IER INSTITUTE FOR ENERGY RESEARCH

COMMENT ON REVISED DRAFT GUIDANCE FOR FEDERAL DEPARTMENTS AND AGENCIES CONSIDERATION OF GREENHOUSE GAS EMISSIONS AND THE EFFECTS OF CLIMATE CHANGE IN NEPA REVIEWS, 79 FED. REG. 77,802 (DECEMBER 24, 2014)

Institute for Energy Research[*]

* * *

INTRODUCTION

On December 18, 2014, the Council on Environmental Quality (CEQ) unveiled revised draft guidance on consideration of greenhouse gas emissions and the effects of climate change in NEPA reviews.[1] This new draft guidance is internally inconsistent, fails to require information about climate change itself, is inconsistent with NEPA, is inconsistent with current NEPA regulations, is inconsistent with case law, and uses the arbitrary and capricious social cost of carbon. CEQ should withdraw this guidance.

I. CONTRARY TO THE GUIDANCE ITSELF, THE DRAFT GUIDANCE FAILS TO CONSIDER THE POTENTIAL IMPACTS OF A PROPOSED ACTION ON CLIMATE CHANGE

The first requirement in the Draft Guidance states, "Federal agencies, to remain consistent with NEPA, should consider the extent to which a proposed action and its reasonable alternatives contribute to climate change …"[2] Contrary to this directive, however, the Draft Guidance does not do this. Instead of considering how a Federal action would "contribute to climate

[*] The Institute for Energy Research (IER) is a not-for-profit organization that conducts intensive research and analysis on the functions, operations, and government regulation of global energy markets. IER maintains that freely-functioning energy markets provide the most efficient and effective solutions to today's global energy and environmental challenges and, as such, are critical to the well-being of individuals and society.

[1] Council on Environmental Quality, *Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts*, 79 Fed. Reg. 77,802, Dec. 18, 2014, http://www.gpo.gov/fdsys/pkg/FR-2014-12-24/pdf/2014-30035.pdf.

[2] *Id.* at 77,825.

change," CEQ directs agencies to "use the projected GHG emissions and also, when appropriate, potential changes in carbon sequestration and storage, as the proxy for assessing a proposed action's potential climate change impacts."

Merely describing GHG emissions does not describe how an action will "contribute to climate change." GHG emissions are not synonymous with climate change—they are merely a number that provide policymakers and the public with no real information. As CEQ states later in the Guidance, "An agency must present the environmental impacts of the proposed action in clear terms and with sufficient information to ensure the professional and scientific integrity of the discussion and analysis."[3] By stressing GHG emissions instead of actual impacts, the guidance is arbitrary and capricious and fails to provide "clear" and "sufficient" information.

Describing climate change impacts requires a discussion of climate change itself. For example, CEQ argues:[4]

> Climate change impacts will have important consequences for the resilience of Federal actions, including more frequent heat waves and high-intensity precipitation events, rising sea levels, and more prolonged droughts.

Temperature change, heat waves, high-intensity precipitation events, rising sea levels, and more prolonged droughts are climate change impacts. These are exactly the type of impacts that should be required in a NEPA analysis if the CEQ believes that climate change impacts should be considered.

CEQ's approach of only describing the number of tons of carbon dioxide emissions, by itself, does not say anything about climate change or climate change impacts.

CEQ admits that it is difficult to describe climate change impacts from federal actions. In response to comments that cite *Department of Transportation v. Public Citizen*, 541 U.S. 752, 767 (2004), where the U.S. Supreme Court stated that the obligation of an agency to discuss particular effects turns on "a reasonably close causal relationship between the environmental effect and the alleged cause.'" CEQ takes the wrong tack that provides less information than a qualitative explanation. If CEQ believes it is important to examine the GHG emissions, then it is important to make use of that information and

[3] *Id.* at 77,826.
[4] *Id.* at 77,816.

provide context of actual impacts on climate.

EPA's MAGICC climate model is readily available to assess actual quantitative impacts. GHG emissions by themselves provide no real information. If CEQ believes climate change impacts should be reported in NEPA documents, then actual impacts should be disclosed through the use of a climate model that has passed federal data quality tests, such as the MAGICC.

The point of NEPA is to provide policymakers and the public with useful information. Merely providing the tons of GHG emissions does not provide the public with any information in context. The required context is actual climate change impacts. If NEPA analyses should consider climate change impacts, then those impacts should be quantified using the MAGICC model. It is true that the impact of any given project is small, but the failure to disclose actual climate impacts of the specific action would be arbitrary and capricious.

If CEQ believes that the impact of any federal action is small, as CEQ seems to suggest, then CEQ should state as much and not require the consideration of climate change impacts in NEPA analyses.

II. THE DRAFT GUIDANCE IMPERMISSIBLY INCLUDES AN OVERLY BROAD ASSESSMENT OF UPSTREAM AND DOWNSTREAM IMPACTS

Current NEPA regulations create boundaries for NEPA review by limiting the scope of a NEPA document to only the impacts that are "reasonably foreseeable." For example, 40 CFR 1508.8 contemplates that NEPA reviews should consider direct effects and indirect effects "which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable."

Even this reasonably foreseeable standard is further limited by case law to not include more than a "but for" causal relationship. Rather, according to the Supreme Court, it requires a "reasonably close causal relationship between a change in the physical environment and the effect at issue. This requirement is like the familiar doctrine of proximate cause from tort law."[5] Furthermore, the Supreme Court has also explained that "where an agency has no ability

[5] Metropolitan Edison Co. v. People Against Nuclear Energy, 460 U.S. 766, 774 (1983).

to prevent a certain effect due to its limited statutory authority over the relevant actions, the agency cannot be considered a legally relevant 'cause' of the effect. Hence, under NEPA . . . the agency need not consider these effects…"[6]

In sum, the Supreme Court has explained that NEPA analyses should consider the reasonably foreseeable proximate cause of an impact and these analyses should not consider the impacts the agency has no ability to prevent due to limited statutory authority. CEQ's Draft Guidance, however, appears to contradict the Supreme Court's explanation of NEPA.

CEQ's Draft Guidance does not comply with the Supreme Court's case law on NEPA and requires overly broad consideration of costs and benefits. CEQ's Draft Guidance states:

> When assessing direct and indirect climate change effects, agencies should take account of the proposed action—including "connected" actions—subject to reasonable limits based on feasibility and practicality. In addition, emissions from activities that have a reasonably close causal relationship to the Federal action, such as those that may occur as a predicate for the agency action (often referred to as upstream emissions) and as a consequence of the agency action (often referred to as downstream emissions) should be accounted for in the NEPA analysis. [citations omitted][7]

This sounds like it could comport with case law, but CEQ makes clear, in two important ways, that they are asking for far more than what case law requires. CEQ provides an explanation of a hypothetical open pit mine. CEQ argues:

> For example a particular NEPA analysis for a proposed open pit mine could include the reasonably foreseeable effects of various components of the mining process, such as clearing land for the extraction, building access roads, transporting the extracted resource, refining or processing the resource, and using the resource.

