Tax Policies to Reduce Greenhouse Gas Emissions

This brief outlines the motivation for and key features of a tax designed to reduce emissions of greenhouse gases (GHGs). The two most commonly discussed market-based instruments for reducing GHG emissions are a cap-and-trade system and a GHG (carbon) tax. These mechanisms function in a similar way by establishing a price for GHG emissions. They both correct the market failure that exists when the value of environmental damages is not included in the market price of fossil fuels and other activities that release GHGs. A GHG tax and cap-and-trade approach are compared, with consideration given to how effective each policy instrument may be at meeting key objectives. These objectives include environmental integrity, cost-effectiveness, and distributional equity, and will inevitably involve political considerations. Fundamental design issues of a GHG tax policy are explored, including who would pay the tax and how to set an appropriate tax rate. There are a number of options for determining the appropriate level for a tax, including setting it to equal some estimate of the social cost of carbon or pursuing the long-run goal of stabilizing the concentration of GHGs in the atmosphere. A tax can be levied at various points throughout the energy supply chain, but most proposals call for an upstream tax on fuel suppliers in order to maximize the scope of coverage, which lowers costs, and for administrative simplicity. This brief also reviews existing GHG taxes in Europe and North America, along with several recent U.S. legislative carbon tax proposals. Finally, other pricing strategies to reduce GHG emissions in the transportation and electricity sectors are examined.

A tax on greenhouse gases (GHGs), often called a carbon tax, is a market-based policy instrument that can be used to achieve a cost-effective reduction in GHG emissions. Like a cap-and-trade approach, a GHG tax uses the power of market price signals to encourage GHG emission reductions from a variety of sources. The predominant GHG produced by humans is carbon dioxide (CO_2), which results largely from the burning of fossil fuels. An upstream GHG tax would impose a charge on coal, oil, and natural gas in proportion to the amount of carbon they contain. This tax would be passed forward into the price of electricity, petroleum products, and energy-intensive goods. An inclusive GHG tax could also be imposed on non-energy sources of CO_2 emissions and on other GHGs based on their global warming potential relative to CO_2.

The economic rationale for creating a price on GHG emissions—whether through a GHG tax or cap-and-trade approach—is multifold. First, it would correct an underlying market failure that has led to increasing and potentially dangerous concentrations of GHGs in the atmosphere. The burning of fossil fuels and other activities that release GHGs are associated with warming global temperatures and adverse climate impacts. The costs of these impacts, including an increase in extreme weather events, rising sea levels, loss of biodiversity and other effects, will be borne by society as a whole, including future generations. However, these costs are not currently included in

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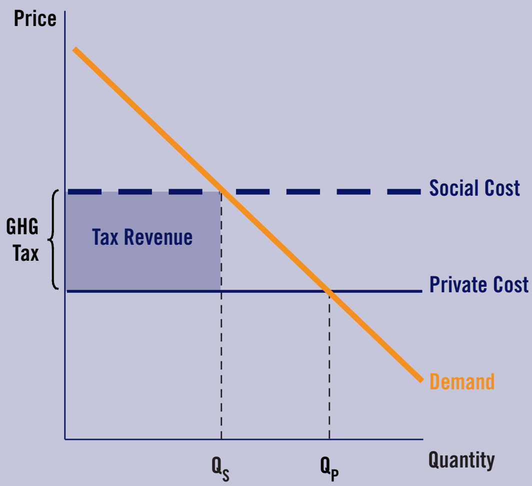
the market prices of GHG-based goods, leading to an inefficient use of resources and excessive emissions from a societal perspective (see Box 1 for a discussion). A GHG tax would result in the inclusion of these costs in the market price.

Second, use of a market-based policy instrument can achieve GHG emission reductions at lower cost to regulated sectors than a command-and-control approach, which emphasizes source- and sector-based mandates for particular technologies or processes. As technologies that reduce CO_2 emissions during or post-combustion are not yet widely available, the primary way to reduce CO_2 emissions is to reduce consumption of fossil fuels. Use of a market-based policy to establish a common price on GHG emissions is necessary in order to provide incentives for a broad range of emission reduction options across firms, households, and activities. Some emission reductions will be achieved by firms as they switch from higher- to lower-carbon fuels and renewable energy and invest in energy-saving technologies. Other reductions will come from consumers, who will respond to higher energy prices by purchasing less energy-intensive goods and changing their behavior in ways that conserve energy. GHG pricing policies can also provide incentives to develop new technologies, such as carbon capture and storage and zero-carbon energy sources, and encourage biological sequestration of GHG emissions in forestry and agriculture.

