; and Mr. James Goodwin, a CPR Policy Analyst.

CPR is an organization of academics specializing in the legal, economic, and scientific issues that surround federal regulation. CPR works to advance the public's understanding of the issues addressed by the country's regulatory laws. In particular, CPR seeks to educate the public and policymakers about how the government's authority and resources may best be used to preserve collective values and to hold accountable those who ignore or trivialize them.

These comments concern the OMB's Draft 2010 Report to Congress on the Benefits and Costs of Federal Regulations (2010 Report or Report).

Our specific conclusions about the Report can be summarized as follows:

[1] Professor Sinden is Associate Professor of Law at the Temple University School of Law. She has taught, lectured, and written in the areas of regulatory design, cost-benefit analysis, environmental law, natural resources law, human rights, and climate change.
[2] Professor Shapiro is University Distinguished Chair in Law at Wake Forest University School of Law, where he is also the Associate Dean for Research and Development. He taught, lectured and written in the areas of administrative law, regulatory law and policy, environmental policy, and occupational safety and health law.
[3] Professor Steinzor is a Professor of Law at the University of Maryland School of Law, with a secondary appointment at the University of Maryland Medical School's Department of Epidemiology and Preventive Medicine. She has taught, lectured, and written in the areas of risk assessment, critical issues in law and science, administrative law, and environmental law.

1) The task of aggregating cost-benefit analyses is fundamentally counterproductive. In particular, we respectfully disagree that the aggregate estimates presented in the Report provide "valuable information." We also urge OMB to abandon its efforts to revive the use of "Morrall tables," since this method of regulatory analysis suffers from many of the same problems as cost-benefit analysis.

2) The contents and recommendations of this year's Report confirm that OMB intends to continue micromanaging agency decisionmaking. Invariably, this micromanagement leads to needless delay of regulatory action and to the promulgation of regulations that deviate from the requirements of applicable law and the available science.

3) In principle, we commend the 2010 Report for seeking to promote greater transparency in the regulatory decisionmaking process. However, its recommendations for increasing transparency are incomplete, since they do not seek to increase the transparency of OMB's participation in the regulatory process. We also strongly oppose any recommendations for increasing transparency that would impose unjustifiably large compliance burdens on regulatory agencies.

4) The report implies that the process the Interagency Task Force followed for developing a proposed value for the Social Costs of Carbon (SCC) offers a good example of transparent regulatory decisionmaking. We disagree, because the Task Force has not revealed the identity of its membership; nor did it invite public comment on its analysis. The proposed SCC value is also substantively wrong. The Interagency Task Force employed flawed economic models, data, and assumptions, and as a result, it generated a proposed SCC that is so low that it will lead to ineffective regulatory action on climate change.

I. THIS YEAR'S REPORT CONTINUES THE DISAPPOINTING TREND OF FOCUSING TOO GREATLY ON THE COUNTERPRODUCTIVE TASK OF AGGREGATING COST-BENEFIT ANALYSES

The authors of this year's Report have repeated the model of previous reports by undertaking the counterproductive task of aggregating the costs and benefits of regulations from the previous year and from the previous ten years. We understand that the Regulatory Right-to-Know Act of 2001 requires OMB to produce an annual "report containing . . . an estimate of the total annual costs and benefits (including quantifiable and nonquantifiable effects) of Federal rules . . . in the aggregate."[4] However, this task can be achieved with substantially less effort and with less opportunity for misrepresentation than the current approach entails. In particular, this task can be fulfilled through a simple presentation such as that provided in the Report's Executive Summary. Unfortunately, this year's Report adheres closely to the format and content of Reports from the previous administration, providing detailed, elaborate, and inevitably flawed analyses of the aggregate costs and benefits of past regulations that go well beyond the requirements of existing law (*e.g.*, the 10-year look-back at major federal regulations reviewed by OMB to examine their quantified and monetized costs and benefits).

[4] Pub. L. No. 106-554, § 624 (2001).

We respectfully disagree that the aggregate estimates presented in the Report provide "valuable information."[5] As in the past, the cost-benefit analyses catalogued in this year's Report are based on incomplete and unreliable information, as well as controversial monetization techniques. (Indeed, we were particularly disappointed to see that this year's report continued the controversial practice of using a 7 percent discount rate in calculating future benefits. *See* Appendix A to CPR Comments at page 15, note 49. [6]) Because such uncertainties and gaps are inevitable and inescapable, a properly developed cost-benefit analysis is always peppered with caveats and conditions that explain the uncertainties underlying the numbers, including which benefits could not be quantified, what assumptions were made to reach the numeric results, how changing those assumptions would effect the outcome, and what baseline the costs and benefits were measured against. Indeed, OMB's own guidance on conducting cost-benefit analyses, Circular A-4, stresses the importance of these narrative explanations of quantitative results, as do the European Union's guidelines on regulatory impact assessment.[7] The monetary estimates of costs and benefits cannot be properly understood in the absence of these caveats; indeed, in their absence, the monetary estimates are not just incomplete, but misleading.

The process of aggregation, however, must of necessity exclude all of this important narrative information. The result is a set of naked sums that at best provides no useful information and at worst can be dangerously misleading. Thus, in the Report's executive summary, OMB announces that the annual benefits of federal regulation "range from $128 billion to $616 billion" and the annual costs "range from $43 billion to $55 billion."[8] The seeming precision of these numbers creates a false illusion of scientific accuracy and objectivity, which belies the vast gaps and uncertainties that lie beneath the numbers and violates the commitment to transparency that OMB made in Circular A-4 and reiterates in this year's Report. Furthermore, as we explain in more detail in Appendix A, these gaps and uncertainties are far more likely to skew the numbers toward lower rather than higher net benefits.

In short, these inescapable shortcomings prevent aggregate estimates of regulatory costs and benefits from providing any useful information about the overall performance of the U.S. regulatory system and how it affects our society.

Every year for the last eight years, we or other CPR Member Scholars have explained in greater detail the shortcomings of cost-benefit analysis in general and of the exercise of aggregating these cost-benefit analyses in particular. We have provided a summary of these previous discussions in Appendix A to these comments. We also invite you to review our past comments for a fuller discussion of these issues (http://www.progressivereform.org/OMBCongress.cfm).

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[5] Draft Report at 4.

[6] Appendix A to these comments presents a summary of criticisms of cost-benefit analysis and of the aggregation of cost-benefit analyses that were included in past comments by CPR Member Scholars. Appendix B to the comments is a report by economists Frank Ackerman (a CPR Member Scholar) and Elizabeth A. Stanton critiquing the work of the Obama Administration's Interagency Task Force on Social Costs of Carbon.

[7] *See* Circular A-4 at 3;European Commission, *Impact Assessment Guidelines* (June 15, 2005), *available at* http://ec.europa.eu/governance/impact/docs/SEC2005_791_IA%20guidelines_annexes.pdf.

[8] Draft Report at 3.

Compounding these problems, this year's Report also attempts to revive the use of "Morrall tables."[9] Morrall tables seek to rank and evaluate environmental, health, and safety regulations according to their estimated cost per life saved—that is, the dollar cost of the regulation per life saved by the regulation. Thus, if a regulation is predicted to impose costs of $15 million and is predicted to prevent three deaths, then that regulation would be listed in a Morrall table as having a cost per life saved of $5 million. This year's Report includes an example of a Morall-style table that compares the net costs per life saved of selected health and safety rules that were reviewed by OMB during the previous year.[10]

Scholars discredited Morrall tables more than a decade ago, showing that they were highly manipulable and full of errors.[11] For example, opponents of strong regulation often used discounting to artificially inflate the net costs per life saved of regulations, with the objective of making regulations look inordinately expensive and inefficient. Discounting makes sense in the context of using cost-benefit analysis for financial decisionmaking, since the value of a dollar three years from now is less than a dollar today. This logic does not apply to Morrall tables comparing costs per life saved, however. As Professor Richard Parker has explained:

> [D]eath does not recognize human accounting conventions and death does not discount. As a result, if 1,000,000 people are exposed to a toxic chemical that produces a 1:10,000 probability of fatal cancer among those exposed, then the odds are quite high that approximately 100 people (not 37 . . .) will lose their lives to cancer. [W]hatever the interior logic to some economists of discounting monetary values for risk to life, the average reader . . . (and, I suspect, the majority of senior policymakers) are unlikely to understand that the physical reality of 100 lives saved in 20 years is, in fact, being treated as 37 . . . lives saved today.[12]

In Morrall tables, what is being discounted is not money or even the monetary valuation of a life (as would be the case in traditional cost-benefit analysis); instead, what is being discounted is lives. Ethically, it is difficult, if not impossible, to defend the conclusion that saving a life today is worth more than saving a life three, fifty, or a hundred years from now. Yet the use of discounting in Morrall tables endorses this conclusion in a way that obscures the underlying ethical conundrum.[13]

The Morrall-style table contained in the Report makes precisely this mistake. As the Report notes, "[t]he net cost per life saved is calculated using a 3% discount rate."[14] Nowhere, however, does the Report explain that by employing this discount rate, it is implicitly placing a higher value on lives saved today as compared to lives saved in the future.

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[9] These tables are often referred to as Morrall tables, since their use was first popularized by a former OMB economist named John Morrall. *See* Lisa Heinzerling, *Regulatory Costs of Mythic Proportions*, 107 YALE L.J. 1981, 1983 (1998). We will follow this convention in our comments.

[10] Draft Report at 23-25. The table in the Report differs slightly from the original Morrall tables in that it accounts for monetized benefits not related to mortality reduction (*e.g.*, lost work days due to illness) by subtracting them from costs. In this regard, the Report's version of the Morrall tables is a slight improvement over the original, which simply ignored monetized benefits not related to mortality reduction.

[11] *See, e.g.*, Heinzerling, *supra* note 9; Richard W. Parker, *Grading the Government*, 70 U. CHI. L. REV. 1345 (2003).

[12] Parker, *supra* note 11, at 1374.

[13] Heinzerling, *supra* note 9, at 2043-56.

[14] Draft Report at 23.

Far from "increase[ing] the likelihood that scarce resources will be used as effectively as possible,"[15] the revived use of this long-discredited technique serves chiefly to obfuscate and mislead. Consequently, we urge OMB to abandon any further efforts to revive the use of Morrrall-style tables.

II. OMB SHOULD ABANDON ITS MICROMANAGEMENT OF THE AGENCIES.

Over four decades, OMB has micromanaged agency decisionmaking by overseeing a system of centralized review of regulations conducted through the lens of cost-benefit analysis. This system has not improved the quality of regulatory decisionmaking; instead, it has degraded it by providing industry with a powerful lever for weakening and delaying agency rules.

Because Barack Obama ran under the banner of bringing change to Washington and activating government to do for people what they cannot do for themselves, we had expected his Administration to discontinue the kind of micromanagement that prevailed at OMB during the George W. Bush Administration. We had hoped to see OMB become instead a champion of the agencies, working to affirmatively help them to achieve their regulatory missions. Those hopes have been disappointed, however. As OMB's review of the Environmental Protection Agency's (EPA) rule for regulating the disposal of coal ash waste illustrates, the office is continuing to use cost-benefit analysis and lobbying meetings with industry to micromanage agencies and delay important health, safety, and environmental rules.

Coal ash is the solid waste left over when power plants burn coal to produce energy. It's dangerous stuff, containing arsenic, cadmium, mercury, and a host of other toxins that pose a significant threat to basic human health. In 2008 alone, coal-fired power plants produced some 136 millions tons of this waste. And yet coal ash disposal is largely unregulated.

Last year, approximately 55 percent of this waste was stored in holes in the ground or in piles surrounded by earthen walls. The coal ash spill in Kingston, Tennessee, two years ago, which involved one billion gallons of inky sludge spreading to cover 300 acres, provided an all-too-graphic illustration of the catastrophic consequences that can result when these weak earthen walls fail.

The 45 percent of the waste that is not disposed in surface impoundments and unlined landfills is "beneficially reused" in various ways, including as an ingredient in the production of building materials like concrete and wallboard, as a soil additive for agriculture, and as an alternative to salt for improving automobile traction control on snowy or icy roads. Not all beneficial reuses are environmentally safe, however. Environmentally safe uses include many of those in which the coal ash remains permanently encapsulated. When it is used as an ingredient in cement, for example, the harmful materials are prevented from escaping into the environment. Use of coal ash in agriculture or as an alternative to road salt, however, is not environmentally safe, since the harmful constituents in coal ash can easily leach into ground water supplies or escape into the air where they can be inhaled by humans and animals alike. Indeed, this latter form of beneficial reuse is no different from careless disposal.

Prompted by the Kingston disaster, EPA crafted a draft proposed rule that would formally declare coal ash to be a hazardous waste whenever it is not destined for specified types of

[15] *Id*. at 24.

environmentally safe beneficial use. (This declaration is known as the Bevill Determination.) The draft proposal also described how—as a hazardous waste—coal ash would be regulated from "cradle to grave" under Subtitle C of the Resource Conservation and Recovery Act (RCRA).[16] EPA submitted this draft proposal to OMB for review last October.

