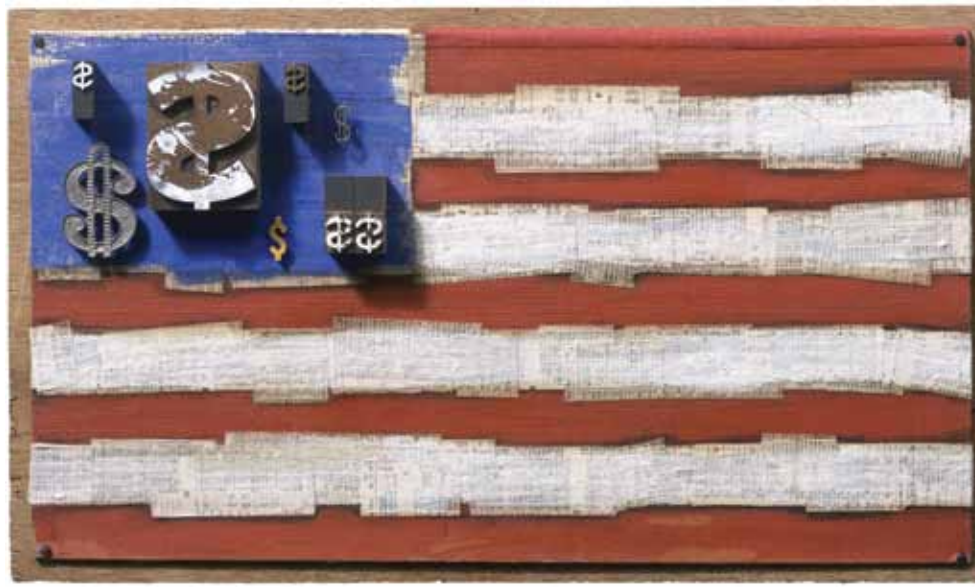

# taxing carbon

## POTENTIAL DEFICIT & EMISSIONS REDUCTIONS

***Roberton C. Williams III** previews early results from a first-of-its-kind modeling effort to analyze the effects of a carbon tax.*

The idea of incorporating a carbon tax into fiscal reform efforts has quietly surfaced in recent policy discussions. Policymakers considering a carbon tax have many questions. Chief among them: How much revenue could a carbon tax raise, and how could it affect emissions and long-term economic growth?

RFF's new energy/deficit reduction model helps answer these questions. Preliminary results suggest that a carbon tax could provide a potentially large new source of

**RFF's New Energy/Deficit Reduction Model**

RFF's new computable general equilibrium model has three features that, taken together, set it apart from other models used to address critical questions about a carbon tax:

» **Overlapping Generations.** The model incorporates an "overlapping-generations" structure for the economy. Each generation of workers progresses through an economic life cycle (working, saving for retirement, and living in retirement until death) that overlaps with the lives of earlier and later generations. This approach can examine the intergenerational equity implications of environmental and budgetary policy. And it allows a more realistic analysis of the economic effects of current and future budget deficits and other fiscal policies than other widely used modeling approaches (such as assuming that individuals live forever).

» **Multiple Sectors.** The model represents the production side of the economy with multiple industries and a particular focus on the energy sector. This disaggregation is essential for looking at the effects of policy on the energy sector and on emissions.

» **Fiscal Detail.** The model includes fairly detailed representations of the government fiscal system, including various taxes, government spending and transfers, and government budget deficits.

Each of these three features is widely used in economic models, but to our knowledge, no other model combines all three.

government revenue—enough to play an important role in a package of deficit-reduction measures. But while modest emissions reductions can be achieved at relatively low cost, that cost rises rapidly as emissions reductions get more aggressive.

## Tax Scenarios

Over the past 18 months, I have worked with colleagues Jared Carbone—a University of Calgary professor and one of RFF's 2011–2012 Gilbert White Fellows—and RFF Senior Fellow Dick Morgenstern to build a new dynamic computable general equilibrium (CGE) model. It is designed to look broadly at the long-term budgetary, environmental, efficiency, and distributional implications of including a carbon tax and/or other energy taxes in a package of measures to address the national budget deficit.

One of our first modeling exercises aims to shed light on the revenue implications of a carbon tax over the next 20 years—and what level of emissions reductions might result from such a tax. This exercise doesn't make full use of the model's capabilities, but it gives a first illustration of the model's results and will permit comparisons between those results and results from other models used to analyze carbon taxes.

The analysis focuses on two carbon tax price paths, both of which are designed to produce a revenue stream averaging $180 billion per year (in 2012 dollars) over the first 10-year budget window, starting in 2013. For simplicity, the revenue goal is measured in terms of gross revenue from the tax. When estimating revenue effects, federal budget agencies take into account that taxes on goods and services (such as a carbon tax or

a sales tax) affect the revenue from taxes on income. These agencies use a standard approximation that every $1 of gross revenue raised by these taxes lowers the revenue from taxes on income by 25 cents, and thus the net revenue is 25 percent less than the gross revenue. This is often informally referred to as the "CBO haircut." So $180 billion in gross revenue is equivalent to $135 billion in net revenue after one applies the standard 25 percent "haircut."