Box 1 *Economic Rationale for Taxing Carbon*

The figure below depicts the market for a good which uses fossil fuel in its production, such as electricity. Consumers determine their demand for the good based on the market price, which reflects the private cost of production—including extraction, processing, and distribution costs that transform fuels like coal and natural gas into electricity—and purchase the amount Q_P. However, the market price does not account for the environmental damage associated with climate change induced by the burning of these fuels. A GHG tax would correct for this divergence between private and social cost. Imposing a GHG tax on each unit of the good would require consumers to pay the full social cost, causing them to lower their consumption to the amount Q_S and thereby reducing total GHG emissions to the socially desirable level.



GHG Tax Versus Cap and Trade

A GHG tax and a cap-and-trade approach have many similarities. By establishing a price on GHG emissions embedded in fuels and energy-intensive goods, both mechanisms can in principle deliver cost-effective emission reductions across firms and households. With perfect information, a GHG tax or system of tradable allowances could be designed to produce the same overall level of emissions, distribution of emission reductions across sources and sectors, and aggregate costs. However, real-world conditions, particularly those having to do with uncertainty over the future cost of reducing emissions, can lead to different outcomes under the two instruments.

Understanding the effects of uncertainty can help inform a well-designed GHG tax or cap-and-trade program to better meet key objectives by which any domestic climate policy should be assessed. These include environmental integrity, cost-effectiveness, distributional equity, each of which will inevitably involve political considerations. Both a tax on GHGs and a cap-and-trade system can be designed and implemented in ways that increase the likelihood of meeting these objectives.

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Environmental Integrity

In contrast to a cap-and-trade approach, a GHG tax would not provide the same level of emissions certainty during any given compliance period. Emissions certainty is particularly important in the area of climate change where the overriding policy goal is to prevent the build-up over time of dangerous levels of GHGs. It is believed that surpassing critical concentration thresholds may trigger large-scale, irreversible changes in climate-sensitive systems that would have catastrophic effects on the planet. These include extensive deglaciation of the Greenland and West Antarctic ice sheets, breakdown of the thermohaline circulation (ocean conveyor belt), and abrupt change in the Asian monsoon.[1] In recent years, there has been increasing evidence that climate models have underestimated changes that are already under way, including disappearing Arctic sea ice and reduced ocean uptake of CO_2.[2] This has intensified concerns about the likelihood of exceeding systemic thresholds.

A GHG tax fixes the price of emissions and thus provides firms with a considerable measure of certainty about their overall costs. Firms will reduce, or abate, their emissions up to the point where it is cheaper to pay the tax than to reduce emissions further. The cost of incremental reductions will therefore never exceed the tax. However, for those setting the tax, firms' abatement cost curves are not well known and will depend on characteristics specific to firms, including their fuel mix and their available abatement opportunities. In addition, changes in conditions external to firms, such as fuel prices, weather patterns, and the development of new low-cost abatement technologies are unpredictable. It is also unclear how the overall economy will adjust to higher prices of energy and energy-intensive goods, which will feed back into the markets in which these firms operate.

For all these reasons, the total amount of emissions abatement that will result from a particular GHG tax rate is uncertain at the time the tax is set. Achieving a long-run emission target may then require adjustments in the tax rate. As most proposals assume a gradually increasing tax, this would likely imply an increase or decrease in the rate of growth of the tax. The extent to which tax rates may have to be adjusted would reduce the amount of cost certainty a tax system could otherwise provide—detracting somewhat from one of the principal arguments in favor of a tax.

A cap-and-trade approach, on the other hand, fixes the supply of emission allowances over the compliance period, thus determining the amount of emissions abatement. Assuming a full or high level of compliance, a cap-and-trade system with a fixed cap will provide a very high degree of certainty about the level of emissions. However, a fixed emissions cap provides less certainty about the price of allowances during the compliance period. The price will fluctuate according to shifts in the demand for allowances, which are determined by firms' abatement cost schedules. For the same reasons that create emissions uncertainty under a tax, these abatement cost schedules are both unknown and uncertain to regulators at the time that the cap is set.

