

Policy Brief: Social Cost of Carbon

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Introduction and Literature Review

Social Cost of Carbon

The Social Cost of Carbon, abbreviated “SCC”, is a value calculated using an economic model that represents the marginal cost to society of an additional ton of carbon that is released into the atmosphere (Scovronick et al., 2019). The SCC is one of three models that are encapsulated in the Social Cost of Greenhouse Gases, abbreviated “SC-GHG,” which also calculates the Social Costs of Methane and Nitrous Oxide. The SCC is provided so that federal agencies can estimate the social cost of carbon emissions in cost-benefit analysis and decision-making (US IAWG., 2021).

The mathematical model used to calculate the SCC is based on William Nordhaus’ 2016 DICE model - Dynamic Integrated model of the Climate and the Economy (Nordhaus, 2017). The SCC is an Integrated Assessment Model which integrates knowledge from two or more domains into a single framework (Nordhaus, 2017). In the case of the SCC these domains include economics, climate models, global population models, and global emissions trends which contribute data, damage functions and discount rates to ultimately output the cost per ton of carbon emissions (Nordhaus, 2017).

Federal Government use of the SCC

The SCC is used primarily in cost-benefit analysis of government programs to monetize climate damages so that policy decision-makers can weigh the cost of climate damages related to a government activity (US IAWG., 2021). Including the SCC of a policy in cost-benefit analysis helps decision-makers to answer an extremely opaque and politically-charged question – what is the effect of this policy in terms of climate damages decades or centuries from today? The SCC can also be thought of as a helpful heuristic for distilling a library of high-level climate economics into a single metric that is easily understood – the dollar cost of emission of a ton of carbon.

Federal agencies have incorporated SCC estimates in cost-benefit analyses since Executive Order 12866 in 2008 (US IAWG., 2021). A search of the Federal Register for “Social Cost of Carbon” yields 88 Rules from 5 agencies that contain a reference to the SCC (see Exhibits 1 and 2); with 45 of those rules being issued by the Energy Department, and 21 from the Environmental Protection Agency (Document Search Results for “Social Cost of Carbon.”). Some of the rules that mention the SCC are easily connected to climate change, such as [Energy Conservation Standards for Portable Air Conditioners](#) and a [Hydrofluorocarbons Trading Program](#), while others are less explicitly climate focused, such as an [Extension of Compliance Date for Entry-level Driver Training](#) (Document Search Results for “Social Cost of Carbon.”).

Critics of the SCC

As a climate-economic model, some critics of the SCC believe that it is over-simplified and does not capture the full effects of climate change. In their 2021 paper, Cromar, Howard, Vasquez, and Anthoff conducted a socioeconomic/health outcome analysis that found climate

change is estimated to significantly affect three outcomes: diarrhea mortality, diarrhea morbidity, and malaria mortality, none of which are priced into the current SCC (Cromar et al., 2021). The SCC has been criticized for not including “tipping point” risks of catastrophe (Dietz et al., 2021). The SCC also does not factor in global or regional inequality in the pricing of carbon, which Nathwani, Lind, Renn, and Schellnhuber argue should be a factor in the model so as not to disadvantage developing regions and nations that need fossil fuels to further industrialize (Nathwani et al., 2021).

Identification of Official and Unofficial Actors and their Role

Official actors

Official actors are defined by Thomas Birkland as those government actors whose responsibilities are sanctioned by laws or the Constitution (Birkland, 2020). The SCC exists in a policy environment of official actors that span all three branches of government. The branch most involved with the SCC is the Executive Branch, which tasks the Interagency Working Group on Social Cost of Greenhouse Gases to define the inputs, functions, and outputs of the SCC; and whose agencies must use the SCC in cost-benefit analysis (US IAWG., 2021). Political control of the Executive Branch has had substantial impacts on the output value of the SCC. First set by President Barack Obama’s Environmental Protection Agency in 2008, the SCC had a value of \$45 USD per ton of emitted carbon. During President Donald Trump’s administration, the EPA was directed to modify the SCC model to only determine the cost of emissions by the United States, rather than global emissions, resulting in an output SCC of \$3 USD (US IAWG., 2021). President

Joseph Biden directed his administration to recalculate the SCC using a return to global emissions as an input which resulted in an SCC of \$51 USD.

