RESOURCES for the FUTURE

Analysis of Alternative Carbon Tax Price Paths for the Climate Leadership Council (CLC) Carbon Dividends Plan

Issue Brief 18-07 by **Marc Hafstead** — June 2018; Revised March 2019

In February 2017, the Climate Leadership Council (CLC), led by Ted Halstead and Republican statesmen George P. Shultz and James A. Baker III introduced **"The Conservative Case for Carbon Dividends."** The CLC's Founding Members help refine the policy details of its carbon dividends plan. Individual Founding Members include leading economists such as Ben Bernanke, Larry Summers and Janet Yellen. Corporate Founding Members include oil and gas companies BP, ExxonMobil, Shell, and Total; General Motors; consumer good giants Johnson&Johnson, P&G, and Unilever; and other multi-national firms. NGO Founding Members include Conservation International, The Nature Conservancy and World Wildlife Fund.

CLC's Carbon Dividend Plan rests on four pillars:

- **A Gradually Increasing Carbon Tax:** "A sensible carbon tax should begin at $40 a ton and increase steadily over time."
- **Carbon Dividends for All Americans:** "All the proceeds from this carbon tax would be returned to the American people on an equal and monthly basis."
- **Border Carbon Adjustments:** "Border adjustments for the carbon content of both imports and exports would level the playing field and promote American competitiveness."
- **Regulatory Simplification:** "The elimination of regulations that are no longer necessary upon the enactment of a rising carbon tax."

The purpose of this RFF analysis is to assess the impacts of alternative carbon tax paths on US energy-related CO_2 emissions.[1] Our sole focus is on the emissions impact of CLC's first pillar and we do not consider the impacts of any pillars on households or industry.

Economic Model of Carbon Emissions

We utilize the Goulder-Hafstead Energy-Environment-Economy E3 CGE Model, an economy-wide model of the United States with international trade. Production is divided into 35 industries, with particular emphasis on energy-related industries such as crude oil extraction, natural gas extraction, coal mining, electric power (represented by four industries), petroleum refining, and natural gas distribution. The model is unique in its detailed tax treatment, which allows for interactions of environmental policy and pre-existing taxes on capital and labor, and its attention to capital dynamics, which are important for analyzing how policies impact the economy over time. The model utilizes 2013 benchmark data and solves for impacts at one-year intervals beginning in 2013. Baseline technology and preference forecasts are calibrated to the 2016 Annual Energy Outlook (AEO) from the Energy Information Administration (EIA).

In *Confronting the Climate Challenge: US Policy Options*, published by Columbia University Press (co-authored by Lawrence Goulder of Stanford University), the E3 model is used to evaluate carbon taxes, cap-and-trade programs, clean energy standards, and increases in the federal gasoline tax. The model has also been featured in three peer-reviewed journal publications, and it participated Stanford's Energy Modeling Forum (EMF) 32: Inter-model Comparison of US Greenhouse Gas Reduction Policy Options. For further analyses of a carbon tax using the E3 model, including a wider range of impact results, see **www.rff.org/carbontax**.

Results

Table 1a displays projected E3 energy-related carbon dioxide (CO_2) emissions through 2035 across the four alternative growth rates and a baseline scenario without a federal carbon tax.[2] Table 1b reports emissions relative to 2005 emissions.

Table 1a: Sensitivity of Energy-Related CO_2 Emissions to Different Rates of Growth of the Carbon Tax (billion metric tons)

Year	Baseline Emissions	Growth Rate of Carbon Tax			
		3%	4%	5%	6%
2021	5.1	4.1	4.1	4.1	4.1
2022	5.0	4.0	4.0	4.0	4.0
2023	5.0	3.9	3.9	3.9	3.9
2024	5.0	3.8	3.8	3.8	3.7
2025	5.0	3.7	3.7	3.7	3.6
2026	5.0	3.7	3.6	3.6	3.5
2027	4.9	3.6	3.5	3.5	3.4
2028	4.9	3.5	3.5	3.4	3.4
2029	4.9	3.5	3.4	3.3	3.3
2030	4.9	3.4	3.3	3.3	3.2
2031	4.9	3.4	3.3	3.2	3.1
2032	4.9	3.3	3.2	3.1	3.0
2033	4.9	3.3	3.2	3.1	3.0
2034	4.8	3.2	3.1	3.0	2.9
2035	4.8	3.2	3.1	3.0	2.8

In the absence of carbon pricing or other regulations, energy-related CO_2 emissions are expected to fall at a relatively slow rate through 2035. In 2021, with the initial CLC carbon price of $43, emissions are projected to drop by about one billion metric tons, a 19% reduction relative to business as usual. Emissions after 2021 depend on the growth rate of the tax over time. In 2025, emissions vary between 3.6 and 3.7 billion metric tons (38 – 39% below 2005 energy-related CO_2 emissions).[3] By 2035, the difference in emissions levels across growth rates becomes more pronounced – a difference of 0.4 billion metric tons between the lowest and highest growth rate scenarios. Under the 5% growth rate, energy-related carbon dioxide emissions are 51% below 2005 levels in 2035.

