Congressional Budget Office
Nonpartisan Analysis for the U.S. Congress

How Carbon Dioxide Emissions Would Respond to a Tax

February 17, 2022

Presentation to the Carbon Tax Study Group
PricewaterhouseCoopers

Ron Gecan

Microeconomic Studies Division

Information in this presentation comes from Ron Gecan, *How Carbon Dioxide Emissions Would Respond to a Tax or Allowance Price: An Update*, Working Paper 2021-16 (Congressional Budget Office, December 2021), www.cbo.gov/publication/57580.

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.

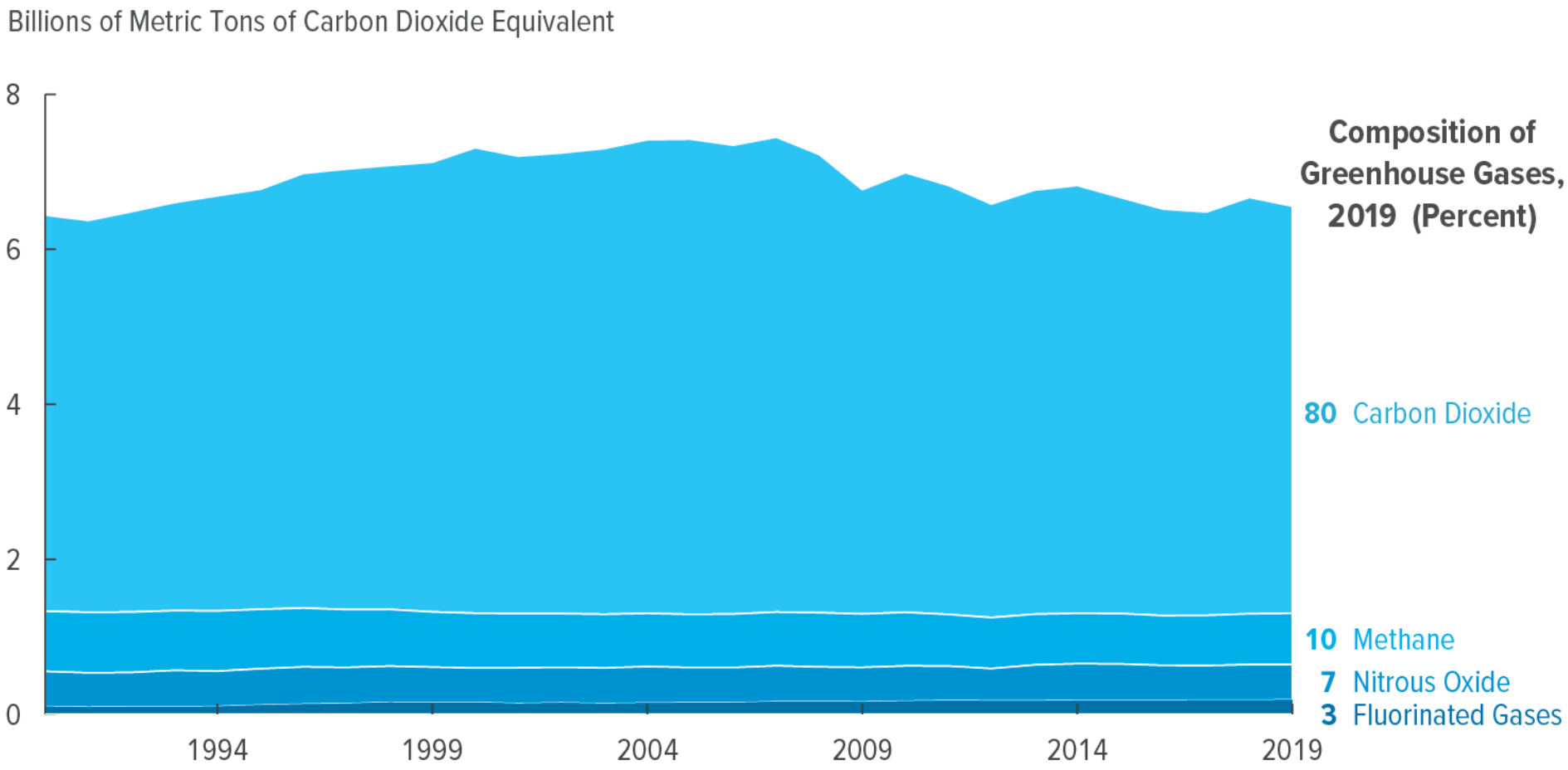
CBO examined the sensitivity of CO_2 emissions in 2020 in three broad sectors: electric power, transportation, and a composite of the residential, commercial, and industrial sectors.

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

a. Congressional Budget Office, *How CBO Estimates the Costs of Reducing Greenhouse-Gas Emissions* (April 2009), www.cbo.gov/publication/41745; and Mark Lasky, *The Economic Costs of Reducing Emissions of Greenhouse Gases: A Survey of Economic Models*, Technical Paper 2003-03 (Congressional Budget Office, May 2003), www.cbo.gov/publication/14414.

