



**Written Testimony of  
Robert P. Murphy, Senior Economist,  
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Before the  
Senate Committee on Environment and Public Works  
On the Matter of  
“The ‘Social Cost of Carbon’: Some Surprising Facts”  
July 18, 2013**

**1. About IER**

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 energy and environmental challenges and, as such, are critical to the well-being of individuals and society.

Founded in 1989 from a predecessor nonprofit organization, IER is a public foundation under Section 501(c)(3) of the Internal Revenue Code and is funded entirely by contributions from individuals, foundations, and corporations. Headquartered in Washington, D.C., IER supports public policies that simultaneously promote the welfare of energy consumers, energy entrepreneurs, and taxpayers.

## **2. Robert P. Murphy Resumé**

Robert Murphy earned his Ph.D. in economics from New York University in 2003. From 2003 – 2006 he taught economics at Hillsdale College. After three years teaching, Murphy left academia for the private sector, taking a job with Laffer Investments. In this capacity, Murphy maintained and improved stock selection models, and also helped write research papers for clients.

In the summer of 2007 Murphy joined IER as an economist. His academic research has focused on climate change economics, specifically the proper discount rate to use when evaluating mitigation policies. He has published an academic paper analyzing the assumptions of William Nordhaus' "DICE" integrated assessment model of the global climate and economic system,<sup>1</sup> and has prepared a study for IER on carbon "tax swap" proposals.<sup>2</sup>

## **3. The "Social Cost of Carbon": Definition and Importance**

According to the White House Interagency Working Group assigned to the project, the social cost of carbon is defined 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. [Working Group May 2013, p. 2]<sup>3</sup>

The quantitative estimates of the social cost of carbon (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<sub>2</sub>) 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 greenhouse gas regulations, efficiency standards for household appliances, and programs to subsidize so-called "alternative"

energy sources and transportation technologies. Critics of the Keystone XL pipeline have recently called for a second look into the environmental impact of the project, citing the SCC as one of the justifications for a revised assessment.

Through its role in justifying regulations and other policy actions that will restrict carbon dioxide emissions, the estimate of the SCC could have profound impacts on both industry and consumers.

#### **4. The “Social Cost of Carbon” Is Not an “Objective” Measurement But Instead a Malleable Concept Dependent on Modeling Assumptions**

Because of the significant impact it could have on energy prices and other economic conditions, it is crucial that citizens and policymakers alike realize that the SCC is a very malleable figure. It is *not* analogous to a physical constant such as the charge on an electron or the boiling point of water, with scientists coming up with ever more precise estimates of a feature of nature that is “out there” to be measured. Instead, the estimation of the SCC relies on computer simulations of the economy and climate system for hundreds of years into the future, and furthermore depends on many subjective modeling assumptions. As I will demonstrate, these assumptions can have an enormous impact on the final number, meaning that an analyst can generate just about any SCC he or she wishes by adjusting certain parameters.

Perhaps more significant, when reporting various estimates of the SCC, the White House Working group explicitly disregarded two default guidelines provided by the Office of Management and Budget (OMB) for cost/benefit analysis. Had the Working Group heeded both guidelines, the officially reported SCC would be virtually \$0 if not negative, meaning that there would be no justification for government restriction of carbon dioxide emissions.

##### **A. Choice of Discount Rate**

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 the year 2050. Indeed, the patterns in the output of the Working Group’s own computer runs suggest that their approach shows net external *benefits* from global warming in the early years. Therefore, the rate at which we discount future impacts (both positive and negative) 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 Office of Management and Budget writes instructions for federal agencies in regulatory analysis. These are called “OMB Circulars.” OMB Circular A-4<sup>4</sup> (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, 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; instead it says quite clearly that estimates should be made using both rates.

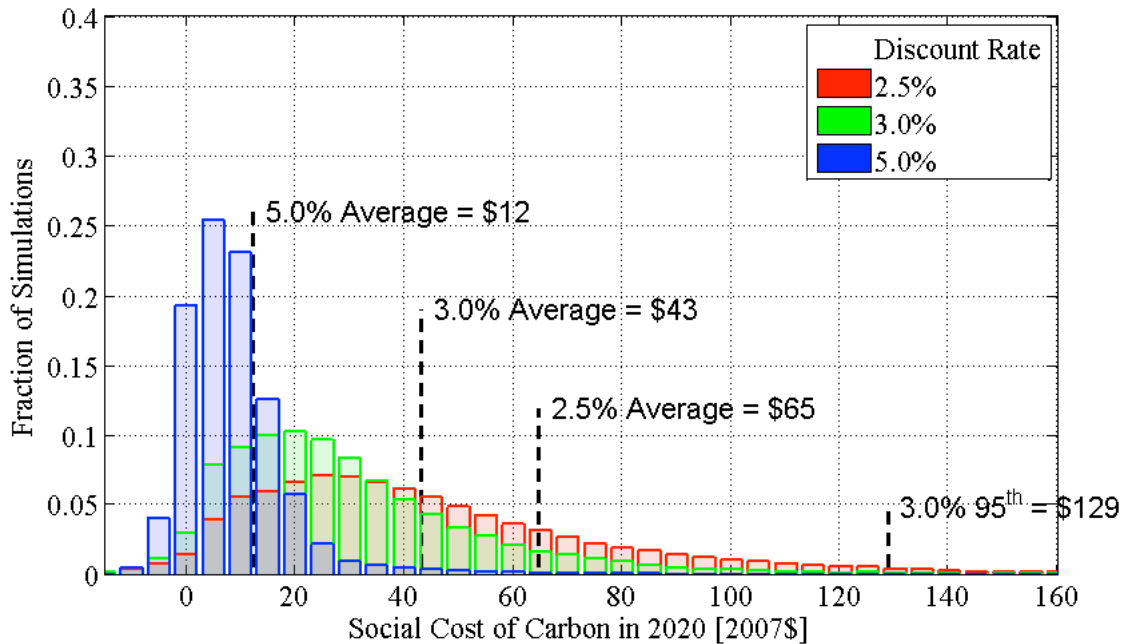
In the economics of climate change academic literature, there are disputes over the proper discount rate, with some economists arguing that very low rates should be used in order to place future generations on a nearly equal footing with the present generation in policy analysis. Circular A-4 and the White House’s primer on Circular A-4,<sup>5</sup> 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.<sup>6</sup> Nonetheless, after this discussion the 2011 primer still concluded:

