



# Building a 21st Century Economy

## The Case for a Progressive Carbon Tax

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By Alison Cassady, Greg Dotson, Michael Madowitz, and Alexandra Thornton

December 2016

Center for American Progress



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# Introduction and summary

Climate change is a classic market failure. The price of fossil fuels does not reflect the costly effects of those fuels on the environment and climate. As long as the cost of climate change remains outside the market, the economy will consume more fossil fuels than it otherwise would if prices accurately reflected the costs and risks posed to society and the economy by greenhouse gas pollution.

To address this market failure, economists and other scholars across the political spectrum have made the case for a carbon tax as the most efficient way to internalize the cost of greenhouse gas emissions and achieve pollution reductions across all sectors. In essence, a carbon tax sends a powerful market signal that would shift private and public investment away from polluting sources of energy to lower-carbon sources of energy.

Left unchecked, climate change will have costly—not to mention catastrophic and irreversible—effects on human health, the environment, national security, and the global economy. The window of opportunity is closing to decarbonize the world's economy on a trajectory sufficient to avert the worst impacts of climate change.

The Center for American Progress has developed one approach to implementing a carbon tax in the United States that would achieve a dual goal: setting the United States on a path toward decarbonization of the economy, while protecting low- and middle-income energy consumers and ensuring the nation's continued economic growth.

CAP modeled the effects of imposing a tax on all greenhouse gases beginning in 2020 at \$30 per ton of carbon dioxide equivalent, or CO<sub>2</sub>e. For the first 10 years, the tax would escalate at a 5.2 percent annual rate until it hits the social cost of carbon, or SCC, in 2030, which is currently set at \$50 (in 2007 dollars). The carbon tax would then track the SCC, rising to \$55 in 2035 and \$60 in 2040 (in 2007 dollars). The SCC reflects the best estimate of the economic damage wrought by 1 ton of carbon emissions.

The proposed carbon tax would generate an average of \$200 billion per year over 20 years. Carbon tax experts and other stakeholders have varying opinions about the best way to use this revenue, ranging from corporate tax breaks to investing all of it in new spending.

One approach to carbon taxation that has gained traction is a revenue neutral approach in which any new carbon tax revenue is offset by returning it to taxpayers. Carbon tax experts generally lay out three primary options for returning the revenue: as a lump sum to taxpayers, the most progressive option that provides the greatest relative benefit to lower-income households; as a labor tax cut to wage earners; or as a corporate tax cut to businesses, which provides the least benefit to lower-income households.

CAP examined the benefits of a hybrid approach that combines the progressivity of a lump sum return with a labor tax cut that recognizes the economic value of work. The hybrid revenue return includes a guarantee that 11 percent of the carbon tax revenues will go ratably to households with annual incomes below \$25,000; a flat percentage, refundable labor tax cut will go to households with combined wage and nonwage incomes of \$25,000 to \$150,000; and an additional lump sum supplement will go to households with combined wage and nonwage incomes of less than \$100,000.

This hybrid approach has several benefits, as described in more detail in this report:

- All households making less than \$150,000 are protected from increases in direct energy and consumer costs. The lump sum rebate and labor tax cut are progressive and counteract the inherently regressive nature of consumer price increases.
- It protects the poorest households from the impacts of other indirect costs and mitigates the impact for other households.
- The refundable labor tax cut lowers the overall effective tax rate on wages.
- The impact on national gross domestic product, or GDP, is minimal overall and is negligible when compared with the potential economic impact of unmitigated climate change.

The revenue return is a key component of a progressive carbon tax design. But policymakers will have to grapple with a number of other design issues, including how to address concerns from industry sectors that are energy intensive and trade exposed and how to overlap a federal carbon tax with state climate programs and federal environmental regulations. This report describes how to tackle these questions in a way that achieves emissions reductions while positioning the U.S. economy for continued growth in the 21st century.

# The case for a carbon tax

The burning of fossil fuels releases greenhouse gases that cause climate change, but the price of fossil fuels does not reflect these costly environmental impacts. As long as climate change remains an external market cost—also called a negative externality, in economists’ parlance—the market will not respond appropriately to incentivize the development and deployment of cleaner, lower-carbon processes. Instead, the economy will consume more fossil fuels than it otherwise would if prices accurately reflected the costs of greenhouse gas pollution.

Economists and other scholars across the political spectrum have made the case for a carbon tax as the most efficient way to internalize the cost of carbon and achieve greenhouse gas emissions reductions across all sectors. Ian Parry, the principal environmental fiscal policy expert at the International Monetary Fund, has said that “there is near-universal agreement among economists that [carbon pricing] will be essential if U.S. emissions are ultimately to be rolled back at reasonable cost.”<sup>1</sup> Adele Morris, a senior fellow at the Brookings Institution, has cited the “remarkable consensus of economists” on how a carbon tax would “minimize the cost of steering economic activity away from the greenhouse gas emissions that threaten the climate.”<sup>2</sup>

Many conservatives agree with the need to combat climate change through market mechanisms, though they often pair support for a carbon tax with elimination of environmental regulations. Jerry Taylor of the Niskanen Center, a libertarian think tank, argues that a carbon tax can cut pollution at the least cost by “leaving the decision about where, when, and how to reduce greenhouse gas emissions to market actors (via price signals) rather than to regulators (via administrative orders).”<sup>3</sup> Similarly, Andrew Moylan from the R Street Institute says the “best policy to address greenhouse gas emissions, while adhering to conservative principles, is a carbon tax combined with tax and regulatory reform.”<sup>4</sup>