Cost-effectiveness

Greenhouse gases are a stock pollutant, meaning once emitted, they are very long-lived in the atmosphere and their build-up has consequences over the course of centuries. Ultimately, it is the stock, or concentration, of GHGs that contributes to climate change and its attendant damages. Any given year's emissions will have a relatively small impact on the overall stock, which has been building up over the course of the industrial age. This affords a certain degree of flexibility in terms of the timing of emission reductions, provided that cumulative emission targets over time are attained and that critical GHG concentration thresholds are avoided.

A GHG tax allows firms to adjust their emissions according to current conditions, increasing emissions and paying more taxes when abatement costs are high (due to extreme weather patterns, for example) and reducing emissions when abatement costs are low (following the introduction of low carbon technologies or fuel sources, for example). This built-in flexibility of a tax helps firms to minimize their compliance costs over time. A cap-and-trade system can achieve similar temporal flexibility by the use of effective cost containment mechanisms like banking and borrowing provisions and multi-year compliance periods (see Pew Center Congressional Policy brief, *Containing the Costs of Climate Policy*). These features allow firms to shift emissions forward and backward through time as abatement costs fluctuate, without compromising the integrity of the cumulative emissions cap.

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Shorter-term cost containment mechanisms like price ceilings and price floors could be implemented to help reduce volatility in allowance prices, which has been a problem in previous cap-and-trade programs. Volatility can discourage long-term investment in low-carbon technologies, raising the overall costs of the policy over time. If the price of allowances exceeds some pre-designated threshold, perhaps for some sustained amount of time, sources will be allowed to purchase additional allowances from the government at the threshold price. In these circumstances, the cap-and-trade program effectively reverts to a tax, fixing the price of allowances and thus the cost of additional emissions. (A price ceiling can also be used to trigger an increase in available offsets, as in the Regional Greenhouse Gas Initiative.) Importantly, any revenues raised could be used to buy back allowances in future years or finance reductions from uncapped sources, preserving the integrity of the cumulative cap.[3] While a price ceiling will only prevent price spikes, adding a price floor on allowances would help narrow the band of expected prices and help maintain the incentive for low-cost emission reductions.

In addition, either a GHG tax or a cap-and-trade system that auctions emission allowances has the potential to raise significant revenues for the government. The revenue raised could be tens or hundreds of billions of dollars each year, depending on the carbon price. For example, many economists suggest an initial GHG tax between $5 and $20 per ton of CO_2. At the upper end of this range, a $20 per ton CO_2 tax would likely raise $100 billion in tax revenues.[4] Under a cap-and-trade approach that yields the same overall level of emission reductions as a $20 per ton tax, the revenue generated would depend on the share of allowances that were sold through auction versus distributed through free allocation.

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While there are many possible ways that these revenues could be used, a large body of research suggests that using these revenues to reduce pre-existing taxes on labor and capital can help lower the economy-wide costs of the program.[5] These costs include the direct compliance costs that firms, such as electric power producers and oil refineries, will incur in order to reduce their emissions. They also include the indirect costs brought about through price changes that take place throughout the rest of the economy and which can further affect labor supply and investment and lower long-run economic growth. Using GHG tax or cap-and-trade auction revenues to lower personal and/or corporate income tax rates would increase economic incentives to work and invest and can improve the overall efficiency of the economy. This may offset some or all of the negative economic effects of domestic climate policy, which will be incurred whether the policy takes the form of a GHG tax or a cap-and-trade approach.

Of course, attainment of the economy-wide cost savings described above presumes that revenues raised under a GHG tax or cap-and-trade auction will actually be used to lower pre-existing tax rates and not directed to other purposes. There is no guarantee that this will be the case and will depend on the specifics of the legislation. The experience of other countries has been mixed on this front. Sweden and British Columbia provide two examples of GHG taxes being used to specifically offset taxes on, respectively, labor and individuals/businesses.[6] In past U.S. cap-and-trade programs for other pollutants, allowances have generally been allocated for free to regulated firms. While some degree of free allocation to affected firms and sectors can help achieve important political buy-in by easing the transition to a low carbon economy, an overly generous allocation can forego significant economy-wide cost savings. In the GHG context, these savings have been estimated to be as much as 40 to 50 percent lower under a full allowance auction where revenues are used to reduce pre-existing taxes, compared to giving all allowances away for free to firms.[7] Similarly, a tax on GHGs that does not return tax revenues to households, but diverts them into socially undesirable spending, would likely be even more costly.[8]

Revenues from a GHG tax or cap-and-trade auction can also be used to fund research and development of new technologies that reduce or eliminate GHG emissions, including carbon capture and storage and other innovations which are not expected to be sufficiently stimulated by a price on GHGs alone. Such public funding could lower the future costs of reducing GHGs provided that it helps to promote valuable knowledge spillovers, is anticipated to yield positive returns, and does not "crowd out" private investment.[9] Research and development in strategies to adapt to climate change may also prove valuable. In recently proposed federal cap-and-trade legislation, proposals have been made to allocate allowances to states or other intermediaries acting on their behalf. To the extent that these allowances could be sold and the proceeds used in similar ways that boost economic efficiency or promote R&D at the state or regional level, the line between auctioning and free allocation of allowances becomes somewhat blurred.

