Steffen Coenen

In order to develop a realistic pathway towards achieving the carbon (and, more broadly, GHG) emission reduction targets set out by WA, the auction floor and ceiling prices for carbon emission allowances laid out in WAC 173-446-335 of the proposed program rules must be set significantly higher.

There has been plenty of research and practical evidence assessing the true environmental and social costs of carbon emissions, resulting in values starting at around $50 (see, for example, https://www.edf.org/true-cost-carbon-pollution). Most experts agree that the true costs of carbon pollution are substantially higher. The document attached to this comment prepared by the EPA back in 2016 lists carbon prices ranging from $14 (lower limit) through $138 (for high impact) for 2025 in 2007 dollars (meaning that these values need to be adjusted for inflation, resulting in values ranging from $19.52 to $192.42 for 2025, according to https://www.usinflationcalculator.com/). The United States and WA state commit to the Paris Agreement and, explicitly, the 1.5 °C target (see https://www.whitehouse.gov/briefing-room/statements-releases/2021/11/13/fact-sheet-renewed-u-s-leadership-in-glasgow-raises-ambition-to-tackle-climate-crisis/ and https://www.seattletimes.com/seattle-news/washington-politicians-promote-state-climate-laws-at-glasgow-un-summit/, respectively). To have any chance of reaching these goals, the lower limit estimates on carbon prices will not suffice: In Chapter 2 of its 2018 Special Report on Global Warming of 1.5 °C (https://www.ipcc.ch/sr15/chapter/chapter-2/), the IPCC outlines carbon pricing figures necessary to achieve the 1.5 °C limit, with specific estimates of no less than $50, the majority of the estimates beginning at arond $120, and the median of all estimates at more than $400 (see e.g. Figure 2.26 of the report). Below such figures, the goal of staying within the total carbon emission budget available for the 1.5 degree limit is unattainable.

This enourmous discrepancy between the proposed floor and ceiling price for carbon auctions laid out in WAC 173-446-335 and the carbon prices found by an astounding amount of research and evidence signifies the strong and urgent need to readjust both the auction floor and ceiling prices in the proposed program rules. A doubling of both the lower and upper limit would be the minimum increase necessary for the carbon emission allowancs in WA to develop a steering effect away from carbon-emitting industries and processes. Higher increases would be required to keep WA on a pathway in line with the carbon emission budget associated with the 1.5 degree limit.

Note: As per common practice and in line with the units in the proposed program rules, all carbon prices refered to in this comment are in units of $/metric ton of CO2-eq. emission.

EPA FACT SHEET

SOCIAL COST OF CARBON

Background

EPA and other federal agencies use estimates of the social cost of carbon ($SC\text{-}CO_2$) to value the climate impacts of rulemakings. The $SC\text{-}CO_2$ is a measure, in dollars, of the long-term damage done by a ton of carbon dioxide (CO_2) emissions in a given year. This dollar figure also represents the value of damages avoided for a small emission reduction (i.e. the benefit of a CO_2 reduction).

The $SC\text{-}CO_2$ is meant to be a comprehensive estimate of climate change damages and includes, among other things, changes in net agricultural productivity, human health, property damages from increased flood risk and changes in energy system costs, such as reduced costs for heating and increased costs for air conditioning. However, it does not currently include all important damages. The IPCC Fifth Assessment report observed that $SC\text{-}CO_2$ estimates omit various impacts that would likely increase damages. The models used to develop $SC\text{-}CO_2$ estimates do not currently include all of the important physical, ecological, and economic impacts of climate change recognized in the climate change literature because of a lack of precise information on the nature of damages and because the science incorporated into these models naturally lags behind the most recent research. Nonetheless, current estimates of the $SC\text{-}CO_2$ are a useful measure to assess the climate impacts of CO_2 emission changes.

The timing of the emission release (or reduction) is key to estimation of the $SC\text{-}CO_2$, 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 $SC\text{-}CO_2$. For example, the $SC\text{-}CO_2$ 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. The $SC\text{-}CO_2$ will vary based on the year of emissions for multiple reasons. In model runs where the last year is fixed (e.g., 2300), the time span covered in the present value calculation will be smaller for later emission years—the $SC\text{-}CO_2$ in 2050 will include 40 fewer years of damages than the 2010 $SC\text{-}CO_2$ estimates. This modeling choice—selection of a fixed end year—will place downward pressure on the $SC\text{-}CO_2$ estimates for later emission years. Alternatively, the $SC\text{-}CO_2$ should increase over time because future emissions are expected to produce larger incremental damages as physical and economic systems become more stressed in response to greater levels of climatic change.

