Carbon Pricing:

Why We Need It, How It's Working, and How to Build Support

Research posts by Jonathan Marshall

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Citizens' Climate Lobby

Contents

Introduction

In October 2024, the United Nations Environmental Program issued its annual *Emissions Gap Report*, subtitled *No more hot air … please!* It warned that current trends put the world "on course for a temperature increase of 2.6-3.1°C over the course of this century" and for "debilitating impacts to people, planet and economies." To achieve the "sweeping and fast emissions cuts" needed for a more sustainable outcome, it declared, will require "enhanced international collaboration" for "reform of the global financial architecture, strong private sector action and a minimum six-fold increase in mitigation investment."

The report cited a recent global study which found that carbon pricing—imposing a cost penalty for greenhouse gas (GHG) pollution through charges on fossil fuels—has proven one of the most successful mitigation policies since 1990. That study—discussed in the body of this book—lends support to the overwhelming consensus of U.S. economists, including many notable Republicans, that taxing carbon dioxide and other climate pollutants is "the most powerful lever" for mitigating this global environmental, health, and economic crisis. Similar support for carbon pricing has come from the Intergovernmental Panel on Climate Change, International Monetary Fund, World Bank, World Trade Organization, National Academy of Sciences, and a host of other public institutions. Numerous business groups and corporations agree. Careful empirical work by economists, reviewed in this chapter 3 of this book, confirms that practice and theory align: Carbon pricing is already achieving substantial emissions reductions in many parts of the world.

If carbon pricing is so great, why isn't everyone doing it? The reasons are many, starting with the potent political opposition of powerful fossil fuel interests that spend billions of dollars worldwide lobbying against restrictions on their business. Some energy-intensive industries fear they may face a competitive disadvantage in global markets if hobbled by higher prices for oil, natural gas, or coal. Many voters also react skeptically to any policy that would raise their energy bills today in the name of a distant and nebulous cause like slowing climate change. In addition, countries may hold back from acting on this global problem out of concern that other emitting countries refuse to shoulder their fair share of the burden.

Fortunately, smart carbon pricing programs can deal with at least some concerns. So called "carbon border adjustments" can eliminate unfair competitive threats to domestic industry by levying duties on carbon-intensive imports from countries that don't have carbon pricing. Public fears about financial burdens can be eased by returning some or all revenues from carbon pricing to individuals, turning a net tax into a net benefit for most households. Several countries such as Austria and Canada have adopted this policy innovation. Studies of its potential impact on public support for carbon pricing are reported in chapter 4.

Overcoming such political obstacles, dozens of countries are already making climate polluters pay, even without globally coordinated action. By the end of 2023 some 75

countries and other jurisdictions had carbon pricing programs in place. More than a quarter of world GHG emissions were covered by explicit carbon prices. Counting fuel excise taxes as well, 42% of GHG emissions in 79 major economies were subject to an effective price on carbon. In 2024, China, the world's largest emitter of greenhouse gases, complemented its spectacular buildout of clean generation with record prices for emissions permits.

Current prices and coverage still aren't nearly great enough to address the problem, of course. International Monetary Fund economists estimated in 2022 that the global average carbon price amounted to only $6 per ton of carbon dioxide, a far cry from the $75 per ton needed by 2030 to keep global warming reasonably in check. As a result, global carbon dioxide emissions, far from falling last year, rose about 0.8 percent over 2023 levels, putting the goal of "net zero" further from reach.

Fortunately, new domestic carbon pricing programs are under discussion in countries such as Brazil, Chile, Colombia, India, Indonesia, Israel, Malaysia, Morocco, Thailand, and Turkey. Many of them hope to avoid paying carbon duties on sales of goods into the European Union (EU), whose Carbon Border Adjustment Mechanism (CBAM) will take effect in 2026 to level the playing field for manufacturers that pay carbon prices within the EU.

As more and more countries introduce border carbon adjustments of their own to maintain fair competition, the world could see a virtuous cycle of "cascading carbon prices and coordinated trade measures incentivizing greater global climate action," in the words of several influential climate policy experts.

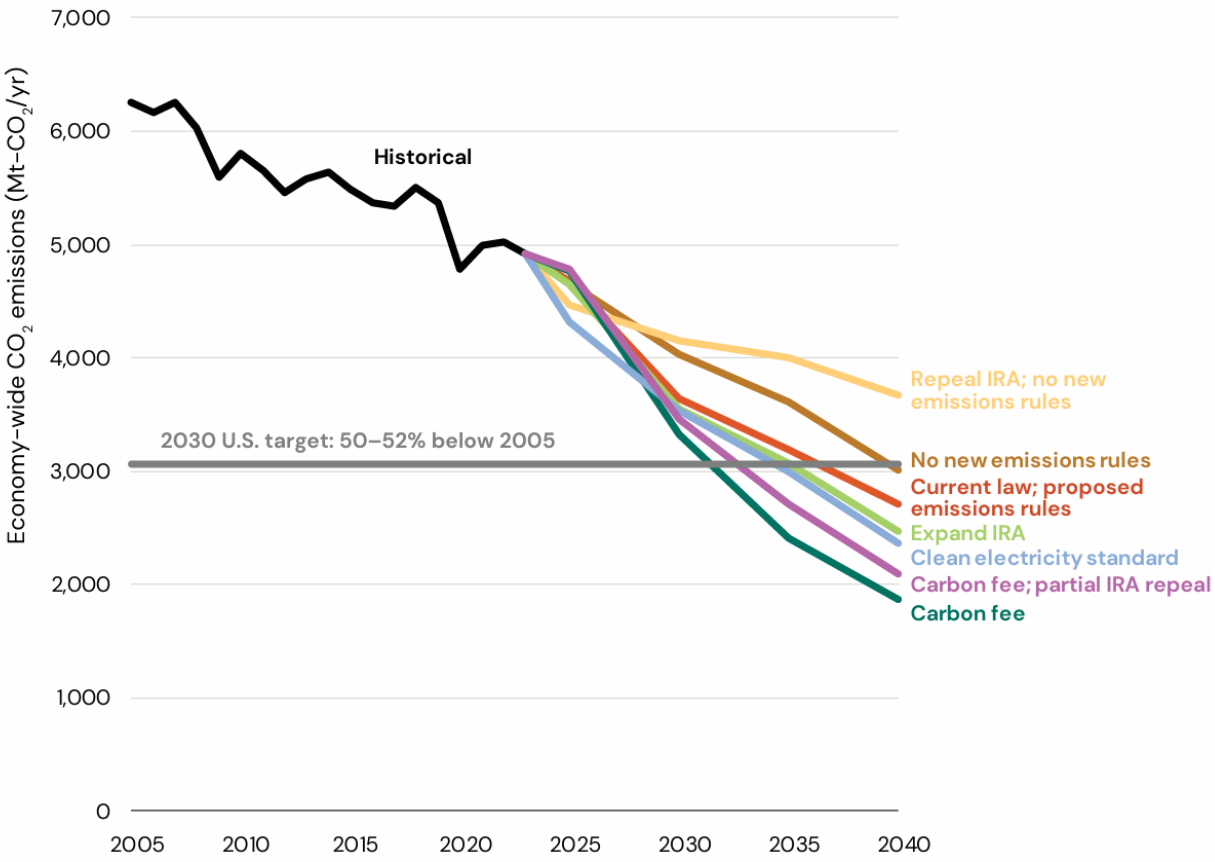
Policy options for the United States

Despite the election of a climate skeptic as president in 2024, some economists and other policy experts argue that 2025 is a promising year for carbon pricing in the United States, owing to the impact of climate-related natural disasters, the international spread of carbon pricing to most U.S. trading partners, the success of the Inflation Reduction Act in lowering the cost of clean-energy solutions, and the realization that carbon pricing represents one of the most promising sources of new revenue at a time of soaring deficits and national debt.

A major report issued in February 2024 by five leading U.S. economists for the Brookings Institution on "Climate tax policy reform options in 2025" determined that a national carbon fee, starting at $15 per ton of CO2 in 2027 and rising to just $65 per ton in 2035, would drive national emissions down 62% by 2035 relative to 2005 levels. Under current law, with no stringent new emissions rules, emissions would decline only 42% over the same period.

A rising national carbon fee would also provide a welcome boost to the Treasury, generating fiscal savings of nearly $600 billion over 10 years. The impact of carbon pricing on household budgets would be virtually unnoticeable by 2035, thanks to the preponderance of clean, untaxed electricity by then.

Economy-wide CO_2 emissions, by climate policy scenario



Source: Bistline et al. 2024.

Note: Emissions include gross energy and industrial process CO_2 emissions but do not include emissions from the land sink or non-CO_2 GHG emissions. Mt = metric ton.

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Anticipated budgetary scores of proposed legislation to enact scenarios, billions of dollars

Scenario	Estimate of budget score
Current law; proposed emissions rules	N/A
No new emissions rules	N/A
Repeal IRA; no new emissions rules	$1,500
Expand IRA	—$530
Carbon fee	$590
Clean electricity standard	—$230
Carbon fee; partial IRA repeal	$1,390

Source: Bistline et al. 2024.

Note: These estimates cover cumulative impacts across the 10-year budget window (in billions of nominal dollars), assuming a baseline of current law. In scenario seven (i.e., "Carbon fee; partial IRA repeal"), the total includes fiscal savings from a partial repeal of IRA. Negative numbers indicate an increase in the federal budget debt.

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Source: 20240227_THP_ClimateTaxPaper.pdf

In a companion study for the National Bureau of Economic Research, the same economists found that a larger carbon fee, starting at $64/t-CO2 in 2026 and rising 6% annually plus inflation, would lead to a dramatic 66% decline in CO2 emissions by 2035 and revenue of about $2 *trillion*.

These findings also highlight the inadequacy of current policies to deliver on America's pledge to slash greenhouse gas emissions in half by 2030. "No models indicate the 2030 U.S. climate target would be met with the IRA alone," Democratic Senator Sheldon Whitehouse of Rhode Island said in 2024. "If we want a pathway to climate safety, it will require we do what's economically and morally right and price carbon pollution."

Citizens' Climate Lobby research coordinator Richard Knight ran scenarios through the respected Energy Policy Simulator (EPS) from Energy Innovation LLC on expected 10-year impacts of the Inflation Reduction Act with and without carbon pricing, relative to a pre-IRA business-as-usual baseline. "These results show that the IRA alone could mobilize about $1.0 trillion in private investment over 10 years, and an additional $1.3 trillion through 2050," he reported.

> That sounds impressive, but when we add a CFD [carbon fee and dividend] starting in 2025, it would stimulate an *additional* $0.8 trillion of private investment in the first 10 years, and an *additional* $5.6 trillion between 2034 and 2050.
>
> Put another way, the addition of the CFD to current policy would nearly *quadruple* the amount of private capital mobilized under the IRA alone. And not one penny of that additional money comes from the Treasury; it all comes from private investors who are wise enough to see that climate-friendly technologies – not more fossil fuels – are the future and want to be part of it.

Although prospects for a national carbon price in the United States appear dim at present, some climate activists see a path forward. The first steps toward eventual carbon pricing here may take the form of carbon tariffs, a controversial proposal to tax foreign imports based on their carbon content, even in the absence of a domestic carbon price. Danny Richter, co-director of Pricing Carbon Initiative, calls such border-first policies "fourth generation" carbon prices. Meanwhile, as the implementation date for the EU's CBAM approaches, it may promote greater interest in U.S. carbon pricing among major U.S. exporters. Carbon pricing may also continue to expand in states such as Washington and New York.

Whatever the political climate, sound empirical findings are essential underpinnings of smart climate activism and effective policy. The professional literature on the impact, efficacy, and public support for carbon pricing is enormous and constantly growing. It is also spread across a bewildering variety of journals in the United States and abroad, posing a challenge even for experts to follow. Since 2019 I have located and read hundreds of scholarly articles and working papers to stay abreast of the latest findings. I have synthesized much of this high-

quality research in a series of whitepapers for Citizens' Climate Lobby (CCL) that explore the impact of carbon pricing on greenhouse gas emissions, transportation, innovation, and policy formation (see below).

I have also reviewed and discussed this ever-growing literature in a series of posts on CCL member forums since 2022. This book, revised to incorporate the latest studies through 2024, compiles edited versions of about fifty of my posts related to carbon pricing in all its ramifications. I hope that by disseminating these short essays more widely, members of the lay public and policy makers alike will better appreciate the remarkable progress made by social scientists and public policy scholars in understanding the impact of carbon pricing, its relation to other climate policies, and the challenges of winning public support. To facilitate further study, I have included selected journal or book references at the end of most posts in addition to the many other sources identified through hyperlinks in the text.

Source:

Bistline, John, Kimberly Clausing, Neil Mehrotra, Jim Stock, and Catherine Wolfram, "Climate Policy Reform Options in 2025," National Bureau of Economic Research Working Paper 32168.

Biographical note

Jonathan Marshall works with Citizens' Climate Lobby to promote national (and global) policies to prevent further climate disruption. He served as the organization's Economics Research Coordinator and co-founded its Economics Policy Network. During two previous decades as an award-winning journalist, he spent eight years as Economics Editor of the *San Francisco Chronicle*. He also has relevant experience in industry as a communications director at the largest U.S. power contractor and largest combined gas and electric utility. He has published widely on carbon pricing in the *New York Times*, *Boston Globe* (with climate scientist James Hansen), *San Jose Mercury News*, *Reason* magazine, and other publications.

Selected CCL whitepapers

- **Building Support for Carbon Pricing: A Research Guide** (2024)
- **How Carbon Taxes Induce and Accelerate Clean Innovation** (2022)
- **How Carbon Taxes Reduce CO2 Emissions in Transportation** (2022)
- **The Case Against (Some) Carbon Tax Critics** (2021)
- **How Carbon Fee & Dividend Can Serve Economic & Environmental Justice** (2021)
- **Carbon Taxes Can Do the Job: International Evidence** (2019)

1. Why We Need Carbon Pricing (More than Ever)

Why We Still Need a National Carbon Fee

September 2022 (CCL blog)

The historic Inflation Reduction Act (IRA), which will deliver more than $400 billion in climate spending over a decade, is easily the most powerful climate policy ever enacted in the United States. Coming on top of significant climate-related provisions in the Infrastructure Investment and Jobs Act and the CHIPS and Science Act, America is finally taking the global crisis seriously.

But most climate experts probably agree with CCL Executive Director Madeleine Para, who said, "We're eager to build on today's big step forward and continue to work for even more, and even better, climate action in the future."

The reason should be obvious. Although all this climate legislation may cut U.S. greenhouse gas emissions 40 percent (relative to 2005) by 2030, that's still well short of our national commitment of a 50 percent reduction. If we want any hope of keeping global warming under 2°C, moreover, we (and other countries) will need to get all the way to net zero by 2050, a far bigger lift.

Just spending more money to subsidize renewable energy, electric vehicles, and other clean technologies won't do the job, for several reasons:

- Simple budget math works against us. As the size of the clean sector grows, the cost of subsidies will grow in tandem, dwarfing even the huge numbers seen to date. Finding that money without major tax increases or ballooning the national debt will be a mathematical impossibility.
- The law of diminishing returns also works against us. Subsidized renewable energy will indeed drive out more expensive fossil fuels, like Canadian tar sands and much coal, but only up to a point. There are plenty of cheap oil and gas reserves still around. More important, the huge installed base of fossil fuel infrastructure is a sunk cost whose value can be written down to zero to stay competitive for years to come.
- Cost-effectiveness is also an issue: subsidies are often wasted on people who would have bought electric vehicles or invested in wind farms even without them. Worse yet, they can create political coalitions that demand subsidies in perpetuity, long after they are economically justified.

Going forward we'll need new approaches, above all a national tax or fee on greenhouse gas pollution. A technology-neutral carbon fee would work with clean energy subsidies and

regulations to rapidly accelerate the phase-out of fossil fuel emissions. A carbon fee could take effect quickly and cover most sectors of the economy in one fell swoop. Instead of costing the government billions of dollars, it would raise revenue that can be used to soften impacts on households, invest in green programs, or reduce the deficit. These are just a few of the reasons why more than 3,600 U.S. economists declared, "A carbon tax offers the most cost-effective lever to reduce carbon emissions at the scale and speed that is necessary."

How subsidies could pave the way for carbon fees

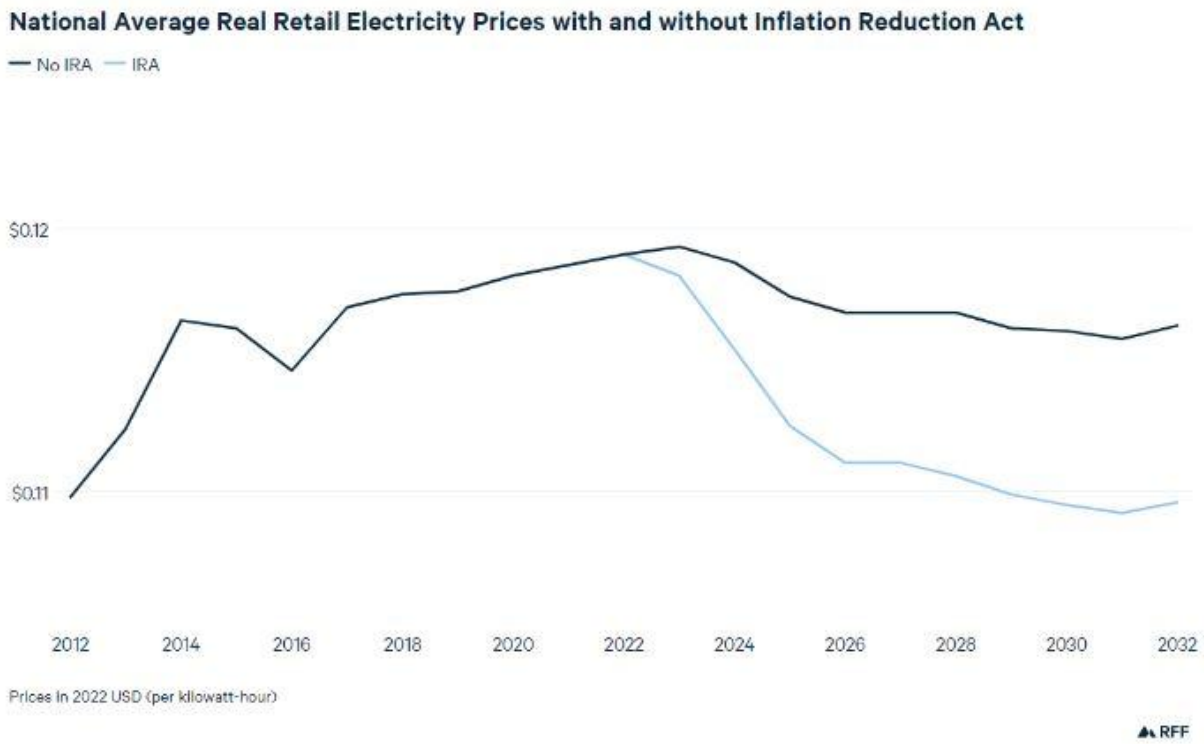
Although Congress missed (by as little as one vote in the Senate) the opportunity to include a carbon fee in the reconciliation package, the IRA's climate provisions may well pave the way for carbon pricing in the not-too-distant future. That's the logical conclusion one can draw from policy experts who argue that the best way to build public support for a carbon tax is through "policy sequencing": starting with the carrots before getting to the sticks.

In a 2015 article in the prestigious journal *Nature*, Environmental Defense Fund's lead economist Gernot Wagner praised carbon pricing but deplored its limited adoption. He called for well-conceived subsidies akin to those in the IRA to create the right political environment.

"The current inadequacy of carbon pricing stems from a catch-22," he wrote. "Policymakers are more likely to price carbon appropriately if it is cheaper to move onto a low-carbon path. But reducing the cost of renewable energies requires investment, and thus a carbon price. In our view, the best hope of ending this logjam rests with tuning policies to drive down the cost of renewable power sources even further and faster than in the past five years."

Two years later, in *Nature Energy*, Wagner and two colleagues reviewed the successful history of carbon pricing in the European Union and California and observed that "policymakers initially supplied benefits to clean-energy constituencies before imposing costs on polluters." They concluded that "lower mitigation costs may reduce the opposition to carbon policy from energy consumers such as households and energy-intensive manufacturers."

Past subsidies for wind and solar energy and batteries have indeed created huge economies of scale in production along with leaps in technology, putting these clean technologies in reach of consumers with little or no financial sacrifice. The IRA promises to extend the popular honeymoon with clean technologies. At a time when households are straining to cope with soaring fossil fuel prices, Resources for the Future estimates that retail costs of electricity will decline about six percent over the next decade, "saving electricity consumers $209-278 billion." That's about $200 a year per household.



Carbon taxes magnify the effect of subsidies

The other good news is that a carbon tax would magnify the effect of the IRA's subsidies, accelerating shifts in consumer demand and business production methods to favor low-carbon goods and services. We already have evidence of this proposition from several forecasts related to President Biden's original Build Back Better (BBB) bill.

Using Energy Innovation's respected model, the Committee for a Responsible Federal Government concluded in 2022 that the climate provisions of BBB would cut emissions 34 percent by 2030 relative to 2005, but the addition of a $40 carbon tax would slash emissions all the way to 44 percent, much closer to America's Paris commitment. The organization applauded the fact that such a carbon tax would raise $1,550 billion in new revenue over 10 years, rather than adding to the national debt.

	Reduction in Emissions in 2030 Relative to 2005
Business As Usual	-20%
Build Back Better Climate Provisions	-34%
$20/ton carbon tax (1 percent growth)	-31%
$40/ton carbon tax (5 percent growth)	-37%
Build Back Better + $20/ton carbon tax	-40%
Build Back Better + $40/ton carbon tax	-44%
U.S. Paris Agreement NDC	-50% to -52%

Source: Energy Innovation

Source: Committee for a Responsible Federal Government

Confirming this general story with a different model, Resources for the Future reported in 2021 that a rising carbon tax, reaching $50 per ton by 2030, would cut emissions more than 13 percentage points beyond the impacts of IRA-type subsidies for renewable energy, clean vehicles and the like. Such cuts would readily meet the Paris target.

In the electric power sector, RFF projected that an all-subsidy approach would cut cumulative emissions of CO2 by 3.8 billion metric tons of CO2 from 2022-31. A modest carbon fee, on its own, would cut cumulative emissions by 5.5 billion metric tons. The two together, however, achieved cumulative reductions of 7.2 billion tons—a big win for decarbonization.

Going forward, Congress should heed the Rhodium Group's informed observation last year about what policies could take the United States closer to the net-zero goal line after the enactment of clean energy subsidies:

"A carbon price, applied to key sectors or across the entire economy, has been seen as the most efficient and straight-forward way to tackle climate change. A carbon price can amplify the impact of clean energy incentives included in our joint action scenario and sends a long-term signal for investors to shift towards a net-zero economy."

Or as the World Resources Institute declared last year, "We need all measures – everything in the [infrastructure bill], everything in the reconciliation package *and* carbon pricing. We can't accept anything less than enough."

Sources:

Gernot Wagner et al., "Push renewables to spur carbon pricing," *Nature*, 525 (September 3, 2015), 27-29

Jonas Meckling, Thomas Sterner, and Gernot Wagner, "Policy sequencing toward decarbonization," *Nature Energy*, 2 (2017), 918-922.

Nicholas Roy et al., "Cost Analysis and Emissions Projections under Power Sector Proposals in Reconciliation," Resources for the Future Issue Brief 21-15, October 2021.

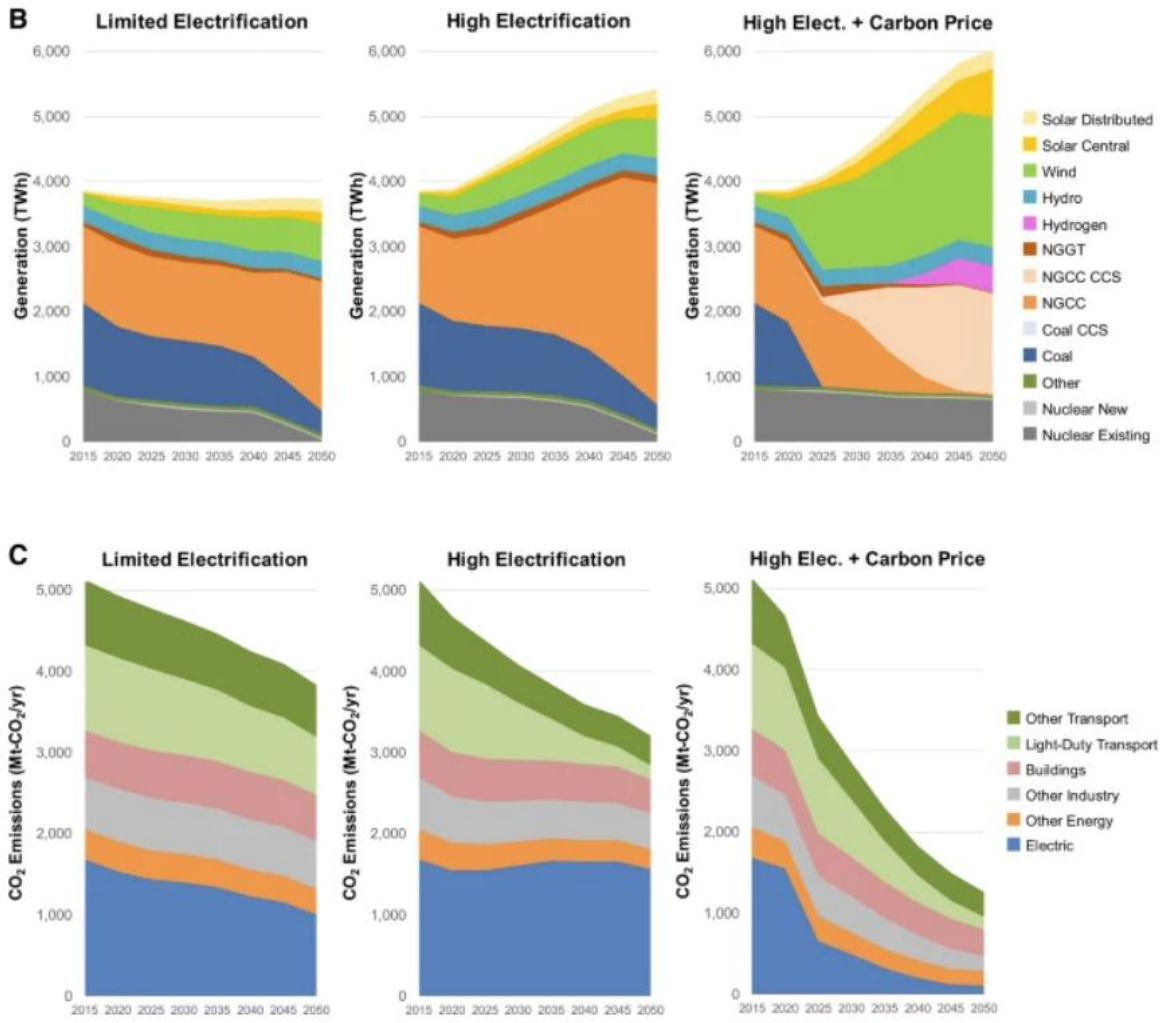
Nicholas Roy et al., "Retail Electricity Rates under the Inflation Reduction Act of 2022," Resources for the Future Issue Brief, August 3, 2022.

New Study Confirms Why We Still Need a Carbon Price

November 2022

If you have any doubts about why we still need carbon pricing to get the United States to the net-zero finish line by 2050, check out a new study published in *Nature Communications*. Titled "Economy-wide evaluation of CO2 and air quality impacts of electrification in the United States," it combines unusually sophisticated models of U.S. energy systems and air quality to demonstrate that a rising carbon fee would accelerate both clean generation and widespread electrification of transportation and buildings, resulting in "substantially lower CO_2 and improve(d) air quality."

The paper evaluates three alternate scenarios. One, which may have been rendered moot by the Inflation Reduction Act (IRA), assumes slow adoption of electric vehicles and no growth in building electrification. A second "high electrification" scenario, which strikes me as a



reasonable post-IRA baseline, assumes faster adoption of EVs and heat pumps but no carbon price. A third assumes a national carbon price starting in 2025 at a little above $50/tCO2 and growing 7% annually to reach $271/tCO2 by 2050.

The impact of the added carbon fee is striking: "coal is phased out decades earlier; most natural gas is equipped with carbon capture and storage (CCS) or is co-combusted with hydrogen; nuclear remains in the mix; and solar and wind see much larger increases."

With a carbon price, CO2 emissions plummet much faster. Without a carbon price, the goal of net zero remains a distant aspiration.

The study also indicates that even current policies to accelerate electrification will greatly improve air quality (ozone and fine particulates), but "these benefits are amplified by carbon pricing policy." The impact of carbon pricing on air quality will be "most evident in the Midwest and eastern Texas" by 2035, it adds.

Source:

John Bistline et al., "Economy-wide evaluation of CO2 and air quality impacts of electrification in the United States," *Nature Communications*, 13 (2022).

What's Next After the IRA? Carbon Pricing!

August 2023

A major assessment of the IRA delivered at a Brookings Institution conference this spring by three leading energy economists gives the law high marks for accelerating new clean technologies and lowering future greenhouse gas emissions. Those reductions will come at a very high cost (roughly a trillion dollars), but still well below the social cost of the CO_2 that it avoids.

But the paper, titled "Economic Implications of the Climate Provisions of the Inflation Reduction Act," also reminds us why a carbon tax has become more important than ever to achieve our clean-economy goals without breaking the bank. It estimates that *a carbon tax would have cost the U.S. economy only one-seventh as the IRA will to achieve its projected emissions reductions in the electric power sector by 2030*.

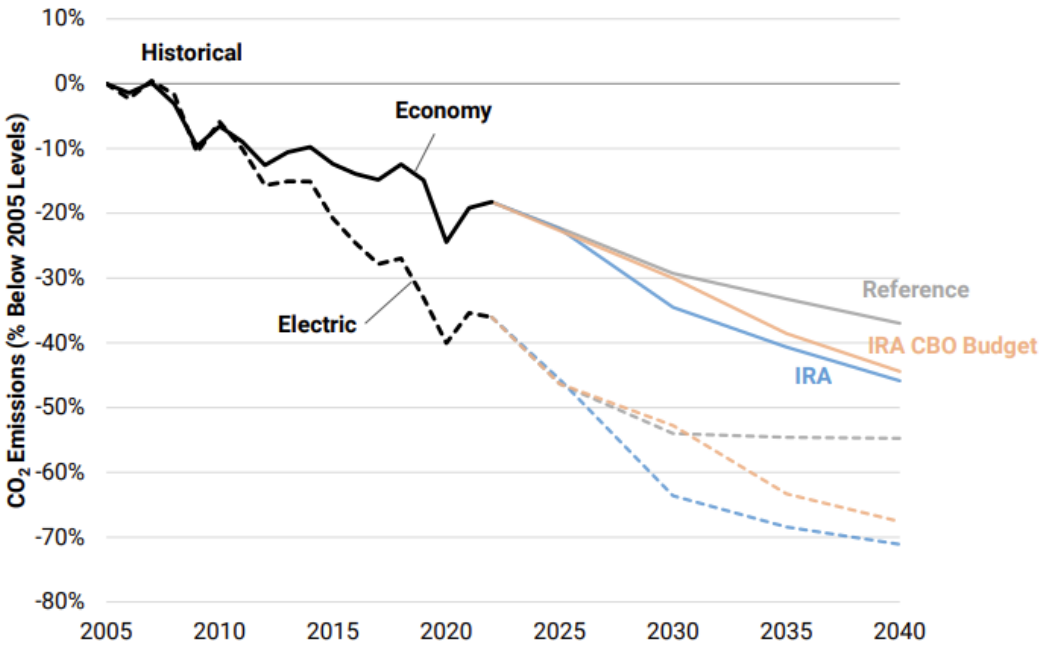
Here are a few apt quotes from the report:

- "Relative to a carbon tax, subsidies encourage electricity consumption and discourage conservation. If household and industrial demand for electricity is sensitive to price, a carbon tax would have a relatively large effect on electricity consumed and hence emissions. By contrast, a subsidy policy – by encouraging electricity consumption – would partially undo the switch from fossil to clean energy by raising overall electricity consumption."

- “A single clean energy subsidy does not reflect the fact that the benefits of zero carbon power sources will vary depending on which unsubsidized energy resources they displace. . . Under IRA, clean energy that displaces zero-carbon energy such as hydropower is subsidized at the same rate as clean energy that displaces the dirtiest resources.”
- “Other provisions of IRA subsidize the energy-using or energy-producing asset, irrespective of how much it is operated. . . Similarly, the electric vehicle tax credits subsidize vehicle purchases without regard to how much they are driven. Electric vehicles that are used as second cars and driven less will offset fewer emissions than vehicles that replace a household’s only car.”
- “Overall, a shortcoming of fixed tax credit rates for supply- and demand-side resources is that they are relatively inflexible as technology and market conditions change. Carbon pricing enables households and businesses to select their preferred approaches to lower emissions, which can help to reduce costs and account for other welfare-relevant considerations that vary across individuals and firms. Carbon pricing also can enable coordination across sectors and geographies.”
- “One important difference is that pricing carbon, depending on how it is implemented, could generate revenue for the government. These revenues could be used to offset other distortionary taxes, address equity concerns, or be directed toward other policy objectives. A subsidy-based approach costs the government the subsidy amounts and imposes the marginal cost of raising government funds on the economy.”
- “One argument against carbon taxes is that these taxes adversely impact poor households . . . So long as absolute energy consumption is increasing in household income, a carbon tax distributed as lump sum dividend provides poor households sufficient resources to both maintain their pre-tax energy consumption and increase non-energy consumption.”

But here’s the key caveat that carbon pricing advocates must keep working hard to overcome through education of the public and legislators:

- “Although carbon pricing approaches can be efficient, effective, and equitable, their strengths can create political liabilities by raising costs of energy. Many Americans support government action to address climate change, but willingness-to-pay may be low. In contrast, tax credits can lower energy prices and hide policy costs, which may be one reason why subsidies tend to poll better in the U.S. relative to carbon pricing.”



Source:

John Bistline, et al., "Economic Implications of the Climate Provisions of the Inflation Reduction Act," Brookings Papers on Economic Activity, BPEA Conference Drafts, March 2023.

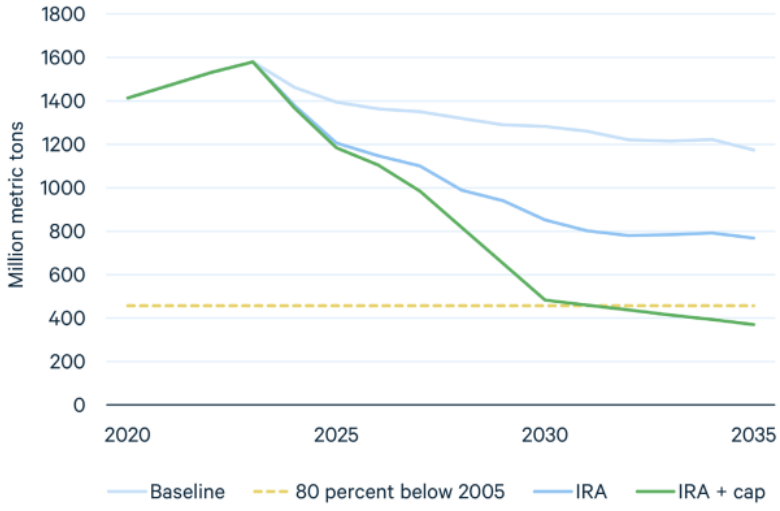
How a National Carbon Price Would Supercharge the IRA

November 2023

A new working paper issued by Resources for the Future is the first I've seen to explicitly model the impact of carbon pricing on top of the IRA's huge subsidies for clean energy. It deals only with the U.S. electricity sector, where the Biden administration set a goal of cutting emissions 80% by 2030 (also known as "80x30"). A true national price on carbon would have greater impacts than the paper models by covering the entire economy.

Thanks to the IRA's many incentives for clean energy, the study concludes, even a relatively low carbon price of just $28 per ton in the electricity sector would achieve the 80x30 goal, setting the stage for clean electrification of the broader economy. That amounts to a huge reduction of nearly 400 million metric tons of CO2 relative to the IRA alone by 2030.

Figure 1. Electricity Sector Carbon Emissions

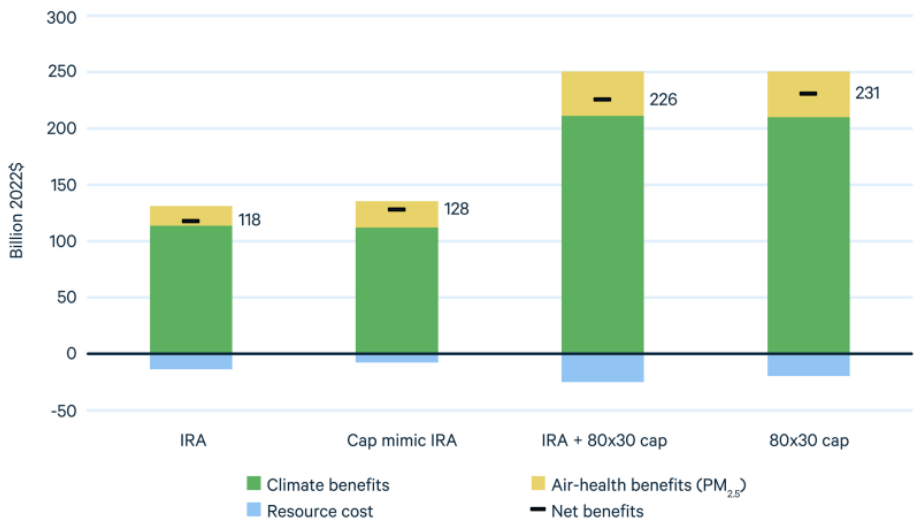


Thanks also to the impact of IRA subsidies, retail electricity prices would sink 3.4 percent below baseline levels by 2030 even with carbon pricing—a win for consumers and for the political viability of climate mitigation efforts. Of course, that benefit comes at the expense of many billions of dollars in fiscal costs to the federal government to pay for all those subsidies. Revenue from a modest add-on carbon price, however, would bring those costs down by $7 billion a year in 2030.

Achieving 80 percent emissions reductions in the power sector through an additional carbon fee would nearly double the climate and air pollution-related health benefits of the IRA, the paper also finds. Those net benefits would jump from $118 billion to $226 billion.

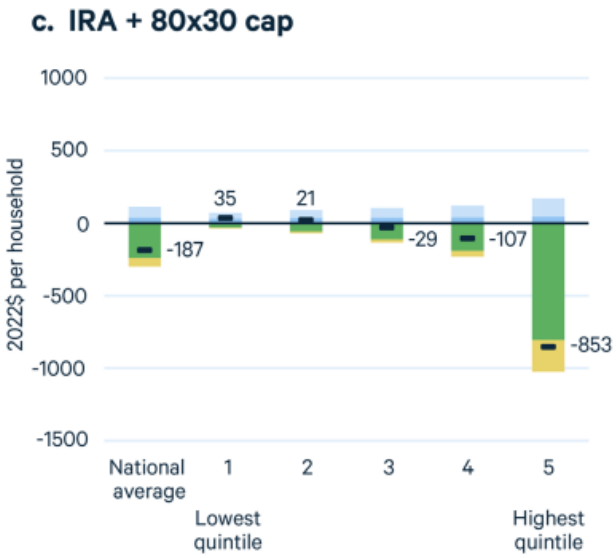
There's more good news: the IRA + carbon price has a small but welcome positive financial impact on the two lowest-income quintiles of American households, with most of the burden falling on the highest-income quintile. That's due in significant measure to the projected drop in prices for electricity, consumption of which takes a bigger share of income from poorer households.

Figure 5. Net Social Costs and Benefits



I fault Resources for the Future for having too narrow a political vision for the future of carbon pricing in the United States, but I welcome this new economic analysis. It should help make the case for an efficient economy-wide carbon price coupled with a socially just cash-back dividend, as embodied in the Energy Innovation Act.

Source:
Maya Domeshek, et al., "Leveraging the IRA to Achieve 80x30 in the US Electricity Sector," Resources for the Future, Working Paper 23-42, November 2023.



New Study Highlights Impact of a Post-IRA Carbon Tax

February 2024

New research confirms that the most effective new climate policy for the United States—and the only one that will get us within reach of our Paris commitment to slash CO2 emissions in half by 2030—is a national carbon fee.

A new working paper available from the National Bureau of Economic Research, "Climate Policy Reform Options in 2025," models the impact of various policy options on emissions, fiscal costs, and household energy expenditures.

The economists conclude that tougher EPA emissions rules would help cut CO2 output 49% by 2035, relative to 2005. Expanding the IRA's tax credits for clean energy or implementing a clean electricity standard would drive emissions down slightly faster.

But a modest carbon fee would slash emissions 62 percent by 2035, putting the United States on a credible path to net zero emissions by 2050. It would also do so at much lower cost per ton of CO2 than alternative policies, reflecting its efficient promotion of least-cost solutions. A higher carbon fee, still well within the range already implemented by many other countries, would drive emissions down 66%.

Last but not least, as should be obvious, carbon fees produce a huge boon for the Treasury, especially relative to IRA expansion, which would balloon an already huge budget deficit.

Table S1: Summary of policy impacts across sensitivities.

Scenario	2035 Economy CO_2 (Decline from 2005)	Fiscal Costs to 2035 ($ billion)	Revenue from Carbon Fee to 2035 ($ billion)
4-IRAexp	51%	$2,100	$0
IRAexpH	53%	$3,390	$0
5-Fee	62%	$2,010	$590
FeeH	66%	$2,830	$2,010

Notes: Economy CO_2 includes energy and industrial process CO_2 only (not land sink or non-CO_2 GHGs). Cumulative fiscal costs and revenues from carbon fee revenues over ten-year budget window are shown in nominal terms. Costs do not include $121 billion in direct spending through the IRA.

Scenarios:

• IRAexp: Expands IRA's power sector credits by 50% beginning in 2026.

• IRAexpH: Expands IRA's power sector credits by 100% beginning in 2026.

• Fee: carbon fee starting at $15/t-CO2 in 2027 and rising to $65/t-CO2 by 2035.

• FeeH: carbon fee starting at $64/t-CO2 in 2026 and rising 6% annually plus inflation.

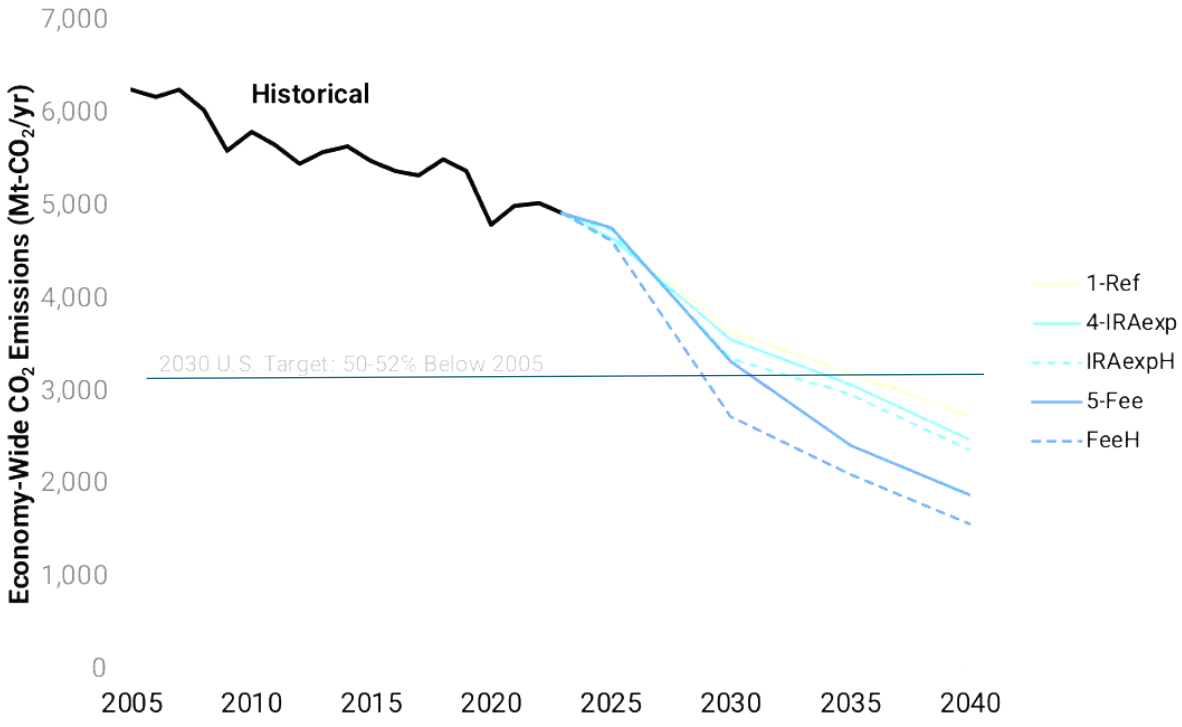


TABLE 2

Summary of impacts across climate policy scenarios

Scenario	2035 economy CO_2 (decline from 2005)	Average abatement cost ($2023/t-$CO_2$)	2035 household energy ($2023/yr)
Current law; proposed emissions rules	49%	$43	$3,770
No new emissions rules	42%	$69	$3,790
Repeal IRA; no new emissions rules	36%	N/A	$3,900
Expand IRA	51%	$50	$3,730
Carbon fee	62%	$25	$3,800
Clean electricity standard	52%	$59	$3,730
Carbon fee; partial IRA repeal	57%	$18	$3,930

Source: Bistline et al. 2024.

Note: Average abatement costs and household energy expenditures are shown in 2023 dollars and abatement costs are relative to scenario 3 ("Repeal IRA; no new emissions rules.")

THE HAMILTON PROJECT
BROOKINGS

Economists tell us "there's no such thing as a free lunch," and they're right. But carbon fees, with their dramatic impact on emissions and big fiscal benefits, come about as close as you'll ever see in the real world.

TABLE 3

Anticipated budgetary scores of proposed legislation to enact scenarios

Scenario	Estimate of budget score
Current law; proposed emissions rules	N/A
No new emissions rules	N/A
Repeal IRA; no new emissions rules	$1,500
Expand IRA	−$530
Carbon fee	$590
Clean electricity standard	−$230
Carbon fee; partial IRA repeal	$1,390

Source: Bistline et al. 2024.

Note: These estimates cover cumulative impacts across the 10-year budget window (in nominal dollars), assuming a baseline of current law. In scenario seven (i.e., Carbon fee; partial IRA repeal), the total includes fiscal savings from a partial repeal of IRA. Negative numbers indicate an increase in the federal budget debt.

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Sources:

Bistline, John, Kimberly Clausing, Neil Mehrotra, Jim Stock, and Catherine Wolfram. 2024. "Climate Policy Reform Options in 2025." NBER Working Paper 32168.

Climate tax policy reform options in 2025 - The Hamilton Project

Central Banks Point to Carbon Pricing for Economic Relief

March 2023

Earlier this month, Treasury Secretary Janet Yellen highlighted the urgent need for major financial regulators to "understand and mitigate the risks that climate change poses to U.S. financial stability." As climate change intensifies, she said, "natural disasters and warming temperatures can lead to declines in asset values that could cascade through the financial system. And a delayed and disorderly transition to a net-zero economy can lead to shocks to the financial system as well."

Yellen is in good company. Around the world, 116 central banks and supervisors have joined the Network for Greening the Financial System (NGFS) to support "the development of climate– and environment–related risk management in the financial sector and mobilizing mainstream finance to support the transition toward a sustainable economy."

Together with a wide range of academic researchers, NGFS published a detailed set of climate scenarios last fall to shed further light on those financial risks. It's a good resource for anyone interested in climate impacts, forecasts, and even carbon pricing.

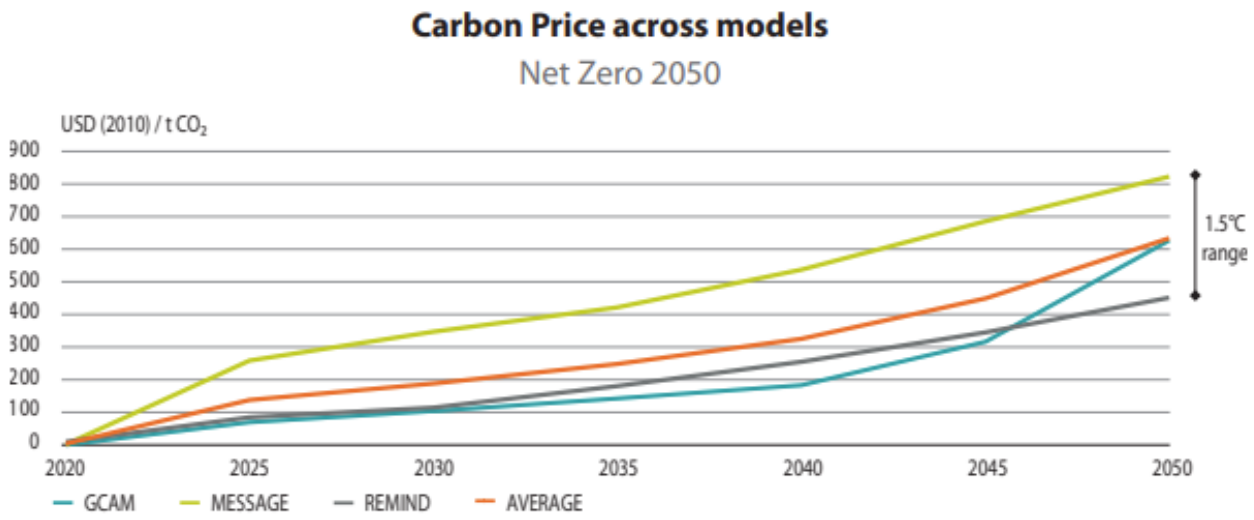
One sobering conclusion from its modeling is that if every country follows through on its emissions commitments under the Paris Agreement, global temperatures will still increase about 2.6°C by 2050. On the economic front, global GDP would fall about 7% to 13% depending on the model. In contrast, reaching net-zero emissions by 2050 would hold GDP losses to 2-5%.

Most interesting, it finds that a global average carbon price of about $200/ton of CO2 (in constant 2010 dollars) reached over the next decade would help drive the world toward net zero by 2050 and hold warming to about 1.5°C (a target the Intergovernmental Panel on Climate Change says may soon be out of reach).

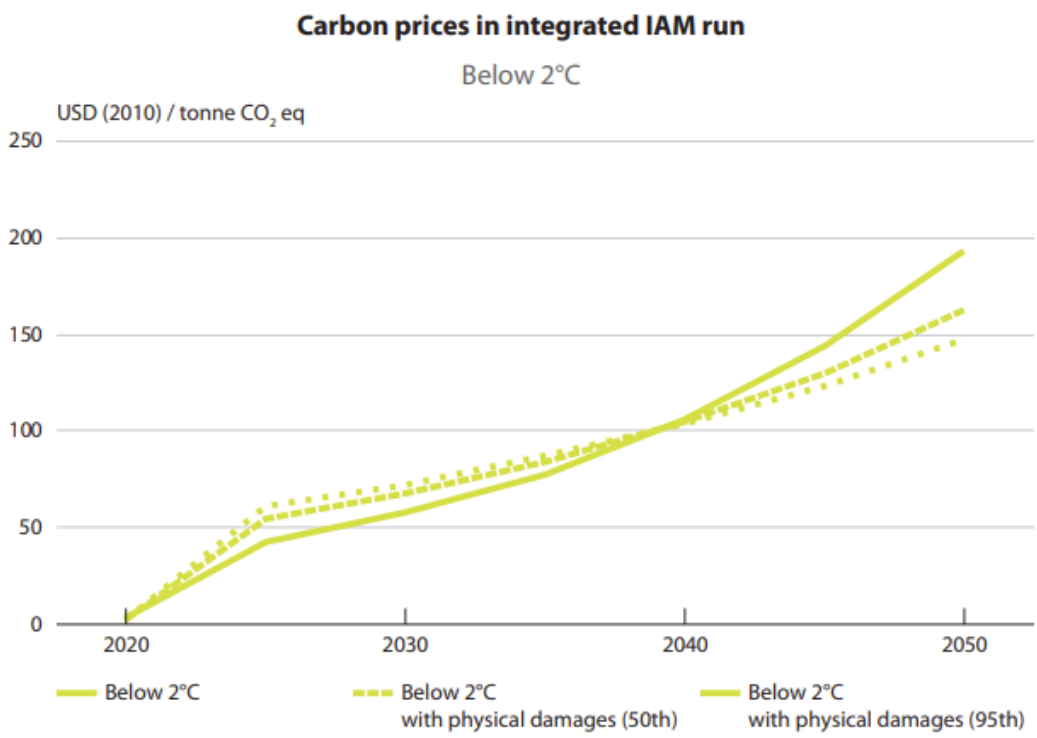
Getting global cooperation on such a high number is a huge stretch but far from impossible. It's a lot easier than dealing with the chaos and misery that could ensue from allowing warming to continue with little abatement.