This is far, far beyond anything that is required under NEPA case law. The refining, processing, transportation and use of the resource, at very least, is beyond the control of the permitting agency. As the Supreme Court explained

[6] Dep't of Transp. v. Public Citizen, 541 U.S. 752, 770 (2004).
[7] CEQ, *Revised Draft Guidance* at 77,826.

in *Department of Transportation v. Public Citizen*, effects should not be considered in a NEPA analysis "where an agency has no ability to prevent a certain effect due to its limited statutory authority over the relevant actions, the agency cannot be considered a legally relevant "cause" of the effect. Hence, under NEPA . . .the agency need not consider these effects…"[8]

III. THE SOCIAL COST OF CARBON IS IMPERMISSIBLY ARBITRARY AND CAPRICIOUS FOR USE IN NEPA ANALYSES

The second way that CEQ's guidance does not comport with the reasonably foreseeable standard is through the use of the Social Cost of Carbon (SCC). Using the SCC makes impacts impermissibly remote and unforeseeable. The Draft Guidance states, "When an agency determines it appropriate to monetize costs and benefits . . . the Federal social cost of carbon . . . offers a harmonized, interagency metric that can provide decision makers and the public with some context for meaningful NEPA review."[9]

Contrary to CEQ's assertion, however, the SCC does not provide decision makers and the public with meaningful context. This is because the SCC is an impermissibly arbitrary and capricious metric. First, consider the fact that the SCC purports to include impacts from now until the year 2300. As EPA explains:

> The timing of the emission release (or reduction) is key to estimation of the SCC, which is based on a present value calculation. The integrated assessment models first estimate damages occurring after the emission release and into the future, often as far out as the year 2300. The models then discount the value of those damages over the entire time span back to present value to arrive at the SCC. For example, the SCC for the year 2020 represents the present value of climate change damages that occur between the years 2020 and 2300 (assuming 2300 is the final year of the model run); these damages are associated with the release of one ton of carbon dioxide in the year 2020.[10]

By including the Social Cost of Carbon as a way to monetize climate change impacts, CEQ is impermissibly including the downstream impacts for the

---

[8] Dep't of Transp. v. Public Citizen, 541 U.S. 752, 770 (2004).

[9] CEQ, *Draft Guidance* at 77,827.

[10] Environmental Protection Agency, *Fact Sheet: Social Cost of Carbon*, Nov. 2013, http://www.epa.gov/climatechange/Downloads/EPAactivities/scc-fact-sheet.pdf.

next 285 years. Impacts over the next 285 years are not "reasonably foreseeable" as required by NEPA case law and regulations.[11] As the Supreme Court has explained, "highly speculative harms" are not reasonably foreseeable.[12]

Not only are impacts 285 years from now not reasonably foreseeable, but today the values calculated by the federal Social Cost of Carbon are "close to useless", according to MIT economist Robert Pindyck.[13] In a peer reviewed paper, Pindyck explains the arbitrary nature of the damage functions, which underlie the SCC estimates generated by the computer models:

> When assessing climate sensitivity, we at least have scientific results to rely on, and can argue coherently about the probability distribution that is most consistent with those results. When it comes to the damage function, however, we know almost nothing, so **developers of IAMs [Integrated Assessment Models] can do little more than make up functional forms and corresponding parameter values. And that is pretty much what they have done.** [Pindyck p. 11, bold added.][14]

Pindyck then goes on to say:

> Most IAMs [Integrated Assessment Models] (including the three that were used by the Interagency Working Group to estimate the SCC) relate the temperature increase T to GDP through a "loss function" L(T), with $L(0) = 1$ and $L'(T) < 0$. For example, the Nordhaus (2008) DICE model uses [an] inverse-quadratic loss function…
>
> Weitzman (2009) suggested the exponential-quadratic loss function…which allows for greater losses when T is large. But remember that **neither of these loss functions is based on any economic (or other) theory. Nor are the loss functions that appear in other IAMs. They are just**

[11] 40 C.F.R. 1508.7 & 1508.8.

[12] *See e.g.* Robertson v. Menthow Valley Citiznes Council, 490 U.S. 332, 356 (1989) & City of Shoreacres v. Waterworth, 420 F.3d. 440, 453 (5th Cir. 2005).

[13] Robert Pindyck, (2013) "Climate Change Policy: What Do the Models Tell Us?" *Journal of Economic Literature*, Vol. 51, No. 3, September 2013, pp. 860-72.

[14] Robert Pindyck, (2013) "Climate Change Policy: What Do the Models Tell Us?" *Journal of Economic Literature*, Vol. 51, No. 3, September 2013, pp. 860-72.

> **arbitrary functions, made up** to describe how GDP goes down when T goes up.
>
> **The loss functions in PAGE and FUND, the other two models used by the Interagency Working Group, are more complex but equally arbitrary...[T]here is no pretense that the equations are based on any theory.** [Pindyck p. 11, bold added.]

Because the equations that make up the SCC are not "based on theory," and are wholly arbitrary, the SCC is wholly arbitrary. Using an arbitrary metric to calculate impacts 285 years into the future does not produce information that could be "reasonably foreseeable" as required by NEPA regulation and case law.

Appendix I provides additional information on why the use of the SCC is arbitrary and capricious. This is a comment previously sent to the OMB and explains in detail why the SCC is impermissibly arbitrary and capricious.

CONCLUSION

CEQ's revised draft guidance on consideration of greenhouse gas emissions and the effects of climate change in NEPA reviews is fatally flawed. The new draft guidance is internally inconsistent, fails to require information about climate change itself, is inconsistent with NEPA, is inconsistent with current NEPA regulations, is inconsistent with case law, and uses the arbitrary and capricious social cost of carbon. For these reasons, CEQ should withdraw this guidance.

APPENDIX I

COMMENT ON TECHNICAL SUPPORT DOCUMENT: TECHNICAL UPDATE OF THE SOCIAL COST OF CARBON FOR REGULATORY IMPACT ANALYSIS UNDER EXECUTIVE ORDER NO. 12866

Institute for Energy Research[*]

* * *

INTRODUCTION

The Administration's Interagency Working Group (IWG) on the Social Cost of Carbon has issued two reports containing estimates of the social cost of carbon (henceforth SCC), first in February 2010 and then an update in May 2013.[15] Federal agencies have been using these estimates of the SCC to conduct cost/benefit analyses of proposed federal rules. A major justification for many rules—in particular, regulations involving the energy and transportation sectors—is a reduction in greenhouse gas emissions. The SCC serves to quantify, in dollar terms, the value of such emission reductions, to be added to the "benefit" side of the ledger of a proposed rule.

This comment explains that that the use of the SCC as an input into federal regulatory actions is totally inappropriate. The Administration is treating the SCC as if it is a scientifically valid, objective fact of the external world, akin to the charge on an electron or the boiling point of water at sea level. However, the SCC is no such thing, at least in our present state of understanding. Rather, the SCC is an arbitrary output from very speculative

[*] The Institute for Energy Research (IER) is a not-for-profit organization that conducts intensive research and analysis on the functions, operations, and government regulation of global energy markets. IER maintains that freely-functioning energy markets provide the most efficient and effective solutions to today's global energy and environmental challenges and, as such, are critical to the well-being of individuals and society.

[15] Interagency Working Group on Social Cost of Carbon. (2010) "Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866." February 2010. IWG on Social Cost of Carbon. (2013) "Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866." May 2013.

computer models. It can be adjusted up or down as the analyst wishes, simply by changing a few key parameter choices. Simply by adjusting the parameter and modeling choices in plausible ways, a knowledgeable economist can generate SCC estimates that are very high, very low, or even *negative*—meaning that carbon dioxide emissions actually shower "positive externalities" on humans beyond the direct benefits to the emitters, and therefore should (according to the Administration's logic) receive federal subsidies.

