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Social Cost of Greenhouse Gases: Issues for Congress

On January 20, 2021, President Biden issued Executive Order (E.O.) 13990, "Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis." It contains directives to update the social cost of greenhouse gases (SC-GHG), a tool that agencies have typically used to estimate the benefits of GHG reductions.

SC-GHG estimates have informed decisionmaking on federal actions, including GHG-related rules, since 2008. Members of Congress have taken divergent views on the adequacy and use of the SC-GHG. Some Members of Congress have questioned whether the SC-GHG methodology was consistent with federal guidance. Others have raised concerns that the SC-GHG estimates are outdated and that they underestimated climate benefits. The SC-GHG remains a topic of interest in the 117th Congress as the Biden Administration updates the estimates and implements its climate change directives.

What Is the Social Cost of Greenhouse Gases (SC-GHG)?

The social cost of a specific GHG is a monetary estimate of the economic impacts associated with emitting an additional ton of that GHG in a given year. Conversely, this dollar figure represents the benefit of a one-ton reduction. The social cost of carbon dioxide (SCC) includes net changes in agricultural productivity, property damage from increased flood risk, and changes in energy system costs, such as reduced costs for heating and increased costs for air conditioning. Similarly, the social cost of methane (SCM) and the social cost of nitrous oxide (SCN) estimate the monetary value of impacts from marginal changes in methane and nitrous oxide, respectively, in a given year. Each SC-GHG is typically presented as dollars per metric ton of a GHG in a given year. Hereinafter, "SC-GHG" refers collectively to estimates of the SCC, SCM, and SCN.

How Is the SC-GHG Calculated?

SC-GHG values are calculated using models that translate changes in emissions into economic impacts through a multistep process. As with any scientific or economic analysis, there are limitations and uncertainties associated with the calculation of the SC-GHG estimates. One limitation is that the underlying models do not include all potentially significant climate change impacts.

The sources of uncertainty associated with the SC-GHG estimates include the quantification of the physical effects of GHG emissions (e.g., the way that the models estimate changes in global average temperature), socioeconomic factors (e.g., population and economic growth), projected GHG emissions, translation of physical and climate impacts into economic impacts, and the role of adaptation. Another source of uncertainty is discounting, which occurs in the last step of the SC-GHG calculation.

Discount Rate

Discounting, which is standard practice in benefit-cost analysis, allows for apples-to-apples comparisons of economic impacts that occur at different times. It helps answer the question about how much future benefits and costs are worth today ("present value"). It adjusts future values based on the observation that people usually prefer a value today compared with the same amount in the future. Higher discount rates give less present value to benefits or costs that accrue in the future, and lower discount rates give more present value. Given the long time horizons analyzed, SC-GHG estimates are highly sensitive to the discount rate.

Discount rate selection is particularly challenging in climate change analyses because GHG emissions remain in the atmosphere for a long time—e.g., hundreds of years—which means the GHG impacts span generations of people. Observed market rates can inform this selection, but current markets do not capture intergenerational rates. There is no consensus on the appropriate discount rate to choose in estimating the SC-GHG.

Geographic Scope

Another methodological consideration is whether the SC-GHG should measure global or domestic impacts. While most published estimates of the SC-GHG have measured global impacts, some have called on federal agencies to use domestic values in benefit-cost analysis. Those recommending use of global SC-GHG values have concluded that there is no clear distinction between domestic and global climate change impacts and that a domestic SC-GHG understates the benefits to the United States because climate impacts that occur outside U.S. borders may affect the welfare of U.S. citizens and residents. Reciprocity—whether U.S. mitigation policies motivate other countries to likewise reduce GHGs—may also justify use of global values, given that reductions (or increases) by other countries benefit (or harm) those within U.S. borders. Others disagree with a focus on global values, expressing skepticism about the likelihood of complete reciprocity and a view that federal analyses should focus on domestic impacts. These stakeholders also noted that while federal guidance allows consideration of international impacts, it requires consideration of a domestic perspective.

How Is the SC-GHG Used?

Federal agencies have primarily used the SC-GHG to estimate the climate benefits of GHG reductions from proposed rules. The social cost of each gas is applied to changes in that gas (e.g., the SCC is applied to changes in

carbon dioxide emissions with the proposed rule, and the SCM is applied to changes in methane emissions). The SC-GHG has been used to value climate impacts in other federal actions, though to a much lesser extent than in regulatory impact analysis. For example, the Obama Administration used the SCC and SCM to value climate change impacts in some assessments under the National Environmental Policy Act. The General Services Administration also used the SCC to value carbon emissions associated with a delivery services contract. State governments and other organizations have used the SC-GHG in rulemakings and other applications.