A 2021 report by NGFS provided useful carbon tax curves for a 2°C warming scenario. With carbon prices well under $100/ton—admittedly, several times more than the current world average—this warming goal looks far more achievable.

Whatever numbers you pick, it's hard to argue with the report's conclusions that "immediate coordinated transition will . . . be less costly than inaction or disorderly transition in the long run" and that business as usual "will lead to the strongest negative impacts on GDP." The bottom line, as we've long known, is that climate mitigation—and carbon pricing—is an investment in our economy and our future, not a "cost" to be avoided.



Source : IIASA NGFS Climate Scenarios Database.



Source: IIASA NGFS Climate Scenarios Database, REMIND Model with integrated physical risk GDP damages.

Sources:

NGFS, "NGFS Climate Scenarios for Central Banks and Supervisors," June 2021.

NGFS, "NGFS Scenarios for Central Banks and Supervisors," September 2022.

Why Getting U.S. Climate Policy Right Matters So Much for the World

July 2023

If you ask me why I've devoted the past several years of my life to helping promote carbon pricing in the United States, it isn't primarily to bring down *U.S.* greenhouse gas emissions. Instead, my hope is that U.S. leadership will rally the *entire world community* to adopt this powerful, fair, and cost-effective approach to global climate mitigation.

In a recent post, I quoted the simple but often ignored observation of two prominent U.S. energy economists that "the only GHG reduction goal that really matters is the global one." They focused on the importance of programs that promote the spread clean *technologies* from rich countries like the United States to the rest of the world, but it's just as important for climate leaders to spread their successful *policies* to the global community.

One of the most powerful steps in that direction is the European Union's Carbon Border Adjustment Mechanism. By making preferential access to the huge EU market contingent on countries adopting domestic carbon pricing, it has created enormous interest around the world in this policy solution. In other posts I've noted the impact of the EU's policy on carbon pricing initiatives in countries as diverse as Uruguay and Thailand.

More good news on this front comes from a new paper published in *Nature Climate Change* with the apt title, "Global Benefits of the International Diffusion of Carbon Pricing Policies." The authors explain that "Domestic climate policies can show the political feasibility and certain benefits of carbon pricing, and they can create incentives related to trade and diplomacy that can nudge other countries to adopt the same or similar policies. This latter process whereby adoption of a policy in one country increases the policy of adoption in other countries is usually referred to as policy diffusion."

Going beyond traditional anecdotal studies, they conducted a systematic global study of the diffusion of carbon pricing policies from 1988 to 2021. They report "robust and statistically significant evidence showing that the adoption of carbon pricing in one country can explain the subsequent adoption of carbon pricing in other countries."

Thanks to this force-multiplier effect of carbon pricing policies, they further conclude, "for many countries, decreases in emissions as a result of diffusion could be larger than domestic emission reductions." That finding parallels the results of an innovative study by Rhodium Group on technology diffusion, suggesting that the effects of clean tech subsidies in the Inflation Reduction Act could eventually spill over into emissions reductions abroad that are two to three times greater than those in the United States.

Although the *Nature* paper focuses on carbon pricing, evidence suggests that the Biden administration's bold climate initiatives in the Inflation Reduction Act are being emulated

abroad as well. After initially protesting the law's strong buy-American provisions, many U.S. trading partners are moving rapidly to follow the U.S. model:

- In February, the European Commission and its member states began considering a Green Deal Industrial Plan. As two analysts with the Center for Strategic and International Studies commented, "If the long-term impact of the U.S. IRA in Europe is to encourage greater investment and incentives for green technologies, then this will only bring the world to cleaner energy and a more carbon-neutral planet even sooner."
- In May, Japan's parliament passed a $150 billion Green Transformation Act to finance a host of new decarbonization initiatives. (Unlike the United States, however, Japan intends to pay for the program eventually through a carbon pricing mechanism.)
- Meanwhile in Asia, according to *Time* magazine, "India is pursuing a 'Make in India' program to bolster its own domestic clean energy manufacturing."

This spring an analyst at the distinguished Spanish think-tank Real Instituto Elcano addressed the issue of policy diffusion as it pertains to U.S. climate leadership:

> In climate diplomacy, credibility and legitimacy are key. It is difficult to convince others to lower their emissions faster and get to net zero earlier when one is unable to showcase a roadmap on how to get there. While climate change has been a top foreign policy priority for the Biden Administration, a lack of concrete domestic action and continued shortfall in its international climate finance disbursement have limited US climate diplomacy clout in global forums. . . . The IRA partially changes that. It gives the US much-needed credibility in its efforts to encourage others to raise their ambition, makes the US a stronger partner for the EU in global climate negotiations and, if the law lives up to its potential, can have positive spill-over effects for industrial decarbonization around the world and can help put pressure on China, the top global emitter, to step up its game.

His last point highlights what is perhaps the most important message of the *Nature* study. Many U.S. climate skeptics disparage policies to reduce emissions at home because they insist countries like China and India will just keep in pouring carbon dioxide into the atmosphere—an issue that looms large in discussions of U.S. foreign policy. It appears instead that most countries—even China and India—seek to follow international norms. Good policies, in short, beget good policies. Strengthening international cooperation to reinforce that virtuous cycle should remain a central goal of U.S. climate policy.

Source:

Manuel Linsenmeier et al., "Global benefits of the international diffusion of carbon pricing policies," *Nature Climate Change*, 13 (2023), 679-684.

Subsidies or Taxes: The Great Climate Policy Debate

September 2022

Following passage of the Inflation Reduction Act, reporters and pundits remarked on a seemingly powerful irony. In the words of economist and New York Times columnist Paul Krugman, a "huge array of economists agreed that climate change mitigation should take the form of a carbon tax" but the IRA instead "relies almost entirely on subsidies intended to promote clean energy, . . . incentives to buy electric vehicles and make homes more energy efficient."

I call this irony only "seemingly" powerful because this was hardly the first time that legislators dismissed the advice of economists. Indeed, none other than Krugman himself once declared, "I'm kind of sick of being Cassandra," the prophet of Greek mythology who was doomed to be always right and always ignored.

Perhaps the bigger irony is that hardly any journalists have taken the time to explain why economists overwhelmingly agree that carbon fees, not subsidies, offer "the most cost-effective lever to reduce carbon emissions at the scale and speed that is necessary." Going forward, understanding that proposition will be critical if the United States and other nations hope to meet their Paris commitments by 2030 and ultimately reach net-zero emissions.

To be sure, the inefficiency of many subsidies doesn't mean we should do away with them. If we can't muster political support for better policies like carbon fees, subsidies may still be much better than nothing at all. Economists have a term for such approaches: "second-best policies." Like a bird in the hand, they'll do until we can round up the rest of the flock.

Subsidies may even be optimal in some cases. When private markets underproduce social benefits, many economists call for subsidies to encourage more of them, such as R&D or pre-K education. The challenge is to avoid subsidizing special interests that simply claim to benefit the public.

But when private behavior creates social costs, such as the public health costs of tobacco addiction, most economists support imposing a tax to discourage that harm. Sometimes a stick is the most appropriate tool.

Greenhouse gas pollution falls squarely in the second category. Directly taxing the source of the problem, primarily fossil fuels, leverages the full power of market incentives to discourage

them. Subsidies aimed at the same goal, on the other hand, almost always involve compromises:

- Subsidies don't directly target the real problem. For example, taxing fossil fuels raises the cost of all energy, encouraging efficiency and conservation even as it also encourages the substitution of carbon-free energy for fossil fuels. Subsidizing wind and solar, on the other hand, lowers the cost of all energy, discouraging efficiency and conservation. Consumers will buy too much energy and won't cut back on fossil fuels as much as they would with a tax.
- Subsidies usually aren't finely tuned. For example, tax credits for buying electric vehicles don't discriminate between them based on their efficiency. Some of the heavier EV models today require twice as much energy as more efficient models to cover the same distance, yet they get the same subsidy. Given how much fossil power remains on the grid, that's inefficient. Carbon taxes, in contrast, rise directly in proportion to the amount of damage caused by fossil fuels.
- Subsidies can be wasted when regulatory policies accomplish the same task. In the short run, for example, EV subsidies may simply help automakers achieve requirements set by federal fuel economy standards, without reducing overall fleet emissions. Carbon (or fuel) taxes may also overlap in part, but at least they don't cost the public any money.
- Without careful calibration, subsidies often end up putting public tax money into the pockets of more affluent households, which can afford to install solar panels and EV charging outlets in their homes. Two University of California economists determined that the top fifth of households by income received 90% of federal tax credits for EVs in the years 2009-2012. In contrast, carbon fee and dividend policies are highly "progressive" in their economic impact. (To its credit, Congress included means tests on many of the subsidies in the IRA.)
- Finally, subsidies too often end up aiding people who would have done the right thing without financial encouragement. Research shows that *at least* two out of every three people who received federal tax credits for buying an EV several years ago would have bought such vehicles anyway. In many cases, taxpayers spent more than the price of a new car for every *additional* EV sold.

This last problem is sometimes known as the "additionality" or "free rider" problem. It's been the subject of intense research since a famous 1992 study by two MIT energy economists estimated the social benefits of energy efficiency subsidies. The authors cited utility surveys suggesting that up to half of claimed benefits of their efficiency programs were achieved by customers who planned to make the investments anyway and became free riders on those programs.

The authors explained:

> A similar problem arises whenever economic agents are to be paid an incentive to do what they might have otherwise done anyway. This problem is inherent, e.g., in proposals that emitters of CO_2 be allowed to offset those emissions (if they are regulated in the future) by reforestation projects. The cheapest source of reforestation, from the polluter's point of view, will be from timber companies that would have planted the trees anyway. An offset system will thus need some mechanism for distinguishing a 'true' incremental tree from a 'free rider.' Similarly, proposals to reduce pressure on over-harvested fishing stocks sometimes include the idea of paying incentives to boat owners to retire from the business. Such incentives will clearly be most attractive to the marginal producers, i.e., those that would have stopped producing anyway.

Since then, a host of studies have highlighted the problem. A few examples:

- A 2016 study of a Maryland program to subsidize installation of heat pumps found "pervasive" evidence of free riding. More than half of participants simply took advantage of subsidies to replace or upgrade appliances they already deemed "inadequate." In some cases, they bought more efficient but bigger heat pumps, leading to no net reduction in electricity use.
- A 2014 study of federally funded subsidies for efficient refrigerators, clothes washers, and dishwashers found virtually zero effect on average energy use. Up to 12 times as many free riders took advantage of the rebates as people who were actually induced to buy more efficient models. The cost of energy saved ranged up to $1.50 per kilowatt-hour, more than ten times the residential rate for electricity.
- A study of incentives for energy efficient heating systems in Europe uncovered so many free riders that the net cost per metric ton of CO2 reduced by the program often exceeded 500 €/tCO_2—far above the cost of any reasonable carbon tax.
- Better results were found in a 2016 study of a Canadian tax credit program to upgrade home furnaces. Although half the subsidies went to people who would have upgraded anyway, the modest size of the credits kept the cost of the program to between $70 and $110/t CO_2, a much more reasonable figure.
- And as a reminder that research findings often vary, a 2018 study of an Irish building efficiency program found that only 7% of subsidy recipients were free riders. A 2021 study of a similar program in Norway calculated a free-riding rate of just 10%, but also found that most of the subsidies went to high-income households.

If you want to learn more about tax and subsidy policies, check out this nontechnical 2009 article by Gilbert Metcalf, a distinguished economist at Tufts University. A bit more

comprehensive is "A Subsidy Primer" published by the International Institute for Sustainable Development.

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Matthew Collins and John Curtis, "Low rates of free-riding in residential energy efficiency retrofit grants," *ESRI Research Bulletin,* no. 4, 2018.

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Sebastien Houde and Joseph Aldy, "Belt and Suspenders and More: A Look at the Incremental Impact of Energy Efficiency Subsidies," *Resources*, September 25, 2014.

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IMF Report Backs Carbon Pricing Over Subsidies and Regulations

October 2023

With so much attention being paid to implementing the Inflation Reduction Act and addressing obstacles to its success (like permitting delays), I've seen remarkably little discussion of what should come next for U.S. climate policy. A new report from the International Monetary Fund provides strong guidance—and support for ongoing efforts to enact carbon fee-and-cashback policies at the national level.

The IMF's report, *Climate Crossroads: Fiscal Policies in a Warming World*, pulls no punches about the severity of the crisis and the urgency of constructive mitigation policies. "Climate action is an urgent global imperative," it declares. "The time to act is now, with a strong, clear, and concerted mix of policy efforts on the part of governments."

But what should that mix consist of? Of great relevance to U.S. policy makers, the report declares that more IRA-type green subsidies won't achieve our goals.

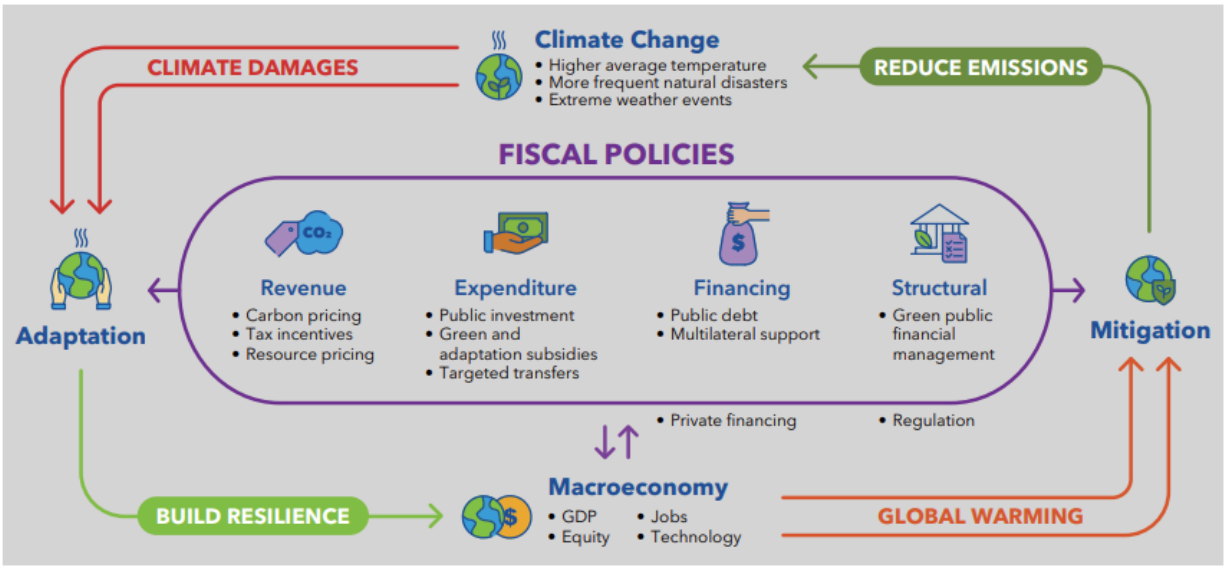
"Relying mostly on spending-based policies to achieve the net-zero-emissions goal will lead to fast-rising debt beyond the currently projected rising path, exacerbating risks to fiscal sustainability," it warns.

Moreover, it observes, "subsidies promote only limited mitigation responses. For example, subsidies for wind and solar generation only favor their use; they do not encourage a broad shift toward sources of less-polluting energy, such as from coal to gas or to other renewables."

Similarly, traditional regulations "promote only narrow behavioral shifts." For example, "requirements regarding shares of electric vehicles in vehicle sales do not promote shifts to more efficient internal combustion engine vehicles. Regulations are also unlikely to generate fiscal revenue and can be costly for firms to comply with, particularly small and medium-sized enterprises."

Instead, the report champions carbon pricing as "the most efficient mitigation instrument" because it steers private sector investment throughout the entire economy toward cleaner and more efficient uses of energy.

Figure 1.2. The Green Transition Brings Close Interactions among Fiscal Policies, Climate, and Macroeconomy



Source: IMF staff compilations.

IMF, "Climate Crossroads," *Fiscal Monitor*, October 2023

“It can also incentivize the private sector to innovate in and adopt new, low-carbon technologies,” the IMF report observes. “Over the short to medium term, carbon pricing can raise substantial revenue, which can be used to finance other mitigation instruments and achieve broader economic and distributional objectives and thereby gain public support. Carbon taxes are relatively easy to administer and can be integrated into existing procedures for collection of fuel taxes and extended to fossil fuels.”

To achieve net zero emissions by 2050, advanced economies like the United States will need carbon prices that rise to about $235 per ton by mid-century, a level fully compatible with the Energy Innovation Act.

The IMF report is too sophisticated to offer just another textbook defense of carbon pricing, however. Despite growing application of carbon pricing abroad, it remains a politically challenging policy. As a result, both carbon pricing coverage and stringency remain far too weak globally to put the world on a trajectory to net zero by 2050.

Moreover, relying only on carbon pricing to squeeze emissions would miss emissions from some sectors, potentially cause some economic dislocations, and run the risk of political backlash (particularly in the absence of cash-back programs to mitigate the financial impact on households).

The IMF team thus concludes that “carbon pricing is necessary but not sufficient to reduce emissions.” It must be accompanied with “a carefully calibrated mix” of other policies “to address distributional concerns and cost-of-living impacts.”

These other policies include two built into the Energy Innovation Act: cash-back programs to mitigate the financial impact on households and border carbon adjustments to mitigate the competitive impacts on energy-intensive industries exposed to international trade.

Other familiar policies include carefully targeted public investments in key infrastructure undersupplied by the market (like high-voltage transmission lines to access renewable energy) and support for clean-tech research and development. To avoid needless costly waste, of course, subsidies and tax incentives “will need to be time bound, transparently presented in budgets under a strong governance framework, and complemented with carbon pricing.” The latter is especially important because carbon tax revenues can help pay for subsidies and prevent fiscal deficits from ballooning.

Finally, advanced economies will need to provide financial support to lower-income countries if they expect the rest of the world to follow their lead in mitigating greenhouse gas emissions.

Source:

IMF, *Climate Crossroads: Fiscal Policies in a Warming World*, October 2023.

Is Joe Manchin Right to Question EV Subsidies?

June 2022

Until a few weeks ago, I never would have taken seriously Senator Manchin's objections to extending federal tax credits for purchases of new electric vehicles. Now, having reviewed a host of economic studies, I think his views at least merit real consideration.

Since 2009 the federal government has provided billions of dollars in tax credits to jump-start the EV industry and curb auto and truck pollution. House Democrats recently proposed increasing the maximum credit from $7,500 to $12,500 as one of many climate provisions in the reconciliation bill. But Manchin, the swing vote in the Senate, shut them down.

"There's a waiting list for EVs right now with the fuel price at $4," the West Virginia Democrat huffed in April. "But they still want us to throw [a] $5,000 or $7,000 or $12,000 credit to buy electric vehicles. It makes no sense to me whatsoever. When we can't produce enough product for the people that want it and we're still going to pay them to take it—it's absolutely ludicrous in my mind."

Before you dismiss his point, consider what Senator Sheldon Whitehouse conceded: "As somebody said, When there's a line out the door of the ice cream store, you don't really need to be subsidizing ice cream. They can't make electric vehicles fast enough. . . The market is really doing a very, very good job of solving the uptake problem."

Still, the current supply shortage—and high gas prices that have supercharged demand for EVs—may not last. If so, shouldn't we put in place stronger subsidies in place to help us meet our Paris climate commitments?

Maybe, but first we should consider some powerful cautionary evidence raised by a host of studies that lay bare the inefficiency of untargeted EV subsidies. Among other problems, subsidies are wasted because most buyers would have bought EVs anyway; subsidies discourage purchases of fuel-efficient cars more than gas-guzzlers; and EVs mostly displace cars that don't get driven much in the first place.

Let's take these one at a time:

1. The whole point of EV tax credits is to drive new sales, not to put money into the pockets of people who would have bought them anyway. Study after study, however, shows that the credits have motivated well under half of EV sales. A 2016 study found that credits increased sales of the Tesla Model S by a mere 14 percent—meaning that taxpayers doled out seven tax credits at a cost of $53,000 for every additional Tesla sold. According to a comprehensive literature survey in the *Annual Review of Resource Economics*, "empirical evidence suggests that roughly two out of every three PEVs [plug-in electric vehicles] purchased would have been purchased regardless of the federal tax credit. . . . This translates into poor cost-

effectiveness, with the cost per additional PEV at $30,000–$35,000, greater than the purchase price of some PEV models." Newer research suggests that estimate may in fact be low.

Even in regions with relatively clean electric generation, such lavish subsidies cost many hundreds of dollars per ton of CO2 avoided. In areas of dirtier generation, like the Midwest and Southeast, EV subsidies get even less bang for the buck. Similar costs of hundreds of dollars per ton afflict EV subsidy programs in Canada, Norway, and Sweden. A lot of low-hanging emissions could be picked for less money.

Source

2. The picture gets even worse when we examine what kind of vehicles EV buyers might otherwise have purchased—in other words, how many emissions do EVs really avoid? The bad news is that comparing emissions attributable to EVs to the emissions of the *average* combustion vehicle overstates the real environmental benefits of EVs by 39 percent, according to a 2021 study in the *Journal of Environmental Economics and Management*. That's because EV buyers have a history of buying relatively fuel-efficient cars "rather than gas-guzzlers," the authors note. One important caveat: their data don't reflect the recent market shift toward larger EVs, which may attract more traditional buyers of SUVs and trucks, like the Ford F-150.

3. EV buyers also tend to drive much less than average—as little as half as much as people in gas-powered cars. Kristin Eberhard at the Niskanan Center complains in a recent study that "electric vehicle subsidies are going to the wrong drivers, and we're paying for it in carbon and cash." Based on a 2021 report by the non-profit Coltura, Eberhard notes that buyers of EVs typically to live in urban areas and burn only a tenth as much gasoline as the 10 percent of "Super-Users" who tool around the countryside in their pickup trucks and burn about a third of all gasoline sold. Finding a way to motivate Super-Users to buy EVs—for example, conditioning subsidies on how much a person usually spends on gasoline—could reduce greenhouse gas emissions and air pollution at far less cost than today's untargeted subsidies.

"If we want to achieve a 50 percent reduction in climate pollution from cars and light-duty trucks by 2030 wholly by switching out gas-burners for electric vehicles," Eberhard notes, "we could get there with just 100 million electric vehicles, if those all go into the hands of Super-Users. But suppose Super-Users are last in line to get EVs. In that case we will need to

effectively replace the entire U.S. fleet by 2030 — rolling out nearly 250 million vehicles in eight years, a Herculean feat given that fewer than 500,000 EVs were sold in the U.S. in 2021."

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New Studies Point to Carbon Tax Benefits in Transportation

January 2023

One of the best pieces of climate news in 2022 was soaring demand for electric vehicles. Their share of new U.S. vehicle sales last year nearly doubled to 5.8%. In China, sales of battery electric vehicles soared 73%, making up almost 19% of all new vehicle sales. World-champion Norway achieved a market share for EVs of more than 79%.

Plenty of studies show that EVs produce fewer emissions of greenhouse gases and local air pollution than traditional gas-powered cars and trucks. But many of them take potentially misleading shortcuts, according to new papers by economists with the University of California at Davis and Resources for the Future.

One of the most important conclusions of these careful new studies is that not all policies to promote EV sales are created equal. The best ones encourage EVs in the process of *discouraging* the sale of gas-guzzling cars. That's one reason why a steadily rising carbon price on fossil fuels remains such an important climate policy tool.

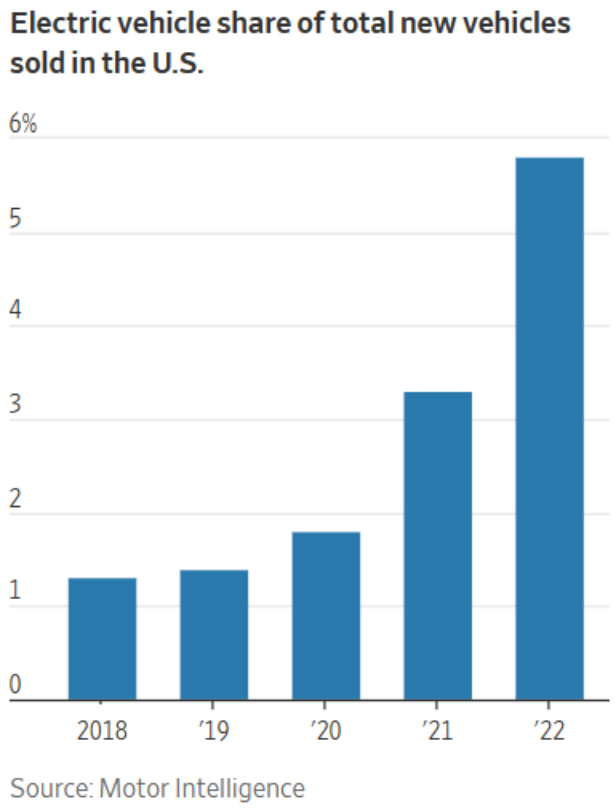
One of the many subtle and difficult questions a serious EV policy analyst must answer is *what kind of cars would be purchased* if government programs don't prompt buyers to go electric. If EV buyers tend to be especially socially conscious and would otherwise buy traditional cars with much higher fuel efficiency than the fleet average, as one 2021 study found, the emissions benefits of EV sales may be greatly overestimated.

In the latest issue of the *Journal of the Association of Environmental and Resource Economists*, Erich Muehlegger and David Rapson at UC Davis make clever use of data from California to show that, in the period 2015-17, buyers of subsidized EVs would otherwise have bought cars

with an average fuel economy of 35 miles per gallon, compared to the overall state average of 22 mpg.

Their disappointing conclusion is that "the actual incremental pollution abatement arising from EVs today is thus substantially smaller than one would predict using the fleet average" fuel economy as a baseline standard. Indeed, failing to account for this fact could overstate the savings in CO2 emissions by 50%.

Graphic: Wall Street Journal



The truth isn't quite as bad as it sounds. Muehlegger and Rapson concede that "as electric vehicles become a larger share of the vehicle fleet, we would expect . . . the fuel economy of the marginal replacement vehicle to move closer to the fleet average." Given that the share of new car and light truck sales represented by zero-emission vehicles has grown in California from 4% in 2017 to nearly 19% in 2022, and that the state's electric grid continues to get cleaner, it's likely that EV sales are having a bigger emissions impact than ever.

Equally important is a brief observation the authors make in conclusion. "For those wishing to maximize environmental benefits of EV adoption, these insights highlight why it might be desirable to pair electric vehicle subsidies with policies to discourage the ownership or encourage the retirement of particularly fuel-inefficient [combustion cars]," they write. For example, "a carbon price . . . would make it more expensive to operate fuel-inefficient vehicles." Or to put it another way, with a higher price on fuel, owners of gas guzzlers would be much more likely to join their eco-conscious neighbors to check out EVs in auto showrooms.

A new paper on the environmental and health benefits of EVs, released earlier this month by Resources for the Future, points to similar conclusions. The RFF authors attempt an equally meticulous but farther-reaching analysis, estimating the dollar benefits of various public policy alternatives for encouraging EV sales. The alternatives include accelerating the drop in battery costs, extending purchase subsidies for new EVs, mandating sales requirements for zero emissions vehicles (ZEVs), and higher gas prices.

	Climate benefit (2020$/vehicle)		Health benefit (2020$/vehicle)	
Scenario	**Electric**	**Plug-in hybrid**	**Electric**	**Plug-in hybrid**
Low battery cost	3,080	1,800	835	488
Extended subsidy	3,810	2,230	687	402
ZEV	13,500	7,890	1,840	1,080
High gas prices	34,400	20,100	3,270	1,910
Combined	16,100	9,390	1,660	969

Average lifetime climate and health benefits, per vehicle. The table reports the net present value of environmental benefits of additional electric vehicles purchased in 2022, if each respective scenario had been in effect by 2022.

Source: Environmental Benefits of Plug-In Vehicles Depend on Public Policy and Market Forces (rff.org)

As you can see from the chart, higher gasoline prices produce the greatest benefits per EV, followed by higher sales requirements for ZEVs.

Their finding relates directly to the point made by the UC Davis economists about the importance of determining what cars people would have purchased otherwise.

In the low battery cost and extended subsidy scenarios, the consumers who buy EVs switch from relatively fuel-efficient gas-powered cars. “In contrast,” the RFF authors note, “high gasoline prices and ZEV standards cause substitution from less efficient gasoline vehicles to [EVs], and the emissions reductions are greater for these scenarios.” That’s because, unlike subsidy programs, ZEV standards and higher gas prices actively penalize the sale and use of gas guzzlers.

Sources:

Joshua Linn et al., “What Are the Climate, Air Pollution, and Health Benefits of Electric Vehicles?” Resources for the Future working paper, January 2023.

Janwei Xing, “What does an electric vehicle replace?” *Journal of Environmental Economics and Management*, 107 (May 2021).

Erich Muehlegger and David Rapson, “Correcting Estimates of Electric Vehicle Emissions Abatement: Implications for Climate Policy,” *Journal of the Association of Environmental and Resource Economists*, 10:1 (March 2024).

Are EV Subsidies Worth the Cost?

October 2024

Most climate activists, myself included, were thrilled by passage of the Inflation Reduction Act (IRA), the most sweeping piece of climate and clean energy legislation in U.S. history. At a projected cost of roughly a trillion dollars, give or take a few hundred billion, the IRA should significantly (if still inadequately) ratchet down U.S. greenhouse gas emissions.

But models of future impacts always need to be tested and refined by empirical studies of actual results, in economics as well as climate science. One of the first major assessments of the real-world impact of IRA tax credits on electric vehicles offers mixed results—and clear messages for how such credits could be made more effective in the future.

Five U.S. economists affiliated with the National Bureau of Economic Research (NBER) issued a working paper earlier this month titled "The Effects of "Buy American": Electric Vehicles and the Inflation Reduction Act." Contrary to the title, the paper addresses a much wider range of issues than trade effects. It provides credible estimates for the effect of subsidies on vehicle purchases and climate effects by evaluating prices and sales as eligibility rules changed under the IRA.

The first piece of good news—which economists have not taken for granted—was that subsidies primarily lowered costs to consumers rather than giving automakers an excuse to raise prices. As intended, this buyer incentive stimulated an increase in sales of about 90,000 EVs per year, mostly at the expense of sales of gasoline vehicles.

Unfortunately, the authors report, about "three-fourths of the IRA EV credits went to taxpayers who would have bought an EV anyway." In effect, then, taxpayers shelled out $32,000 (four credits of $7,500) for each additional EV sold. That figure aligns well with estimates I cited in "Is Joe Manchin Right to Question EV Subsidies?"

Is such a big subsidy worth it? To help decide that question, the authors gauged the climate benefits of lower EV emissions based on a generous global estimate of the "social cost of carbon" at $241 per ton of CO2 emissions. Partially offsetting that benefit are the increased risks of vehicle accidents from heavy EVs and the loss of gasoline tax revenues. On average, they conclude, "the average EV generates $16,000 and the average gasoline vehicle generates $19,000 in lifetime social costs." That's a much narrower gap than I would have assumed, had I not previously reported research on the social costs of oversized EVs.

Although many smaller EVs are climate champions, bigger ones like the Ford F-150 Lightning or the Hummer EV that President Biden touted in January 2023 actually impose greater social costs than many gasoline cars. "Switching from a Prius gasoline vehicle to a Cybertruck, for example, increases climate pollution," the authors note. They conclude, "differentiating

subsidies across EVs"—to favor lighter vehicles—"could have substantially increased policy benefits."

The authors don't address another key issue: inequities in the distribution of tax benefits. Another paper issued this month by University of California economists Severin Borenstein and Lucas Davis, using information from tax returns, calculates that since 2006 the top fifth of households by income have received more than 80% of tax credits for EV. This is a particularly striking example of the "reverse Robin Hood" effect—taking money from middle-income taxpayers to subsidize the rich.

None of these findings make the IRA bad law, but they certainly suggest it could be improved. More targeted subsidies (for lighter vehicles and lower-income households) would help, but there's a better and far cheaper way to promote clean vehicles, as MIT economist Catherine Wolfram told a New York Times reporter after reviewing the main NBER paper discussed above.

"Frankly, I think it highlights all the difficulties associated with subsidy-based policies that aren't faced if you have something like a carbon price," she said.

Sources:

Hunt Alcott, et al., "The Effects of 'Buy American': Electric Vehicles and the Inflation Reduction Act," Haas Energy Institute WP 350R, November 2024.

Severin Borenstein and Lucas Davis, "The Distributional Effects of U.S. Tax Credits for Heat Pumps, Solar Panels, and Electric Vehicles," Haas Energy Institute WP 348R, October 2024.

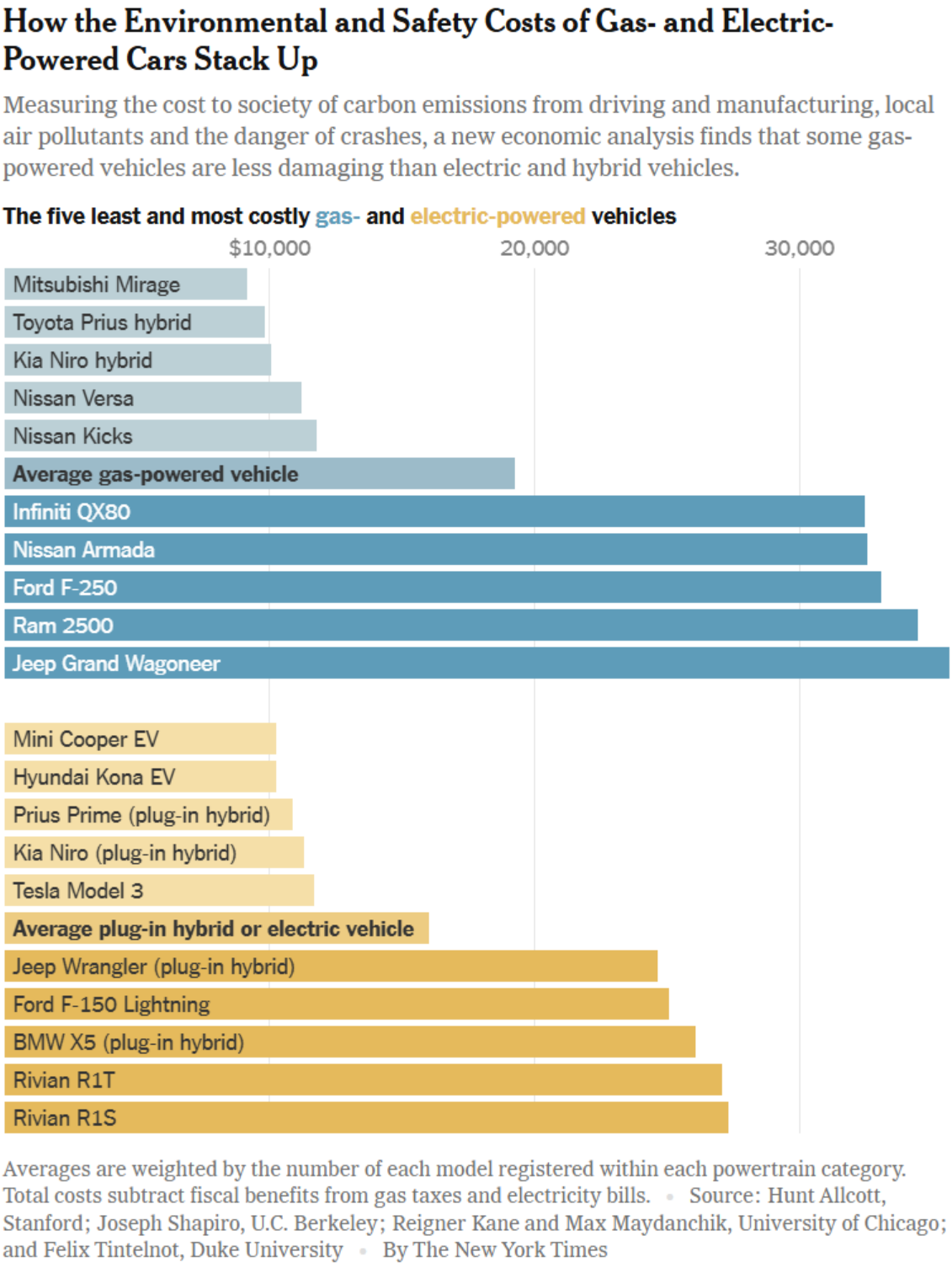


Chart: New York Times

For a more thorough discussion of the superiority of carbon pricing over EV subsidies, see my CCL whitepaper, "How Carbon Taxes Reduce CO2 Emissions in Transportation."

Memo to Biden: Support EVs with a Carbon Fee and Dividend

June 2022

To: President Biden
From: CCL Board of Economic Advisers
Re: How to promote EVs (and decarbonize transportation)

You've set a worthy national goal of ensuring that half of all passenger vehicles sold in 2030 have zero tailpipe emissions. The bipartisan infrastructure bill you championed will help get us there by funding thousands of new charging stations. However, your attempt to raise tax credits for buyers of new EVs has hit not one but two brick walls: opposition from Senator Manchin, and the specter of hundreds of billions of dollars in unfunded new costs to the Treasury.

Fortunately, your allies at Citizens' Climate Lobby have a better solution: a rising carbon fee to bring effective taxes on gasoline and diesel fuels more in line with those of other developed nations and the true social costs of pollution. Unlike the current temporary spike in prices for gasoline driven by wartime disruption of world oil markets, a modest but rising carbon tax *coupled with a dividend* would cause little hardship while still sending a strong signal to drivers to steer toward lower-carbon transportation alternatives.

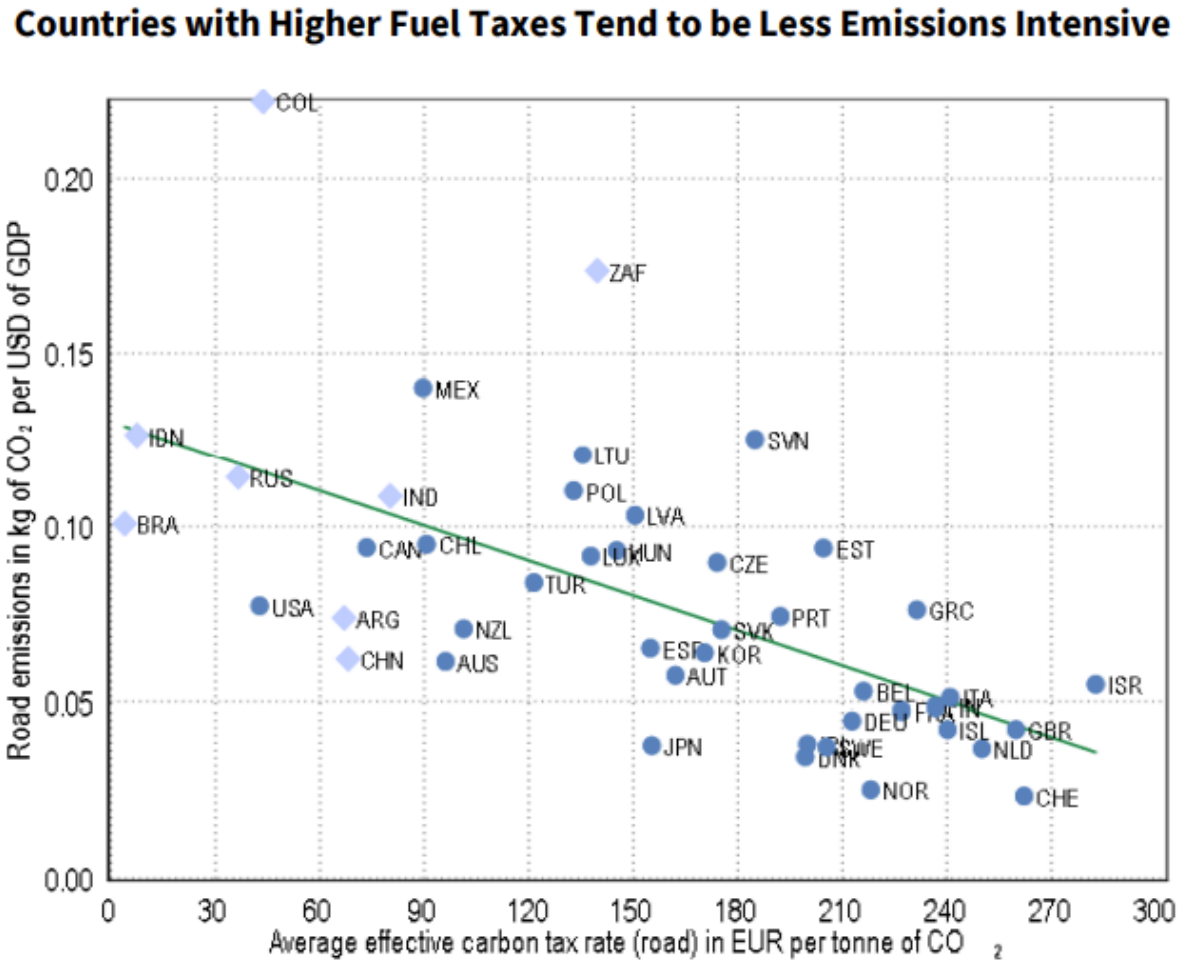
You don't have to take our word for it. "As a tool to change behavior, a non-refundable credit is a clear second-choice to a carbon tax," declared Howard Gleckman at the Urban Institute's Tax Policy Center. University of California economist James Bushnell commented, "current policies like the $7,500 federal tax credit treat low-mileage and high-mileage drivers uniformly. Is there some better policy that would target EVs to high-mileage drivers? Why, yes, there is. It is called a gasoline tax. Making gasoline more expensive would incentivize EVs for all drivers, but the biggest incentive would be for people who drive a lot of miles."

Policies like EV subsidies and fuel economy standards touch only the new vehicle market and do so inefficiently. In contrast, fuel and carbon taxes immediately affect the behavior of *all* drivers on *multiple* fronts. They encourage owners of traditional cars and trucks to

- drive fewer discretionary miles (bundling errands, carpooling, and so forth);
- conserve fuel while driving (sticking to the speed limit can save as much as 20% of fuel on the highway); and
- leave their truck in the garage and take a more fuel-efficient vehicle or alternative means of transportation (bus, train, bicycle, foot).

Even more important in the long run, higher fuel prices encourage car owners to buy more efficient vehicles (used as well as new) and even to avoid long commutes by moving closer to work or transit stations.

Real-world evidence bears out these intuitions. In a recent CCL research paper, "How Carbon Taxes Reduce CO2 Emissions in Transportation," I cite numerous economic studies confirming that fuel demand in the United States and Europe is surprisingly sensitive to tax levels. I quote one German economist's finding that "[high] fuel taxes are the single most powerful climate policy instrument implemented to date. . . . Had the whole OECD instead had fuel (gasoline and diesel) prices like the US then consumption would be . . . 30% higher than actual current use."



In a recent forum post, I point to current evidence that today's high prices are in fact depressing demand for gasoline, despite all the pent-up demand for travel unleashed by the easing of pandemic fears. I also cite some of the myriad stories about soaring consumer interest in EVs.

The positive impact on the EV market should come as no surprise. Three economists at UC-Davis reported this year from past data that an increase of just 40 cents per gallon in California led to a "whopping 57 percent" increase in statewide demand for EVs. In Norway, demand for EVs increases 6 percent for every 10 percent increase in the price of gasoline and diesel, according to a recent study.

Unlike subsidies, moreover, gasoline taxes come out of the pockets of polluters, not of people who take buses, trains, and bicycles to their destinations. Fuel taxes don't put money unnecessarily *into* the pockets of affluent households, either. And they don't raise the federal deficit.

Remember those considerations as your staffers ponder innovative proposals like one from the non-profit Coltura, whose tag line is "for a gasoline-free America." It supports replacing the current untargeted tax credit for purchases of new EVs with an incentive payment equal to $10 for every gallon of gasoline the buyer consumes annually. The clever (and good) idea is to induce high-mileage drivers of gas guzzlers who emit the most pollution to switch first to EVs.

As Coltura's own report notes, however, "A $10 per gallon gasoline displacement incentive is of roughly equal value to a $100/ton carbon price. In essence, a carbon tax charges drivers $100 to emit a ton of carbon, and the $10/gallon displacement incentive pays drivers $100 not to emit a ton of carbon."

For all the reasons stated above, most economists would choose the carbon tax as the better option. Certainly your Treasury Secretary, Janet Yellen, and Transportation Secretary, Pete Buttigieg, have been eloquent and outspoken supporters of carbon taxes, but I respect the fact that some of your political advisers may differ. We mustn't let the perfect be the enemy of the good and all that. But I hope for the sake of the planet you'll revive your expressed support for a carbon tax as you develop a fresh and bold new legislative agenda for 2023.

See also my two previous forum posts on EV policies here and here.

Sources:

Jonathan Marshall, "How Carbon Taxes Reduce CO2 Emissions in Transportation," Citizens' Climate Lobby, May 2022.

Lucas Davis, "All Charged Up, No Place to Go," Haas Energy Institute Blog, November 5, 2018.

James Bushnell, "A Silver Lining to the Oil Price Cloud," Haas Energy Institute Blog, March 14, 2022.

Lasse Fridstrøm and Vegard Østli, "Direct and cross price elasticities of demand for gasoline, diesel, hybrid and battery electric cars: the case of Norway," *European Transport Research Review*, 13 (January 2021).

2. The U.S. Experience

California's Cap-and-Trade Program: How Does it Stack Up?

April 2023

The fourth biggest economy in the world also has one of the broadest carbon pricing policies in the world, covering about 80% of all its carbon emissions. But until last month, no rigorous study quantified the overall emissions impact of its program.

I'm referring, of course, to California and its "cap-and-trade" program. Authorized by the state's Global Warming Solutions Act in 2006, it finally launched in 2013 with a goal of helping beat back greenhouse gas emissions to their 1990 level by 2020. California later committed to slashing emissions 40% below 1990 levels by 2030.

The cap-and-trade program makes power plants, major industries, and fuel suppliers acquire allowances to emit greenhouse gases. They can buy or sell allowances in a market to set an effective price on carbon emissions. The system is more complicated than a carbon tax but it didn't require a two-thirds vote to pass the California legislature.

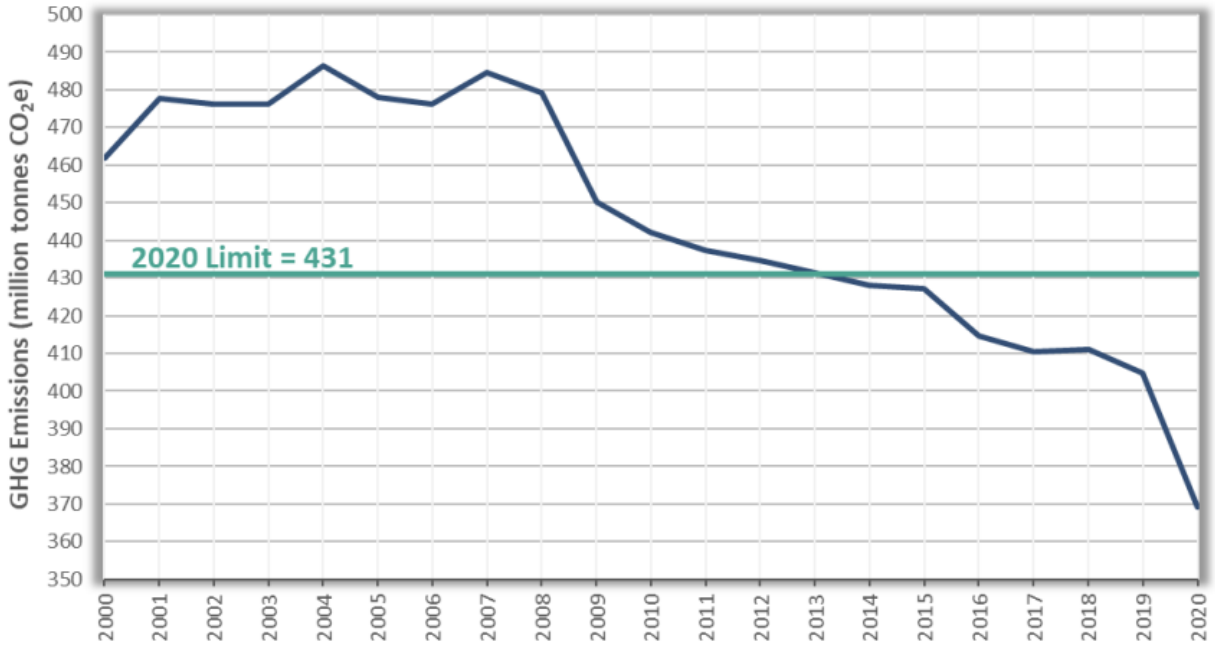
By ratcheting down the number of allowances over time, the state sets a declining cap on carbon emissions. As allowances become more scarce, the carbon price has grown from just over $12 per ton of CO2 in 2014 to just over $27 per ton in February 2023.

California Carbon Allowance Prices

Source: Carbon Allowance Prices

Along with other climate programs launched earlier, California achieved its 2020 emissions goals several years early (see “Figure 1”).

Figure 1. Compares Annual Statewide GHG Emissions to the 2020 GHG Limit.



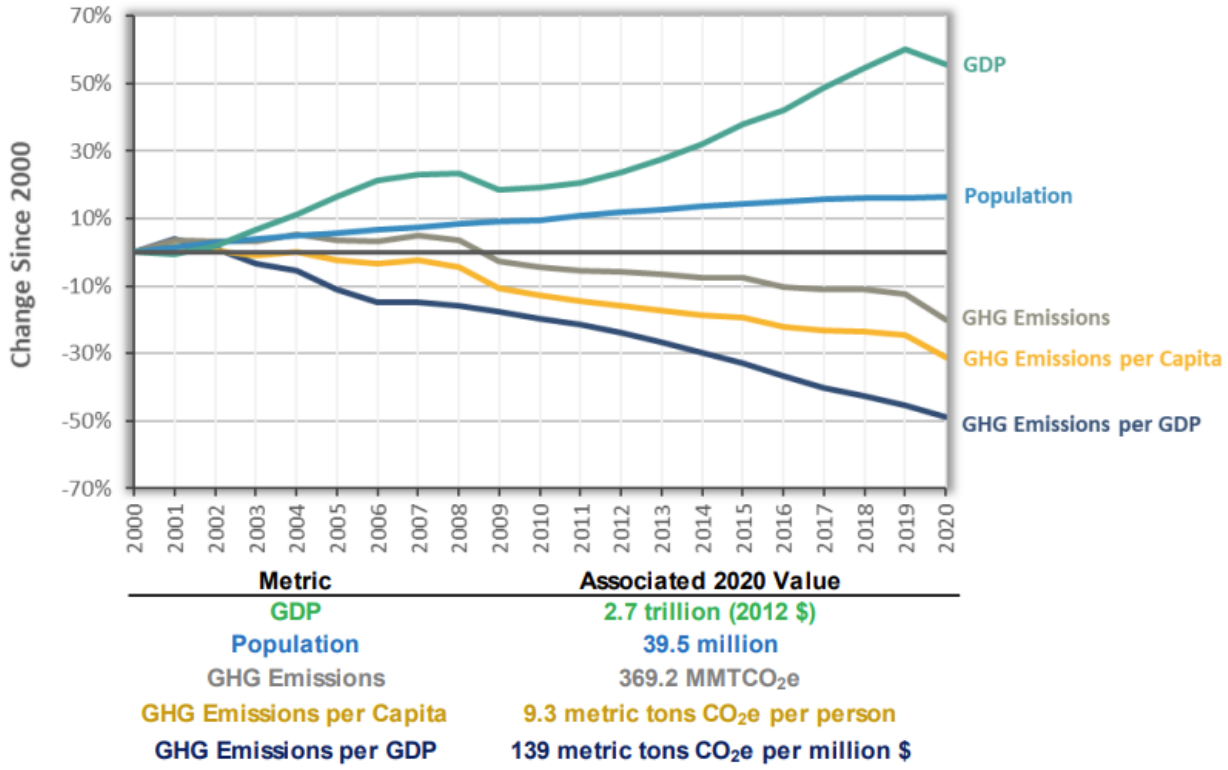
This graph shows California’s annual GHG emissions from 2000 to 2020 in relation to the 2020 GHG Limit required by the California Global Warming Solutions Act (Assembly Bill 32) [1]. Emissions were 431.5 in 2013, and in 2014, California’s GHG emissions dropped below the 2020 GHG Limit and have remained below the 2020 GHG Limit since that time.