One of the most important factors influencing $SC\text{-}CO_2$ estimates is the discount rate. A large portion of climate change damages are expected to occur many decades into the future and the

present value of those damages (the value at present of damages that occur in the future) is highly dependent on the discount rate. To understand the effect that the discount rate has on present value calculations, consider the following example. Let's say that you have been promised that in 50 years you will receive $1 billion. In "present value" terms, that sum of money is worth $291 million today with a 2.5 percent discount rate. In other words, if you invested $291 million today at 2.5 percent and let it compound, it would be worth $1 billion in 50 years. A higher discount rate of 3 percent would decrease the value today to $228 million, and the value would be even lower—$87 million-- with a 5 percent rate. This effect is even more pronounced when looking at the present value of damages further out in time. The value of $1 billion in 100 years is $85 million, $52 million, and $8 million, for discount rates of 2.5 percent, 3 percent, and 5 percent, respectively. Similarly, the selection of a 2.5 percent discount rate would result in higher SC-CO_2 estimates than would the selection of 3 and 5 percent rates, all else equal.

Process Used to Develop Estimates of the Social Cost of Carbon for Regulatory Analysis

The SC-CO_2 allows the benefits of emission reductions to be compared to the costs of mitigation policies within benefit-cost analysis. The SC-CO_2 is used by EPA and other agencies in the executive branch of the U.S. federal government in their analysis of regulatory actions that are subject to Executive Order 12866, which directs agencies "to assess both the costs and benefits of the intended regulation…." Prior to 2009, multiple Federal agencies, including EPA, began developing their own analyses of the SC-CO_2 as part of the rulemaking process. In November 2007, an agency was ordered by the courts to consider the SC-CO_2 in a rulemaking process. U.S. Ninth Circuit Court of Appeals remanded a fuel economy rule to DOT for failing to monetize CO_2 emissions, stating that "[w]hile the record shows that there is a range of values, the value of carbon emissions reduction is certainly not zero."

In 2009, an interagency working group was convened by the Council of Economic Advisers and the Office of Management and Budget to determine how best to monetize the net effects (both positive and negative) of CO_2 emissions and sought to harmonize a range of different SC-CO_2 values across multiple Federal agencies. The purpose of this process was to ensure that agencies were using the best available information and to promote consistency in the way agencies quantify the benefits of reducing CO_2 emissions, or dis-benefits from increasing emissions, in these regulatory impact analyses. The interagency group was comprised of scientific and economic experts from the White House and federal agencies, including: Council on Environmental Quality, National Economic Council, Office of Energy and Climate Change, and Office of Science and Technology Policy, EPA, and the Departments of Agriculture, Commerce, Energy, Transportation, and Treasury. The interagency group identified a variety of assumptions, which EPA then used to estimate the SC-CO_2 using three integrated assessment models, which each combine climate processes, economic growth, and interactions between the two in a single modeling framework.

Social Cost of Carbon Values

The 2009-2010 interagency group recommended a set of four SC-CO_2 estimates for each emissions year for use in regulatory analyses. The first three values are based on the average SC-CO_2 from three integrated assessment models, at discount rates of 5, 3, and 2.5 percent. SC-CO_2 estimates based on several discount rates are included because the literature shows that the SC-CO_2 is highly sensitive to the discount rate and because no consensus exists on the appropriate rate to use for analyses spanning multiple generations. In addition, as discussed in the 2010 SC-CO_2 Technical Support Document (TSD), there is extensive evidence in the scientific and economic literature on the potential for lower-probability, but higher-impact outcomes from climate change, which would be particularly harmful to society and thus relevant to the public and policymakers. The fourth value is thus included to represent the marginal damages associated with these lower-probability, higher-impact outcomes. Accordingly, this fourth value is selected from further out in the tail of the distribution of SC-CO_2 estimates; specifically, the fourth value corresponds to the 95th percentile of the frequency distribution of SC-CO_2 estimates based on a 3 percent discount rate. See the 2010 SC-CO_2 TSD for a complete discussion about the methodology and resulting estimates.

