



# SOCIAL COST OF CARBON POLLUTION FACT SHEET

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## WHAT IS THE SOCIAL COST OF CARBON POLLUTION?

Scientists predict that climate change will lead, and in some cases has already led, to negative consequences such as the spread of disease, decreased food production, coastal destruction, and many more. The social cost of carbon pollution calculates the economic cost of these problems and estimates the damage done by each ton of carbon dioxide<sup>1</sup> that is spewed into the air. The current estimate is around \$40.<sup>2</sup>

## HOW IS THE SOCIAL COST OF CARBON POLLUTION USED?

The social cost of carbon pollution is used in official benefit-cost analyses of federal regulations that reduce greenhouse gas emissions. It allows us to compare the costs of limiting our pollution to the costs of climate change. In benefit-cost analyses, agencies use social cost of carbon pollution to measure the monetary benefits of regulations that reduce carbon emissions, and weigh them against the costs of the regulation.<sup>3</sup>

Decades of economic research have demonstrated that the “cost-free” behavior of using fossil fuels and emitting carbon dioxide has led to an over-reliance on fossil fuels. The social cost of carbon pollution removes that bias by accounting for the costs of pollution.

Many other nations use the social cost of carbon pollution (estimated independently from the U.S. number) or similar concepts in making regulatory decisions, including Canada, France, Germany, Mexico, Norway, and the United Kingdom. Some U.S. states also use the social cost of carbon pollution. Minnesota<sup>4</sup> recently used the U.S. social cost of carbon pollution to determine the value of solar energy.

Companies also use a cost of carbon pollution, but in a different way: the private sector considers climate change in financial planning. According to the London-based Carbon Disclosure Project (CDP), 29 companies based (or doing business) in the United States reported in 2013 that they use an internal price on carbon pollution in their financial planning to help weigh the risks and opportunities related to climate change.<sup>5</sup>

## HOW IS THE SOCIAL COST OF CARBON POLLUTION ESTIMATED?

Economists estimate the social cost of carbon pollution by linking together a global climate model and a global economic model. The resulting models are called Integrated Assessment Models, or IAMs. This integration helps economists take a unit of carbon emissions (such as from driving a car or burning coal in a power plant) and translate that into an estimate of the cost of the impact that emissions have on our health, well-being, and quality of life in terms of dollars. The models are based on the best available science and economics from peer-reviewed publications.

The three most-cited models are William Nordhaus' **DICE model** (Yale University), Richard Tol's **FUND model** (Sussex University), and Chris Hope's **PAGE model** (Cambridge University).

### *In the United States:*

President Obama formed the Interagency Working Group (IWG) on the Social Cost of Carbon in 2010 and again in 2013. To estimate the social cost of carbon pollution used in the United States, the IWG used: Nordhaus' DICE model, Tol's FUND model, and Hope's PAGE model.

The IWG made several slight changes to the models based on the most current economic and scientific literature. It then ran the three models using five different socio-economic and emission trajectories: four average (business as usual) trajectories and one best-case (optimistic) trajectory.<sup>6</sup> Averaging the results across the models and trajectories, the IWG produced four different social cost of carbon pollution estimates. All four are available for government agencies to use. The central estimate—around \$40 for a unit of emissions in 2015—uses a 3 percent discount rate.

## WHY ARE THERE MULTIPLE ESTIMATES?

The IWG produced four different social cost of carbon pollution estimates by using different discount rates. The discount rate is how economists measure the value of money over time—the tradeoff between what a dollar is worth today and what a dollar would be worth in the future.<sup>7</sup> Economists often measure the discount rate using various market interest rates, including the savings rate at your bank and the 30-year U.S. Treasury bond.

The current social cost of carbon pollution estimates for a unit of emissions in 2015 are \$57, \$37, and \$11 using discount rates of 2.5 percent, 3 percent, and 5 percent, respectively. The fourth social cost of carbon pollution estimate of \$109 uses a 3 percent discount rate and describes the 95th-percentile value for the social cost figure, in an attempt to capture the damages associated with extreme climatic outcomes. The estimate of \$37, which uses a 3 percent discount rate, is considered the “central” estimate for a unit of emissions in 2015.<sup>8</sup> That \$37 value is denoted in 2007 USD and equals around \$40 in today's dollars.

The social cost of carbon pollution estimate decreases as the discount rate increases because a higher discount rate implies that people care less about future generations than they do about the present.

## HOW ACCURATE IS THE SOCIAL COST OF CARBON POLLUTION?

The central social cost of carbon pollution estimate of around \$40 is our best available estimate for now. Of

course, there is uncertainty over the science and economics of climate change. This uncertainty is partly due to the complexity of the climate system, the imprecision of placing a monetary value on environmental services, the long-term time horizon over which climate change occurs, and the unprecedented rate of carbon emissions and level of carbon concentration that has entered the atmosphere since the industrial revolution. As science and economics improve and progress, this uncertainty will decline, but is unlikely to be eliminated.