Source: California Air Resources Board, California Greenhouse Gas Emissions for 2000 to 2020 Trends of Emissions and Other Indicators

At the same time, it achieved robust economic growth (GDP), except for recessions in 2008 and 2020. Emissions per resident and per dollar of economic output have steadily declined, proving that climate action can go hand in hand with growth and prosperity.

But how much of this result can be attributed to the cap-and-trade program? That’s a really tough question. It requires, first, estimating how fast emissions would have grown in the absence of any programs. Next, it requires estimating the impact of other programs, such as the state’s renewable portfolio standard for utilities and energy efficiency incentives, on emissions. Further complicating the picture is the possibility that California simply shifted some of its carbon emissions to other states or countries through its imports of power and carbon-intensive goods.

Figure 2a. Change in California GDP, Population, and GHG Emissions Since 2000.



Metric	Associated 2020 Value
GDP	2.7 trillion (2012 $)
Population	39.5 million
GHG Emissions	369.2 $MMTCO_2e$
GHG Emissions per Capita	9.3 metric tons CO_2e per person
GHG Emissions per GDP	139 metric tons CO_2e per million $

Source: CARB, California Greenhouse Gas Emissions for 2000 to 2020 Trends of Emissions and Other Indicators

Wading through this thicket of tough methodological issues, two academic economists from Dresden, Germany of all places have just provided the first well-grounded answers. Their new paper attributes a 6.3% decline in total emissions from 2013 to 2019 to the state's carbon pricing program, with the effects most pronounced in the electricity and building sectors.

That may not seem like a lot, but when you consider that the state's carbon price was only $13 to $17 per ton for most of that period, it's a pretty good showing. It bodes well for the potential impact of the program now that prices are running double those levels.

And there's more good news: instead of retarding the state's economic growth, the program "positively affected macroeconomic outcomes." That's a fancy way of saying it probably boosted California's economy, including jobs, as advocates of clean technology have long predicted.

Source:

Niklas Kramer and Christian Lessmann, "The Effects of Carbon Trading: Evidence from California's ETS," Technische Universität Dresden, March 2023.

California's Cap-and-Trade Program: Good for Environmental Justice

June 2022

At least since 2020, when presidential candidate Joe Biden introduced his $2 trillion climate proposal as a "Plan to Secure Environmental Justice and Equitable Opportunity in a Clean Energy Future," growing numbers of Americans have seen climate policy and environmental justice as intertwined issues. The environmental justice movement has focused long overdue national attention on the disproportionate levels of unhealthy pollution faced by poor and minority communities, among other issues.

Fortunately, strong and effective climate policies that discourage the burning of fossil fuels will almost always be good for such disadvantaged populations, which are especially vulnerable both to the immediate health impacts of local air pollution and to growing threats created by extreme weather and other effects of climate disruption. Carbon fee and dividend is strong medicine for both ills and a remarkably progressive way to protect lower-income households from the costs of transitioning to a zero-carbon economy.

But some progressive activists, distrustful of market-based solutions, have accused California's system of carbon pricing of simply shifting ongoing industrial pollution into poor and minority neighborhoods. Some of these critics raise the specter that carbon pricing is simply a "license to pollute" rather than an effective solution to systemic injustice. Addressing this claim—and rectifying any problems with carbon pricing—is essential to the credibility of our advocacy of carbon fee and dividend as a national climate policy.

California's "cap-and-trade" program, which kicked off in 2013, requires major greenhouse gas polluters to acquire permits, which they can buy and sell. The number of permits is slated to decline over time. The market for these permits determines a statewide price for emissions of carbon dioxide.

One key feature of California's system is the ability of polluters to "offset" some of their emissions, and thus require fewer permits, by investing in out-of-state climate projects, such as forest protection. Critics have raised legitimate questions about the effectiveness and permanency of such offsets. Many environmental justice advocates also see them as a way to continue polluting inside the state at the expense of disadvantaged communities.

An oft-cited 2016 paper by several California-based scholars reported that the state's program indeed failed to discourage many of the worst greenhouse gas polluters from curbing their emissions. It thus allowed dangerous co-pollutants, such as fine particulates, to continue harming residents—particularly those in communities of color. But the paper failed to prove a cause-and-effect relationship between the cap-and-trade program and the conditions it described.

Since then, several economists have taken a much deeper dive into the data. Their sophisticated methods help to tease out what changes in the geographic composition of pollution were caused by the cap-and-trade program, versus those caused by unrelated economic trends.

- A 2018 paper by University of Oregon economist Ryan Walch examined emissions data from virtually all power plants in the United States to gauge the effect of California's specific policies. His findings all pointed toward state reductions in harmful air pollutants with "no compelling evidence for adverse environmental justice impacts for co-pollutants in low-income or high-minority-share communities in California."
- A 2019 paper by Kyle Meng, an environmental economist at University of California, Santa Barbara compared emissions from all covered facilities in California by zip code. He reported that "If anything, the evidence suggests that disadvantaged communities may have experienced on average a greater decline in emissions since the start of the cap-and-trade program than other communities."
- An even more sophisticated 2022 paper by Meng and a colleague at Arizona State University found that over a period of five years (2012-2017), *California's cap-and-trade program cut emissions from covered facilities of deadly particulates and smog-forming gases by 15 to 45 percent*. Just as strikingly, it showed that previously *widening* gaps between disadvantaged and other communities began *narrowing* as carbon pricing drove down air emissions. Figure 3 of their paper, reproduced below, shows the sharp break in relative exposure to four air pollutants starting in 2013, after the program took effect.

Concluding remarks

The California Environmental Protection Agency reported earlier this year that the state's cap-and-trade program had saved significant numbers of lives—disproportionately among people of color—by reducing exposure to fine particulate pollution (see chart below).

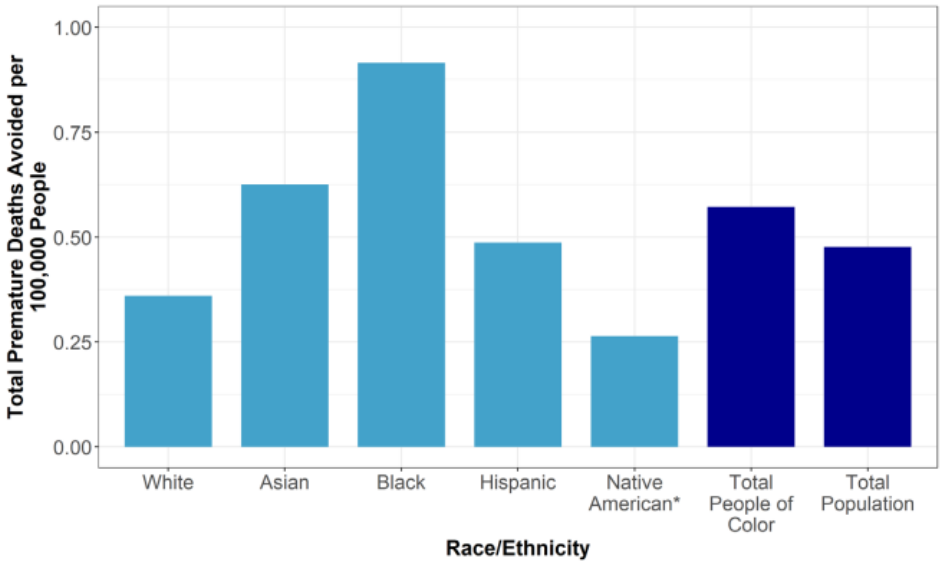
Nonetheless, many environmental justice activists legitimately complain that carbon prices in California remained far too low for many years to make a substantial dent in either carbon emissions or local co-pollutants. That's an indictment of the program's administration rather than carbon pricing itself. To avoid such problems, the state's Environmental Justice Advisory Committee recommended in 2017 that cap-and-trade be replaced with a "system like a carbon tax or fee and dividend program."

For all this good news about carbon pricing, deep inequities continue to plague too many communities even in California and much work remains to be done to address environmental justice concerns. Continued dialogue with members of frontline communities is essential and will lead to better policy.

Figure 3: Environmental justice gap before and after the cap-and-trade program

NOTES: Panels show the estimated average daily pollution concentration gap (in $\mu g/m^3$/day) between disadvantaged and other zip codes (i.e., "EJ gap") during 2008-2017 for $PM_{2.5}$, PM_{10}, NO_x, and SO_x,

Population-Adjusted Premature Deaths Avoided with Change in PM2.5 Emissions from California Facilities Covered by Cap-and-Trade from 2012 to 2017 by Race/Ethnicity



Source: Zeise and Blumenfeld, "Impacts of Greenhouse Gas Emission Limits Within Disadvantaged Communities: Progress Toward Reducing Inequities," CalEPA, 2022.

New Report Calls on California to Strengthen Carbon Pricing

January 2023

Environmental activists look to California to set an example for national and even global climate policies. A new report by the state's non-partisan Legislative Analyst's Office (LAO), however, finds California's latest climate roadmap seriously wanting. In particular, the LAO urges the state to rely more on carbon pricing to achieve its ambitious goal of cutting greenhouse gas emissions at least 85 percent below the 1990 level by 2045.

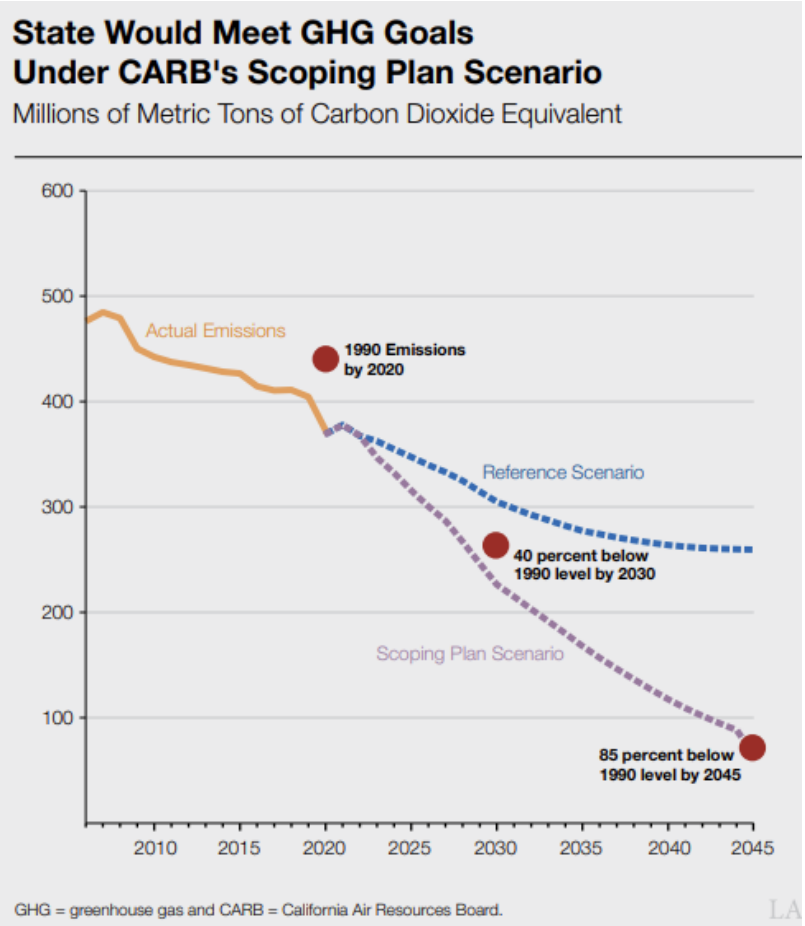
State law requires the California Air Resources Board (CARB) to develop a "scoping plan" to meet statutory emissions goals every five years. Its latest plan, issued in November and covering nearly 300 pages, offers a wealth of policy options and analysis but "does not identify which specific policies it will implement," the LAO complains. "For example, the plan is unclear regarding how much the state will rely on financial incentives, sector-specific regulatory programs, or cap-and-trade."

Just as problematic, according to the LAO, "The plan does not provide the Legislature with sufficient information—such as about cost-effectiveness, distributional impacts, or other environmental impacts—to evaluate the merits of new policies that might be needed to meet" CARB's proposed 2030 goal of reducing emissions 48 percent below 1990 by 2030, just seven years from now.

Of special interest to me, and I imagine to other advocates of carbon pricing, was LAO's lament that CARB did not recommend greater reliance on California's cap-and-trade program, which prices about 75% of all greenhouse gas emissions in the state, including those from transportation fuels, electricity, natural gas, and industry. CARB simply promised to report back to the legislature at the end of 2023 any suggested changes to the program.

That's a lost opportunity according to the analysis. "Economywide carbon pricing policies, such as cap-and-trade, generally have been found to be the most cost-effective approaches to reducing GHG emissions," the LAO declares. In previous reports, LAO has noted that many other state climate programs cost much more per ton of reduced CO2 emissions than cap-and-trade.

The LAO critique continues: "In a cap-and-trade program, covered entities face a choice to either (1) purchase allowances or offsets to be able to continue to emit, or (2) reduce emissions. As a result, the program sends price signals to households and businesses to encourage them to identify and undertake low-cost emission reduction activities. . . .



"Also, in theory, the 'cap' on emissions—which controls emissions by limiting the number of allowances issued—can serve as a backstop to other programs and policies to ensure the state meets certain goals. Strict enforcement of this cap can thereby reduce uncertainty about whether the state will meet its overall emission reduction goals, even if other factors—such as unsuccessful policy implementation or changing economic conditions—drive emissions higher than expected. As a result, we think using cap-and-trade as a key policy tool for achieving the state's GHG goals is a reasonable approach."

Unfortunately, the program as currently administered is not cranking up carbon prices fast enough either to curb emissions at the necessary pace or to raise additional revenue the state could use to fund other climate programs. The LAO warns that without modifications to the cap-and-trade program, the emissions it covers will fall only 29% below the 1990 level in 2030, far short of both statutory and CARB goals.

"We find that, although the program can be a cost-effective way to achieve GHG goals, cap-and-trade is not currently positioned to make up for any significant shortfall in emissions reductions from other programs," the LAO report concludes. It recommends that the state legislature hold hearings on the program and direct CARB "to explain how potential programmatic changes would address concerns about program stringency and help the state meet its near-term GHG goals."

Source: California Legislative Analyst Office, "Assessing California's Climate Policies: The 2022 Scoping Plan Update," January 2023.

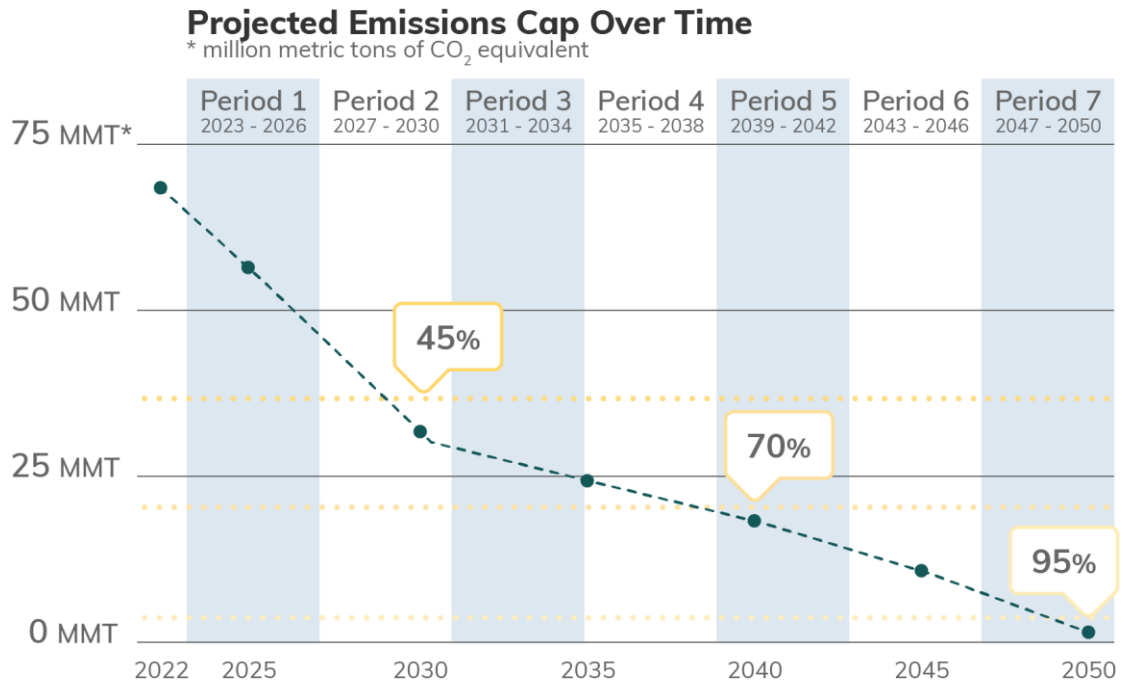
Washington State Joins the Carbon Pricing Parade

January 2023

A couple of months ago, New York Times columnist Paul Krugman pronounced the politics of carbon taxes "poisonous" and "hopeless." His timing was poor to say the least. Six weeks later, at the start of 2023, Washington state began implementing an ambitious carbon pricing program that will go a long way toward achieving its mandated goal of net-zero emissions by 2050.

Washington's cap-and-invest program was established by passage in 2021 of the Climate Commitment Act, after the failure of two carbon tax ballot measures in 2016 and 2018. Like California's cap-and-trade program, it will issue a limited number of greenhouse gas emissions allowances to major climate polluters, ratcheting down the total about 7% each year. Polluters can buy or sell allowances on a trading market. The carbon price it establishes will create the same powerful incentives as a carbon tax for producers and consumers to shift toward cleaner energy.

The entities initially covered by the program—large industrial facilities, electricity producers and importers, natural gas distributors, and fuel suppliers—account for about three-quarters of the state's GHG emissions. Later the program will cover waste-to-energy facilities, landfills, and railroads. Fuels used for agriculture, aviation, and marine vessels are exempt.



Cap-and-invest - Washington State Department of Ecology

The details

The first quarterly auction of emissions allowances will be held on February 28, with a price floor of about $22 per metric ton of CO_2 equivalent. (One market model commissioned by the state assumes a 2023 price of $41to $68.) Annual revenue from the auctions could top a billion dollars. The funds will support a variety of climate mitigation and adaptation initiatives, such as nature-based programs to enhance forest lands and the electrification of buildings and transit.

Reflecting the legislature's strong interest in environmental justice, more than a third of the revenue is earmarked for "overburdened" communities, with at least 10 percent going to benefit native tribes. Additional measures in the law specifically target local air pollution in overburdened communities.

Washington will let carbon polluters acquire a very limited number of allowances using "offsets," such as forestry or livestock projects that capture or reduce carbon emissions. Such programs are highly controversial because of their poor record of permanently reducing carbon. (Forest fires have sent a lot of offsets up in smoke.) Unlike California, however, Washington won't add offsets to the overall emissions cap; the state will remove allowances equal to the number of offsets it grants.

Like many carbon pricing jurisdictions, Washington will also give a limited number of allowances at no charge to "emissions intensive trade-exposed" industries that might otherwise relocate out of state to take advantage of cheaper fossil energy. Free allowances will also be granted to electric and natural gas utilities, presumably to hold down bills for consumers and prevent a political backlash. Like every other covered entity, these beneficiaries will still face strong incentives to cut their carbon emissions. They can make a profit by polluting less and selling their allowances on the trading market.

How will consumers (and voters) react?

The issue of consumer cost is sure to loom large in future political debates. In late January, just three weeks after the new program took effect, an analyst for a conservative state think-tank blamed "Washington state's new tax on CO2 emissions" for driving up gasoline prices 25 cents per gallon compared to other West Coast states. Governor Inslee was quick to blame oil companies for price gouging and the state's Department of Ecology insisted it was much too soon to implicate the carbon pricing program.

All of this points to a potential problem: The program allocates no revenue back to households in the form of dividends, so consumers have no financial cushion against rising energy prices. In contrast, New York Gov. Kathy Hochul has proposed a state cap-and-invest program with $1 billion in "climate action rebates" to mitigate consumer costs. Studies show time and again the power of dividends to enhance public support for carbon pricing. The coming months will provide a test of how committed Washington state residents are to

spending more to reduce carbon pollution even if they see no direct climate benefits. (Washington's contributions to global carbon emissions are tiny.)

Improvements in local air pollution will be more tangible but may not be enough to mollify consumers and voters. I hope state legislators stay closely attuned to their constituents so this important new climate pricing program doesn't get discredited through poor design. The last thing we need is further evidence that carbon pricing is politically "poisonous."

Postscript

As I predicted, there are loud rumblings of discontent in Washington state as price shocks from its "cap-and-invest" program drive up gasoline prices with no dividend to provide pocketbook relief. Here are excerpts from a recent article in the *Seattle Times*:

> **WA's carbon-pricing auctions collect nearly $1.5 billion as allowances reach record price**
>
> 9/6/2023
>
> The price of Washington's carbon emission allowances reached an all-time high in the state's fourth auction last week, with revenue from the program nearing $1.5 billion in its first year.
>
> The revenue has far outpaced early estimates, and now a group that helped advocate for and pass the legislation that created the carbon-pricing market is calling on lawmakers to get more of the collected money back in the hands of Washingtonians.
>
> The program, which was designed to make it costlier to pollute, has been linked to an increase in prices at the gas pump as refiners, suppliers and other businesses may pass along their compliance costs.
>
> The group, Clean & Prosperous Washington, is advocating for lawmakers to infuse the extra revenue in programs to lower the cost of transportation, reduce car-tab fees for two years and increase incentives for electric-vehicle purchases.
>
> State Sen. Mark Mullet, D-Issaquah, who voted for the program and is running for governor, also released a legislative proposal aimed at reining in any impact of the climate policy on fuel prices and reducing car-tab fees.
>
> "I really worry we won't see other governments following Washington's leadership on climate if we can't show that it's possible to fight carbon pollution while still balancing it with affordability," he said in a news release. . .
>
> Lawmakers this year budgeted about $2 billion in anticipated revenue from the carbon allowance auctions over the next two years for projects intended to reduce emissions and improve air quality.

> That money is destined to help overburdened communities and people with lower incomes electrify their homes, provide rebates and incentives to people buying electric bikes and cars, and help the trucking and freight industries decarbonize, among other things. . .
>
> Clean & Prosperous also pitched expanding sales tax exemptions, eliminating fees for electric vehicle purchases and establishing rebates for low-income people buying EVs or medium- and heavy-duty zero-emission vehicles.

A new article in *Grist*, reports that hedge fund manager Brian Heywood "has funded a petition drive to repeal the Climate Commitment Act, over its effects on gas prices, along with other petitions to strike down the state's capital gains tax, give the police more leeway to pursue vehicles, and grant parents access to their kids' medical records at school. The repeal could be headed to voters as a ballot initiative this November. If voters approve it, Heywood's initiative wouldn't just cancel the climate law; it would block the state from creating any other cap-and-trade system in the future."

It adds, "The fate of the climate law could have ripple effects beyond Washington, the second state to adopt a cap on carbon after California. New York, for example, just unveiled plans for a cap-and-invest program in December. Officials in New York are closely monitoring the backlash in Washington state, and, in turn, other Northeastern states are watching New York to see what it decides. If Washington's law goes up in flames, states might decide against enshrining similar carbon-cutting laws. But if it survives the backlash, it could boost other politicians' confidence in putting a price on carbon pollution.

"Grist spoke with experts in Washington about the lessons they've learned, one year into the program. They suggested that advocates for any stringent carbon price should be ready to play defense right away — and should work to make its benefits tangible to people around the state."

Remarkably, the experts surveyed by the reporter don't seem to have learned any lessons about the benefits of a climate dividend. They need to get real. Providing more incentives for expensive home heat pump installations and the like isn't going to persuade the average state resident whose gasoline prices have jumped upwards of 50 cents per gallon that this sacrifice is worth making. Nor do well-meaning efforts to direct revenues toward programs helping disadvantaged communities prevent this from having regressive economic impacts on most lower-income households. A dividend would do more to alleviate both the political and economic effects of higher fossil fuel prices.

Note: Spending many millions of dollars, a wide coalition of climate activists beat back the initiative to overturn Washington's cap-and-invest program in November 2024. Nonetheless, the experience demonstrated the perils of ignoring public concerns about affordability when introducing policies that drive up the cost of energy.

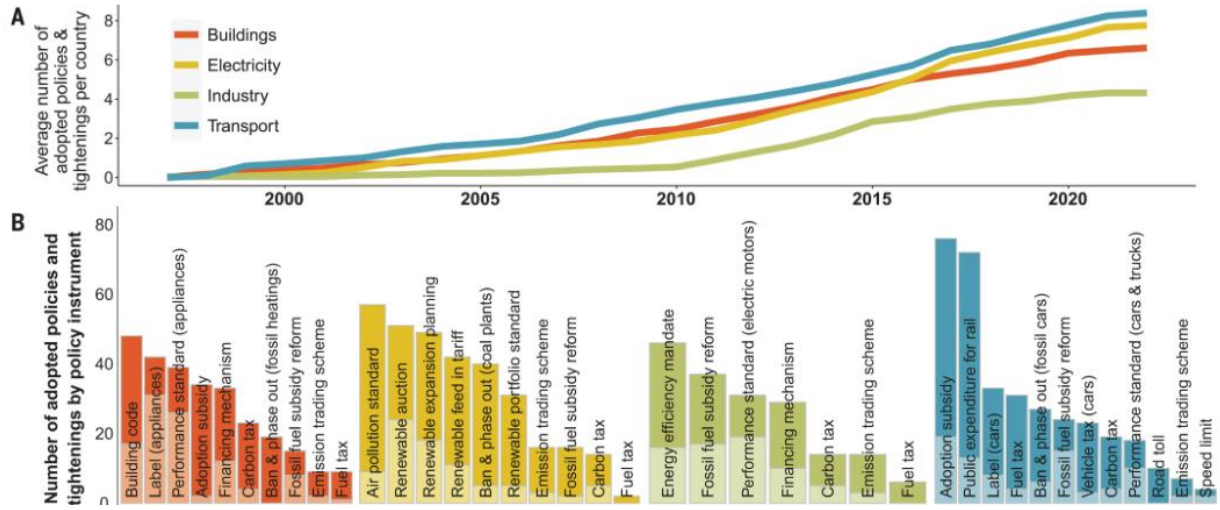
3. International Experience

New International Study Supports Adoption of Carbon Pricing

August 2024

Models showing that national carbon pricing would be the ideal next step to help the United States meet its Paris climate pledge win broad empirical support from a major new study of climate policy effectiveness published in the prestigious journal *Science* by a team of German researchers.

The German team harnessed techniques from machine learning to evaluate the impact of 1,500 climate policies implemented in 41 countries from 1998 to 2022. These policies ranged from market-based carbon pricing to subsidies and non-market regulations, mandates, and bans. Their feat of data analysis identified 63 successful policy interventions that produced meaningful reductions of carbon dioxide emissions and shed light on policy *mixes* that proved especially favorable.



In most cases, they found, individual policies had greater effect when implemented in tandem with others, suggesting the existence of synergy. The one (favorable) exception was carbon taxation. “It stands out as the only policy instrument that achieves near equal or larger effect size as a stand-alone policy across all sectors,” the paper reports.

Furthermore, “in most cases pricing is the complement that enables effective emission reductions [from other policies]. For example, in the electricity sector all mixes that were associated with large emission reductions have pricing elements.” Indeed, pricing was central to half of all successful policy mixes they uncovered.

"The key ingredient if you want to reduce emissions is that you have pricing in the policy mix," said study co-author Nicolas Koch. "The most frequently used policy tools, which are subsidies and regulations, alone are insufficient," Koch told another interviewer. "Only in combination with price-based instruments – such as carbon prices, energy taxes – can they deliver substantial emission reductions."

Carbon taxes proved somewhat less successful in developing economies, "consistent with claims that the lack of liberalized markets and existence of other price distortions can limit the effectiveness of price-based instruments."

The authors say their findings support "the theory of policy sequencing, which states that in a first stage of climate policy-making, regulations and subsidies are effective in building economic interest in green technology and reducing the cost of technologies." As I argued in a CCL blog, the IRA represented exactly such a first stage for the United States. As its incentives take increasing effect, they should pave the way for more powerful carbon pricing to propel adoption of cleaner and more efficient uses of energy here at home.

Major New Study Supports Effectiveness of Carbon Pricing

May 2024

Economists overwhelmingly favor carbon taxes as "**the most cost-effective lever to reduce carbon emissions at the scale and speed that is necessary**," but specific empirical evidence for the benefits of carbon pricing in real-world applications is surprisingly sparse and uneven.

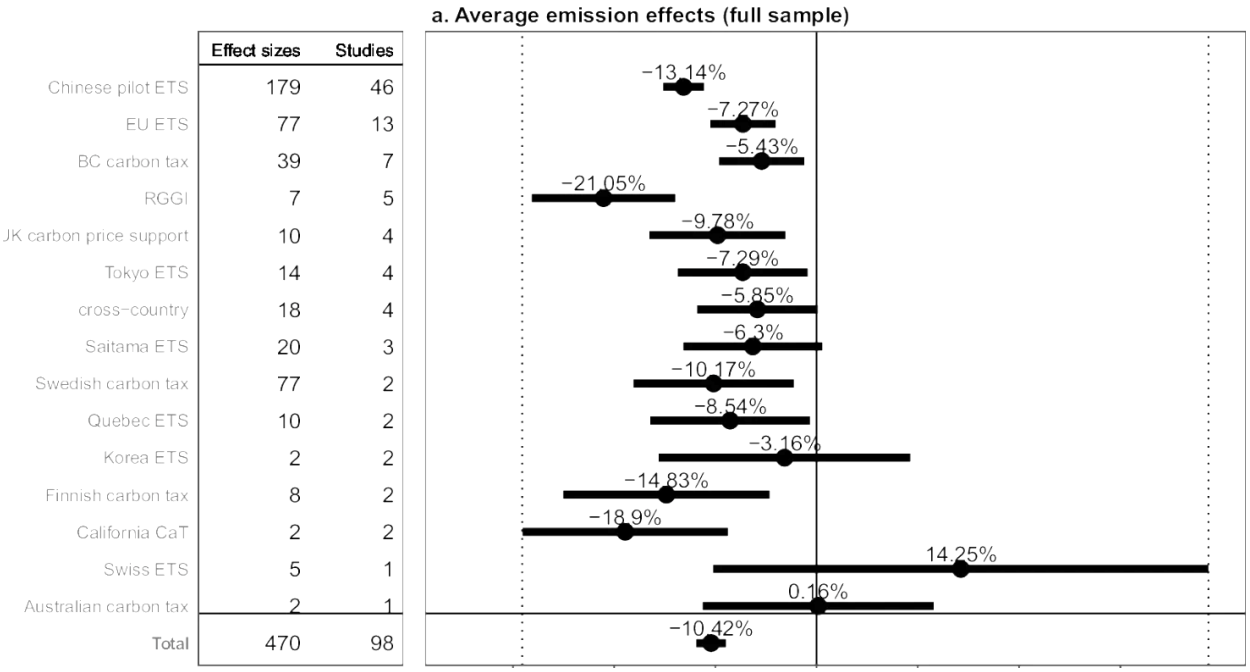
It's tough to determine causality when myriad factors influence greenhouse gas emissions—changes in GDP, new technology, the shifting mix of industrial production, variations in international trade, and even the weather. The same problem afflicts a wide range of empirical assessments, ranging from the clinical value of new drugs to the effectiveness of anti-poverty programs. Thousands of empirical economists spend their time developing and implementing sophisticated statistical methods to measure the true impact of key inputs on outcomes of interest. Their answers, unfortunately, are rarely cut and dried.

A **major new study** published in *Nature Communications* offers reassurance that carbon taxes really are effective. The (rather showy) paper provides a "rigorous, machine-learning assisted systematic review and meta-analysis" of 80 evaluations of 21 carbon pricing policies around the world. It finds at least 17 of those policies "yielded immediate and substantial emission reductions" and "statistically significant emissions reductions" ranging from 4% to 15%, despite low carbon prices in most cases.

One promising finding is that emissions appear to fall more as years go by, likely as new investments and new technologies take root in response to carbon prices. Evidence also

confirms that rising carbon prices within a country (greater “policy stringency”) do indeed lower emissions.

Average emissions change by scheme



Source: [Systematic review and meta-analysis of ex-post evaluations on the effectiveness of carbon pricing | Nature Communications]

Until now, policy makers have had to draw mostly from unsystematic literature reviews—laundry lists of empirical papers offering brief synopses of often-conflicting results. One of the first systematic attempts to summarize the empirical literature on carbon pricing effectiveness was **published in 2021** by the Canadian political scientist Jessica Green.

Green concluded that carbon pricing had only "a limited impact on emissions,” probably reducing them less than 2% per year. That finding wasn’t particularly helpful, since it didn’t relate the effectiveness of the policy to the price. That was be akin to judging the effectiveness of drugs without noting the dose.

Nonetheless, her study was highly influential. According to the publisher, *Environmental Research Letters*, her article has been downloaded 77,626 times, cited by other scholars 194 times, picked up by 41 news outlets, posted by 644 X users, and cited in 6 Wikipedia pages.

In other forums, Green has waged a campaign against carbon pricing. In the socialist journal *Jacobin*, **she declared** that governments should “abandon” carbon pricing, which she accused of promoting “class divisions,” in favor of “transformative climate policies that deliver immediate material gains to workers.” Left-of-center political scientists in the United States cited her claims in their own **influential critiques of carbon pricing**, which likely informed the Biden campaign’s decision not to include it in his climate policy.

The Nature authors mention Green's study only briefly, dismissing it for lacking "any formal methodology" for evaluating the studies she considered. In contrast, they boast, "our methodology is transparent and reproducible," and thus suitable for incorporating new studies as they appear.

Moreover—and this is no criticism of Green—many relevant studies have appeared since she pulled together the papers for her article. Time and again they support the overall effectiveness of carbon pricing, particularly when prices rise to meaningful levels.

Below I list several of these recent papers, in rough chronological order. Some, like the first one mentioned, draw on data from dozens of countries over many years; others deal with specific countries, such as Great Britain and Finland. Together, they should persuade any serious analyst to put carbon pricing high on their list of effective climate policies.

Recent relevant empirical studies of carbon pricing effectiveness:

Niklas Döbbeling-Hildebrandt, et al., "Systematic review and meta-analysis of ex-post evaluations on the effectiveness of carbon pricing," *Nature Communications*, v. 15, Article number: 4147 (2024).

Rohan Best, et al., "Carbon Pricing Efficacy: Cross-Country Evidence," *Environmental and Resource Economics*, 77 (June 2020), 69–94.

Mojtaba Khastar et al., "How does carbon tax affect social welfare and emission reduction in Finland?" *Energy Reports*, 6 (November 2020), 736-744.

Klaus Gugler et al., "Effectiveness of climate policies: Carbon pricing vs. subsidizing renewables," *Journal of Environmental Economics and Management*, 106 (March 2021).

Ryan Rafaty, et al., "Carbon Pricing and the Elasticity of CO2 Emissions," Resources for the Future Working Paper (21-33), October. 25, 2021.

Torben Medeksa, "Pricing for a Cooler Planet: An Empirical Analysis of the Effect of Taxing Carbon," CESifo Working Paper, No. 9172, Munich, 2021.

Jan Abrell et al., "How Effective Is Carbon Pricing?—A Machine Learning Approach to Policy Evaluation," ZEW-Leibniz Centre for European Economic Research, Discussion Paper 21-039, April 2021.

Emanuel Kohlscheen et al., "Effects of Carbon Pricing and Other Climate Policies on CO2 Emissions," CESifo Working Paper No. 9347, October 18, 2021.

Marion Leroutier, "Carbon pricing and power sector decarbonization: Evidence from the UK," *Journal of Environmental Economics and Management*, 111 (January 2022).

Filippo D'Arcangelo, et al., "Estimating the CO2 emission and revenue effects of carbon pricing: New evidence from a large cross-country dataset,"OECD Economics Department Working Papers, no. 1732, November 14, 2022.

Diego R. Känzig and Maximilian Konradt, "Climate Policy and the Economy: Evidence from Europe's Carbon Pricing Initiatives," NBER Working Paper 31260, August 2023.

Klaus Gugler, et al., "Carbon pricing and emissions: Causal effects of Britain's carbon tax," *Energy Economics*, 121 (May 2023).

Massimo Bordignon et al., "Third Time's a Charm? Assessing the Impact of the Third Phase of the EU ETS on CO2 Emissions and Performance," *Sustainability*, 15 (2023).

Antoine Dechezleprêtre et al., "The joint impact of the European Union emissions trading system on carbon emissions and economic performance," *Journal of Environmental Economics and Management*, 118 (2023).

Bertrand Candelon and Jean-Baptiste Hasse, "Testing for causality between climate policies and carbon emissions reduction," *Finance Research Letters*, May 2023.

The Power of Carbon Pricing Reaffirmed by a Major New Study

December 2022

In a recent Forum post on the effectiveness of carbon pricing in Scandinavia, I quoted a declaration by the Intergovernmental Panel on Climate Change that "Among the wide range of climate policy instruments, pricing carbon such as a carbon tax or an emissions trading system has been one of the most widely used and effective options to reduce GHG emissions."

That conclusion still remains controversial in some quarters, so I was delighted to see a new study by the Organization of Economic Cooperation and Development (OECD) on the effects of emissions pricing in 44 major countries from 2012 to 2018.

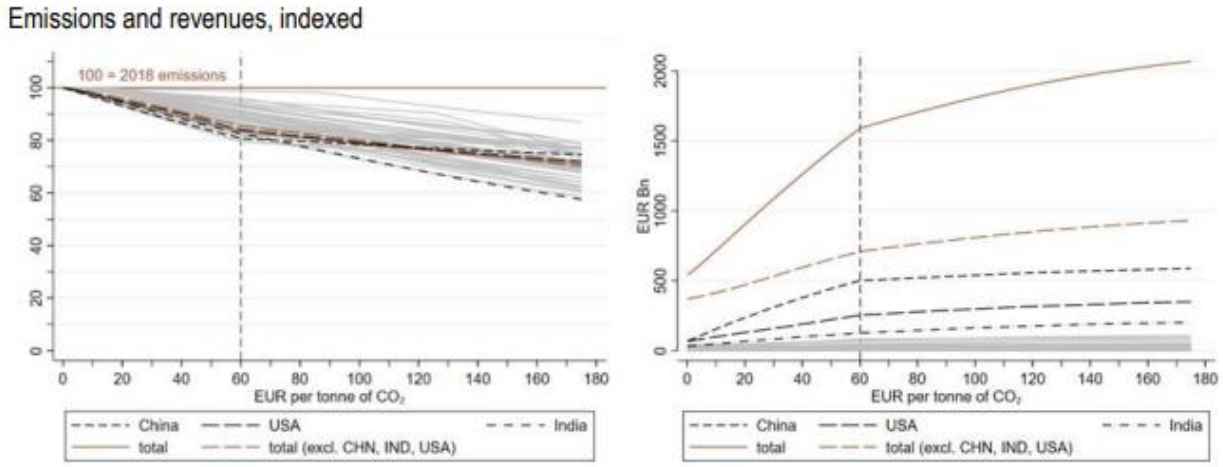
The OECD paper estimates that every increase of EUR 10 (just over US$10) in a jurisdiction's carbon price decreases CO2 emissions from fossil fuels by nearly 4% on average over the long term. A global carbon tax of just EUR 60 would cut emissions about one-fifth relative to 2018 levels.

The study also notes that this estimate is likely on the low side, since "abatement technologies and alternative energy sources are becoming increasingly available and cheaper" since the years in which data were collected and analyzed.

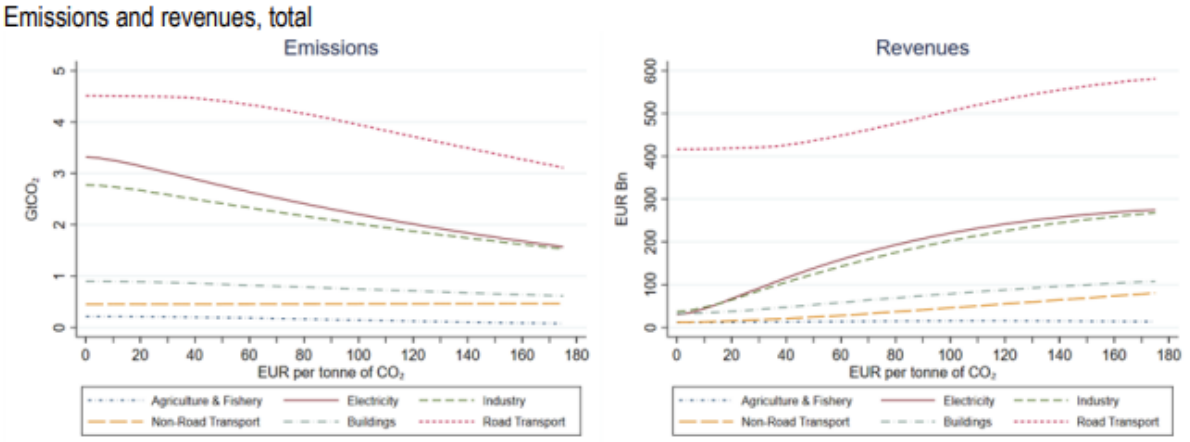
Carbon Tax Impacts

In just the past two years, subsequent to the paper's study period, the price of carbon under the European Union's Emissions Trading System has jumped about EUR 50/ton of CO2. That increase, along with other measures many European nations are taking to reduce their

reliance on fossil fuels in the wake of Russia's invasion of Ukraine, should pay off in significant emissions reductions.



Note: Simulations of a global ECR floor, by EUR 5 increments. The maximum ECR floor for emissions unpriced in 2018 is EUR 60. Beyond EUR 60, the price floor on emissions already priced in 2018 keeps on rising until EUR 175, while that for unpriced emissions in 2018 rises up to EUR 60. Left panel: emissions in gigatonnes of CO_2. Right panel: revenues in EUR billion. Semi-elasticities are allowed to differ by sector.
Source: OECD.



Note: Simulations of a global ECR floor applied to all emissions priced in 2018, by EUR 5 increments. Left panel: emissions from fossil fuel use in gigatonne of CO_2. Right panel: revenues in EUR billion. Semi-elasticities are allowed to differ by sector.
Source: OECD.

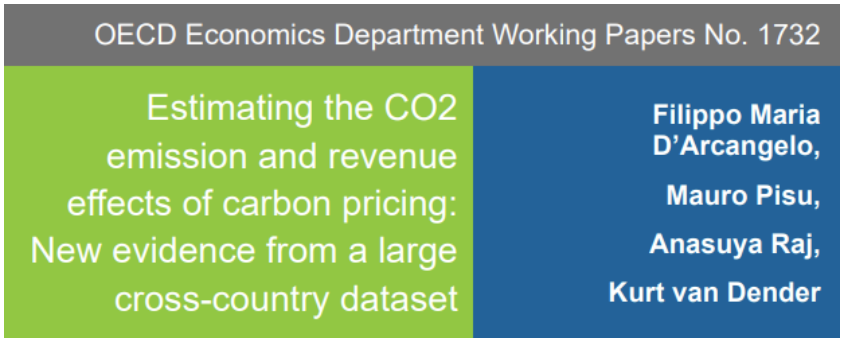
In just the past two years, subsequent to the paper's study period, the price of carbon under the European Union's Emissions Trading System has jumped about EUR 50/ton of CO2. That increase, along with other measures many European nations are taking to reduce their reliance on fossil fuels in the wake of Russia's invasion of Ukraine, should pay off in significant emissions reductions.

The study may be the most comprehensive analysis ever conducted. It uses a huge cross-country dataset that includes fuel taxes and other implicit carbon prices across multiple economic sectors. It covers 80% of worldwide emissions from energy use.

The study refutes any lingering claims that carbon pricing barely moves the needle on emissions. That only appears to be true because many countries have implemented low prices in just a few sectors of their economies. In other words, weak policies produce weak results.

The news isn't all good, however. To reach a net-zero target by 2050 *with carbon pricing alone*—assuming no significant improvements in technology or other measures to increase emissions responsiveness—would require "steep and persistent" increases in effective carbon prices to more than EUR 1,000 per ton by the late 2030s.

Fortunately, even a gradual improvement in responsiveness driven by technology or policies—for example, faster adoption of electric vehicles—could keep the required carbon price to a much more reasonable EUR 220 by 2040.



"These results point to the importance of additional policies – such as green technology support measures, regulations, standards – to complement emissions pricing measures," the authors note. "Indeed, these policies can reduce abatement costs and ease the substitution of clean energy sources for fossil fuels, increasing emission responsiveness to carbon prices."

Other experts have also recognized the potential synergy between future carbon pricing and recent legislation subsidizing clean energy and R&D. As the Rhodium Group observed last year, "A carbon price can amplify the impact of clean energy incentives . . . and sends a long-term signal for investors to shift towards a net-zero economy."

Source:

Filippo Maria D'Arcangelo, et al., "Estimating the CO2 emission and revenue effects of carbon pricing: New evidence from a large cross-country dataset," OECD Economics Department Working Papers, no. 1732, November 2022.

Carbon Pricing Works: Look at the UK's Electricity Sector

January 2024

Here's a bit of good news to kick off the new year: "The amount of UK electricity generated from fossil fuels fell 22% year-on-year in 2023 to the lowest level since 1957," according to CarbonBrief, a British organization focused on climate change and policy. Or as the headline in the *Times* of London read, "Fossil fuels fall to 35% of Britain's electricity supply."

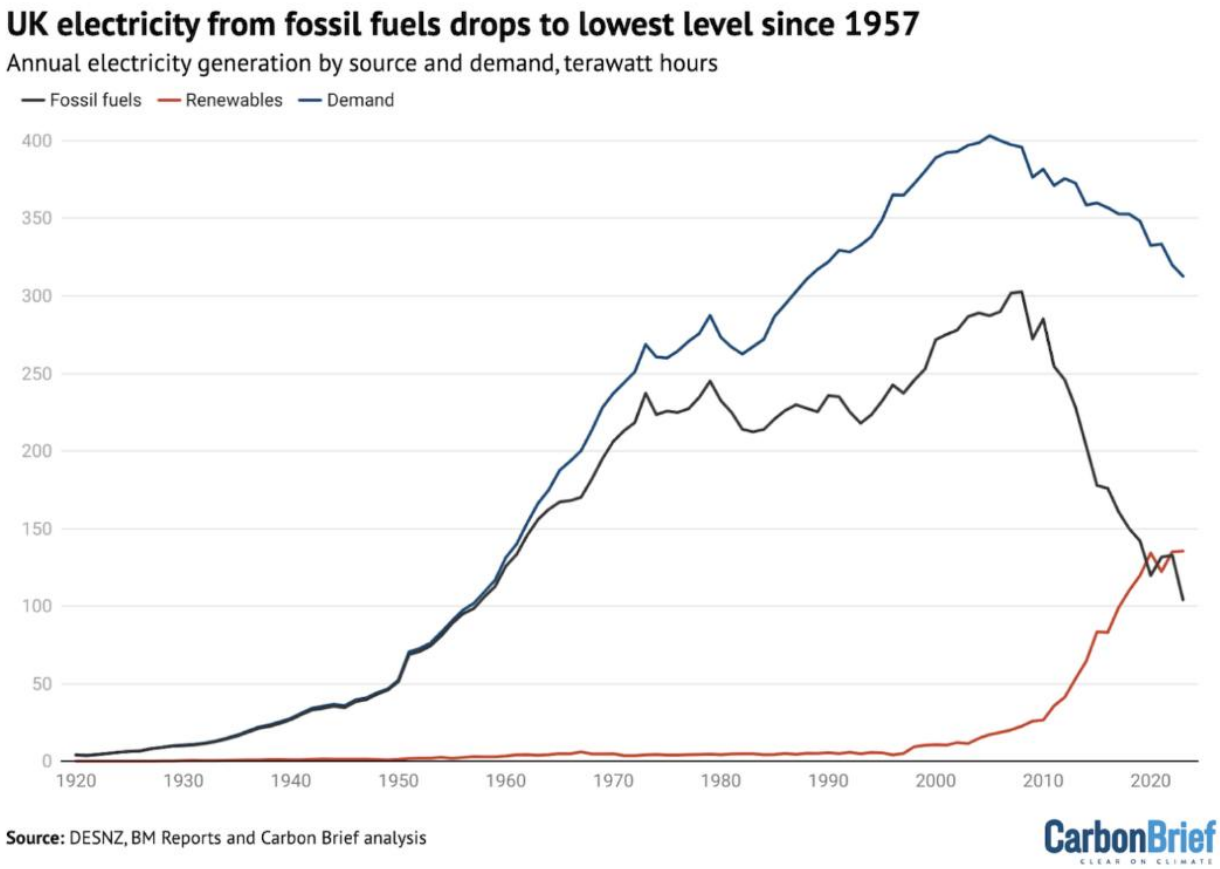
Since electricity generation in the UK from fossil fuels peaked in 2008, generation from coal has virtually disappeared – down 97% - and gas-fired generation has plummeted 45%.

The CarbonBrief's analysis attributes these declines to "the rapid expansion of renewable energy (up six-fold since 2008, some 113TWh) and by lower electricity demand (down 21% since 2008, some 83TWh)." But those numbers don't explain the cause, they merely observe what took the place of fossil fueled generation.

To appreciate one of the most important underlying causes, check out "Carbon pricing and power sector decarbonization: Evidence from the UK," a 2022 paper in the *Journal of Environmental Economics and Management* (JEEM). Economist Marion Leroutier demonstrates that a carbon tax implemented in the UK's power sector in 2013 slashed greenhouse gas emissions by 20% to 26% *per year* from 2013 to 2017 (the years studied). Over that period, the tax rate grew from £5 to £18 per ton of equivalent carbon dioxide on top of the EU's carbon price. Total emissions over the same period fell as much as 190 million tons, Leroutier estimates.

By making all polluting fossil fuels more expensive, carbon taxes have strongly encouraged "the rapid expansion of renewable energy," which CarbonBrief cited in its new report about the UK's electricity sector. Indeed, a 2021 article in JEEM, comparing Britain's carbon tax to Germany's heavy subsidies for wind and solar power, concluded unequivocally that "carbon pricing is superior to subsidizing wind or solar power in these two countries." The UK achieved much steeper reductions in emissions at much lower cost per ton of CO2.

And by raising energy prices more generally, carbon taxes "improve customer payback and adoption of energy efficiency measures," according to a new issue brief by the energy consulting firm ICF, titled "The impact of carbon pricing on energy efficiency program potential." That's at least one important driver behind the "lower electricity demand" cited by CarbonBrief.



Bottom line: When more than 3,600 U.S. economists declare that a "carbon tax offers the most cost-effective lever to reduce carbon emissions at the scale and speed that is necessary," they aren't just relying on theoretical models. Real-world evidence from the UK and other countries consistently points to the power of economy-wide price incentives to accelerate the transition to cleaner energy and less climate pollution.

Sources:

Marion Leroutier, "Carbon pricing and power sector decarbonization: Evidence from the UK," *Journal of Environmental Economics and Management*, 111 (January 2022).

Klaus Gugler, et al., "Effectiveness of climate policies: Carbon pricing vs. subsidizing renewables," *Journal of Environmental Economics and Management*, 106 (March 2021).

Ali Bozorgi and Pratik Dhoot, "The impact of carbon pricing on energy efficiency program potential," ICF, November 2023.

Do Carbon Taxes Work in the Real World? (Spoiler Alert: Yes!)

November 2022

Most economists support carbon taxes as a key policy for climate mitigation, but embarrassingly few studies of carbon pricing in the real world, as opposed to models, show unambiguously strong impacts on greenhouse gas emissions.

A literature review last year in *Environmental Research Letters* observed, "For a policy that has dominated much of the discourse in climate politics, . . . we know relatively little about its ex-post performance, and what we do know is concentrated in a few jurisdictions. The available information indicates that its impact on emissions is limited at best."

The International Monetary Fund put a more positive spin on the literature: "Most empirical studies find that carbon-pricing programs implemented so far, even though quite modest, have led to significant reductions in emissions. . . . Empirical analyses find that despite low carbon prices, emission-trading markets and carbon taxes have led to sizable reductions in emissions."