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Under either policy approach, there is a similar need for effective complementary policies that can also help lower costs. These include regulatory measures to address market failures in energy efficiency and forestry/land use, promote technological innovation, and address infrastructure needs. (See Pew Center Congressional Policy briefs on complementary policies.)

Distributional Equity

GHG tax revenues, allowance auction proceeds, and the allocation of free allowances could also be used in other ways that do not necessarily lower the overall costs of climate policy but may help to achieve other socially desirable objectives. Even with a market-based approach, climate policy will bring about adverse impacts on affected firms and sectors, who will desire compensation for the loss of profitability and premature turnover in their capital stock and assistance in addressing competitiveness concerns. However, it is anticipated that the overwhelming economic impact of any climate policy will be borne by energy end users and households in the form of higher prices for energy and other goods. Furthermore, unless accommodations are made, the impact of a GHG tax or cap-and-trade program is likely to disproportionately affect low-income households and certain regions and communities.

Some tax-shifting options could lessen the burden on low-income households while still helping to lower economy-wide costs, though by a smaller amount than options aimed at lowering these aggregate costs alone.[10] These include raising existing threshold exemptions for personal income taxes and introducing similar threshold exemptions for payroll taxes. Other options, including lump-sum rebates to households or targeted energy assistance, could be implemented with the sole objective of providing greater relief to the lowest income families and the elderly or unemployed.

Both a tax on GHGs and a cap-and-trade system will be subject to political compromises that can dilute the effectiveness of the policy.

Additionally, funds could be created to facilitate adaptation to climate change and to provide transition relief for particular industries or communities whose local economies are more dependent on fossil fuel-based industries. Current proposals also include the provision of free allowances to local electric and gas distribution companies on the condition that they use the allowance value to fund efficiency programs to help lower their customers' bills without diluting the GHG price signal.

Political Considerations

Both a tax on GHGs and a cap-and-trade system will be subject to political compromises that can dilute the effectiveness of the policy. Some argue that a cap-and-trade program is susceptible to political pressure from powerful interest groups and that the extent to which these groups are successful in lobbying for free allowances will raise the overall cost of the program. However, under a GHG tax, it can also be expected that certain sectors will argue for reductions in or exemptions/rebates from the tax. If decisionmakers yield to these pressures, the scope of the program under a tax will be reduced, compromising the environmental objective and reducing the availability of potentially lower cost emission reductions. This is why others argue that through judicious use of free allocation, a cap-and-trade approach presents opportunities to resolve distributional conflicts and achieve political buy-in without compromising the environmental integrity of the program—an additional dimension of freedom not as readily available under a tax.

The experience of Norway illustrates the potential difficulties of implementing a GHG tax. Norway set a high nominal carbon tax in 1991 but under political pressure ended up exempting the majority of its industries, with the effect that only 60 percent of its CO_2 emissions are taxed.[11] (The tax did not achieve sufficient emission reductions and Norway decided to join the European cap-and-trade program in 2008.) Instead of blanket exemptions, "inframarginal" exemptions are recommended instead: the GHG tax would apply only to emissions in excess of some given percentage of a firm's historical emissions. Like a free allocation of allowances, this would provide targeted compensation to the firm while still preserving the marginal incentive to reduce emissions.[12]

One important distinction between a carbon tax and a cap-and-trade approach concerns the likelihood that the policy will actually be adopted. The longer the delay in implementation, the greater the aggregate costs will be in achieving a given stabilization target or the more likely it is that GHG concentrations will be higher with greater attendant damages. Cap and trade may currently have more support across the political spectrum, given enormous political resistance to new taxes and also because the costs for consumers under cap and trade are perhaps less transparent than those of a tax, especially if allowances are freely distributed. This is because consumers may fail to recognize that the opportunity costs of these allowances will likely be passed on to them in the form of higher prices for energy and the vast array of goods that are produced with energy, which may underscore the need the for effective compensation measures to help families and communities.[13]

Design Issues Involving a GHG Tax

Who Pays the Tax

A GHG tax can be levied at any point in the energy supply chain. For administrative simplicity, most proposals target upstream suppliers of coal, oil, and natural gas as opposed to points midstream (electric utilities or oil refineries) and downstream (energy-using industries, households, vehicles). Measuring the carbon content of fuels is a straightforward task and there are relatively fewer fuel producers and importers. To be fully inclusive, a downstream tax would potentially have to fall on millions of users, increasing the likelihood that the scope of the program would be more limited with higher aggregate and administrative costs.