Models predict that a carbon tax would achieve significant emissions reductions in the United States. For example, the U.S. Energy Information Administration, or EIA, examined the impact of a \$25-per-ton tax on energy-related carbon dioxide emissions.<sup>5</sup> According to the EIA's analysis, if the United States had assessed a \$25-per-ton carbon tax in 2014, energy-related carbon dioxide emissions in 2025 would have fallen 22 percent below business-as-usual projections and 28 percent below 2005 levels. By 2040, energy-related carbon dioxide emissions would have fallen 36 percent below business-as-usual projections and 40 percent below 2005 levels.<sup>6</sup> In another study, researchers modeled a \$15 tax on each ton of carbon dioxide escalating at 4 percent above inflation each year. They found that after 25 years, carbon dioxide emissions would be 20 percent lower than the business-as-usual baseline.<sup>7</sup> Similarly, researchers at the Massachusetts Institute of Technology modeled a \$20 tax starting in 2013 at \$20 per ton and rising at 4 percent annually in real terms. In their simulations, this tax reduced carbon dioxide emissions to 14 percent below 2006 levels by 2020 and 20 percent below by 2050.<sup>8</sup>

The model outputs vary based on assumptions, starting price, and the annual tax ramp, but the conclusions are similar: A carbon tax produces substantial emissions reductions.



# A progressive approach to a carbon tax

The impact of a carbon tax—on emissions, the U.S. economy, and households—depends entirely on its design. A poorly designed carbon tax will shift the costs of higher energy prices to consumers without achieving the necessary environmental goals. A properly designed carbon tax, however, has the potential to reduce greenhouse gas emissions across all industries while shielding low- and middle-income households from these potential price increases.

This report offers an approach to a U.S. carbon tax that would set the United States on a path toward decarbonization of the economy while protecting low- and middle-income energy consumers and ensuring continued economic growth. Key elements of CAP's carbon tax proposal are described below.

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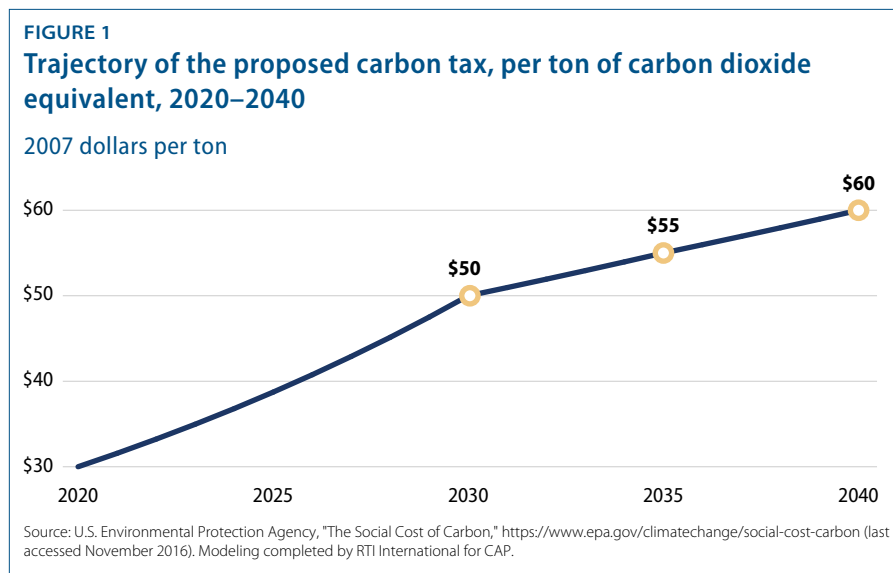
## Start the carbon tax at a reasonable level and escalate to meet the social cost of carbon

In 1993, Executive Order 12866 directed federal agencies to assess the costs and benefits of regulatory actions.<sup>9</sup> In 2007, the U.S. Court of Appeals for the 9th Circuit ruled that a vehicle rulemaking during the George W. Bush administration failed to account for the cost of carbon pollution, which the court said is “certainly not zero.”<sup>10</sup> Following this ruling, agencies began to put a value on this social cost of carbon, which is an estimate “of the long-term damage done by one ton of carbon emissions.”<sup>11</sup> In 2015, the White House updated its analysis of the SCC to be \$36 per metric ton in 2007 dollars at a 3 percent discount rate.<sup>12</sup> While this analysis has undergone rigorous government review, it may well prove to underestimate the actual SCC emissions, as it does not factor in ocean acidification and other climate impacts. Stanford University analysts believe that the true SCC could be as high as \$220 per metric ton.<sup>13</sup>

Rather than setting a carbon tax to match the SCC in the first year, CAP proposes starting the tax at a lower level and ramping it up over time to meet the SCC.

Specifically, CAP proposes imposing a tax on all greenhouse gases beginning in 2020 at \$30 per ton of carbon dioxide equivalent. For the first 10 years, the tax would escalate at a 5.2 percent annual rate until it hits the SCC in 2030, which is currently set at \$50 (in 2007 dollars). The carbon tax then would track the SCC, rising to \$55 in 2035 and \$60 in 2040 (in 2007 dollars). (see Figure 1)

An interagency working group first estimated the SCC in 2010. Since that time, the working group has updated it twice to reflect the latest models and technical corrections.<sup>14</sup> If experts revise the SCC to better reflect the costs of climate change, the tax should respond accordingly.