Similarly, the Intergovernmental Panel on Climate Change declared this year that "Among the wide range of climate policy instruments, pricing carbon such as a carbon tax or an emissions trading system has been one of the most widely used and effective options to reduce GHG emissions."

Still, whether you think the impacts are best characterized as "limited at best" and "quite modest" or "sizeable" and "effective," carbon pricing to date hasn't come close to sending any country on a clear path toward net zero emissions.

There are two main reasons for this disappointing result. One, which the IMF alluded to, is that very few countries have had sizeable carbon prices covering most of their economic sectors for very long. Globally, carbon prices covered only 13 percent of carbon emissions in 2020 and the price averaged only a few dollars per ton of CO_2 – not enough to move many needles.

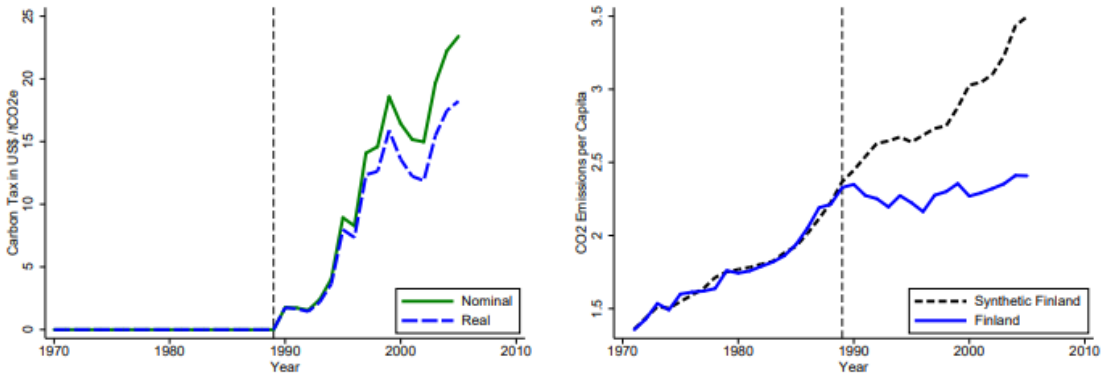
The other problem is it's really hard to reliably measure the impact of carbon pricing independent from business cycles, other taxes and regulations, changes in technology, population growth, and other factors affecting emissions. That's why I keep my eyes peeled for new studies that use best available statistical methods to evaluate the true impact of carbon pricing.

A focus on Finland and Sweden

Several high-quality studies caught my eye because they concern two countries with the longest history of carbon pricing: Finland, which enacted the world's first carbon tax in 1990, and Sweden, which followed in 1991. Over time, tax rates in both countries have grown high

by world standards: $60-$85 in Finland, depending on the sector, and $130 in Sweden. In both countries, unfortunately, these taxes for many years covered only about 40% of their economies.

Starting with Finland's experience, a 2021 study for the Munich-based Center for Economic Studies concluded that "taxing carbon reduces emissions by big margins." Based on a statistical model of what the growing country's emissions would have been absent carbon pricing, economist Torben Mideksa estimated that Finland's carbon tax reduced CO2 emissions in the transport sector about 16% by 1995, 25% by 2000, and 30% by 2004, a major accomplishment indeed. Over that period, Finland's carbon tax grew from US$1.75 to US$23.39 per metric ton of CO2.



(a) CO_2 Tax in Finland.

(b) CO_2 Emissions from Transportation Activities.

Figure 1: Carbon Tax and the Impact on Emissions in 1970 – 2005.

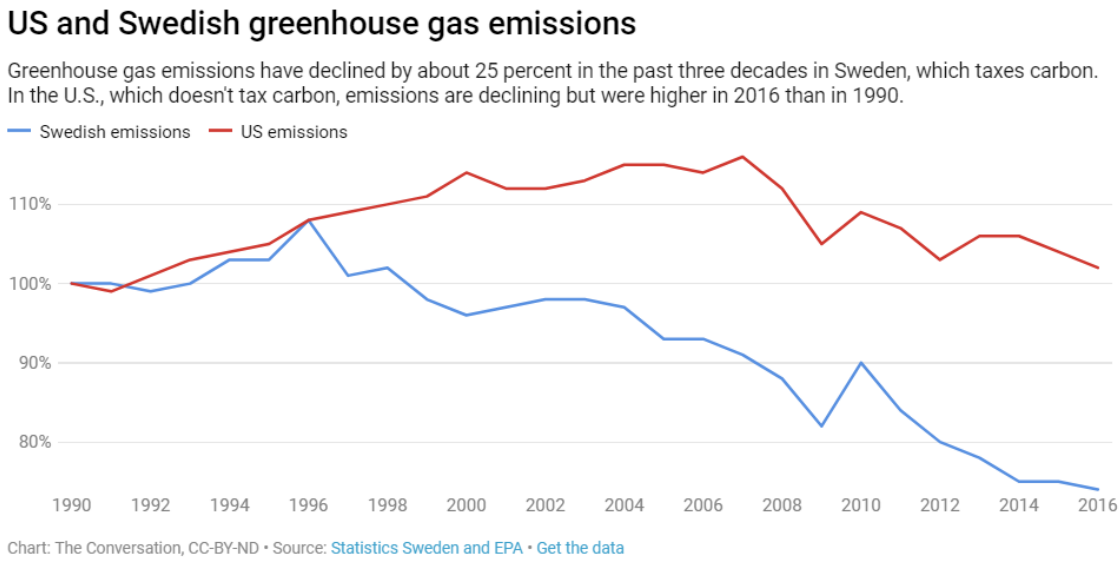
Mideksa's paper parallels an important study in the *American Economic Journal*, which found that Sweden's introduction of a carbon tax in 1991 helped drive its transportation emissions 11 percent. Together their findings are significant because many critics still maintain—in the face of growing evidence to the contrary—that carbon taxes do little to affect the behavior of drivers.

Looking at the bigger picture in Sweden, from 1990 to 2018 it managed to cut CO2 emissions 27% even as its GDP grew more than 78%. Sweden cut its greenhouse gas emissions 65% per capita over that period, compared to just 13% for the United States. Much of the credit goes to Sweden's carbon tax.

Sources:

Torben Medeksa, "Pricing for a Cooler Planet: An Empirical Analysis of the Effect of Taxing Carbon," CESifo Working Paper, No. 9172, Munich, 2021.

Andersson, Julius J. 2019. "Carbon Taxes and CO_2 Emissions: Sweden as a Case Study." *American Economic Journal: Economic Policy*, 11 (4): 1–30.



Source: https://theconversation.com/with-the-right-guiding-principles-carbon-taxes-can-work-109328

How Carbon Pricing Cuts Manufacturing Plant Emissions

September 2024

Many studies attempt with limited success to measure the impact of carbon pricing on greenhouse gas emissions from entire national economies. Such estimates are hard to nail down because carbon prices vary so much from sector to sector between countries, making broad national comparisons really tough.

An alternative approach is to look at national economies through a microscope and analyze the impact of carbon pricing in specific sectors, where pricing is more consistent. A good place to start is manufacturing emissions. Two new papers taking that approach find significant evidence for strong positive impacts of carbon pricing on dampening plant-level emissions.

A new paper in *The Review of Financial Studies* examines the case of Sweden, which pioneered carbon pricing in 1991. The authors compiled data tracking CO_2 emissions from Swedish manufacturing firms over more than two decades to estimate the impact of carbon pricing on firm-level emissions. By tracking emissions across firms and over time, as tax rates and special firm-level exemptions changed, they were able to credibly estimate the true impact of carbon pricing on emissions.

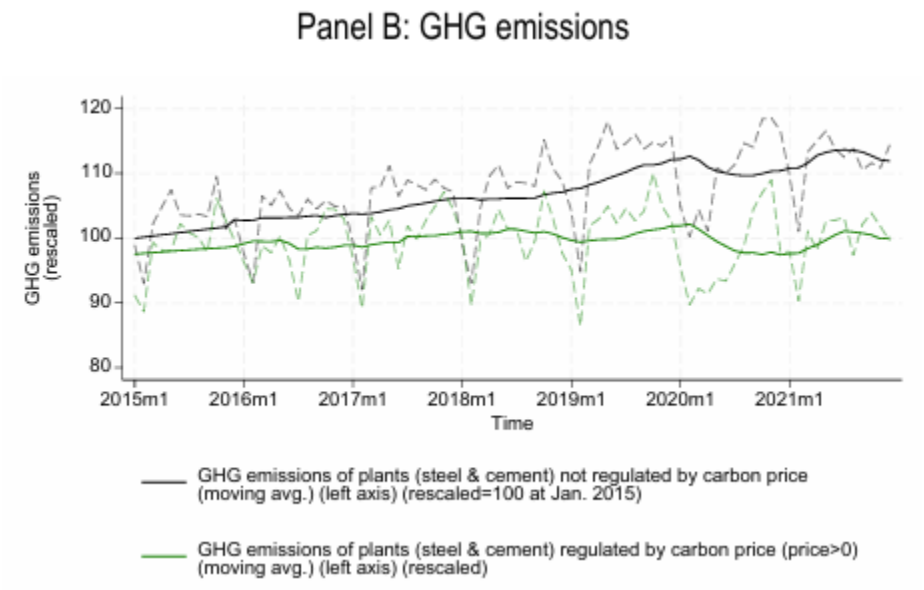
Over the period 1990-2015, CO2 emissions from Swedish manufacturing plants decreased 31 percent, while output remained almost constant. The authors' calculations show that carbon pricing accounted for at least a third and possibly all of that drop. The fact that Sweden's manufacturers were able to thrive in a competitive world market in the face of some of the

world's steepest carbon taxes is a testament to their nimble adaptation to changing price signals.

Another new paper, issued by the OECD's economics department, focuses on emissions from heavy cement and steel plants in 140 countries from 2015 to 2021. Over that period, carbon prices rose dramatically in some countries while remaining zero in others, giving the economists a handle with which to estimate the impact of pricing on emissions.

Their data show that emissions from plants in these carbon-intensive sectors increased more than 10% over the period in the absence of carbon pricing but remained stable (on average) in jurisdictions that imposed some form of carbon price (see chart below). On average, a $1 increase in the price of carbon price per ton of CO2 cut emissions from cement and steel plants by 1.3%, a really big effect.

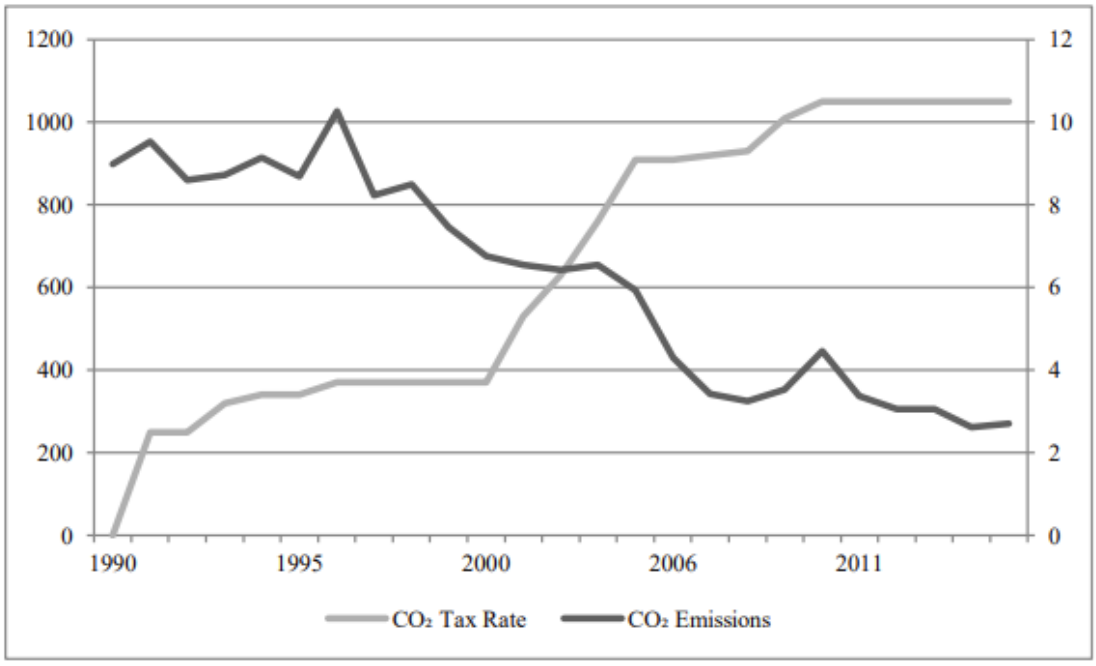
The impact was dampened a bit by "carbon leakage," that is, shifts in international trade that increased imports from cement and steel producers in countries without carbon pricing. However, such leakage offset emissions reductions by only about 13 percent. The European Union is taking steps to minimize such leakage by taxing imports of high-carbon goods from countries that don't price carbon. Border carbon adjustments are also a hot topic in Washington these days, and are a key feature of the Energy Innovation and Carbon Dividends Act.



How carbon taxes affect spur building electrification

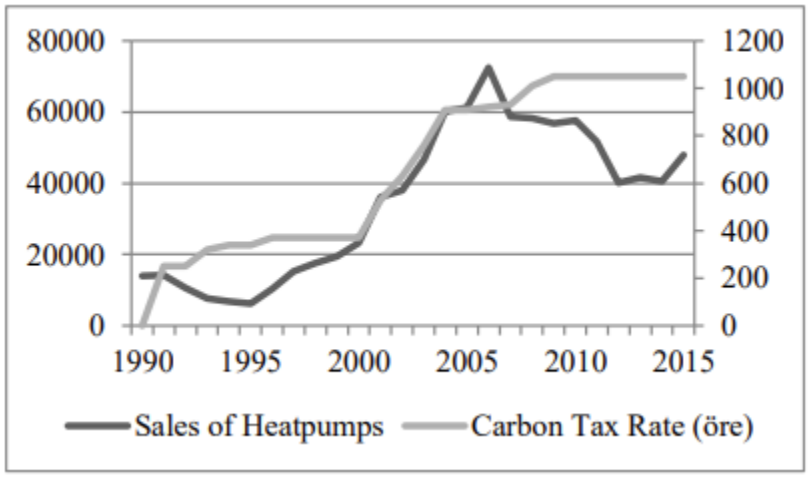
For example, Sweden's residential sector reacted strongly to a sharp rise in carbon taxes in the early 2000s, according to a 2019 paper by two economists in Germany. Compared to other countries without a carbon tax, per capita household emissions of CO2 in Sweden fell at least 800 kg (about 1,760 lbs.) per year in that period.

Figure 2. Development of CO_2 Emissions by Swedish Residential Buildings (in million tons of CO_2, right hand axis) and Development of Swedish Carbon Tax rate (in SEK/ton CO_2, left hand axis)



Source: "Dosis Facit Effectum" (2019)

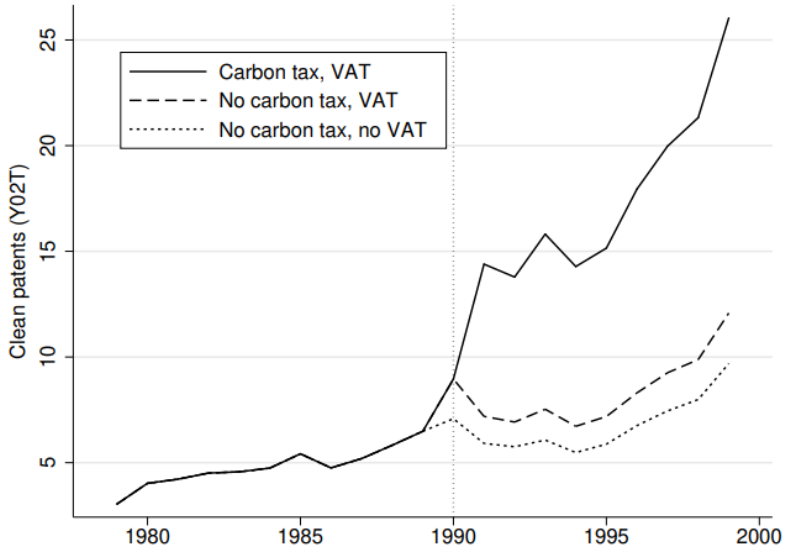
One important contributor to those residential emissions reductions was widespread adoption of low-carbon heat pumps. Annual sales jumped from about 23,000 to 60,000 after the year 2000, when carbon taxes began rising steeply. Advocates of building electrification and efficiency should take note.



Source: "Dosis Facit Effectum" (2019)

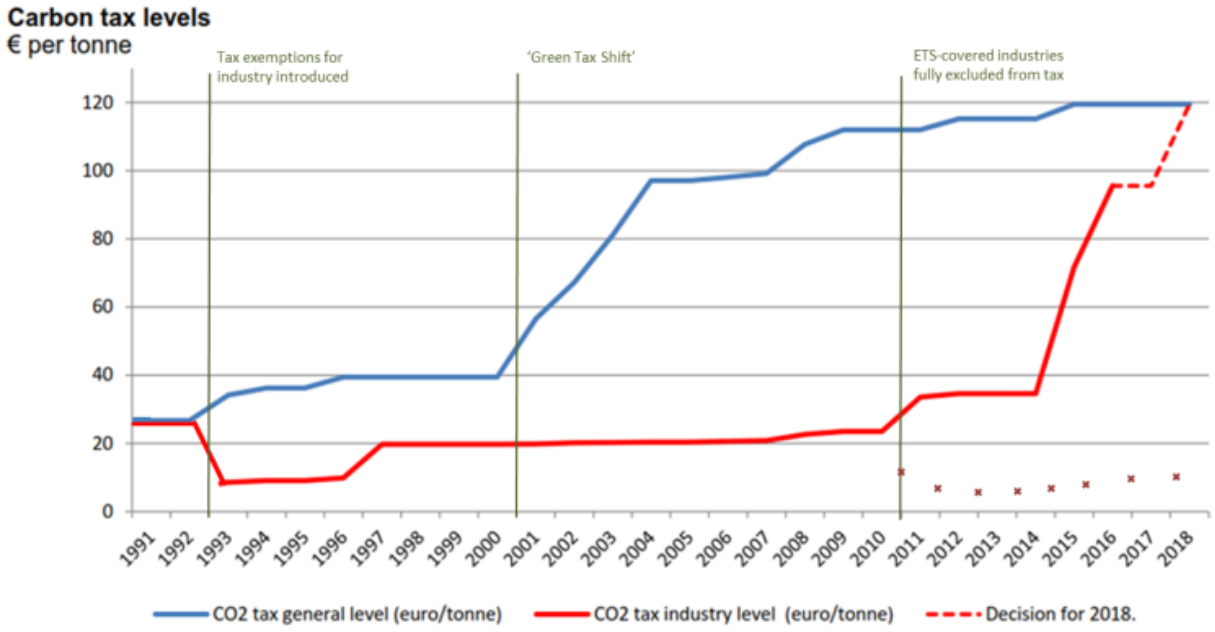
Yet another study by three German economists, which appeared this January, concluded that Sweden's green tax reform drove manufacturers to innovate, increasing the number of clean transport patents by 71 percent.

Figure 12: Disentangling the Tax Components



Source: "Driving Innovation" (2022)

A new study issued by a team of Swedish economists in October takes a close look at Sweden's manufacturing sector over the period 1990-2015, during which its CO2 emissions fell 31%. The study takes advantage of numerous changes in tax rates, exemptions, and other factors to help pin down the effects of carbon taxation. The economists conclude that carbon taxes caused at least a third and possibly all of that substantial drop. They added, however, that Sweden "could have achieved significantly larger reductions in CO2" had it not exempted many firms from the full impact of the tax (see chart below).



Source: Ecofys

Even before these studies appeared, an overview of Sweden's carbon tax experience by the international energy consultancy Ecofys and climate think tank Adelphi concluded in 2018 that it "reaffirms the lesson from other contexts that high carbon prices are highly effective and efficient instruments to drive emissions reductions. . . . Overall, the Swedish carbon tax has been a highly effective instrument in reducing emissions."

In other words, carbon pricing works in the real world after all.

Sources:

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The Impact of Carbon Pricing on Global Emissions to 2050

October 2023

Just how much difference would carbon pricing make to global efforts to keep climate disruption in check? A comprehensive analysis by four economists and energy analysts at the Massachusetts Institute of Technology offers striking confirmation that making climate polluters pay is the key to keeping greenhouse gas emissions in check.

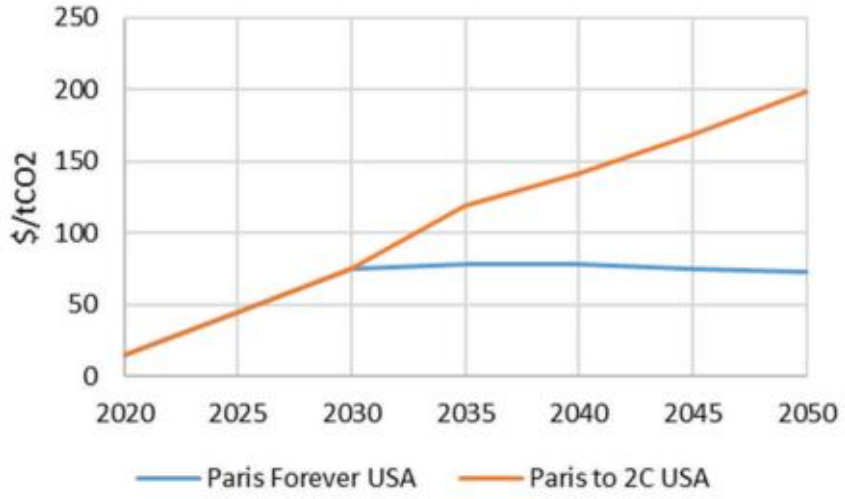
Their study, published in the journal *Economics of Energy & Environmental Policy*, concerns trends in the global electrification of passenger cars through 2050, based on the stringency of climate policies in major markets such as the United States, Europe, and China. Buried in their analysis, however, are bigger-picture estimates of how such policies could affect CO_2 emissions and global economic growth.

Using an enhanced version of the MIT Economic Projection and Policy Analysis model, a sophisticated tool uses historical data from 34 different sectors to forecast economic trends, they examine three different scenarios:

- Their *Reference* scenario assumes expanded use of renewable energy for electric power generation and a strengthening of fuel efficiency standards for light-duty vehicles.
- Their *Paris Forever* scenario models a limited increase in global climate mitigation efforts over today's levels. It "assumes that the country-level commitments pledged under the Paris Agreement are met by 2030 and retained thereafter."
- Their *Paris to 2°C* scenario "assumes the same mitigation efforts as the *Paris Forever* scenario up to 2030, but more aggressive policy action thereafter to reach the global emissions trajectory needed to limit global average surface temperature warming to 2°C."

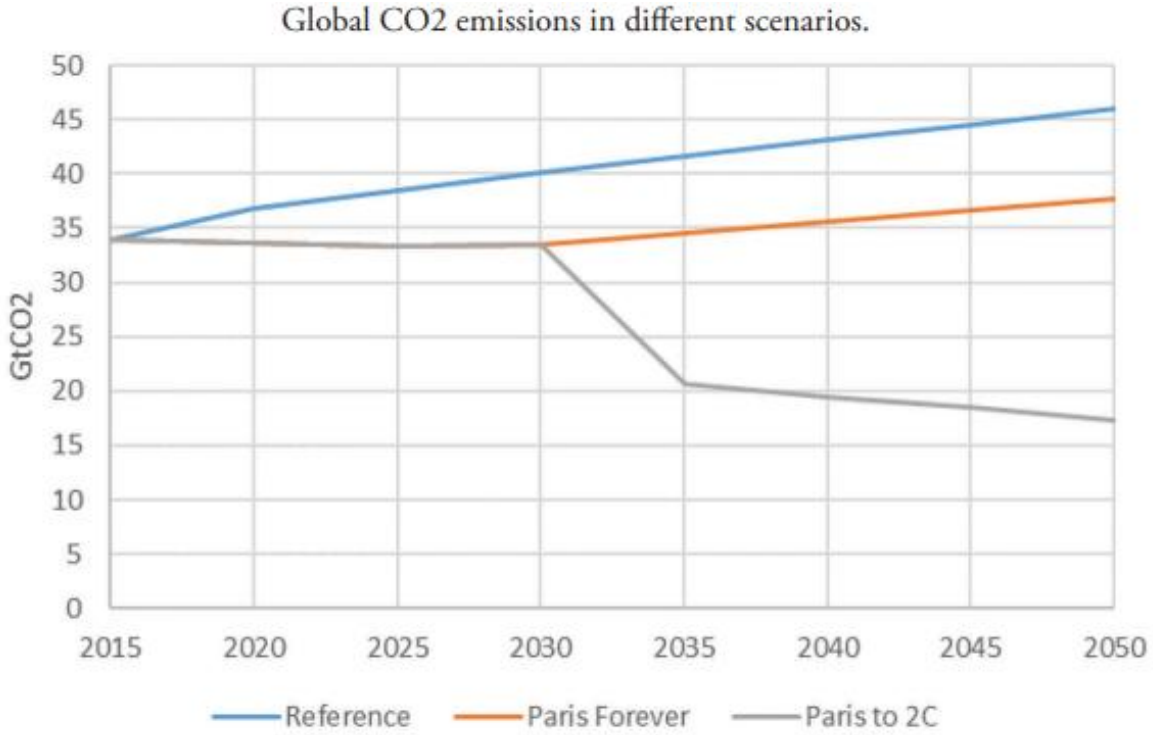
From a U.S. perspective, *Paris Forever* is more aggressive than current U.S. policy. The Inflation Reduction Act at best gets us only to about a 40% reduction in carbon dioxide emissions relative to 2005. To meet our Paris commitments, the United States must ratchet emissions down 50% by 2030. In other words, this model offers helpful insights into what policies must come next for the United States to achieve something close to "net zero by 2050."

Their model indicates that the *Paris to 2°C* trajectory will require economies around the world to impose carbon prices that climb to \$140/t CO_2 in 2040 and about \$200/t CO_2 in 2050. Here's a depiction of how carbon prices in the United States would need to rise, first to meet the 2030 Paris Commitment, and then to hold warming in check by 2050:

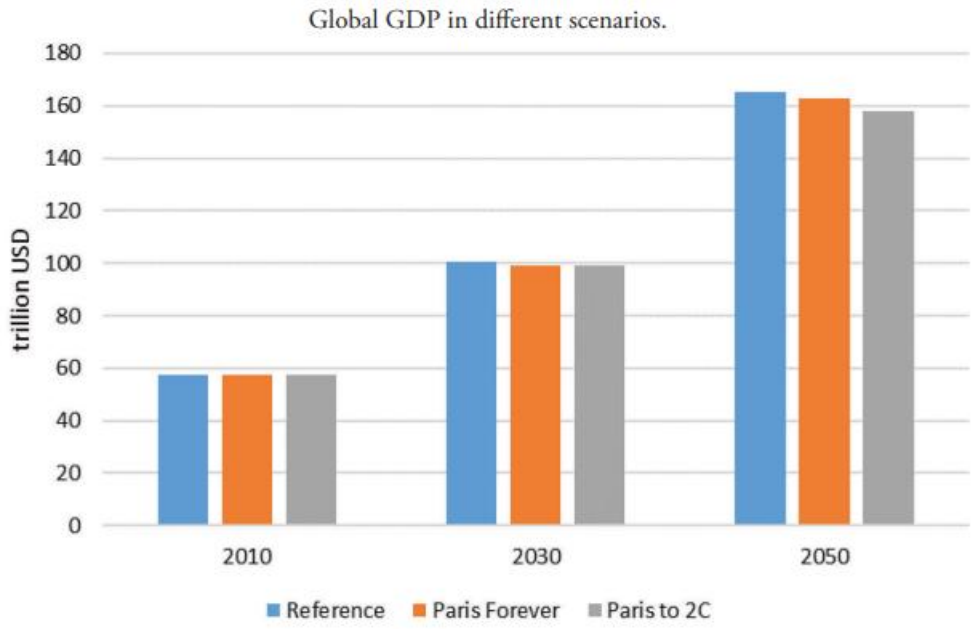


Economics of Energy and Environmental Policy (iaee.org)

And here's what the resulting emissions path would look like if other countries follow suit:

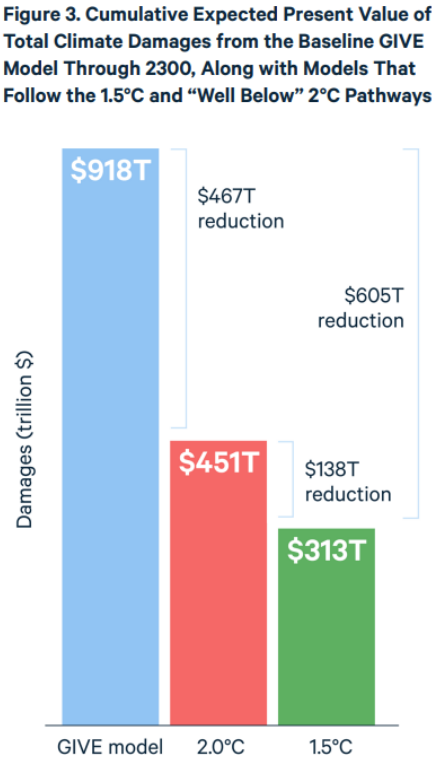


Their model forecasts that a full $200 carbon tax would cost the global economy about 3% of GDP by 2050 relative to the *Reference* scenario. No one should lose sleep over that—it's equal to just one or two years of economic growth over several decades. People in 2050 will still enjoy far higher levels of output than they do today—and with far less disruptive warming and air pollution than they would otherwise.



Postscript

A new study issued by Resources for the Future sheds light on what many economic models of climate policy miss--the avoided damages from minimizing global warming and climate disruption.



Holding global temperature rise to 1.5°C instead of 2.5°C would produce roughly $605 trillion in present-value benefits (reduced damages) through 2300, the study finds. These benefits, which total about $6.8 trillion per year, are equivalent to 2 percent of projected global GDP between 2020 and 2300. (Keep in mind that these numbers are huge in part because the time period is extremely long.)

Sources:

Sergey Paltsev et al., "Global Electrification of Light-duty Vehicles: Impacts of Economics and Climate Policy," *Economics of Energy and Environmental Policy*, 11:1 (January 2022).

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The State of Carbon Pricing Around the World

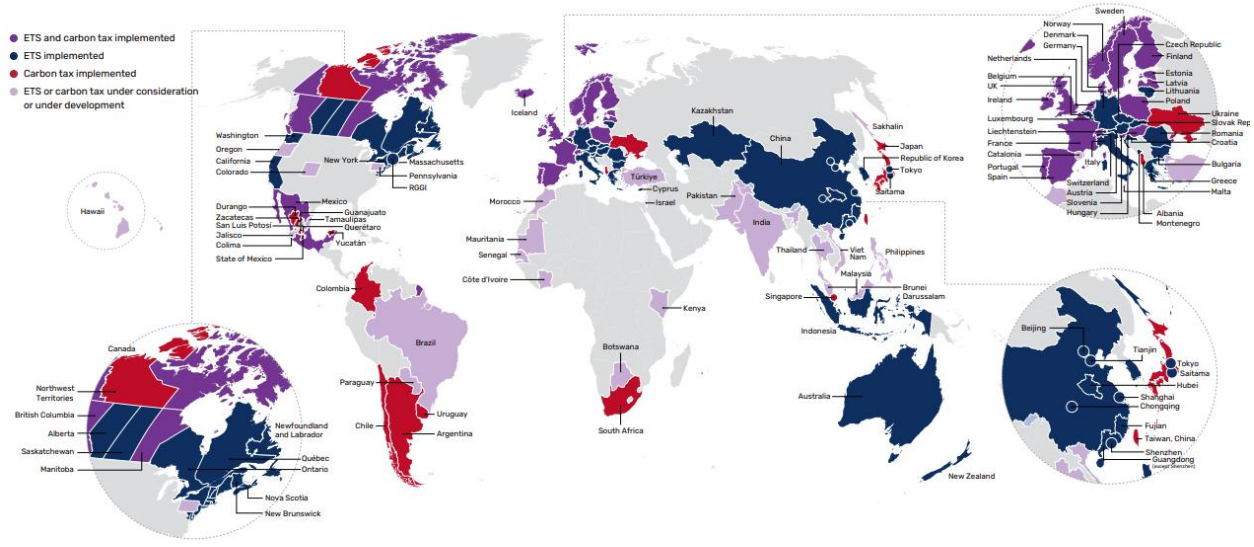
May 2024

Carbon pricing has this in common with other climate policies adopted around the world: It's helping to control greenhouse gas pollution, but not nearly enough to stave off unacceptable disruption of the global climate.

That's the message I take away from the latest annual report from the World Bank, *State and Trends of Carbon Pricing 2024*. It provides invaluable data charting the progress of this most powerful climate policy in the face of daunting political obstacles that confront virtually all efforts to put a lid on emissions of carbon dioxide and other heat-trapping gases.

On the bright side, carbon pricing now reaches a quarter of those emissions, up from only 7% a decade ago. The number of countries and other jurisdictions adopting carbon pricing grew by two last year to 75, with more plans in the works in such important countries as Brazil, Chile, Colombia, India, and Turkey. And the European Union's Carbon Border Adjustment Mechanism will provide strong incentives for these and other trading partners to join the carbon pricing bandwagon.

FIGURE 4
Map of carbon taxes and ETSs



As global emissions rose, carbon pricing *revenues* set a new record of $104 billion last year. More than half went to fund climate and environmental programs. Only about 10% of revenues were redistributed to households in the form of dividends or the like, with Austria and Canada as leaders in that policy.

Effective carbon *prices*, however, slipped in some countries, including the UK and the European Union, in the face of voter discontent with high energy prices. In virtually all countries, carbon prices remain "fall short of the ambition needed to achieve the Paris

Agreement goals," the report notes. That shortfall puts at serious risk any hope of limiting global warming to 2°C above pre-industrial levels.

As the report elaborates, "In 2017, the High-Level Commission on Carbon Prices concluded that carbon prices needed to be USD 40-80/ton of carbon dioxide equivalent (tCO2e) in 2020 and reach USD 50-100/tCO2e by 2030 to be on track to limit temperature rises to well below 2°C. 47 In 2024, only seven carbon pricing instruments, covering less than 1% of global GHG emissions, reached price levels at or above the inflation-adjusted minimum level of USD 63 per tCO2e (in 2024 USD)."

The bottom line should come as no surprise: the world needs to do more, and quickly:

"Despite the positive trends that are outlined in this year's report, higher pricing and wider coverage are going to be essential to really unlock the potential of carbon pricing. This will require political commitment, stronger global frameworks, and initiatives to share best practices that can help drive ambition. Time is not on our side as countries will need to move further, faster to decisively bend the emissions curve and safeguard a livable planet."

FIGURE 2

Global total carbon price for the period 2015-2021 (USD 2023)

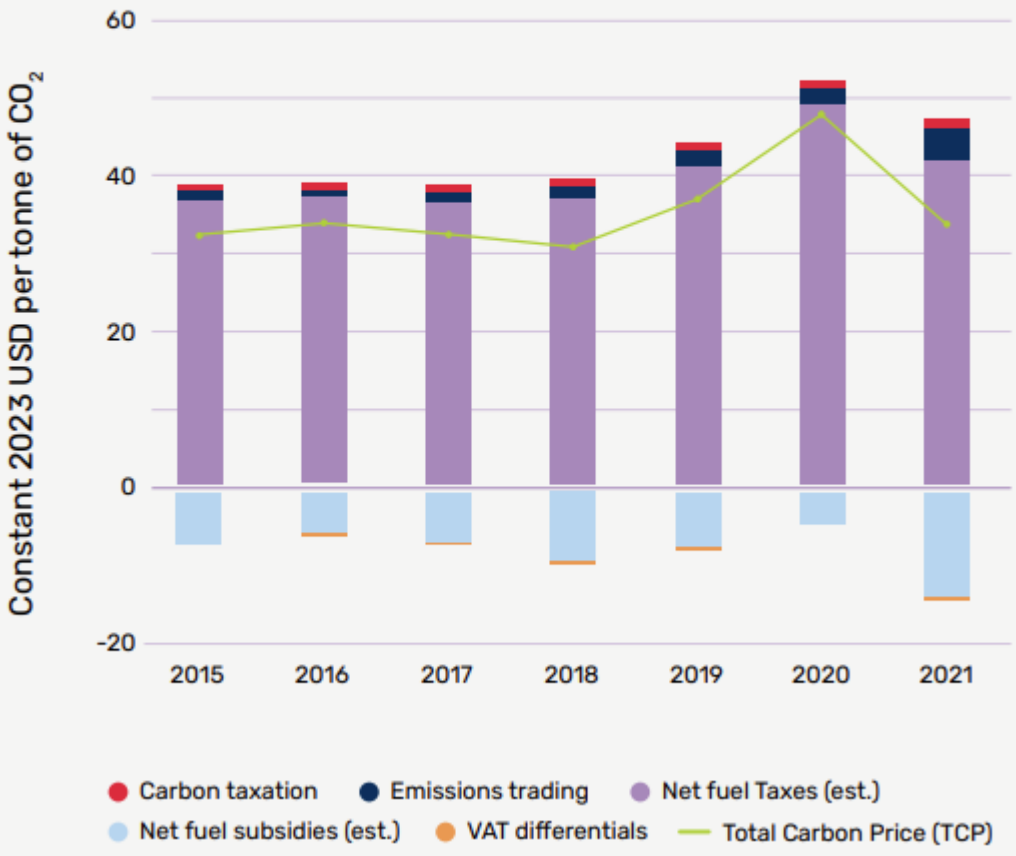
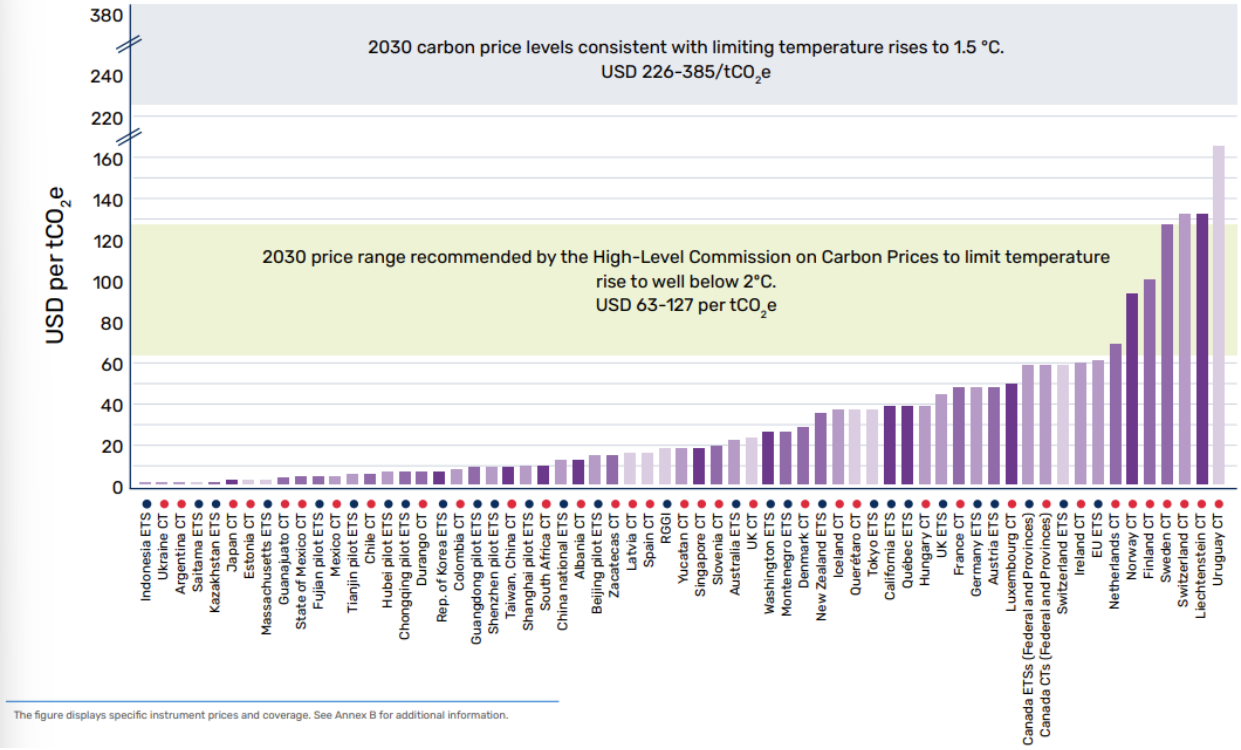


FIGURE 7

Prices and coverage across ETSs and carbon taxes, as of April 1, 2024



Postscript

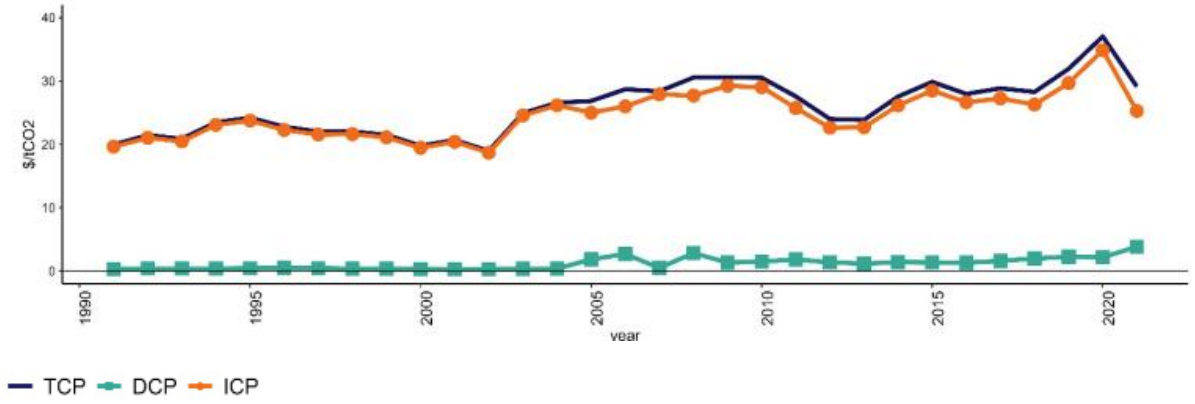
The World Bank's annual report on carbon pricing tells only part of the story. It deals with *direct* pricing programs in the form of explicit carbon taxes or emissions trading systems but fails to credit many countries around the world, including the United States, that *indirectly* price emissions through policies such as gasoline or diesel fuel taxes that aren't directly linked to carbon content.

A major new World Bank working paper, "Measuring Total Carbon Pricing," seeks to paint a fuller picture of global carbon pricing. It estimates indirect taxes without straying into more nebulous territory of trying to assign price equivalents to non-price policies such as renewable portfolio standards or clean energy subsidies. The common denominator across genuine pricing policies, it points out, is the "polluter pays principle."

One result of this sophisticated study of 142 countries from 1991 to 2021 is to demonstrate that carbon pricing is far more widespread and robust than previously reported. Many developing nations, in particular, deserve much more credit than they've previously received for their fossil fuel taxes. As of 2021, 87% of the global total carbon price consisted of indirect pricing, mostly of transportation fuels.

Unfortunately, the study also reports relatively little progress over the past three decades in growth of total carbon prices (TCP). One culprit, it explains, is the prevalence of offsetting fuel subsidies that undercut the benefit of direct and indirect carbon pricing (DCP and ICP).

Figure 1. Global TCP and its components in 2021 dollars. Only the ICP is shown when it identically overlaps with the TCP. The list of countries belonging to each of the four groups is shown in Appendix C.



Source:

Paolo Agnolucci et al., "Measuring Total Carbon Pricing," World Bank Group, Policy Research Working Paper 10486, June 20223.

Will the Real Carbon Price Please Stand Up?

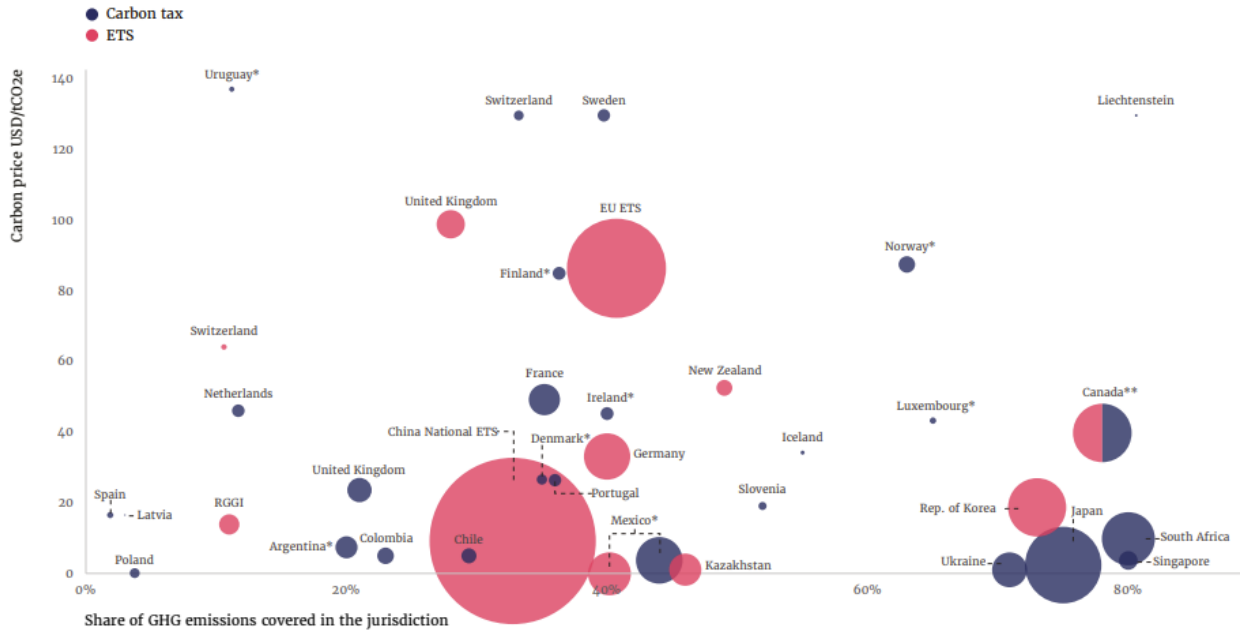
October 2022

If you want to gauge the impact of carbon pricing in the 43 countries and 32 subnational jurisdictions that have it, you need to look not only at the level of the price but its coverage. Many countries exempt entire industries to avoid political backlash or trade issues. The result sometimes looks more like Swiss cheese than true economy-wide price incentives to reduce dependence on fossil fuels.

The World Bank has long emphasized this interplay in its annual reports on the "State and Trends of Carbon Pricing." As this chart taken from the 2022 edition shows, some countries like Sweden and Switzerland have heroically high carbon prices but only middling coverage. Others, like Canada, have modest tax rates but exempt fewer sectors of their economies.

A new World Carbon Pricing Database developed by Resources for the Future and researcher Geoffroy Dolphin offers an online tool that lets you see at a glance not only what countries and jurisdictions have carbon pricing, but what their effective, or emissions-weighted, prices really are. That is to say, the average carbon price across all sectors, weighted by each sector's share of the economy's total carbon dioxide emissions.

Absolute emissions coverage, share of emissions covered, and prices for CPIs across jurisdictions



Bubble size represents absolute covered total greenhouse gas emissions.

*For CPIs that have multiple price levels, the price applying to the larger share of emissions is used.

**This is a composite presentation representing total emissions covered by carbon pricing instruments under the Pan-Canadian Framework. It includes a combination of ETS-like and carbon tax-like instruments, implemented at both provincial and federal levels.

The RFF database provides insights you can only guess at from the World Bank's map above. For example, it reports that China's effective carbon price in 2020, from its nascent emissions trading scheme, was a mere $0.37 per metric ton of CO2.

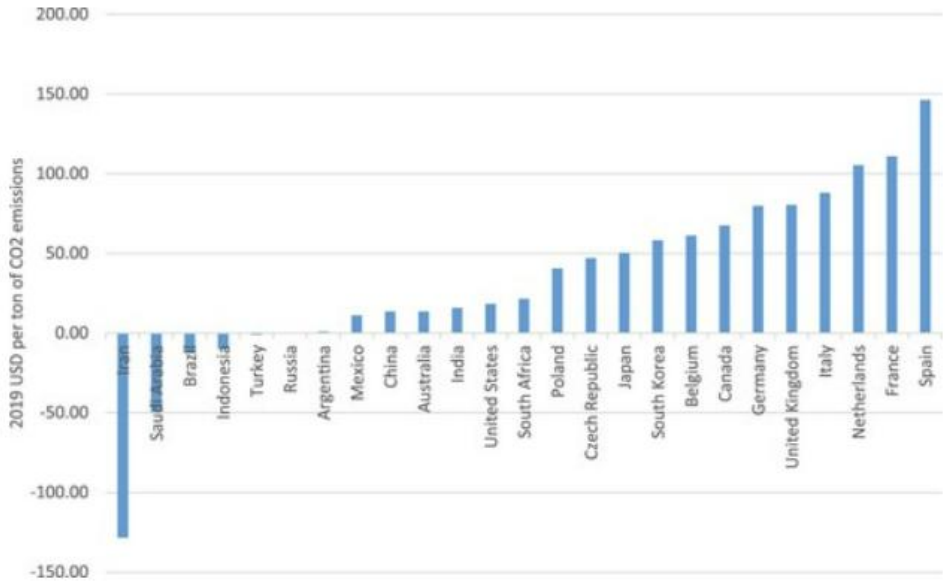
Sweden, which introduced a carbon tax in 1990, has long boasted of a carbon price of nearly $130 per metric ton. Because of its many exemptions, however, RFF reports an effective carbon price of only $56.57 in 2020 (still one of the highest in the world).

As a California resident, I was interested to note that my state's effective carbon price in 2020 was $13.63, thanks to the fact that our cap-and-trade market covers 82% of emissions. That rate compares favorably to Germany's effective price of $12.55, the UK's effective price of $11.40, and Canada's of $11.18. Prices in all of these jurisdictions have risen substantially since then, so this tool is already a little dated.

RFF isn't the only data source available. OECD has a database on effective carbon rates for the major economies it covers as well as a glossy brochure on "Effective Carbon Rates 2021."