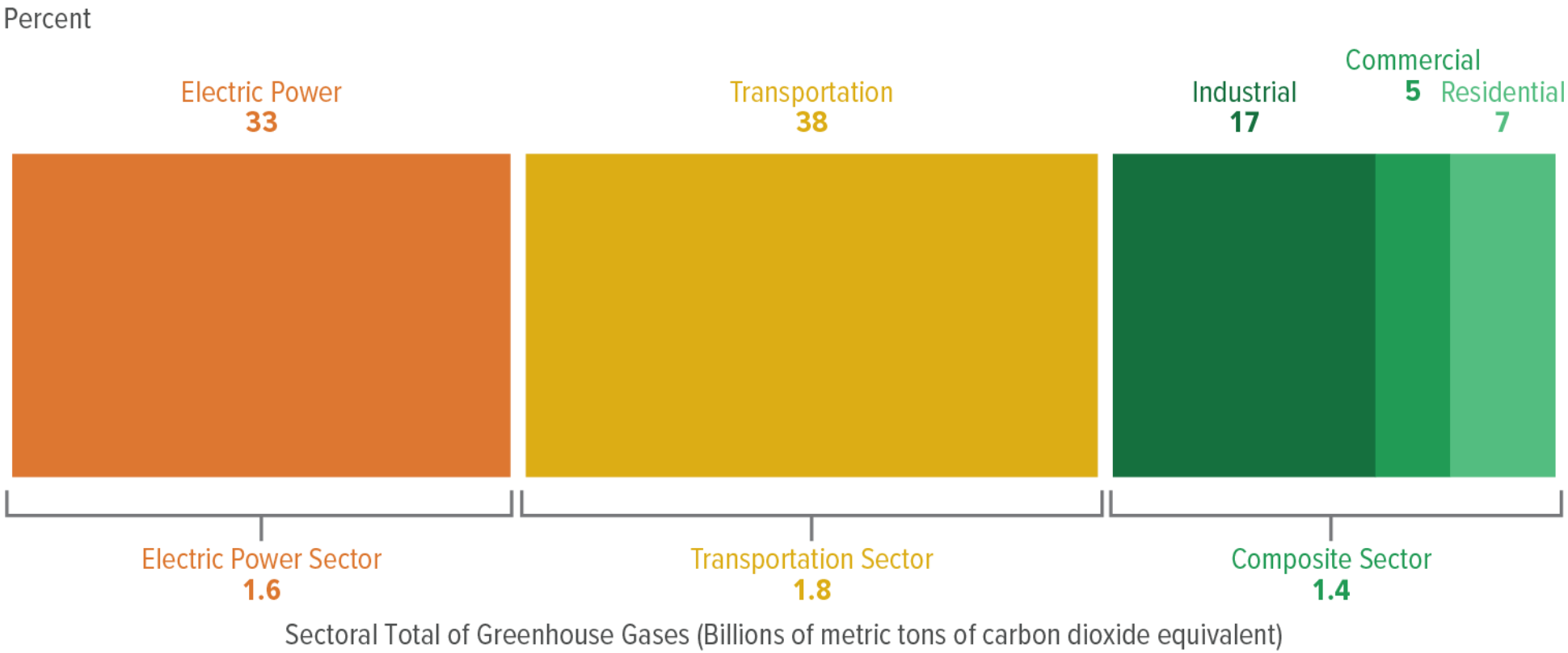
Trends in U.S. Emissions of Carbon Dioxide and Other Greenhouse Gases

U.S. Greenhouse Gas Emissions, 1990 to 2019



Source: Figure 1 in *How Carbon Dioxide Emissions Would Respond to a Tax or Allowance Price: An Update*, www.cbo.gov/publication/57580.

Distribution of Energy-Related Emissions of Carbon Dioxide in the United States, by Sector, 2019



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 CO_2 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 CO_2 and grew in real (inflation-adjusted) terms at 1 percent annually.
- A tax that started at $25 per metric ton of CO_2 and grew in real terms at 5 percent annually.
- A tax that started at $50 per metric ton of CO_2 and grew in real terms at 1 percent annually.
- A tax that started at $50 per metric ton of CO_2 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 CO_2 and grew in real terms at 5 percent annually.