The Judicial Branch played a key role in the creation of the SCC when the U.S. Ninth Circuit Court of Appeals required the Department of Transportation to create a fuel economy rule using the SCC, stating that “while the record shows that there is a range of values, the value of carbon emissions reduction is certainly not zero.” (US IAWG., 2021). One of the most influential cases since the creation of the SCC is the 2014 District of Colorado case *High Country Conservation Advocates v. United States Forest Service (High Country)*, where plaintiffs argued that Bureau of Land Management and the U.S. Forest Service did not disclose the social, environmental, and economic impacts of greenhouse gas emissions from modifications to existing coal leases (Palenik, 2020). The court ruled in *High Country* that not every project that has carbon impacts is required to include an SCC analysis, but in cases where cost-benefit analysis requires a description of carbon emissions, the agency should use the SCC as a quantitative measure rather than a non-empirical qualitative description (Palenik, 2020). A 2018 District of Montana case narrowed this opinion further, ruling in *Wilderness Workshop v. BLM* that Agencies have the discretion to choose empirical models other than the SCC, and that an “economic analysis” is not always the same as a “cost-benefit analysis” (Palenik, 2020).

The Legislative Branch has not acted as forcefully as the Judicial or Executive Branches. Legislation to impose a tax on carbon emissions was considered in the “Build Back Better” Reconciliation Bill passed by the House in November 2021 but did not make it into the final version. One policy in consideration was a tax on carbon tied to the SCC (Patnaik & Kennedy, 2021).

Unofficial Actors

Unofficial actors are defined by Thomas Birkland as groups that are not officially sanctioned by law or policy and operate to advance their desired political outcomes in government and society (Birkland, 2020). Climate change activists are an outspoken unofficial actor that have lobbied the federal government and brought seven of the eleven cases involving the SCC from 2013 to 2019 (Palenik, 2020).

Meanwhile, fossil fuel or carbon intense corporations have as acted as unofficial actors by intensely lobbying against the SCC and climate policy. Kyle Meng and Ashwin Rode found a statistically significant relationship between the amount a firm spent lobbying against the 2009 Waxman-Markey climate bill and how much the policy is expected to alter its stock value (Meng & Rode, 2019). The US Chamber of Commerce lobbied against the “Build Back Better” Reconciliation bill which includes spending on climate change, vowing to “do everything we can to prevent this tax raising, job killing Reconciliation Bill from becoming law” (Milman, 2021). The Business Roundtable opposed passage of the Reconciliation Bill because it raises taxes on the wealthy, and whose organization includes the CEOs of Apple, Amazon, Google and Exxon (Milman, 2021).

Identification of Policy Solutions

Alternatives to the SCC Integrated Assessment Model

Due to the abstract nature of the SCC model, there is room for critique and analysis of the theoretical underpinnings of the model’s calculations. Robert Pindyck argued in his 2019 article *The Social Cost of Carbon Revisited* that the current SCC does not effectively price catastrophes,

which he believes should be one of the main functions of the SCC. Pindyck designed a probabilistic model based on survey input from climate, economics and demographics experts and calculated an SCC of \$291 USD, well above President Biden's current price of \$51 USD (Pindyck, 2019). Pindyck also found variation between group averages for respondents who identified as Economists and Climate Scientists, where Economists provided a mean SCC of \$173.70, Climate Scientists provided a mean of \$316.30 (Pindyck, 2019).

Similar to climate catastrophes are climate "tipping points". Dietz, Rising, Stoerk, and Wagner found in their meta-analytic integrated assessment model the greatest tipping-point risks of climate catastrophe come from dissociation of methane hydrates and permafrost carbon feedback, neither of which are accounted for in the SCC (Dietz et al., 2021).

Kaufman, Barron, Krawczyk, Marsters, and McJeon describe in their 2020 paper an alternative model that sets the SCC based on a society's trajectory to net zero carbon dioxide emissions by a certain date (Kaufman et al., 2020). Their model sets the price of carbon at the level required to reduce short-term CO₂ emissions on a linear path to zero emissions. In their benchmark scenario, they found CO₂ prices at of \$32, \$52, and \$93 per metric ton for net-zero targets in 2060, 2050 and 2040, respectively (Kaufman et al., 2020).

Policy decision-makers also need to account for the fact that not every industry is elastic enough to accept an SCC-based tax or decarbonization effort. Roth, Adams, Jaramillo, and Muller estimated the opportunities for decarbonization in various sectors of the US economy and found the energy sector has ample opportunities to decarbonize, but the transportation sector will not be deeply decarbonizing within the next 10 years unless renewable energy sources become prevalent in public transportation (Roth et al., 2020).

Capturing Health Impacts

It is well documented that the SCC does not factor in public health outcomes. Four main public health issues that need to be addressed in the current SCC are: global and regional SCC damage functions, accounting for catastrophes and uncertainty, vulnerable groups, and social change over time (Scovronick et al., 2019). Scovronick and his fellow researchers found that damage functions that are created solely by economists do not account for key issues that would be included if more public health officials and epidemiologists had input during the construction of the SCC model (Scovronick et al., 2019).

