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

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In February 2017, led by Ted Halstead and Republican statesmen George P. Shultz and James A. Baker III, the Climate Leadership Council (CLC) introduced "The Conservative Case for Carbon Dividends." In June 2017, the CLC announced its Founding Members, including economists Lawrence Summers, Martin Feldstein, and N. Gregory Mankiw, as well as business leaders such as Ratan Tata, Rob Walton, and Michael Bloomberg. Corporate Founding Members of CLC include oil companies BP, ExxonMobil, Shell, and Total; General Motors; consumer goods giants Johnson&Johnson, P&G, and Unilever; and other multinational firms. NGO Founding Members include The Nature Conservancy and Conservation International.

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 analysis is to assess the impacts of alternative carbon tax paths on US energy-related carbon dioxide (CO_2) emissions.[1] The sole focus is on the emissions impact of CLC's first pillar and this brief does 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 preexisting 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 US Energy Information Administration (EIA).

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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.

[1] This analysis uses the EIA definition of energy-related CO_2 emissions. The Environmental Protection Agency's Inventory of Greenhouse Gas Emissions and Sinks reports levels of energy-related CO_2 emissions that exclude emissions from international bunker fuels and includes emissions from US territories.

In *Confronting the Climate Challenge: US Policy Options*, published by Columbia University Press (coauthored 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, visit www.rff.org/carbontax.

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 of $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 preexisting 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).

Results

Table 1a displays projected E3 energy-related 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. *(See both tables on the next page.)*

In the absence of carbon pricing or other regulations, energy-related CO_2 emissions are expected to remain relatively flat through 2035, with slight growth between 2035 and 2050. In 2021, with the initial CLC carbon price of $43, emissions are projected to drop by about one billion metric tons, a 19 percent reduction relative to business as usual. Emissions after 2021 depend on the growth rate of the tax over time. In 2025, emissions vary between 3.8 and 3.9 billion metric tons (34–36 percent 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 percent growth rate, energy-related CO_2 emissions are 45 percent below 2005 levels in 2035.

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) 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.

[2] Emissions under the baseline scenario are derived from average rates of change in GDP and emissions intensity from EIA's AEO 2018. Emissions under the carbon tax are derived from multiplying the percentage change in emissions from the E3 model with a slightly different reference case to 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 31% from 2005 levels to achieve the 2025 26% net greenhouse gas reduction target.

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	5.2	4.2	4.2	4.2	4.2
2022	5.2	4.1	4.1	4.1	4.1
2023	5.2	4.1	4.1	4.0	4.0
2024	5.2	4.0	4.0	4.0	3.9
2025	5.3	3.9	3.9	3.9	3.8
2026	5.3	3.9	3.8	3.8	3.8
2027	5.3	3.8	3.8	3.7	3.7
2028	5.3	3.8	3.7	3.7	3.6
2029	5.3	3.8	3.7	3.6	3.5
2030	5.3	3.7	3.6	3.5	3.5
2031	5.3	3.7	3.6	3.5	3.4
2032	5.3	3.6	3.5	3.4	3.3
2033	5.4	3.6	3.5	3.4	3.3
2034	5.4	3.6	3.5	3.3	3.2
2035	5.4	3.6	3.4	3.3	3.2

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	30%	29%	29%	29%
2022	31%	31%	31%	31%
2023	32%	32%	33%	33%
2024	33%	34%	34%	34%
2025	34%	35%	35%	36%
2026	35%	36%	37%	37%
2027	36%	37%	38%	39%
2028	37%	38%	39%	40%
2029	37%	39%	40%	41%
2030	38%	39%	41%	42%
2031	39%	40%	42%	43%
2032	39%	41%	43%	44%
2033	40%	42%	43%	45%
2034	40%	42%	44%	46%
2035	41%	43%	45%	47%