How CBO Determined the Price of Embedded Carbon Dioxide

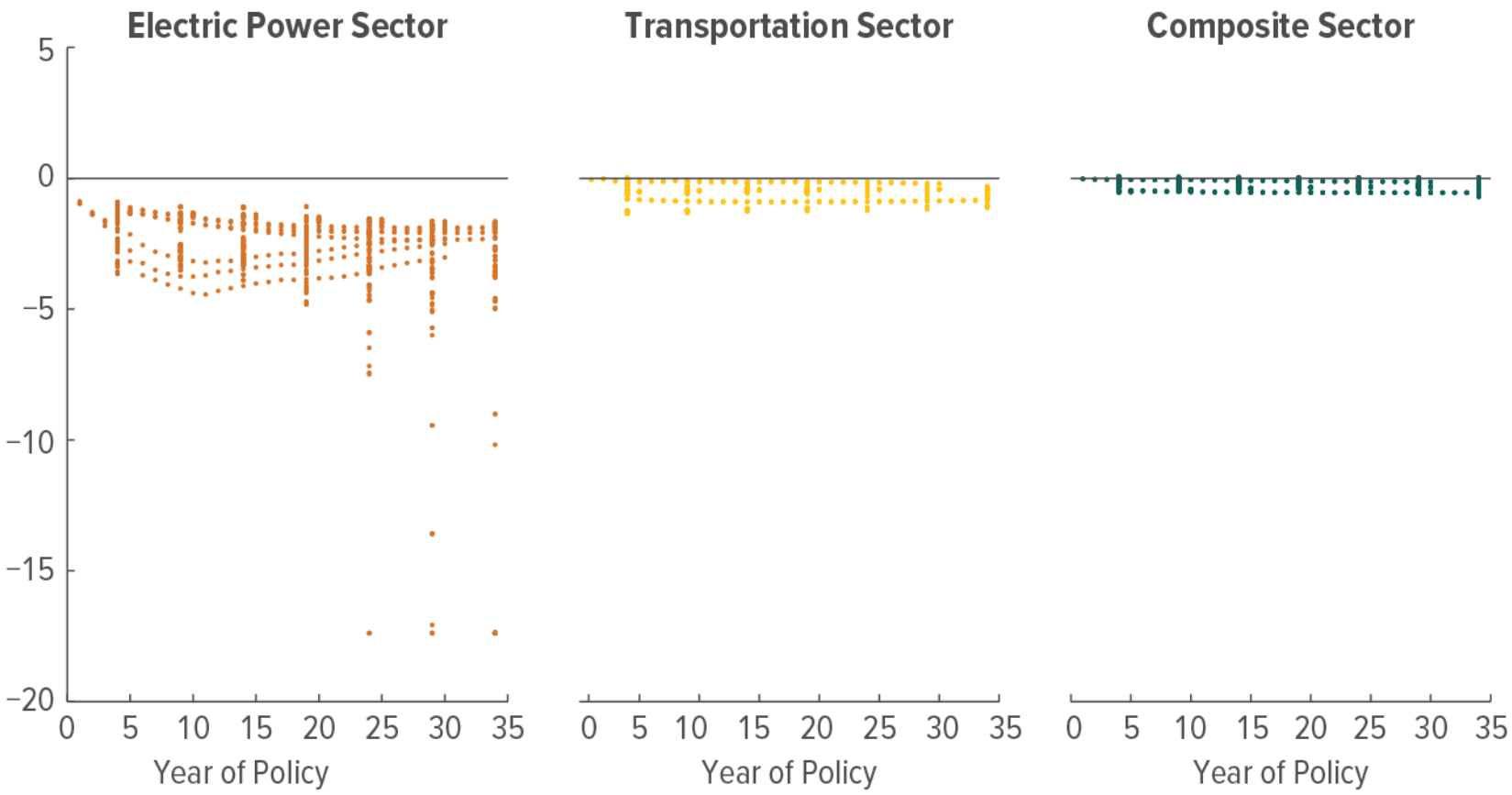
The price of embedded CO_2 is the average price that final purchasers of fossil fuels (or electricity) implicitly pay for the CO_2 that is emitted when the fuels are burned. Based on information in the AEO 2020, current prices are approximately as follows:

- $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_2 emissions would raise the price of fossil fuels (oil, coal, and natural gas) and increase the price of embedded CO_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.

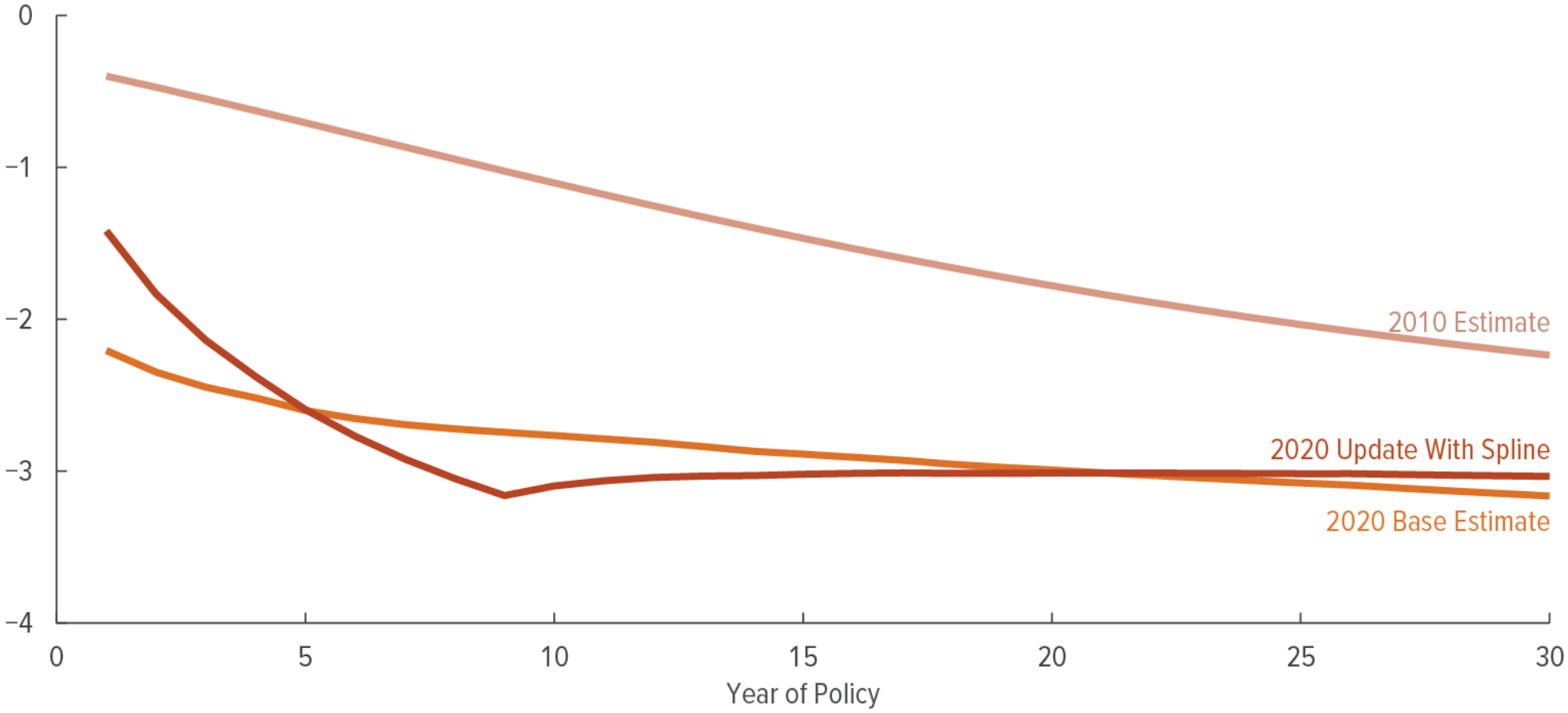
For each model and policy observation, CBO calculated a baseline price of embedded CO_2 and compared how a tax-induced change in that price would affect emissions.