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.]

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.

This omission of a 7 percent figure masks just how dependent the SCC is on discount rates. As indicated in Figure 1 from the May 2013 update, 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 Figure 1 below.) If the Working Group ran the computer models again, this time using a 7 percent discount rate and an earlier reference year such as 2015, presumably a larger fraction of simulations would register zero or negative values for the SCC, so that the mean result would itself be closer to zero—or conceivably even negative, meaning that carbon dioxide emissions conferred extra *benefits* on humanity.

**FIGURE 1. SOCIAL COST OF CARBON AT VARIOUS DISCOUNT RATES.**



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

My point in this discussion is not to argue for or against a particular discount rate. Rather, I am demonstrating 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 zero, this is clearly a matter that should not be left to a handful of regulators to decide. It underscores my claim that the “social cost of carbon” is not an objective empirical feature of the world, but is rather a very malleable figure dependent on subjective modeling assumptions, and can be made large, small, or even negative depending on parameter choices.

### **B. 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 compliance 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 recent headline SCC estimate of \$33/ton, this regulation would apparently pass a cost/benefit test, because the \$25 cost to American industry 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.

To be sure, as with the discount rate, here too the Working Group gave a justification for its decision to report only the global SCC, rather than following OMB guidelines. I am bringing up this issue merely to show the huge impact their decision has, so that policymakers understand this decision will allow regulations to appear to pass cost/benefit tests when they actually do not confer net benefits on Americans.

## **5. Conclusion**

The American public and policymakers alike have been led to believe that the social cost of carbon is an objective scientific concept akin to the mass of the moon or the radius of the sun. However, although there are inputs from the physical sciences into the calculation, estimates of the social cost of carbon are heavily dependent on modeling assumptions. In particular, if the White House Working Group had followed OMB guidance on *either* the choice of discount rate *or* reporting from a domestic perspective, then the official estimates of the current SCC would probably be close to zero, or possibly even negative—a situation meaning that (within this context) the federal government should be subsidizing coal-fired power plants because their activities confer external benefits on humanity.

The reason for this outcome is that some computer models show significant benefits of global warming through mid-century, and moreover the United States is poised to reap a larger share of the global benefits than the stipulated global damages from climate change. This is why following standard OMB guidelines—by at least providing an estimate of the SCC that uses a 7 percent discount rate and looks at only domestic impacts—would paint a completely different picture from the one that Americans have thus far seen.

Clearly, the public and policymakers have not been fully informed on what the economics profession actually has to say about climate change. Before justifying economically damaging regulations by reference to “the” social cost of carbon, policymakers must realize the dubious nature of this concept.

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<sup>1</sup> Murphy, Robert P. (2009) “Rolling the DICE: William Nordhaus’ Dubious Case for a Carbon Tax.” *The Independent Review*, vol. 14, no. 2, Fall 2009, pp. 197-217. Available at: [http://www.independent.org/pdf/tir/tir\\_14\\_02\\_03\\_murphy.pdf](http://www.independent.org/pdf/tir/tir_14_02_03_murphy.pdf).

<sup>2</sup> Murphy, Robert P. (2012) “Carbon ‘Tax Swap’ Deals: A Review and Critique.” Institute for Energy Research, November 2012. Available at: <http://www.instituteforenergyresearch.org/wp-content/uploads/2012/11/IER-Murphy-Carbon-Tax-Swap-Deals-A-Review-and-Critique.pdf>.

<sup>3</sup> Interagency Working Group 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.

<sup>4</sup> OMB Circular A-4 available at: [http://www.whitehouse.gov/omb/circulars\\_a004\\_a-4](http://www.whitehouse.gov/omb/circulars_a004_a-4).

<sup>5</sup> “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](http://www.whitehouse.gov/sites/default/files/omb/inforeg/regpol/circular-a-4_regulatory-impact-analysis-a-primer.pdf).

<sup>6</sup> See: [http://www.whitehouse.gov/sites/default/files/omb/inforeg/regpol/circular-a-4\\_regulatory-impact-analysis-a-primer.pdf](http://www.whitehouse.gov/sites/default/files/omb/inforeg/regpol/circular-a-4_regulatory-impact-analysis-a-primer.pdf).