In one version, the carbon tax rate is held constant in real terms; in the other, the rate rises over time at a real rate of 3 percent per year. To achieve the same revenue target, the version with the rising real carbon tax rate starts with a lower rate than the version that stays constant but finishes the first 10-year window with a higher rate. Moreover, the rate continues to rise, producing significantly more revenue than the constant tax does in the second 10-year budget window.

These carbon tax scenarios are revenue-neutral. More specifically, any revenue raised through the introduction of a carbon tax is offset by proportional cuts in tax rates on capital and labor income, leaving real government revenues and spending (and thus also the budget deficit) unchanged from the baseline.

With a constant real tax rate designed to meet the $180 billion average annual revenue target, the carbon tax is fixed at a little more than $33 per ton (in 2012 dollars) over the entire period. For the alternative version that ramps up over time, the tax rate starts out slightly lower ($31 per ton) and rises throughout the period. After the first budget period, the rate continues to rise at the same 3 percent annual rate, which naturally increases the revenues in later years.

**Putting Carbon Tax Revenue in Context**

This analysis uses a gross revenue goal of $180 billion per year, which implies net revenue of $135 billion per year. How does this compare to other potential revenue sources or spending cuts currently under discussion? The federal Office of Management and Budget provides some useful points of comparison:

» Eliminating the home mortgage interest deduction would raise an average of $120 billion annually from 2013 to 2017.

» Eliminating the tax deduction for employer payments for health insurance would raise an average of $337 billion annually from 2013 to 2017.

» Forgoing a "fix" to the Alternative Minimum Tax would save an average of $239 billion from 2013 to 2021.

» The Budget Control Act of 2011 imposes automatic cuts of $55 billion annually in defense spending and $36 billion in discretionary domestic spending from 2013 to 2021.

» Financing the current 2 percent reduction in payroll taxes paid by workers requires about $110 billion annually.

Source: Office of Management and Budget. Budget of the United States Government Fiscal Year 2012, Analytical Perspectives, Table 17-1.
www.whitehouse.gov/sites/default/files/omb/budget/fy2013/assets/teb2013.xls.

## Revenues and Effects on Emissions Levels

The alterative tax scenarios we analyzed generate significant revenues. The constant carbon tax rate initially yields slightly under $180 billion per year, and those revenues then rise slowly over time. The scenario in which rates ramp up over time starts out with slightly lower revenues, but revenues rise moderately throughout the period, surpassing the constant-tax case after a few years. While the revenues, over the first 10 years are equal by design to those of the constant-rate case, they rise to nearly $275 billion per year by 2030.

Emissions fall substantially below the baseline as a result of imposing the carbon tax. In the constant-tax scenario, emissions drop initially to approximately 17 percent below baseline but then rise slowly from 2015 to 2030, driven by economic growth over that period (which slightly outweighs a fall in the emissions–GDP ratio). This emissions growth leads to a slight increase in carbon tax revenues over the 2015 to 2030 period.

The rising-tax case results in somewhat greater emissions reductions over the entire period, although the reductions are slightly lower in the early years, reflecting the lower tax rate that rises over time.

For the sake of comparison with other climate policies, we also ran a third scenario defined by specified emissions reduction targets rather than revenue targets. In particular, we ran a scenario in which the carbon tax was designed to meet the percentage reductions in domestic energy-related carbon emissions in the years 2020 and 2030 that were projected for the Waxman–Markey cap-and-trade bill that passed the US House of Representatives in 2009.

Reaching the Waxman–Markey levels of domestic abatement requires a carbon tax rate that starts out substantially lower than either scenario at $5 per ton but then rises dramatically to more than $100 by 2030 as low-cost emissions reduction opportunities are exhausted. Similarly, revenue starts out at $30 billion per year, rising to more than $500 billion per year by the end of the period. This scenario yields roughly the same cumulative emissions reduction over 20 years as the constant tax, although at a significantly higher total cost: a rapidly rising carbon tax is less cost-effective than a tax that starts higher but rises more slowly.

## Policy Implications

Overall, two key results from this analysis stand out. First, the carbon tax could provide a potentially large new source of government revenue. Our results indicate that a tax starting at roughly $30 per ton and rising at 3 percent per year in real terms would yield average gross revenue of $180 billion per year over the first 10-year budget window, and $250 billion per year over the second. That's not enough revenue to put the federal debt on a sustainable long-run trajectory by itself, but it is enough to play an important role in a package of deficit-reduction measures.

Second, although modest emissions reductions can be achieved at relatively low cost, that cost rises rapidly as emissions reductions get more aggressive. This is evident in the emissions-target case, in which the 2020 emissions target can be met with a very low carbon tax rate, but the substantially larger reductions in 2030 require a much higher rate, more than $100 per ton. While such rates may be justified depending on the expected damage from climate change, it is considerably easier to make the case for the relatively low carbon tax rates needed to achieve modest emissions reductions, at least at the outset. ●