OMB's review of the coal ash rule lasted over six months—well past the 120-day time limit that Executive Order 12866 allows. During that time, OMB hosted 43 meetings regarding the coal ash rule—by far the most meetings the office has ever held for a single rule. Thirty of these meetings were with industry groups opposed to a strong coal ash rule, including the power plant industry and its affiliates, the coal mining industry, and the beneficial reuse industry and its clients. The remaining thirteen meetings were with groups in favor of a strong rule, including various public interest groups and a company specializing in environmental cleanup projects.

When the proposed coal ash rule finally emerged from regulatory review, it looked vastly different from the one that EPA had originally sent over. Rather than endorsing one clear regulatory option, the final proposal instead "co-proposed" two strikingly different alternatives—one strong and one weak—thereby ensuring that definitive regulatory action on this toxic waste would be delayed for at least another six months, if not longer.[17] The weak alternative would declare coal ash to be a non-hazardous waste (*i.e.*, no different from household garbage) and leave it up to a patchwork of state regulatory programs to govern its disposal, pursuant to Subtitle D of RCRA.[18] The strong alternative is similar to EPA's original proposal in that it would regulate coal ash according to RCRA's strict Subtitle C program; the big difference is that the strong alternative would designate the stuff as a "special waste" rather than as a "hazardous waste." A "special waste" designation is unprecedented, so it is not clear if it makes this co-proposed alternative "weaker" than the original proposal. In any event, EPA appears to have abandoned the idea of designating coal ash as a hazardous waste in its final proposal.

EPA made these changes largely in response to OMB's criticisms of its original proposal. OMB's comments on the rule, which were inadvertently posted to the rule's online docket shortly after the proposed rule was released, show that OMB was primarily concerned that the cost-benefit analysis for the original proposal (1) did not adequately account for the possibility that regulating coal ash as a hazardous waste would reduce beneficial reuse, costing the beneficial reuse industry billions of dollars annually, and (2) did not adequately assess the costs and benefits of regulatory alternatives other than EPA's preferred option. OMB also sought to discourage EPA from identifying the Subtitle C program as its preferred regulatory option for coal ash waste—even though the agency also solicited comments on other regulatory alternatives in its original draft proposal—since even this gesture might be enough to attach a stigma to coal ash waste sufficient to discourage its beneficial reuse. OMB's comments state: "Proposed rule invites comments on alternative approaches, but a proposed rule with a preferred option [for a Subtitle C program] alone may have unintended consequences on beneficial reuse, even if an alternative option is selected for final."[19]

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[16] 42 U.S.C. §§6901 – 6992k (2010). RCRA's Subtitle C provisions are at 42 U.S.C §§6921 – 6939e (2010).
[17] Disposal of Coal Combustion Residuals from Electric Utilities, 75 Fed. Reg. 35127 (proposed June 21, 2010) (to be codified at 40 C.F.R. pts. 257, 261, 264, 265, 268, 271 and 302).
[18] RCRA's Subtitle D provisions are at 42 U.S.C. §§6941 – 6949a (2010).
[19] Regulations.gov, *Interagency Working Comments on Draft Rule Under EO 12866*, *Document ID: EPA-HQ-RCRA-2009-0640-0350*, http://www.regulations.gov/search/Regs/home.html#documentDetail?R=0900006480af0f01 (follow "Portable Document Format (PDF) Logo" hyperlink) (last visited June 16, 2010).

Notably, EPA's final proposal no longer identifies regulating coal ash under Subtitle C of RCRA as its preferred option.

The practical effect of these changes to EPA's proposed rule is that it increases the likelihood that coal ash waste will be regulated no differently from standard household garbage under Subtitle D of RCRA. Given that coal ash waste is significantly more toxic than what you take out to your curb every Monday morning, this outcome would leave people and the environment unprotected. Existing dangerous dump sites will continue to operate with little or no restriction, increasing the chances of another Kingston-type catastrophe. Future dumps for coal ash will continue to have inadequate linings, so that toxic constituents such as arsenic and selenium in the coal ash waste will be able to freely leach into nearby groundwater supplies and surface waters. The citizens who are adversely affected by the weak regulations—a population that comprises disproportionately high numbers of low-income and African-American people—will be left with little legal recourse. Since Subtitle D of RCRA gives EPA no enforcement authority, these citizens will have to resort to costly and complex lawsuits if they are to obtain any justice at all.

OMB's micromanagement of EPA's decisionmaking did nothing to improve the quality of the agency's proposed coal ash rule. Rather, it delayed the rule by six months and forced EPA to include a weaker alternative that the agency had in its expert judgment already rejected.

Unfortunately, one of the recommendations for reform included in this year's Report appears to move in exactly the wrong direction by threatening to increase OMB's micromanagement of the agencies. The report proposes to give OMB nearly unbridled authority to review agency regulations that employ disclosure as a regulatory tool to ensure that they "are empirically informed and sensitive to how people process information."[20] OMB's interference with the National Highway Traffic Safety Administration's (NHTSA) Tire Fuel Efficiency Consumer Information Program illustrates how this expanded micromanagement might lead to further delays in agency action.

The Energy Independence and Security Act of 2007 directs NHTSA to draft a rule establishing a Tire Fuel Efficiency Consumer Information Program. The Program is to include a "a national tire fuel efficiency rating system" as well as "requirements for providing information to consumers, including information at the point of sale"—that is, labels for tire manufacturers to affix to their products that convey the efficiency ratings to consumers, so they can consider fuel-efficiency when deciding which tires to buy.[21]

When NHTSA sent OMB its draft final rule on tire fuel efficiency in December, it appeared that the rule was nearly ready to go. In full accordance with its duties under the Energy Independence and Security Act of 2007, the agency had devised a system for rating tire fuel efficiency, and a label for conveying that information to consumers. The agency had used extensive survey and focus group research in designing the label, and had made a determination based on that research that the labels it had created were comprehensible and effective in conveying information about a tire's fuel efficiency rating and the significance of this rating.

By the time the final rule emerged from OMB three months later, only half of the draft final rule still remained. OMB had approved NHTSA's tire fuel efficiency ratings, but rejected its

[20] Draft Report at 43-44.
[21] 49 U.S.C. §32304A(a)(1) – (2).

proposed labels. Accordingly, on March 30, NHTSA published a final rule putting the tire fuel efficiency ratings system into effect but postponing a final label design until the completion of a new set of studies.[22] According to NHTSA's research plan, these studies will not be completed until September 30, 2010—a full six months after publication of the final rule. After that, NHTSA must "re-propose" a new label requirement in a supplemental Notice of Proposed Rulemaking and go through the whole notice-and-comment process again. It could be well over a year before NHTSA is able to issue a final rule for its label. Until then, the agency's recently adopted tire fuel efficiency ratings system is of little use.

According to a Review Letter[23] issued by Office of Information and Regulatory Affairs (OIRA) Administrator Cass Sunstein, the first such letter from the Obama Administration, the new research plan was necessary because the original label design was based on focus group testing, which is incapable of quantifying "consumers' understanding of the label." The letter directed NHTSA to undertake a new research plan that included "scientifically valid experiments" that were capable of such quantification.[24] As NHTSA scrambles to respond to the Toyota recalls, OMB's insistence that this chronically overworked and underfunded agency go back to the drawing board in some quixotic pursuit of regulatory perfection seems counterproductive.

Rather than spending valuable time and resources on this kind of micromanagement of agency rulemakings, we urge OMB instead to find ways that it can affirmatively help agencies to carry out their regulatory missions. To this end, we reiterate the recommendations that Professors Sinden and Steinzor and Mr. Goodwin made in their comments on the 2009 Draft Report.[25]

III. OMB SHOULD INCREASE THE TRANSPARENCY OF ITS PARTICIPATION IN THE REGULATORY PROCESS.

The Obama Administration has sought to increase transparency in government, and we are generally supportive of these efforts. OMB has likewise directed agencies to introduce more openness into the regulatory process. We are concerned, however, that OMB is not living up to these transparency principles. Indeed, these concerns prompted us to send a letter last March to White House Counsel Robert Bauer[26] requesting a review of OMB's repeated violations of Executive Order 12866's transparency requirements. We still have not received a response to this letter.

One of the Report's recommendations for reform seeks to introduce greater openness into agencies' regulatory analysis, by, among other things, requiring agencies to present these analyses in a more transparent format.[27] Specifically, the report recommends that "[r]egulatory analysis should be made as transparent as possible by a prominent and accessible summary—written in a plain

[22] Tire Fuel Efficiency Consumer Information Program, 75 Fed. Reg. 15893 (Mar. 30, 2010) (to be codified at 49 C.F.R. pt. 575).
[23] Letter from Cass R. Sunstein, Administrator, OIRA, to David Strickland, Administrator, NHTSA, Mar. 19, 2010, *available at* http://www.reginfo.gov/public/postreview/Tire_Fuel_Efficiency_Consumer_Information_Final_Rule.pdf.
[24] *Id*.
[25] *See* Letter from CPR to Darcel D. Gayle, 11/5/09 at 3-11, *available at* http://www.progressivereform.org/articles/2009_CPR_Comments_OMB_Report.pdf.
[26] Letter from Robert Glicksman, Member, Board of Directors, CPR, et al., to Robert Bauer, Esq., White House Counsel, March 17, 2010, *available at* http://www.progressivereform.org/articles/WH_Counsel_re_OIRA_March2010.pdf.
[27] Draft Report at 39-41.

language‘ manner designed to be understandable to the public—that outlines the central judgments that support regulations, including the key findings of the analysis (such as central assumptions and *uncertainties*).”[28]

Yet, OMB fails to present its own regulatory analyses in a transparent format, as exemplified by the Report‘s presentation of its retrospective analysis and aggregation of past cost-benefit analyses. For example, the Report fails to present a prominent and accessible summary of the unquantified or nonmonetized effects of the rules that the Report analyzes and aggregates. According to footnote 10, the Report has ―conveyed the essence of these unquantified effects on a rule-by-rule basis in the columns titled ‗Other Information‘ in Appendix A.”[29] Of the 66 rules presented in the Appendix A table, however, only two (FDA‘s Rule on Use of Ozone-Depleting Substances; Removal of Essential Use Designations [Epinephrine] and the Department of Labor‘s Abandoned Mine Land Program) provide any discussion of unquantified effects. Many other rules in the table undoubtedly contain large unquantified effects, such as the Department of Energy‘s Rule on Energy Efficiency Standards for General Service Fluorescent Lamps and Incandescent Lamps (unquantified environmental benefits) and EPA‘s Review of the National Ambient Air Quality Standards for Lead (unquantified public health benefits). But these effects go entirely unmentioned.

A prominent and accessible summary of unquantified effects is particularly important for environmental, health, and safety regulations, since the bulk of their benefits defy quantification and monetization. As such, the omission of such information from the Report is particularly troubling, since these massive unquantified and nonmonetized benefits introduce a great deal of uncertainty into the Report‘s analysis.

A similar lack of transparency has marked much of OMB‘s participation in the regulatory process, as exemplified by its review of EPA‘s proposed coal ash rule. Executive Order 12866 §6(b)(4)(D) provides that ―a[]fter the regulatory action has been published in the Federal Register or otherwise issued to the public, . . . OIRA shall make available to the public *all documents* exchanged between OIRA and the agency during the review by OIRA.”[30] The proposed coal ash rule was first issued to the public on May 4, 2010, yet few of the documents exchanged between OIRA and EPA during OIRA‘s six-month-long review of the proposed rule have been made public. So far, the only such documents to be published are the original proposed rule, the original regulatory impact analysis, and a ―red-lined” version of the proposed rule, showing all the changes that were made to it during the review. Surely other documents were exchanged between OIRA and EPA during that period, including alternative revisions to the proposed rule that were considered but rejected, additional studies or reports that were considered as evidence for or against the proposed rule, and correspondence (*e.g.*, letters, electronic mail, and faxes) between members of the two staffs. This last category of documents is especially important, since such documents would likely highlight what the major points of contention were during the review and how they were ultimately resolved.

OIRA‘s failure to comply with Executive Order 12866 §6(b)(4)(D) is by no means limited to its review of EPA‘s coal ash rule. It has failed to release most or any documents exchanged between it and the rulemaking agency on numerous other rules, including (as of this date) NHTSA‘s final rule

[28] *Id*. at 40 (emphasis added).
[29] *Id*. at 10 n. 10.
[30] Executive Order 12866 §6(b)(4)(D) (emphasis added).

for the Tire Fuel Efficiency Consumer Information Program,[31] and EPA's rule amending the Opt-out and Recordkeeping Provisions in the Renovation, Repair, and Painting Program for Lead under the Toxic Substances Control Act.[32]

Despite OMB's own lack of transparency, the Report's recommendations for reform focus entirely on ways that regulatory agencies can introduce greater openness into their regulatory analysis. We support these efforts to increase the openness of regulatory decisionmaking, as long as they are not implemented in a way that imposes significant additional burdens on agencies and delays important rulemakings. Agencies such as OSHA are already so overburdened with procedural constraints and limited resources that their regulatory output has been reduced to a trickle during the last decade.[33] We assume, for example, that OMB's suggestion that agencies be required to provide a "period for public comment on their regulatory analyses and supporting documents"[34] contemplates an additional comment procedure that would run concurrently with the normal notice-and-comment period of informal rulemaking.