Cromar, Howard, Vasquez, and Anthoff studied the health-based aspects of the current SCC estimates, and by accounting for prevalence of tropical diseases such as diarrhea mortality, diarrhea morbidity, and malaria mortality using calculated “equity weights” for health outcomes dramatically increased the role of health outcomes in the SCC model (Cromar et al., 2021).

Social Justice and a Regional SCC

Kornek, Klenert, Edenhofer, and Fleurbaey outline in their 2021 article a model for accounting for inequality between and within countries to set the optimal SCC (Kornek et al., 2021). The researchers model SCC between and within countries based on several factors, including redistribution of taxes related to the SCC. The functions they create demonstrate that if countries do not institute a redistribution policy for the collected taxes on SCC, SCC will actually increase over time as income inequality increases due to climate change (Kornek et al., 2021).

Policy decision-makers also need to account for the possible economic damages caused by the SCC in developing nations and regions who are not ready to decarbonize or pay a carbon tax. Nathwani, Lind, Renn, and Schellnhuber proposed that the SCC be calculated with their Development and Climate Change Performance Index which allows for country-level analysis of the effect of climate change on that country's economic development and quality of life (Nathwani et al., 2021). This need for regional SCCs (the current DICE 2016 SCC is a globally aggregated model) is partially met by William Nordhaus' 2016 Regional Integrated model of the Climate and the Economy (RICE) (Nordhaus, 2017).

Identification of Decision-Making Process

After the U.S. Ninth Circuit Court of Appeals required the Department of Transportation to create a fuel economy rule in 2008 that included the social cost of carbon, it was up to the Obama administration to decide on the type of model to be used. The policy output is essentially a pricing model, albeit a politically controversial one. The desired policy outcome of the adoption of an SCC is an easy-to-understand tool that agencies can use in cost-benefit analysis to better understand the agency's actions in the context of climate change (US IAWG., 2021). The SCC is updated at the direction of the President to the Interagency Working Group (IWG) on the Social Cost of Greenhouse Gases. In 2017 the National Academies of Sciences, Engineering and Medicine issued recommendations for an updating process, but President Trump disbanded the IWG and required agencies to use Office of Management and Budget's Circular A-4 (US IAWG., 2021). President Biden re-formed the IWG in 2020 and instructed agencies the IWG to use the 2017 National Academies model recommendations.

Since it is virtually impossible for an elected official to also be a highly-educated climate economist, they must rely on a panel of experts in the form of the IWG and the National Academies. Understanding the constraints placed on elected officials through the lens of bounded rationality, the President must make a decision using highly aggregated data and trust expert opinion when making directions to the IWG. Now that the model has been created and implemented for some time, it is unlikely there will be a significant overhaul of its key pieces, and it is more likely that it will be incrementally updated over time to address the concerns of the current administration.

Proposed Evaluative Criteria

The SCC's main reason for existence is so that agencies can realistically price the carbon impact of a government program in cost-benefit analysis. Using elements from Levine, Peters, and Thompson's characteristics of policy instruments as an evaluative criterion, the SCC can be evaluated according to effectiveness, efficiency, and flexibility (Levine et al., 1990). The effectiveness of the SCC can be ambiguous. The SCC model has been shown by multiple researchers to lack coverage in public health and climate catastrophes, and therefore has questionable validity for pricing carbon emissions. However, the SCC's availability as an easily understood metric that is statistically in the ballpark allows some level of satisficing by the agencies without being encumbered by a complex "black box" algorithm.

The efficiency of the SCC is debatable in terms of how high the cost of carbon should be priced. The SCC is not an intuitive or common-sense calculation, it is a range of numbers that are narrowed down to achieve a certain political outcome. While public health and climate