## Assess the tax using data from the Greenhouse Gas Reporting Program

Policymakers should apply the carbon tax at a point that both maximizes coverage and minimizes administrative complexity. CAP's proposal assesses the carbon tax using the greenhouse gas pollution data that the federal government already collects through the Environmental Protection Agency's Greenhouse Gas Reporting Program, or GHGRP. Each year, the EPA collects facility-level greenhouse gas data from the top emitting sectors of the U.S. economy. The EPA uses these data to inform domestic policy and improve the U.S. Greenhouse Gas Inventory, a comprehensive annual report that is submitted to the United Nations in accordance with the Framework Convention on Climate Change.

The GHGRP data would determine which entities are subject to the tax and the volume of emissions subject to the tax. Using the GHGRP as the basis for assessing the carbon tax has several advantages. Foremost, the GHGRP currently tracks 85 percent to 90 percent of U.S. greenhouse gas emissions from large industrial facilities and end-use fuel.<sup>15</sup> By using the GHGRP to identify emissions subject to the carbon tax, policymakers could achieve near-complete coverage of domestic greenhouse gas emissions while minimizing the compliance burden for emitters and the federal government.

In addition, stakeholders have provided input into the shape and scope of the GHGRP and offered the EPA constant feedback on the data. When the EPA first proposed the rule creating the GHGRP, the agency received more than 17,000 comments from stakeholders and interested parties, including the American Petroleum Institute, the U.S. Chamber of Commerce, and energy companies such as Exelon and Duke Energy.<sup>16</sup> Since the EPA finalized the rule in 2009, the agency has revised it on several occasions to address concerns about monitoring requirements and data disclosure.<sup>17</sup>

The carbon tax would be assessed on industrial sources of pollution and fuel suppliers, reflecting the structure of the GHGRP.

- **Industrial sources.** Facilities in most industrial sectors—including electric utilities; oil and gas production and refinery operations; and industrial manufacturing of concrete, metals, paper, and chemicals—report their greenhouse gas emissions to the GHGRP if their annual emissions exceed 25,000 metric tons of CO<sub>2</sub>e.
- **Suppliers of fuels for consumer use.** Fuel suppliers provide a variety of fuels and industrial gases that are used throughout the economy. Unlike the industrial sources of emissions, the greenhouse gas emissions they report do not occur at the supplier’s facility but instead at the point of use. Fuel suppliers, such as refineries and local natural gas distribution companies, report the quantity of greenhouse gases that would be emitted if the fuels and industrial gases that they “produce, import, or export each year were combusted, released, or oxidized.”<sup>18</sup>

Using carbon tax revenue to protect lower- and middle-income households

According to modeling completed by RTI International for the authors, the proposed carbon tax would generate an average of \$200 billion per year over 20 years. (see Table 1) The revenue would decline as greenhouse gas emissions abated in response to the carbon tax.

There are many ways to use this revenue, such as funding tax breaks elsewhere in the economy or increasing spending. Some policymakers and stakeholders have pointed to the importance of revenue neutrality of any carbon tax—that is, that the carbon tax does not generate any new net revenue for the government assessing the tax. British Columbia’s carbon tax, for example, was designed to be revenue neutral.<sup>19</sup>

Carbon tax experts generally lay out three primary options for designing a revenue neutral return of carbon tax revenues to the economy. First, policymakers could return the revenue as a corporate, or capital, tax cut. This would be nominally net positive for the overall economy; however, because these taxes are concentrated among high-income earners, this option is regressive and provides the least benefit to the majority of households. Second, policymakers could return all of the revenue to American households as a dividend or lump sum payment. This is the most progressive option, since this dividend, as a proportion of household income, would benefit lower-income households more than wealthier households. Many economists believe, however, that this option could slow the economy over time. A third option—often seen as the middle ground—would be to use the carbon tax revenue to cut taxes on labor, such as through a payroll tax cut. This option would have a minimal impact on the economy while leaving the majority of households better off than they would be under a corporate tax cut.<sup>20</sup>

CAP proposes a hybrid approach that combines the benefits of a labor tax cut with the progressivity of a lump sum revenue return. In total, the CAP proposal would return \$182 billion to households in 2020, the first year of the proposal. (see Table 2) The proposed revenue return includes:

- A guarantee that 11 percent of the carbon tax revenues will go ratably to households with annual incomes below \$25,000.

TABLE 1  
Gross revenue generated by the proposed carbon tax, 2020–2040  
In billions of 2016 dollars

Year	Revenue generated
2020	\$210.0
2025	\$219.8
2030	\$215.1
2035	\$189.9
2040	\$167.0

Source: Modeling completed by RTI International for CAP.

- A flat percentage, refundable labor tax cut for households with combined wage and nonwage incomes from \$25,000 to \$150,000.
- An additional lump sum supplement for households with combined wage and nonwage incomes of less than \$100,000. Specifically, CAP proposes providing annual lump sum payments of an additional \$115 per household for those making less than \$25,000; \$350 per household for those making from \$25,000 to \$75,000; and \$175 per household for those making from \$75,000 to \$100,000.

**TABLE 2**

### Fiscal summary of the carbon tax proposal

In billions of 2016 dollars

	2020	2025	2030	2035	2040
Total gross receipts	\$210.0	\$219.8	\$215.1	\$189.9	\$167.0
Lump sum payments and tax rebates	\$182.0	\$173.2	\$158.2	\$130.0	\$107.5
Fiscal haircut*	\$28.0	\$46.6	\$56.9	\$60.0	\$59.5

\* The CAP proposal does not assume that all revenue collected can be returned to households as a lump sum payment or tax rebate. The proposal includes an implied fiscal haircut of 25.6 percent on average over the 20-year period. When scoring tax proposals, the Congressional Budget Office approximates that every \$1 in gross revenue generated by a tax lowers revenue generated from income taxes by 25 cents. See Congressional Budget Office, "The Role of the 25 Percent Revenue Offset in Estimating the Budgetary Effects of Legislation" (2009), available at <http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/96xx/doc9618/01-13-25percentoffset.pdf>.