Earlier this year, the journal Climate Policy published an analysis by three scholars of "comprehensive carbon prices of national climate policies," taking into account the implicit carbon prices reflected by a broad range of non-price policies that reduce carbon emissions. Their analysis tells a rather different story, shown in the chart below:

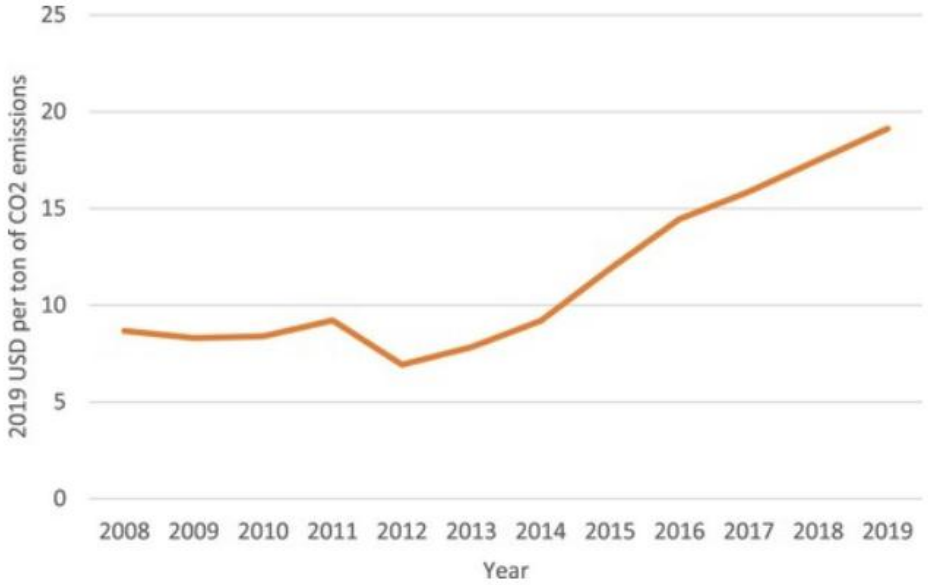
Figure 2. Country-Level Comprehensive Carbon Price by Country in 2019 USD



Measuring comprehensive carbon prices of national climate policies (2022)

They report that their comprehensive measure shows a meaningful rise in global climate mitigation efforts over the past decade:

Figure 1. Global Comprehensive Carbon Price from 2008 to 2019



Source:

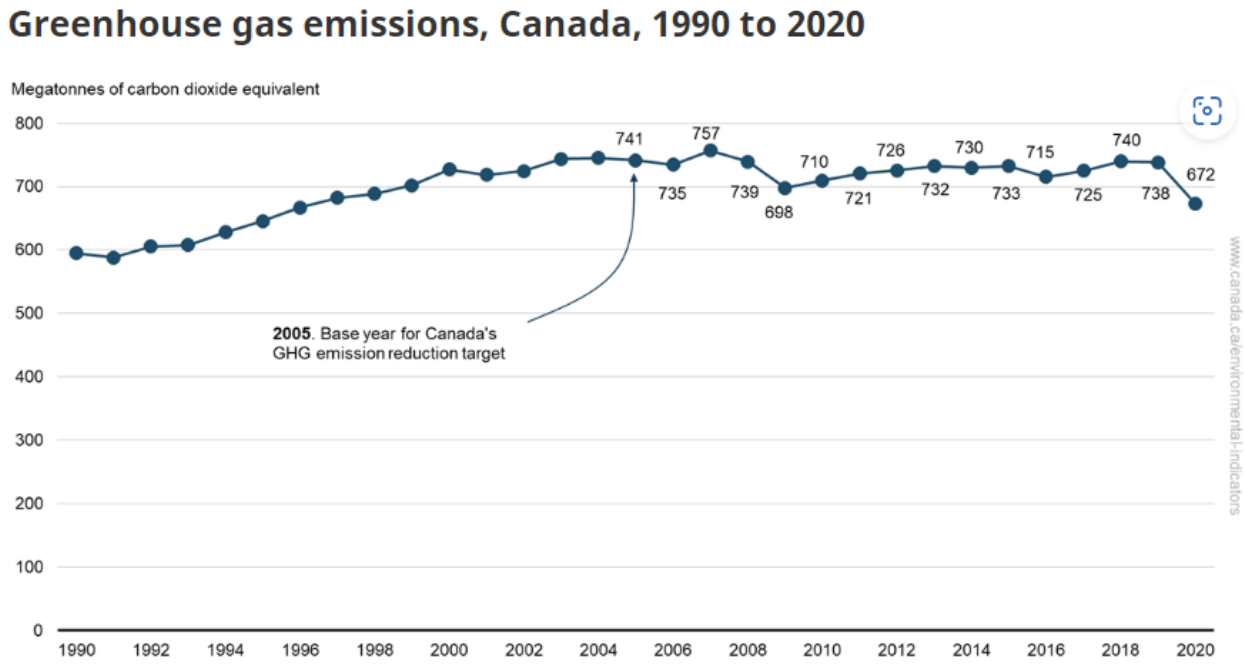
Mark Carhart, et al., "Measuring comprehensive carbon prices of national climate policies," *Climate Policy*, 22:2, January 2022.

What's the Matter with Canada?

November 2022

Ever since Canada enacted a carbon fee and dividend policy in 2019, I've been a huge fan. (Other enthusiasts include Nobel Prize-winning economists William Nordhaus and Joseph Stiglitz and the International Monetary Fund.) Its benchmark fee started at C$20 per metric ton of CO2 and is programmed to rise to C$170/t by 2030, which will make it the highest in the world. The law also returns 90 percent of the revenue to individuals, making it highly progressive and helping to shield it against ongoing political attacks.

So I was distressed to read that Canada ranks dead last among the world's 10 most developed countries in terms of meeting its greenhouse gas emissions targets for 2030, according to Corporate Knights, a sustainable economy research firm. In 2019, the last pre-pandemic year for which data are available, Canada's emissions were down only 3 million metric tons (Mt) from the 2005 baseline. It will need *annual* cuts of about 30 Mt to reach its goal of a 40-45% reduction by 2030. (The United States aims for a reduction of 50-52%.)



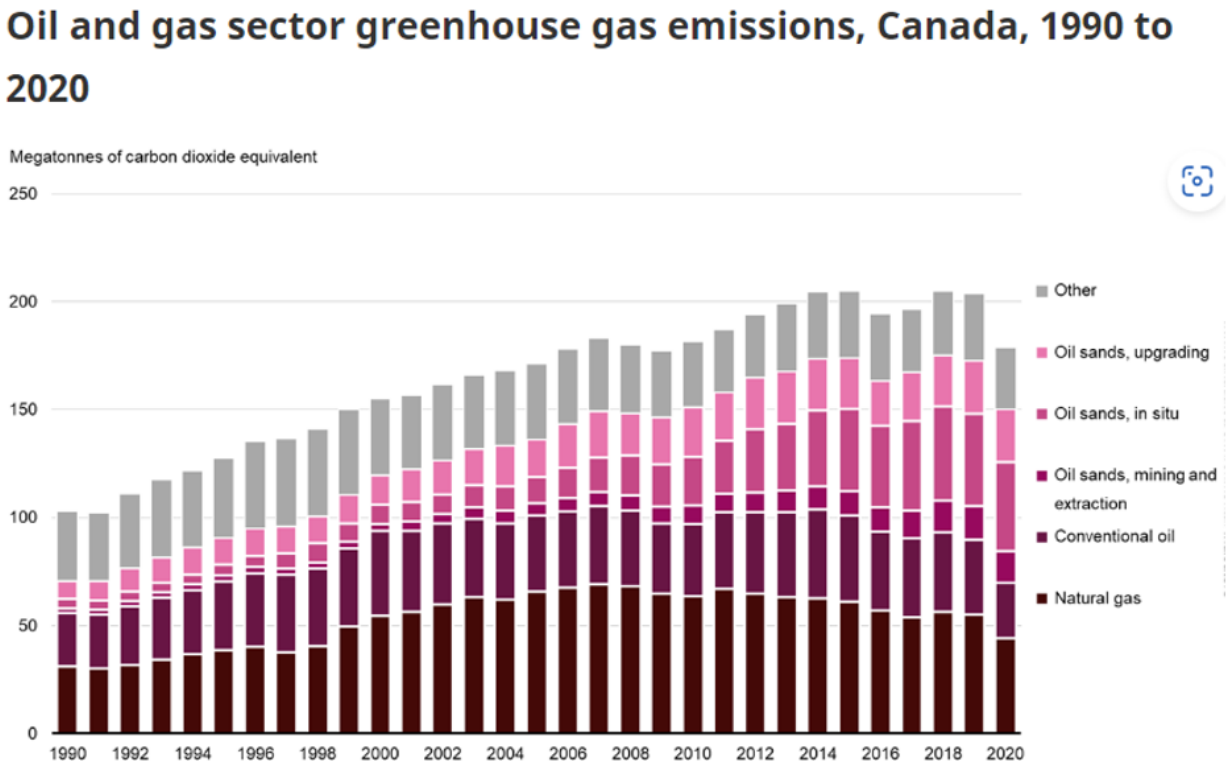
Source: Government of Canada

So what's the matter with Canada? I spoke with one of the country's most distinguished economists, Nicholas Rivers, Canada Research Chair in Climate and Energy Policy at the University of Ottawa and followed up by reading a variety of studies. In brief, the problem with Canada's carbon tax seems rooted in three main issues:

- It hasn't been in effect long enough, although some provinces had carbon pricing programs that predate it. The national policy setting a minimum price only passed in

2019 after [many years of relative inaction by the former government](). The tax also started at a low level and only this year climbed to C$50/t.

- Canada's carbon policy permits considerable variation from province to province and goes easy on many major industries, including the booming oil and gas sector. That's a problem since [emissions from oil and gas production]() have increased 74% since 1990 and now account for 27% of national greenhouse gas emissions, more than any other sector.
- The impact of the carbon tax has been blunted by ongoing uncertainty over its political future. The Conservative Party continues to inveigh against it, much as Republicans vow to overturn Obamacare. That discourages investment by businesses and households in longer-lived equipment that would reduce emissions.



Source: [Government of Canada]()

Too many loopholes

To avoid political brawls with provinces like petroleum-rich Alberta and with major industries concerned over their international competitiveness, the carbon tax policy had "lots of loopholes," Rivers explained, including wide latitude for differences in provincial administration. "The government's philosophy was 'Let's get something in place and then work on tightening it over time,' but that meant that in many cases [the policy was] more lenient than we'd like to see."

The first independent review of carbon pricing last year by the Canadian Institute for Climate Choices identified weak and inconsistent provincial pricing of emissions from major industrial plants as one key drawback. "We were surprised at the large variation in average cost applied to large emitters both across and within jurisdictions, ranging between $1.80 and $26 per tonne with an average of $4.96 per tonne in 2020," it reported. "This average cost signal is exceptionally low."

A major climate-policy report issued earlier this year by Canada's Auditor General similarly criticized "weak minimum national standards for large emitters" like oil and gas producers. It praised carbon pricing as "one of the most efficient policy approaches to reducing greenhouse gas emissions" but noted that its effectiveness "requires that it be applied broadly and promptly and becomes increasingly stringent."

Exemplifying the problem with provincial exceptions to national policy, the Alberta government earlier this year used revenue from its provincial tax on industrial polluters to purchase ads promoting an oil sands pipeline expansion. The province's minister of energy previously worked for the Canadian Energy Pipeline Association.

Too much uncertainty

Rivers told me further that "although the carbon price schedule is high, firms aren't able to finance some low-carbon investments because of the political risk that the tax will be withdrawn. This doesn't appear in the models. There is a great deal of practical uncertainty."

The Canadian Climate Institute addressed that issue head on in a report issued this October, "Closing the Carbon-Pricing Certainty Gap":

> Decarbonizing Canadian industry requires billions of dollars in private-sector investments today to achieve our 2030 targets. In order for those investments to make sense for firms and investors, they must be confident that Canada's carbon price will actually increase as scheduled. . . .
>
> This is a real problem — it isn't theoretical. Over the course of dozens of conversations with industry, business associations, commercial investors, and other stakeholders, the authors heard again and again that the carbon-pricing certainty gap is inhibiting investment and needs to be addressed urgently in order to accelerate industrial decarbonization.

One of its recommendations, which is under serious official consideration, is for the federal government in effect to guarantee the future carbon price through contracts with firms undertaking major carbon-reducing investments. If the price rises as expected, the government would pay nothing. If a future government reneges on planned price increases, it would be contractually obligated to make up the firms' lost revenue.

Too much misinformation

The Liberal government is listening to constructive critics and working to reform carbon pricing and other national policies to help meet the country's emissions goals. But the political future of its carbon fee remains uncertain owing to relentless opposition by the rival Conservative Party. Its leaders have taken advantage of rising energy prices to condemn the cost to consumers, without acknowledging either the offsetting dividend or the benefits of climate mitigation.

Prime Minister Justin Trudeau vented this September against one such critic, the Conservative premier of Manitoba: "What the premier and others across the country don't seem to be honest about with Canadians is in the places like Manitoba, where the federal price on pollution applies, average families get more money back from the price on pollution than the extra price on pollution costs them. We found a way of fighting climate change while supporting families who need that support, and that's something that we are going to continue to do."

Some of the biggest Conservative talking points were provided by a parliamentary report issued in March, which claimed that "most households" would "see a net loss" from the program owing to its negative impact on economic growth.

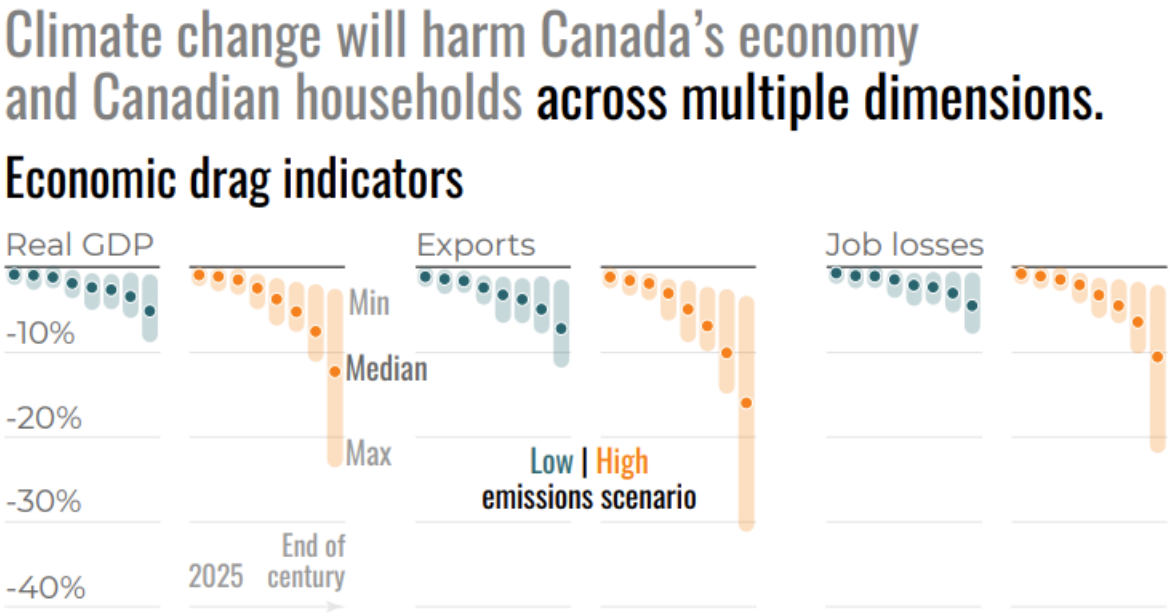
There were two huge problems with the report. One is that its economic model doesn't accord with real-world studies, which show again and again and again that carbon taxes have no meaningful negative impact on economic growth. A 2021 study of British Columbia's experience with carbon taxes since 2008 declared, "revenue-neutral carbon taxation has no negative impacts on GDP. We thus conclude that implementing a pre-announced policy of revenue-neutral carbon taxation . . . contributes to lowering harmful greenhouse gases into the atmosphere without hurting the overall economy of the associated region."

The other problem with the report is it examined only the costs and not the potential benefits of carbon pricing. Any investment looks bad under such one-sided scrutiny. Indeed, a scholarly study published in Environmental Politics last year complained about "economic consultants hired by the petroleum industry" who "used models that inflated predicted costs while ignoring policy benefits" to "undermin[e] numerous major climate policy initiatives in the US over a span of decades, including carbon pricing."

The Parliamentary Budget Office was not hired by the petroleum industry, of course, but it ignored facts about the economic harm to Canada from climate change like those reported recently by the Canadian Climate Institute:

- By 2025, climate impacts will slow Canada's economic growth by $25 billion annually, which is equal to 50 per cent of projected GDP growth.

- Low-income households could see income losses of 12 per cent in a low emissions scenario and 19 percent in a high emissions scenario by the end of the century.
- Job losses could increase to 2.9 million by end-of-century.
- Proactive adaptation measures combined with global mitigation measures would cut costs to Canada by three-quarters.



Source: "Damage Control: Reducing the Costs of Climate Impacts in Canada," 2022

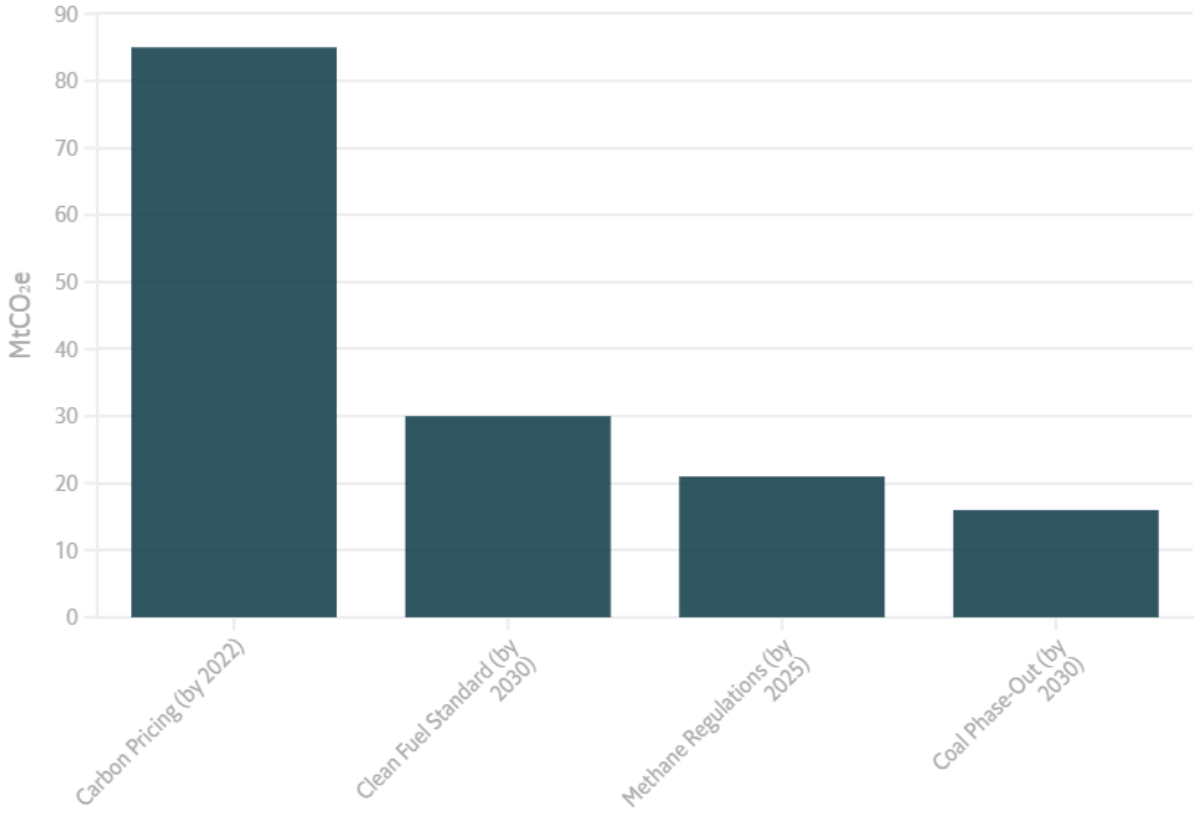
Canada's prestigious Ecofiscal Commission, in contrast, did examine both sides of the equation and reported that "carbon pricing tops the list" of policies to meet Canada's GHG reduction target:

"It delivers the lowest cost emissions reductions. A steadily rising carbon price can achieve Canada's target *and* maintain strong economic growth. It can also generate revenue that can be returned to Canadians to maintain affordability. . . Our modelling shows that carbon pricing will grow Canadian incomes on average by $3,300 *more* in 2030 relative to a policy approach that relies on a mix of subsidies and industry-only regulations."

Amen to that.

P.S. I recently came across this interesting projection by the International Energy Agency in 2020 of the impacts of various climate policies in Canada. It's too soon to know whether carbon pricing is setting Canada on track to meet that prediction. Here's a chart showing the full range of policies that IEA considered:

Estimated cumulative emissions reductions due to carbon pricing in Canada compared with other federal policies



Source: IEA

Sources:

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Canadian Climate Institute, "Damage Control: Reducing the Costs of Climate Impacts in Canada," 2022

Don't Believe the Misinformation About Canada's Carbon Tax and Rebate

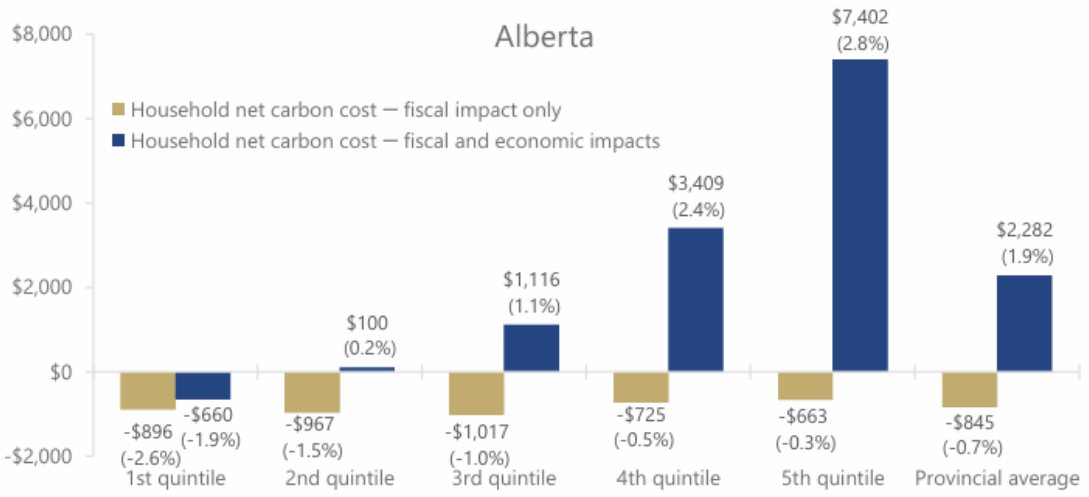
October 2024

If Conservative Party demagogues in Canada succeed in their campaign to "ax the tax" and repeal the country's model carbon fee and dividend policy, a big part of the blame will lie with the nonpartisan and ostensibly expert Parliamentary Budget Office (PBO).

In 2022, the PBO issued a seemingly authoritative but deeply flawed economic and financial analysis of carbon pricing in Canada. (For more details, see my post, "What's the Matter with Canada?")

Although the PBO conceded that most households would get back more in rebates than they paid in higher energy prices (the fiscal impact), it emphasized that most Canadians would suffer losses from "the overall negative . . . impact of carbon pricing" on the country's economy. By 2030, it estimated for example, the shortfall in potential growth would cost many middle-income households in Alberta more than 1% of disposable income (see Summary Figure 1).

Summary Figure 1 Household net carbon costs in 2030-31 under HEHE carbon pricing



A Distributional Analysis of Federal Carbon Pricing under A Healthy Environment and A Healthy Economy – PBO 2022

While anti-government Conservatives and media jumped on those estimates as proof that voters were being fleeced, many economists decried the PBO's failure to weigh the cost of doing nothing to curb the large and growing impact of climate change on Canada's economy. If businesses adopted such a methodology—looking at only one side of the cost/benefit equation—they would never invest a dollar in anything.

Economists also criticized the PBO for serious technical errors. Earlier this month, as a result, the PBO issued a revised report fixing those errors. The report still fails to estimate the benefits of climate action, but now it concedes that costs to households will be much lower than previously reported. In the case of Alberta, for example, the PBO now estimates the average net cost per household at $697 in 2030, down from $2,773.

But both PBO reports suffer from another structural failing: the critical assumption embedded in their economic model that taxing fossil fuels while recycling revenues will curb economic growth.

In my previous post, I noted that "its economic model doesn't accord with real-world studies, which show **again** and **again** and **again** that carbon taxes have no meaningful negative impact on economic growth. A **2021 study** of British Columbia's experience with carbon taxes since 2008 declared, "revenue-neutral carbon taxation has no negative impacts on GDP. We thus conclude that implementing a pre-announced policy of revenue-neutral carbon taxation . . . contributes to lowering harmful greenhouse gases into the atmosphere without hurting the overall economy of the associated region."

One of the world's leading authorities on the economics of carbon pricing, Tufts University economist Gilbert Metcalf, last year summarized the results of many empirical studies in a review essay for *Oxford Review of Economic Policy*. "[O]nce [business] creation and technology adoption are incorporated into modelling," he observed, "carbon taxes may lead to modestly positive impacts on economic output (in addition to the environmental benefits)."

A new paper circulated by two economists at the University of California Los Angeles and Wake Forest University reports success in replicating a landmark 2023 study by Metcalf and famed Harvard economist James Stock. Metcalf and Stock analyzed data on carbon pricing and macroeconomic growth in 31 European countries from 1990 through 2018. In addition to finding that carbon pricing significantly reduced carbon dioxide, they demonstrated that "carbon taxes have no adverse effects on GDP growth or employment. In fact, . . . carbon taxes may have a zero to modestly positive effect on both indicators." The new replication study strengthens that conclusion through additional tests using different statistical specifications.

In short, the only major finding worth believing from the updated PBO study is that most Canadian households would come out significantly ahead—by as much as 1% of disposable income—from the combined carbon tax and rebate in 2030. (See Table 1 below, noting that negative numbers represent an income gain.). That is, if opponents fail to "ax the tax" and Canada's flagship climate policy remains on the books.

Table 1 – Average household net cost of the federal fuel charge in 2030-31 by income quintile in dollars and as a percentage of disposable income (fiscal impact only)

Backstop province	1st quintile	2nd quintile	3rd quintile	4th quintile	5th quintile	Average
Newfoundland and Labrador	-$893	-$971	-$642	-$606	-$467	-$713
Newfoundland and Labrador	-2.8%	-1.8%	-0.8%	-0.5%	-0.2%	-0.7%
Prince Edward Island	-$491	-$404	-$317	-$123	$302	-$204
Prince Edward Island	-1.6%	-0.7%	-0.4%	-0.1%	0.1%	-0.2%
Nova Scotia	-$598	-$549	-$222	-$249	$50	-$313
Nova Scotia	-2.0%	-1.0%	-0.3%	-0.2%	0.0%	-0.3%
New Brunswick	-$472	-$336	-$240	-$178	$22	-$241
New Brunswick	-1.5%	-0.6%	-0.3%	-0.2%	0.0%	-0.2%
Ontario	-$642	-$472	-$243	-$277	-$28	-$331
Ontario	-1.9%	-0.7%	-0.2%	-0.2%	-0.0%	-0.3%
Manitoba	-$793	-$636	-$611	-$537	-$126	-$537
Manitoba	-2.5%	-1.1%	-0.7%	-0.4%	-0.1%	-0.5%
Saskatchewan	-$1,424	-$1,385	-$1,298	-$1,185	-$733	-$1,205
Saskatchewan	-4.5%	-2.2%	-1.4%	-0.9%	-0.3%	-1.0%
Alberta	-$768	-$888	-$856	-$339	-$782	-$725
Alberta	-2.1%	-1.3%	-0.8%	-0.2%	-0.2%	-0.5%

Source

Office of the Parliamentary Budget Officer.

Note

Net cost (fiscal impact only) is calculated as the federal fuel charge and related GST paid (that is the gross cost), less the Canada Carbon Rebate received. A negative cost is a "net gain", meaning the amount of the Canada Carbon Rebate received exceeds the gross cost to the household. The 1st quintile represents the lowest household income quintile; the 5th quintile represents the highest household income quintile.

PBO 2024 A Distributional Analysis of the Federal Fuel Charge – Update

The Story of Ireland's Carbon Tax

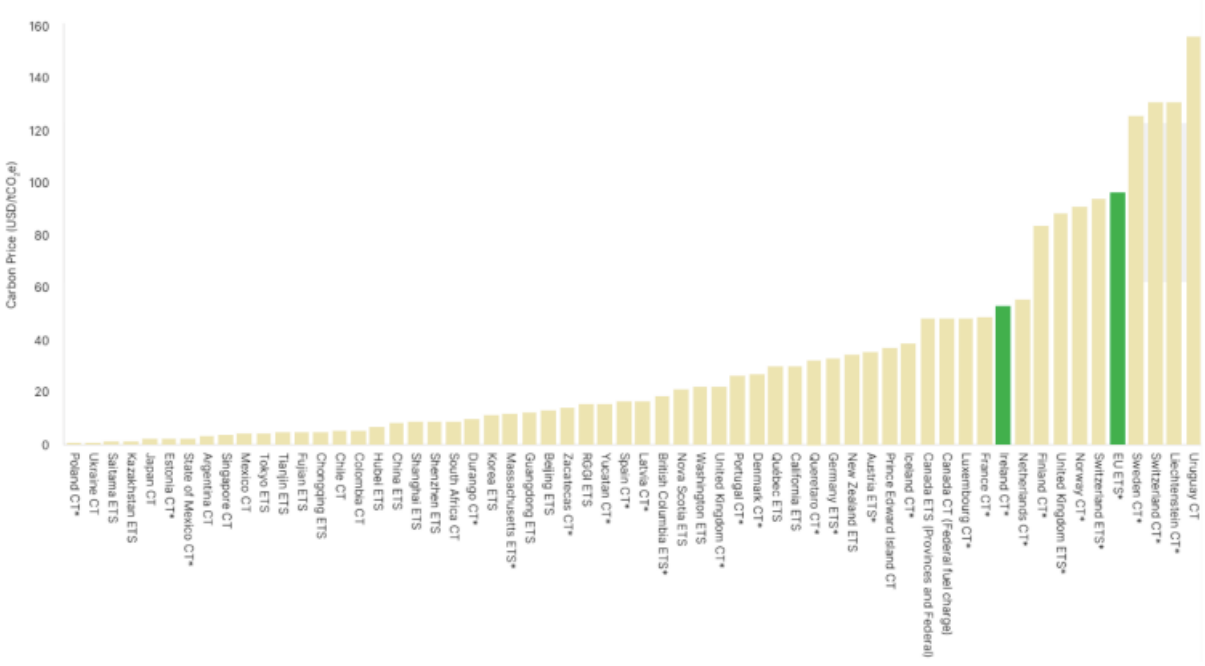
May 2024

At the end of his official visit to Ireland last year, President Biden remarked that stories of his ancestral country "have become part of my soul." Here's a new story he should take to heart in his next term: how Ireland is meeting its climate obligations with a national carbon tax.

Most Americans have no clue that neighboring Canada has a national carbon tax that rose to C$80 this April, so it's hardly surprising that Ireland's carbon tax is little known even among climate activists.

To the average Irish resident, however, the tax is real enough. On May 1, it increased by €7.50 to €56 per metric ton of CO2 (about US$60). The average household will pay about $125 per year in carbon taxes embedded in the energy and goods they consume. Ireland's carbon tax is now one of the highest in the world, according to World Bank data.

Figure 1 *International comparison of carbon prices for ETS and tax measures in 2023*[3]

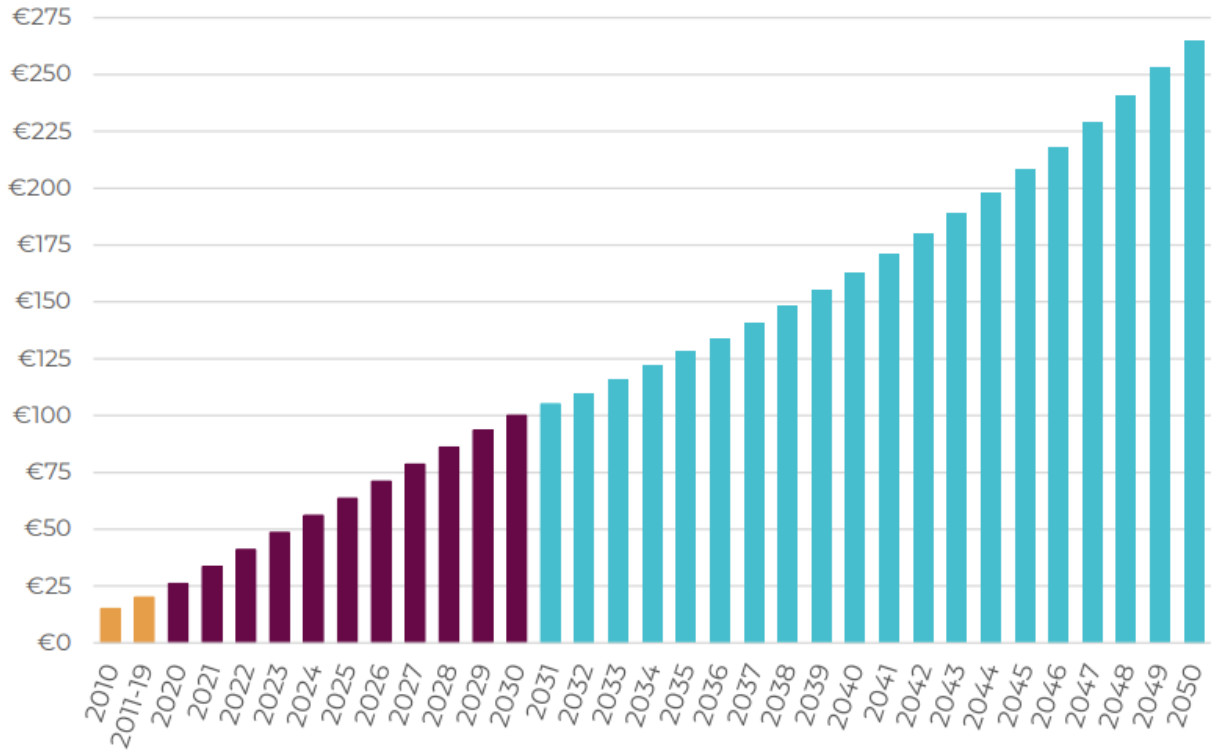


Under leadership of its Green Party, and with strong support from economists at a time of fiscal turmoil, Ireland introduced its carbon tax in December 2009 at a rate of €15 per metric ton. It was soon levied on all major fossil fuels but exempted sectors like power generation covered by the European Union's Emissions Trading System. 2009 was the same year a

proposed U.S. cap-and-trade law passed the House but died in the Senate, leaving the United States as one of the few advanced industrial nations today without carbon pricing.

Following intense public debate, Ireland's Finance Act of 2020 set in motion a steady increase in the country's carbon price, which is slated to reach €100 per metric ton of CO2 in 2030. At that rate, the tax will have sharp teeth. In 2011, a consumer paid only €2.78 in carbon taxes to fill a 60 liter tank of gasoline. By 2030, filling the same tank will cost €13.89 in carbon taxes.

Figure 1: Carbon Tax Rates 2010-2050



Source: Department of Finance's Tax Strategy Group (TSG) and *Infrastructure Guidelines*.

Note: rates marked in blue represent shadow carbon prices to be used for estimating future costs of infrastructure projects, but are not legislated increases in carbon taxes.

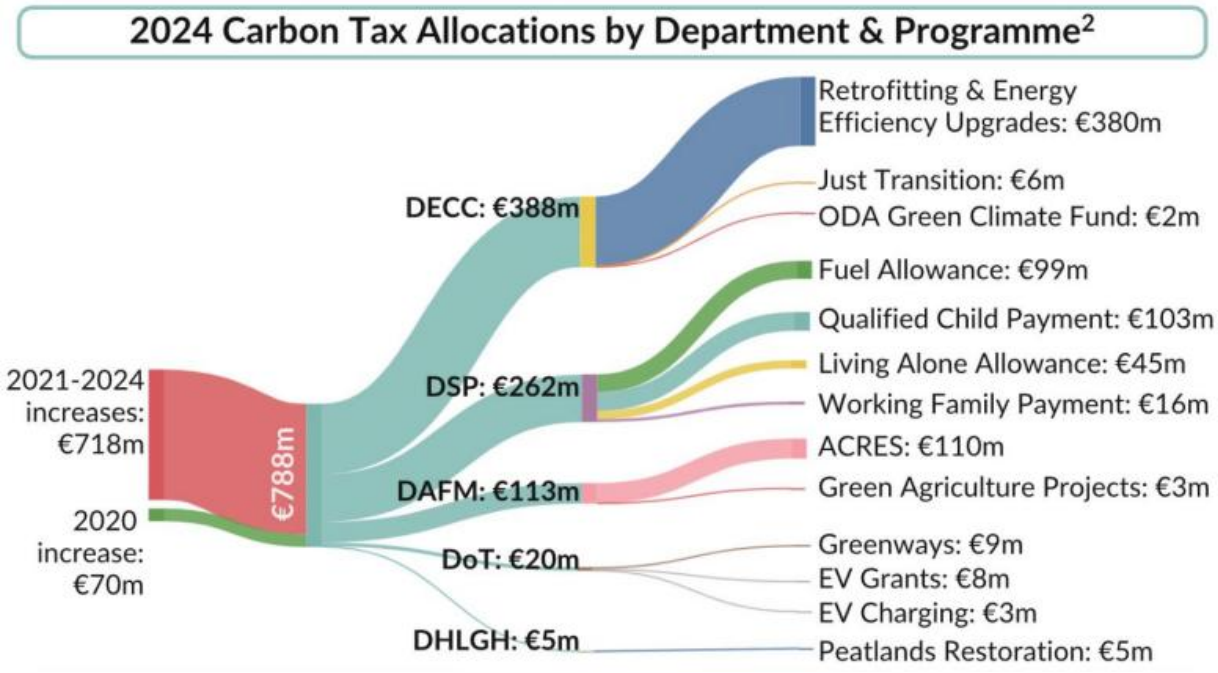
Ireland's carbon tax has clearly affected behavior. Through 2017, it cut emissions from agriculture and the residential and commercial building sectors by about 23% relative to 1990, though it failed to suppress transport emissions. Even so, the planned tax increases won't be enough to meet Ireland's legally binding target of reducing greenhouse gas emissions reductions 51% by 2030. The government estimates that its carbon tax and other existing climate programs will reduce overall emissions only 29% by then.

Recycling revenues for equity and political buy-in

In Ireland, as everywhere, strict climate policies run up against voters who are loathe to pay higher prices for energy. To help make the costs of its carbon tax palatable following France's

"Yellow Vest" protests, the Irish government in 2018-19 strongly considered introducing a universal carbon dividend. "I'm very much of the view that the money raised from carbon tax from households should be given back to households," said Prime Minister Leo Varadkar.

His view did not carry the day, however. Instead, the government opted for a hybrid recycling program. In 2020 it began earmarking new revenues from the tax for a variety of popular "green" programs and social welfare funds to ease the burden on low- and moderate-income households. For example, €5 billion were earmarked for retrofits of Ireland's notoriously energy-inefficient homes, particularly in lower-income neighborhoods. Such a program, if administered efficiently, could reduce energy bills and carbon emissions in one go.



Department of Public Expenditure, Budget 2024: The Use of Carbon Tax Funds

Thanks also to increases in Qualified Child Payments and Working Family Payments, both programs aimed at reducing poverty, the net effect of the carbon tax and earmarked spending programs in 2024 will lift family incomes in the bottom half of the income distribution, the Department of Public Expenditure reports.

Because the government rejected a universal dividend, however, the benefits of carbon tax revenues are unequally distributed. "Gains at the bottom of the income distribution are driven by large changes for a relatively small number of households," according to a recent report by the Parliamentary Budget Office. "For instance, our estimates indicate that 31 per cent of bottom decile households receive revenues from the recycling package, falling to 18 per cent in the second decile and decreasing further to 14 per cent by the fifth decile." Reforms of the current revenue recycling program "could be useful in order to facilitate an equitable transition to a low-carbon economy," the report concluded.

For all their limitations, decisions by the Irish government to allocate carbon tax revenue for green programs and social welfare "directly addressed the expressed preferences of the public and those of powerful interest groups, such as business associations, to secure political support for reform," noted by Daniel Muth in a recent article in *Ecological Economics*, which analyzes the political economic implications of carbon tax revenue recycling. Cases like Ireland "demonstrate that a hybrid use of revenue can simultaneously serve the objectives of enhancing public acceptability, reversing negative distributional impact, and furthering climate change mitigation efforts." That's a story President Biden would do well to learn.

Austria's Climate Bonus Arrives Just in Time for the Holidays

November 2022

The hills are alive with the sound of . . . millions of Austrians enjoying a €500 ($520) bump in their bank accounts. It's a "Klimabonus" (climate bonus) paid out by the national government from expected carbon-fee revenues as part of its comprehensive "eco-social tax reform" enacted last year. (**Update**: For 2024-25, the climate bonus amounts to €145, €195, €245 or €290 depending on the primary place of residence and its local infrastructure.)

As of Nov. 2022, about 8.7 million people had received climate bonus payments totaling almost €4 billion.

Contrary to the claims of a certain prominent U.S. columnist that "the politics of carbon taxes are poisonous," Austria has now expanded carbon pricing to virtually the entire economy, including fossil fuels used in transportation, buildings, agriculture, and small industries. The Klimabonus is the spoonful of sugar that helps the medicine go down (sorry).

The new pricing scheme applies to upstream fuel suppliers and begins at €30 per metric ton (t) of CO2. It will rise each year to €55/t/CO2 in 2025, after which prices will be determined in a yet-to-be-established market for emissions allowances.

Austria is following in the footsteps of Germany, which began pricing the carbon content of fuel used in the building and transportation sectors last year. Its price is scheduled to rise more modestly, from €10/tCO2 in 2021 to €35/t in 2025.

Both Austria and Germany participate in the European Union's Emissions Trading System, which prices emissions from electric power, large industry, and domestic aviation. The effective price has risen sharply in the last couple of years to more than €70/tCO2.

Austrians and legal residents are getting an unusually large climate bonus this year to offset the effects of high inflation. Starting next year, Austria will also adjust the size of the annual bonus based on whether people have access to convenient public transportation.

Here's how the Austrian government explains the climate bonus:

> Every euro earned through CO2 pricing goes directly back to the people in Austria. The entire revenue is reimbursed in such a way that climate-friendly behavior and climate-friendly production pay off more and more. The principle behind it: The less CO2 is consumed, the more remains of the climate bonus. In this way, climate protection also pays off financially and the climate bonus will provide important support, especially for low incomes. At the same time, Austria is assuming its responsibility for climate protection and at the same time implementing European requirements.

You couldn't ask for a clearer explanation, and in English no less!

Sources:

Austria, Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology, "Klimabonus."

International Carbon Action Partnership, "Austria's national ETS enters into force," October 1, 2022.

How Carbon Pricing Would Accelerate Building Electrification: Lessons from Japan

July 2023

The huge task of electrifying American homes and office buildings is off to a great start thanks to subsidies for heat pumps and other solutions provided by the Inflation Reduction Act. But we should never forget the expert opinion of the American Council for an Energy Efficient Economy that a national fee on carbon emissions "could be the single most impactful policy to drive building electrification forward on the federal and state levels."

In a previous post I cited convincing evidence from Sweden that sales of heat pumps soared after 2000, when carbon taxes began rising steeply, leading to a dramatic fall in carbon emissions from residential buildings.

Also relevant is a 2022 study by University of California economist Lucas Davis of what caused the growth of residential electric heating in the United States over the past seven decades.

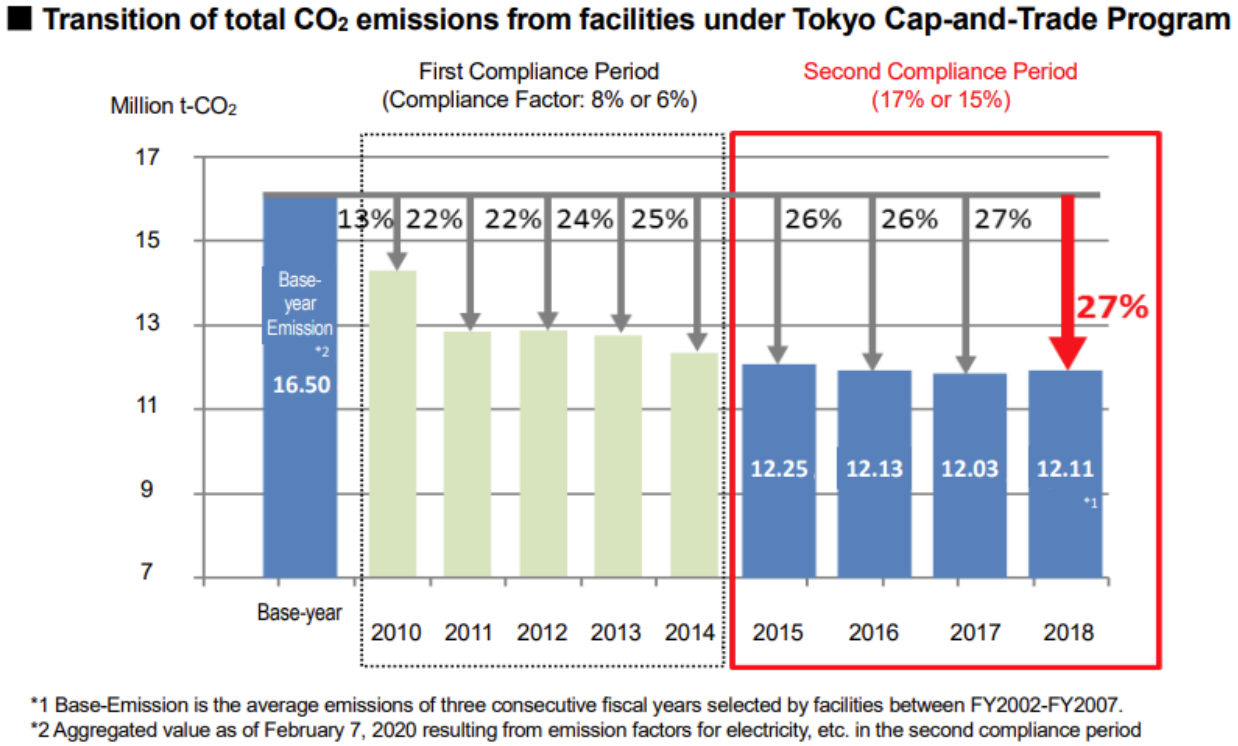
“By far, the single most important factor is energy prices,” he concluded, suggesting that a national carbon fee could strongly induce a shift from natural gas to efficient electric heating.

The other day I stumbled on a remarkable demonstration of the power of carbon pricing to promote electrification and efficiency improvements in the huge office building sector. It comes in all places from Japan, the world’s fifth largest carbon polluter.

Japan has generally been slow to adopt carbon pricing; earlier this year it finally approved a national emissions trading program, but it will not begin to bite for several years.

However, in 2010, the city of Tokyo adopted the world’s first urban cap-and-trade program, aimed at lowering carbon emissions from large commercial and industrial buildings. Its emissions trading scheme imposed carbon prices on about 1,000 office buildings and 300 factories, which accounted for about 40% of all CO2 emissions from the metropolitan area’s commercial and industrial sectors. (Tokyo accounted for more than 5% of Japan’s total greenhouse gas emissions in 2012, according to a case study of the program.)

With careful monitoring, Tokyo’s metropolitan government documented a remarkable reduction in carbon emissions from covered offices and factories, as shown in this figure:



Since 2018, emissions have fallen 33% relative to the baseline average set in the years 2002-7.

Widespread adoption of high efficiency heating and cooling systems, as well as of super-efficient LED lights, helped drive these results.

"The program's design and implementation reflects a clear approach to using environmental policies to increase market payoff, maximize flexibility in compliance and boost the ability to implement new knowledge in buildings – all ways to nurture market success of eco-friendly technology and mitigate carbon emissions," said Ying Hua, a Cornell University professor who co-authored a 2016 analysis of Tokyo's program in the journal Building Research and Information. "It's a unique, effective mandatory policy alternative to building codes."

A more recent and sophisticated econometric analysis of the program's effects, published in Environmental Economics and Policy Studies, found that half the measured emissions reductions were due to the city's emissions trading system, and half to a national spike in electricity prices triggered by the forced closure of the Fukushima nuclear plant in 2011.

The study concluded that carbon pricing in Tokyo proved to be "an effective environmental tool."

In the United States, a national carbon fee, unencumbered by the complexity of emissions trading systems, could be even more effective at lowering emissions in the building sector and every other part of our economy. The IRA was a good start, but we still need a serious price on carbon to create the cleaner and more sustainable economy we so urgently require.

Sources:

Toshi Arimura and Tasuya Abe, "The impact of the Tokyo emissions trading scheme on office buildings: what factor contributed to the emission reduction?" *Environmental Economics and Policy Studies*, 23 (March 2020), 517-533.

Yuko Nishida et al., "Alternative building emission-reduction measure: outcomes from the Tokyo Cap-and-Trade Program," *Building Research & Information*, 44:5 (2016), 644-659.

Tokyo Metropolitan Government, "Results of Tokyo Cap-and-Trade Program in the 9th Fiscal Year," March 26, 2020.

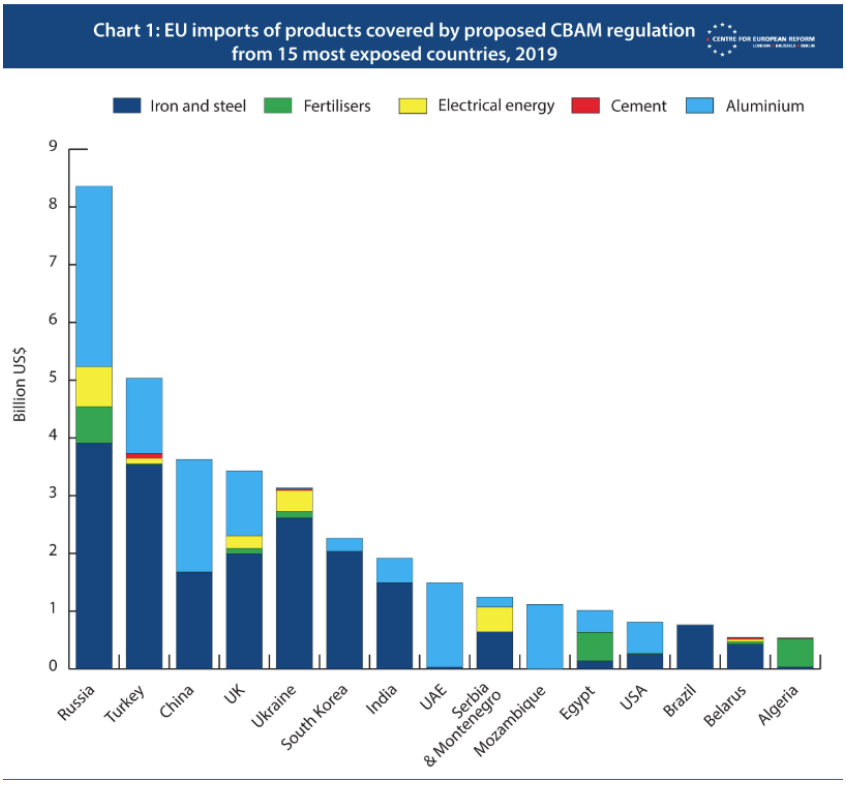
Lucas Davis, "The Economics of Building Electrification," Kleinman Center for Energy Policy, June 29, 2022.

BAM: Europe gets ready to pull the trigger on a carbon border adjustment

December 2022

Proponents of a national carbon price in the United States may soon enjoy welcome support from allies across the Atlantic Ocean. Members of the European Parliament on Tuesday reached a provisional agreement to levy import duties on goods from countries outside the European Union (EU) that don't have carbon prices comparable to those in the EU.

The long-discussed EU Carbon Border Adjustment Mechanism (CBAM), part of a much larger set of policies to slash Europe's greenhouse gas emissions, will "equalize the price of carbon paid for EU products operating under the EU Emissions Trading System (ETS) and the one for imported goods," according to the European Parliament's announcement. "This will be achieved by obliging companies that import into the EU to purchase so-called CBAM certificates to pay the difference between the carbon price paid in the country of production and the price of carbon allowances in the EU ETS."



The goal of the CBAM is two-fold: to encourage non-EU countries to "increase their climate ambition," and to ensure that the EU's climate mitigation policies "are not undermined by production being relocated from the EU to countries with less ambitious policies."

Studies suggest that the latter issue—sometimes known as "leakage"—undercuts the effectiveness of the EU's climate policy as much as 20%. That is to say, for every 10 tons of carbon dioxide reduced in the region, emissions go up 2 tons in the rest of the world.

Fear of leakage has led the EU ETS to charge very low effective carbon prices for carbon-intensive industries that face international competition. In exchange for protection against unequal competition, EU producers will gradually pay higher carbon prices once a CBAM takes effect in 2026. If granted formal approval by the European Parliament and member

states, the CBAM will mainly cover iron, steel, cement, aluminum, fertilizers, electricity, and hydrogen.

Mohammed Chahim, a member of the Progressive Alliance of Socialists and Democrats in the European Parliament, said "CBAM will be a crucial pillar of European climate policies. It is one of the only mechanisms we have to incentivize our trading partners to decarbonize their manufacturing industry. On top of this, it is an alternative to our current carbon leakage measures, which will allow us to apply the polluter pays principle to our own industry. A win-win situation."

Not everyone will consider it a win. American exporters may have to face new tariffs to enter the EU market, unless the Biden administration negotiates exceptions based on the stringency of U.S. climate policies. Russian, Chinese and Turkish exporters, with their higher average emissions rates and much higher share of EU imports (see charts), will face the greatest disadvantage.

The leverage exercised by the EU by virtue of its huge market could encourage the United States to reconsider carbon pricing and China to put more force behind its nascent emissions trading system.

But critics outside the EU have contended that new tariffs instituted by a CBAM would simply represent discriminatory and unfair trade barriers. No one knows how the World Trade Organization, which adjudicates disputes under international trade law, will rule. European leaders insist the border fee is fair because EU industries will face the same price at home. "It's not trade protectionism, it's a level playing field," said the head of the European parliament's environment committee. "What we are saying to Turkey or China is just: Put a carbon price."