Distribution of Price Sensitivities of Energy-Related Emissions of Carbon Dioxide in Models Surveyed, by Sector



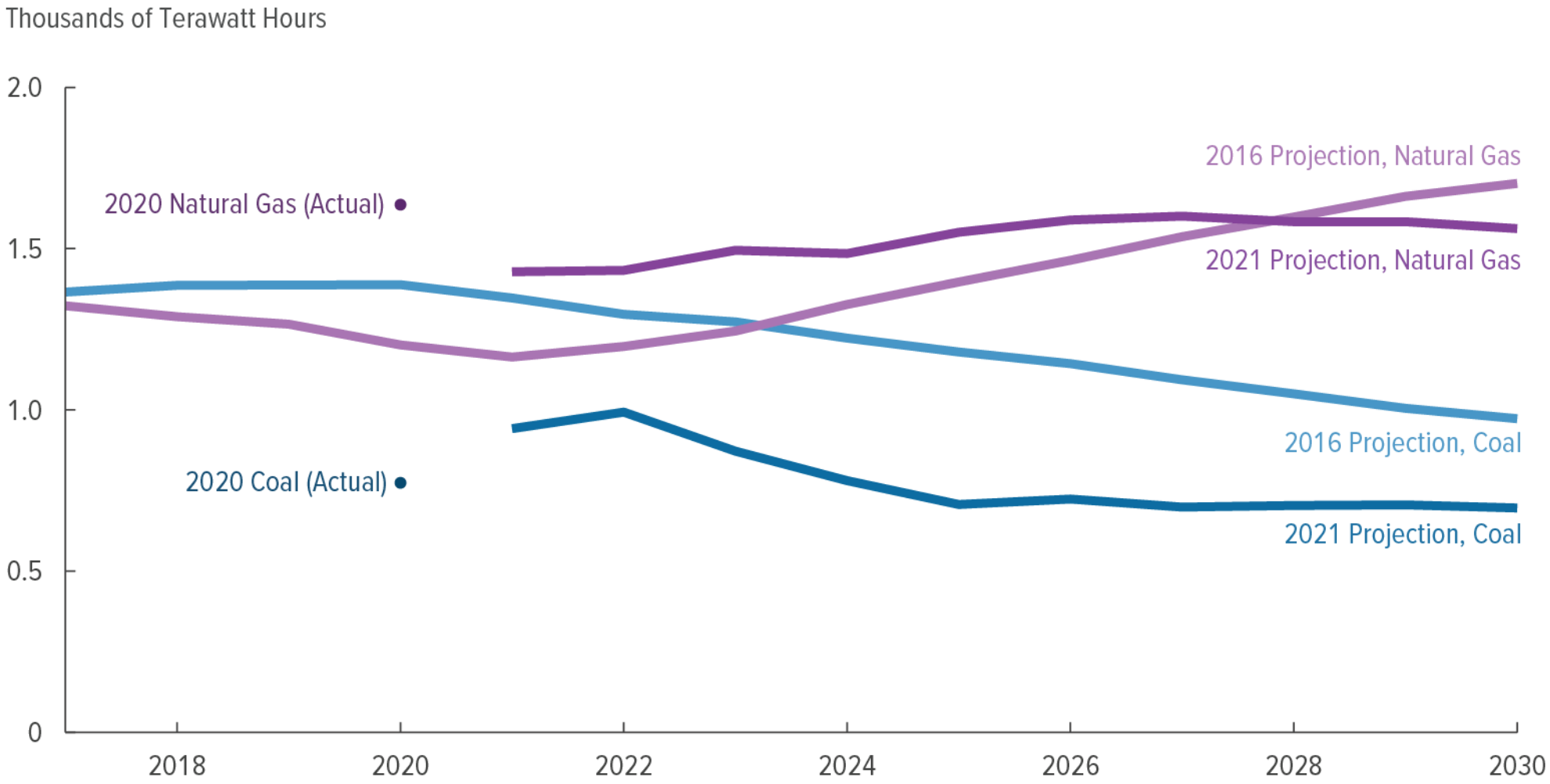
Source: Figure 3 in *How Carbon Dioxide Emissions Would Respond to a Tax or Allowance Price: An Update*, www.cbo.gov/publication/57580.

