How Carbon Dioxide Emissions Would Respond to a Tax

Presentation to the Carbon Tax Study Group
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Background

CBO and the staff of the Joint Committee on Taxation projected the budgetary effects and the change in emissions of carbon dioxide (CO$_2$) and other greenhouse gases (GHGs) that would stem from a potential tax on those emissions.

The sensitivity of energy-related CO$_2$ emissions to a tax-induced change in the price of those emissions is a key input into the modeling of the budgetary effects of a potential tax.

CBO examined the sensitivity of CO$_2$ emissions in 2020 in three broad sectors: electric power, transportation, and a composite of the residential, commercial, and industrial sectors.

That analysis of sectoral price sensitivities extends work CBO previously published in 2003 and 2009.$^a$

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Trends in U.S. Emissions of Carbon Dioxide and Other Greenhouse Gases
U.S. Greenhouse Gas Emissions, 1990 to 2019

Billions of Metric Tons of Carbon Dioxide Equivalent

Composition of Greenhouse Gases, 2019 (Percent)

- **80** Carbon Dioxide
- **10** Methane
- **7** Nitrous Oxide
- **3** Fluorinated Gases

Source: Figure 1 in How Carbon Dioxide Emissions Would Respond to a Tax or Allowance Price: An Update, [www.cbo.gov/publication/57580](http://www.cbo.gov/publication/57580).
Distribution of Energy-Related Emissions of Carbon Dioxide in the United States, by Sector, 2019

Percent

Electric Power 33
Transportation 38
Industrial 17
Commercial 5
Residential 7

Electric Power Sector 1.6
Transportation Sector 1.8
Composite Sector 1.4

Sectoral Total of Greenhouse Gases (Billions of metric tons of carbon dioxide equivalent)

Source: Figure 2 in How Carbon Dioxide Emissions Would Respond to a Tax or Allowance Price: An Update, www.cbo.gov/publication/57580.
How Energy-Related Emissions of Carbon Dioxide Would Respond to a Tax
How CBO Estimated the Sensitivity of CO₂ Emissions to a Tax

CBO surveyed the results of 11 carbon tax analyses.

Ten of those analyses came from an evaluation of carbon taxes conducted as part of the 2017 Energy Modeling Forum (EMF-32). Participants examined four carbon tax policies:

- A tax that started at $25 per metric ton of CO₂ and grew in real (inflation-adjusted) terms at 1 percent annually.
- A tax that started at $25 per metric ton of CO₂ and grew in real terms at 5 percent annually.
- A tax that started at $50 per metric ton of CO₂ and grew in real terms at 1 percent annually.
- A tax that started at $50 per metric ton of CO₂ and grew in real terms at 5 percent annually.

The 11th analysis was based on carbon tax cases from the Energy Information Administration’s 2020 Annual Energy Outlook (AEO). That analysis considered three carbon taxes, which started at $15, $25, and $35 per metric ton of CO₂ and grew in real terms at 5 percent annually.
The price of embedded CO\textsubscript{2} is the average price that final purchasers of fossil fuels (or electricity) implicitly pay for the CO\textsubscript{2} that is emitted when the fuels are burned. Based on information in the AEO 2020, current prices are approximately as follows:

- $135 per metric ton in the electric power sector
- $310 per metric ton in the transportation sector
- $100 per metric ton in the composite sector

A tax on CO\textsubscript{2} emissions would raise the price of fossil fuels (oil, coal, and natural gas) and increase the price of embedded CO\textsubscript{2} in those fuels. That increase would in turn cause consumers and businesses to switch to lower-carbon fuels, invest in energy-efficient upgrades, or reduce fossil fuel purchases, among other options.

For each model and policy observation, CBO calculated a baseline price of embedded CO\textsubscript{2} and compared how a tax-induced change in that price would affect emissions.
Distribution of Price Sensitivities of Energy-Related Emissions of Carbon Dioxide in Models Surveyed, by Sector

Source: Figure 3 in How Carbon Dioxide Emissions Would Respond to a Tax or Allowance Price: An Update, www.cbo.gov/publication/57580.
CBO’s Prior and Updated Estimates of Price Sensitivities of Energy-Related Emissions of CO₂ in the Electric Power Sector

Source: Figure 4 in How Carbon Dioxide Emissions Would Respond to a Tax or Allowance Price: An Update, www.cbo.gov/publication/57580.
Projections of Electricity Supply in the Electric Power Sector, by Fuel, 2017 to 2030

Thousands of Terawatt Hours

Source: Figure 5 in How Carbon Dioxide Emissions Would Respond to a Tax or Allowance Price: An Update, www.cbo.gov/publication/57580.
CBO’s Prior and Updated Estimates of Price Sensitivities of Energy-Related Emissions of CO₂ in Other Sectors

Source: Figure 4 in How Carbon Dioxide Emissions Would Respond to a Tax or Allowance Price: An Update, www.cbo.gov/publication/57580.
Effects of the Price Sensitivity Update on Carbon Dioxide Emissions and Projected Tax Revenues
Estimates are based on a tax of $25 per metric ton on most emissions of greenhouse gases in the United States (in carbon dioxide equivalent units) starting in 2021 and growing at an inflation-adjusted rate of 5 percent per year. Source: Figure 6 in How Carbon Dioxide Emissions Would Respond to a Tax or Allowance Price: An Update, www.cbo.gov/publication/57580.
Estimates are based on a tax of $25 per metric ton on most emissions of greenhouse gases in the United States (in carbon dioxide equivalent units) starting in 2021 and growing at an inflation-adjusted rate of 5 percent per year. Source: Figure 9 in How Carbon Dioxide Emissions Would Respond to a Tax or Allowance Price: An Update, www.cbo.gov/publication/57580.
Effect of Price Sensitivity Update on Gross Revenues From a Potential Tax on Energy-Related Emissions of Greenhouse Gases

Estimates are based on a tax of $25 per metric ton on most emissions of greenhouse gases in the United States (in carbon dioxide equivalent units) starting in 2021 and growing at an inflation-adjusted rate of 5 percent per year. Source: Figure 8 in How Carbon Dioxide Emissions Would Respond to a Tax or Allowance Price: An Update, www.cbo.gov/publication/57580.
Estimates are based on a tax of $25 per metric ton on most emissions of greenhouse gases in the United States (in carbon dioxide equivalent units) starting in 2021 and growing at an inflation-adjusted rate of 5 percent per year. Source: Figure 7 in How Carbon Dioxide Emissions Would Respond to a Tax or Allowance Price: An Update, www.cbo.gov/publication/57580.