Prior Federal Actions on SC-GHG

Federal agencies began to consider various published SC-GHG estimates in regulatory analysis in the 2000s. By 2009, the Obama Administration convened an interagency working group (IWG) to develop a consistent set of estimates. The IWG developed a methodology and, in 2010, published a set of four SCC estimates, which measured the global value of carbon dioxide reductions, for use in regulatory analysis. The first three values were based on the average SCC from three integrated assessment models, at discount rates of 5%, 3%, and 2.5%. The fourth value corresponded to the 95th percentile of the frequency distribution of SCC estimates based on a 3% discount rate. The IWG updated the SCC estimates in 2013 and published two technical corrections to the estimates in 2015. Agencies began using the SCM in 2015 and the SCN in 2016.

The IWG also requested that the National Academies of Sciences, Engineering, and Medicine (NASEM) provide advice on future updates to SCC estimates. The NASEM's January 2017 report recommended a different modeling framework, research needs for each calculation step, and criteria for future SCC updates. It observed that advances would "require significant investments in both economic and climate modeling." The NASEM also recommended development of a new approach to calculate discount rates, noting that Office of Management and Budget (OMB) Circular A-4 guidance does not adequately address discounting over long time periods or the effect of uncertainty on discount rates.

In March 2017, the Trump Administration disbanded the IWG and withdrew the IWG's SC-GHG estimates. It directed agencies to ensure that any new SC-GHG estimates were consistent with guidance for regulatory analysis in OMB Circular A-4. The Trump EPA developed a new set of estimates using the same models and assumptions as the IWG except they were domestic measures and included estimates discounted at rates of 3% and 7%. The domestic perspective and use of a 7% rate lowered the SCC estimates of benefits related to GHG reductions. The Trump Administration presented SCC and SCM estimates in several regulatory analyses.

Current Federal Actions on SC-GHG

The Biden Administration reestablished the IWG and reinstated the Obama Administration's SC-GHG estimates, adjusted for inflation. **Table 1** presents the interim estimates for 2030. The interim estimates replace the Trump Administration's estimates.

The IWG announced a longer-term update of the SC-GHG and plans to publish results by January 2022. The IWG requested comment about how to incorporate the 2017 NASEM recommendations and other recent science and economics into the SC-GHG (86 *Federal Register* 24669; May 7, 2021), with comments due by June 21, 2021.

Table 1. IWG Interim SC-GHG Estimates
Dollars per metric ton for emissions in 2030

	Discount Rate, Statistic			
	5%, Average (Avg)	3%, Avg	2.5%, Avg	3%, 95th percentile
SCC	$19	$62	$89	$187
SCM	$940	$2,000	$2,500	$5,200
SCN	$7,800	$23,000	$33,000	$60,000

Source: IWG Technical Support Document (February 2021).
Notes: Estimates are stated in 2020$/metric ton. SC-GHG estimates vary depending on the year of GHG emissions.

E.O. 13990 specifies deadlines by which the IWG is to develop recommendations in three areas:

- recommendations for SC-GHG use in decisionmaking, budgeting, and procurement (by September 1, 2021);
- recommendations for a process to review and update SC-GHG estimates (by June 1, 2022); and
- recommendations for the SC-GHG calculation to account for climate risk, environmental justice, and intergenerational equity (by June 1, 2022).

EPA has estimated the social cost of hydrofluorocarbons (HFCs), which are potent GHGs used in cooling and other applications. EPA used a methodology consistent with the IWG's interim SC-GHG estimates. It estimated the social cost of nine HFCs to inform a rulemaking that begins to implement legislation phasing down HFCs. The average social cost in 2030, discounted at 3%, ranged from $7,400 per ton of HFC-152a to $790,000 per ton of HFC-236f(a).

Issues for Congress

The Administration's pending update of the SC-GHG and consideration of additional uses raises questions, such as:

- What resources will be required to update the SC-GHG? Should the federal government develop its own models or partner with other researchers/model developers?
- How can the federal government ensure that, over time, the SC-GHG accounts for advances in science and economics while reducing the risk of political volatility in decisions on SC-GHG estimates and uses?
- Should policy deliberations inform SC-GHG estimation and its applications? Discount rate selection reflects implicit policy judgments (e.g., the interests of future generations). Equity considerations may also be relevant within a generation.

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