CBO's Prior and Updated Estimates of Price Sensitivities of Energy-Related Emissions of CO_2 in the Electric Power Sector



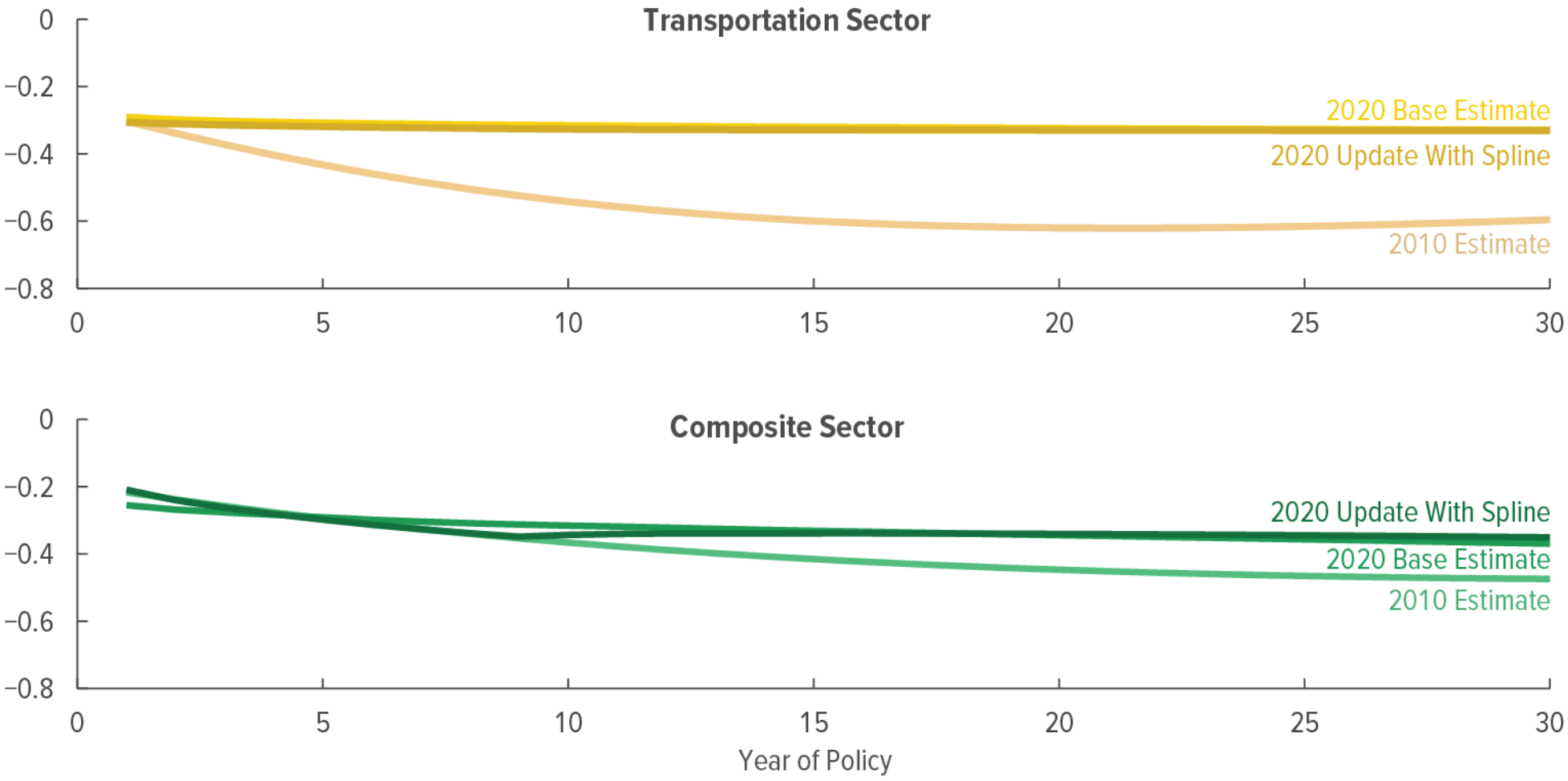
Source: Figure 4 in *How Carbon Dioxide Emissions Would Respond to a Tax or Allowance Price: An Update*, www.cbo.gov/publication/57580.

Projections of Electricity Supply in the Electric Power Sector, by Fuel, 2017 to 2030



Source: Figure 5 in *How Carbon Dioxide Emissions Would Respond to a Tax or Allowance Price: An Update*, www.cbo.gov/publication/57580.