In addition, we strongly urge OMB to take steps to improve the openness of its own participation in the regulatory process. Most importantly, we urge OIRA to comply with Executive Order 12866 §6(b)(4)(D) and begin publishing all documents that are exchanged between it and the agencies during regulatory review. As we noted in our letter to White House Counsel Robert Bauer on this issue last March, the "failure to post [these documents] deprives the public of the transparency that the Obama Administration has promised."[35]

IV. THE PROPOSED SOCIAL COSTS OF CARBON WAS DEVELOPED WITHOUT ADEQUATE TRANSPARENCY AND IS SUBSTANTIVELY FLAWED

The Report commends the Interagency Task Force for employing an open process for calculating a proposed Social Costs of Carbon (SCC) value.[36] We disagree with this assessment. To begin with, the Task Force has never revealed the identity of the individuals that comprise its membership. Instead, all we know is that its membership consisted of "representatives" from various executive branch offices and agencies. Next, the Interagency Task Force could have promoted greater transparency and public participation by providing the public with an opportunity to review and comment on the proposed SCC, in a process similar to what is required for informal rulemaking under the Administrative Procedure Act. Inviting public comment would have been more consistent with the Obama Administration's efforts to promote transparency in the regulatory process and likely would have contributed to the development of a more accurate SCC value.

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[31] Tire Fuel Efficiency Consumer Information Program, 75 Fed. Reg. 15893 (Mar. 30 ,2010) (to be codified at 49 C.F.R. pt. 575).
[32] Lead; Amendment to the Opt-Out and Recordkeeping Provisions in the Renovation, Repair, and Painting Program, 75 Fed. Reg. 24802 (May 6, 2010) (to be codified at 40 C.F.R. pt. 745).
[33] For example, during the past decade, OSHA issued comprehensive workplace regulations for only two chemicals, even though it has established legally enforceable exposure limitations for fewer than 200 of the approximately 3,000 chemicals that EPA characterizes as "high production volume" chemicals.
[34] Draft Report at 40.
[35] Letter from Robert Glicksman, Member, Board of Directors, CPR, et al., to Robert Bauer, Esq., White House Counsel, March 17, 2010, *available at* http://www.progressivereform.org/articles/WH_Counsel_re_OIRA_March2010.pdf.
[36] Draft Report at 43.

In developing the proposed SCC, the Interagency Task Force relied on deeply flawed economic models, data, and assumptions that lead to gross miscalculations of the impact of carbon on the climate and on the nation's economic future. These shortcomings have been comprehensively documented and analyzed in *The Social Costs of Carbon*,[37] a report by economists Frank Ackerman (a CPR Member Scholar) and Elizabeth A. Stanton, which we have appended to these comments as Appendix B.

While the Task Force has not set an official SCC, it has endorsed a "central" estimate of $21 per ton of CO_2 in 2010 in its two recent analyses. If widely adopted, this value will provide nowhere near the kind of economic incentives that are necessary to induce society to reduce atmospheric CO_2 concentrations to 350 ppm, a level now advocated by a growing number of climate scientists and policy analysts. One problem with the Task Force's analysis was its heavy reliance on a 2008 "meta-analysis" of the SCC performed by economist Richard Tol.[38] This "meta-analysis" surveyed 211 estimates of the SCC in the economics literature and concluded that the mean estimate was approximately $20 to $25 per metric ton of carbon.[39] But of the 211 studies included, 112 were authored by Tol. Moreover, they did not represent 112 separate estimates of the SCC, but rather simply multiple scenarios and sensitivity analyses within the same small number of studies. Tol's models were also based on certain unwarranted assumptions, like the assumption that climate change in the early stages will produce a large reduction in mortality.[40] Many of the remaining studies in Tol's meta-analysis were authored by William Nordhaus. Like Tol, Nordhaus builds problematic assumptions into his models, including the assumption, based on little evidence, that most people in the world would be willing to pay for a warmer climate.[41] At the same time, the Interagency Task Force ignored several influential climate models, such as that used in the Stern Review.[42] Another problem is that the Task Force was overly aggressive in discounting the value of future costs, using rates of 2.5 to 5 percent per year.[43] In the context of climate change, where the choice of discount rate implicates our ethical obligations to future generations, these discount rates are extraordinarily high and controversial. The Stern Review, for example, used a discount rate of just 1.4 percent.[44]

V. CONCLUSION

While oil continues to gush into the Gulf of Mexico, the need for forceful and effective environmental regulation has never been clearer. It is disheartening, then, to see OMB continuing business as usual—micromanaging agency decisionmaking, operating under a shroud of secrecy, offering a back door to industry lobbyists, and continuing to waste scarce government resources on

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[37] FRANK ACKERMAN & ELIZABETH A. STANTON, THE SOCIAL COST OF CARBON (A Report for the Economics for Equity and the Environment Network, Apr. 1, 2010), *available at* http://www.e3network.org/papers/SocialCostOfCarbon_SEI_20100401.pdf.

[38] Richard S.J. Tol, *The Social Cost of Carbon: Trends, Outliers and Catastrophes*, 2 ECON: OPEN-ACCESS, OPEN-ASSESSMENT E-J. (2008), *available at* http://www.economics-ejournal.org/economics/journalarticles/2008-25.

[39] *Id*. at 9-10 (in 2000 dollars).

[40] *Id*.

[41] WILLIAM D. NORDHAUS & JOSEPH BOYER, WARMING THE WORLD: ECONOMIC MODELS OF GLOBAL WARMING 84-85 (2000).

[42] NICHOLAS STERN, THE ECONOMICS OF CLIMATE CHANGE: THE STERN REVIEW 322 (2007).

[43] The larger the discount rate, the less future costs are valued in present-day terms, and therefore the less we would be willing to spend now to prevent future climate-related damage. Because the costs of climate change are likely not to occur until the distant future, the choice of discount rate can have a huge impact on the SCC value.

[44] STERN, *supra* note 42, at 49-61.

the inane task of aggregating a set of disparate, inconsistent, and fundamentally flawed cost-benefit analyses into a set of meaningless and misleading numbers. True regulatory reform has never been more urgent. Now is the time for OMB reinvent itself, to think of creative and constructive ways to support the beleaguered and underfunded protector agencies and to affirmatively assist them in achieving the crucial regulatory mission of protecting people and the environment.

Thank you for your attention to these comments.

Sincerely,

Sidney Shapiro, J.D.
Board Member, Center for Progressive Reform
University Distinguished Chair in Law
Wake Forest University
School of Law

Amy Sinden, J.D.
Board Member, Center for Progressive Reform
Associate Professor of Law
Temple University
Beasley School of Law

Rena Steinzor, J.D.
President, Center for Progressive Reform
Professor of Law
University of Maryland
School of Law

James Goodwin, J.D., M.P.P.
Policy Analyst, Center for Progressive Reform

Appendix A to CPR Comments on 2010 Draft CBA Report

OMB'S AGGREGATION OF REGULATORY COSTS AND BENEFITS IS MISGUIDED AND MISLEADING.

We respectfully disagree that the practice of aggregating *ex ante* projections of costs and benefits of federal regulations provides "valuable information" about the effects of such regulation. The estimates of costs and benefits for each rule are based on such flawed and uncertain information that it is impossible to compare or aggregate cost-benefit analyses in any meaningful way. Indeed, in the process of aggregating these cost-benefit analyses, crucial information about each of the rules—information that cannot be reduced to a number and dollar value—is inevitably lost, even though this information may provide the real benchmark by which to judge the quality of these rules. The simple measurement of whether these rules' benefits outweigh their costs does not demonstrate whether or not our regulatory system has been "efficient" or "optimal." If anything, this simplified version of cost-benefit analysis leads to systematic under-regulation that leaves people and the environment insufficiently protected against unreasonable risk. In short, the practice of aggregating regulatory costs and benefits is at best unhelpful and at worse harmful to Americans and to the environment upon which we depend.

A. The Enterprise of Aggregating the Purported Costs and Benefits of All Federal Regulations is Fundamentally Misguided and has no Basis in Economics.

The entire premise of this Report—the notion that the aggregation of *ex ante* projections of the costs and benefits of all federal regulations can provide "valuable information" about the effects of such regulation—is misguided. It is based on a fundamental misunderstanding of the economic theory in which OMB purports to ground its cost-benefit mandate. Rather than illuminating the issues surrounding federal regulatory design, it serves only to distract attention from the real issue—namely, whether or not regulatory agencies are fulfilling their statutory missions in as effective and timely manner as possible.

If in a perfect world we could accurately measure and express in dollar terms all of the costs and all of the benefits to society as a whole of various regulatory alternatives,[45] then, under basic principles of welfare economics, we could use that information to determine which regulations would produce economically "efficient" results. That is, we could determine which regulations would maximize overall social welfare.

If, for example, we were designing a regulation to limit the amount of mercury emitted by electric power plants, we would estimate the costs and benefits that would accrue to society as a whole from incrementally more stringent levels of regulation. (The change in the level of costs or benefits produced by each incremental change in the stringency of the regulation is called a "marginal cost" or a "marginal benefit.") Assuming (as is usually the case) that at low levels of stringency the marginal benefits of pollution control outweighed the costs but that as the stringency of regulation increased the marginal costs gradually increased while the marginal benefits gradually decreased, then the optimal (or economically efficient) level of regulation would be that level at which marginal costs were just equal to marginal benefits. That would also be the level at which the net benefits of regulation were maximized.

[45] As the next section explores, this is a very big "if."

Thus, a cost-benefit analysis, as understood by an economist, considers the marginal costs and benefits of a series of regulatory options and picks the one for which marginal costs equal marginal benefits. Or, said another way, the cost-benefit analyst picks the option that produces the highest possible net benefits. So the criteria for an economically efficient regulation—that marginal benefits equal marginal costs and net benefits are therefore maximized—are very different from a criterion that simply requires the total benefits of a regulation to exceed its total costs. The latter criterion tells us very little about the efficiency of a regulation. While it is probably true that a regulation that produces more total costs than total benefits is inefficient, the converse is not true: Just because a regulation produces total benefits in excess of total costs does not mean that it is efficient.

Many grossly inefficient regulations produce overall benefits in excess of costs. Imagine for example that the efficient level of mercury regulation would reduce national emissions from 48 to 15 tons per year, and that such a regulation would cost society $5 billion and produce $45 billion in social benefits. This regulation would pass either version of the cost-benefit test—it maximizes net benefits *and* total benefits exceed total costs. But while this is the only level of mercury regulation that meets the economists' cost-benefit test, many other alternatives could meet the simple benefits-exceed-costs criterion. In our example it is easy to imagine, for example, that a regulation that reduced national mercury emissions by just one ton—from 48 to 47 tons per year—would still produce benefits that significantly outweighed the costs and thus would pass the simple benefits-exceed-costs test with flying colors. But such a regulation would not be at all efficient. In order to be efficient, the regulation would have to be much tougher: It would have to cut emissions down to the 15 tons-per-year level.

Thus, the simple benefits-exceed-costs criterion is a poor proxy for actual economic efficiency. Moreover, it is systematically biased toward striking down regulations that are too stringent and allowing regulations that are too lenient. This is because a regulation for which total costs exceed total benefits is usually one that is too stringent. A regulation that errs in the other direction, on the other hand—one that is too lenient—will likely produce positive net benefits, just less of them than an efficient regulation would have produced. Accordingly, a lenient regulation will be upheld under the simple benefits-exceed-costs test, even when under an efficiency test, it ought to be made more stringent. In this way, as Prof. David Driesen has shown, the simple version of cost-benefit analysis operates as a one-way ratchet—always pushing regulation toward less stringency, but never in the opposite direction.[46]

OMB purports to ground its policies in economic theory, and indeed, it explicitly adopts the more sophisticated economics-based version of cost-benefit analysis in its guidelines to agencies. Thus, Circular A-4 instructs agencies ~~to~~ measur[e] incremental benefits and costs of successively more stringent regulatory alternatives [in order to] identify the alternative that maximizes net benefits."[47] But OMB does not consistently hold agencies to that standard—particularly not when doing so would point toward a more stringent regulation.[48] And OMB's annual report to Congress abandons the economic-based version of cost-benefit analysis in favor of the simplistic benefits-exceed-costs test. Accordingly, it tells us virtually nothing about the actual efficiency of regulations.

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[46] *See* David M. Driesen, *Is Cost-Benefit Analysis Neutral?*, 77 U. COLO. L. REV. 335, 380 (2006).
[47] OMB Circular A-4 at 10. *See also* Executive Order 12866, 58 Fed. Reg. 51735 (Sept. 30, 1993) (Section 1: directing agencies to choose regulatory approaches that ~~—~~maximize net benefits").
[48] *See* Lisa Heinzerling & Rena Steinzor, *A Perfect Storm: Mercury and the Bush Administration, Part II*, 34 ELR 10485, 10487 (2004); Driesen, *supra* note 46.