Climate Leadership Council (2022)

		Imports
Rank	Origin Country	Embodied Emissions in Imports; ($MtCO_2$)
1	China	201
2	Russia	154
3	Other Asia and Pacific	125
4	Middle East	110
5	United States	63
6	United Kingdom	46
7	Other Europe	45
8	India	39
9	South Africa	30
10	Africa (Excl. South Africa)	30

Significantly, he didn't include the United States in that admonition. The same parliamentarian told another reporter that the EU might work out a special deal with Washington. "We need to avoid frictions among the countries or within the club of countries that are willing to move forward on climate action."

His comment reflects the realities of global power politics. In a New York Times column this week, Paul Krugman remarked (not disapprovingly):

“Some of the tariffs Trump imposed are still in place, and on Friday the World Trade Organization, which is supposed to enforce rules for global commerce, declared that the official rationale for these tariffs — that they were needed to protect U.S. national security — was illegitimate. And the Biden administration, in turn, told the W.T.O. — in startlingly blunt language — to take a hike.

“This is a very big deal, much bigger than Trump’s tariff tantrums. The Biden administration has turned remarkably tough on trade, in ways that make sense given the state of the world but also make me very nervous. Trump may have huffed and puffed, but Biden is quietly shifting the basic foundations of the world economic order.”

Postscript:

The impact of a pending EU CBAM on developing countries has been the focus of considerable study and debate.

In deference to obvious equity issues, the European Parliament proposed in March 2021 that “Least Developed Countries and Small Island Developing States should be given special treatment in order to take account of . . . the potential negative impacts of the CBAM on their development.”

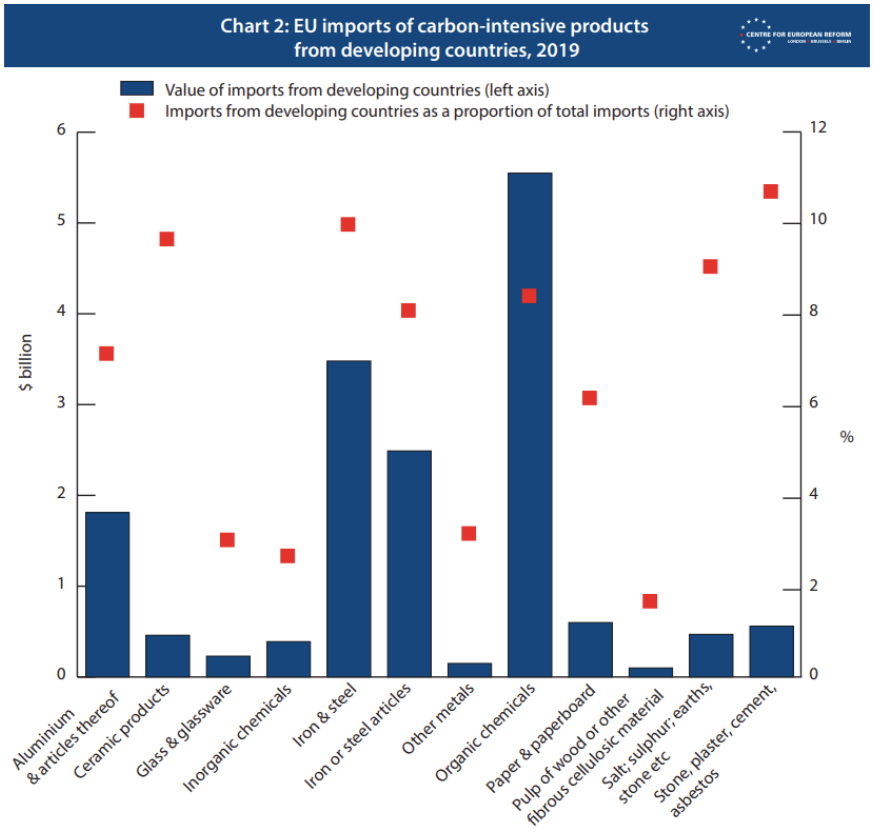
The final proposal adopted that July said only that the European Commission (EC) “should strive to engage in an even-handed manner” with trading partners, making no mention of LDCs or SIDCs. It did leave open “possibilities for dialogue and cooperation” between the EU and countries affected by the CBAM. The proposal clearly favored cooperation with poor nations outside the context of a CBAM, however:

“As the CBAM aims to encourage cleaner production processes, the EU stands ready to work with low and middle-income countries towards the de-carbonization of their manufacturing industries. Moreover, the Union should support less developed countries with the necessary technical assistance in order to facilitate their adaptation to the new obligations established by this regulation . . .

“Further, the introduction of CBAM certificates based on actual emissions would protect against the risk of carbon leakage while incentivizing third country producers to move towards cleaner production processes, with the support of Official Development Assistance when applicable.”

In an issue brief last year on “pitfalls” of the CBAM, the London-based Centre for European Reform acknowledged the EC’s concern that “positive discrimination in favor of LDCs could be hard to legally justify. . . The Commission also worries that exemptions could undermine the raison d’être of the regulation: preventing carbon leakage.”

However, the Centre argued that the economic impact of a CBAM on poor countries far outweighed the relatively small carbon leakage that would result from exempting their exports. By its calculation, some $16 billion in exports from developing countries could be subject to CBAM duties.



That's not a big number, but it's sizeable compared to the GDP of some poor nations. A technical paper issued by the IMF in March offered further simulation results, including estimates of the impact of a European CBAM on the GDP of various trading partners. Some rich nations like the United States and Japan would experience almost no impact, but Mozambique, Egypt, Indonesia and Ukraine would suffer notable setbacks.

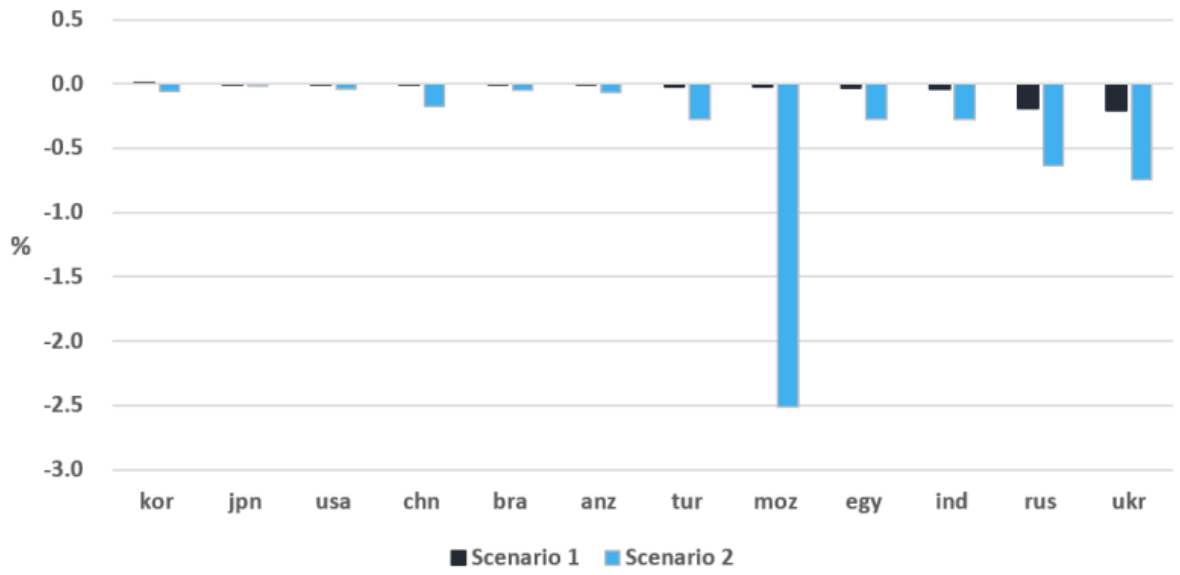
pbrief_cbam_sl_21.4.21.pdf (cer.eu)

"While designed with a good intention to accelerate the global transition towards net zero GHG emissions, the CBAM may worsen the income distribution between rich and poor economies and erode the capacity of some low-income countries to decarbonize their economies," the authors concluded. They proposed earmarking CBAM revenues "to help developing countries transit toward low carbon economies," thus helping both their economic development and the cause of climate mitigation.

Two Swiss economists, writing this November in the journal Energy Policy, examined numerous alternative policies to alleviate the impact of a CBAM on LDCs. They rejected calls to exempt those countries on grounds that increased carbon leakage would harm the environment. Instead—and in line with the IMF report's recommendations—their simulations showed that redistributing CBAM revenue "to promote clean energy or improve energy efficiency" would significantly improve LDCs' welfare while greatly reducing emissions leakage. Europe could do this through existing climate finance channels including additional lending from the European Investment Bank.

We're already seeing some promising steps along these lines. Major industrialized nations and international lenders have recently inked multi-billion-dollar deals with Indonesia, South Africa, and Vietnam to encourage their rapid phase-out of coal and increased utilization of renewable energy. Such steps are long overdue in view of the industrialized world's disproportionate contribution to cumulative greenhouse gas emissions. Let's hope that the EU's policies, as they evolve with respect to both CBAM and broader climate policy, place increased emphasis on such win-win outcomes.

FIGURE 8 Impact of CBAM on GDP (% change from baseline, 2030)



"The Global Impact of a Carbon Border Adjustment Mechanism," IMF, March 2022

Sources:

Elisabetta Cornago and Sam Lowe, "Avoiding the Pitfalls of an EU Carbon Border Adjustment Mechanism," Centre for European Reform, July 2021.

He Xiaobei et al., "The Global Impact of a Carbon Border Adjustment Mechanism: A Quantitative Assessment," Task Force on Climate, Development, and the International Monetary Fund, March 2022.

Sigit Perdana and Marc Vielle, "Making the EU Carbon Border Adjustment Mechanism acceptable and climate friendly for least developed countries," *Energy Policy*, 170 (November 2022).

4. How to Win Public Support for Carbon Pricing

How a Climate Premium Can Build Support for Carbon Pricing

January 2024

An important new study by four international economists adds a surprising new twist to past findings that that recycling of revenues can significantly boost public support for carbon pricing. Indeed, it shows that public support can rise well above levels estimated by most experts.

As I've previously discussed in a CCL research guide to "Building Support for Carbon Pricing," a great deal of social science research, based mostly on public opinion surveys, confirms that earmarking revenues either for lump-sum "dividends" or to fund climate programs can make carbon pricing a popular policy option in many countries.

The new paper, with the (suspiciously similar!) title "How to Increase Public Support for Carbon Pricing," offers a major substantive contribution to this body of research by demonstrating that a novel revenue-recycling option garners even more support. That option, which the authors dub a "Climate Premium," is like an advance down payment of the dividend. It "compensates citizens at the time when the carbon price is introduced with a fixed payment equal to the expected revenues from carbon pricing."

The paper also breaks new methodological ground by combining a large population survey (of a representative sample of German adults) with monetary incentives to help ensure unbiased responses. The latter control is important because it's easy for people to give insincere responses that sound moral if nothing is at stake. For example, people overwhelmingly tell pollsters they love green energy, but few are willing to spend more than a small premium for it when given the choice by their utility.

Here's how the survey of 1,100 German adults worked: "Participants had to make two purchase decisions about a valuable but CO2-generating product. The first decision involved a low price per unit, while the second decision had an additional carbon price (50 euros per ton). Following these decisions, the participants voted to determine whether to implement the purchase decision with or without the carbon price. Importantly, all decisions in the experiment have real consequences. The participants' purchase decisions resulted in monetary payoffs and real CO2 emissions. By voting, each participant had an equal chance to determine whether purchase decisions with or without a carbon price were relevant to their own and other participants' payoffs."

Participants also voted on how to use carbon pricing revenues. They could choose to replenish the German Treasury (presumably lowering deficits), fund additional climate

projects, redistribute revenue as cash-back dividends (to everyone or just to the poor), or to implement an immediate “Climate Premium” payout to individuals.

The experiment showed a strong impact of these various choices on public support for carbon pricing. The budget option garnered support from only 47% of participants. Earmarking revenues for climate projects or poor relief bumped support slightly above 60%. The two favorite options were a universal dividend, with 69% support, and the Climate Premium, with commanding support of 73% of surveyed adults. Only 4% of respondents declared the Climate Premium to be the worst policy, suggesting that it could avoid polarizing political battles.

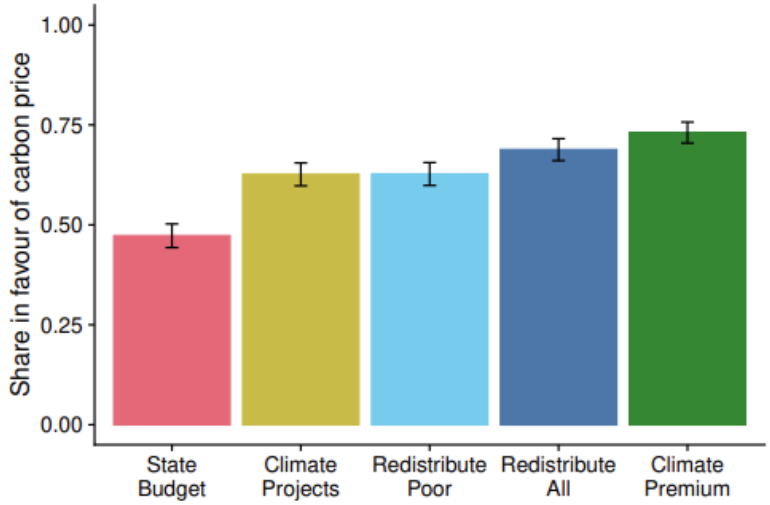


Fig. 2: Share of participants voting in favour of a carbon price under five revenue recycling schemes.

“Overall, these results show that the Climate Premium is the most popular scheme,” the authors observe, “and they confirm that revenue recycling is an effective lever to increase support for carbon prices. Choosing the right mechanism can increase support by more than 25 percentage points.”

A parallel survey of 369 academic economists determined that they underestimated public support for carbon pricing by almost 18 percentage points, and wrongly assumed that lump-sum dividends would be the most favored recycling option. Imagine how much greater the gap between expectations and reality would been if those responding were political scientists!

Unless I missed it, the authors don’t discuss in any depth why the Climate Premium option was so popular. I suspect that’s because—as many surveys have shown—people simply don’t trust governments to follow through on their promises. (See my research guide cited above.) An immediate Climate Premium in the hand is thus worth two future dividends in the bush, if you’ll pardon me butchering the old cliché.

Postscript: Another new paper, titled "Inequality beyond income quantiles: Distributional effects of climate mitigation policies" (*Ecological Economics*, February 2024), offers further confirmation that dividend-type rebates of carbon pricing revenue are both economically just and politically pragmatic for building public support. It goes beyond many past distributional research papers by analyzing a variety of advanced inequality measurements at a detailed household level in seven European countries.

"The key findings are that a carbon tax implemented without any revenue recycling scheme always has a negative impact on inequality. However, the magnitude of the negative impact across measures and countries varies considerably. Moreover, a household-size specific lump-sum refund is highly effective in limiting the negative distributional effects. In the overwhelming majority of scenarios, inequality is actually reduced compared to the baseline scenario with no tax at all. This is of great importance for the overall political feasibility of a carbon tax."

Meanwhile, an article in the latest issue of *Review of Environmental Economics and Policy*, titled "The Poverty and Distributional Impacts of Carbon Pricing: Channels and Policy Implications," confirms that "in most cases, targeted/universal cash transfers for households and targeted assistance to particularly affected workers could fully protect low-income and vulnerable populations from carbon pricing reforms, while leaving a significant share of carbon revenues to improve economic efficiency."

Note, by the way, that most climate mitigation policies have regressive effects (falling hardest on the poor) because they raise the cost of energy or push people to buy cleaner technologies. Carbon fees are unique in that they raise revenue at they same time they mitigate greenhouse gas emissions. That revenue that can be used to "fully protect low-income and vulnerable populations" without extra pressure on government budgets. That's one reason why many smart progressives have traditionally supported fee-and-dividend policies.

Addendum, January 2024:

Here are a couple of other important discussions of the concept of a Climate Premium. In the professional literature, it usually goes by the less interesting name of "antedated cash transfers" – that is, payments made *before* members of the public start feeling the tax. You may be surprised, as I was, to learn that Iran has something to teach us about this strategy:

From Goran Dominioni and Dirk Heini's article "Behavioural Economics and Public Support for Carbon Pricing: A Revenue Recycling Scheme to Address the Political Economy of Carbon Taxation" in *European Journal of Risk Regulation*, September 2019:

> First, distributing cash before people start feeling the tax incidence could reduce opposition due to risk aversion. Many benefits of carbon pricing can appear to be uncertain for the public. The public may fear that the government may not follow through with any promises of reimbursing citizens for the carbon tax burden via cash transfers, for instance as revenues might instead get lost to corruption, inefficient government administration, or the influence of interest groups. Others may be sceptical of the climate mitigation effects and the co-benefits of carbon pricing. Low general trust in the government further fuels these fears. Expected payoffs from reform become more certain for transfer recipients after the distribution takes place. When the distribution of cash is antedated, payoffs become more certain at an earlier stage than if revenues were disbursed after collection. More certain payoffs will reduce opposition due to risk-aversion.
>
> Second, anticipating compensation can address opposition due to discounting. Since a more substantial proportion of the benefits than of the costs of environmental taxation are spread out over time, discounting makes carbon tax reforms less appealing to the population. Ex-ante transfers can reverse this pattern. This effect is further amplified if, as it is sometimes the case, delayed financial gains are discounted more than delayed losses. Also, concrete benefits tend to be discounted less than more abstract ones. Arguably, a cash transfer is a less abstract gain than the health benefits that may derive from, for instance, earmarking revenues for additional climate-related expenditures.
>
> Third, timing the distribution of compensation payments to coincide with the onset of the environmental tax, i.e. distributing revenues on the first day the tax is applied, helps to communicate the logic of a fiscal shift, as this practice would highlight the link between the increased fiscal pressure and the distribution of benefits.

From Miria Pigato's report for the World Bank, Fiscal Policies for Development and Climate Action (2019):

> Traditionally, the costs of [environmental taxes] accrue before most of the benefits. Paying compensation to households before, instead of after, the environmental tax is introduced can overcome several biases (such as discounting, lack of trust in the government, and risk aversion). The Islamic Republic of Iran, for example, formally locked compensation payments into personal bank accounts that were unfrozen on the day of energy price increase (box 1.6). As a result, the reforms were perceived as more credible and personally valuable. . .
>
> **Box 1.6: Antedating of Benefits: The 2010 Iranian Strategy**
>
> In 2010, the Islamic Republic of Iran embarked on a significant energy price reform. In one day, the government increased the consumer price of diesel by about 2,000 percent. At the same time, the government provided significant compensation to households. At

least 50 percent of the revenues were earmarked for household compensation, initially in the form of bimonthly cash transfers. In addition, 30 percent of the revenues were earmarked to support firms during the transition phase toward less energy-intensive production, and the remaining 20 percent were retained in the public sector.

Uniquely, the reform used antedated benefits: cash transfers were visible on bank accounts before and then released to citizens on the day of the price increase. Iranians were allocated frozen personal bank accounts in their name, which were visible via a website and publicized in the media in advance of the reform. Having already paid, or appeared to have paid, compensation into citizens' accounts, the government sent a stronger signal of its commitment to compensation. In addition, while the lock was in place, the government communicated that, if it had to abandon the fuel price increase because of opposition, it would not unlock the accounts. Because the compensation in these locked accounts amounted to very significant sums for most Iranians, the cash transfers and the locking mechanism provided a strong incentive for the population to support the reform's implementation.

Public support for this reform was also raised by a large-scale informational campaign. Different types of media and a diverse set of communicators (politicians, business people, clerics, and researchers) were employed to reach different sections of society. The authorities also instituted phone hotlines to answer citizens' questions.

For more fascinating details on Iran's successful strategy for selling its controversial energy pricing reform, see the IMF working paper, "Iran–The Chronicles of the Subsidy Reform," July 2011.

Sources:

Andrej Woerner et al., "How to Increase Public Support for Carbon Pricing," Discussion Paper No. 489, December 21, 2023.

Daniel Rüb, "Inequality beyond income quantiles: Distributional effects of climate mitigation policies," *Ecological Economics,* 216 (February 2024).

Baoping Shang, "The Poverty and Distributional Impacts of Carbon Pricing: Channels and Policy Implications," *Review of Environmental Economics and Policy*, 17:1 (Winter 2023), 64-85.

CFD and Public Approval

November 2023

A new paper by two scholars at the University of Oxford, "Increasing the acceptability of carbon taxation: The role of social norms and economic reasoning," reports the significant positive effects on public attitudes among people exposed to one (or two) short videos explaining 1) the policy and 2) the facts about public opinion toward climate mitigation.

Below I excerpt sections of the paper, deleting in-line references :

> We investigate how acceptability of carbon taxes is jointly influenced by economic reasoning on the policy's functioning as well as societal norms toward pursuing carbon neutrality. We do so by conducting a representative survey experiment in the U.S. and testing how different combinations of information videos affect individual policy preferences, both immediately after exposure and several months later, in an obfuscated follow-up survey.
>
> In one of the video interventions, we briefly explain carbon taxation in layman's terms, including how it can help the economy transition to carbon neutrality . . . and how redistribution of revenues (via uniform cash transfers) can ease the burden on vulnerable households. [Previous research shows that] clear and transparent policy communication may be essential to dispel misconceptions and doubts about its effectiveness and distributional impacts.
>
> At the same time, climate policy support is strongly related to general climate-related beliefs and concerns. Thus, growing political polarization over climate issues may undermine broad acceptability of carbon taxation. In fact, . . . representations of partisan divides – for example in the media – can cause the public to systematically underestimate the level of climate concern and policy support in the general population by large margins. . . One might therefore argue that "[c]orrecting misperceived norms of opposition and decoupling policy evaluation from identity concerns would help overcome [...] seemingly insurmountable barriers to bipartisan support for climate policy." Thus, our second video intervention highlights the remarkably broad societal consensus on climate action by truthfully informing individuals that, according to a recent poll, a clear majority of American adults (69%) support the country's efforts to achieve carbon neutrality by 2050.
>
> Finally, we include an experimental condition that combines the norm-based and the policy-centered information videos, as these two perspectives may be intricately linked. For instance, stressing the societal agreement on carbon neutrality may also increase people's receptivity to further information on specific policy proposals, in our case carbon taxation. . . To the best of our knowledge, we are the first to study the joint causal effects of economic reasoning and social norm perceptions on policy acceptance.

Our study design proceeds in three steps. In the first step, we conducted an initial survey experiment in August 2022 with a representative sample of 2,688 U.S. adults . . . Subjects were randomly assigned to be exposed to different information videos . . ., focusing either on explaining how carbon taxation works (Policy), informing about climate action support in the U.S. (Norm), the combination of both (Norm + Policy), or a placebo video of similar length but on an unrelated topic (Control). We then investigate the effects of different information conditions on attitudes toward carbon taxation after video exposure . . .

Several findings emerge from our study. First, we confirm that, prior to receiving any information, most individuals underestimated general support for carbon neutrality in the U.S. – consistent with previous studies that document pluralistic ignorance in the climate domain and that most subjects displayed considerable knowledge gaps about carbon taxation as a policy tool.

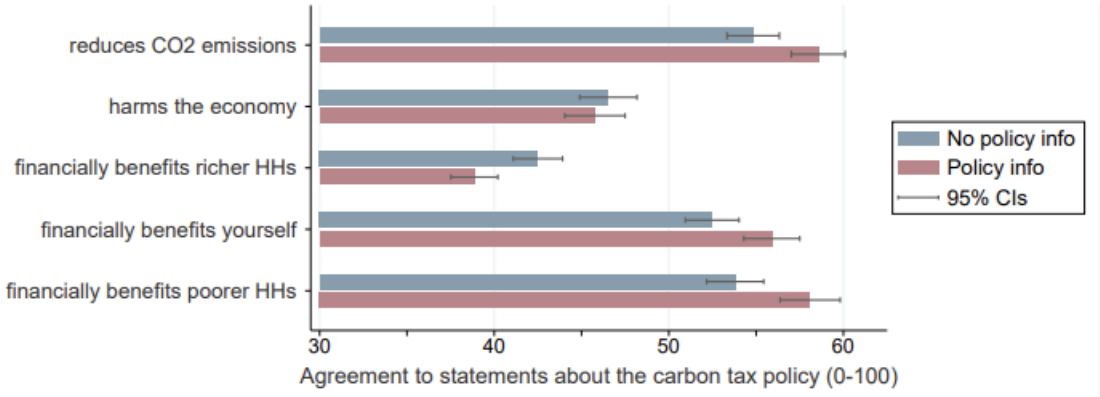


Figure 7: Impact of policy explanation on reasoning about carbon taxation

Second, providing information through video interventions resulted in a significant increase in the share of participants who support carbon taxation (with uniform redistribution) by around . . . an 8% increase relative to 63% in the control group. We find similar positive effects no matter whether information focused more on explaining the policy or on norms toward carbon neutrality, although point estimates are highest in the combined treatment. . .

Overall, our study finds that policy-specific economic reasoning and general social norms can play a joint role in fostering public acceptability for ambitious climate measures like carbon taxes. . .

Source:

Ximeng Fang and Stefania Innocenti, "Increasing the acceptability of carbon taxation: The role of social norms and economic reasoning," University of Oxford Working Paper No. 2023-25, November 2023.

Major International Survey Highlights Value of Carbon Tax Education

October 2022

One of the most ambitious international surveys ever conducted of public attitudes toward climate mitigation policies sends a powerful but nuanced message on carbon taxes: On first hearing they are among the least popular policies, just as detractors claim, but public support jumps markedly with a little education.

The study covered more than 40,000 respondents in 20 countries, which account for nearly three-quarters of global CO2 emissions. Although the Organization of Economic Cooperation and Development (OECD) released a working draft in late June, the latest version of "Fighting climate change: International attitudes toward climate policies" was only posted on Harvard University's site last month. To date I have seen no English-language media coverage of this impressive report.

The six authors, all eminent in the fields of climate economics and politics, show that three factors best explain support for climate policies: effectiveness, fairness, and self-interest. That is to say, public acceptance goes up when people *believe* that policies reduce emissions, spare low-income households undue burden, and avoid crimping their own budgets or lifestyles.

The study also goes beyond most previous surveys in demonstrating that education about how climate policies work and who may benefit often has a large impact on public support. In contrast, simply frightening people about impending climate risks does little to arouse more support for action. These findings should provide important direction and motivation for grassroots climate activists involved in public education campaigns.

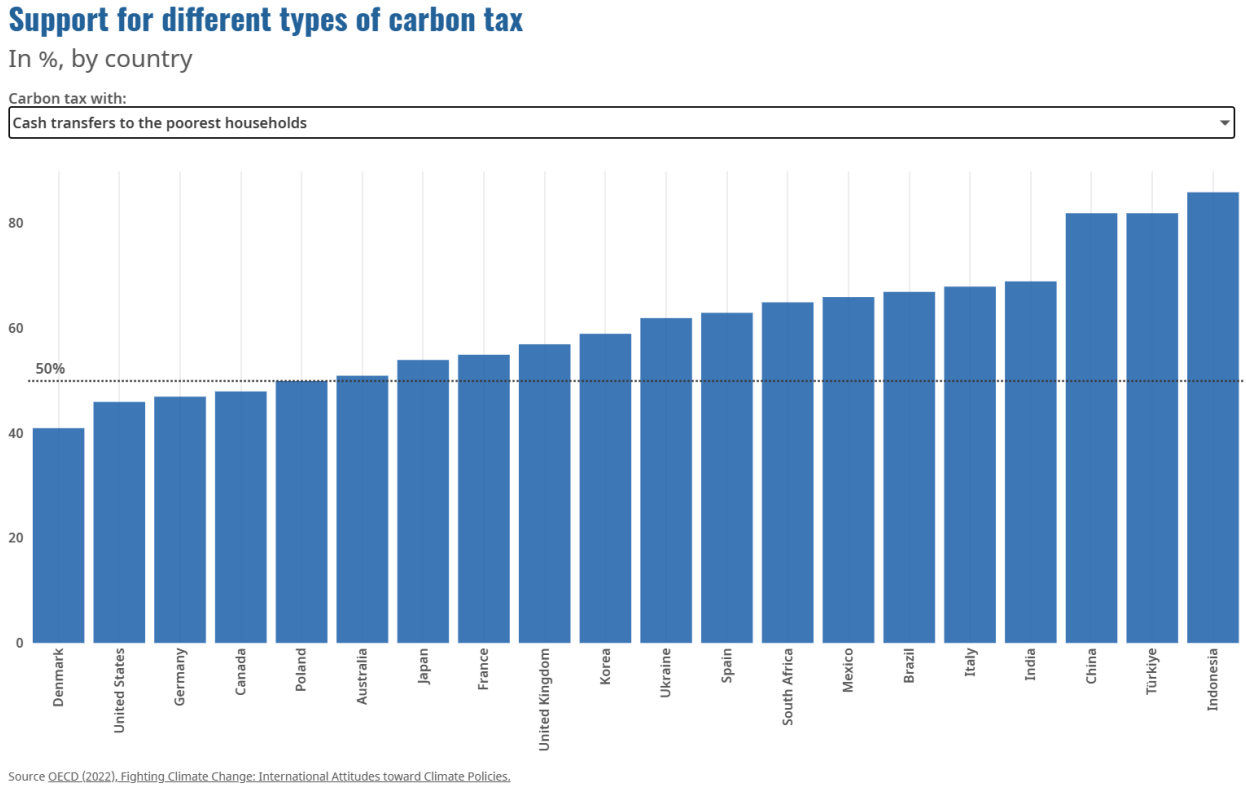
Aside from the scope of the study, and the detailed demographic information it reports, one key innovation was its random exposure of people to short informative videos on climate impacts and climate policies (see links and script below). The goal was to derive reliable experimental evidence of how information changes perceptions, and how those perceptions in turn drive policy support.

Without any exposure to these videos, people in high-income countries who had an opinion responded most favorably (87% support) to using government to subsidize low-carbon technologies. A modest majority (56%) backed a carbon tax with cash transfers. Only 46% supported a $45 carbon tax with no provision for revenue distribution. At least carbon taxes did better than a proposal to tax beef, which garnered a mere 39% support.

But that's far from the end of the story. Support for carbon taxes went way up depending how the revenue is used. More than seven in 10 respondents who had an opinion (71%) backed a carbon tax with cash transfers to the poorest households, showing the importance of perceived fairness.

85% of those with an opinion supported carbon taxes when revenues are earmarked for low-carbon technology. Previous studies suggest that many people don't understand how carbon taxes themselves encourage decarbonization. They see taxes mainly as a way to raise money. They approve only when the revenue is put directly to use for environmental causes.

The charts below show baseline public support by country for various carbon tax policies as a percentage of all respondents, including those with no opinion.



International attitudes toward climate policies - OECD

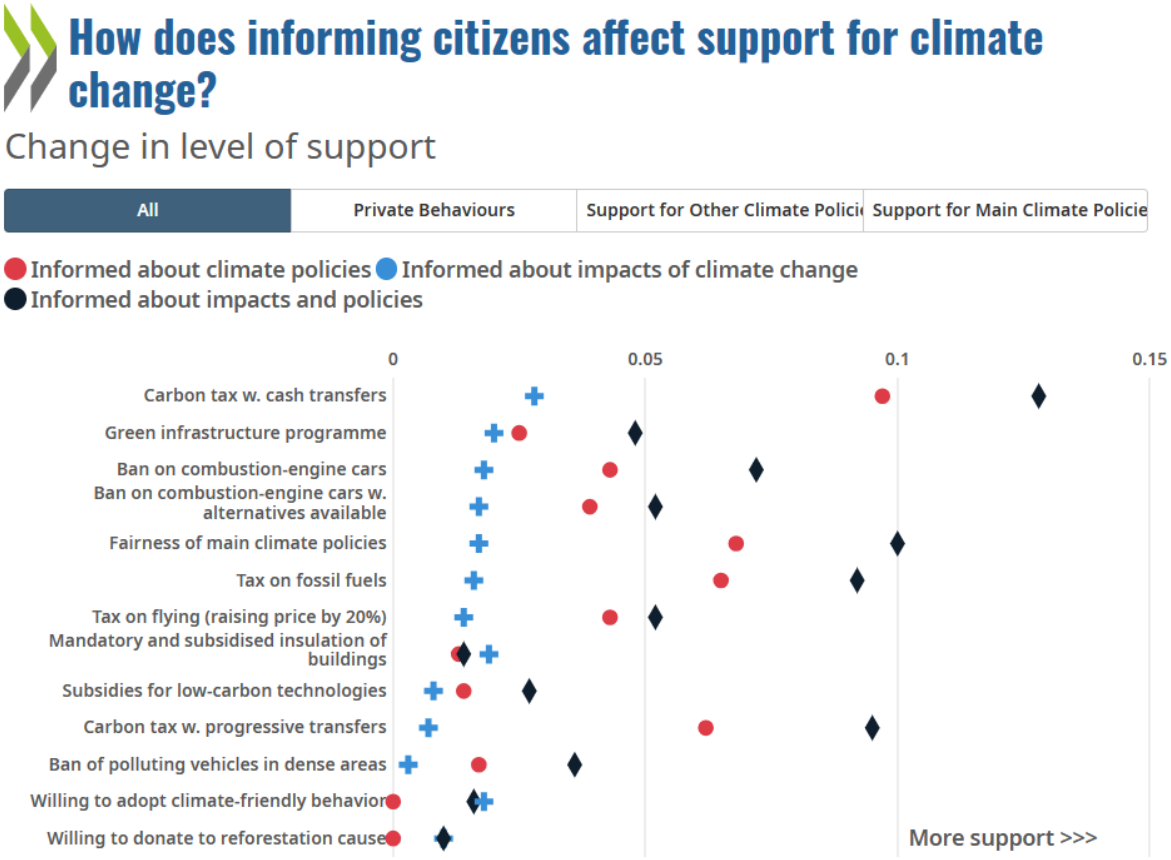
One of the most encouraging findings was that a carbon-tax-and-dividend was the most responsive of all tested policies to the two brief educational videos about general climate impacts and policy alternatives.

The climate policies video described the advantages and drawbacks of a ban on the sale of most new combustion-engine cars; a carbon tax with equal cash transfers (dividends); and extensive public investment in green energy, transportation, and agriculture.

Regarding carbon taxes, the video disclosed the impact on gasoline prices, explained how a $45 tax would discourage fossil fuel consumption and CO2 emissions, and informed viewers that an equal distribution of revenues would make lower-income earners better off even after the tax.

The five-minute policies video boosted support by nearly 10 percentage points. Watching a three-minute video on climate impacts bumped up support another three percentage points.

The combined impact was double or more the effect of education on most other policy alternatives. Across all countries, it was enough to bring public support to nearly 60% of all respondents who saw the videos.



[International attitudes toward climate policies - OECD]

This chart shows changes in the share of respondents out of the entire sample who somewhat or strongly support climate change policies after seeing the videos.

The study contains lots of other rich detail, but at bottom it shows “strong majority baseline support” in most countries for “policies perceived to be effective, progressive, or both,” including “carbon taxes with strongly progressive use of revenues.”

It also demonstrates that explaining to people why a policy is both effective and fair significantly increases support. In other words, grassroots education campaigns can have a powerful impact on public attitudes.

Source:

A. Dechezleprêtre, et al. (2022), "Fighting climate change: International attitudes toward climate policies," *OECD Economics Department Working Papers*, No. 1714, July 2023.

Carbon Dividends: New Experiment Shows Potential for Carbon Pricing Support

August 2022

Canadians, like Americans, are suffering the slings and arrows of global energy inflation. Unlike Americans, however, they began receiving quarterly Climate Action Incentive Payments—what we call carbon dividends—in July. Over the course of 12 months, the typical family of four will receive dividends ranging from $745 to $1,101 depending on what province they live in.

For a family of four, total annual CAI payments for 2022-23 will be as follows:

Family Member	Ontario	Manitoba	Saskatchewan	Alberta
First adult	$373	$416	$550	$539
Second adult	$186	$208	$275	$270
First child	$93	$104	$138	$135
Second child	$93	$104	$138	$135
Total	$745	$832	$1,101	$1,079
Amounts do not reflect the 10 per cent supplement for residents of small and rural communities.				

Source: Department of Finance Canada

The revenue for those dividends comes from Canada's rising carbon tax, which hit $50 per metric ton of CO2 this year. Ideally, those payments should build political support for a model climate policy that faces ongoing attacks from Canada's Conservative Party.

Welcome as those payments should be to most households, however, the government has consistently missed opportunities to make them a political asset. In the past, it disbursed them as refundable tax credits, which many Canadians failed to notice or connect to the carbon tax. Starting in July, the government switched to a much smarter system of quarterly direct payments. Even so, it blundered by sending many of the dividends through cryptic electronic transfers labeled "federal payment," "Canada Fed," or "EFT Credit Canada."

In other words, at least some of the bureaucrats in charge were marketing dunces. That matters—a lot.

As *National Observer* columnist Max Fawcett commented, "when you combine this sort of consistently confusing communication with the long-standing conservative campaign to mislead and misinform Canadians about the carbon tax and rebate, it amounts to gross political malpractice. It's an unfortunate reminder, not that we really needed one, that the best ideas in the world can fail if they're not sold properly."

"Make no mistake," he continued, "the fate of the carbon tax, and Canada's broader climate policy, is still very much in question. . . And because the current federal government has failed to establish a clear connection in the minds of enough Canadians between the tax and the rebate, getting rid of it won't come with much of a political cost. . . All wonkish academic endorsements in the world won't mean anything if voters don't understand why you're doing something and how it benefits them personally."

That was also a key lesson of a much-heralded study published this January in *Nature Climate Change*, titled "Limited impacts of carbon tax rebate programmes on public support for carbon pricing." It reported surveys confirming that large numbers of Canadians were unaware of climate-related credits on their federal income tax returns.

Discouragingly, however, it also found than when Canadians were informed of the rebates, many still assumed (incorrectly) they were net losers, paying out more in carbon taxes than they received in credits. In short, a little knowledge didn't solve the political challenge of boosting public support for the country's carbon tax policy in the face of waves of negative advertising by the Conservative Party.

In a blog several months ago, Dana Nuccitelli commented, "If you only take one thing away from this study, make it this: dividends must be coupled with educational efforts to inform citizens about how much the carbon price is increasing their costs and that the carbon fee and dividend system is generating a net income for most households."

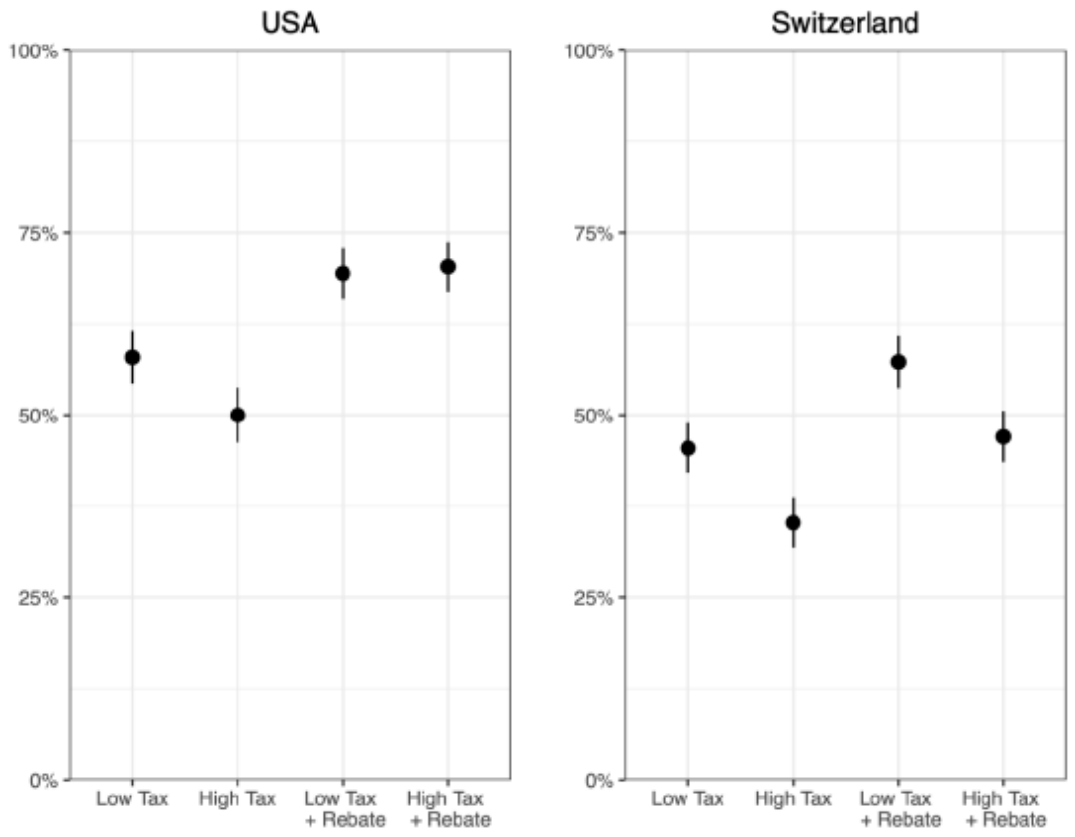
In an important new paper scheduled for publication in *Environmental Research Letters*, one of the co-authors of the original study teamed up with several other scholars to perform a novel experimental test of how further education—and political messaging—could affect the impact of carbon dividends on public opinion.

The authors created a carbon tax calculator to show individual Americans their estimated tax burden as well as their carbon dividend at two levels: a modest tax of $50 per metric ton of CO2, and a much higher tax of $230. In short, they provided people with the full financial equation that was missing from the earlier study. They then asked respondents whether they would support either tax.

Even without any financial information on costs and benefits, 58% of Americans surveyed supported the $50 tax and 50% supported even the $230 tax, which is far higher than any current carbon tax around the globe.

But when people were informed about the financial impacts of the tax-and-dividend on their households, roughly 70 percent supported both the low and the high tax scenarios. That's huge.

Figure 2. Support for a Carbon Tax by Treatment Condition



Fremstad, et al., "The role of rebates in public support for carbon taxes," 2022.

Note: This chart shows support for a carbon tax among individuals who received personal estimates of their carbon tax burden at $50/t and $230/t, without and with information about their rebates.

In the real world, of course, proponents don't get to control the messaging or do the "educating" in a vacuum. The test the effects of pro-and-con arguments on public opinion, the authors provided a random sample of respondents with the following message:

"Many [environmentalists/Democrats] say this is a vital policy to fight climate change, create millions of clean-energy jobs, and save billions of dollars on climate-related natural disasters like wildfires and hurricanes. By contrast, many [business groups/Republicans] say this is a poorly designed policy to increase energy costs by billions of dollars and hurt the economy, without significantly reducing carbon pollution."

The bad news is the added messaging cut support for carbon taxes among Democrats, Republicans, and Independents. The really good news is that carbon dividends still increased support among all three groups, just as proponents have long hoped and expected.

Technically, the latter finding was not statistically significant, meaning it can't be asserted with 95 percent confidence. That's mainly due to small sample sizes, but the authors acknowledge that "the effect of rebates remains suggestively positive."

Sources:

Matto Mildenberger, et al., "Limited impacts of carbon tax rebate programmes on public support for carbon pricing," *Nature Climate Change*, 12 (January 2022), 141-147.

Anders Fremstad, "The role of rebates in public support for carbon taxes," *Environmental Research Letters*, 17:8 (August 2022).

How Resilient is Public Support for Carbon Pricing?

July 2023

Efforts by CCL volunteers and other climate activists to enact carbon pricing in the United States last year faced an insuperable obstacle: the giant run-up in energy prices following Russia's invasion of Ukraine. With gasoline prices soaring above $5 per gallon, federal and state legislators were far more inclined to consider price subsidies, even for fossil fuels, than new energy taxes.

But fears of a voter backlash may have been a bit overblown, if results from a new study of German public opinion can be extended to the United States. In a paper posted by the Berlin School of Economics, three prominent European climate policy researchers find that the huge run-up in energy prices in Germany in 2022 did not dampen support for modest levels of carbon pricing.

In addition, the study reaffirmed the value of carbon dividends—a form of "social conditioning" to help lower-income households afford the clean energy transition—in bolstering public support for carbon pricing.

BERLIN SCHOOL OF ECONOMICS
DISCUSSION PAPERS

Discussion Paper #21
June 2023

How resilient is public support for carbon pricing? Longitudinal evidence from Germany

The scholars collected data from three public opinion surveys in Germany between 2019 and 2022. Germany is already a party to the European Union's emissions trading system, covering electric power, large industry, and aviation, It added an additional carbon price to its building and transportation sectors of €25 per ton in 2021. The tax increased to €30 in 2022 even as natural gas prices nearly doubled and residential electricity prices jumped about 19%. The surveys were thus able to test the impact of these events on public attitudes toward carbon pricing.

Their encouraging finding: about 60% of respondents support these modest additional levels of carbon pricing, and "support seems to have marginally increased over time" despite the jump in energy prices and the small increase in carbon taxes. "Moreover," they report, "support is persistent, as respondents who support carbon pricing in one survey wave are much more likely to support it later on."

Their other key finding relates to the use of carbon tax revenues. Earmarking them for green investments remains the most popular option, though support fell a bit over the period. In the meantime, compensating low-income households became more popular, attracting nearly 50% support. The scholars found—and this should come as no surprise—that "people experiencing high energy costs are more likely to increase their support for direct transfers."

Their conclusion: "To maintain strong public support for climate action, policymakers can pair stringent policies with visible compensation and adapt measures to external events that increase the vulnerability of households to high energy prices."

Note: it's possible that other official policies also affected public attitudes in this period. For example, the German government lowered the federal tax on oil, introduced cheaper ticket prices for regional transit, and granted households a special allowance to pay heating bills in 2022 to cushion the blow of higher energy prices.

Source:

Stephan Sommer et al., "How resilient is public support for carbon pricing? Longitudinal evidence from Germany," Berlin School of Economics Discussion Paper #21, June 2023.

Does Public Education Build Support for Carbon Pricing?

January 2024

Recent posts by Dana Nuccitelli ("What's happening with Canada's carbon price and emissions?") and Rick Knight ("Perception gap plagues Canada's carbon price") highlight the need for more public education about benefits to shore up political support for the federal carbon fee and dividend in Canada (and, by extension, here in the United States). Another recent post, by Robin Paone, reports on the recent creation of a carbon dividend calculator for Canadians, an educational tool the Canadian government should have created and publicized as soon as its federal carbon tax took effect.

Those are good lessons. Unfortunately, however, recent social science research suggests that shaping public opinion through education will be much more difficult than most of us would like to believe.

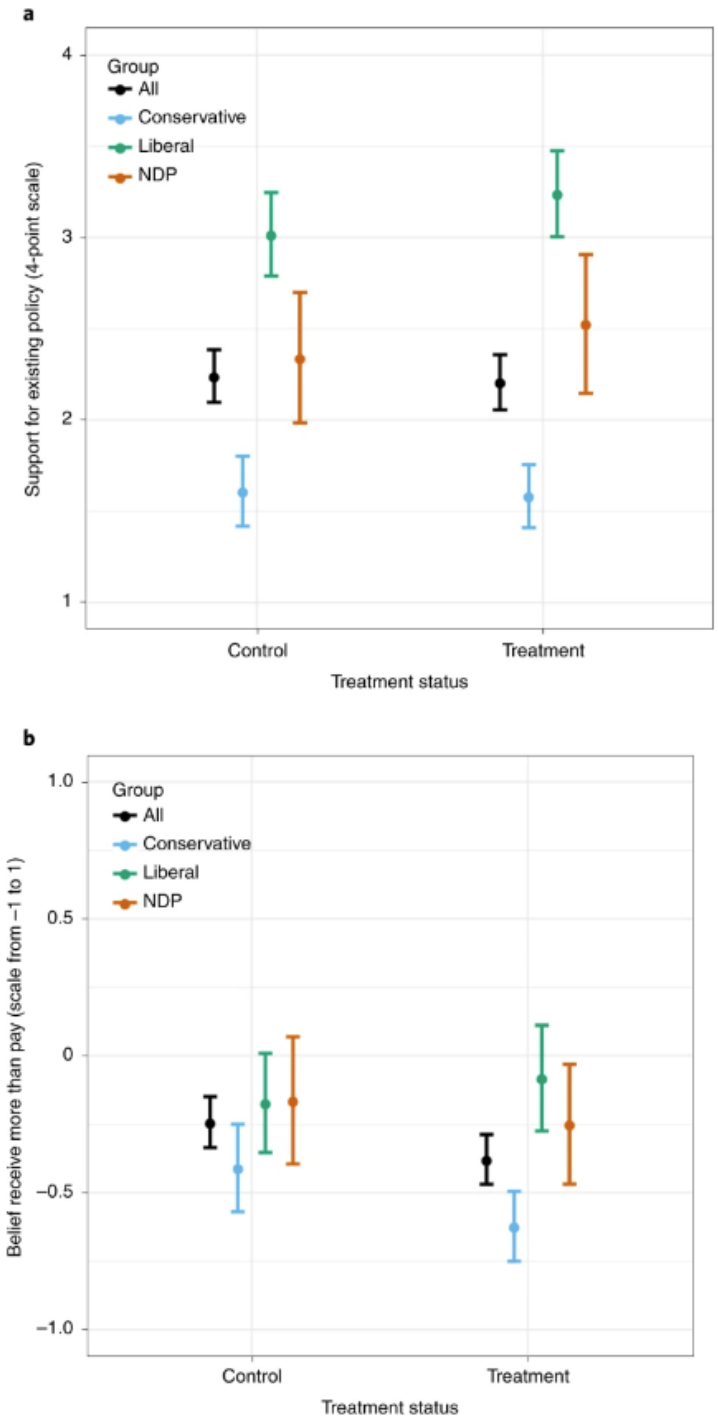
A widely cited 2022 paper in *Nature Climate Change* discussed widespread public ignorance in Canada about the existence and size of carbon tax rebates as a factor in limiting public support for the program. Unfortunately, however, when the authors supplied Canadian survey participants with information about the true size of their benefits, their support for carbon pricing actually *dropped*. Many people apparently concluded, wrongly, that they would be net losers.

"This shift was concentrated among Conservative Party of Canada supporters," the authors noted. The results suggested "that policy preferences remain conditioned primarily by partisanship." Will that come as any shock to those of us in the United States?

A subsequent paper in *Environmental Research Letters*, co-authored by one of the *Nature* paper authors, offered a more optimistic finding that the provision of dividends would strongly increase support for carbon pricing in the United States. I was delighted by that news until I read the caveat that "policy is always politicized, and when respondents are exposed to political messages about carbon pricing the effects associated with rebates are dampened or eliminated." With political messaging, dividends still increased support for carbon taxes among U.S. survey participants, but the reduced effect was no longer quite statistically significant.

I discussed these and many more relevant papers in my research guide, "Building Support for Carbon Pricing." But a couple of important new papers, authored by researchers at the London School of Economics and Politics and ETH Zurich, are also relevant.

Fig. 4: The effect of rebate information on carbon pricing support in Canada.



a,**b**, Exposure to individualized information about a respondent's true climate rebate amount in Canada did not shape carbon pricing support (**a**) but instead generated a backlash by making respondents believe they paid more in tax than they received as their rebate (**b**). Full sample is in black, with subgroups defined by wave 4 party preference. Error bars depict 95% confidence intervals. NDP, New Democratic Party.

The first, just published in the *European Journal of Political Research*, is titled "Carbon inequality and support for carbon taxation." Based on extensive surveys in Germany, it tests how various kinds of information affect public attitudes toward carbon taxation. The authors tested how support changed with the provision of information about each respondent's carbon footprint and how carbon footprints vary by household income.

Among their findings:

- Consistent with past research, richer individuals generally show more initial support for carbon taxation (probably because they don't worry about day-to-day energy costs).
- However, richer households significantly *reduce* their support for carbon taxation when informed about their carbon footprint and how that stacks up against other households, increasing their awareness of how carbon taxation might affect them. Poorer households, on the other hand, increase their support as they realize the tax will cost them less than they imagined.

- On balance, in Germany at least, the provision of all this information increases overall public support for carbon taxation, thanks to strong increases among lower-income households.

"From a policy perspective," they conclude, "individuals' beliefs about the material burdens they would face from carbon taxation, and other ambitious costly climate policy, are a key input for political feasibility. Therefore, policy designs which are able to offset or diffuse these costs, for example, through revenue recycling and rebate schemes, continue to offer an avenue to increasing climate ambition." However, they make it clear that "education" about the effects of carbon taxation can work two ways, and dividends alone won't inoculate the public against disinformation.