Wherever the tax is imposed, the price signal it creates will theoretically be passed backwards and forwards through the energy supply chain in the

Box 2 *Congressional Committee Jurisdiction for a GHG Tax Versus Cap-and-Trade*

One factor differentiating a GHG tax and cap-and-trade program is the potential ability to get a proposal passed through Congress and signed into law by the president. Tax legislation falls strictly in the domain of the two tax-writing committees in Congress: the House Ways and Means Committee and the Senate Finance Committee. Provided that a GHG tax proposal had enough support, it could travel a fairly straightforward road towards becoming a law.

On the other hand, a GHG cap-and-trade bill that includes tax provisions may create some confusion over which Congressional committee has lead jurisdiction. Generally speaking, a GHG cap-and-trade program falls under the domain of the Environment and Public Works Committee (EPW). However, if a cap-and-trade bill has significant tax incentives, it could be referred to a tax committee. For example, the Kerry-Snowe Global Warming Reduction Act, a GHG cap-and-trade bill, was sent to the Finance Committee (rather than EPW). Similarly, the Doggett cap-and-trade bill, which included significant tax provisions, was referred to the House Ways and Means Committee, as well as several other committees—including the House Energy and Commerce Committee. When committee chairs are unable to agree on jurisdiction, the Senate or House parliamentarian decides which committee is the lead.

same way. In principle, a tax, regardless of where it is levied, will bring about the same behavioral response and economic burden to firms and consumers (prior to any potential decisions about how to compensate them with tax revenues). This might not be the case, however, if downstream consumers are sluggish to respond to price increases unless faced with a more visible tax.[14] For firms, their ultimate burden will depend on their ability to pass through abatement and tax costs to their customers and on the ensuing reductions in demand they experience in response to higher product prices. End-use consumers, of course, cannot pass on their increased costs and it is expected that much of the ultimate burden of a GHG tax, like a cap-and-trade program, will fall on them.

Wherever the tax is imposed, the price signal it creates will theoretically be passed backwards and forwards through the energy supply chain in the same way.

Setting the Tax Rate

Economic theory suggests that a GHG tax should be set to equal the social cost of carbon, which is the present value of estimated environmental damages over time caused by an additional ton of CO_2 emitted today. Theory also recommends that the tax rate should rise over time with the growth rate of the marginal damages from emissions. There are many estimates of the social cost of carbon and they vary widely, ranging from $3 to $95 per ton of CO_2 with a mean of $12.[15] Under conventional discounting, and without incorporating the risks of catastrophic climate change, most estimates fall between $5 and $20 per ton.[16] These estimates are highly uncertain because the impacts of climate change, including non-market impacts and catastrophic effects, are very hard to pin down.

An alternative approach would set the tax on GHGs so as to achieve an emissions trajectory over time that would effectively stabilize the atmospheric concentration of GHGs at some target level or cap global temperature increases.[17] The social cost of carbon approach generally recommends that a tax be set at a relatively low level and then ramp up over time in order to minimize economic disruption. Approaches that attempt to stabilize GHG concentrations would generally require higher starting tax rates and more aggressive reductions early on, especially for more conservative concentration targets. At the very least, steady increases in the tax rate will also be necessary in order to offset emission increases from inflation and economic growth.

Energy policy would need to be scrutinized for possible erosion of the effective or net rate of the tax on GHGs. For example, the fossil fuel industry has been heavily subsidized in the past and continuing these subsidies would erode the net impact of any GHG tax. Ideally, an accounting of the effects of existing energy taxes and subsidies should be determined when computing the GHG tax rate. Examples of existing pricing policies towards energy include gasoline taxes, the gas guzzler tax, production and investment tax incentives for electricity generation, and subsidies for energy-efficient investments in housing.