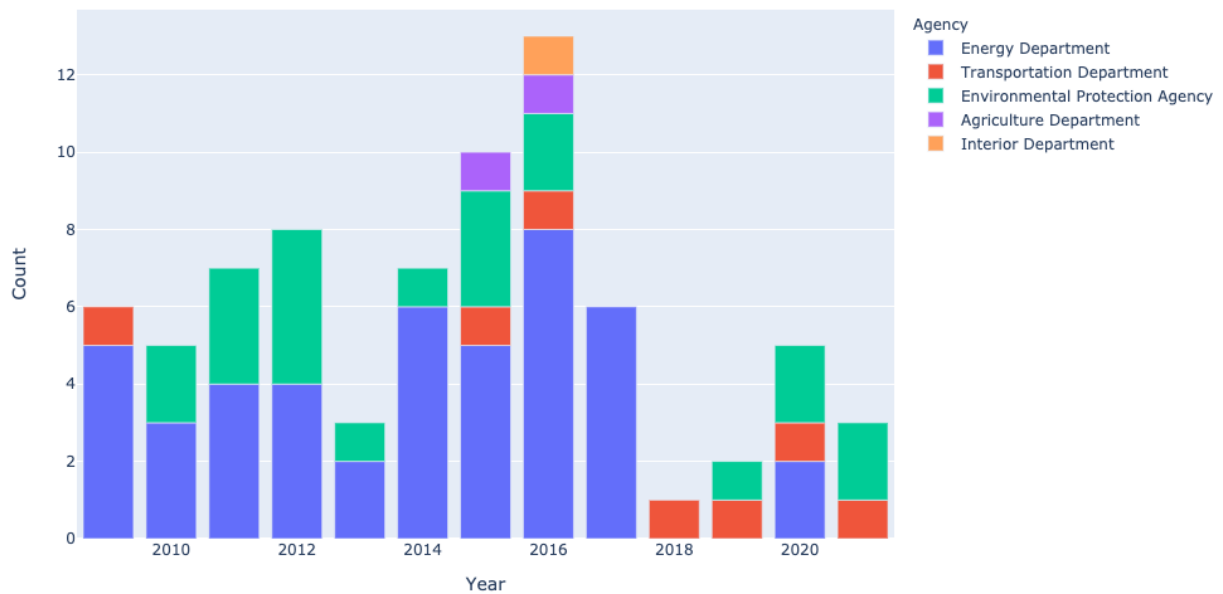
experts have argued the SCC is too low, and thereby inefficient in its capture of emissions costs, some economists such as Bjorn Lomborg at the Copenhagen Consensus believe that pricing carbon too high will damage the economy more than the effect of climate change and argues for an optimal level of climate cost versus climate policy cost (Lomborg, 2021).

The SCC as a policy tool can be extremely flexible. History has shown that administrations can modify the inputs and underlying functions that output the SCC as desired without consulting with scientific institutions. However, modifying the SCC introduces risk in the form of statistical uncertainty as to its validity in cost-benefit analysis. When modifications are made to the SCC that are not backed up by science and statistical reasoning, there is the possibility of the SCC to drift away from the actual cost of carbon and decrease efficiency.

Exhibits

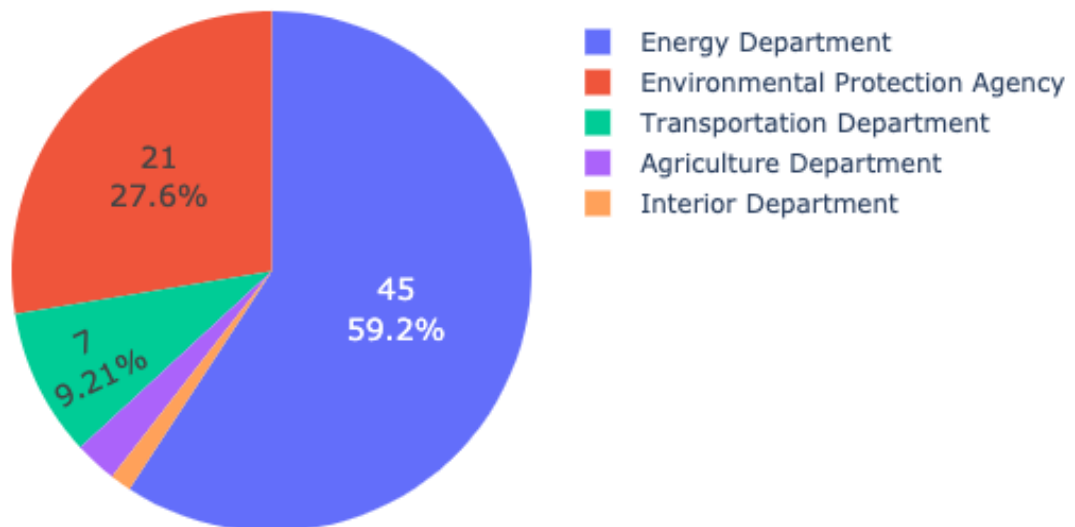
1. Federal Register - Rules that mention “Social Cost of Carbon”

Federal Register Rules that mention "Social Cost of Carbon"



2. Federal Register - Agency Rules that mention "Social Cost of Carbon"

Agency Rules that mention "Social Cost of Carbon"



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[availability-and-request-for-comment-on-technical-support-document-social-cost-of-carbon](#)