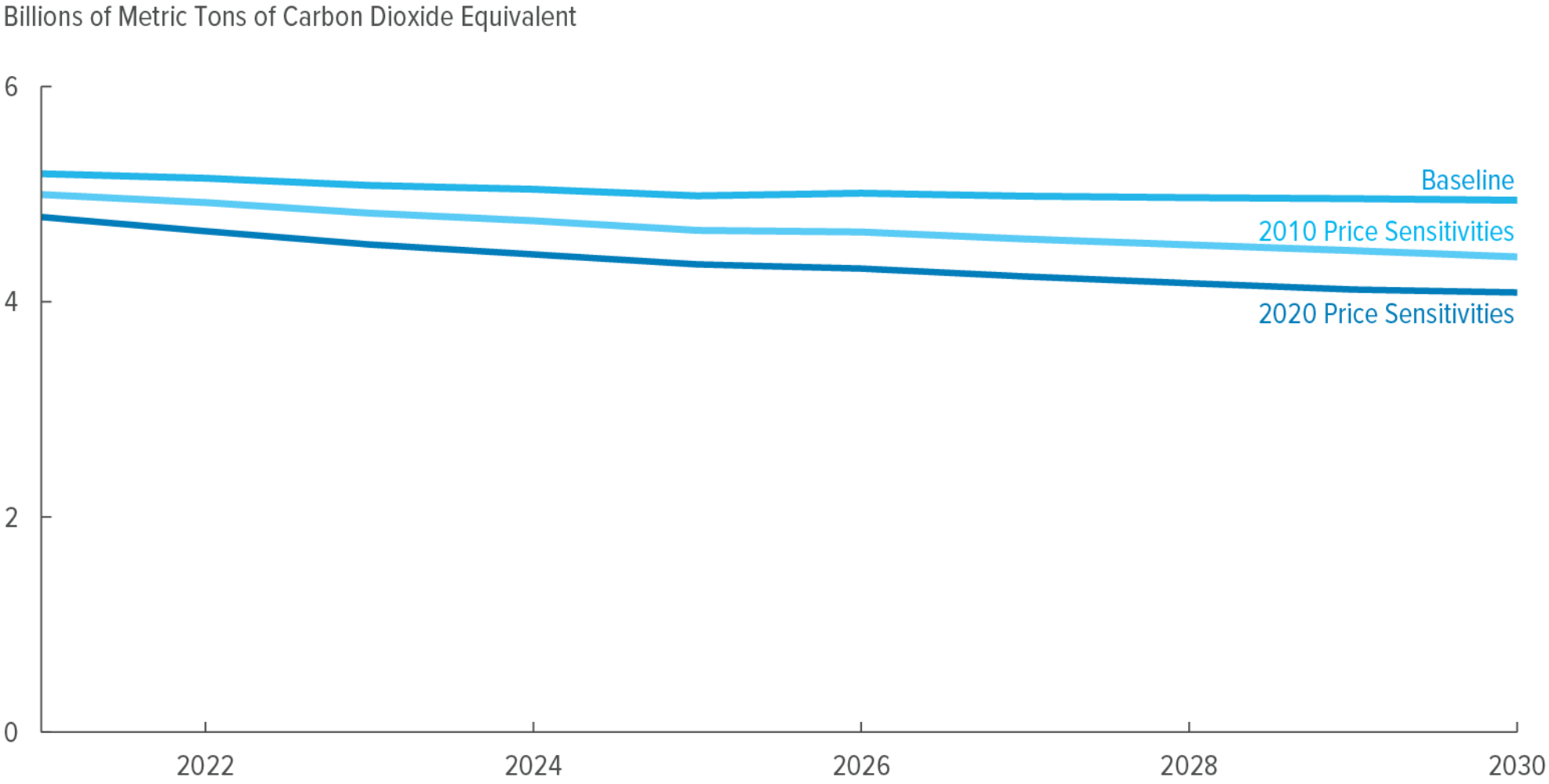
CBO's Prior and Updated Estimates of Price Sensitivities of Energy-Related Emissions of CO_2 in Other Sectors



Source: Figure 4 in *How Carbon Dioxide Emissions Would Respond to a Tax or Allowance Price: An Update*, www.cbo.gov/publication/57580.

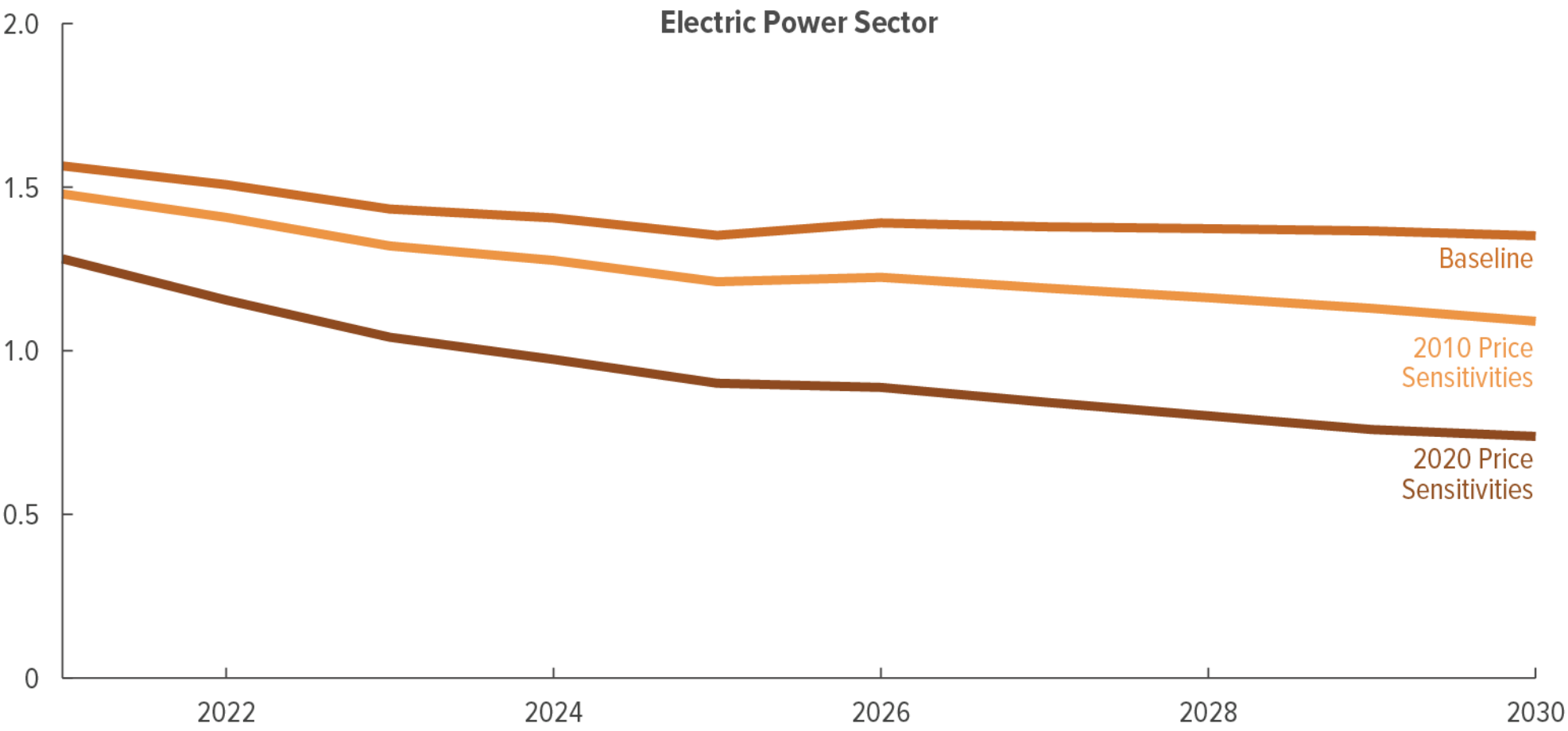
Effects of the Price Sensitivity Update on Carbon Dioxide Emissions and Projected Tax Revenues

