

Should carbon emissions be taxed or capped and traded?

FREE

In the fight against climate change, many nations and states have put systems in place to price carbon dioxide emissions. There is no consensus on which of two mechanisms is better.

David Kramer



Physics Today 72 (12), 28–30 (2019);
<https://doi.org/10.1063/PT.3.4361>



CrossMark



INSACO INC. has the ability to grind and polish almost any geometric feature in glass, ceramic, and sapphire!

Should carbon emissions be taxed or capped and traded?

In the fight against climate change, many nations and states have put systems in place to price carbon dioxide emissions. There is no consensus on which of two mechanisms is better.

In October, media outlets trumpeted the headline conclusion of an analysis from the International Monetary Fund (IMF): A global tax of \$75 per ton of carbon dioxide emissions from fossil fuels could put the world on track to limit future temperature increases to 2 °C above preindustrial levels. Unfortunately, experts say, it's not that simple.

The IMF report said that the production of oil, gas, and coal should each be assessed a fee based on the CO₂ content. The tax should be imposed immediately and rise to \$75 per ton by 2030. It estimated that the tax would cause gasoline prices to rise by an average of 15% and electricity charges by 45%. The revenues generated could be rebated to consumers or used for other purposes, such as providing assistance to low-income households or reducing budget deficits.

Economists of all stripes agree that imposing a price on CO₂ emissions is the single most efficient way to prod the world into the urgent decarbonization required to prevent the worst effects of climate change. But even if a globally observed and uniform tax on CO₂ was feasible, it would not be enough to ensure that the technologies needed to supplant fossil fuels would be developed and implemented in the time frame required to prevent the worst effects of climate change.

"The view of economists is that carbon pricing is necessary but not sufficient," says Robert Stavins, professor of energy and economics at Harvard University's Belfer Center for Science and International Affairs. "There are other market failures that affect technological change. Even the right price signals won't bring about what economists would consider to be the efficient amount of R&D activity."

Companies that perform early stage R&D don't get all the benefits from the technologies they develop. Competitors reap some of the spillover benefits from those investments, Stavins says; he points to how Apple's research for the iPhone was copied by others. Companies don't typically have incentives to carry out the right amount of R&D because of the spillover. "That's an important factor in the climate change context because of the huge amount of the technology, invention, and innovation that will be required," he says.

Some additional policies targeting technological change will be required to go along with a carbon price, but "unfortunately, it's easier to say that than to say what those policies would be," says Stavins. "It might be government funding of private-sector research, or funding of research at Department of Energy labs." Clean-energy standards alone won't incentivize R&D, but will stimulate diffusion of existing clean-energy technologies, he adds.

Erica Morehouse, senior attorney with the Environmental Defense Fund, agrees that market barriers prevent the level of investment in R&D and innovation that would achieve a zero-carbon economy. That's a problem for mitigation technologies still in their infancy, such as direct air capture of CO₂ and long-term energy storage. "There is an important role for government to play in directly investing in those innovation-spurring technologies," she says.

As for what the required carbon price should be, those interviewed for this article demurred. "The IMF is correct that what's in place now is definitely insufficient, but in terms of how much is being covered by a price and what the prices are,



I wouldn't hang my hat on \$50, \$75, or \$100 as being right," says Kevin Kennedy of the World Resources Institute.

Questions of international equity would complicate adoption of a uniform international carbon price, given the wide disparity of wealth and development among nations. "You're not going to be able to wave a wand and say there is a global carbon price," says Nathan Hultman, director of the Center for Global Sustainability at the University of Maryland. "If you suggest to people from different countries that everyone gets the same carbon price, you will get a lot of conversation about that, to put it diplomatically." In other words, there would have to be some degree of differentiated responsibility in any global carbon-pricing arrangement.

A single world price would be most efficient to incentivize polluters to cut emissions where it is cheapest, the IMF says. But equity might be achieved by charging a higher tax to developed



TENS OF THOUSANDS OF DEMONSTRATORS marched through central Paris in October 2018 to demand stronger actions to address climate change. The government's proposed increase in France's fuel tax, including a hike to the carbon tax, touched off the yellow vest protests the following month.

economies or by providing financial or technological assistance to less developed countries in exchange for their adherence to the global price.

Taxes and trading

Carbon pricing isn't new; the World Bank counts 46 nations and subnational entities that have implemented carbon taxes or emissions trading systems (ETSs), covering 20% of global emissions. Better known as cap and trade, an ETS allows the market to set a carbon price after a set amount of CO₂ allowances are auctioned or distributed to major emitters. The cap on allowances is gradually lowered over time to bring emissions down. Emitters are free to buy or sell their allowances to other sources depending on how rapidly they curtail their own emissions.

ETSs vary in the proportion of the total emissions they cover. The oldest and largest, the European Union's, covers 11 000 power plants and manufacturing facilities and applies to aviation within the EU, but it still excludes 55% of total EU greenhouse-gas emissions. Much of the remainder is subject to carbon taxes that have been enacted by many EU member states. Those levies vary widely from more than \$120 per ton in Sweden to \$2.20 per ton in Estonia.

Once allowances are auctioned off or issued by the government, their value in ETSs fluctuates according to market conditions and the effects of other climate change mitigation policies, such as renewable and energy efficiency standards, on reducing CO₂ emissions. Soon after the ETS was initiated in 2005, val-

ues fell to zero as the cap was set higher than actual emissions. EU allowances traded this fall for about \$32.50 per ton, according to the International Carbon Action Partnership. As recently as 2017, credits traded for around \$5 a ton.