Non-energy CO_2, Other GHGs, and Sequestration

A truly comprehensive and cost-effective GHG tax would target GHG emissions beyond CO_2 from energy-related activities. There are non-energy sources of CO_2 emissions, including land-use emissions from agriculture and forestry and industrial process emissions. Emissions of other GHGs like methane and nitrous oxide arise in the agricultural, energy production, and waste processing sectors as well as from land-use activities and can be measured and taxed in terms of their CO_2 equivalence. Inclusion of these and other high global-warming-potential GHGs under the GHG tax policy as a means of reaching the same target reductions is estimated to offer a significant source of cost savings, particularly in the early years of a program.[18] Taxing GHG emissions should also be accompanied by provisions that extend tax credits to activities that sequester GHGs as they become available, such as carbon capture and storage, forestry conservation, and feedstock uses of fossil fuels in manufacturing activities.

A truly comprehensive and cost-effective GHG tax would target GHG emissions beyond CO_2 from energy-related activities.

International Considerations

A challenge for both a GHG tax and a domestic cap-and-trade system is linkage with other systems internationally, which can lower the overall costs of achieving global targets. Prior to implementing its cap-and-trade program, the European Union tried for several years but failed to agree on a harmonized carbon tax across member states. GHG tax harmonization would ideally require a global assessment of existing energy taxes and subsidies in order to compute net GHG tax rates across countries. A U.S. cap-and-trade program, on the other hand, would allow for linkage to the existing (and emerging) global emissions trading market and to potentially lower-cost reductions, such as those available in developing countries through the Kyoto Protocol's Clean Development Mechanism. Others have argued that the potentially valuable allowances created under an international cap-and-trade system could lead to socially wasteful behavior in seller countries as individuals try to capture this value, perhaps aided by corrupt regimes, and that individual country GHG tax systems would be less susceptible to these problems.[19] This line of thinking posits that an international GHG tax agreement would separate the thorny issue surrounding potentially large wealth transfers from developed to less developed countries (where emission reductions can be made much more cheaply), because GHG tax revenues would be retained by individual countries.[20]

Administration, Monitoring, and Enforcement

Proponents of a GHG tax argue that administrative tax functions already exist within firms and government offices to handle current tax requirements and that a GHG tax could be accommodated within this existing administrative structure. They also point out that while incentives for tax evasion exist on the part of firms (e.g., through underreporting their emissions), the government has an incentive to document and verify reports because revenues are at stake. Analogously, cap-and-trade programs can be accommodated within the administrative structures developed to deal with environmental compliance.

A challenge for both a GHG tax and a domestic cap-and-trade system is linkage with other systems internationally, which can lower the overall costs of achieving global targets.

Existing GHG Taxes and Proposed U.S. Legislation

A number of countries have existing GHG taxes or are considering them. In 1990, Finland became the first country to enact a carbon tax. As of January 2008, the tax per ton of CO_2, levied based on the carbon content of fossil fuels, was about $8.18 per ton CO_2 (in US$). Sweden and Norway enacted carbon taxes in 1991, followed by Denmark in 1992. While not strictly a carbon tax, Great Britain introduced a "climate change levy" in 2001 on electricity, coal, and natural gas.

In Canada, the province of Quebec began collecting a hydrocarbon fuels tax on coal, oil, and natural gas in 2007. However, Quebec's tax rates are low and most of the province's power is hydroelectric. In July 2008, British Columbia enacted a more ambitious carbon tax. The tax rate starts at US$9.43 per metric ton of CO_2, and is set to rise by US$4.71 per ton annually to reach US$28.29 per ton in 2012. Carbon tax revenues are to be returned to taxpayers through cuts in personal and business income taxes.

In the United States, the city of Boulder, Colorado enacted a tax on carbon emissions from electricity generation. The tax rate is based on the equivalent of $1.91 per ton of CO_2. The tax is expected to cost the average household a little over one dollar per month and generate about one million dollars annually for the city. Households that use renewable energy receive a discount on their energy bills. In the Bay Area of California, regulators recently began charging over 2,500 businesses 4.4 cents for every ton of CO_2 they emit. The fee is expected to raise $1.1 million in its first year.