Indeed, it could easily be that the overall benefits of regulation outweigh the overall costs, and yet regulations on the whole are far less stringent than they should be if they were set at economically efficient levels. (It is less likely that they err in the direction of too much stringency if total benefits exceed total costs.)

All of this, of course, assumes that the estimates of costs and benefits that form the basis of the Report bear some relationship to reality to begin with. In fact, as the next sections will show, OMB's accounting of the overall costs and benefits of federal regulation is built on estimates of regulatory costs and benefits that are almost certainly inaccurate, and thus untrustworthy.

B. In the Process of Aggregation, Crucial Information is Lost.

Cost-benefit analysis attempts to distill a large and complicated body of information into a few numbers. The information on which the analysis is based is always full of uncertainty and imperfections. Data are never complete. Scientific conclusions are never certain. And the process of converting intangible environmental values into monetary terms is fraught with unsolvable theoretical conundrums.[49] Accordingly, a properly developed cost-benefit analysis is always peppered with caveats and conditions that explain the uncertainties underlying the numbers, including which benefits could not be quantified, what assumptions were made to reach the numeric results, how changing those assumptions would effect the outcome, and what baseline the costs and benefits were measured against. Indeed, OMB's own guidance on conducting cost-benefit analyses, Circular A-4, stresses the importance of these narrative explanations of quantitative results,[50] as do the European Union's guidelines on regulatory impact assessment.[51] The monetary estimates of costs and benefits cannot be properly understood in the absence of these caveats.

The process of aggregation, however, must of necessity exclude all of this important narrative information. The result is a set of naked sums that at best provides no useful information and at

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[49] Prominent among these theoretical conundrums is the problem of discounting. Although discounting based on inflation and interest rates makes sense for purely monetary costs, there is considerable debate and controversy over OMB's practice of applying a discount rate to benefits of environmental health and safety regulation, like the value of human life, prevention of harms to future generations, and the prevention of ecological harms. Several of CPR's Member Scholars and other prominent academics have argued that there is no theoretical justification for using any discount rate at all for ecological benefits and other benefits implicating future generations. *See, e.g.,* Lisa Heinzerling, *Discounting Our Future*, 34 LAND & WATER L. REV. 39, 40-41 (1999) (arguing that discounting should be abandoned for measuring future lives saved); *see also* Richard Revesz, *Environmental Regulation, Cost-Benefit Analysis, and the Discounting of Human Lives*, 99 COLUM. L. REV. 941, 955–86 (1999). Indeed, use of a discount rate in such circumstances can yield absurd results. Applying a discount rate of five percent to the prevention of a billion deaths 500 years from now, for example, yields the conclusion that such a measure is less beneficial than the prevention of one death today.

Nonetheless, despite this wide-spread discrediting of the practice of discounting benefits and despite Professor Sinden's extensive comments criticizing OMB's use of discounting in response to previous draft reports, *see, e.g.*, Letter from CPR to Lorraine Hunt, 5/20/04 at 13-14, OMB once again announces in the 2009 Report its continued practice of using a seven percent discount rate across the board, without acknowledging the considerable controversy surrounding this practice. Draft Report at 9 n. 6, 69 (Appendix A).

[50] *See* Circular A-4 at 3 (—A complete regulatory analysis includes a discussion of non-quantified as well as quantified benefits and costs. . . . A good analysis is transparent. . . . For transparency's sake, you should state in your report what assumptions were used, such as the time horizon for the analysis the discount rates applied to future benefits and costs. It is usually necessary to provide a sensitivity analysis to reveal whether, and to what extent, the results of the analysis are sensitive to plausible changes in the main assumptions and numeric inputs.")

[51] *See* European Commission, *Impact Assessment Guidelines* (June 15, 2005), *available at* http://ec.europa.eu/governance/impact/docs/SEC2005_791_IA%20guidelines_annexes.pdf.

worst can be dangerously misleading.[52] Thus, in the Report's executive summary, OMB announces that the annual benefits of federal regulation "range from $128 billion to $616 billion" and the annual costs "range from $43 billion to $55 billion." The seeming precision of these numbers creates a false illusion of scientific accuracy and objectivity, which belies the vast gaps and uncertainties that lie beneath the numbers and violates the commitment to transparency that OMB made in Circular A-4. Furthermore, these gaps and uncertainties are far more likely to skew the numbers toward lower rather than higher net benefits.

Perhaps the biggest factor leading to the undercounting of benefits is the fact that many regulatory benefits are simply unquantifiable. Indeed, OMB acknowledges that "[i]n many instances, agencies were unable to quantify all benefits and costs."[53] In fact, for 13 of the 29 major environmental, health, and safety regulations reviewed by OMB this past year, the agencies were unable to provide a quantified estimate of any of the benefits at all. (They could not provide any quantified estimate of costs for 11 of the rules.)[54] Undoubtedly, there were other rules for which the benefits estimates reported by OMB were incomplete. OMB directs the reader to Table A-1 (part of an appendix to the report) for a narrative description of these "unquantified effects on a rule-by-rule basis,"[55] and in the earlier years of these reports, Table A-1 has indeed provided that information. In more recent years though, the explanations in the fifth column of the Table A-1 (labeled "Other Information") contain little or no mention of unquantified benefits.

Another factor leading to the undercounting of net benefits is the systematic over-counting of regulatory costs. There is considerable evidence that agencies routinely over-estimate the costs of regulatory compliance *ex ante*.[56] This is not surprising in light of the fact that agencies are usually heavily dependent on regulated industries themselves for information on compliance costs and those industries have an incentive to exaggerate the potential costs of regulation in hopes of pushing agencies toward less stringent rules.

C. The Underlying Estimates of the Costs and Benefits of Each Rule are not Trustworthy.

Ultimately, the individual cost and benefit estimates on which OMB's aggregate accounting is built are simply not trustworthy. The problem is that, at least in the context of environmental, health and safety regulation, the numbers produced by cost-benefit analysis are built on so many layers of assumption and uncertainty that they are ultimately endlessly contestable and manipulable.

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[52] *See* Parker, *supra* note 11, at 1348–49, 1404–06.
[53] *See* Draft Report at 10 n. 10.
[54] *See id*. at 20-23 (Table 1-4).
[55] *See id*. at 10 n. 10.
[56] *See* Frank Ackerman, *The Unbearable Lightness of Regulatory Costs*, 33 FORDHAM URB. L.J. 1071(2006); W. Harrington & R.D. Morgenstern, et al., *On the Accuracy of Regulatory Cost Estimates*, 19 J. POL'Y ANALYSIS & MGMT. 297 (2000); H. Hodges, *Falling Prices: Costs of Complying with Environmental Regulations Almost Always Less Than Advertised* (Econ. Pol'y Inst., 1997); U.S. Congress, Office of Tech. Assessment, *Gauging Control Technology and Regulatory Impacts in Occupational Safety and Health—An Appraisal of OSHA's Analytic Approach*, U.S. Gov't Printing Office OTA-ENV-635, *available at* http://www.fas.org/ota/reports/9531.pdf; Thomas O. McGarity & Ruth Ruttenberg, *Counting the Cost of Health, Safety, and Environmental Regulation,* 80 TEX. L. REV. 1997, 2042- 44 (2002) (collecting studies); Ruth Ruttenberg, *Not Too Costly After All: An Examination of the Inflated Cost Estimates of Health, Safety, and Environmental Protections*, (Public Citizen White Paper, Feb. 2004), *available at* http://www.citizen.org/documents/ACF187.pdf.

In 2006, Professor Sinden used the Environmental Protection Agency's (EPA) cost-benefit analysis of the Mercury Rule as a cautionary tale to show how cost-benefit analysis can fluctuate wildly in the political winds. EPA's cost-benefit analysis for the mercury rule went from estimating net benefits in connection with the proposed rule of $13 to 70 billion to estimating *negative* net benefits of $850 million in connection with the only slightly less stringent final rule. The story of how EPA went about achieving such a dramatic about-face involved stunning leaps of logic—like counting the fact that people with lower IQs tend to attend fewer years of school than those with higher IQs as a *benefit* of mercury poisoning—and the mysterious exclusion from the second analysis of large categories of benefits that had been quantified and included in the first analysis. But the point of the story was simply to illustrate again the indeterminacy and contestability of the numbers upon which agency cost-benefit analyses are built.

In 2007, the National Highway Traffic Safety Administration's (NHTSA) rule setting new fuel efficiency standards for light trucks stood out as one that received considerable attention from the media and accordingly was presumably subject to relatively careful review by the agency. Indeed, fuel efficiency has been a particularly salient political issue because of widespread consensus and concern about global warming. Nevertheless, the benefits estimate for the fuel efficiency rule did not include global warming impacts, because NHTSA deemed them too difficult to quantify—an admission that is buried on page 252 of the 316-page cost-benefit analysis report.[57] (The analysis did, however, go on to calculate—down to the penny—the monetary value of the five minutes drivers would save each time they did not have to visit a gas station because the increased efficiency of their engine allowed them to go farther on a tank of gas.)[58] If cost-benefit analysis cannot incorporate the issue that constitutes one of the most important reasons for promulgating a rule in the first place, one has to wonder if cost-benefit analysis has any relevance at all for public policy-making. Equally troubling was the fact that the 2007 Draft Report provided no hint of this striking omission from the cost-benefit estimate for the NHTSA rule. Although OMB promised that year (as it does again this year) to convey information about omitted, unquantifiable benefits on a rule-by-rule basis, it only met this obligation for those patient enough to dig to the table buried in Appendix A.[59] But for the NHTSA rule, even the Appendix was silent on this point, providing no clue that significant benefits might be missing from the estimate.[60]

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[57] *See* U.S. Department of Transportation, National Highway Traffic Safety Administration, *Final Regulatory Impact Analysis, Corporate Average Fuel Economy and CAFE Reform for MY 2008-2011 Light Trucks* VIII-64 to VIII-65 (March 2006)[hereinafter NHTSA RIA], *available at* http://www.nhtsa.dot.gov/staticfiles/DOT/NHTSA/Rulemaking/Rules/Associated%20Files/2006_FRIAPublic.pdf.

[58] *Id.* at VIII-66 to VIII-69.

[59] *See* 2007 Draft Report at 7 n. 8 ("In many instances, agencies were unable to quantify all benefits and costs. We have conveyed the essence of these unquantified effects on a rule-by-rule basis in the columns titled 'Other Information' in Appendix A.").

[60] Moreover, even if NHTSA's benefits estimate had provided some reasonable approximation of the true social benefits of its rule, the method NHTSA used to conduct its analysis would have provided little useful information about the desirability of the rule. NHTSA's cost-benefit analysis—like virtually all of the cost-benefit analyses produced by federal agencies and approved by OMB—failed to analyze the efficiency of the rule in a manner consistent with the fundamental principles of economic theory to which OMB purports to subscribe. Instead, NHTSA analyzed a set of only three alternatives, which varied some in their administrative details but all of which accomplished roughly the same increase in average fuel efficiency—a modest increase of less than two miles per gallon over a four year period. (The 2007 standard was 22.2 miles per gallon (mpg). *See* Average Fuel Economy Standards for Light Trucks, Model Years 2008-2011, 71 Fed. Reg. 17566, 17568 (Apr. 6, 2006). The new rule raised the standard each year for the next four years, reaching a high of 24 mpg for model year 2011. *See id*. at 17566, 17645 (Table 15)). It justified this increase by concluding that the benefits exceeded the costs, but failed to consider whether more stringent options would have produced even higher net benefits. *See* NHTSA RIA, *supra* note 57, at IX-7.

In 2008, EPA's cost-benefit analysis for its Mobile Sources Air Toxics (MSAT) Rule demonstrated once again the futility of trying to express the benefits of environmental regulations in quantified, monetized terms. This rule—aimed specifically at the reduction of air toxics—produced a cost-benefit analysis that literally left the effects of air toxics out of its benefits estimate entirely.[61] This was not because the agency believed those effects to be insignificant. EPA acknowledged that it "expect[ed] to see significant reductions in mobile source air toxics" as well as reductions in volatile organic compounds as a result of this rule, and that those reductions would produce significant health benefits, including reductions in cancer, asthma, reproductive and developmental effects, anemia, and the still unspecified premature mortality risk associated with ozone exposure.[62] Nonetheless, the benefits analysis for the MSAT Rule was limited exclusively to consideration of *some* of the health benefits of reducing particulate matter (a non-toxic air pollutant) that arise as *co-benefits* to controlling air toxics from mobile sources.[63]

The underlying deficiencies described above are inherent to the exercise of cost-benefit analysis, and thus are not limited to those included in Reports to Congress on the Benefits and Costs of Federal Regulation issued during the previous administration. Indeed, virtually every one of the cost-benefit analyses included in the 2009 Draft Report involved untrustworthy estimates of regulatory costs and benefits. For example, EPA candidly acknowledged that the cost-benefit analysis for its rule controlling air pollution from locomotive and smaller marine compression ignition engines did not account for all of the benefits that the rule would achieve by reducing particulate matter, ozone, and toxic air pollution.[64]

Other cost-benefit analyses from the 2009 Draft Report relied on questionable methods for attempting to put a monetary value on important health benefits. For example, in its rule on controlling air pollution from various types of spark ignited engines, EPA employed a "cost of illness" approach for measuring such health benefits as avoided hospital admissions. This approach assumes that the full "value" of avoiding a hospital admission is equal to the direct costs that one incurs as a result of a hospital admission. EPA, however, candidly acknowledges that the "cost of illness" approach greatly understates the value of

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[61] U.S. Envtl. Prot. Agency, Office of Transp. & Air Quality, *Regulatory Impact Analysis for Final Rule: Control of Hazardous Air Pollutants from Mobile Sources* 12-6 to 12-7 (Feb. 2007) (Table 12.1-2) [hereinafter EPA HAP RIA], *available at* http://epa.gov/OTAQ/regs/toxics/fr-ria-sections.htm.