The ultimate reason federal agencies use the SCC is in order to comply with Executive Order 12866, which requires agencies to "assess both the costs and the benefits of the intended regulation."[16] Yet Executive Order 12866 *also* requires costs and benefits to be quantified "to the fullest extent that these can be usefully estimated."

This comment explains that the costs and benefits of proposed federal regulations *cannot* be "usefully estimated" by the inclusion of the SCC. Because the SCC as implemented federal agencies is completely arbitrary and without theoretical or experimental support, not to mention a lack of data supporting the Working Groups calculation, this calculation of the SCC also violates the Information Quality Act of 2001 (IQA). According to OMB's own guidelines, the IQA requires information disseminate by agencies to be "accurate, reliable, and unbiased" and "presented in an accurate, clear, complete and unbiased manner."[17]

Our objections can be classified as both theoretical and practical. First, in terms of the pure theory, the SCC is inappropriate for use in federal rule-making because of the malleability of the underlying concept itself; to repeat, the SCC is not an objective feature of the world "out there" but is instead reliant on subjective modeling decisions made by the analyst.

Second, in terms of the practical implementation, use of the SCC has lacked transparency and—more serious—has violated long-standing OMB guidelines. Even if the SCC were an objective scientific parameter—which it is not—these procedural abuses in the *use* of the SCC would alone render it a dubious element for continued use in the regulatory process.

This comment deals with each category of objections—both theoretical

---

[16] Executive Order 12866, Sept. 30, 1993, http://www.archives.gov/federal-register/executive-orders/pdf/12866.pdf.

[17] Office of Management and Budget Information Quality Guidelines, Oct. 1, 2002, at 8.

and procedural—in sections I and II, respectively. We then conclude that in light of these serious problems, the SCC should no longer be used as an input in federal regulatory analysis and rule-making.

I. THEORETICAL PROBLEMS WITH USING THE SOCIAL COST OF CARBON IN FEDERAL REGULATORY ANALYSIS AND RULE-MAKING

Even on a purely theoretical level, the SCC is a dubious concept that is inappropriate for use in federal regulatory analysis and rule-making.

A. Economic Theory Background: Market Failure, Negative Externalities, and Social Costs

In standard economic analysis, the decentralized market economy contains tendencies for equilibrium outcomes to correspond to socially "optimal" arrangements. Market prices, and the corresponding profits and losses that they imply, provide incentives for entrepreneurs to efficiently allocate resources across sectors. As Adam Smith's famous metaphor of the "Invisible Hand" illustrated, the self-interest of market participants leads them to promote (perhaps unwittingly) the general welfare.

However, the typical textbook economic analysis also categorizes examples of "market failure," where market forces do *not* guarantee socially desirable outcomes. One such example is the case of a "negative externality," in which a firm's market activities impose harms on others, even though the firm is not penalized for such harms.

Following in the framework established by A.C. Pigou,[18] economists often distinguish between the *private costs* of the firm's actions versus the *social* costs. The owners of the firm want to maximize profits, and thus will adjust its activities in accordance with the private benefits and private costs of its actions. However, in the case of a negative externality, the firm will *overproduce*, because the owners are only considering the out-of-pocket expenses (such as wages) but are ignoring all of the social costs.

[18] Pigou, A.C. (1920) *The Economics of Welfare*. London: Macmillan.

B. Anthropogenic Global Warming and the SCC

The 2007 Nobel Peace Prize awarded to the Intergovernmental Panel on Climate Change (IPCC) and Al Gore underscored the public's growing awareness and concern over anthropogenic (manmade) global warming. Many climatologists and other relevant scientists claim that unchecked emissions of greenhouse gases (GHGs) from human activity will lead to significantly rising temperatures, which in turn will spell potentially catastrophic hardship for future generations.[19] If this is true, then the economist will recognize what former Chief Economist of the World Bank Nicholas Stern described, in his famous report to the British government, as "the greatest example of market failure we have ever seen."[20]

Within this context, we can understand that the "social cost of carbon" (SCC) is simply the particular label given to the social costs imposed on third parties from the negative externality of carbon dioxide emissions because of anthropogenic global warming (or climate change more generally).

For a formal definition, we can turn to the White House Interagency Working Group. Its May 2013 report defines the SCC as:

> an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year. It is intended to include (but is not limited to) changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services due to climate change.[21]

The quantitative estimates of the SCC are extremely significant. The Working Group document itself states that the purpose of the SCC estimates "is to allow agencies to incorporate the social benefits of reducing carbon dioxide (CO_2) emissions into cost-benefit analyses of regulatory actions that impact cumulative global emissions." Some obvious examples of the application of the SCC estimates are fuel economy standards, EPA

---

[19] IPCC. (2007) *Climate Change 2007: The Physical Science Basis, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, UK and New York: Cambridge University Press).

[20] Stern, Nicholas. (2007) *The Economics of Climate Change: The Stern Review*. Cambridge, UK: Cambridge University Press, online at: http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm, page 1.

[21] Working Group May 2013, page 2.

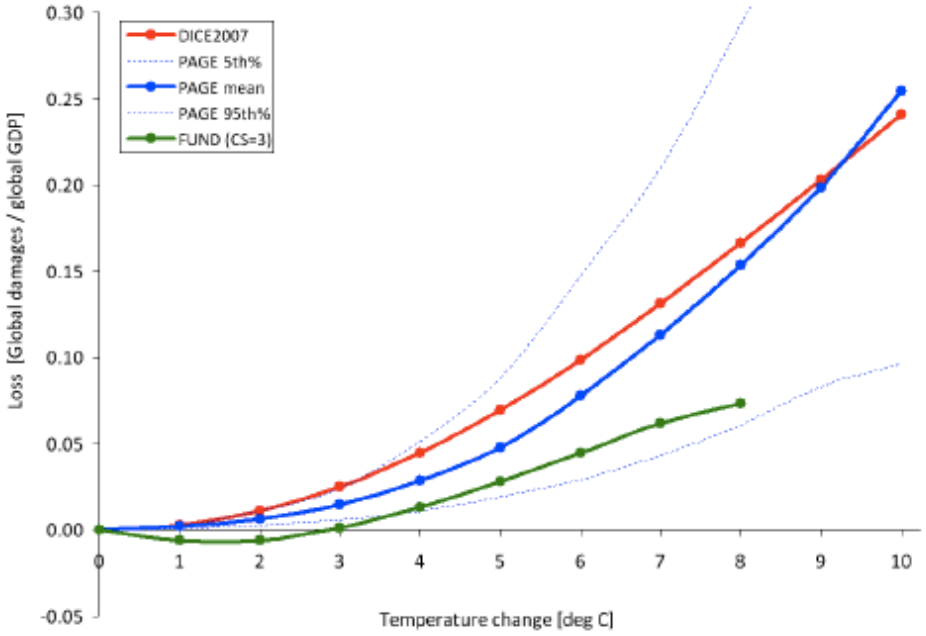
greenhouse gas regulations of power plants, efficiency standards for household appliances, and programs to subsidize so-called "alternative" energy sources and transportation technologies.