Source: Modeling completed by RTI International for CAP.

The hybrid approach has four primary benefits.

#### 1. All households making less than \$150,000 are protected from increases in direct energy and consumer costs

Under a carbon tax, prices for higher-carbon-emitting goods, such as electricity generated by a coal-fired power plant or gasoline, would rise to reflect the cost of carbon pollution to society. As Chad Stone from the Center on Budget and Policy Priorities explains, low- and middle-income households “feel the squeeze the most” from higher energy prices, “both because energy-related expenditures constitute a larger share of their budgets and because they have less ability to make investments needed to adapt to higher energy prices (such as buying new, more energy-efficient appliances or home-heating systems) than better-off households.”<sup>21</sup> A well-designed carbon tax can generate and distribute enough revenue to offset or mitigate the impact of higher energy costs on low- and middle-income households.



TABLE 3

## Using the carbon tax revenue return to cover household increases in direct energy and consumer costs

In 2016 dollars

		Household income								
		< \$10K	\$10K to \$15K	\$15K to \$25K	\$25K to \$35K	\$35K to \$50K	\$50K to \$75K	\$75K to \$100K	\$100K to \$150K	\$150K+
2020	Consumer cost increase	\$14	\$44	\$53	\$76	\$124	\$166	\$192	\$213	\$205
	Revenue return	\$797	\$797	\$797	\$635	\$849	\$1,242	\$1,499	\$2,191	n/a
	Revenue return as share of income	16%	6%	4%	2%	2%	2%	2%	2%	n/a
2025	Consumer cost increase	\$25	\$71	\$92	\$134	\$210	\$290	\$353	\$441	\$557
	Revenue return	\$799	\$799	\$799	\$649	\$874	\$1,285	\$1,560	\$2,284	n/a
	Revenue return as share of income	16%	6%	4%	2%	2%	2%	2%	2%	n/a
2030	Consumer cost increase	\$36	\$102	\$137	\$199	\$306	\$431	\$535	\$706	\$972
	Revenue return	\$756	\$756	\$756	\$647	\$870	\$1,277	\$1,546	\$2,256	n/a
	Revenue return as share of income	15%	6%	4%	2%	2%	2%	2%	2%	n/a
2035	Consumer cost increase	\$45	\$125	\$172	\$253	\$383	\$545	\$686	\$934	\$1,344
	Revenue return	\$657	\$657	\$657	\$600	\$785	\$1,123	\$1,315	\$1,867	n/a
	Revenue return as share of income	13%	5%	3%	2%	2%	2%	2%	1%	n/a
2040	Consumer cost increase	\$52	\$142	\$199	\$293	\$441	\$633	\$803	\$1,113	\$1,640
	Revenue return	\$572	\$572	\$572	\$551	\$699	\$967	\$1,080	\$1,473	n/a
	Revenue return as share of income	11%	5%	3%	2%	2%	2%	1%	1%	n/a

Note: The revenue return as a share of household income is based on the income that falls at the midpoint of the income range.

Source: Modeling completed by RTI International for CAP.

The hybrid approach outlined above returns enough revenue to households to compensate for any increase in direct energy costs and prices of other consumer goods. All households making less than \$150,000 per year would receive a labor tax cut and/or a lump sum payment that more than covers new household costs arising from the carbon tax. As shown in Table 3, the revenue return constitutes a higher percentage of income for households on the lower end of the income scale than for those higher up. This revenue return approach is more progressive and counteracts the inherently regressive nature of consumer price increases.

The revenue return succeeds because price changes for the household consumption bundles—the individual quantities of all the goods and services a household buys—are slight. Modeling completed by RTI International for the authors shows that energy expenditures are a relatively small percentage of the consumption bundle—about 5 percent.<sup>22</sup> Table 4 shows how a carbon tax would affect prices for household consumption bundles, averaged over the 2020–2040 period, by income group. Higher-income households would experience a slightly lower percentage increase, since they spend a smaller fraction of their income on energy and energy-intensive goods relative to lower-income households. For all households, regardless of income group, consumption bundle prices will rise by less than 1 percent.

**TABLE 4**  
**Household consumption bundle price changes with the proposed carbon tax, 2020–2040**

Percent change in price for all goods and services a household buys

Household income	Consumption bundle price change
Less than \$10K	0.68%
\$10K to \$15K	0.77%
\$15K to \$25K	0.65%
\$25K to \$35K	0.63%
\$35K to \$50K	0.69%
\$50K to \$75K	0.66%
\$75K to \$100K	0.62%
\$100K to \$150K	0.54%
More than \$150K	0.47%

Note: Price changes for household consumption bundles are aggregated for the whole policy period.  
Source: Modeling completed by RTI International for CAP.

2. It protects the poorest households from the burden of other indirect costs and mitigates the impact for other households

As noted above, a carbon tax could increase energy and consumer prices as industry internalizes the costs of climate change. The revenue return more than compensates for these higher direct costs, as reflected in the consumption bundle prices. But economists often talk about other indirect welfare costs that households could experience as well. These indirect costs—which households would not see on an electricity bill or on their receipt at the grocery store—are harder to quantify with precision, as they are not reflected in the price of consumer goods and services.