[62] Control of Hazardous Air Pollutants From Mobile Sources, 71 Fed. Reg. 15804, 15907, 15909 (Mar. 29, 2006).

[63] Unfortunately, table A-1 in the 2008 Draft Report, which was supposed to provide a narrative description of "unquantified effects on a rule-by-rule basis," made no mention of these deficiencies. If anything, the entry in the "Other Information" column seemed misleadingly to suggest that the benefits estimate actually included the health benefits associated with reductions in one of the most dangerous air toxics targeted by the Rule, benzene. *See* Draft 2008 Report at 70. In order to discover that benzene, as well as all other air toxics, were in fact excluded from the analysis, one had to sift through either the hefty 807-page Regulatory Impact Analysis or the 160-page *Federal Register* notice for the final MSAT Rule.

[64] U.S. Envtl. Prot. Agency, Office of Transp. & Air Quality, *Regulatory Impact Analysis for Final Rule: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder* 6-5 (May 2008) [hereinafter EPA, LOCOMOTIVE RIA], *available at* http://www.epa.gov/oms/regs/nonroad/420r08001a.pdf ("[T]he full complement of human health and welfare effects associated with PM [particulate matter], ozone and air toxics remain unquantified because of current limitations in methods or available data").

these types of benefits by not accounting for the value of things such as avoided pain and suffering.[65] Thus, by overlooking entire benefits categories and by employing monetization techniques that greatly undervalue regulatory benefits, these and other cost-benefit analyses included in this year's Report present a greatly distorted view of the value of the regulations that agencies have promulgated in the past year. As in previous year's reports, however, table A-1 makes no mention of these deficiencies in the cost-benefit analyses that were aggregated in last year's report.[66]

D. Summary

Because of its many flaws, the practice of aggregating *ex ante* projections of regulatory costs and benefits is counterproductive and potentially even harmful. We understand that OMB is required by the Regulatory Right-to-Know Act of 2001 to assemble an annual report in which it aggregates these regulatory costs and benefits. However, we are also aware that regulatory agencies are in desperate shape right now; they are beset by so many challenges that they cannot properly fulfill their statutory missions. OMB is uniquely well positioned to help revitalize these agencies. Accordingly, OMB should focus its energies on helping agencies to fulfill their crucial missions of protecting people and the environment.

[65] U.S. Envtl. Prot. Agency, Office of Transp. & Air Quality, *Regulatory Impact Analysis for Final Rule: Control of Emissions of Air Pollution from Marine SI and Small SI Engines, Vessels, and Equipment* 8-28 (Sept. 2008) [hereinafter EPA, SI ENGINE RIA], *available at* http://www.epa.gov/OMS/regs/nonroad/marinesi-equipld/420r08014.pdf (–These cost-of-illness (COI) estimates generally understate the true value of reducing the risk of a health effect, because they reflect the direct expenditures related to treatment, but not the value of avoided pain and suffering" (internal citation omitted)).

[66] 2009 Draft Report at 54-60.

Appendix B to CPR Comments on 2010 Draft CBA Report

FULL SET OF COMMENTS ON THE SUBSTANTIVE FLAWS OF THE SOCIAL COSTS OF CARBON CALCULATION

The Social Cost of Carbon

A Report for the
Economics for Equity and the Environment Network

by

Frank Ackerman
Stockholm Environment Institute – U.S. Center

Elizabeth A. Stanton
Stockholm Environment Institute – U.S. Center

April 1, 2010

ECONOMICS
FOR EQUITY &
ENVIRONMENT

www.e3network.org

Executive Summary

In its first attempts to regulate carbon emissions, the U.S. government is undermining its own efforts by relying on deeply flawed economic models that lead to gross miscalculations of the impact of carbon on the climate and on the nation's economic future.

Agencies seeking to incorporate climate change considerations in rules and regulations often rely on a cost-benefit analysis, weighing the cost of curbing emissions against the expected damages from every ton of carbon dioxide (CO_2) that goes into the atmosphere – a value known as the "social cost of carbon" (SCC). The higher the SCC, the more stringent the regulatory standards: If it's $5, say, only regulations that cost less than $5 to implement would be deemed worthwhile; if it's $500, the demands imposed on polluters could be 100 times more costly. While no definite SCC has been set so far, an interagency working group has endorsed a "central" estimate of $21 per ton of CO_2 in 2010, or roughly 20 cents per gallon of gasoline – far too small a price incentive to prompt substantive mitigation measures. If widely adopted, this low estimate of the SCC could result in ineffectual regulations that would barely reduce U.S. emissions, if at all.

The proposed SCC value is so low due to very specific, erroneous choices, starting with a narrow reading of the climate economics literature that considers only three models, FUND, PAGE, and DICE. All three are problematic: FUND mistakenly predicts a huge reduction in mortality from warming, then values the lives supposedly saved on the basis of their per capita incomes. As a result, it makes the morally offensive assumption that human lives in poor countries are worth less than in rich ones. PAGE has produced a wide range of estimates, the higher of which the working group ignored, and most of its estimates assume that developed nations will adapt to climate change at near-zero cost. DICE assumes on very thin evidence that most people in the world would prefer a warmer climate, and recommends a very slow "climate policy ramp" as a result.

The working group has also been overly aggressive in discounting the value of future costs, using rates of 2.5 to 5 percent per year. At the "central" estimate of 3 percent, the present-day value of $100 in damages a century from now shrinks to as little as $5. Because the costs today will benefit not those who incur them, but future generations, the choice of a discount rate is really an ethical judgment. For these reasons, we advocate lower discount rates and/or decreasing rates over time.

The working group's estimates of the SCC largely omit the widely discussed risks of catastrophic climate damage. While the average expected damages from climate change are substantial, the credible worst-case outcomes are disastrously greater; the urgent priority is to avoid those worst-case scenarios. Policy designed from this perspective would not rely on cost-benefit calculations, but would set a "safe" minimum standard, based on the scientific analysis of potential risks, and determine the least-cost strategies to meet it. The "cost" of carbon emissions would equal the cost of those strategies.

Different choices on any of these points would have led to a higher price on carbon emissions and, as a result, to the recommendation of more stringent regulations. We do not

have enough data to determine what the "correct" value should be, but believe there is a need for more research, examining the full range of available studies of climate damages and costs, and analyzing assumptions about the risks and magnitudes of potential climate catastrophes.

Carbon concentrations are already too high; there were 280 parts per million (ppm) of CO_2 in the atmosphere before the industrial revolution, in 1750, and now there are 385 ppm. If current trends continue, we will reach 560 ppm within this century, increasing the average global temperature by 3° – 6°C (5.4° – 11°F). The average American caused 21 tons of CO_2 emissions in 2005; there is an immediate need for effective, science-based climate policy to dramatically reduce those emissions.

In the United Kingdom, which started estimating prices for carbon emissions several years ago, the government's latest calculation is a range of $41 – $124 per ton of CO_2, with a central case of $83. An expanded calculation of carbon prices for the United States should at least explore prices in this range, and should be open to considering the full range of implications of the extensive research that is needed to compute a better estimate of the cost of carbon emissions.

1.Introduction

The social cost of carbon may be the most important number you've never heard of. U.S. climate legislation may or may not make it through Congress this year, but in the meantime, the Environmental Protection Agency is moving ahead, authorized by the Supreme Court to limit greenhouse gas emissions. The Department of Energy is setting energy efficiency standards for residential appliances and commercial equipment, based in part on their contribution to climate change. Other agencies may address the same issues, when their regulations affect energy use and carbon emissions.

The social cost of carbon (SCC), defined as the estimated price of the damages caused by each additional ton of carbon dioxide (CO_2) released into the atmosphere, is the volume dial on government regulations affecting greenhouse gases: The higher the SCC is set, the more stringent the regulatory standards. This white paper explains how economists estimate the social cost of carbon, why the Obama Administration's current analyses are on a path to grossly underestimating it, and why relying on the SCC in the first place may be unproductive.

The EPA, DOE, and other agencies are deciding on values to assign to the SCC in the next few months as part of "rulemaking" processes that are couched in very technical terminology and largely invisible to the general public. In theory, it appears possible to derive the SCC from economic analysis, and the administration appears to have done so. In reality, it's not so simple: Any estimate of the SCC rests on a

"A low SCC could result in ineffectual regulations that lead to few if any reductions in U.S. emissions until Congress passes a climate bill. "

number of value judgments and predictions about uncertain future events, and so far, the administration has made choices that lead to very low SCC values. In an interim and then a revised analysis, an interagency working group has presented multiple scenarios and possible values for the SCC; the interim analysis suggests, and the revised analysis explicitly endorses, a "central" estimate of $21 per ton of CO_2 in 2010. This amounts to roughly 20 cents per gallon of gasoline, an extremely modest price incentive for carbon reduction. If adopted, this obscure number will have immense practical consequences: A low SCC could result in ineffectual regulations that lead to few if any reductions in U.S. emissions until Congress passes a climate bill.

Even greater harm could result if Congress interprets the $21 SCC as an endorsement of that level for a carbon tax or permit price. This could clash with the widely discussed, science-based goal of achieving an 80 percent reduction in U.S. emissions by 2050, an objective that will almost certainly require a much higher price on carbon. In the revised analysis, the central SCC estimate rises only to $45 per ton (in 2007 dollars) by 2050.[1] If climate economics is (mistakenly, in our view) interpreted as supporting an SCC of only $21 today and $45 by mid-century, it could also be interpreted as advocating only the emission reductions that would result from those prices. That is, working backwards from the proposed SCC, one could infer that the appropriate cap on carbon emissions is much weaker than those found in recent legislative proposals. The resolution to this paradox is that, as we argue in this paper, the $21 SCC is based on flimsy analyses and multiple mistakes. Sound economic analysis would show that the SCC should be much higher, and thus could be consistent with the carbon prices required to achieve science-based targets for emission reduction.

Calculating the SCC is a new undertaking for the administration, and these initial estimates may represent work in progress rather than a final answer. In its first attempts, however, the administration's interagency working group has left itself plenty of room for improvement.

2. The Back Story

A ton of CO_2 is the basic unit of emissions for climate policy, but it may be hard to visualize – especially since it's a colorless, odorless gas that mixes into the air around us. In the United States, one ton of CO_2 is emitted, on average, by:

- A family car every two and half months.[2]

[1] U.S. Department of Energy (2010), "Final Rule Technical Support Document (TSD): Energy Efficiency Program for Commercial and Industrial Equipment: Small Electric Motors," Appendix 15A (by the Interagency Working Group on Social Cost of Carbon): "Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866," available online at http://www1.eere.energy.gov/buildings/appliance_standards/commercial/sem_finalrule_tsd.html.

[2] Average U.S. passenger fuel efficiency for 2007 was 22.5 mile per gallon (BTS RITA Table 4-23, http://www.bts.gov/publications/national_transportation_statistics/html/table_04_23.html). Motor gasoline emissions coefficient, 19.564 lbs. per gallon (USEIA, Voluntary Reporting of Greenhouse Gases Program, http://www.eia.doe.gov/oiaf/1605/coefficients.html). U.S. miles per passenger car in 2001, 12,000 (USEIA NHTS Table A3, http://www.eia.doe.gov/emeu/rtecs/nhts_survey/2001/tablefiles/table-a03.pdf).

- A household's use of heating and cooking fuel every four months (if energy use were spread equally throughout the year). That's every four years in Hawaii or every six weeks in Maine.[3]
- A household's use of electricity every six weeks.[4]
- The typical use of a microwave oven every seven years or of a refrigerator every 15 months.[5]

U.S. residents emitted 21 tons of CO_2 per person in 2005: 33 percent from transportation, 15 percent from residential electricity, 6 percent from home heating and cooking, and the remaining 46 percent from industry, retail stores, and government.[6]

Each person's annual 21 tons of CO_2 add to the stockpile of greenhouse gases in the atmosphere. The more CO_2, the hotter the average global temperature (the "greenhouse effect"), the faster sea levels rise (warmer waters expand to take up more room, while glaciers and polar ice caps melt), and the more our weather patterns diverge from historical trends (changes to rainfall, more intense storms).