## IS THE SOCIAL COST OF CARBON POLLUTION UPDATED OVER TIME?

The U.S. government updates the social cost of carbon pollution estimates over time to account for new scientific and economic information. In 2013, the Interagency Working Group on the Social Cost of Carbon updated its 2010 estimates in line with updated versions of DICE, FUND, and PAGE. The IWG made no other changes to its modeling process between 2010 and 2013.

## WHY DOES THE SOCIAL COST OF CARBON POLLUTION INCREASE OVER TIME?

As the effects of climate change intensify over time as more carbon fuels are used and more carbon is emitted, the social cost of carbon pollution increases. In this way, the cost of carbon pollution increases over time because the amount of carbon in the atmosphere increases over time. By 2050, the central estimate from the 2013 Interagency Working Group will be around \$70.

## DOES THE SOCIAL COST OF CARBON POLLUTION ESTIMATE CAPTURE ALL RELEVANT DAMAGES?

No. The models used by the Interagency Working Group on the Social Cost of Carbon omit several types of climate impacts; these omissions are often due to a lack of monetary damage estimates for many climate impacts to integrate into these underlying models. Some of the omitted damages are the effects of climate change on fisheries; the effects of increased pest, disease, and fire pressures on agriculture and forests; and the effects of rising sea levels and resource scarcity due to migration. Additionally, these models omit the effects of climate change on economic growth and the rise in the future value of environmental services due to increased scarcity.

Although the models also fail to account for some climate benefits, omitted negative impacts are almost certainly to overwhelm omitted benefits. As a consequence, \$40 should be interpreted as a lower-bound central estimate.

## ARE THERE BENEFITS TO CARBON AND ARE THESE ACCOUNTED FOR?

Yes and yes. There are benefits to carbon and some of these benefits that are the result of climate change, such as potential increases in agricultural yields, are captured in the social cost of carbon pollution estimate; these benefits reduce the magnitude of the social cost of carbon pollution. Other benefits that are the result of climate change are omitted, including the lower cost of supplying renewable energy from wind and wave sources, the increased availability of oil due to higher temperatures in the Arctic, and fewer transportation delays from snow and ice are excluded. However, omitted negative impacts are almost certainly to overwhelm omitted benefits. As a consequence, \$37 should be interpreted as a lower-bound central estimate.

The other benefits from the use of carbon fuels that are unrelated to climate change (such as economic output) are omitted from the social cost of carbon pollution, but they are *always* included in any analysis in which the

social cost of carbon pollution is used. In a benefit-cost analysis, the cost of regulations, such as the potential loss of output, is always balanced against the benefits of carbon reductions as partially measured by the social cost of carbon pollution.

## NOTES

- <sup>1</sup> There are many ways to measure a ton (2000 pounds) of carbon dioxide. In its simplest sense, a ton of carbon dioxide is the amount of carbon dioxide that the average U.S. car emits in 2 to 2.5 months. An important distinction is that, because carbon dioxide consists of carbon and oxygen, 3.67 tons of carbon dioxide is equivalent to 1 ton of carbon.
- <sup>2</sup> The precise, central value for a ton of carbon dioxide emitted in 2015 is \$37, in 2007 USD (<http://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf>).
- <sup>3</sup> In addition to considering the benefit of carbon reductions, benefit-cost analyses consider the cost of reduced use of carbon fuels, such as potential lost economic output and higher energy costs, which are not accounted for in the social cost of carbon pollution. Additionally, the social cost of carbon pollution includes the benefits from climate change. In this way, the costs of a regulation are always weighed against the social cost of carbon pollution and other regulatory benefits.
- <sup>4</sup> See: <http://www.midwestenergynews.com/2014/03/12/minnesota-becomes-first-state-to-set-value-of-solar-tariff/>
- <sup>5</sup> These companies include Microsoft, General Electric, Walt Disney, ConAgra Foods, Wells Fargo, DuPont, Duke Energy, Google, Delta Air Lines, Walmart, and PG&E. The Exxon Mobil Corporation uses \$80 for a metric ton of CO<sub>2</sub> emissions in 2040 (<http://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf>); this exceeds the central U.S. SCC estimate for 2040.
- <sup>6</sup> A socio-economic and emission trajectory consists of specifying GDP, population, and greenhouse-gas-emission paths over time.
- <sup>7</sup> If offered \$1 now or \$1 in a year, almost everyone would choose to receive the \$1 now. Most individuals would only wait until next year if they were offered more money in the future. The discount rate is how much more you would have to receive to wait until next year. Similarly, if individuals were asked to pay \$1 now or \$1 next year, most individuals would choose to pay \$1 later. Most individuals would only pay now if they were asked to pay more money in the future. The discount rate is how much more you would have to pay in the future to be willing to pay \$1 in the present.
- <sup>8</sup> \$37 is considered the central estimate because it uses the central (i.e. middle) discount rate and is based on an average, rather than worse-than-expected, climate outcome; the average climate outcome is the standard assumption made by the IWG.

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