In a new study forthcoming in the *Journal of Politics*, the same authors offer more pessimistic conclusions about the impact of "pocketbook and distributional concerns" about carbon taxes. When high-income people in both Germany and the United States are informed about how a carbon tax would affect them, they lose their inclination to support environmental policies. That trend is even worse among affluent Americans when they are informed that revenues will be used to fund equal dividends. (In contrast, when higher-income Germans learn about the benefits to poorer households, their support grows.)

In the United States, these findings cross partisan lines. "We find that voters who . . . are supportive of green, liberal, and left-wing political parties, do not always differ from right-wing voters in response to income information," the authors write. "For example, high income Democrats in the US learning about a [carbon fee and dividend] that would reduce their own income but benefit the lowest 70% of earners, significantly reduce support for carbon taxation to the same level as Republicans."

Their surveys do show that dividends bolster political support for carbon taxation in both the United States and Germany, but they have a much more positive effect in Germany (see chart below). Americans, it seems, care much less about redistribution than they do about costs.

"Our findings emphasize that pocketbook effects in particular, are important for understanding political coalitions behind policies aimed at emerging societal problems," they conclude. That's particularly true for carbon pricing, they emphasize, where the costs are hard to hide. All this points to the need for really creative marketing, messaging, and political coalition-building to make carbon fee and dividend legislation succeed in the United States.

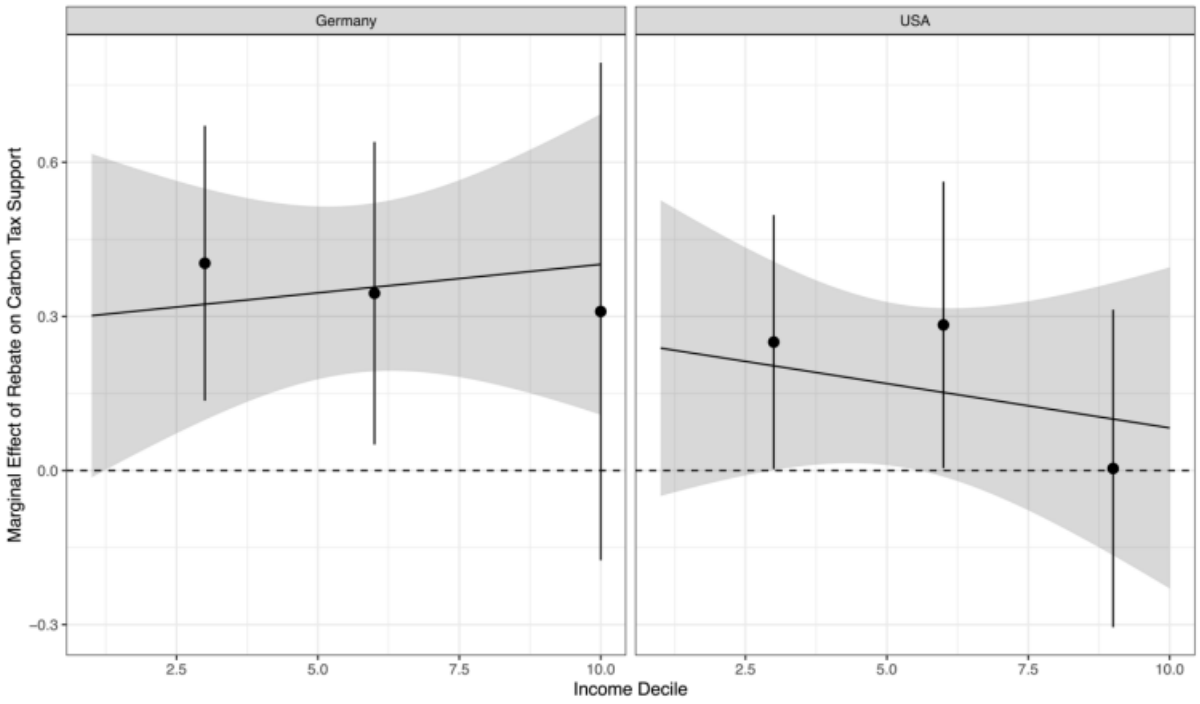


Figure 3 Effect of Including a Rebate upon Support for Carbon Taxation in the Control Group

Sources:

Matto Mildenberger et al., "Limited impacts of carbon tax rebate programmes on public support for carbon pricing," *Nature Climate Change*, 12 (January 2022), 141-147.

Anders Fremstad, et al., "The role of rebates in public support for carbon taxes," *Environmental Research Letters*, 17:8 (2022).

Liam Beiser-McGrath and Thomas Bernauer, "Carbon Inequality and Support for Carbon Taxation," *European Journal of Political Research*, December 2023.

Liam Beiser-McGrath and Thomas Bernauer, "How Do Pocketbook and Distributional Concerns Affect Citizens' Preferences for Carbon Taxation?" *Journal of Politics*, forthcoming, 2024.

Jonathan Marshall, "How to make carbon pricing more popular," CCL blog, January 29, 2023.

Jonathan Marshall, *Building Support for Carbon Pricing: A Research Guide*. Citizens' Climate Lobby, 2023.

Germany Shows Why Carbon Dividends Are So Important

January 2024

A recent AP-NORC poll shows tremendous public sensitivity toward energy costs as a potential roadblock to climate mitigation policies like carbon pricing. Support for carbon pricing in Canada and the state of Washington, among other places, is eroding as a result. That's why we have to make cashback dividends such a key part of our message.

That lesson seems lost on some key policy makers in Germany, however. With the nation's economy in the doldrums and energy prices still high, many German economists, as well as members of the Social Democratic and Green parties, are calling for dividend-like climate payments to compensate individuals for rising carbon prices.

But Finance Minister Christian Lindner said although the government will soon have the technical ability to make dividend payments, it will hold off on any commitments until after the next election, in part because of budget-cutting priorities.

Caption: Economist Veronika Grimm says climate money will lead to a more socially fair distribution of the burden caused by the rising CO2 price. *Rheinische Post*, December 29, 2023

Germany has at least two carbon prices. One price is set by the European Union's emissions trading system (ETS). It covers the power sector, large industry, and airlines. That price has been trending down since last spring and is now around 70 euros ($76) per ton of CO2.

In 2021 Germany also introduced a supplementary carbon tax, which covers fuels for the transportation and building heating sectors. Last year it amounted to 30 euros (about $35) per ton of CO2. It jumped to 45 euros at the start of this year, which is expected to increase the price of gasoline about 8.4 cents per liter and add 50 euros to the average annual home heating bill.

Following Austria's example, the government originally said it would soften the blow of high energy prices through a "climate bonus" (Klimageld) paid to every citizen. That proposal followed publication research by the German Institute for Economic Research (DIW) showing that "private households with low incomes are particularly burdened" by carbon pricing and

advising that it would "be possible to relieve the burden on private households in a revenue-neutral manner by . . . introducing a uniform per capita climate premium." (I recently posted about a paper by three German economists making the same case at greater length.)

DIW's president recently said it was "high time" for Germany to implement a climate bonus. However, Germany's current approach, like that of Washington and California, is to funnel revenue into various green programs rather than consumers' pockets. Said Finance Minister Lindner, "the revenues are being used to promote heating, building renovation, green steel production, charging stations for electric cars and so on. In short, because one household receives a heat pump subsidy, several hundred others cannot receive climate money that year. You can't spend the money twice. So the climate money would replace the subsidies we have now."

Lindner's caution was also prompted by a looming budget crisis. Unfortunately, budget austerity means many other social welfare and transfer payment programs will also be cut, no doubt fueling popular dissatisfaction with the cost of environmental programs including carbon pricing. As I noted in a recent post, high energy costs are propelling the rises of Germany's neo-fascist party. All of which is a reminder why it's vital to build dividends into any national or state carbon pricing strategy from the start.

Indeed, German economist Veronika Grimm said exactly that last month: "The climate money should have been established from the outset – before the increase in CO_2 pricing. Then it would be crystal clear that the increasing CO_2 pricing is not a tax increase, but simply a steering instrument."

A typical family of four would get a climate bonus of more than 650 euros a year with a carbon price of 45 euros per ton, she noted.

"Climate money has a very positive redistributive effect – on the one hand from high to low incomes, and on the other hand from those with a high to a low carbon footprint," she told one German newspaper. "This is exactly the desired steering effect: social balance on the one hand and appreciation of low-emission behavior on the other."

As icing on the cake, she added, implementing the carbon bonus sooner rather than later "would even benefit the government in the election campaign." Indeed, a new paper I covered in Nerd Corner last week, based on a national survey of German adults, showed a remarkable increase in public support for carbon pricing when accompanied by dividends of "climate premiums."

Source:

Stefan Bach, et al., "Lenkung, Aufkommen, Verteilung: Wirkungen von CO2-Bepreisung und Rückvergütung des Klimapakets," DIW Berlin, October 2019.

Why Carbon Dividends are Socially Just: A German Analysis

September 7, 2023

Growing appreciation of carbon dividends as a tool to help ensure that the cost burdens of climate policies are fairly apportioned is highlighted in a new paper in the journal *Energies* by three researchers at Germany's Wuppertal Institute for Climate, Environment and Energy. Titled "Can a CO2 Tax Be Socially Just? Analysis of the Social Distribution Effects of the German CO2 Taxation," the paper concludes, "the introduction of a per capita flat rate [dividend] fed by CO2 tax revenues could be a suitable way to reduce the burden on low-income households."

The scholars remind readers that even rich Germany, renowned for its generous social safety net, has big pockets of poverty. As one illustration, they point to the quarter million electricity and gas customers who were disconnected in 2021 as a result of late payments.

They also note the irrationality of many of Germany's policies, starting with a special tax levied on electricity rates since 2000 to subsidize renewable energy. In part because of this tax, electricity prices have far outstripped average wages and pensions since 2008. Needless to say, this levy, which accounted for a fifth of electricity rates by 2020, has discouraged clean electrification. It also punished lower-income households, who pay a much larger fraction of their income on energy than more affluent ones.

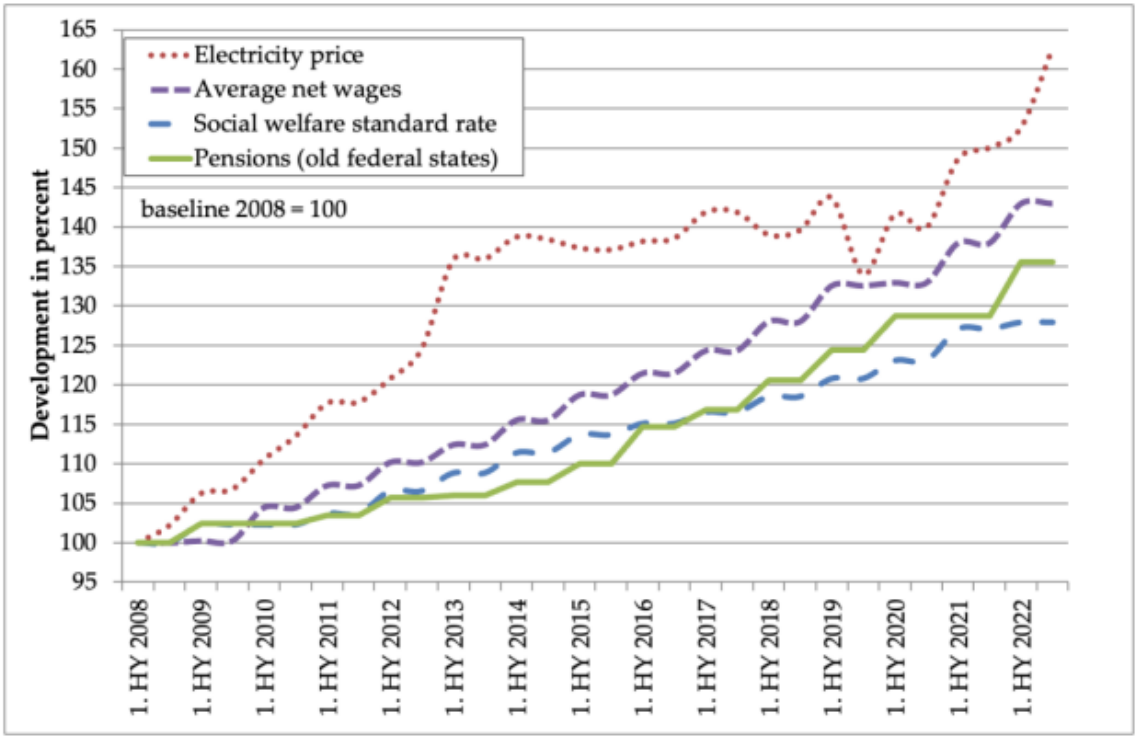


Figure 1. Development of electricity prices compared with various incomes since 2008 [12–16].

The electricity tax ended in the summer of 2022 when the government instituted a relief package for soaring energy costs in the wake of Russia's invasion of Ukraine. Unfortunately, the government also reduced energy taxes on fossil fuels at the same time. Since 2021, the government has also offered ill-considered subsidies to long-distance commuters. As the authors note, "The distance allowance provides an incentive for people with particularly high incomes to move their residence from the city to the countryside and to commute, which also deprives the municipalities of the municipal share of income taxes, which nevertheless have to finance large parts of the social and cultural infrastructure."

The scholars argue, "It is therefore time to again take a closer look at the CO2 tax and to discuss appropriate compensation mechanisms. The possibilities for returning the revenues of a CO2 tax include, above all, the per capita flat rate (also climate dividend, climate bonus, energy transition bonus, etc.) This is paid out (in the same amount) as a lump sum to all citizens. Due to the fact that poorer households generate lower CO2 emissions in absolute terms, such a reimbursement would cause a financial redistribution from richer to poorer households. If the per capita flat rate is also paid to children, families would also be relieved. Such a refund would be extremely well targeted, as it would also reach people who currently fall through the cracks of social transfers because, for example, they are just above an assessment threshold. The per capita flat rate would also increase the acceptance of CO2 pricing among the entire population, since everyone would receive cash."

Sound familiar?

The paper analyzes three representative families—a relatively affluent "double-income, no kids" household, a family with three kids living in the country, and a single parent with one or two children. As expected, the higher income DINK family suffers the least and the one-parent family suffers the most from a carbon tax. However, that order reverses with the addition of a flat dividend. That's what US studies show as well.

When designing climate policies, they conclude, "social justice must be a priority in addition to achieving the climate targets. . . . We derive the conclusion that the payment of a per capita flat rate is an adequate way to consider social justice in climate protection."

But they wisely add a caveat: "It is simply not possible, nor does it make sense, to try to solve social problems through climate policy measures alone. Low incomes, which lead to precarious living conditions, make it necessary to find other redistribution mechanisms to provide social support for climate policy requirements." The same observation, one might add, applies to important but often distinct issues of environmental justice.

Source:

Maike Venjakob, et al., "Can a CO2 Tax Be Socially Just? Analysis of the Social Distribution Effects of the German CO2 Taxation," *Energies*, 16 (August 2023).

Long Live Carbon Dividends!

May 2023

The 28 Nobel laureates and four former chairs of the Federal Reserve Board who joined 3,600 other U.S. economists to endorse carbon taxes as "the most cost-effective lever to reduce carbon emissions at the scale and speed that is necessary" had this to say about carbon dividends:

"To maximize the fairness and political viability of a rising carbon tax, all the revenue should be returned directly to U.S. citizens through equal lump-sum rebates."

Proponents call such rebates "carbon dividends" or "carbon cashback." While climate activist continue working to implement them as national policy in the United States, it's great to see the concept being integrated into other carbon pricing plans, from New York State to the European Union (EU).

The EU's Social Climate Fund

In 2005 the EU established the world's first international "cap and trade" system to price carbon emissions in key sectors of its member countries' economies.

Not until December 2022, however, did Europe reach provisional agreement to create a Social Climate Fund to help vulnerable groups afford rising energy prices as the EU moves to extend carbon pricing to transport and building fuels.

The fund will provide "temporary income support" to needy households and small businesses, as well as investment subsidies for energy efficiency, building electrification, and other measures to help reduce fossil fuel costs.

Major climate action groups have praised the EU's new fund for striking "the right balance between financing structural investments and providing temporary direct income support to households in need, as a new carbon price is introduced in 2027 by the new [emissions trading system] for road transport and buildings. The investments will enable vulnerable citizens to renovate their homes, to adopt energy efficient technologies, and to access renewable energy and sustainable transport modes. This will reduce their dependence on fossil fuels in the medium to long-term, while direct income support will mitigate potential negative effects in the short-term."

As I've noted before, some EU member countries already have model carbon dividend programs. Austria's "Climate Bonus," for example, provided every adult citizen 500 Euros last year from revenue raised by the country's tax of 30 Euros per metric ton of carbon dioxide. (Minors got half that amount.) Austria's carbon price will rise to 55 Euros by 2025, and the bonus will rise accordingly.

Washington and California should take note

Although its ban on natural gas in new buildings received much more publicity, New York State passed a landmark "cap-and-invest" program earlier this month, pursuant to slashing greenhouse gas emissions 85% by 2050. Unlike Washington state's similar carbon pricing program, which took effect January 1, New York plans to earmark a third of program revenue for consumer and small business rebates—akin to dividends.

And let's not forget that our neighbor to the north, Canada, once again adjusted both its default national carbon tax *and* its provincial dividends—known as "climate action incentive payments"—upward for 2023. Those tax-free payments will now be paid directly to households each quarter.

California, home of a pioneering state cap-and-trade program, would do well to heed these examples and the many studies showing the power of dividends to enhance public support for carbon pricing. Its small rebate program, which shows up a "California Climate Credit" to California utility customers, has totaled only about $600 per household cumulatively since 2014. In contrast, the state boasts of spending $4.3 billion in cap-and-trade revenue on the High-Speed Rail Project, which a New York Times expose last year called a "multi-billion-dollar nightmare" that may never be finished.

Total spending of state cap-and-trade revenue on such "climate investments," some of which are doubtless worthy, has totaled $13.6 billion since 2014. As California's carbon price increases—as it should—I worry that consumers in this expensive state may someday rebel. Without a dividend to cushion the pain, studies show that people who *say* they support clean energy are not always willing to put their money where their mouth is. The last thing California needs is a climate revolt like the 1977 tax revolt.

Source:

Lauren Knapp et al., "Will consumers really pay for green electricity? Comparing stated and revealed preferences for residential programs in the United States," *Energy Research & Social Science*, 65 (July 2020).

Bridging the Partisan Divide: How to Reach Republicans?

October 2023

Finding common ground on effective national climate policies presents a special challenge since the partisan gap in the United States over climate has widened more than any other major issue in the past two decades.

A recent study published in *Climate Policy* by three Spanish economists offers highly relevant if not revolutionary insights on how activists can work to overcome that challenge. It's titled,

appropriately, "Carbon tax acceptance in a polarized society: bridging the partisan divide over climate policy in the US."

The first half of the study, consistent with much previous research, establishes the importance of group political identify as a powerful driver of emotional responses and "motivated reasoning" that predispose Democrats and Republicans to reach conflicting positions on climate. The conclusion is pretty dismal: it's really hard to change minds, especially with traditional kinds of logical arguments and scientific evidence.

In a more novel vein, they report on experimental tests of whether tailored messages appealing to individuals' political identities can sway their perceptions of fairness and increase acceptance of carbon taxes.

The researchers selected a sample of 300 American adults, half Democrats and half Republicans. Every participant was informed about the basic concept of a carbon tax as "a levy that polluters pay on the carbon emissions they emit. This encourages people and businesses to make choices and investments that are good for the environment."

Two experimental sub-groups then got additional messages about fairness. One message emphasized distributional fairness: "The carbon tax is a fair policy because it raises money that can be returned to taxpayers in the form of lump-sum payments to support low-income groups and disproportionately affected communities transitioning out of high-carbon industries."

Another experimental group received a more conservative-leaning message about *personal* fairness: "The carbon tax is a fair policy because it does not limit freedom of choice of businesses and individuals like you: Carbon taxes replace unnecessarily complicated government regulations with transparent, flexible and simple market-based incentives."

The researchers hypothesized, reasonably enough, that Democrats would respond well to the first and Republicans to the second.

The results proved them half right. Democrats did increase their approval of carbon taxes after exposure to the more liberal message about distributional fairness. Their approval held steady (at a high level) with the second message on personal freedom.

Republicans, as expected, started with a lower level of acceptance but really disliked the message about distributional fairness. (Moderate Republicans especially recoiled against it.) Unexpectedly, they didn't much care for the personal fairness message, either. The reasons aren't entirely clear, but any argument from an unvetted source about an issue they perceive as partisan may make Republicans react more negatively.

Bottom line: trying to reach Republicans with any form of "partisan framing"—that is to say, any discussion about climate—may be a losing battle. As an alternative, the authors observe, "experimental evidence shows that energy security frames increase carbon tax support

among Republicans more than framing the policy as a climate change mitigation instrument. Carbon pricing communication could thus use frames that resonate with partisans' identity to increase support and avoid climate change frames when targeting Republicans."

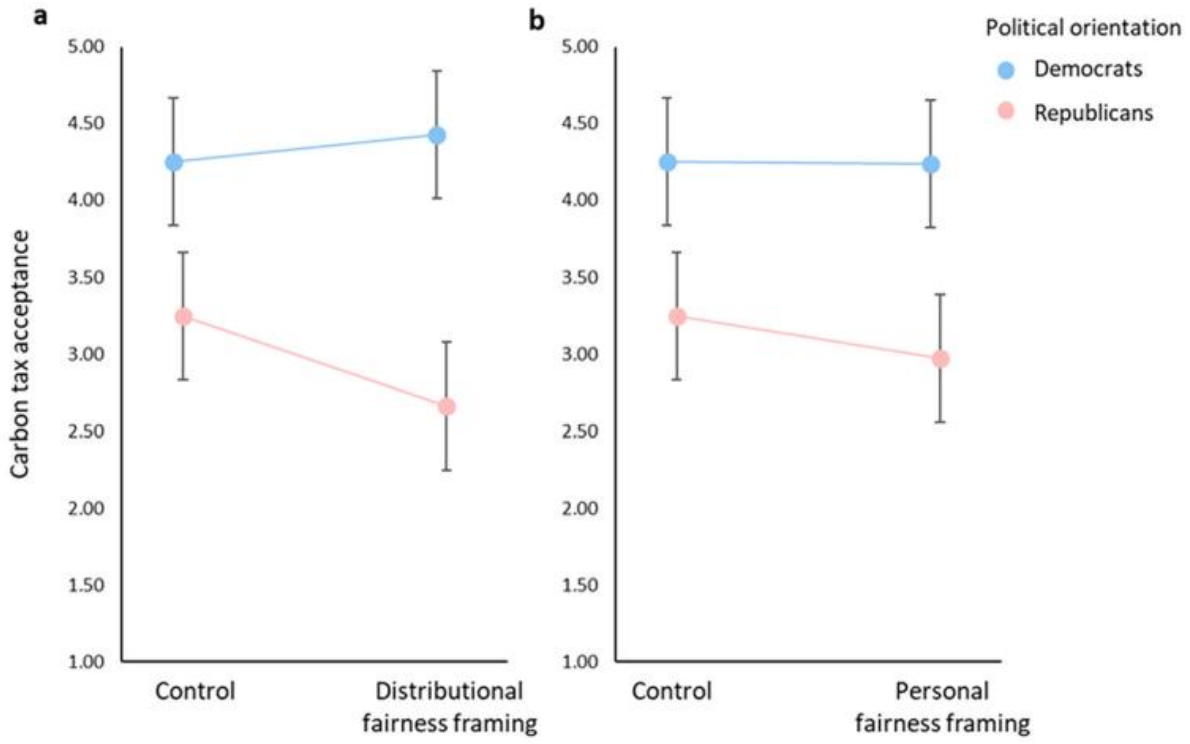


Figure 2. The effect of (a) distributional fairness and (b) personal fairness framings on carbon tax acceptance, moderated by political orientation. *Error bars correspond to 95% confidence intervals.*

In addition, they note sensibly, any messages targeted at Republicans should come from sources they deem credible, to avoid suspicion and backlash. Check out this supporting research published in *Nature Climate Change* in 2021.

Sources:

Frank Newport, "Partisan Gaps Expand Most on Government Power, Climate," Gallup, August 7, 2023.

Aitor Marcos, et al., "Carbon tax acceptance in a polarized society: bridging the partisan divide over climate policy in the US," *Climate Policy*, 23:7 (January 2023).

Clark Merrefield, "After an experimental online advertising campaign, Republicans shifted their views on climate change," *The Journalist's Resource*, July 27, 2021.

How to Make Progressives Love Carbon Taxes

April 2023

The Nation, founded by abolitionists in 1865, may be the oldest avowedly "progressive" magazine in America. Working to fulfill "the promise of a radical tomorrow," it hasn't looked kindly on market-based policies in recent years. So kudos to Charles Komanoff, founder of the Carbon Tax Center, for convincing the editors to publish his convincing call for carbon taxes in its online edition today (April 20, 2023).

His article is a model of how to pick the right argument for the audience. Komanoff doesn't waste time enumerating the virtues of the free market or the perils of heavy-handed government intervention. Instead, he focuses on a villain nearly all Nation readers (me included) love to hate: the cryptocurrency industry.

Citing a recent New York Times expose, Komanoff calculates that 34 giant Bitcoin "mining" sites in the United States consume as much energy as nearly 3 million households—and nearly 10 percent of all U.S. wind energy. Wind farms in only two states, Texas and Iowa, produce more electricity than those Bitcoin sites consume. Shutting down those "mining" sites would instantly free up renewable energy to replace dirty fossil fuel generation.

By now his readers are primed for Komanoff's provocative take: "This raises two uncomfortable questions for the climate movement: Why isn't it rallying against Bitcoin mines and other parasitic users of carbon fuels? And why isn't it taking the obvious step of calling for a tax on carbon emissions to reduce those usages while simultaneously extracting revenues from them?"

With a carbon tax of $100 per ton, about equal to the price in the European Union these days, the government would raise $1.5 billion a year for the Treasury "from the fossil fuel companies that power the Bitcoin operations." What Nation reader could be against that?

Providing a useful analogy, Komanoff adds, those "tax moneys are twice what Fox News will pay Dominion Voting Systems under the settlement reached this week. And they're recurring."

By ignoring the power of carbon pricing, Komanoff concludes, "the climate movement is playing the wrong game. . . Trying to bottle up supply instead of throttling demand is whack-a-mole without end, chasing after but never stopping capitalism's dynamism from erupting in crypto mining and 1,001 other climate-destroying products and technologies. By itself, a carbon tax won't cure that. But it would at least start to steer innovation and cultural norms away from endless new climate horrors."

I'm convinced.

5. Miscellaneous

New Studies Confirm Huge Benefits of Climate Action

September 2022

Last week I reported a stunning estimate by the Office of Management and Budget that the social benefits of the Inflation Reduction Act's climate provisions could be as high as $1.9 *trillion*. That seemed like a big deal to me at the time, and a great return on a 10-year investment of $370 billion.

Starting today, however, that number needs to be revised up—way up. Based on a new study by two dozen leading economists and climate researchers in *Nature* magazine, the actual benefits of the IRA could be *$4.5 trillion* or even higher. Remember that jaw-dropping number anytime someone tells you government solutions never work.

The new study re-estimates dramatically upward what economists call the "social cost of carbon" (SCC). The term refers to the net damage, in current dollars, caused by the emission of an additional metric ton of carbon dioxide into the atmosphere. (That's about what one passenger car produces over 2,500 miles.) The damage can range from fires, droughts, and floods to the loss of human life from excessive heat.

Often called "the most important number you've never heard of," the SCC has become incredibly important to environmental policy and regulation. Careful study by serious experts in the Obama administration set the number at $51 per metric ton of CO2. Federal and state government planners here and abroad have subsequently used SCC estimates to justify fuel economy standards, power plant regulations, limits on emissions from oil and gas facilities, procurement decisions, and national carbon prices.

Because of its importance, the SCC has also become a target of climate skeptics. A research fellow at the right-wing Heritage Foundation dismissed it as "the most useless number you've never heard of." Determined to roll back EPA regulations on power plant emissions and vehicle fuel efficiency, the Trump administration slashed its official SCC estimate to between $1 and $7/t-CO2.

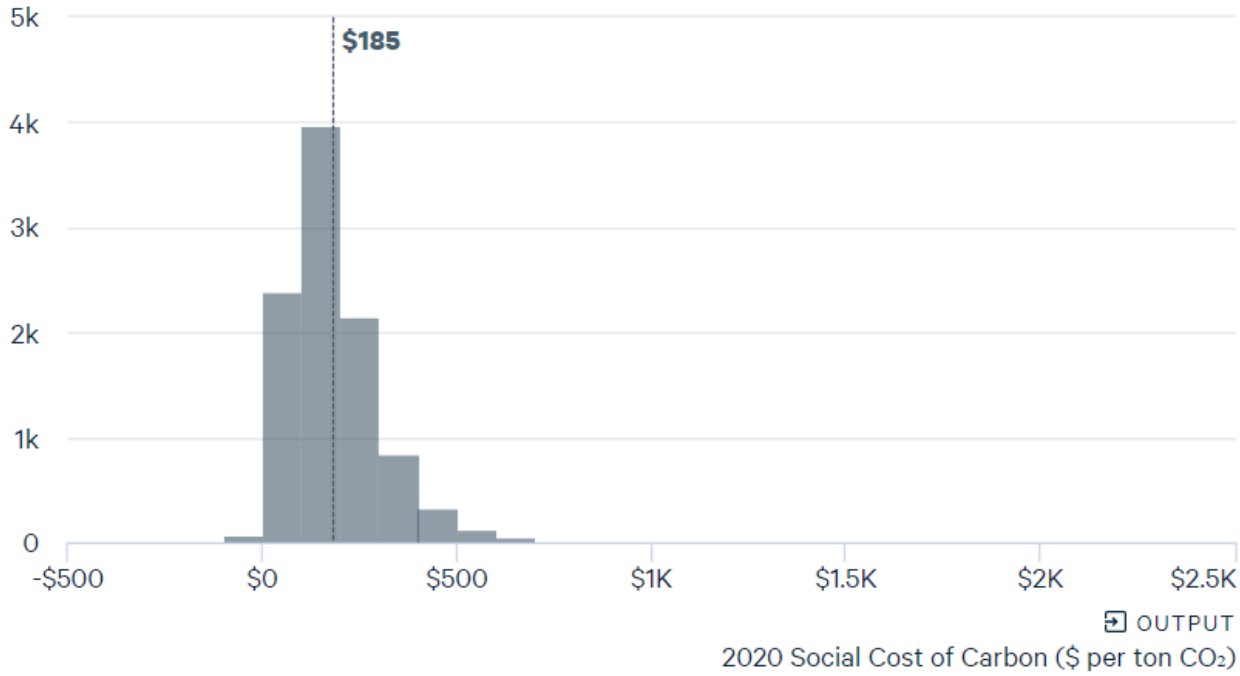
Reflecting its significance, one of President Biden's first acts on taking office was to order a full review of SCC estimates, due sometime this year. In the interim, his administration revived the Obama-era $51 number for use by federal agencies. Last May, the Supreme Court overturned an injunction by a Trump-appointed Louisiana judge and allowed the Biden administration to keep using the SCC for planning purposes.

Beating his administration to the punch, two dozen scholars from institutions such as the University of California, Princeton, Harvard, and Resources for the Future, reported today on

the results of their five years of work to implement a landmark 2017 report by the National Academies of Sciences, Engineering, and Medicine on ways to improve the scientific basis of SCC estimates.

The team's central estimate for the SCC is $185/t-CO2, 3.6 times higher than the government's current value. (The OMB study, cited at top, used a figure of $78 for reasons I won't go into here.)

Social Cost of Carbon



Social Cost of Carbon Explorer (rff.org)

What that means, in short, is most complaints about the cost of implementing climate policies largely miss the point. Some policies are more cost effective than others, of course, but we have a long, long way to go before the costs of action will outweigh the benefits.

The authors acknowledge it's entirely possible that their estimates are still too low. For their damage estimates, they quantified, in dollars, the likely impacts of future climate change on human mortality, crop yields, energy costs, and sea level rise. The first two accounted for nearly all the social costs. In the case of energy, global warming will mean higher costs for air conditioning but lower costs of heating, leaving little net impact.

Regarding sea level rise, the authors drew from a 2016 study which assumed that countries will find optimal ways of adapting and that serious impacts won't begin for many years. I'm not reassured, however, by the report just three days ago in *Nature Climate Change* of an "ominous prognosis" for irreversible melting of Greenland's ice sheet and its impact on coastal communities around the globe.

By their own admission, moreover, the authors didn't account for possible lost labor productivity, many kinds of natural disasters, biodiversity loss, or the impacts of ocean acidification. With their focus on the climate impacts of CO2, they also did not consider the staggering health impacts of other noxious gases emitted by fossil fuels.

I note these gaps not to criticize the authors or their extraordinary research, but to emphasize that their careful findings probably represent conservative estimates. Like global mean temperatures, estimates of the costs of climate disruption just keep going up and up over time. So must our efforts to address the crisis.

Sources:

Kevin Rennert, et al., "Comprehensive evidence implies a higher social cost of CO2," *Nature*, 610 (September 2022).

Brian Prest, et al., "The Social Cost of Carbon: Reaching a New Estimate," *Resources*, September 1, 2022.

National Academies of Sciences, Engineering and Medicine, *Valuing Climate Damages: Updating Estimates of the Social Cost of Carbon Dioxide*. 2017.

Delavane Diaz, "Estimating global damages from sea level rise with the Coastal Impact and Adaptation Model (CIAM)," *Climatic Change*, 137 (April 2016), 143-156.

Addendum: December 2024

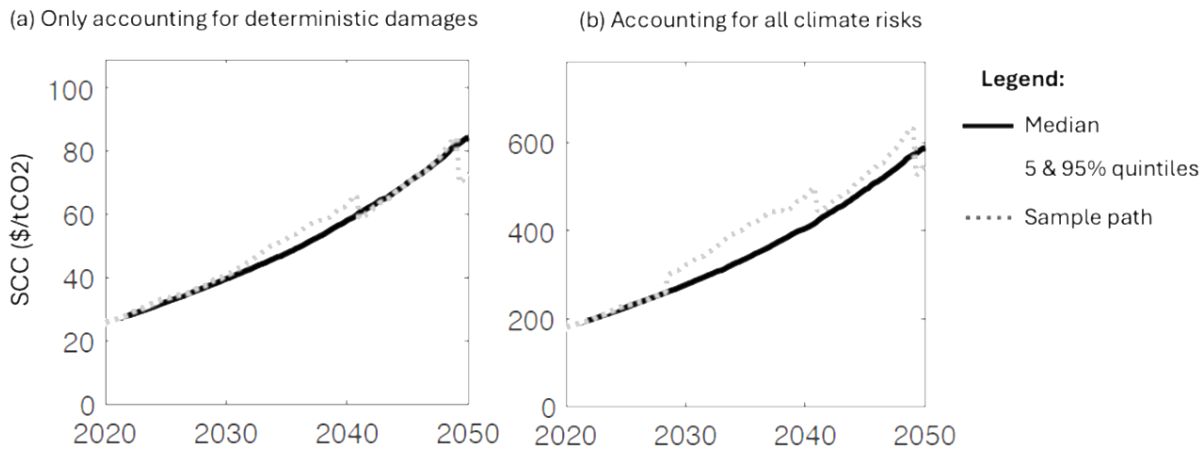
A new paper by three distinguished European economists offers a simple and intuitive method for estimating the "social cost of carbon" in place of more complex and challenging mathematical approaches. It focuses on the impacts of climate change on economic productivity, recurring natural disasters, and the probability of climate tipping points.

Cutting to the chase, they derive estimates of the social cost of carbon that start around $182 per ton of carbon dioxide today, rising to nearly $600 per ton in 2050.

Here's their explanation of what those results signify:

> So, why does the SCC [social cost of carbon] matter so much? It's not just a number—it's a guidepost for policymakers making decisions about climate action. If the true cost of emitting carbon is significantly higher than previously thought, it means the benefits of reducing emissions outweigh the costs by a larger margin. In practical terms, this implies that stronger climate policies, including carbon taxes and regulations, are needed to mitigate the far-reaching consequences of global warming. . . .

Paths for the Social Cost of Carbon Over Time



If the cost of carbon emissions is as high as this new estimate suggests, there is a much stronger case for implementing carbon taxes or other market-based policies that incentivise the reduction of CO2 emissions. Governments should thus consider adopting policies that align more closely with the updated SCC, such as higher carbon taxes, stricter regulations on emissions, and increased investment in renewable energy technologies. . .

Proposals for a carbon tax have gained traction in recent years, but the actual price at which CO2 emissions should be taxed remains a contentious issue. With the new estimate of $185 per ton, the economic justification for such a tax becomes much clearer. It's not just an abstract number — it is a reflection of the growing costs of a warming planet. It should serve as a wake-up call for policymakers and citizens alike: we need to take more immediate and decisive action to avoid the worst impacts of global warming. In the end, higher carbon prices are a crucial step forward in making climate change a priority in the global policy conversation. With a clearer understanding of the true costs of carbon emissions, the world has a better chance of avoiding the worst outcomes and building a more sustainable future.

Source:

van den Bremer, T., C. Hambel and F. Van Der Ploeg, "Three Reasons to Price Carbon Under Uncertainty: Accuracy of Simple Rules," CEPR Discussion Paper No. 19645, Nov. 2024.

Five Myths about Carbon Pricing

April 2023

As a core policy for mitigating climate change, carbon pricing keeps making gains around the world, from Austria to Thailand. It will almost certainly pick up speed with the European Union's decision to impose border "adjustments" on high-carbon goods imported from countries without carbon pricing. Despite its proven track record, however, critics in the United States and abroad still maintain that carbon pricing is ineffective, harmful to the poor, and a job killer.

Professor Gilbert Metcalf, a distinguished economist, climate policy expert, and CCL Advisory Board Member at Tufts University, dispels these notions in a new paper, "Five Myths About Carbon Pricing," slated for publication in the *Oxford Review of Economic Policy*. Although specialists in the field won't discover anything new here, it's a great resource for anyone else interested in the power of carbon pricing to help accelerate the transition from polluting fossil fuels to cleaner alternatives.

Here's a brief summary of his main points:

Myth 1: Carbon Pricing Will Hurt Economic Growth. This claim sounds plausible until you recall that revenue from a carbon tax is recycled into the economy, typically as spending on clean technology programs, a cut in other taxes, or "cashback" dividends. Summarizing empirical studies from many countries, he writes, "once [business] creation and technology adoption are incorporated into modelling, carbon taxes may lead to modestly positive impacts on economic output (in addition to the environmental benefits)."

Myth 2: Carbon Pricing is a Job Killer. Not surprisingly, a policy that doesn't hinder economic growth also doesn't kill jobs overall, though it will certainly redirect them toward cleaner industries. One key to making the transition as smooth as possible will be adoption of new technologies that lower the cost of carbon-free solutions.

Myth 3: Carbon Taxes and Cap and Trade Programs Are Equivalent. If you have the choice, go with carbon taxes over cap-and-trade programs, Metcalf says. His most important point is that with a carbon tax, any other programs to regulate emissions or subsidize clean energy are complementary. With cap and trade, those other programs don't affect the emissions cap, so they don't add any net benefit. Likely they will simply raise the cost of meeting emissions targets.

Myth 4: Carbon Taxes Are Incompatible with Emission Reduction Targets. Defenders of cap and trade argue that carbon taxes don't guarantee that emissions goals will be met. Metcalf discusses several ways that carbon taxes can be modified to ensure they do the job. One solution was built into the Energy Innovation and Carbon Dividend Act: raise the carbon tax every year, and if its performance falls short, increase the annual step-up to close the gap.

Myth 5: Carbon pricing is regressive. This concern is a major impediment to winning public support for carbon pricing in many countries, although rebating carbon tax revenues through cashback dividends makes the overall policy highly progressive. More surprisingly, sophisticated economic models show that even without such progressive dividends, carbon taxes are probably slightly progressive in their "incidence"—they fall more heavily on high-income households than lower-income ones.

Metcalf isn't pollyannish. He acknowledges carbon pricing will cause pain to workers who lose jobs in fossil fuel industries. Even if carbon pricing has a broadly positive impact on the economy, he notes, a "meaningful transition policy for workers in these sectors will be important both from a political economy perspective as well as an environmental justice perspective." But he rightly insists that only if economists dispel the myths about carbon pricing "can we focus on the true political obstacles to enacting meaningful carbon pricing policies."

Source:

Gilbert Metcalf, "Five Myths About Carbon Pricing," NBER Working Paper 31104, April 2023.

How Carbon Dividends Help the Economy

August 2023

Most of us understand by now that carbon pricing is the most efficient way to steer an economy away from dependence on polluting fossil fuels to a healthier and more sustainable climate. But members of the public have widely varying views on how to spend the revenue. Popular choices include green energy investments, paying down the national debt, and providing a "dividend" to help individuals afford the transition to a cleaner world.

A recent paper by economists Diego Känzig at Northwestern University and Maximilian Konradt at Geneva Graduate Institute suggests that recycling revenues to help households, either by cutting other taxes or paying dividends, is good for the economy at large.

The paper compares the impacts of carbon pricing on both greenhouse gas emissions and macroeconomic performance in Europe among countries that do not recycle revenue and those that do. Denmark, Finland, Norway, and Sweden are examples of countries that do recycle carbon tax revenues.

Their stark finding is that countries that don't recycle suffer worse economic side-effects: steeper declines in GDP and industrial production and significantly higher increases in unemployment.

They concede that several factors contribute to these differences but conclude nonetheless that "recycling carbon revenues can mitigate potential adverse economic effects of carbon pricing."

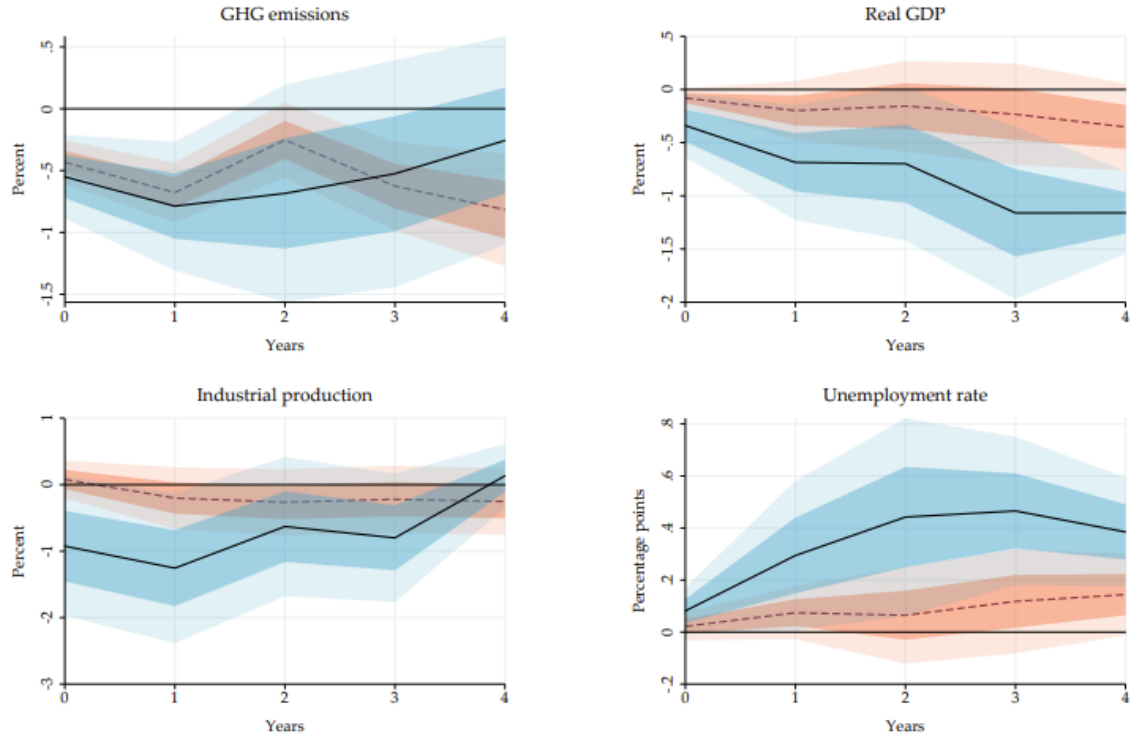


Figure 7: The Role of Revenue Recycling

Notes: Impulse responses to a carbon tax innovation in revenue (dashed line) and non-revenue recycling (solid line) countries in the Western and Northern European sample. The dark and light shaded areas are 68 and 95 percent confidence bands, respectively.

Kanzig and Konradt, "Climate Policy and the Economy: Evidence from Europe's Carbon Pricing Initiatives" (June 2023)

We all know that without revenue recycling, lower-income households suffer more from higher energy prices driven by carbon pricing. In a separate but related paper, Kanzig demonstrates that many of the macroeconomic costs of carbon pricing like falling wages and GDP also fall most heavily on lower-income households. "Solely focusing on the direct effects via higher energy prices can massively understate the actual regressive impact of the policy," he observes.

Fortunately, his model shows that "redistributing carbon revenues to the most affected households can mitigate the aggregate effect on consumption and reduce inequality, without compromising the reductions in emissions."

Such a policy also promises political rewards. Kanzig points to "suggestive evidence that carbon pricing leads to a fall in the support of climate-related policies that is particularly

pronounced among low-income households who are more affected by the policy. Thus, in order to organize a successful transition to a green economy, it is crucial for policymakers to take the distributional impacts – both direct and indirect – into account, and compensate the losers of the transition accordingly."

Sources:

Diego R. Känzig, "The Unequal Economic Consequences of Carbon Pricing," NBER Working Paper 31221, May 2023.

Diego R. Känzig and Maximilian Konradt, "Climate Policy and the Economy: Evidence from Europe's Carbon Pricing Initiatives," NBER Working Paper 31260, May 2023.

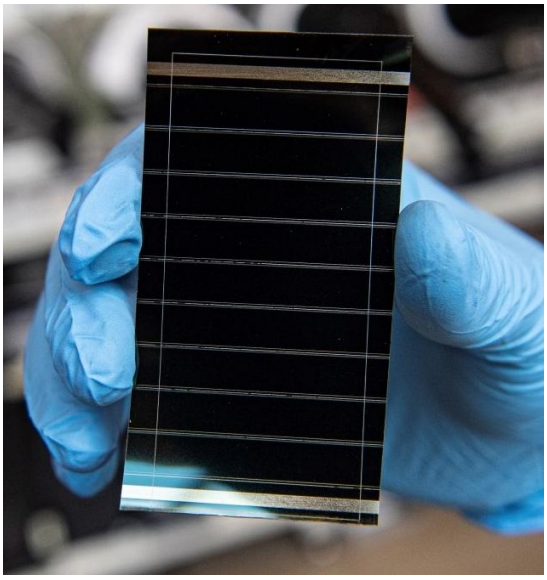
Diego R. Känzig, "Climate policy and economic inequality," VoxEU, June 25, 2023.

New Evidence that Carbon Pricing Promotes Innovation

August 2023

Like a lot of clean tech nerds, I enjoy reading about and trying to assess the latest claims of "breakthroughs" in research on better batteries, heat pumps, green hydrogen, next-generation nuclear, and other technologies that will facilitate global efforts to decarbonize while allowing us to maintain a robust standard of living. But I'd hate to be put in charge of picking the winners. People much more knowledgeable than me get those bets wrong all the time.

That's why it's critical to establish policies that promote clean tech innovation while avoiding heavy-handed government favoritism. Carbon pricing is just such a policy: It creates powerful market incentives to invest in new clean energy breakthroughs without mandating specific solutions. General subsidies for R&D also qualify as an even-handed (and highly beneficial) tool for promoting innovation.



Perovskite Solar Cells | Department of Energy

In a 2022 whitepaper for CCL titled "How Carbon Taxes Induce and Accelerate Clean Innovation," I amassed a large body of evidence demonstrating that such market incentives really work. Now a new article in the *Journal of Cleaner Production* by two professors at the University of Amsterdam and the University of Washington offers more empirical evidence that carbon pricing can be a powerful

driver of long-term innovation as well as short-term emissions reductions.

The two scholars examine the record of patent applications for climate mitigation technologies in 38 member countries of the Organization for Economic Cooperation and Development (OECD) from 1986 to 2019. They find that carbon pricing is associated with an increase of more than 3 patent applications per million population in the year of enactment and more than 5 patent applications per million in the long run. (These results are independent of the precise level of carbon pricing, though they find some evidence that stronger carbon pricing induces more climate innovation.)

"For perspective," they note elsewhere, "between 1986 and 2019, OECD countries filed an average of about 16 patents annually for climate technologies."

By controlling for other policies that may influence the rate of clean innovation, such as macroeconomic factors, feed-in tariffs for green energy, and government spending on R&D for low-carbon technologies, their paper makes a strong case, short of proof, that carbon pricing is an important and independent force driving innovation.

Reflecting on the implications for current climate policy debates, the authors observe, "our finding that carbon pricing might promote technological innovation offers another viable public communication strategy for those who seek to persuade voters and industries to be on board with carbon pricing policies. When informed that regulatory costs of carbon pricing can be effectively overcome through technological innovation, those who oppose carbon pricing policies for cost-related reasons might become more willing to support them. Rather than constructing their messages solely on emission reduction benefits, carbon pricing advocates should emphasize substantial innovation benefits."

Source:

Sijeong Lim and Aseem Prakash, "Does carbon pricing spur climate innovation? A panel study, 1986–2019," *Journal of Cleaner Production*, 395 (April 2023).

More Conservative Praise for Carbon Taxes

July 2022

If any real conservatives remain in the Republican Party, they should sit up and take note. In April the high priests of fiscal conservativism at the Committee for a Responsible Federal Budget issued a report lauding carbon taxes as a way to address the climate crisis without adding to the federal debt. Now the Alliance for Market Solutions, a self-described "organization of conservative leaders addressing two of America's most pressing challenges: the need to reduce carbon pollution and grow the economy," has unveiled a study showing that carbon taxes are much better for the economy than taxes on capital income.

"Good climate policy can be good fiscal policy," said AMS Executive Director Alex Flint. "Congress needs to pay more attention to evidence that a carbon tax is a better way for the government to raise revenue and has the additional benefit of addressing climate change. It's time to turn down the partisan rhetoric and seriously focus on economics and science."

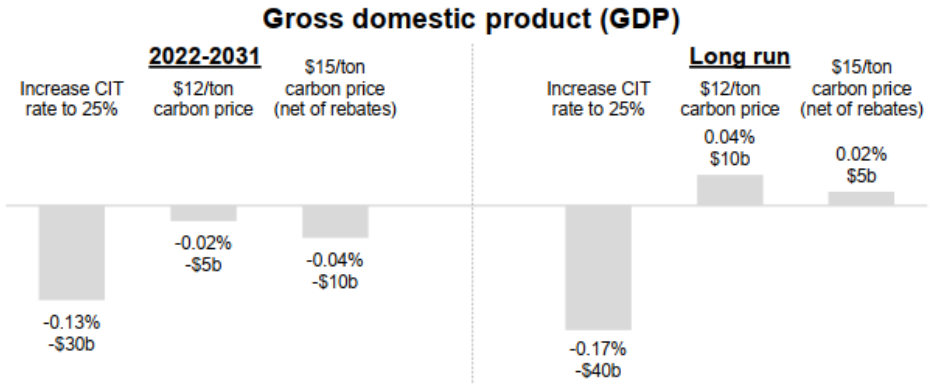
The AMS-sponsored study, "Macroeconomic impacts of carbon pricing relative to a higher corporate income tax rate," was prepared by Ernst & Young's Quantitative Economics and Statistics division. It compares three revenue-equivalent tax policies:

- increasing the federal corporate income tax from 21% to 25%;
- imposing a carbon tax of $12 per ton of CO_2; and
- a $15 carbon tax with a cash dividend to households in the bottom two income quintiles to offset increases in their energy-related costs.

The report doesn't address the climate, health, or other benefits of the carbon taxes, which are reasons enough to implement them. Instead, it looks only at the cost side of the equation. There, its conclusion is unequivocal: "Carbon pricing is more efficient at raising revenue than a corporate income tax increase and results in less drag on GDP growth."

Indeed, if a significant portion of the revenue were devoted to productive public investment, the net economic effect of a carbon tax could be positive. In this scenario, increasing the corporate income tax would cut annual GDP growth by 0.17% per year ($40 billion) in the long run, compared with a *positive* impact of 0.04% ($10 billion) and 0.02% ($5 billion) for the two carbon tax candidates.