The EU ETS is on track to meet its goal of cutting emissions 21% from their 2005 levels by next year. Since inception, it has generated more than \$42 billion in revenues.

China, the world's largest CO₂ emitter, has pilot ETSs underway in seven cities and plans to implement a nationwide system next year. But the country, which has said it anticipates continued increases in emissions until 2030, is expected to employ a tradeable performance standard, aimed at lowering the CO₂ emissions per unit output of individual sources, says Stavins. In that way, it will resemble the inaugural ETS used to phase out leaded gasoline in the 1980s.

The US lacks a national carbon-pricing regime, but California initiated a cap-and-trade system in 2012 that now covers 80% of its CO₂ emissions. Nine states in New England and the Mid-Atlantic region formed the Regional Greenhouse Gas Initiative (RGGI) in 2009. Three other states in the region are planning or considering joining the RGGI. Their initiative covers only the power-generation sector, though most of the RGGI members now plan to add a cap-and-trade system to emissions from transportation.

California's ETS program had less to do with the state achieving its 2020 emissions reduction target four years ahead of time than it did with the effects of energy and mileage standards, says Kennedy. Formerly employed by the state, Kennedy helped design the ETS. "We understood that the heavy lifting out to 2020 was going to be done by the complementary policies," he says. Following implementation of the ETS in 2012, the value of allowances fell to the floor price built into the ETS, but prices recovered once the realization set in that the program would continue through 2030.

In retrospect, California set its emissions caps too high. "Perhaps we could have been more ambitious," Kennedy admits. Still, the ETS provides a policy backstop, says Morehouse. "If one of the other policies wasn't achieving reduc-

SELECTED CARBON PRICING ARRANGEMENTS, 2019

Country or region	Year introduced	2019 price (\$/ton CO ₂)	Coverage of GHGs,* 2018	
			Million tons	Percent
Carbon taxes				
Chile	2017	5	47	39
Colombia	2017	5	42	40
Denmark	1992	26	22	40
Finland	1990	65	25	38
France	2014	50	176	37
Ireland	2010	22	31	48
Japan	2012	3	999	68
Mexico	2014	1–3	307	47
Norway	1991	59	40	63
Portugal	2015	14	21	29
South Africa	2019	10	360	10
Sweden	1991	127	26	40
Switzerland	2008	96	18	35
Emissions trading systems				
California, US	2012	16	378	85
China	2020	na	3232	
European Union	2005	25	2132	45
Korea	2015	22	453	68
New Zealand	2008	17	40	52
Regional Greenhouse Gas Initiative**	2009	5	94	21
Carbon price floors				
Canada	2016	15	na	70
United Kingdom	2013	24	136	24

* GHGs—greenhouse gases

** The Regional Greenhouse Gas Initiative is an emissions trading system formed by nine New England and Mid-Atlantic states.

tions at the rate expected, the cap-and-trade program would pick up the slack.”

As for the likelihood of a global carbon price such as envisioned by the IMF report, Morehouse says efforts involving two or more nations linking their carbon-pricing arrangements are more likely than a top-down, universal approach. She notes California’s recent linkage to Quebec’s ETS, an arrangement that the Trump administration sued to block in October.

What’s ahead

In the past year, there have been several instances of pushback against carbon-

pricing regimes. An increase in France’s fuel tax that was based in part on the country’s carbon tax helped spark the ongoing yellow vest protests, leading the government to rescind the hike. In the US, voters in Washington State rejected for the second time a carbon tax in 2018. Oregon was on track earlier this year to enact an ETS that would link with California’s, but Republican members in Oregon’s state Senate maneuvered to block passage this summer. The likelihood that Virginia will enter the RGGI has risen after Democrats gained control of the legislature in last month’s elections.

Resistance to carbon taxes shows the importance of designing pricing schemes that ensure costs and benefits are shared fairly across a nation or state, says Morehouse. In California, the increase in electricity rates caused by the ETS is rebated to consumers by utilities twice a year in a lump sum that isn’t connected to the amount of electricity used. “For most households, that more than makes up for the rate increases, but it still provides incentives to do energy efficiency improvements and other measures to cut energy costs,” she says.

Economists disagree on the relative merits of a tax or ETS. In principle, an ETS could raise the same revenue as a carbon tax through the auctioning of emissions allowances, the IMF report says. In practice, though, some governments have given the initial permits away. The administrative burden of an ETS could be prohibitive for some governments, whereas a carbon fee could easily be added to existing taxes on fossil fuels, notes the IMF report, which prefers a tax. Stavins’s own research has found little difference in terms of an ETS’s emissions reductions, costs, and other measurements. “You could design one to be just like the other. There’s a continuous spectrum from a pure carbon tax to a pure cap and trade.” What’s more important is the specific designs of the two systems.

Some ETS regimes, for example, have evolved to include attributes of a tax system. California’s features price “collars”—caps and floors—that build in a degree of price certainty. And proposals for carbon taxes being discussed by some Democrats in Congress include an emissions insurance mechanism, says Kennedy, which looks a lot like a cap. “You set an initial rate and an escalation rate [for price], but also an emissions target. If you are falling off the target, the tax goes higher.”

Given today’s polarized US political climate, analysts agree that Democrats winning the presidency and gaining control of the Senate in 2020 is a necessary condition for any hope of a national carbon-pricing scheme. But even if that happens, opposition will likely abound. “There’s a lot of tendency for politicians to try and hide costs. And carbon-pricing systems are not good at hiding the costs,” says Stavins.

David Kramer