C. Computer-Simulated Damages

The Interagency Working Group chose three computer models from the economics of climate change literature in order to estimate the SCC. Specifically, they chose the PAGE, FUND, and DICE models. The specific label for such simulations is "Integrated Assessment Models" or IAMs, because they integrate computer models of the entire global economy and climate system, which is necessary in order to assess the marginal damages caused by the emission of an additional ton of carbon dioxide today. The Working Group ran thousands of simulations through the year 2300, and then analyzed the results in order to report its estimates of the SCC (based on various parameters) through time.

One of the crucial steps in the computer models is to posit a "damage function" that relates a stipulated increase in global temperature with a corresponding impact on global GDP. The following diagram from the February 2010 Working Group report shows how each of the models handles global warming of varying intensity:

Annual Consumption Loss as a Fraction of Global GDP in 2100 Due to an Increase in Annual Global Temperature in the DICE, FUND, and PAGE models



Source: Figure 1A (page 9) of February 2010 Working Group TSD

As the diagram above indicates, the three models selected for the Working Group analysis yield different results. In particular, the FUND model shows much lower impacts from global warming, especially at higher temperatures. Indeed, the green line's initial (and slight) dip into negative territory shows that the FUND model assumes global warming will shower the world with *positive externalities* up through about 3 degrees Celsius. The fact that the FUND model yields (moderate) net *benefits* from global warming in the initial stages will be very significant when we consider the role of discount rates in the analysis.

D. Discount Rates

When estimating the social cost of carbon (SCC), the choice of discount rate is crucial, because the computer simulations of large climate change damages occur decades and even centuries in the future, and also because

some models show net *benefits* from global warming through mid-century.

Indeed, the Working Group generates its estimates of the SCC by equally weighting the estimates provided by the three computer models discussed above (namely the PAGE, FUND, and DICE models). As the diagram in the previous section illustrated, in the early decades (while the earth has only warmed one to two degrees Celsius) the cumulative impact of global warming is either close to zero or even positive.

Therefore, the rate at which we discount future damages into present monetary terms will have an enormous impact on the estimated SCC. For example, in the May 2013 Working Group update, the SCC in the year 2010 was reported as $11/ton at a 5% discount rate, but $52/ton at a 2.5% discount rate. In other words, cutting the discount rate in half caused the reported SCC to more than quadruple. Policymakers and citizens should realize just how influential the choice of discount rate is, when it comes to the SCC.

The problem is that the choice of discount rate *is not something that can be settled objectively* through technical analysis. If policymakers were going to use market rates of interest, there might be some hope of objectivity. There would still be significant "wiggle room" by selecting the time periods and particular interest rates to use in the computation, but at least market rates are externally generated and, in principle, could be measured objectively.

However, the trend in both academia and in policymaking circles is to use discount rates that are influenced by philosophical and ethical considerations, *not* based solely on observed market returns.[22] Presumably the proponents of one discount rate versus another may have strong arguments on their side, but the critical point is that *these "ethical" discount rates are subjective and in an important sense, arbitrary*.

There is no "objective" indicator of how many dollars of climate change damage in the year 2300 would need to be averted, in order to justify $100 of forfeited economic growth today because of regulations restricting carbon dioxide emissions. Therefore, using the SCC as part of regulatory cost/benefit analyses gives great leeway to the analyst, who can alter the benefits and costs (as expressed in present value terms) just by tweaking the discount rate. Because the discount rate is arbitrary, there is no "right" or "wrong" one to

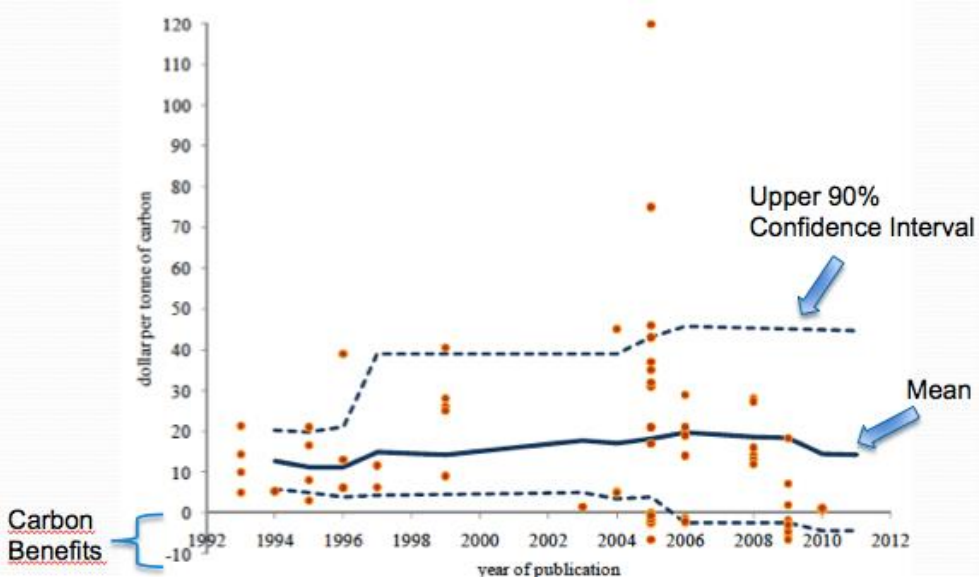
[22] A good example of the current academic thinking on discount rates over centuries is Arrow, Kenneth et al. (2012) "How Should Benefits and Costs Be Discounted in an Intergenerational Context?" *Resources for the Future* Discussion Paper 12-53, December 2012, available at: http://www.rff.org/RFF/documents/RFF-DP-12-53.pdf.

use.

E. The Estimates of the SCC in the Literature Are Quite Dispersed

To illustrate just how tenuous is the scholarly understanding of the SCC—and to see why it is *not* a "fact of the world" in the same way that the boiling point of water is a objective and measurable concept—consider the following diagram taken from a survey article written by a world expert on the SCC literature (and creator of the FUND model):

Survey of Published Estimates of SCC That Use 3% "Pure Time Preference" Rate for Discounting (dot indicates individual estimate).



Source: Richard Tol. (2011) "The SCC," ESRI Working Paper #377.

The diagram above is quite striking. It show that the 90% confidence interval of the "true" SCC has widened over the last two decades. This is *not* what one would expect from a maturing science that is honing in on the "true" value. Even more shocking, from 2006 onward (at least until the time of Tol's survey, in 2011) the lower portion of the 90% confidence interval was in the *negative* region of the graph, meaning that one could not rule out (with 95%

confidence[23]) the possibility that further carbon dioxide emissions at that point would *benefit* humanity at large (beyond the private benefits accruing to the emitters).

The final takeaway from the above diagram is the enormous dispersion in the point estimates of the SCC. In particular, the 2005 estimates show a range from about *negative* $5/ton up to an enormous $120/ton. (Note that the y-axis on the above chart refers to tons of carbon, not carbon dioxide. Thus these values would need to be multiplied by 3.67 to make them comparable to the SCC estimates that are typically used in U.S. policy discussions.) This chart *alone* should disqualify use of the SCC in federal regulatory analysis and rule-making.