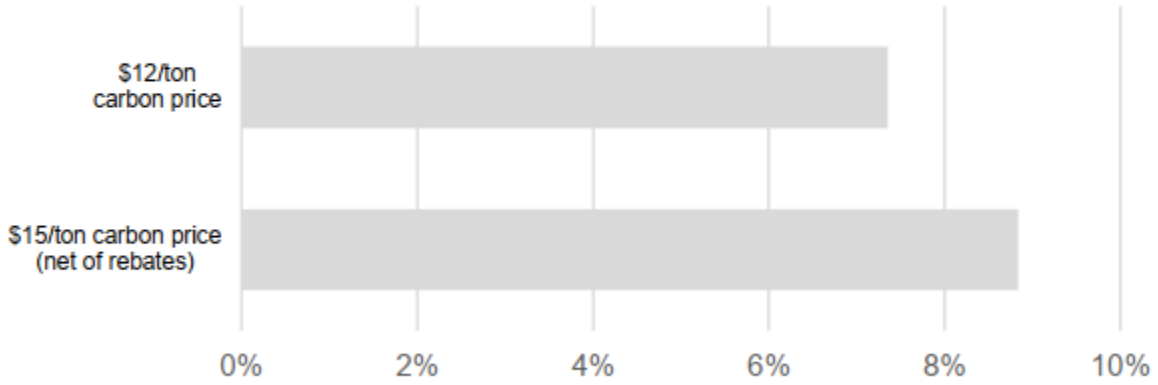
Figure B-1. Economic impact of revenue-equivalent policies
Percent change in level relative to baseline | Annual impact relative to 2022 US economy



*Less than 0.05% in magnitude.
Note: All results are the net impact of raising revenue (either through a corporate income tax rate increase or carbon price) and using that revenue to increase government spending (one half to fund productivity-enhancing public infrastructure and one half to fund government transfers). In some cases, this results in an increase in economic activity because of spending on productivity-enhancing infrastructure; a tax by itself will not increase GDP. Figures are rounded.
Source: EY analysis.

The report also estimates that even these very low carbon taxes would cut greenhouse gas emissions by about 8% relative to baseline, not a bad start. Indeed, the $15/ton level is where the Energy Innovation and Carbon Dividends Act would begin.

Figure 4. Impact of carbon pricing on carbon emissions
Percent decline in level relative to baseline



Source: EY analysis.

These findings are broadly consistent with those of other climate-related economic models, which tend to show that carbon taxes have little or no adverse effect on GDP when used to lower taxes on capital. As the EY study explains, taxes on corporate and other capital income "are generally viewed as relatively inefficient because they discourage investment, which reduces the capital stock, reduces the productive capacity of the economy, and, ultimately, dampens economic growth and living standards."

Source:

Alliance for Market Solutions, "Macroeconomic impacts of carbon pricing relative to a higher corporate income tax rate," July 15, 2022.

How to Play "What If" with Carbon Taxes

July 2022

Are you frustrated and depressed by political gridlock in Washington? It might help your mood to spend less time obsessing over bad news and more daydreaming instead about the ideal carbon tax policy you would enact if you controlled the swing vote in the U.S. Senate.

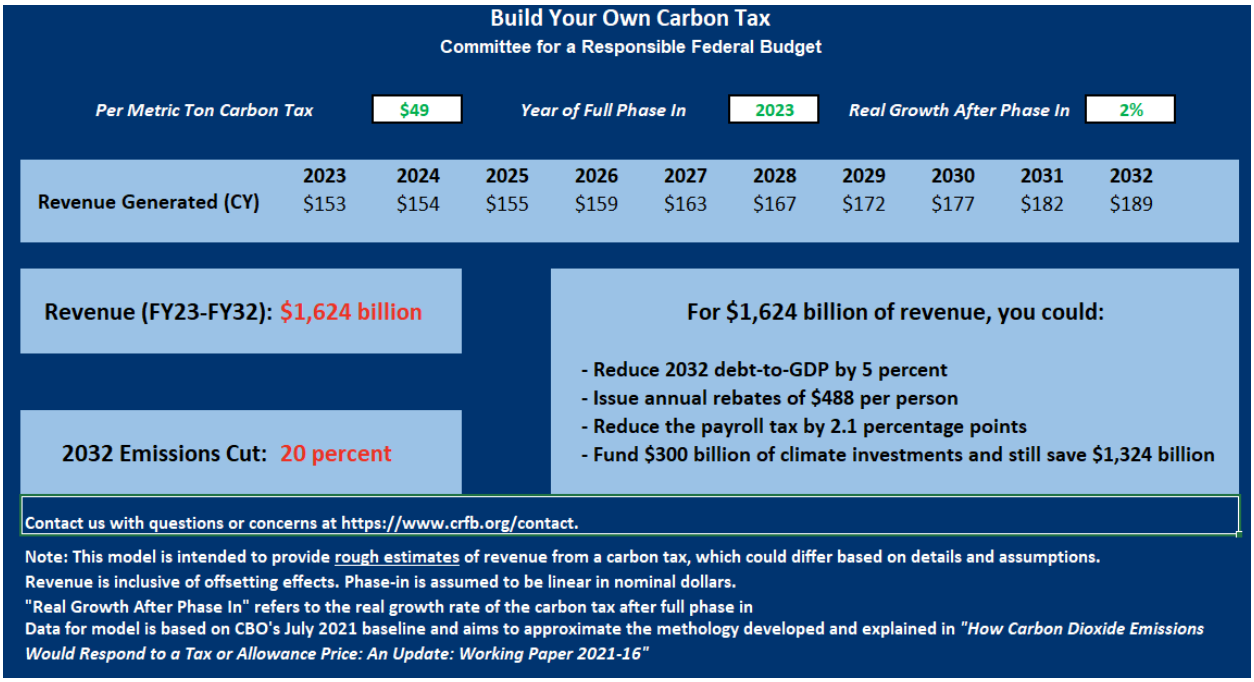
To help fuel those reveries, the non-partisan but fiscally conservative Committee for a Responsible Federal Budget (CRFB) has just released a user-adjustable carbon tax model. It lets you play with various carbon tax levels, rates of growth, and timing choices—giving you an instant readout of emissions cuts and total revenue raised over the next 10 years.

And if revenue numbers like "$1,624 billion" don't mean much to you, it also provides helpful bullets on how that revenue could pay for climate investments, reduce payroll taxes or the federal debt, or provide dividends to help individuals bear the costs of transitioning to a decarbonized economy.

Sadly, the model offers no insight into how many votes or campaign contributions you would gain or forfeit by your choices. Let's hope they include that in version 2.0.

CRFB previously reported on potential synergies between proposed clean energy and transportation subsidies in the reconciliation bill and carbon taxes at the level of either $20 per ton of CO2 or $40 per ton. The report estimated that combining those subsidies with even a modest $40 carbon tax would slash CO2 emissions 44 percent by 2030 (relative to 2005) while raising $900 billion in net federal revenue over 10 years.

CRFB based its projections on a rather conservative model of carbon tax impacts. That model is apparently what the committee has now made available for all to tinker with.

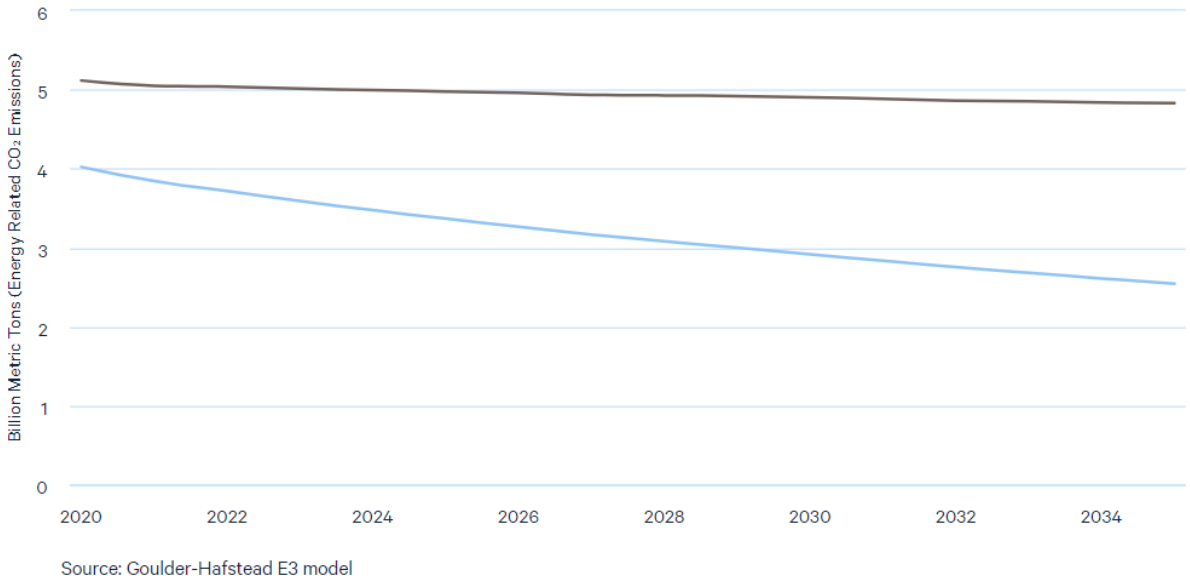


The respected environmental think-tank Resources For the Future (RFF) also offers a carbon tax calculator, based on a more sophisticated economic model. Like the CRFB site, it lets you choose the initial tax and the tax growth rate, but it provides a richer set of projections for annual emissions, annual revenues, cumulative emissions, local air pollutants, consumer prices, gross domestic product, and other variables.

As a nifty addition, it comes pre-populated with estimates for all of the major carbon pricing bills in Congress. As a test, I compared its estimates for the American Opportunity Carbon Fee Act, sponsored by Senators Sheldon Whitehouse (D-RI) and Brian Schatz (D-HI), with those of the CRFB calculator.

Starting with a carbon tax of $49 per metric ton, growing at a real (inflation-adjusted) rate of 2 percent per year, the CRFB calculator promises an emissions cut of 20% in 10 years (see chart above).

Annual Emissions (billion metric tons) – RFF Carbon Pricing Calculator



Source: Goulder-Hafstead E3 model

Data Series

- Business as Usual
- America Wins Act (Larson)
- America's Clean Future Fund Act (Durbin)
- American Opportunity Carbon Fee Act (Whitehouse-Schatz)

In contrast, RFF's calculator generously estimates that the bill would slash emissions about 37% over 10 years relative to its projected baseline. This is definitely the calculator of choice for carbon tax supporters who want to raise their spirits.

Why the differences? Modeling isn't an exact science. Assuming the math is correct, the answers given by any model depend entirely on its assumptions, which are matters of informed judgment.

Projections of the business-as-usual baseline will depend on assumptions about future fossil fuel prices, economic growth, and market penetration of renewable energy, electric vehicles, and other clean technologies. Estimates of carbon tax impacts will depend on assumptions about the sensitivity of consumer demand, business investment, and technology innovation in the face of changing prices for electricity, natural gas, motor vehicle fuels, and the like. As I show in my paper on carbon taxes and transportation, such estimates vary widely even in the peer-reviewed empirical literature. Climate models vary as well, and they don't have to deal with the vagaries of human behavior.

So how should you go about choosing which model to believe? Look for models that have been peer reviewed and that incorporate economy-wide feedback effects (so-called computable general equilibrium models), like RFF's. Better yet, choose to believe the more general results that most or all respected models agree on. These results will be ranges and tendencies rather than single numbers.

The landmark Stanford Energy Modeling Forum exercise 32, whose results were published in 2018, reported on the findings of 11 different models of economy-wide carbon pricing policies. All found strong reductions in greenhouse gas and local air pollutants, very modest impacts on GDP, and clear benefits to low-income households from lump-sum rebates of the tax revenue. You can read a summary of the results in the 2018 CCL blog, "10 fast facts about revenue-neutral carbon fees."

But a couple of conclusions from the modeling forum exercise are especially worth repeating:

- *"Models are best for insight, not foresight*. There is a very natural temptation to want to use these models to form expectations about costs and impacts of carbon price policies. However, because of the inherent challenges and uncertainties, policymakers are on steadier ground if they ask first what modeling can teach us about tradeoffs between policy choices, key sensitivities, and other key design decisions and then design the policy to be robust to variations in both assumptions and outcomes;" and
- "These uncertainties in the long run are not a reason to delay enacting a carbon price in the near future; any pricing policy can be modified as longer-term outcomes evolve, the literature makes clear that delaying action increases the cost to achieve a given level of reductions."

Happy daydreaming.

Sources:

Jonathan Marshall, "How Carbon Taxes Reduce CO2 Emissions in Transportation," Citizens' Climate Lobby, May 2022.

Alexander Barron, et al., "Policy Insights from the EMF 32 Study on U.S. Carbon Tax Scenarios," *Climate Change Economics*, 9:1 (2018).

How Do People Spend Their Carbon Dividends?

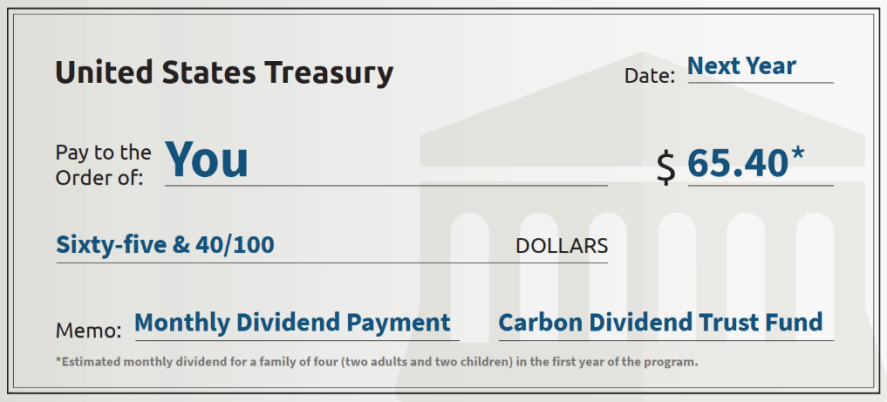
August 2022

"When CCL volunteers advocate for the carbon fee and dividend (CF&D)," wrote two members of CCL's Economics Policy Network in 2019 (including yours truly), "they often encounter skepticism about its effectiveness. In particular, some questioners wonder why people will reduce their purchases of carbon-based goods when they are getting their money back through a dividend.

"The simplest answer is that consumers will still want to spend their dividend in ways that deliver the most "bang" (value) for the buck. By raising the cost of carbon-intensive goods and services, the fee will steer spending by individuals and businesses toward lower-carbon substitutes that cost relatively less. The dividend won't change that calculus."

In other words, if a carbon fee hikes the price of gasoline, people on average will drive less to save money. If a dividend check shows up in the mail, they won't just spend it all on gasoline when there are plenty of other things want like whose prices haven't gone up—trendy new clothes, a Disney subscription, or a meal out. In the long run, they may also save up to buy an electric vehicle to save fuel costs. The overall consumption of carbon-intensive fuels and other goods should fall as their prices rise, regardless of the dividend.

At least that's how economists assume reasonable people should act. But are people reasonable?



Economists have long been the butt of jokes for their unrealistic assumptions about human rationality. They know that real people aren't perfectly rational, but assuming they are makes modeling human behavior much easier and does provide useful insights. After all, people do at least have an *incentive* and thus *tendency* to act purposefully and rationally in the pursuit of their self-interest, however they define it.

In the past few decades, however, economists have put great energy into studying and modeling how people systematically depart from rationality. Whereas a simple economic model might assume that people are as pleased by winning $20 as they are displeased by losing $20, studies show time and again that most of us have a special aversion to losing

money. That's why it's so hard for many investors to sell stocks in a down market; doing so means admitting their paper losses are real.

A new paper by two Canadian economists offers a fascinating test of whether real people will spend their carbon dividends as rationally as most economists assume. Will they ignore the source of the money and spread it among all their various desires? Do they instead have a system of "mental accounts" that causes them to spend the money mainly on fuel purchases and other items the carbon tax encouraged them to forgo, thus undercutting the efficacy of a carbon tax? Or will they respond in another way altogether?

Their test case is the carbon tax introduced in British Columbia in 2008. A significant portion of the revenue—starting at more than 30% and falling over time to about 15%--was returned to households in the form of a "Climate Action Tax Credit." The economists used household spending surveys to gauge how recipients spent the credit, compared to other households in British Columbia and other provinces that did not receive credits.

Their striking finding was that people didn't spend the money neutrally, nor did they spend more on gasoline or other goods the tax discouraged them from consuming.

Instead, they cut back substantially on gasoline expenditures—*over and above the effect of the tax*—and spent much of their rebates on public transportation (where available).

It appears that people may have felt some social obligation to spend their "climate action incentive" on something good for the climate—transit over private car travel. That hypothesis is consistent with studies showing that low-income American families spend most of their food-stamp dollars on food rather than other goods, and that Canadians spend child benefits on food, childcare, and education while *reducing* their expenditures on alcohol and tobacco.

The moral of the story, then, seems to be that we can get more bang for the buck out of carbon dividends by labeling them as climate benefits rather than generic cash handouts. Never underestimate the power and importance of marketing in government programs as in most other realms of human affairs.

Source:

Nicholas Rivers and Blake Shaffer, "How do households spend carbon tax rebates?" Working paper, March 2022.

Why Does Big Oil Support Carbon Taxes

October 2022

Last summer, an undercover reporter with Greenpeace recorded a candid conversation with a Washington lobbyist for ExxonMobil who called the oil major's professed support for a carbon tax an insincere but "easy talking point" to garner credibility with environmentalists.

"Carbon tax is not going to happen," the lobbyist declared, pointing to opposition from Republican members of Congress. "The cynical side of me says, yeah, we kind of know that – but it gives us a talking point that we can say, well, what is ExxonMobil for? Well, we're for a carbon tax."

Exxon's CEO decried his lobbyist's embarrassing comments, but the damage was done. The company was suspended as a member of the Climate Leadership Council, a Washington, D.C.-based nonprofit that advocates for a carbon fee and dividend. Besides ExxonMobil, CLC's founding members in 2017 included BP, ConocoPhillips, Shell, and Total, among other companies. They reportedly donated $1 million to CLC and $2 million to its political action arm, Americans for Carbon Dividends.

In 2021, after years of staunch opposition, the American Petroleum Institute (API) vaguely endorsed "carbon pricing mechanisms that work across the entire economy to maximize environmental benefits." Environmental groups were understandably skeptical given the industry's powerful interest in prolonging demand for fossil fuels and its sordid history of lobbying against climate mitigation. Was this change of heart for real, or just greenwashing to win points with Democrats in the White House and Congress?

In a new working paper, the young French economist Alain Naef analyzes what he calls "The Impossible Love of Fossil Fuel Companies for Carbon Taxes." Naef, a research economist at the Bank of France and former postdoc at the University of California Berkeley, discovered that more than three-quarters of the 50 largest oil and gas companies that have a position on the issue support carbon taxes. Faced with the apparent paradox of why they would back a policy that should, in time, drive them out of business, he offers several possible explanations.

Public position of oil and gas companies who have expressed a view on carbon taxes

	Overall 100 largest oil and gas companies	Top 50 largest oil and gas companies by reserves	Bottom 50 largest oil and gas companies by reserves
In favour of a carbon tax	54%	78%	29%
Opposed to a carbon tax	46%	22%	71%

EconPapers: The Impossible Love of Fossil Fuel Companies for Carbon Taxes

One possibility, supported by the ExxonMobil lobbyist's remarks, is the companies are just engaged in "a communications exercise," and their support for a carbon tax "helps them shift the responsibility from fossil fuel companies to customers, voters and elected officials." A similar rationale likely explains public commitments by BP and Shell to become "net zero" emissions companies by 2050.

Another possibility is that many of the larger oil and gas companies see opportunities to make profits by investing in new technologies as energy markets transition away from fossil fuels,. Naef cites as an example a major investment by BP in a big Australian renewable energy project.

A third plausible reason is the companies' desire to reduce policy uncertainty, which challenges their long-term planning. CLC's proposed carbon tax would have rolled back other environmental regulations related to greenhouse gases and eliminated legal liability for the oil industry's past war on climate science and policy. API had such concerns in mind when it argued that an economy-wide price on carbon would be preferable to "a patchwork of federal and state regulations and mandates."

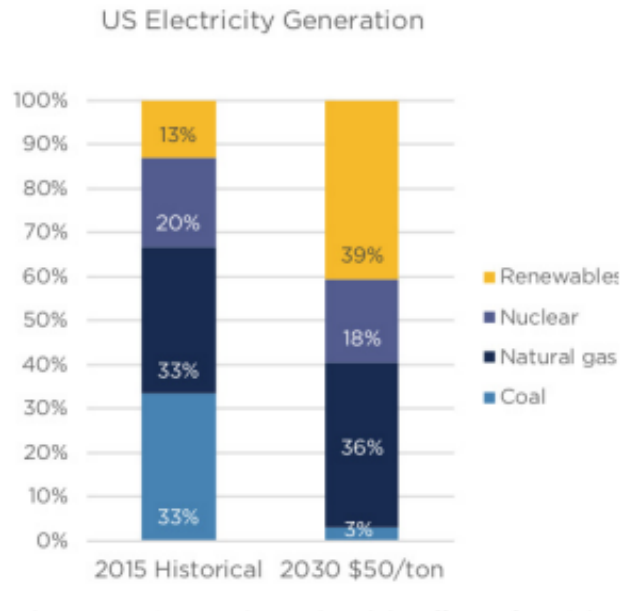
But Naef clearly favors a fourth driver, which was suggested by Australian economist Andrew Hopkins in a 2016 paper. Hopkins, an emeritus professor at Australian National University, declared that "The petroleum industry *should* be lobbying for a price on carbon. This will

impact more heavily on coal than gas and assist in bringing coal-fired power to an end, leading to a greater role for gas in the short to medium term" (my emphasis).

Although most oil companies hadn't yet seen the light, Hopkins pointed to BP's CEO John Browne as a pioneer supporter of carbon pricing:

"As Browne saw it, this would be beneficial for the oil and gas industry. Coal produced considerably more carbon dioxide per unit of energy than did gas - approximately twice as much - and so a price on carbon would encourage electricity generators to switch from coal to gas. Since most of the major oil and gas companies had shed their coal interests in the 1990s, this strategy would benefit the oil and gas majors, at the expense of coal mining companies. BP was among a number of oil and gas companies that began advocating a price on carbon for this reason."

In a 2018 paper on the impacts of a federal carbon tax, Columbia University's Noah Kaufman and Kate Gordan provided evidence that a price on carbon would privilege natural gas over carbon-rich coal while having little effect on demand for oil. Over a span of 10 years, a $50/ton carbon tax would slash the contribution of coal from 33% of U.S. electricity generation to a mere 3%. The share of natural gas, however, would rise from 33% to 36% of total generation despite sharp growth in renewables.



Summary Of Carbon Tax Modeling_CGEP_Report_071618.pdf

"In contrast," they added, "effects on oil markets are small, as petroleum remains the dominant transportation fuel, though the tax does cause a reduction in net imports of petroleum of between 2 and 12 percent by 2030."

In other words, big U.S. oil and gas companies would emerge largely or totally unscathed by the $40 carbon tax proposed by CLC.

Naef fails to cite another earlier paper proposing that "Big Oil's growing stake in natural gas expansion is its economic motive for supporting favorably designed carbon pricing." Writing in Global Environmental Politics in 2020, three researchers at the Fridtjof Nansen Institute in Norway argued that "a moderate carbon price, by triggering coal-to-gas switching, supports the realization of a gray transition in which 'Big Gas' can expand its market share at the expense of coal and become a major bridge fuel next to renewables."

In the United Kingdom, they pointed out, introduction of a modest carbon price of less than $30/ton in the electric generation market "led to a dramatic drop in coal, from 42 to 10 percent between 2012 and 2016, and a parallel growth for gas, from 24 to 42 percent."

At the same time, the authors acknowledged the messy reality that big oil's support for carbon pricing is highly conditional:

"For example, in 2018, BP put more than US$13 million into the opposition campaign . . . a Washington State carbon tax, arguing that their fuel-producing oil refineries had received unfair treatment. . . . Their support for moderate carbon pricing should therefore not be confused with unconditional support for climate policy. On the contrary, the majors can be expected to oppose, delay, or water down any type of regulation or policy support that would strengthen rival renewable energy. But by supporting favorably designed and moderate carbon pricing, the majors may profit from expanding gas markets, while simultaneously 'greening' their image by acting like climate protagonists on the regulatory scene."

On a personal note, if Big Oil's calculations of self-interest help get us a meaningful national carbon price, I won't focus on condemning its motives. But carbon pricing advocates should be clear-eyed about where its allies are coming from to avoid being discredited as naïve tools of corporate lobbies.

Sources:

Alain Naef, "The Impossible Love of Fossil Fuel Companies for Carbon Taxes," Center for Open Science, August 2022.

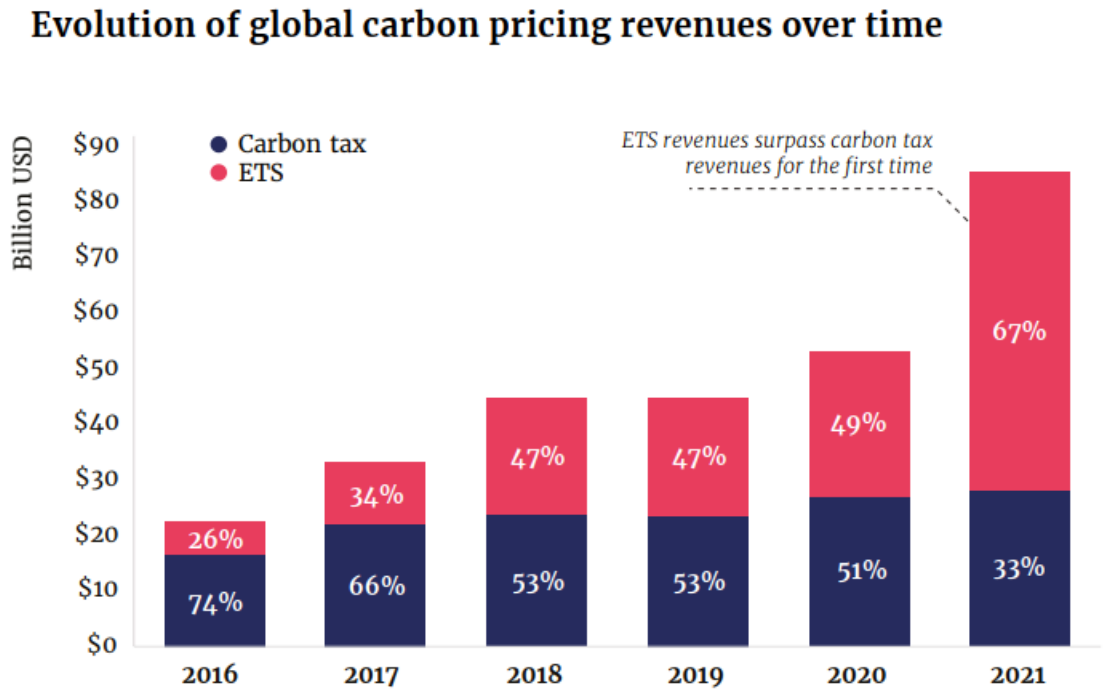
Andrew Hopkins, "From climate pariah to climate saviour? What the petroleum industry can do about climate change," The Australia Institute, discussion paper, July 2016.

Irja Vormedal, et al., "Big Oil and Climate Regulation: Business as Usual or a Changing Business?" *Global Environmental Politics*, 20:4 (2020), 143-166.

Why Carbon Fees are Better than Emissions Trading

August 2023

As carbon pricing continues to spread to new countries and other jurisdictions, emissions trading systems (ETS) are outpacing carbon tax systems in coverage and effective price. The world's biggest emitter of greenhouse gas pollution, China, adopted a nascent emissions trading model in 2017, and the European Union introduced its flagship ETS in 2005. The state of Washington began operating a "cap-and-invest" program this January, and New York State passed legislation this spring to follow suit.



World Bank, State and Trend of Carbon Pricing, 2022

But relative popularity doesn't make emissions trading systems better than carbon taxes. Two papers published last year suggest that taxes are the more efficient way to go in most cases.

The most comprehensive of the two reports was authored by economists at the International Monetary Fund, titled "Carbon Taxes or Emissions Trading Systems?: Instrument Choice and Design" (July 2022). I'll be lazy and just reprint the conclusions, but you can find clear explanations for these findings in the body of the report:

> In summary (see Table 3 [below]) absent political constraints, carbon taxes have appeal on practical grounds. They can provide certainty over future emissions prices (which is needed to promote emissions-saving investments), revenues accrue automatically to finance ministries, and they easily build off existing fuel tax collection. Tax trajectories can

be aligned, and periodically adjusted, to maintain consistency with emissions goals. Carbon taxes are compatible with reinforcing mitigation instruments (for example, feebates) that will be needed for hard-to-abate sectors like buildings and transport and potentially border adjustments. Revenues from carbon taxes can provide robust assistance for low-income groups while still leaving the bulk of revenues for cutting other burdensome taxes or boosting productive investments. . . .

ETSs may also have their own appeal, but they suffer from some limitations. ETSs help achieve emissions targets with more certainty . . . Price stability mechanisms in existing ETSs have not, however, prevented significant price volatility, to the extent revenues have been raised they have been largely earmarked, and ETSs are not practical in some (for example, [administrative] capacity-constrained) countries. In addition, ETSs are not automatically compatible with reinforcing mitigation instruments and legal obstacles to border adjustments may be greater (for example, for export rebates) than for carbon taxes. . . . Linking ETSs into a global carbon market could improve the cost-effectiveness of mitigation across countries but reinforcing the Paris Agreement with a formal international carbon price floor is more effective at scaling up global mitigation, could address international equity concerns, and better accommodate alternative approaches at the national level."

Last year three Chinese economists broke rank with their country's leadership to promote carbon taxes over emissions trading in an article published in the journal Management Science. Titled "Is Price Commitment a Better Solution to Control Carbon Emissions and Promote Technology Investment?" it offered a novel—and highly technical—analysis of company behavior based on uncertainties they face related both to demand for their products and emissions permit prices under an ETS. Under many conditions, they found, profit-maximizing firms in a cap-and-trade system may have unexpected incentives to minimize their investments in clean technologies. In comparison, under plausible scenarios "the carbon tax policy generates a multi-win situation (i.e., more technology investment, higher expected profit and consumer surplus, and fewer carbon emissions)." Their conclusion is stark: "This result validates the strategic advantage of the carbon tax policy."

For another excellent analysis of the superiority of carbon taxes to cap-and-trade emissions trading systems, see CCL adviser Gilbert Metcalf's 2019 paper, "On the economics of a carbon tax for the United States."

Table 3. Summary Comparison of Carbon Taxes and ETSs

Design issue	Instrument	
	Carbon tax	ETS
Administration	Administration is more straightforward (for example, as extension of fuel taxes)	May not be practical for capacity constrained countries
Uncertainty: price	Price certainty can promote clean technology innovation and adoption	Price volatility can be problematic; price floors, and cap adjustments can limit price volatility
Uncertainty: emissions	Emissions uncertain but tax rate can be periodically adjusted	Certainty over emissions levels
Revenue: efficiency	Revenue usually accrues to finance ministry for general purposes (for example, cutting other taxes, general investment)	Free permit allocation may help with acceptability but lowers revenue; tendency for auctioned revenues to be earmarked
Revenue: distribution	Revenues can be recycled to make overall policy distribution neutral or progressive	Free allowance allocation or earmarking may limit opportunity for desirable distributional outcomes
Political economy	Can be politically challenging to implement new taxes; use of revenues and communications critical	Can be more politically acceptable than taxes, especially under free allocation
Competitiveness	Border carbon adjustment more robust than other measures (for example, threshold exemptions, output-based rebates)	Free allowances effective at modest abatement level; border adjustments (especially export rebate) subject to greater legal uncertainty
Price level and emissions alignment	Need to be estimated and adjusted periodically to align with emissions goals	Alignment of prices with targets is automatic if emissions caps consistent with mitigation goals
Compatibility with other instruments	Compatible with overlapping instruments (emissions decrease more with more policies)	Overlapping instruments reduce emissions price without affecting emissions though caps can be set or adjusted accordingly
Pricing broader GHGs	Amenable to tax or proxy taxes building off business tax regimes; feebate variants are sometimes appropriate (for example, forestry,	Less amenable to ETS; incorporating other sectors through offsets may increase emissions and is not cost effective
Global coordination regimes	Most natural instrument for international carbon price floor	Can comply with international price floor; mutually advantageous trades from linking ETSs but does not meet global emissions requirements

Source. IMF staff.
Note: Green indicates an advantage of the instrument; orange indicates neither an advantage nor disadvantage; red indicates a disadvantage of the instrument.

Personally, I don't lose too much sleep when another country joins the carbon pricing bandwagon with an ETS. Sometimes the political reasons are compelling, and the results are usually much better than nothing. But it's always smart to focus on carbon fee and dividend as the fairest and most efficient way to tackle the climate crisis.

Sources:

Ian Perry, et al., "Carbon Taxes or Emissions Trading Systems? Instrument Choice and Design," *IMF Staff Climate Notes*, July 21, 2022.

Xiaoshuai Fan et al., "Is Price Commitment a Better Solution to Control Carbon Emissions and Promote Technology Investment?" *Management Science*, 69:1, January 2023.

Gilbert Metcalf, "On the economics of a carbon tax for the United States," *Brookings Papers on Economic Activity*, March 7, 2019, 405-484.

Addendum: September 2024

"Carbon pricing can be one of the most powerful tools available to policymakers to incentivize reducing emissions as part of an integrated policy mix," the World Bank reminded us in its 2024 report, *State and Trends of Carbon Pricing*. But not all carbon pricing systems perform equally well, according to a new paper by three economists at Copenhagen Business School and NYU's Stern School of Business.

Subtitled "Carbon Price Uncertainty and Decarbonization Investments," the paper offers the first sustained empirical study of how fluctuating and unpredictable carbon prices discourage firms from risking their capital on long-term investments in cleaner energy and processes.

"The effect of increases in carbon price uncertainty on . . . decarbonization investments is economically large and of similar magnitude as the effect of declines in carbon prices," they report. Every one percent increase in uncertainty has an effect similar to a one Euro cut in carbon prices, they estimate.

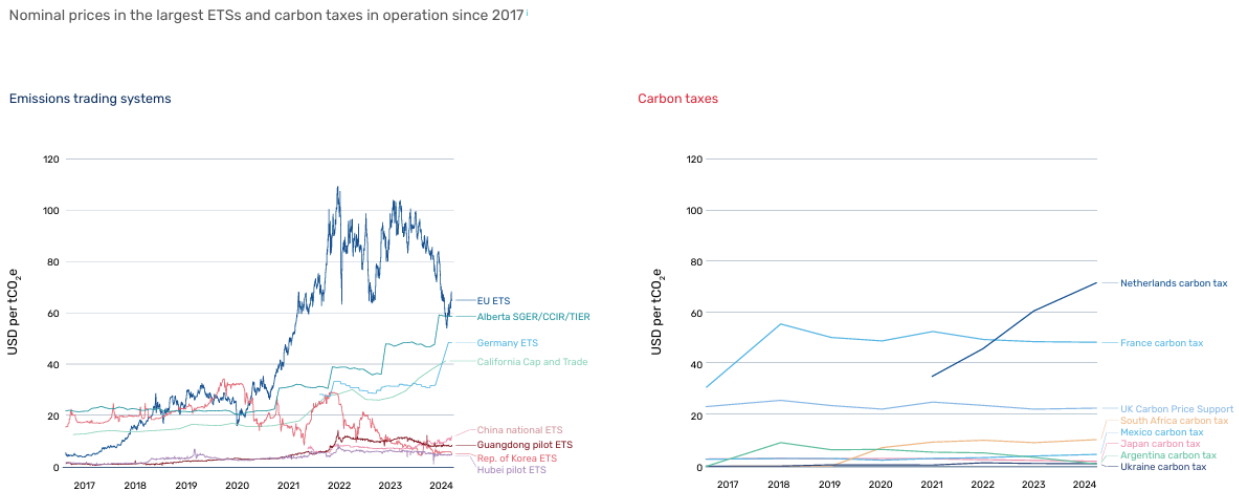
Their finding—which should come as no surprise to anyone who understands why investors generally demand higher returns for volatile stocks compared to more stable bonds—has huge implications for what *kind* of carbon pricing countries should adopt.

Carbon taxes or fees almost always follow a schedule set by legislation. The Energy Innovation and Carbon Dividend Act, for example, would impose a national carbon fee of $15 per metric ton of carbon dioxide on fossil fuels, rising $10 annually. Such a predictable trajectory allows businesses and households to make long-term investment plans based on where carbon fees will be several years from now.

In contrast, so-called *emissions-trading systems* (ETS) allow carbon prices to fluctuate, sometimes wildly, according to market forces. Under an ETS, a government agency sets a cap on emissions allowances. Large emitters buy and sell allowances in a market. If the economy softens, demand for such allowances will drop, causing a sharp drop in carbon prices. The same can happen if the system allows emitters to "bank" allowances and such reserves grow unexpectedly.

In its April 2024 annual report, the World Bank noted that of 75 carbon pricing instruments in operation worldwide, 39 were tax-based and 36 were ETSs. Although slightly less numerous, ETSs had much larger coverage. They accounted for more than 70% of global government carbon pricing revenues last year. Examples include the European Union's ETS and California's cap-and-trade program.

The World Bank also highlighted the vastly greater volatility of carbon prices under ETS systems compared to carbon tax frameworks:



World Bank, 2024

Ten ETSs—including the EU's huge market—actually experienced drops in their carbon prices over the previous year. "Persistent price falls and volatility have the potential to undermine the longer-term price signal and therefore investment certainty," the World Bank warned.

Economists have long made the same point about the impact of carbon price volatility in ETS systems. A major 2013 paper comparing carbon taxes and ETSs noted that "some business groups abhor the fact that cap and trade leaves prices uncertain. They emphasize that uncertainty about emissions prices (under cap and trade) constrains the business community's ability to respond to climate policy: changing the input mix (for, example, engaging in fuel substitution) and investing in research toward new technologies is more risky when future allowance prices are uncertain."

A 2009 study by The Brattle Group of the Waxman-Markey cap-and-trade bill then under consideration by Congress similarly warned that carbon price volatility could become "an impediment to the very investments that the climate policy is attempting to encourage. Compared to a carbon policy regime with more predictable carbon prices, we estimate that CO2 price volatility under current policy proposal could delay investment in low-carbon and carbon abatement technologies by 10 years or more."

To address that problem, many ETS systems, like California's, set up carbon price floors or ceilings (or both) to constrain price movements. The more they limit price volatility, however, the more such administered pricing systems resemble carbon taxes with a giant overlay of expensive and complicated bureaucracy. Surely it makes more sense to get carbon pricing right from the start—with a clear and stable path of rising fees on greenhouse gas pollution.

EU Carbon Permits - Price - Chart - Historical Data (tradingeconomics.com)

Sources:

Maximilian Fuchs, et al., "Carbon VIX: Carbon Price Uncertainty and Decarbonization Investments," NBER Working Paper 32937, September 2024.

Lawrence Goulder and Andrew Schein, "Carbon Taxes vs. Cap and Trade: A Critical Review," NBER Working Paper 19338, August 2013.

Metin Celebi and Frank Graves, "Volatile CO2 Prices Discourage CCS Investment," The Brattle Group, January 2009.

Carbon Pricing Design: What Global Experts Think

A fascinating new paper (October 2024) by three European economists provides new insights into the views of experts from around the world on how carbon pricing should be implemented, whether to include border carbon adjustments, and how to spend the revenue.

The famous 2019 "Economists' Statement on Carbon Dividends," signed by 3,649 U.S. economists, 28 Nobel laureates, 4 former chairs of the Federal Reserve Board, and 15 former chairs of the Council of Economic Advisers, offers an authoritative statement of expert policy preferences that informs the Energy Innovation and Carbon Dividends Act. They include a rising fee on the sale of fossil fuels as "the most cost-effective lever to reduce carbon emissions at the scale and speed that is necessary," a border carbon adjustment "to prevent

carbon leakage and protect U.S. competitiveness," and lump sum rebates of all revenue to U.S. citizens "to maximize the fairness and political viability or a rising carbon tax."

A new working paper issued by the Munich Society for the Promotion of Economic Research (CESifo) takes a global look at expert opinion on the same issues and shows a range of views, depending in part on geography and level of national income.

The authors identified 2,106 experts who had published cited papers on carbon pricing since 2000 and persuaded 467 to answer a detailed survey in 2019. (I'm not sure what took them so on to analyze the results.) Here are some of the highlights of their findings:

1. Experts strongly preferred carbon taxes to cap-and-trade, by a margin of 49 percent to 29 percent. (Most others supported some mix of carbon pricing instruments.) North American experts registered the strongest support for carbon taxes, while those from Asia were evenly split. In general, support for carbon taxes rose with GDP and with the experts' support for more stringent global emissions reductions.
2. Three out of four experts strongly endorsed border carbon adjustments as a supplement to basic national carbon pricing. In the United States, roughly 80 percent of experts showed support. For whatever reason, only half of Norwegian experts agreed, the lowest showing.
3. The biggest divergence of opinion came on the issue of how to spend the revenue. I'm not surprised because this choice is more affected by personal values and priorities, than "scientific" economics. When offered the opportunity to select multiple options from a long list, the experts most often supported spending on green R&D (59%), followed by a reduction in distortionary taxes (43%). Only 25% chose "equal lump-sum transfers to households." However, when asked to pick their top option, the winner was "transfers to particularly affected households" (24%) followed by "equal lump-sum transfers to households" (15%). In other words, equal or means-tested cash transfers won a sizeable plurality of votes. In North America, the lump-sum option was the most recommended, by 30% of experts. In general, experts who supported more stringent reductions of global emissions favored lump-sum transfers.

Bottom line, carbon fee and dividend policies continue to line up well with expert opinion. Carbon pricing, particularly in the form of a tax or fee, remains the climate mitigation policy of choice among experts who have studied it closely. Border carbon adjustments win broad support as an adjunct policy. And redistributing revenue to help households meet the financial burden of transitioning to a low-carbon world also comes endorsed by a large share of U.S. and global experts.

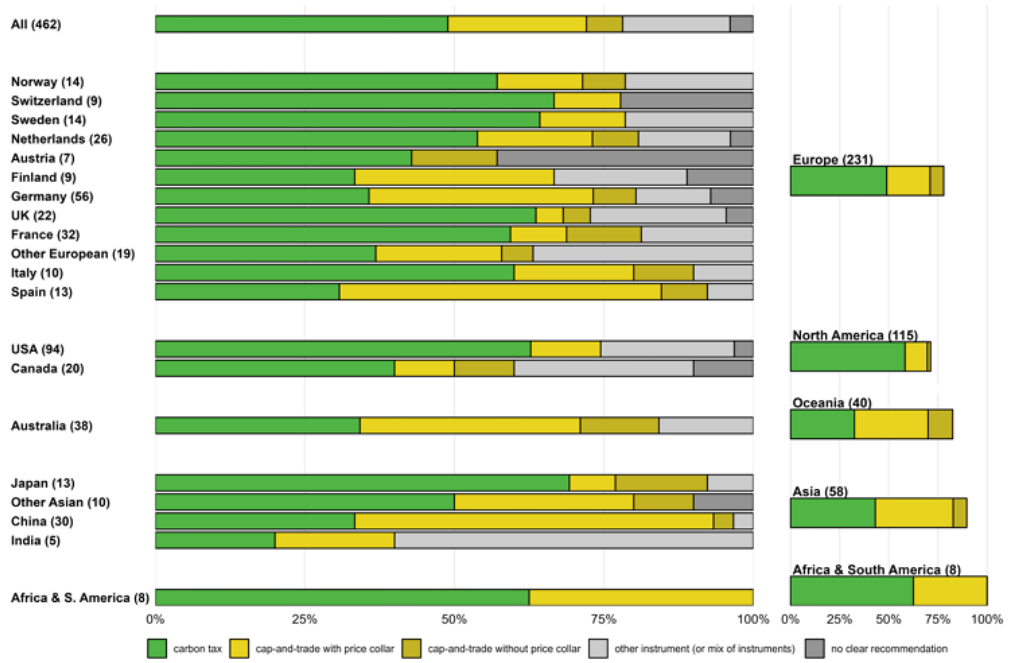


Fig. 1. Carbon pricing instruments. The shares of experts recommending the use of certain carbon pricing instruments, by experts' countries (Panel A), and continental groups of countries (Panel B), with carbon tax (green), cap-and-trade with price collar (yellow), cap-and-trade without price collar (dark yellow), other instrument or mix of instrument (light gray), and no clear recommendation (dark gray). Countries are ordered by

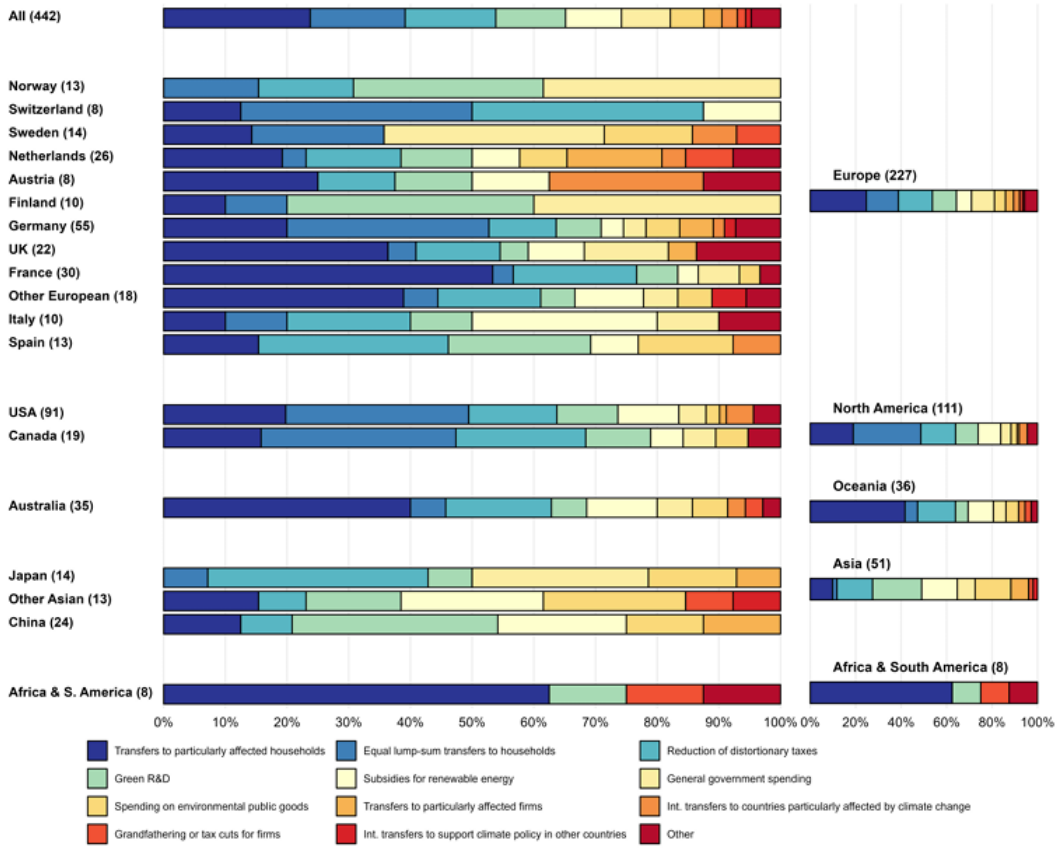


Fig. 3. Carbon pricing revenue use – most recommended option (in percent). Fraction of experts that indicate each of the options for revenue usage as "most recommended" for countries (Panel A) and continental groups of

Postscript

As part of their international survey of carbon pricing experts, the three authors of the new paper on carbon pricing design also asked for recommendations on the most appropriate carbon price in 2020, 2030, and 2050.

The results, published in a separate working paper, were highly dispersed. The surveyed experts favored an average (mean) carbon price for their country (with border carbon adjustments) of just over $50 per metric ton of carbon dioxide in 2030, rising to about $105 by 2030. U.S. experts aligned closely with these averages. Experts from countries with lower incomes and a higher share of fossil fuel consumption tended to favor lower carbon prices. At the high end, experts from Sweden and Switzerland supported national carbon prices of about $210 per tonne in 2030.

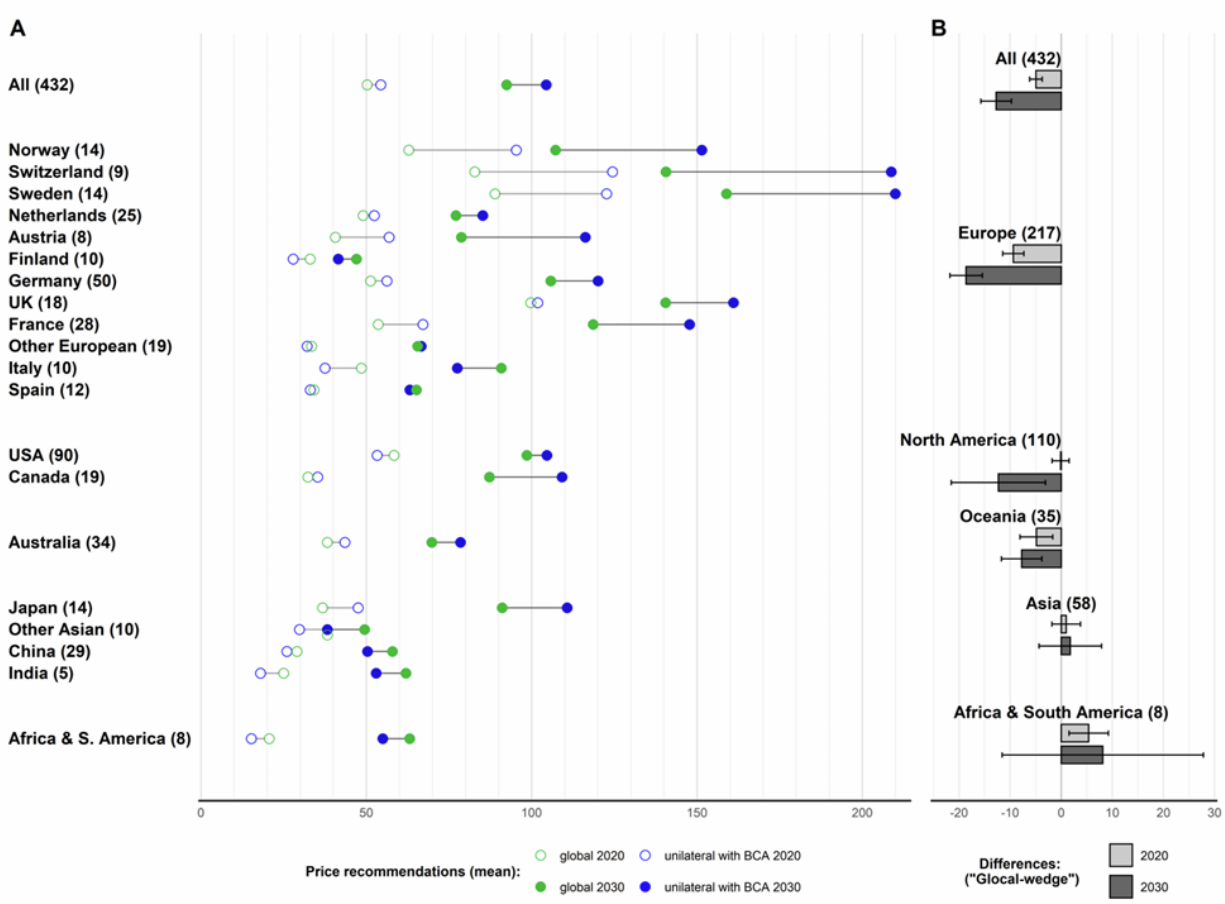


Figure 3: Unilateral and global carbon pricing and *"Glocal-wedge"* in carbon prices

Notes: Panel A shows mean *unilateral with border carbon adjustment (BCA)* (in blue) and *global* (green) carbon price recommendations for 2020 (transparent circle) and 2030 (dot), for all countries or groups of countries with

Despite their range of views, virtually every expert—94% of the total--agreed that existing carbon prices in their own countries were too low. In short, there's a lot of work still to do.