To use a noncarbon example: Some cities are served by two airports, one closer to downtown but with more expensive flights and another cheaper but more remote. Losing access to the nearby airport—say, if an airline stopped servicing that airport—would make many travelers worse off, even if they took every trip they otherwise would have and did so at lower costs. Modelers use equivalent variation to estimate how much these consumers would be willing to pay to bring back service at the nearby airport. To apply that concept to carbon taxation, the indirect welfare effect of a carbon tax reflects the monetized value of what a household would pay to return to the pre-carbon tax state.

The labor tax cut and lump sum payment, which households would see reflected in their paychecks and bank accounts, would mitigate—but would not entirely negate—the indirect costs of a carbon tax for all households. Importantly, this equation, while including the direct and indirect costs of a carbon tax, does not include the indirect benefits of a carbon tax. For every ton of carbon pollution averted, the world sees a \$36 benefit in the form of damages avoided—such as diminished agricultural productivity, property damage from extreme weather and sea level rise, and effects on human health—according to SCC estimates for 2015.<sup>23</sup>

**TABLE 5**  
**Net welfare impact of the carbon tax proposal, per household**

Share of household income

Household income	2020	2025	2030	2035	2040
≤ \$10K	1%	1%	1%	1%	0%
\$10K to \$15K	1%	1%	1%	1%	1%
\$15K to \$25K	0%	0%	0%	0%	0%
\$25K to \$35K	0%	0%	0%	-1%	-1%
\$35K to \$50K	0%	0%	0%	-1%	-1%
\$50K to \$75K	0%	0%	-1%	-1%	-1%
\$75K to \$100K	0%	-1%	-1%	-1%	-1%
\$100K to \$150K	-1%	-1%	-1%	-1%	-1%

Notes: Amounts per household are calculated by applying share changes from the model to the median income in each bracket. Based on a share of the midpoint of each income bracket.  
Source: Modeling completed by RTI International for CAP.

Table 5 shows the net welfare effect of the carbon tax after factoring in direct and indirect costs and the revenue return to households. Notably, it does not include a quantification of the general societal benefit of mitigating climate change. Households in the lowest quintile experience a positive welfare impact or no impact at all. For households in the remaining income brackets, the net welfare impact never exceeds 1 percent of household income, and each year, the societal benefits of stemming climate change would further reduce that impact.

3. Effective tax rates on middle-income households will be lower

The refundable labor tax cut lowers the overall effective tax rate on wage income. Table 6 shows the impact on households making from \$25,000 to \$75,000 per year. For this income bracket, the effective tax rate on wage income would decline markedly in the early years of the program, resulting in a tax rate that is more than 4 percent below business as usual after the first five years.

**TABLE 6**  
**Impact of the carbon tax proposal on middle-income effective tax rates on wage income**

Households with annual income between \$25,000 and \$75,000

	2020	2025	2030	2035	2040
Middle-income tax rate	33.5%	33.9%	34.6%	36.2%	37.7%
Tax rate reduction over business-as-usual	4.6%	4.1%	3.5%	1.9%	0.3%

Source: Modeling completed by RTI International for CAP.

4. The impact on national GDP is minimal overall

The carbon tax would raise the price of inputs to production and consumption of goods. By returning the revenue to consumers as a labor tax cut and lump sum payment, however, policymakers would mitigate the economywide impact of the tax. RTI International’s modeling shows that the gross domestic product would grow by 2.05 percent per year from 2020 to 2040 under the carbon tax. This rate is just 0.16 percent per year lower than is projected to occur in the absence of a carbon tax. (see Figure 2) In 2030, GDP is approximately 14 months behind the business-as-usual projection; it would take just more than a year for the economy to reach that level of GDP.

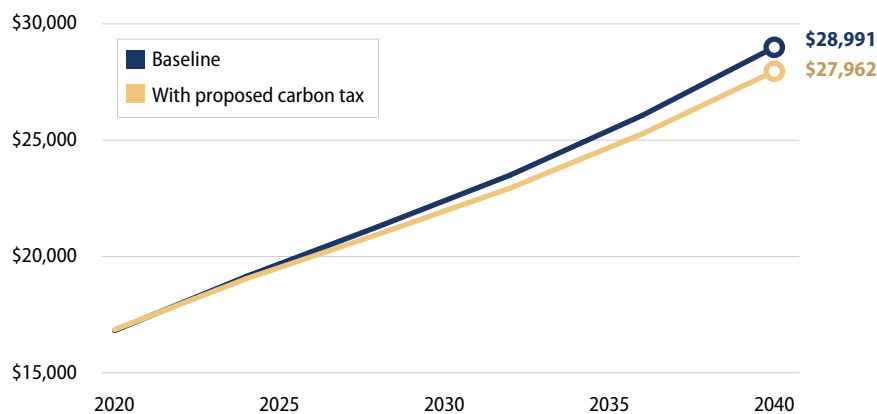
This relatively small impact is consistent with the Energy Information Administration's analysis of the GDP impact of a \$25-per-ton tax. According to the EIA, if the United States had imposed a \$25 carbon tax in 2014, by 2030, GDP would have been only 0.7 percent lower than business as usual.<sup>24</sup>

These EIA projections of GDP growth, however, do not take into account the potentially catastrophic economic effects of unmitigated climate change. Citibank has estimated that failure to mitigate climate change could cost the world up to \$44 trillion in lost GDP by 2060.<sup>25</sup> Researchers at the University of California, Berkeley and Stanford University have predicted that the global economy as a whole will be 23 percent smaller in 2100 if climate change proceeds unchecked.<sup>26</sup> For the United States, these researchers estimate that there is a 79 percent chance that the U.S. GDP per capita will decline by at least 10 percent by 2100 due to climate change and a 28 percent chance that it will fall by more than 50 percent.<sup>27</sup> It is important, therefore, to consider the potentially small impact of a carbon tax on GDP growth within the broader context of the potentially enormous impact of climate change on the global economy.