Effect of Price Sensitivity Update on Energy-Related Emissions of Greenhouse Gases From a Potential Tax on Those Emissions



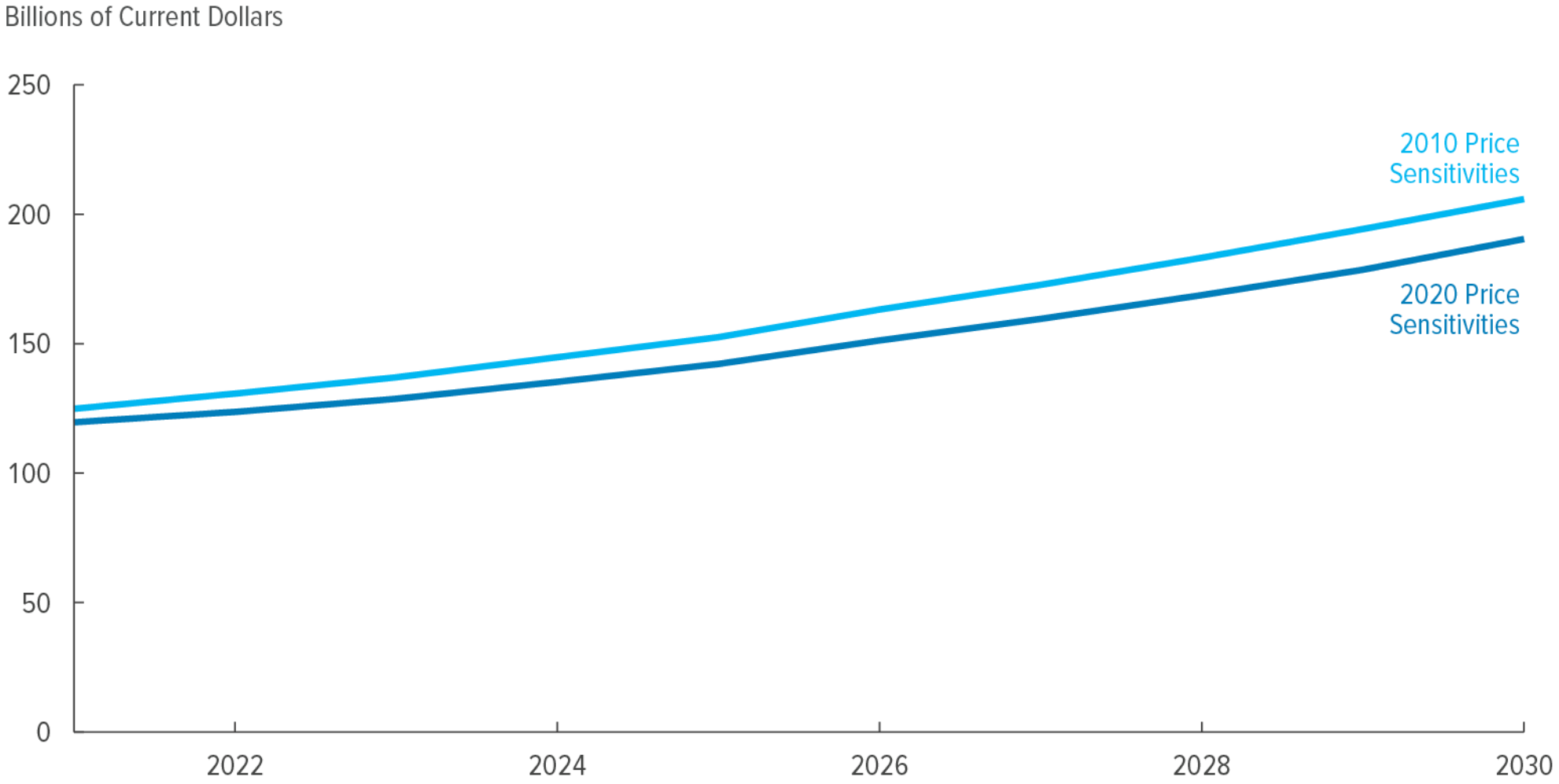
Estimates are based on a tax of $25 per metric ton on most emissions of greenhouse gases in the United States (in carbon dioxide equivalent units) starting in 2021 and growing at an inflation-adjusted rate of 5 percent per year. Source: Figure 6 in *How Carbon Dioxide Emissions Would Respond to a Tax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