The interagency group updated these estimates, using new versions of each integrated assessment model and published them in May 2013. The 2013 interagency process did not revisit the 2009-2010 interagency modeling decisions (e.g., with regard to the discount rate, reference case socioeconomic and emission scenarios or equilibrium climate sensitivity). Rather, improvements in the way damages are modeled are confined to those that have been incorporated into the latest versions of the models by the developers themselves and as used in the peer-reviewed literature. The current SC-CO_2 TSD presents and discusses the 2013 update (including minor technical corrections to the estimates published in November 2013 and July 2015).[1]

The table on the following page summarizes the four SC-CO_2 estimates in certain years. The four SC-CO_2 estimates are: $14, $46, $68, and $138 per metric ton of CO_2 emissions in the year 2025 (2007 dollars).

[1] All versions of the SC-CO_2 TSD are available at: https://www.whitehouse.gov/omb/oira/social-cost-of-carbon.

Social Cost of CO_2, 2015-2050 [a] (in 2007 dollars per metric ton CO_2)

Source: Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (May 2013, Revised August 2016)

	Discount Rate and Statistic			
Year	5% Average	**3% Average**	2.5% Average	High Impact (3% 95th percentile)
2015	$11	**$36**	$56	$105
2020	$12	**$42**	$62	$123
2025	$14	**$46**	$68	$138
2030	$16	**$50**	$73	$152
2035	$18	**$55**	$78	$168
2040	$21	**$60**	$84	$183
2045	$23	**$64**	$89	$197
2050	$26	**$69**	$95	$212

[a] The SC-CO_2 values are dollar-year and emissions-year specific.

Examples of Applications to Rulemakings

EPA has used the interagency group recommended estimates of the SC-CO_2 to analyze the carbon dioxide impacts of various rulemakings since 2010. Examples of these rulemakings include:

- The Joint EPA/Department of Transportation Rulemaking to establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards (2012-2016)
- Amendments to the National Emission Standards for Hazardous Air Pollutants and New Source Performance Standards (NSPS) for the Portland Cement Manufacturing Industry
- Regulatory Impact Results for the Reconsideration Proposal for National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters at Major Sources
- Proposed National Emission Standards for Hazardous Air Pollutants (NESHAP) for Mercury Emissions from Mercury Cell Chlor Alkali Plants
- Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources: Commercial and Industrial Solid Waste Incineration Units Standards
- Final Mercury and Air Toxics Standards
- Joint EPA/Department of Transportation Rulemaking to establish Medium- and Heavy - Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards

- Proposed Carbon Pollution Standard for Future Power Plants
- Joint EPA/Department of Transportation Rulemaking to establish 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards

Limitations

The interagency group developed the SC-CO_2 estimates with the acknowledgement of the many uncertainties involved and with a clear understanding that they should be updated over time to reflect increasing knowledge of the science and economics of climate impacts. The group noted a number of limitations to the SC-CO_2 analysis, including the incomplete way in which the integrated assessment models capture catastrophic and non-catastrophic impacts, their incomplete treatment of adaptation and technological change, uncertainty in the extrapolation of damages to high temperatures, and assumptions regarding risk aversion. Additional details are discussed in the Technical Support Documents.

Next Steps

The EPA and other members of the interagency group continue to engage in research on modeling and valuation of climate impacts and to consider public and expert input on the estimates through a variety of channels. Currently, the interagency group is seeking advice from the National Academies of Sciences, Engineering, and Medicine on how to approach future updates to ensure that the estimates continue to reflect the best available science. An Academies committee, "Assessing Approaches to Updating the Social Cost of Carbon," (Committee) will provide expert, independent advice on the merits of different technical approaches for modeling and highlight research priorities going forward.[2] In January 2016, the Academies released an interim report recommending against a near term update of the SC-CO_2 estimates within the existing modeling framework, and offered recommendations for how to enhance the discussion and presentation of uncertainty in the current estimates. In August 2016, the IWG issued revisions to the SC-CO_2 TSD incorporating these recommendations from the Academies. Longer-term recommendations about how to approach a comprehensive update to the estimates are expected in the Academies' final report in January 2017. EPA will evaluate its approach based upon any feedback received from the Academies' panel.

In the meantime, after careful evaluation of the full range of public comments, the interagency working group continues to recommend the use of the current SC-CO_2 estimates in regulatory impact analysis until further updates can be incorporated into the estimates.

[2] For more information on the charge to the Committee and status of the Academies' process, see: http://sites.nationalacademies.org/DBASSE/BECS/CurrentProjects/DBASSE_167526.