How fast are we making the climate worse? The amount of CO_2 in the air was 280 parts per million (ppm) before the industrial revolution, in 1750, and has now reached 385 ppm. Doubling the concentration of CO_2 – on current trends we will reach 560 ppm, double the pre-industrial level, within this century – has been widely expected to increase the average global temperature by 3°C (5.4°F),[7] but recent research has called this into question. Newer studies are suggesting that doubling the atmospheric CO_2 concentration could raise that average temperature by as much as 6°C (11°F).[8] The size of the temperature increase associated with a doubling of atmospheric CO_2, a number referred to as the "climate sensitivity," is crucial to the scientific analysis of climate change.[9]

The purpose of emission reductions is to limit the change in average global temperature and related climate conditions; many scientists believe that any warming beyond 2°C (3.6°F)

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[3] For direct residential emissions calculations see Stanton, E.A., F. Ackerman, and K. Sheeran (2009), *Greenhouse Gases and the American Lifestyle: Understanding Interstate Differences in Emissions*. Stockholm Environment Institute, Economics for Equity and the Environment Network, available online at http://www.e3network.org/papers/NRDC_state_emissions_report.pdf . Data used here are updated to 2005. Number of households in 2005 by state, ACS 2005 B11001, http://www.census.gov/.

[4] For electricity emissions calculations see Stanton, Ackerman and Sheeran (2009). Data used here are updated to 2005. Number of U.S. households in 2005, 111 million (ACS 2005 B11001, http://www.census.gov/).

[5] Ibid. Average energy use for appliances, 200 kWh/year for microwaves, 1100 kWh/year for refrigerators (USDOE Web site, http://www1.eere.energy.gov/consumer/tips/appliances.html).

[6] For methodology and data sources see Stanton, Ackerman and Sheeran (2009). Data used here are updated to 2005.

[7] Intergovernmental Panel on Climate Change (2007), *Fourth Assessment Report: Climate Change 2007* (AR4).

[8] Hansen, J. et al. (2008), "Target Atmospheric CO_2: Where Should Humanity Aim?" *The Open Atmospheric Science Journal* 2: 217-231, and IPCC (2007).

[9] For recent analyses highlighting scientific concern about climate sensitivity see Roe, G. H., and M. B. Baker (2007), "Why is Climate Sensitivity So Unpredictable?" *Science* 318: 629-632; Clement, A. C., R. Burgman, and J. R. Norris (2009), "Observational and Model Evidence for Positive Low-Level Cloud Feedback," *Science* 235: 460-464; Solomon, S. G.-K. Plattner, R. Knuttic, and P. Friedlingsteind (2009), "Irreversible climate change due to carbon dioxide emissions," *PNAS* 106(6): 1704-1709; and Schellnhuber, H. J. (2008), "Global warming: Stop worrying, start panicking?" *PNAS* 105(38): 14239–14240.

would put the world at too high a risk of catastrophic, irreversible consequences.[10] Already, CO_2 concentrations are well above pre-industrial levels, and CO_2, once emitted, stays in the atmosphere for a long time. This means that even if we could immediately stop all greenhouse gas emissions, there would still be a gradual temperature increase over the next century. The more we can slow down that increase, the easier it will be for human societies to adapt with careful planning and new technologies. Every ton of CO_2 that we can keep out of the atmosphere slows climate change, helps to hold temperatures under that 2°C threshold, and reduces the risk of the worst kinds of damage.

But reducing emissions also carries a cost – including the price of new "green" energy technologies, and more efficient appliances, vehicles, and heating and cooling systems. The policies used to reach this goal may leave households facing bigger energy bills. So to help determine how aggressively to act to cut emissions, policymakers weigh those costs against the cost of inaction, or of less-aggressive action. That's where the social cost of carbon comes in: It asks, how much will each ton of CO_2 that we release into the atmosphere cost us in damages, both today and in the future? If the answer is a big number, then we ought to make great efforts to reduce greenhouse gas emissions. If it's a small number, then the case for reduction is weaker, and only easy or inexpensive changes seem warranted, at least in narrowly economic terms.

For example, if the SCC had a value of $5 of present and future damages per ton of CO_2, we would be willing to pay up to $5 to prevent a ton from being released (just as you would put $4 in a parking meter to avoid a $5 ticket). But if the cost of a particular measure to reduce emissions had a higher price tag than $5 per ton, we might instead accept those future damages (just as you would prefer the $5 ticket to putting $6 in the meter).

"Even if we could immediately stop all greenhouse gas emissions, there would still be a gradual temperature increase over the next century. "

This is why the SCC is so important: The policy choices the government makes would be very different if it estimates climate damages not at $5 but at, say, $500 per ton of carbon (in the same way that a $500 parking fine would make you pay much more attention to putting money in the meter). Right now, of course, the price of carbon emissions is zero.

3. Uses of the Social Cost of Carbon

All current proposals for climate policy are based on the price of carbon emissions, whether it's through a carbon tax, market allowances, or through regulation by government agencies.

[10] See Ackerman, F., E.A. Stanton, S.J. DeCanio, E. Goodstein, R.B. Howarth, R.B. Norgaard, C.S. Norman, and K. Sheeran (2009), *The Economics of 350: The Benefits and Costs of Climate Stabilization*, Stockholm Environment Institute, Economics for Equity and the Environment Network, available online at http://www.e3network.org/papers/Economics_of_350.pdf , and IPCC (2007).

Carbon tax: Under this option – which is popular with some economists, but anathema in actual policy debates – the price per ton of carbon is applied as a tax on fuels. This can be done either at the well-head and the border, or at the point of consumption (a gasoline tax, for example). The government collects the taxes and can use the revenue for virtually any purpose: to reduce other taxes, to invest in clean energy, to assist workers transferring out of the most polluting industries, and so on.

Emission allowance markets: In a "cap and trade" scheme, a limited number of carbon allowances are issued, and a secondary market forms to buy and sell the permits. In a "cap and dividend" system, carbon allowances would be auctioned off, with the revenue returned to the public. Either way, a market is formed (the secondary market or the government auction) that sets the price of carbon through a give-and-take between buyers and sellers.

These two types of policies are symmetrical: A carbon price results in a reduction to emissions; a cap (or limit to emissions) results in a carbon price set by the market. If $X carbon price results in Y tons of carbon emitted, then a cap of Y tons should result in exactly the same $X carbon price. However, the distributional consequences – who ends up with the tax or allowance revenue in their pockets – depend on the exact provisions of a particular climate policy.

Government regulation: A government agency such as the EPA or DOE can ban polluting technologies, require a set of green technologies, or impose performance standards such as emissions limits. Such regulations can be established with little or no reference to economic analysis, in the classic "command and control" mode; or they can be guided by cost-benefit calculations. Under the latter approach, a policy is approved if its cost (per ton of CO_2 eliminated) is less than the carbon price; and a policy is rejected as uneconomical if its per-ton cost is more than the carbon price.[11] The current analyses of the social cost of carbon will be used to apply this kind of logic to U.S. regulatory proposals.

The administration plans to set the carbon price by using data and analyses taken from current climate economics literature. Their method sounds simple: collect a variety of social cost of carbon estimates from the literature, tweak them for comparability, and use the resulting range of values in decision-making. The next section discusses the numerous problems with the administration's initial attempts at picking numbers for the SCC.

4. The Obama Administration and the Price of Carbon

The federal government's estimates of the SCC have been developed by the Interagency Working Group on Social Cost of Carbon, with participation from the Council of Economic Advisers, Council on Environmental Quality, Department of Agriculture, Department of Commerce, Department of Energy, Department of Transportation, Environmental Protection

[11] For a deeper discussion of the process of calculating the social cost of carbon, see Stern, N. (2006), *The Stern Review: The Economics of Climate Change*, London: HM Treasury, Chapter 2, available online at http://www.hm-treasury.gov.uk/stern_review_report.htm: and Clarkson, R., and K. Deyes (2002), *Estimating the Social Cost of Carbon Emissions,* U.K. Department for Environment Food and Rural Affairs (DEFRA), Working Paper 140.

Agency, National Economic Council, Office of Energy and Climate Change, Office of Management and Budget, Office of Science and Technology Policy, and Department of the Treasury. The working group's interim estimates were used in DOE's final rule on energy efficiency in refrigerated vending machines[12] in August 2009, and in EPA's proposed rule on tailpipe emission standards for cars and light trucks[13] in September 2009. The working group's revised, current estimates were used in DOE's final rule on energy efficiency in small electric motors[14] in March 2010, and are expected to be incorporated into the final version of the tailpipe emission standard.

The working group's interim and revised analyses of the SCC have several features in common. Both rely heavily on averages of estimates from three climate economics models: DICE, FUND, and PAGE. Both experiment with a range of discount rates for valuing future outcomes (explained below), showing how the estimated SCC depends on assumptions about discounting.

"The working group's interim and revised SCC estimates rely on a biased and incomplete reading of the economic literature on climate change. "

The interim SCC analysis is the simpler of the two.[15] It follows the latest academic publications that present the three models, modifying them only to use differing discount rates. The revised analysis starts from the same point, performs a similar analysis of discount rates, and then goes on to modify the three models to consider a range of possible values for climate sensitivity, and to constrain them to match socioeconomic and emissions scenarios developed in another modeling exercise, the Energy Modeling Forum 22 (EMF-22) studies.[16]

We believe that the working group's interim and revised SCC estimates rely on a biased and incomplete reading of the economic literature on climate change. The methods used to set these values reveal an unexplained confidence in a handful of authors and models, and offer arbitrary, unsupported judgments as grounds for ignoring important alternatives. Most of the errors, omissions, and arbitrary judgments tend to reduce the estimate of the SCC; a corrected version of the same calculations, therefore, would likely result in a larger SCC – and more stringent regulations of greenhouse gas emissions.

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[12] U.S. Department of Energy, Energy Conservation Program (2009), "Energy Conservation Standards for Refrigerated Bottled or Canned Beverage Vending Machines; Final Rule," 10 CFR Part 431, Federal Register vol. 74, no. 167, Aug. 31, 2009, pages 49914-44968, available online at http://www2.eere.energy.gov/buildings/appliance_standards/commercial/pdfs/bvm_final_rule_notice.pdf.

[13] EPA (2009), "Proposed Rulemaking To Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards," EPA Docket EPA-HQ-OAR-2009-0472, Federal Register vol. 74, no. 186, Sept. 28, 2009, pages 49411-49418, available online at http://www.epa.gov/fedrgstr/EPA-AIR/2009/September/Day-28/a22516d.htm.

[14] U.S. Department of Energy (2010), Appendix 15A (see full reference above)

[15] For a detailed discussion of the interim analysis, see Ackerman, F. (2009), "Comments on EPA and NHTSA 'Proposed Rulemaking to Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards,' " EPA Docket EPA-HQ-OAR-2009-0472, Federal Register vol. 74, no. 186, Sept. 28, 2009, pages 49454-49789, available online at http://www.sei-us.org/climate-and-energy/Ackerman_Sept2009Comments_on_EPA_GHG.pdf.

[16] The EMF-22 studies were published in a special issue of *Energy Economics* in 2009, available online at http://emf.stanford.edu .

Ethical judgments and omitted values imply that any SCC is incomplete

Some of the serious anticipated damages from climate change, such as loss of endangered species, cannot be quantified or monetized. Much of the climate economics literature used to inform the working group's estimates omits these values entirely, effectively giving them a value of zero. As a result, estimates of the SCC may be too low or logically incomplete, in the sense that they exclude crucial, unmonetized dimensions of climate damages.

Ethical judgments about the treatment of unmonetized damages play a role in any climate policy, complementing the quantitative calculations embodied in the SCC: What importance should be given to, for instance, the loss of endangered species, unique habitats and environments, and human lives and communities? Attempts to assign dollar costs to these priceless values leads to meaningless or offensive valuations (some of which are discussed below). Exclusion of them, however (or banishing them to the netherworld of "caveats" and verbal qualifications that are ignored in practice) amounts to treating them as being known to have no value at all. Ethical questions arise, as well, within the calculation of the SCC, particularly in the treatment of costs and benefits to future generations, a topic we address below.

The arbitrary choice of three models biases the analysis

The economic assumptions leading to the choice of the three models, DICE, FUND, and PAGE, are discussed at some length in the interim analysis. (The revised analysis simply says that these are three widely used models.) The interim analysis first takes Richard Tol's 2008 meta-analysis of estimates of the SCC as a starting point; attention is then restricted to peer-reviewed studies; three specific integrated assessment models – FUND, PAGE, and DICE – are selected, while others are ignored; and an unstated corollary is that the data sets developed by the authors of these three models are adopted without discussion. Each step of this process introduces arbitrary biases into the SCC estimate.