Table 1b: Energy-Related CO_2 Emissions (below 2005 levels), by Carbon Tax Growth Rate

Year	Growth Rate of Carbon Tax			
	3%	4%	5%	6%
2021	32%	32%	32%	32%
2022	33%	33%	34%	34%
2023	35%	35%	35%	36%
2024	36%	37%	37%	38%
2025	38%	38%	39%	39%
2026	39%	40%	40%	41%
2027	40%	41%	42%	43%
2028	41%	42%	43%	44%
2029	42%	43%	44%	45%
2030	43%	44%	45%	47%
2031	44%	45%	47%	48%
2032	45%	46%	48%	49%
2033	45%	47%	49%	51%
2034	46%	48%	50%	52%
2035	47%	49%	51%	53%

Projections are not forecasts because they depend on values for a number of variables whose future values are uncertain. Projections in the E3 model represent central estimates of future outcomes conditional on a large number of parameter and model assumptions. Changes to any single assumption may alter projections. Key sources of uncertainty include both baseline forecasts and price elasticities. Chen, Hafstead, and Goulder (2018), available for free download **here**, evaluate the sensitivity of E3's projected emissions to baseline forecasts such as fossil fuel prices, economic growth and the rate of energy efficiency improvements in nonenergy sectors. In future work, we plan to evaluate the sensitivity of emissions to price elasticities to determine appropriate confidence intervals for long-run emissions projections.

Terms of Reference for the Analysis

The model analysis was structured by the specific elements below.

- The tax is imposed on all fossil fuels (coal, petroleum and natural gas) combusted within the United States.
- The tax is based on the carbon content of these fuels.
- Only the effect of the tax on energy-related CO_2 emissions is modeled. Emissions of the other five greenhouse gases (methane, nitrous oxide, HFCs PFCs and SF6) and non-energy-related CO_2 emissions are not included in this analysis.
- The tax is initially imposed in 2021.
- The tax is applied at a rate $43/per ton (in $2021) of CO_2 emitted through combustion. A fee of $43 is an increase from the original CLC proposal of $40 to account for inflation between 2018 and 2021.
- The tax increases annually at a rate of 3, 4, 5, or 6 percent above inflation.
- All of the proceeds from the carbon tax, net of reductions in pre-existing taxes, are returned to the American people on an equal basis.
- Border adjustments are only considered in the model for imports and exports of secondary fossil fuels (such as gasoline).

Notes

1 This analysis uses the EIA definition of energy-related carbon dioxide emissions. The EPA's Inventory of Greenhouse Gas Emissions and Sinks reports levels of energy-related carbon dioxide emissions that exclude emissions from international bunker fuels and includes emissions from US territories.

2 Emissions under the baseline scenario are from EIA's AEO 2019. Emissions under the carbon tax are derived from multiplying the percentage change in emissions from the E3 model with a different reference case to the AEO baseline emissions. As shown in Chen, Goulder, and Hafstead (2018), the percentage change in emissions from a carbon tax are approximately independent of reference case forecast assumptions.

3 The Obama Administration's US Paris Agreement commitment was to reduce *net greenhouse gas* emissions to 26-28% below 2005 levels. Energy-related CO_2 emissions account for about 78% of gross greenhouse gas emissions. Under conservative estimates for changes in non-energy-related CO_2 emissions, non-CO_2 greenhouse gas emissions, and forestry sequestration, energy-related CO_2 emissions need to be reduced by about 30% from 2005 levels to achieve the 2025 28% net greenhouse gas reduction target.

Resources for the Future (RFF) is an independent, nonprofit research institution in Washington, DC. Its mission is to improve environmental, energy, and natural resource decisions through impartial economic research and policy engagement. RFF does not take positions on specific legislative proposals and this memo is not an endorsement of the Carbon Dividends Plan.

Marc Hafstead is a Fellow and the director of the Carbon Pricing Intiative at RFF. He is a leading researcher on the evaluation and design on climate and energy policies. With Stanford professor and RFF University Fellow Lawrence H. Goulder, he wrote Confronting the Climate Challenge: US Policy Options (Columbia University Press) to evaluate the environmental and economic impacts of carbon taxes, cap-and-trade programs, clean energy standards, and gasoline taxes using a sophisticated multi-sector model of the United States. He is also an expert on the employment impacts of carbon pricing and the design of tax adjustment mechanisms to reduce the emissions uncertainty of carbon tax policies.

Financial support for this analysis was provided by the **Climate Leadership Council**. The Climate Leadership Council (CLC) is an international policy institute founded in collaboration with a who's who of business, opinion and environmental leaders to promote a carbon dividends framework as the most cost-effective, equitable and politically viable climate solution. Find more analysis by RFF experts on the impacts of a US carbon tax at **www.rff.org/carbontax**.