F. Computer-Generated SCC Values Are "Close to Useless"

To illustrate just how dubious are the Integrated Assessment Models (IAMs)—including the three particular IAMs chosen for the Working Group's calculations—we quote the abstract of a peer-reviewed article by MIT economist Robert Pindyck:[24]

> **Very little.** A plethora of integrated assessment models (IAMs) have been constructed and used to estimate the social cost of carbon (SCC) and evaluate alternative abatement policies. **These models have crucial flaws that make them close to useless as tools for policy analysis:** certain inputs (e.g. the discount rate) are arbitrary, but have huge effects on the SCC estimates the models produce; the models' descriptions of the impact of climate change are completely ad hoc, with no theoretical or empirical foundation; and the models can tell us nothing about the most important driver of the SCC, the possibility of a catastrophic climate outcome. **IAM-based analyses of climate policy create a perception of knowledge and precision, but that perception is illusory and misleading.** [Bold added.]

[23] Because the interval is 90% confidence, the bottom region (below the interval) corresponds to only 5% of the probability range, meaning that anything above that threshold contains the true SCC with 95% probability.

[24] Robert Pindyck, (2013) "Climate Change Policy: What Do the Models Tell Us?" *Journal of Economic Literature*, Vol. 51, No. 3, September 2013, pp. 860-72.

In the above quotation, Pindyck echoes and confirms our analysis given above. Later in the paper, Pindyck explains the arbitrary nature of the damage functions, which of course underlie the SCC estimates generated by the computer models:

> When assessing climate sensitivity, we at least have scientific results to rely on, and can argue coherently about the probability distribution that is most consistent with those results. When it comes to the damage function, however, we know almost nothing, so **developers of IAMs [Integrated Assessment Models] can do little more than make up functional forms and corresponding parameter values. And that is pretty much what they have done.** [Pindyck p. 11, bold added.]

Pindyck then goes on to say:

> Most IAMs (including the three that were used by the Interagency Working Group to estimate the SCC) relate the temperature increase T to GDP through a "loss function" L(T), with L(0) = 1 and L'(T) < 0. For example, the Nordhaus (2008) DICE model uses [an] inverse-quadratic loss function…
>
> Weitzman (2009) suggested the exponential-quadratic loss function…which allows for greater losses when T is large. But remember that **neither of these loss functions is based on any economic (or other) theory. Nor are the loss functions that appear in other IAMs. They are just arbitrary functions, made up** to describe how GDP goes down when T goes up.
>
> **The loss functions in PAGE and FUND, the other two models used by the Interagency Working Group, are more complex but equally arbitrary...[T]here is no pretense that the equations are based on any theory.** [Pindyck p. 11, bold added.]

Furthermore, the previous administrator of the Office of Information Regulatory Affairs, Cass Sunstein explains that "[m]any people believe that

the TSD relies on unreliable integrated assessment models."[25]

G. Theoretical Flaws With SCC: Summary

As the above analysis demonstrates, the "social cost of carbon" is *not* an objective, empirical fact of the world that could be measured by scientists. Instead, even at a conceptual level the SCC is driven by subjective and ultimately arbitrary choices made by the analyst, including the damage function to be used and the discount rate to apply to those future damages (or benefits).

Because of these tremendous ambiguities in the concept, it is not surprising that even scholarly estimates of the SCC are widely dispersed. As an expert in the field—who is *in favor* of a carbon tax, proving he is not motivated by ideological reasons—describes the situation, the SCC estimates generated through current computer models are "close to useless."

II. PROCEDURAL PROBLEMS WITH USING THE SOCIAL COST OF CARBON IN FEDERAL REGULATORY ANALYSIS AND RULE-MAKING

In the first section of this comment, we showed the theoretical problems with using the SCC for regulatory purposes. In other words, we showed that the SCC is dependent on arbitrary assumptions and does not provide a coherent guide to cost/benefit analysis and rule-making.

Another problem with the Working Group's calculation of the SCC is a number of *process* problems where the Working Group consistently, and without theoretical justification, made arbitrary choices that increased the SCC.

A. Ignoring Clear OMB Guidelines

The most obvious example of the dubious implementation of the SCC in federal cost/benefit analyses is the ignoring of clear OMB guidelines on how

[25] Cass R. Sunstein, *On Not Revisiting Official Discount Rates: Institutional Inertia and the Social Cost of Carbon*, Regulatory Policy Program Working Paper RPP-2013-21, Mossavar-Rahmani Center for Business and Government, Harvard Kennedy School, Harvard University, http://www.hks.harvard.edu/var/ezp_site/storage/fckeditor/file/RPP_2013_21_Sunstein.pdf

such analyses are to be quantified. Specifically, OMB requires that the costs and benefits of proposed policies be quantified at discount rates of 3% and 7% (with additional rates being optional), and OMB also requires that the costs and benefits be quantified at the domestic (not global) level. In practice, the Working Group and agencies that have relied on its estimates of the SCC have simply ignored these two clear OMB guidelines. We explain each issue in the below subsections.

(1) Exclusion of 7% Discount Rate from Cost/Benefit Analysis

The Office of Management and Budget writes instructions for federal agencies in regulatory analysis. These are called "OMB Circulars." OMB Circular A-4[26] (relying in turn on Circular A-94) states that "a real discount rate of 7 percent should be used as a base-case for regulatory analysis," as this is the average before-tax rate of return to private capital investment. However, Circular A-4 acknowledges that in some cases, the displacement of consumption is more relevant to assess the impact of the policy under consideration, in which case a real discount rate of 3 percent should be used. Thus it states: "For regulatory analysis, you should provide estimates of net benefits using both 3 percent and 7 percent." Note that Circular A-4 does *not* say that a discount rate should be chosen based on the impacts, and which of the two rates is deemed more appropriate to the situation; instead it says quite clearly that estimates should be made *using both rates*. In addition, the agency is also free to use other discount rates, as long as both 3 and 7 percent are used.

In the economics of climate change academic literature, there are disputes over the proper discount rate, with some economists arguing that very low rates should be used in order to place future generations on a nearly equal footing with the present generation in policy analysis. Circular A-4 and the White House's primer on Circular A-4,[27] explicitly cited the work of Martin Weitzman, one of the leading scholars in the field on this issue, who argues for a low discount rate in climate change analysis.[28] Nonetheless, after this discussion the 2011 primer still concluded:

---

[26] OMB Circular A-4 available at: http://www.whitehouse.gov/omb/circulars_a004_a-4.

[27] "Regulatory Impact Analysis: A Primer," available at: http://www.whitehouse.gov/sites/default/files/omb/inforeg/regpol/circular-a-4_regulatory-impact-analysis-a-primer.pdf.

[28] See: http://www.whitehouse.gov/sites/default/files/omb/inforeg/regpol/circular-a-4_regulatory-impact-analysis-a-primer.pdf.

> If the regulatory action will have important intergenerational benefits or costs, the agency might consider a sensitivity analysis using a lower but positive discount rate, ranging from 1 to 3 percent, **in addition to calculating net benefits using discount rates of 3 percent and 7 percent.** ["Regulatory Impact Analysis: A Primer," p. 12, bold added.]

Note the significance of the above quotation: The 2011 primer is fully aware that some policies have intergenerational effects spilling into the distant future, and that a discount rate lower than even 3 percent might be appropriate for such analyses. Yet it *still* said that the cost/benefit analysis should be reported at the 7 percent rate.