**FIGURE 2**

### **Change in U.S. GDP under the proposed carbon tax, 2020–2040**

In billions of current dollars



Source: Modeling completed by RTI International for CAP.



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## Adjust the carbon tax at the border for imports and exports

Some stakeholders may raise concerns that U.S. companies in energy-intensive industrial sectors may choose to relocate abroad, allowing domestic carbon emissions to leak to other countries. To mitigate these concerns, policymakers could include a border tax adjustment as part of the carbon tax regime.

### Concerns about carbon leakage and competitiveness

As a general matter, energy expenditures are a small percentage—just 2 percent, on average—of the value of the U.S. manufacturing sector’s output. Industries with energy expenditures below the 2 percent average account for three-quarters of all manufacturing output.<sup>28</sup> But some U.S. industries are more energy intensive—that is, they use more electricity or energy to produce their goods. Within this group, some are also trade exposed—that is, they compete in global markets and, therefore, are less able to pass on increased costs to consumers without losing out to lower-cost foreign competitors. These energy-intensive, trade-exposed industries, or EITEs, include aluminum and steel manufacturers, cement and glass manufacturers, and segments of the chemicals and paper sectors.<sup>29</sup>

EITEs may feel the greatest economic impact of a carbon tax and have the strongest incentive to move abroad. At the same time, products imported from higher-carbon countries could gain market share over their lower-carbon counterparts in the United States. These actions could cause greenhouse gas emissions to fall in the United States and rise abroad. The resulting carbon leakage could erode the emissions reduction benefits of a carbon tax.<sup>30</sup>

### The border tax adjustment and trade law

One solution would be to assess a carbon border tax adjustment on EITE goods. A border tax adjustment would provide a rebate for American goods destined for export markets and apply the domestic carbon tax to imported goods.

The design of the border tax adjustment is critical. As a member of the World Trade Organization, or WTO, and a signatory of the General Agreement on Tariffs and Trade, or GATT, the United States must meet certain standards when applying any tax to goods entering or exiting the country. The GATT

prohibits preferential treatment of imports from certain countries over others, selling goods substantially cheaper abroad than at home, and other methods of manipulating trade flows. The WTO establishes fairly strict rules governing how member countries treat each other's imports and has a bias against trade protectionism and restrictions.

Article XX of the GATT offers the most likely route for WTO compliance of a border tax adjustment. This provision allows a WTO member country to implement a trade measure that violates other GATT provisions under narrow circumstances. To meet the requirements of Article XX, U.S. policymakers would first have to prove that the border tax adjustment is “necessary to protect human, animal or plant life or health” or “relating to the conservation of exhaustible natural resources.”<sup>31</sup> The United States likely would be able to make this case. It will be more difficult, however, for the United States to overcome the second hurdle: demonstrating that the border tax adjustment does not constitute “arbitrary or unjustifiable discrimination” among its trading partners and is not a “disguised restriction on international trade.”<sup>32</sup>

One approach to designing a border tax adjustment that meets these requirements would include the following elements.

The designated federal agency would identify U.S. industry sectors that would be most sensitive to the effects of the carbon tax: industries that are particularly energy or greenhouse gas intensive. For example, eligible sectors could include those that have an energy or greenhouse gas intensity of at least 5 percent and a trade intensity of at least 15 percent, or alternatively, a very high energy or greenhouse gas intensity of at least 20 percent regardless of trade intensity.<sup>33</sup> Products from these sectors only—not all sectors of the U.S. economy—would be eligible for a border tax adjustment, for two reasons. First, these are the sectors that are most likely to feel the price impacts of a carbon tax most acutely. Second, in order to simplify the administration of the border tax adjustment, policymakers need to minimize the number of products to which the adjustment applies.

For this subset of industry sectors, the United States would apply a border tax adjustment. For exported U.S. goods from these industry sectors, the United States would provide a carbon tax rebate. To prevent leakage in this carbon reduction scheme, the United States would also assess a carbon tax on imported goods that are similar to these energy- or greenhouse gas-intensive U.S. goods. The United States would calculate the border tax rebate for exported goods based on the carbon content of

those goods. For imported goods, officials would assume that the carbon content for a particular imported good was the same as if it had been manufactured using the predominant method of production for that good in the United States.

Using this sound methodology to calculate the border tax adjustment would assuage concerns that it is arbitrary and unjustifiable. To further mitigate those concerns, the United States would develop a formal process to allow WTO members the opportunity to demonstrate to the United States that certain products have a lower carbon content and therefore should be subject to a lower tax when exported to the United States.

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### Integrate the carbon tax with state and regional carbon prices

Several U.S. states have set a price on carbon for certain sources within their borders.