First, Tol's meta-analysis of SCC estimates, which describes itself as a comprehensive review of published research, is in fact a highly personal view of the economics literature, with a strong emphasis on Tol's own work.[17] It includes 211 estimates of the SCC, of which 112 come from Tol.[18] Disproportionate numbers also come from a few other authors and models. Every version of William Nordhaus' DICE model is included, despite the fact that the newer versions were created to update and replace the older versions.

Tol has not published 112 separate studies of the SCC; rather, he has counted multiple scenarios and sensitivity analyses within his own studies as separate estimates. He has extended the same treatment to some, but not all, other economists. For example, the Stern Review,[19] which included multiple scenarios and sensitivity analyses, is treated as only generating a single estimate of the SCC in Tol's meta-analysis. Thus the use of Tol's meta-

[17] Tol, R., "The Social Cost of Carbon: Trends, Outliers and Catastrophes," *Economics* (e-journal), Vol. 2, 2008.
[18] Ibid, Table 2, for author counts.
[19] Stern (2006).

analysis as a starting point is not a neutral decision; it introduces biases in favor of the work of Tol and Nordhaus, and against the Stern Review, among others.

Second, insisting on peer review as an absolute criterion for inclusion in the SCC process also creates a bias. Indeed, a principal effect is to rule out consideration of the widely discussed Stern Review, which offered an innovative, rigorous analysis leading to a relatively high estimate of the SCC, $85 per ton of CO_2. Tol and some other economists have criticized the Stern Review for appearing as a government policy report rather than in a peer-reviewed journal. The level of professional review and detailed scrutiny applied to the Stern Review both before and after its publication was, however, far beyond the normal peer review process for articles published in academic journals. Following the publication of the Stern Review, the American Economics Association published a symposium on it in the *Journal of Economic Literature*, and invited Stern to give the prestigious Ely Lecture at the AEA's annual meeting in 2008; that lecture was published in the *American Economic Review*, the highest-status journal in the field.[20]

Third, the FUND, PAGE, and DICE climate economics models are not the only relevant climate economics models. The interim SCC analysis simply asserts without any documentation or other justification that "the FUND, PAGE, and DICE models now stand as the most comprehensive and reliable efforts to measure the economic damages from climate change."[21]

No evidence is offered to support that judgment; the reader must take it or leave it, on the personal authority of the authors of the proposed rule. The judgment, however, is not universal. The EPA's own "Climate Economic Modeling" Web page[22] makes no mention of FUND, PAGE, or DICE, but describes the ADAGE and MiniCAM models, among others. The three chosen models, misidentified as the "most comprehensive and reliable," are in fact among the simplest of all IAMs in current use.[23]

Finally, the data sets developed for FUND, PAGE, and DICE are not the only data that should be considered. The transparency of simple models like these allows a relatively clear view of the data and relationships that drive the model results. For climate economics models in general, including FUND, PAGE, and DICE in particular, the software and model relationships are often less decisive than the data inputs in shaping the results. Extensive experiments with DICE by a range of researchers have shown that with small, reasonable changes to the basic data, DICE can yield very different projections (our own contribution to that "modified DICE" literature is cited below). The procedure suggested in the tailpipe emissions case not only endorses three specific models; it implicitly endorses the data sets offered by the models' authors. Those data sets embody a number of controversial judgments.

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[20] Stern, N., "The Economics of Climate Change," *American Economic Review* (2008), 98:2, 1-37.
[21] EPA (2009), "Proposed Rulemaking" (see full reference above).
[22] http://www.epa.gov/climate/climatechange/economics/modeling.html
[23] Stanton, E.A., F. Ackerman, and S. Kartha, "Inside the integrated assessment models: Four issues in climate economics," *Climate and Development* (2009), 1: 166-184.

FUND, originally developed by Richard Tol, relies on data from numerous studies of particular climate-related costs and impacts by Tol and his coauthors. In the problematic area of monetary valuation of the loss of human life, Tol argues that the value of life in a country depends on how rich it is: As he and two coauthors wrote in a paper on valuation of health, "Following Tol (2002a), we value a premature death at 200 times per capita income [i.e., average per capita income for the region where the death occurs]."[24] The assumption that higher-income lives are of greater monetary value than lower-income ones is morally offensive.

Tol and his coauthors also conclude, based on a series of mistakes and miscalculations, that the early stages of global warming will cause a huge *reduction* in mortality.[25] Valuing these allegedly saved lives at 200 times their per capita incomes creates a huge, spurious benefit of moderate warming, thereby reducing the net cost of climate damages and the SCC. The multiple mistakes in Tol et al.'s calculation of mortality reduction are explained in our response in the same journal.[26]

Chris Hope, the developer of PAGE, has responded to several objections to particular data inputs by converting them to uncertain parameters, allowing them to vary across a range of different values and looking at the average result. PAGE has produced many different estimates, including the Stern Review results which the interagency working group ignored, as well as the lower SCC values which the working group adopted. In a collaboration between Hope's research group and ours, we came to question PAGE's low projections of climate damages to the United States, even in the Stern Review version of the model.[27] The PAGE data set assumes that developed countries can and do engage in nearly costless adaptation to most climate damages in the next century. In addition, PAGE sets a relatively high temperature threshold for the onset of catastrophic damages, which seems inconsistent with recent scientific discussion of climate risk. Based on changes to these and other assumptions, we worked with Hope to produce several alternate estimates for U.S. and global damages due to climate change, ranging up to five to six times the PAGE defaults used by the working group.

The DICE model, developed by William Nordhaus, is known for its finding that the optimal climate policy is a very gradual one, starting on a small scale and expanding at a leisurely pace; Nordhaus refers to this as the "climate policy ramp." The gradualism of the default DICE projections is driven by the DICE estimate of climate damages, which is surprisingly low. One factor holding down the overall damage estimates is the assumed large benefit of warmer temperatures. On very thin evidence, Nordhaus assumes that most people in the world would be willing to pay for a warmer climate; he concludes that the optimal

[24] Bosello, F., R. Roson, and R. Tol, "Economy-wide estimates of the implications of climate change: Human health," *Ecological Economics* (2006), 58: 579-591; quote from 585.
[25] Bosello, Roson, and Tol 2006; see Table 1, page 582, for projected changes in the number of deaths.
[26] Ackerman, F. and E.A. Stanton, "A comment on 'Economy-wide estimates of the implications of climate change: Human health,' " *Ecological Economics* (2008), 66:8-13.
[27] Ackerman, F., E.A. Stanton, C. Hope, and S. Alberth, "Did the Stern Review underestimate U.S. and global climate damages?" *Energy Policy* (2009), 37:2717-2721.

temperature is far above the current global average.[28] In work in progress, University of California-Berkeley economist Michael Hanemann has used up-to-date information to re-estimate each of the economic impacts of climate change included in the DICE damage function, concluding that damages in the United States could be four times as large as the estimates implied by the DICE defaults.[29]

The conclusion is clear: The decision to rely exclusively on the FUND, PAGE, and DICE models and their underlying data sets imposes a narrow, biased filter on the economic analysis of the SCC. If agencies rely on these model results, especially in the absence of other analyses, they will almost certainly underestimate the social cost of carbon.

Casual, undocumented estimates are used to justify the choice of discount rate

Estimates of the social cost of carbon combine present and future damages together as one value, the total impact of an additional ton of CO_2. The process for combining costs from different time periods is called "discounting." The farther into the future that costs take place, the less these costs are assumed to matter in today's decision-making. But discounting also involves a judgment call: Future values can be discounted a lot, so that they have little bearing on our decisions; not at all, so they weigh equally with present costs, or somewhere in between. The higher the "discount rate" that is chosen, the less future costs are valued in present-day terms.[30]

"If agencies rely on these model results, especially in the absence of other analyses, they will almost certainly underestimate the social cost of carbon. "

When discounting is used to combine values from a short span of years, a market rate of interest is often taken to be an appropriate discount rate; this may be 5 percent or even higher. In theory, if we knew that climate damages would cost $100 ten years from now, we could invest $64 today at 5 percent interest to cover those costs in the future. To put this another way, at a 5 percent discount rate, a $100 cost ten years from now can be valued at $64 today; anyone who expects to incur a $100 cost ten years from now could put $64 in the bank in 2010, and withdraw $100 in 2020.

However, when discounting takes place across a longer span of time, the logic of using market rates becomes muddied. Climate policy is inescapably concerned with mitigation

[28] Nordhaus, W., and J. Boyer, *Warming the World: Economic Models of Global Warming* (MIT Press, 2000), 84-85. The assumed positive value of warmer temperatures for most of the world is still visible in the "lab notes" documenting the data set for the newest version of DICE, http://nordhaus.econ.yale.edu/Accom_Notes_100507.pdf (page 24, "time use" column). For a critique, see Ackerman, F., and I. Finlayson, "The economics of inaction on climate change: A sensitivity analysis," *Climate Policy* (2006), 6: 509-526.

[29] Hanemann, W.M. (2009),"What is the Economic Cost of Climate Change?" University of California-Berkeley. On errors in an influential early analysis of agriculture and climate change coauthored by Nordhaus, see Schlenker, W., W.M. Hanemann and A.C. Fisher, "Will U.S. Agriculture Really Benefit from Global Warming? Accounting for Irrigation in the Hedonic Approach," *American Economic Review* (March 2005) 395-406.

[30] For a detailed discussion of discounting, see Stern (2006) and Arrow, K. J., W.R. Cline, K.-G. Maler, M. Munasinghe, R. Squitieri, and J.E. Stiglitz (1996), "Chapter 4 - Intertemporal Equity, Discounting, and Economic Efficiency," in *Climate Change 1995 - Economic and Social Dimensions of Climate Change, Contribution of Working Group III to the Second Assessment Report of the IPCC*, J. P. Bruce, H. Lee and E. F. Haites, Eds. New York, NY: IPCC and Cambridge University Press: 125-144.

costs incurred today that will have their greatest benefits a century or more into the future, yet there is no single individual who can compare her own costs today with benefits 100 years from now. The choice of a discount rate for intergenerational impacts is an ethical judgment, not a data point that can be found in the financial pages. Lower discount rates, decreasing rates over time, and even a zero discount rate (no discounting) can be used to show that our society takes seriously the costs to be suffered by future generations.[31]

The interim analysis recommends two alternate discount rates, 3 percent and 5 percent, for use in calculating the SCC, while noting that "decisions based on cost-benefit analysis with high discount rates might harm future generations."[32] Casual estimates and unsupported judgments are used to justify discount rates that are inappropriately high for an analysis that spans several generations. The Office of Management and Budget guidelines encourage sensitivity analysis with discount rates below 3 percent for intergenerational problems.[33] The revised SCC analysis takes a timid step in that direction, adding a discount rate of 2.5 percent, along with 3 percent and 5 percent.

Catastrophic climate risk is left out of the calculations

The administration's estimates of the social cost of carbon largely omit the risk of catastrophic climate damage. (DICE includes the expected value of a moderately catastrophic economic downturn, with a magnitude based on a very old opinion survey; PAGE includes a Monte Carlo analysis of the risk of a similar-sized catastrophe; FUND ignores the issue.) The interim analysis mentions this issue only briefly in its "caveats" to its estimates; the revised analysis discusses catastrophic risk at greater length, suggesting it as an area for future research on the SCC.

"The choice of a discount rate for intergenerational impacts is an ethical judgment, not a data point that can be found in the financial pages. "

In fact, the treatment of catastrophic risk is one of the most important parts of climate economics, and has been the subject of extensive theoretical analysis and debate. Martin Weitzman's important recent work on uncertainty suggests that policy should be directed at reducing the risks of worst-case outcomes, not at balancing the most likely values of costs and benefits.[34] This fits well with a large portion of the prevailing discourse on climate change: The expected damages are important and costly; the credible worst-case outcomes are disastrously greater. The urgent priority is to protect ourselves against those worst cases, not to fine-tune expenditures to the most likely level of damages.

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[31] For a more detailed discussion see Ackerman (2009), "Comments on EPA and NHTSA 'Proposed Rulemaking.' "
[32] EPA (2009), "Proposed Rulemaking" (see full reference above).
[33] As cited in EPA (2009), "Proposed Rulemaking."
[34] Weitzman, M. (2009),"On Modeling and Interpreting the Economics of Catastrophic Climate Change," *Review of Economics and Statistics*, 91:1-19; see also Weitzman, M. (2007) "A Review of the Stern Review on the Economics of Climate Change," *Journal of Economic Literature*, 45:703-724. For a non-technical presentation of the Weitzman analysis of uncertainty as applied to climate change, see Ackerman, F. (2009), *Can We Afford the Future? Economics for a Warming World*, London: Zed Books, Chapter 3.

Protection against worst-case scenarios is familiar, though it takes us outside the realm of cost-benefit analysis, into the discussion of insurance policies. Insurance is normally taken out against events which, on average, are unlikely to occur: The average U.S. housing unit can expect to have a fire every 250 years, so the most likely number of residential fires you will experience in your lifetime is zero.[35] Moreover, insurance is guaranteed to fail a simple cost-benefit test – the average value of payments to policyholders must be less than the average value of premiums, in order for any insurance company to remain in business.