Yet even though the guidance from OMB was quite explicit on this point, both the initial White House Working Group report from 2010, as well as the recent update in May, did *not* report the SCC using a 7 percent discount rate; they only used discount rates of 2.5, 3, and 5 percent. Furthermore, the various responses on this point, offered by Administration officials, dodge and dissemble on this crucial issue.[29] For example, last July Howard Shelanski, the Administrator of the Office of Information and Regulatory Affairs of the Office of Management and Budget testified on the omission of the SCC at 7 percent:

> We don't use 7 percent when what we are interested in understanding are effects on future consumption by individuals, by consumers, by citizens.
>
> …
>
> Now, that said, just two things. To be sure, 7 percent was not used in the range of numbers given for social cost of carbon ***because of the belief that it was inappropriate to discount to zero intergenerational effects***, effects that would occur one or two generations in the future.
>
> …
>
> So while it is clearly the case that a separate 7 percent number was not listed, and we generally do, where appropriate, ask regulatory agencies to include that in rulemakings, for the purpose of this

[29] *See e.g.* testimony of Honorable Howard Shelanski, Administrator, Office of Information and Regulatory Affairs, Office of Management and Budget, before the Subcommittee on Energy policy, Health Care and Entitlements of the Committee on Oversight and Government Reform of the House of Representatives, July 18, 2013, http://oversight.house.gov/wp-content/uploads/2013/07/Shelanski-OIRA-Testimony-SCC-7-18.pdf. Mr. Shelanksi's full quote in in Appendix I below.

> estimate, which was not a rulemaking, it was an input to rulemakings, the judgment was reached that 7 percent was not appropriate.

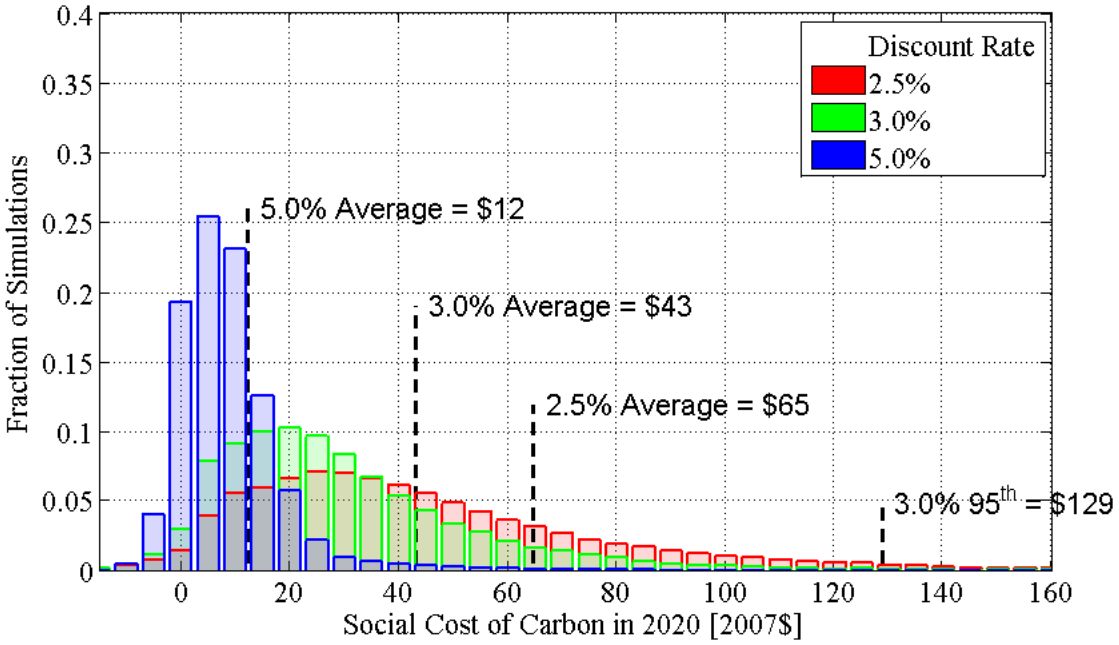
Mr. Shelanski's statement is contrary to the plain language of Circular A-4. As noted above, Circular A-4 explicitly contemplates intergenerational discounting and still requires reporting the SCC (or other benefits and costs) at 3 percent ***and*** 7 percent rates. Despite Mr. Shelanksi's statement, the failure of the Working Group to report the SCC at 7 percent is arbitrary and capricious.

No one is arguing that the Working Group or federal agencies should be prohibited from reporting results using a low discount rate. Rather, the public deserves to know what the results would be, were the cost/benefit calculations performed at a 7 percent discount rate, as OMB guidelines clearly require.

This omission of a 7 percent figure masks just how dependent the SCC is on discount rates. The figure below is taken from the May 2013 Working Group update. It shows the distribution of simulation outcomes in which the SCC fell into a certain range, with the color coding representing the discount rate used. (The reason there are ranges of SCC estimates, as opposed to a single number, is that each simulation is unique, because it draws a random value of the "equilibrium climate sensitivity" from the distribution put into the computer models by the programmers.)

In the diagram, we can see that moving from the 2.5 percent discount rate (red bars) to the 3.0 percent (green) and then to the 5.0 percent rate (blue), causes the range of possible values for the SCC to fall drastically. Indeed, when the Working Group used a discount rate of 5 percent, more than a fifth of the computer simulations reported a SCC that was near-zero or even *negative*, and that was for the year 2020. (See the three left-most blue bars in the figure.) Once the pattern exhibited in the figure below is understood, we can see the tremendous relevance of the Working Group's decision to omit the 7 percent discount rate from its list of SCC estimates. At the 7 percent rate, the estimated SCC for early years would be close to $0/ton, if not negative.

SOCIAL COST OF CARBON AT VARIOUS DISCOUNT RATES.



SOURCE: Figure 1 in May 2013 White House Working Group on Social Cost of Carbon.

Although the Working Group did not analyze its thousands of computer runs using a 7 percent discount rate, analysts at the Heritage Foundation have been able to conduct such an experiment using two of the models that the Working Group selected.[30] (Specifically, Heritage used William Nordhaus' DICE model and Richard Tol's FUND model.) The following table shows their findings for the DICE model:

[30] Dayaratna, Kevin and David Kreutzer. (2013) "Loaded DICE: An EPA Model Not Ready for the Big Game." Heritage Foundation Backgrounder #2860, November 21, 2013, available at: http://www.heritage.org/research/reports/2013/11/loaded-dice-an-epa-model-not-ready-for-the-big-game.

TABLE 1

Average SCC Baseline, End Year 2300

Year	Discount Rate: 2.5%	Discount Rate: 3%	Discount Rate: 5%	Discount Rate: 7%
2010	$46.57	$30.04	$8.81	$4.02
2015	$52.35	$34.32	$10.61	$5.03
2020	$56.92	$37.79	$12.10	$5.87
2025	$61.48	$41.26	$13.60	$6.70
2030	$66.52	$45.14	$15.33	$7.70
2035	$71.57	$49.03	$17.06	$8.70
2040	$76.95	$53.25	$19.02	$9.85
2045	$82.34	$57.48	$20.97	$11.00
2050	$87.69	$61.72	$23.06	$12.25

Source: Calculations based on Heritage Foundation Monte Carlo simulation results using the DICE model. B 2860 heritage.org

SOURCE: Table 1 from "Loaded DICE: An EPA Model Not Ready for the Big Game." Heritage Foundation.

The table above shows that moving from the Working Group's highest discount rate of 5 percent to the OMB guideline of 7 percent would essentially cut the SCC *in half* for the years through 2050. This outcome yet again underscores the tremendous sensitivity of SCC estimates to the discount rate used in the analysis.