The Regional Greenhouse Gas Initiative, or RGGI, was the country's first market-based regulatory program designed to reduce carbon pollution from the electric power sector. The RGGI states—Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont—set a cap on power-sector carbon pollution, issue an allowance for each ton of pollution, and support a regional auction to allow sources to buy and sell allowances.<sup>34</sup> California has its own program that covers multiple sectors and additional greenhouse gases beyond carbon, including methane, nitrous oxide, and the fluorinated greenhouse gases. Starting in 2013, California power plants and industrial facilities emitting at least 25,000 metric tons of CO<sub>2</sub>e per year had to comply with the state emissions cap. Fuel distributors meeting the 25,000 metric ton threshold had to begin complying with the state cap as of January 1, 2015.<sup>35</sup>

A federal carbon tax proposal must address the question of how to handle state-level carbon reduction programs such as the RGGI and California's program. One approach is to credit state taxes and fees paid on a per-ton basis toward the federal tax. Under this approach, each source covered by both federal and state carbon pricing policies would pay the incremental difference between the federal and state carbon price to the federal government. In the RGGI states, for example, carbon allowances sold for approximately \$4.50 per ton of carbon in June 2016.<sup>36</sup> In 2020, the first year of the proposed carbon tax, power plants in the RGGI market would pay the difference between the RGGI price and the federal carbon tax of \$30—or approximately \$25.50.

This approach is not unlike other federal tax provisions where policymakers have acknowledged that federal tax policy should reflect certain state tax policies. Under federal law, for instance, state income tax and property taxes are often deductible under individuals' federal income tax filings.<sup>37</sup> Additionally, it is important that only taxes and fees paid pursuant to state law that specifically apply to carbon emissions be credited toward the federal tax. Otherwise, taxes or fees that were established for purposes other than internalizing the price of carbon pollution or achieving pollution reductions could be inappropriately credited toward the federal carbon tax.

Factoring in state programs in this manner would reduce the amount of federal revenue collected and available for return to taxpayers, but it would ensure that pollution sources in these early action states are not unfairly penalized. It would also have the benefit of encouraging states to move forward with plans to establish carbon reduction regimes rather than waiting for enactment of a federal carbon tax. The early actors would keep a portion of revenue in the state coffers, while late actors would not have that opportunity.

States may also need to make certain adjustments if a federal carbon tax is adopted. The value of state carbon allowances theoretically could drop to zero. California and the RGGI have already set a minimum price for allowances sold at auction. For 2016, California established a so-called reserve price at \$12.73 per ton.<sup>38</sup> The RGGI established a minimum reserve price of \$2.10 per ton for the 2016 calendar year.<sup>39</sup> If a federal carbon tax seeks greater reductions in carbon and other greenhouse gases than those envisioned by the California and RGGI programs, those states may decide to increase the minimum allowance prices prior to enactment of a federal tax in order to maintain a certain level of revenue.

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## Leave existing climate regulations and programs in place

Some participants in the debate about the benefits of a carbon tax argue that a carbon tax, if enacted, should nullify existing regulations, mandates, subsidies, and tax breaks that encourage clean energy and energy efficiency deployment or require electricity generation from low-carbon fuels.<sup>40</sup>

Others, such as Dallas Burtraw and Karen Palmer from Resources for the Future, argue that practical limitations in the implementation of a carbon tax leave room “for the coexistence of other policies at the state and local levels and

regulations at the national level.”<sup>41</sup> Economists generally agree that a carbon tax is an “efficient instrument,” but “an efficient instrument does not guarantee an efficient policy.”<sup>42</sup> For many reasons, federal policymakers are unlikely to enact an optimal carbon tax that can overcome all market barriers that prevent participants from perfectly adjusting their consumption and investment. Essentially, the messy reality of politics—and the political concessions needed to enact policy in Congress—will intervene in the development of model policy that mimics the results of economic modeling.<sup>43</sup> It is in this real world, not the world of economic models, that regulations and other policies can complement a carbon tax to achieve emissions reductions.

## The Clean Power Plan

On August 3, 2015, the EPA finalized the Clean Power Plan, which promises to cut carbon pollution from the power sector by 32 percent below 2005 levels by 2030.<sup>44</sup> The rule is currently stayed pending review by the U.S. Supreme Court.

Some economists and policy analysts have argued that any carbon tax should replace the Clean Power Plan or even supplant the EPA’s authority to regulate greenhouse gas emissions under the Clean Air Act.<sup>45</sup> Some have suggested that preempting the Clean Power Plan makes sense on substantive grounds, arguing that a textbook carbon tax is more economically efficient than a regulatory approach.<sup>46</sup>

A carbon tax in itself does not cap emissions. Instead, the size of the tax, as well as any exemptions, determines how effective it will be at cutting pollution. If the tax is too low or does not escalate over time, it may not send a price signal strong enough to influence economic decisions, drive investment in low-carbon technology, and reduce emissions. The Clean Power Plan—and other authority offered by the Clean Air Act—might be essential if the tax, for whatever reason, does not provide adequate environmental results.

In addition, the Clean Power Plan will facilitate compliance with any future carbon tax. A carbon tax would simply be a fee on each ton of carbon emitted. Thus, the more that power plants increase their efficiency and lower emissions under the Clean Power Plan, the lighter the impact of the carbon tax.



## Vehicle efficiency standards

Some carbon tax supporters argue that any legislation to enact a carbon tax should also nullify the EPA and National Highway Traffic Safety Administration, or NHTSA, greenhouse gas emissions and corporate average fuel economy standards for model year 2017–2025 light-duty vehicles.<sup>47</sup>

The transportation sector, however, is less responsive to a carbon price in the short term than the power sector. Consumers often cannot find new ways to work or run errands without making significant changes that take time, such as moving to a new home closer to public transit. Similarly, automakers cannot quickly modify their production plans or supply chains. Unlike the electricity market—where utilities can choose to dispatch electricity from a number of energy sources, including low-carbon sources—the transportation sector faces constraints because of “the relative lack of low-carbon substitute products.”<sup>48</sup> As a result, unless gasoline prices rise dramatically, most people will continue to drive their cars, at least in the short term.