In the past two years, several bills have been introduced in the U.S. Congress that include GHG taxes. In 2007, Reps. Stark (D-CA) and McDermott (D-WA) introduced a bill that would impose a $2.73 per ton of CO_2 ($10/ton carbon) charge on coal, petroleum and natural gas. The tax would increase by $2.73 per year until U.S. CO_2 emissions fell to 20 percent of 1990 levels. A similar bill introduced by Rep. Larson (D-CT) would begin taxing emissions of CO_2 at $15 per ton in 2008, rising 10 percent annually (plus an adjustment for inflation). Revenues from the Larson bill would go to a research and development fund for clean energy technology as well as transition assistance for affected industries, with the remainder used to rebate payroll taxes. Also in 2007, Rep. Dingell (D-MI) floated a proposal that would have included a carbon tax on fossil fuels and gasoline, but then in 2008 collaborated with Rep. Boucher (D-VA) to produce a discussion draft of federal cap-and-trade legislation. Major features of the Larson and Stark-McDermott bills are provided in Table 1.

Table 1 *U.S. Carbon Tax Legislation*

	Larson 2007	Stark-McDermott 2007
Bill Number; Name	H.R. 3416; America's Energy Security Trust Fund Act of 2007	H.R. 2069; Save Our Climate Act of 2007
Basic Tax	Starting in 2008: \$15/ton CO_2, increases at 10% real annually	Starting in 2008: \$2.72/ton CO_2, increases by \$2.72 nominal annually; tax rate frozen when emissions reach 20% of 1990 level
Projected Tax Rates in Selected Years (per ton CO_2)	2015: \$20, 2020: \$32, 2030: \$83, 2050: \$561	2015: \$10, 2020: \$23, 2030: \$43, 2050: \$69
Additional Details	• Carbon tax covers coal, petroleum and petroleum products, and natural gas • Does not apply to land-use emissions from agriculture or forestry • Tax rate increase includes a cost of living adjustment • No tax on the sale of taxable substances for export • Provisions to ensure a substance is only taxed once	• Carbon tax covers coal, petroleum and petroleum products, and natural gas • Does not apply to land-use emissions from agriculture or forestry • No tax on the sale or exchange of taxable fuel for export or for deposit in the Strategic Petroleum Reserve • Provisions to ensure a substance is only taxed once
Credit for Sequestration and Offsets	• Credit or refund for sequestered carbon and qualified offset projects in the U.S.	• Credit or refund for embedded or sequestered carbon
Use of Revenues	• Revenue from tax goes to: 1) tax credit for R&D and investment in clean energy technology (1/6 of fund or \$10 billion, whichever is less), 2) affected industry transition assistance (portion of funds from 2008, declines annually), 3) payroll tax relief (remaining funds) • Study shall be conducted on the best methods to assess and collect a tax on non-carbon GHGs	• Use of revenue from tax undetermined • A study shall be conducted every 5 years on the environmental, economic, and revenue impacts of the tax

Note: Tax rate units converted to CO_2 for comparison.

Source: Adapted from Metcalf, Gilbert E. et al., *Analysis of U.S. Greenhouse Gas Tax Proposals*, MIT Joint Program on the Science and Policy of Global Change, Report No. 160, April 2008.

Energy-Related Pricing Policies

Some analysts have proposed creative pricing policies in the transportation sector as part of a comprehensive and balanced policy package to reduce transportation-related GHG emissions. Some of these policies, such as congestion pricing, do not target GHG emissions per se but have the side benefit of reducing vehicle GHG emissions. Other policies include vehicle feebates and measures to convert the fixed costs of driving into variable costs. Some of these are discussed in more detail in the Pew Center Congressional Policy brief on transportation policy.

Congestion Pricing

Traffic congestion increases time spent idling, which uses more fuel and increases GHG emissions. Congestion pricing is often advocated to reduce congestion in metropolitan areas. Motorists would be charged a fee to use particular roadways, bridges, or tunnels that are prone to congestion, and would pay more during peak hours of use. This would create an incentive for commuters to use other means of transportation and for drivers to time shift their travel outside of peak hours. The ultimate reduction in GHG emissions could be weak, however, if most of the behavioral response takes the form of trip reallocation rather than reductions in overall travel demand. And unlike carbon or fuel taxes, congestion taxes do not promote greater fuel economy.

Vehicle Feebates

"Feebates" are proposed as an alternative to fuel economy regulations. Manufacturers of low-efficiency vehicles would be charged a fee, while manufacturers of high-efficiency vehicles would be issued a rebate. Feebates are designed to correct the current problem under fuel economy standards in which vehicle manufacturers bear the research, development, and retooling costs of increasing fuel efficiency but vehicle purchasers reap the savings of reduced fuel costs.