The results were even more striking when the Heritage programmers re-ran the FUND model, plugging in a 7 percent discount rate.[31] They found that the SCC was *negative* at least through the year 2030:

Table 1

	Average SCC: Baseline			
Year	**Discount Rate: 2.50%**	**Discount Rate: 3%**	**Discount Rate: 5%**	**Discount Rate: 7%**
2010	$29.69	$16.98	$1.87	-$0.53
2020	$32.90	$19.33	$2.54	-$0.37
2030	$36.16	$21.78	$3.31	-$0.13
2040	$39.53	$24.36	$4.21	$0.19
2050	$42.98	$27.06	$5.25	$0.63

SOURCE: "Building on Quicksand: The Social Cost of Carbon." Heritage Foundation.

[31] Dayaratna, Kevin and David Kreutzer. (2014) "Building on Quicksand: The Social Cost of Carbon." Heritage Foundation, February 12, 2014, available at: http://blog.heritage.org/2014/02/12/building-quicksand-social-cost-carbon/.

The results in the table above are simply astounding. To reiterate, the FUND model was one of the three *chosen by the Obama Administration's Working Group* to represent the academic community's understanding of climate change economics. This was not a product of the Heritage Foundation; they simply took the model and plugged in the parameter (a 7 percent discount rate) that OMB said was a necessary component of any federal cost/benefit analysis.

The purpose of this discussion is not to argue for or against a particular discount rate. Rather, it demonstrates how crucial this apparently innocuous modeling choice is. Further, in neglecting the clear guidance from OMB on reporting costs and benefits using a 7 percent discount rate, the Working Group on Social Cost of Carbon has misled policymakers, most of whom probably had no idea of the significance of this parameter. If the choice of discount rate means the difference between a SCC of $50/ton versus $1/ton, this is clearly a matter that should not be left to a handful of regulators to decide. It underscores our position that the "social cost of carbon" is not an objective empirical feature of the world, but is rather an arbitrary, malleable figure dependent on subjective modeling assumptions, and can be made large, small, or even negative depending on parameter choices.

(2) Domestic versus Global Social Cost of Carbon

Related to its decision regarding discount rates, the Working Group has also neglected clear OMB guidance to report costs and benefits from a *domestic* perspective. As the original 2010 Working Group report admits: "Under current OMB guidance contained in Circular A-4, analysis of economically significant proposed and final regulations from the domestic perspective is required, while analysis from the international perspective is optional" (p. 10). Nonetheless, the Working Group goes on to explain why it will instead use a global perspective in reporting its estimates of the SCC.

Were the Working Group to present its main findings from the domestic perspective, the impact would be striking. Using two different approaches, the Working Group in 2010 "determined that a range of values from 7 to 23 percent should be used to adjust the global SCC to calculate domestic effects. Reported domestic values should use this range" (p. 11).

When the May 2013 update came out, the headline media reports typically focused on the SCC figure for the year 2010 at a 3 percent discount rate, which was $33/ton; this value was often reported as "the" social cost of carbon. Yet this was a *global* estimate of the SCC. If instead the default reports were expressed from the *domestic* perspective, then the same 2010 figure at a 3 percent discount rate would only have been in the range of $2 to $8 per ton.

To see the significance of this decision by the Working Group, consider the following scenario: Suppose the EPA issues a new regulation that causes private industry to restrict carbon emissions, and that the economic costs (in terms of forfeited economic output in the U.S. because of the new regulation) work out to $25/ton. Using the Working Group's May 2013 headline SCC estimate of $33/ton, this regulation would apparently pass a cost/benefit test, because the $25 cost to American industry and consumers for every ton of restricted emissions would be counterbalanced by $33 in avoided future climate change damage. However, *Americans* would still on net be hurt by the regulation, as they would only receive $2 to $8 of the stipulated benefits (i.e. avoiding the *domestic* social cost of carbon on each ton no longer emitted), while suffering the full $25 in compliance costs.

A related problem is that reporting the global cost and omitting the domestic cost ignores the well-known issues of "leakage." As the Resources for the Future explains, "If emissions regulation raises prices for domestic producers, the loss of competitive advantage would lead to the displacement of production and thereby emissions abroad."[32] The result of "leakage" could be so great that leakage rates could be "as high as 130%, in which case GHG [greenhouse gas] control policies in the industrialized countries actually lead to higher global emissions," according to a paper by Mustafa H. Babiker published in the Journal of International Economics in 2005.[33]

To understand why leakage rates could be very high, note that many of the regulations that use the SCC increase the cost of energy or the cost of using energy in the United States. This means a loss of competitive advantage for the United States and a displacement of production abroad. By naively

---

[32] Carolyn Fischer & Alan K. Fox, *Comparing Policies to Combat Emissions Leakage: Border Tax Adjustments versus Rebates*, Resources for the Future, Feb. 2009, http://www.rff.org/documents/RFF-DP-09-02.pdf.

[33] Mustafa H. Babiker, *Climate change policy, market structure, and carbon leakage*, 65 Journal of International Economics 421 (Mar. 2005), http://www.sciencedirect.com/science/article/pii/S0022199604000467.

relying on a global SCC, the Working Group is implicitly assuming that if a ton of carbon dioxide is not emitted in the United States, then there would be no displacement and trade effects. This assumption is clearly wrong and contrary to standard economics. Because leakage could be as high as 130 percent, U.S. federal regulations could be given credit (in the form of the reduced social cost of carbon) even though they spur an *increase* in carbon dioxide emissions.

B. Lack of Transparency

According to Cass Sunstein, the man who convened the SCC Working Group, "Neither the 2010 TSD nor the 2013 update was subject to peer review in advance, though an interim version was subject to public comment in 2009."[34] This is a direct violation of the administration's stance on "Transparency and Open Government."[35]

President Obama's transparency and open government initiative rests on three pillars: (1) the government should be transparent, (2) the government should be participatory, and (3) the government should be collaborative. The estimation of the SCC, especially the 2013 update, is anything but transparent. Earlier we have explained the troubling omission of key data that would allow agencies to comply with OMB guidelines. Making matters worse, outside groups can't simply generate the 7 percent rates themselves, or even reproduce the Working Group's numbers. This is because one of the three computer models—specifically, the PAGE model—is not publicly available, as are the other two. (This is why the Heritage programming team was able to re-run the DICE and FUND results at a 7 percent discount rate.) Chris Hope, the developer of the PAGE model, has insisted on either co-authorship of papers relying on his model, or asked for a fee in the thousands of dollars to train outsiders on how to use it. This is certainly Hope's right in his capacity as the developer of a computer model, but it places an excessive burden on outside groups who want to check the robustness of the Working Group's results, or who simply want to make sure it committed no error in its calculations. By picking a computer model that is not publicly available, the

[34] Cass R. Sunstein, *On Not Revisiting Official Discount Rates: Institutional Inertia and the Social Cost of Carbon*, Regulatory Policy Program Working Paper RPP-2013-21, Mossavar-Rahmani Center for Business and Government, Harvard Kennedy School, Harvard University, http://www.hks.harvard.edu/var/ezp_site/storage/fckeditor/file/RPP_2013_21_Sunstein.pdf

[35] President Barack Obama, *Memorandum for the Heads of Executive Departments and Agencies on Transparency and Open Government*,

Working Group effectively established a "paywall" around its work. This situation is antithetical to the administration's stance on "Transparency and Open Government."[36]

The announcement of the 2013 update to the SCC was especially non-transparent. Instead of announcing the update in a proposed rule, the administration made the announcement in a final rule, in the "Energy Conservation Program: Energy Conservation Standards for Standby Mode and Off Mode for Microwave Ovens; Final Rule."[37]

The Office of Management and Budget has taken the appropriate action by establishing a comment period on the 2013 update, but because OMB has failed to provide key criteria, such as the SCC at 7 percent and domestic benefits, OMB has not been transparent and open with the public.