The EIA modeled the emissions effects of a \$25-per-ton carbon tax that increases by 5 percent annually to about \$85 per metric ton in 2040. This analysis showed that energy-related carbon dioxide emissions from the electric power sector plummet by 79 percent from 2012 levels by 2040.<sup>49</sup> Emissions from light-duty vehicles fall by 33 percent over that time, but the EPA and fuel economy regulations—not the carbon tax—are driving the majority of these emissions reductions. The carbon tax only achieves a 7 percent additional reduction in carbon emissions from light-duty vehicles than under business as usual, which includes the EPA and NHTSA standards.<sup>50</sup> Moreover, the carbon tax does not drive a large increase in sales of alternative-fuel cars, including electric vehicles, plug-in hybrids, and hydrogen fuel cell vehicles. With a carbon tax, sales of these cars grow only 9.5 percent faster than business-as-usual estimates between 2012 and 2040.<sup>51</sup>

Emissions reductions aside, the EPA and NHTSA standards offer a less tangible benefit—a coordinated national program that offers automakers regulatory certainty.

## Other regulations, mandates, and incentives

Some carbon tax supporters argue that any legislation to enact a carbon tax should also nullify renewable electricity and energy efficiency standards, clean energy tax breaks and subsidies, and other programs to achieve carbon pollution reductions.<sup>52</sup> One carbon tax scholar suggests:

*... as long as electricity prices reflect the environmental damages associated with electricity production and consumers have good information about the energy use of the products they buy, then arguably consumers (rather than federal agencies) should decide what products best serve their needs.*<sup>53</sup>

But consumers also do not always act as rationally as models would hope. Burtraw and Palmer note that a carbon price may not motivate consumers to make the most economically efficient choices given consumers' general tendency toward myopic decision-making. Consumers may continue to purchase goods that are cheaper in the short run but that incur higher energy costs over time.<sup>54</sup> Or the entity purchasing the goods may not have the same economic motives as those who will be using them. For example, a landlord has an incentive to purchase the cheapest possible appliances for the apartments in his building, even if they are not energy efficient, because the tenant pays the electricity costs. These types of market failures justify maintaining certain standards under a carbon tax regime, such as product efficiency standards.

A carbon tax would also interact with energy research and development spending. Adele Morris from the Brookings Institution has concluded that a carbon tax should not preclude additional federal spending on research and development, or R&D, on clean energy and low-carbon technology, as “the private sector is likely to undersupply” this critical need.<sup>55</sup> Richard Newell—a professor at Duke University and former head of the EIA—agrees, arguing that the federal government should fund strategic climate technology research and development even as it implements a carbon tax. He notes that because knowledge is a public good, “companies cannot capture the full value of investing in innovation, as that value tends to spill over to other technology producers and users, thereby diminishing individual private incentives for R&D.”<sup>56</sup>

# Conclusion

The world has united to fight climate change, and more and more countries—and corporations—are turning to carbon pricing to reduce their greenhouse gas emissions. In North America, carbon pricing initiatives are taking hold across Canada and Mexico.<sup>57</sup> During the Paris summit, governments, nongovernmental organizations, and more than 70 businesses launched the Carbon Pricing Leadership Coalition with the goal of amplifying “effective carbon pricing policies that can maintain competitiveness, create jobs, encourage innovation, and deliver meaningful emissions reductions.”<sup>58</sup> In 2015, more than 1,000 companies reported that they currently use or plan to use some variety of internal carbon price.<sup>59</sup>

In 2015, the World Bank’s top climate official noted a “growing sense of inevitability” for carbon pricing worldwide.<sup>60</sup> Pricing carbon allows governments to correct the market’s failure to internalize the climate costs of burning fossil fuels; in doing so, carbon pricing encourages polluters to find cleaner, lower-carbon processes.

It remains unclear when momentum for a federal-level carbon price will take hold in the United States. But when it does, policymakers will need to design a pricing mechanism that achieves significant pollution reductions while protecting low- and middle-income households from potential energy price increases. This report offers one approach to designing a carbon tax that achieves these goals.

# The model

RTI International modeled the impacts of a carbon tax starting in 2020 at \$30 per ton of carbon dioxide equivalent. For the first 10 years, the tax rises at a 5.2 percent annual rate until it hits the social cost of carbon in 2030, which is currently set at \$50 (in 2007 dollars). The tax then tracks the SCC, rising to \$55 in 2035 and \$60 in 2040 (in 2007 dollars).

RTI used its ADAGE model, which represents the United States as a collection of interacting industrial sectors and regions. The model is tractable and provides results that are easily relatable to the National Energy Modeling System, used by the U.S. Department of Energy and the Environmental Protection Agency to evaluate long-term policies.

In its model, RTI imposed a tax on greenhouse gas emissions from all sectors of the economy. The tax applies to carbon dioxide, methane, nitrous oxide, and three fluorinated gases—hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. U.S. exporters of energy-intensive, trade-exposed goods receive a rebate at the border that approximates the value of the embedded carbon in those goods. The United States imposes a border tax adjustment on imports based on the total embodied carbon and direct noncarbon emissions for the domestic production of the equivalent good. U.S. exports of fossil fuels are not taxed.

Before modeling the revenue return to households, RTI assumed an implied fiscal haircut averaging 25.6 percent over the 20-year model horizon. This constrains the amount of recyclable revenue. RTI then subtracted the lump sum payments and lowest-quintile transfers from the remaining revenue before apportioning the balance to the labor tax cut. Since the policy is revenue neutral and holds real government expenditures constant, the size of the labor tax cut is determined by the solution of the model.

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