Effect of Price Sensitivity Update on Energy-Related Emissions of CO_2 From a Potential Tax on Those Emissions



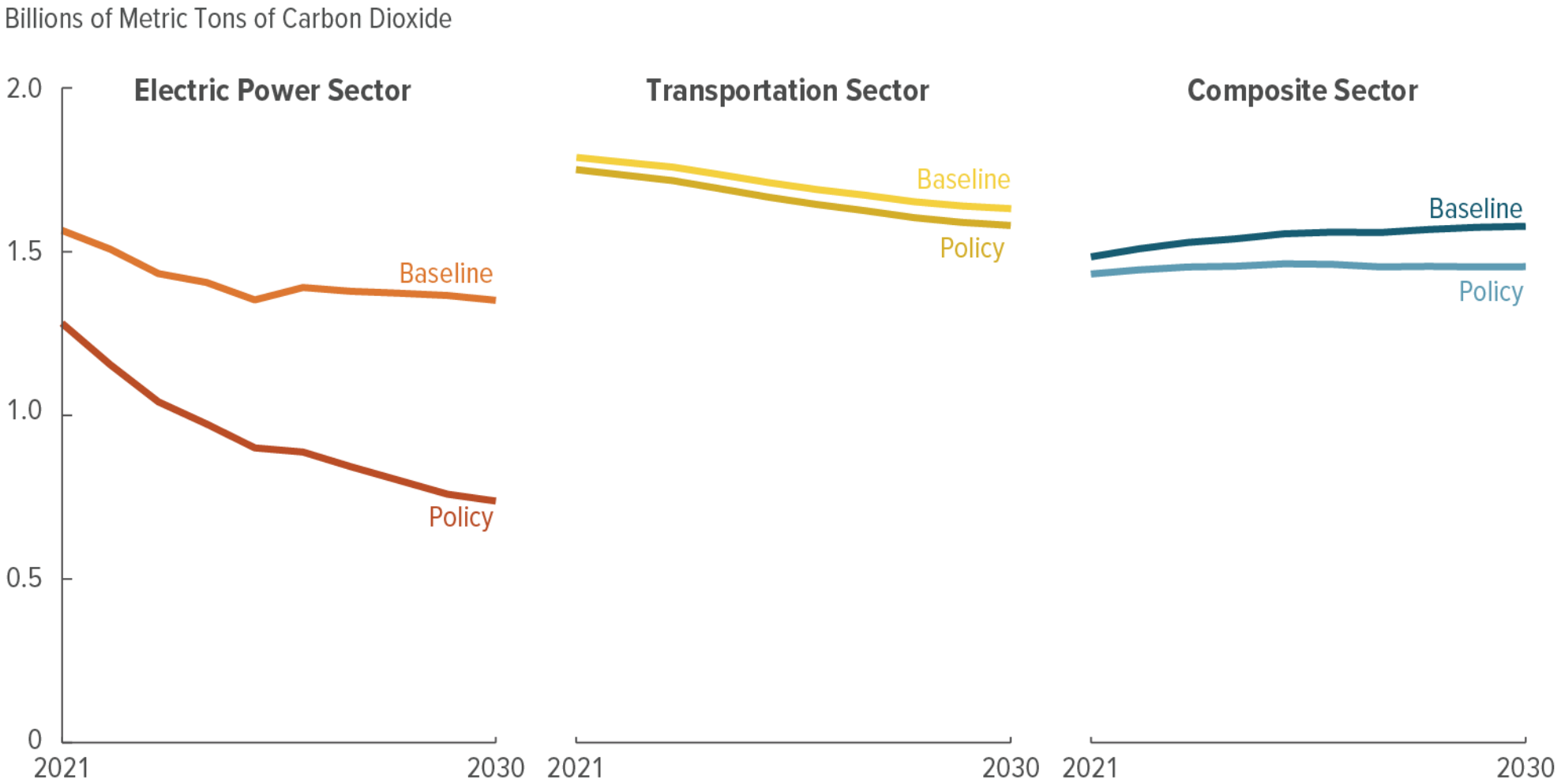
Estimates are based on a tax of $25 per metric ton on most emissions of greenhouse gases in the United States (in carbon dioxide equivalent units) starting in 2021 and growing at an inflation-adjusted rate of 5 percent per year. Source: Figure 9 in *How Carbon Dioxide Emissions Would Respond to a Tax 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.

Effect of a Potential Tax on Energy-Related Emissions of Carbon Dioxide, by Sector



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.