C. Cherry-Picking of "Updates"

Finally, it is troubling to note that the Working Group updated its estimates from 2010 to 2013 by heavily favoring those developments in the scientific literature that would *increase* the estimated SCC, while downplaying or ignoring those that would decrease it. This procedure results, of course, in an estimate of the SCC that is biased upward.

For example, as professional climate scientists Patrick Michaels and Paul Knappenberger explain in their own January 27, 2014 Comment submitted on behalf of the Cato Institute,[38] the May 2013 TSD ignored the growing evidence in the peer-reviewed research that the "equilibrium climate sensitivity" parameter is lower than what had been used in the 2010 estimate. The equilibrium climate sensitivity (ECS) relates a doubling of atmospheric

---

[36] President Barack Obama, *Memorandum for the Heads of Executive Departments and Agencies on Transparency and Open Government*,

[37] U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, *Energy Conservation Program: Energy Conservation Standards for Standby Mode and Off Mode for Microwave Ovens; Final Rule*, 78 Fed. Reg. 36316, June 17, 2013, http://www.regulations.gov/#!documentDetail;D=EERE-2011-BT-STD-0048-0027.

[38] Patrick Michaels and Paul Knappenberger, Comment for Cato Institute on "OMB's Office of Management and Budget's Request for Comments on the Technical Support Document entitled Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866," January 27, 2014, available at: http://object.cato.org/sites/cato.org/files/pubs/pdf/omb_scc_comments_michaels_knappenberger.pdf.

CO_2 concentrations (relative to the preindustrial benchmark) to the long-term (including feedback effects) increase in average global temperature. The ECS is thus a critical input into the three computer models chosen by the Working Group to estimate the social cost of carbon. The higher the ECS, the more damaging a ton of carbon dioxide emissions will appear in these simulations, because it will cause a greater increase in global temperature and the assumed negative impacts following from this warming.

As Michaels and Knappenberger explain in their Comment, in the Working Group's original 2010 report, there was a lengthy discussion about the probability density function (pdf) plugged into the computer models, which would reflect the discussion in the IPCC's Fourth Assessment Report (published in 2007) on the distribution of possible values for the ECS.

Yet by the time the 2013 IPCC Report came out, there had been several papers calling into question the Fourth Assessment Report's discussion. Indeed, the IPCC itself in 2013 admitted that it was lowering the bottom limit of the "likely" range of the equilibrium climate sensitivity from 2°C down to 1.5°C.

Even though the IPCC from 2007 to 2013 has reduced its (probabilistic) ranges of where the true ECS lies, the Working Group failed to revise the specific probability distribution function that it plugged into the three computer models. Had the Working Group revised the distribution downward, it naturally would have reduced estimates of the social cost of carbon across the board.

At the same time, the Working Group relied on several changes to their three chosen computer models that *increased* the SCC. To give one specific comparison, illustrating the rapid escalation of the estimate: The February 2010 Working Group report estimated the 2030 SCC, using a 3 percent discount rate, at $32.80. Yet just three years later, the May 2013 TSD estimated the 2030 SCC (again at 3 percent) at $52, a 59 percent increase.

In addition to all of the other theoretical and procedural problems, the Working Group's apparent cherry-picking of developments casts serious doubts upon use of the SCC for federal regulatory purposes.

CONCLUSION

In the above Comment we have documented numerous flaws, both theoretical and procedural, with the use of the SCC for regulatory purposes. On the theoretical side, the SCC is an arbitrary, malleable concept, which can be made quite large, small, or even negative simply by adjusting parameters in plausible ways. The estimates of the SCC are generated by computer simulations that stretch centuries into the future, and which rely on "damage functions" that are ad hoc, based neither on economic theory nor empirical observation.

As if the theoretical problems with use of the SCC weren't serious enough, the *process* by which the administration's Working Group has issued its updated estimates has also been deeply flawed. Most obvious, the Working Group's results failed to heed two clear OMB guidelines—namely, inclusion of a 7 percent discount rate and domestic (not global) calculations. Moreover, the process has been far from transparent, with the important 2013 update being buried in a microwave rule. Even worse, one of the three computer models used to generate the official SCC estimates is not publicly available. Finally, when incorporating the developments in the scientific literature to update the SCC, the Working Group seemed to heavily favor those changes that would increase the number, while downplaying those that would decrease it.

In conclusion, on both theoretical and procedural grounds, there are several fatal flaws in the use of the SCC for regulatory purposes. The SCC is an arbitrary metric that *cannot* be "usefully estimated" as required by Executive Order 12866. The administration should withdraw both the 2010 and the 2013 Social Cost of Carbon estimate along with all rules that have used this arbitrary and capricious metric.

APPENDIX II

Testimony of OIRA Administrator Shelanski before the Subcommittee on Energy policy, Health Care and Entitlements of the Committee on Oversight and Government Reform of the House of Representatives:

Mr. SHELANSKI. Well, I will come back to that in a moment.

The social cost of carbon, we are trying to get a measure of what the cost to society will be over time of a ton of carbon emissions, and we could ask ourselves, well, what would the effect be on the rate of return to private investment, and typically 7 percent is used as a discount rate because it roughly approximates the rate of return to business investment; real estate, small business, corporate investment. We don't use 7 percent when what we are interested in understanding are effects on future consumption by individuals, by consumers, by citizens.

What we are trying to get at with the social cost of carbon is what carbon emissions will mean for the expenditures and the quality of life and the standard of living of every American going forward. So consistent with OMB guidance, we would want to use the 3 percent number, which OMB says what is appropriate for consumption effects rather than investment effects.

Now, that said, just two things. To be sure, 7 percent was not used in the range of numbers given for social cost of carbon because of the belief that it was inappropriate to discount to zero intergenerational effects, effects that would occur one or two generations in the future. And, indeed, that is consistent with the OMB guidance document A–4, which states very clearly that when intergenerational effects are at issue, lower discount rates, perhaps even lower than 3 percent, should be used.

And, in fact, there is an emerging body of thought amongst leading economists that for climate change the 3 percent number is too high and should be declining over time. There is a forthcoming article in Science magazine by a number of the leading economists of the past half century that make this argument.

What the working group did in 2010 and again in 2013 was to provide a range, 2.5, 3 percent, and 5 percent. Now, that 5 percent number is quite a high number if you look at what it implies for future generations, and it also

happens to be a blend of considering the consumption effects at 3 percent, or can be thought of, and the investment effects at 7 percent.

So while it is clearly the case that a separate 7 percent number was not listed, and we generally do, where appropriate, ask regulatory agencies to include that in rulemakings, for the purpose of this estimate, which was not a rulemaking, it was an input to rulemakings, the judgment was reached that 7 percent was not appropriate.