> "The urgent priority is to protect ourselves against the worst cases, not to fine-tune expenditures to the most likely level of damages. "

Policy designed from this perspective would not be framed in terms of cost-benefit calculations. Rather, it would begin with adoption of a safe minimum standard, based on the scientific analysis of potential risks. The economic analysis would then seek to determine the least-cost strategy for meeting that standard. For example, we recently examined, together with a group of coauthors, the costs of lowering atmospheric CO_2 concentrations to 350 ppm, a level now advocated by a growing number of climate scientists and policy analysts.[36] The best available estimates suggest that the costs would be noticeable, but manageable. The risk of spending "too much" on clean energy alternatives pales in comparison with the risk of spending too little and irreversibly destabilizing the earth's climate.

The revised analysis adds complexity, but not insight

The features, and problems, described above are common to both the interim and revised calculations of the SCC. The more elaborate analysis in the revised calculation, used in the small electric motors case, adds two more major features.

First, the working group performed a Monte Carlo analysis of the effects of scientific uncertainty about climate sensitivity. This appears to be done in a rigorous, appropriate manner. One might expect the result to be a much higher SCC, but that is not the case. We made a similar, unexpected discovery in recent research with DICE: Varying the climate sensitivity alone caused surprisingly little change in the model results.[37] In schematic terms, climate sensitivity governs the model's translation of CO_2 concentrations into temperature increases, but the model's damage function translates temperatures into economic damages. If the damage function is sufficiently "optimistic" – or perhaps "Polyanna-ish" – then even relatively high temperatures may impose limited costs, and therefore inspire limited policy responses. The DICE damage function rises at a leisurely pace as the world gets warmer, and does not project that half of global output is lost to climate damages until warming reaches 19°C (34°F), far above the range of temperatures normally considered in even the most disastrous climate scenarios.

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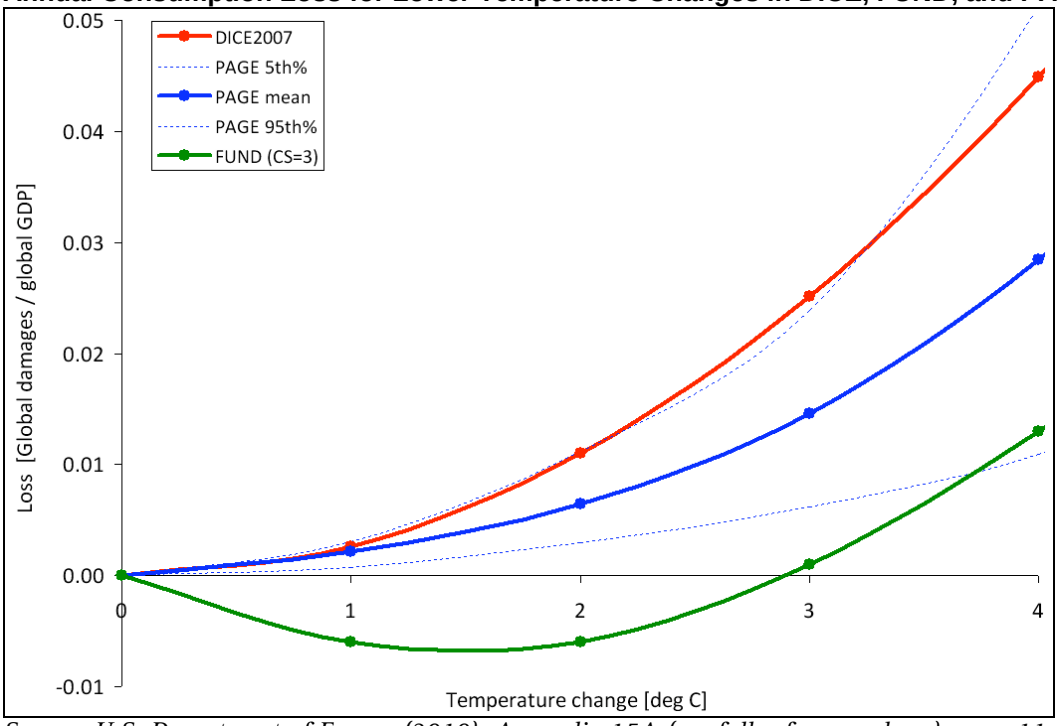
[35] See Ackerman (2009), Chapter 3, for details.
[36] Ackerman et al. (2009), *The Economics of 350* (see full reference above).
[37] Ackerman, F., E.A. Stanton, and R. Bueno (2010), "Fat Tails, Exponents, and Extreme Uncertainty: Simulating Catastrophe in DICE," forthcoming in *Ecological Economics*.

Second, the working group chose a set of macroeconomic growth and emissions scenarios for use in the three models. Rather than using relatively familiar IPCC scenarios, the working group opted, with little explanation, for a group of five scenarios extracted from the Energy Modeling Forum 22 (EMF 22) process. EMF 22 compared the latest projections from about a dozen climate economics models (including FUND, but not DICE or PAGE). The working group took four distinct business-as-usual scenarios, from four different EMF 22 models, and one policy scenario achieving moderate emissions reduction. It then used these scenarios in DICE, FUND, and PAGE, and averaged the results. For DICE in particular, significant software modifications were required to reproduce the EMF scenarios.

This hybrid modeling exercise is unsatisfying all around: It has neither the benefits of relative familiarity with the three simple models and the standard IPCC scenarios, nor the advantages of applying the more complex, larger models used in EMF 22. If such large pieces of the EMF 22 apparatus needed to be used, why not review the findings of the EMF 22 models as a whole?

One conclusion from the revised analysis is that FUND is an outlier among climate economics models. As the working group's Figure 1B (reproduced here) shows, DICE and PAGE project

Annual Consumption Loss for Lower Temperature Changes in DICE, FUND, and PAGE



Source: U.S. Department of Energy (2010), Appendix 15A (see full reference above), page 11, Figure 1B.

modest but positive damages at low temperature changes, but FUND projects net benefits (in the graph above these are represented as negative – below zero – costs) to the world from warming until the world is almost 3°C (more than 5°F) hotter. That is, FUND believes the world will be better off as a result of the first several decades of global warming. With a

high enough discount rate, those decades of desirable warmth outweigh the far future when we move beyond 3°C; at a 5 percent discount rate, FUND's estimate of the SCC is negative![38] According to FUND, that is, at a 5 percent discount rate, it would be appropriate to provide a (small) subsidy to those who emit carbon, because they are accelerating the arrival of the gloriously hotter mid-century years.[39]

Our reading of these results is that the FUND model needs to be towed back to the shop for major repairs. The interagency working group, however, has concluded that FUND is an appropriate choice for its short list of three models providing estimates of the SCC for U.S. policy purposes.

The results of the analyses will be interpreted as clustering around $21 per ton

Neither of the analyses resulted in a single bottom-line estimate of the one and only SCC. Both produced multiple figures, primarily reflecting differing assumption about the discount rate. The figures are presented in Table I.

Table I: Estimates of the SCC in two recent analyses

	Social cost of carbon, 2010 (in 2007$)	
	Interim analysis	Revised analysis
Fixed discount rates, mean estimates		
5 percent	$5	$5
average of 3 and 5 percent	$21	–
3 percent	$37	$21
2.5 percent	–	$35
Other estimates		
discount rate declines from 5 percent	$11	–
discount rate declines from 3 percent	$61	–
95th percentile risk, 3 percent discount rate	–	$65

Note: Published SCC values in the interim analysis are for 2007; we have escalated them at the recommended 3 percent annual real growth rate to yield figures for 2010, comparable to the revised values.

Both the interim and revised analysis provided three estimates involving fixed discount rates and mean risks; at first glance the ranges of numbers are very similar. The definitions, however, are different: At a 5 percent discount rate, the SCC is the same for both, but at 3 percent the revised SCC is $21, while the corresponding interim value is $37. At least at lower discount rates, the two analyses embody very different views of the damages caused

[38] See U.S. Department of Energy (2010), Appendix 15A (full reference above), page 27, Table 3; see also EPA (2009) "Proposed Rulemaking," page 49615, Table III.H.6–1, for comparable results in published FUND studies.
[39] At higher discount rates, FUND's estimates of the SCC move into barely positive territory: $6 per ton at a 3 percent discount rate, and $14 per ton at 2.5 percent, still far below DICE and PAGE. DOE (2010), Table 3, p. 27.

by greenhouse gas emissions. Due to the accidents of presentation, however, each has a (differently defined) "central" estimate, in this group, of $21.

Each analysis also considered one alternative assumption. The interim analysis examined the implications of discount rates that decline over time, starting at either 5 percent or 3 percent. The revised analysis calculated the 95th percentile risk, from its Monte Carlo analysis of climate sensitivity, using its "central" estimate of a 3 percent discount rate. The uppermost values projected are, coincidentally, not far apart, though again the definitions differ. While the upper values are academically interesting, both analyses are being taken as projecting that the SCC is $21 per ton of CO_2 in 2010, measured in 2007 dollars, or roughly 20 cents per gallon of gasoline. It is hard to reconcile a carbon price that is well within the range of normal price fluctuations at the gas pump with the policy goal of substantially reducing carbon emissions.

"It is hard to reconcile a carbon price that is well within the range of normal price fluctuations at the gas pump with the policy goal of substantially reducing carbon emissions. "

5. Conclusion and Recommendations

The administration's narrow proposed range of SCC values, with a likely "central" estimate of $21, is a function of its choice of a limited range of underlying studies, high discount rates, and insufficient emphasis on the risk of catastrophic climate damage. Different choices at several points in the methodology would have resulted in a far higher SCC and, as a result, more stringent and more expensive emissions reduction would be considered economical.

The discussions of the SCC in the working group analyses to date do not contain enough information to construct a better estimate. Instead, there is a need for more extensive research, examining the full range of available studies of climate damages and costs, and analyzing assumptions about the risks and magnitudes of potential climate catastrophes. If one or more of the simple climate economics models highlighted in the rulemaking process – DICE, FUND, and PAGE – are to be used, then the default data sets supplied by the modelers need to be independently validated against the latest research on climate damages and other input assumptions. FUND, in particular, needs to be re-examined to understand its projections of net benefits from warming, and to consider the potential need for modification.

Additional research on climate damages could address the potential disconnect between science-based and economics-based targets for emission reduction. If, as climate science forecasts with increasing urgency, there are severe risks from just a few degrees of warming, this should be reflected in the economic estimates of damages. Models which claim that the first 3°C of warming are beneficial to the world will inevitably endorse very little reduction in greenhouse gas emissions; models which imply that 2°C is the limit for avoiding serious risks of destabilizing the earth's climate will suggest much greater reduction. They can't both

be right. There is no reason to think that three small economic models contain insights into climate dynamics superior to those from the massive, extensively tested general circulation models of climate science. Thus it is time to construct an economic analysis consistent with the concerns and constraints that emerge from the science of climate change.

There is a related need for policies to address the crucial but unmonetized aspects of climate impacts, and to face the ethical choices raised by these impacts. These choices are difficult to fit into the cost-benefit framework implicit in the SCC calculation.[40] An alternative approach could assert that it is essential to set an absolute limit on climate damages, and therefore to keep emissions and temperature increases under strict ceilings — such as 350 ppm of CO_2 in the atmosphere, or no more than a 2°C temperature increase. This would lead to a cost-effectiveness analysis, seeking the least-cost scenario for achieving the needed emission reductions. That scenario would consist of adopting all the lowest-cost reduction opportunities, starting from the measure with the lowest cost per ton of avoided emissions and adopting additional measures in order of their expense. In a cost-effectiveness framework, the carbon price is still important to decision-making, but it is calculated on a different basis. Instead of an SCC, the carbon price would instead represents the per-ton cost of the most expensive mitigation measure that is required to meet the emission reductions target.

"There is a need for policies to address the crucial but unmonetized aspects of climate impacts, and to face the ethical choices raised by these impacts. "

How high might an alternative carbon price turn out to be? The United Kingdom, which pioneered the use of SCC estimates for policy purposes, abandoned calculation of the SCC altogether in 2009, and now bases its carbon price on estimates of mitigation costs (as would be required under a cost-effectiveness approach). The latest estimate is a range of $41 – $124 per ton of CO_2, with a central case of $83 — which is very close to the estimate of the SCC in the Stern Review.[41] An expanded calculation of carbon prices for the United States should at least explore prices in this range, and should be open to considering the full range of implications of the extensive research that is needed to compute a better estimate of the price of carbon emissions.

[40] Ackerman, F., and L. Heinzerling (2004). *Priceless: On Knowing the Price of Everything and the Value of Nothing*, New York, NY: The New Press.

[41] U.K. Department of Energy & Climate Change (2009), "Carbon Appraisal in UK Policy Appraisal: A Revised Approach," available online at http://www.decc.gov.uk/en/content/cms/what_we_do/lc_uk/valuation/valuation.aspx. Pounds sterling converted to dollars using an exchange rate of £1.00 = US$1.625.