Changing the Fixed Cost of Driving

A significant portion of vehicle transportation costs accrue as fixed costs to vehicle operators, such as insurance and administrative costs. These costs bear no relation to the number of miles traveled. Some of these fixed costs could be converted to variable or per gallon gasoline costs. Liability insurance and licensing and registration fees could be collected as a gasoline surcharge paid at the pump. This would convert these expenses into vehicle fuel taxes that would create an incentive to drive less and boost fuel economy, without changing the total costs of travel.

States have also implemented pricing policies to promote energy efficiency and greater use of renewable fuels in the electric power sector. These include public benefit funds, net metering programs, and green pricing policies.

Public Benefits Funds

About half of U.S. states have implemented "public benefits funds" that are financed by small charges on utility customer bills or utility company contributions. These funds are used to promote energy efficiency programs or programs in renewable energy and efficiency. A dozen states have pooled their fund resources to form the Clean Energy States Alliance in order to coordinate public benefit fund investments in renewable energy.

Net Metering

Electricity customers who produce some of their own power from renewable sources can receive retail credit for their contributions to the grid. They are required to pay only for the electricity that they purchase net of the amount that they generate themselves. Net metering programs will vary in how long they allow customers to bank their credits and what rate they receive for them.

Green Pricing

Green pricing programs allow electricity customers the option of paying a premium on their electric bills in order to ensure that some portion or all of their electricity has been generated from renewable sources. Electricity from renewable sources is not provided directly to customers who pay the premium, but the utility certifies that it generated (or purchased) renewable electricity in proportion to premium payments.

Box 3 *Setting a Price Floor on Gasoline*

Under a cap and trade or a carbon tax, the transportation sector will likely be least affected in the near term. As a result, other measures with both GHG emissions and oil saving benefits are often contemplated. One revenue-generating option to curb carbon emissions, address oil dependence, and spur clean technology R&D is setting a price floor on fuel. For a commodity with volatile market prices, like gasoline, investments in fuel use alternatives are often hampered as high prices are regularly followed by lower prices. The use of a price floor is a transparent way to put a price on the true costs of using gasoline, including environmental effects, congestion, etc. By setting a minimum price, a price floor can help eliminate wide price volatility and generate revenue like a tax. Whenever the market price falls below the price floor, the difference would be collected by the government. These funds would be pooled and used in any number of ways, including tax rebates to low-income households and technology funds for renewable fuels or low-emission vehicles. The price floor would encourage fuel-saving behavior and provide an incentive for developing fuel-efficient vehicles and other technology. It also has the advantage of redirecting some of the surplus profits that currently go to oil-exporting countries to U.S. consumers instead. A price ceiling could also be set to keep prices below a certain threshold. Revenue generated by the price floor could be used to fund the price ceiling.

The high gas prices of the summer of 2008 demonstrated that price increases can be successful at achieving reductions in gasoline consumption. Based on this summer's experience, behavioral changes were notable once the price of gas rose beyond $3.50 or $4.00 per gallon. Mass transit saw a significant increase as did the sales of hybrid vehicles.[21] Like a carbon tax, a gas price floor would need to be set at a level capable of changing behavior. Ideally, it could be introduced slowly, giving people the opportunity to adjust over time. Both liberal and conservative opinion leaders have advocated for setting a gas price floor somewhere between $3.50 per gallon and $4.00 per gallon.[22] That is not to say that everyone is an advocate. Those opposed cite the very real issue that raising gas prices intentionally would not be acceptable to the public and therefore politically infeasible. Here curbing oil dependence may provide stronger political motivation than climate impacts.

Key Design Questions

This brief examined how a tax on GHGs, like other market-based policy instruments, establishes a price on carbon and can be used to achieve a cost-effective reduction in GHG emissions. It compared the use of a GHG tax versus a cap-and-trade approach and explored ways in which both policy instruments can be implemented to increase the likelihood of meeting key objectives. As with a cap-and-trade system, there are a number of important issues that are particular to the design of a GHG tax. How they are dealt with will influence the efficacy of the tax in achieving environmental, distributional, and cost-effectiveness objectives.

- At what point in the energy supply chain should the tax be levied?
- At what level should the GHG tax rate be set and how should it rise over time?
- Should existing energy tax rates, e.g., on gasoline, be altered concurrent with the imposition of a GHG tax?
- How can non-energy sources of CO_2 and other GHGs be covered by the tax?
- How should funds generated from the tax be used, given the often competing objectives of economic efficiency, distributional equity, and political expedience?
- What other pricing policies may be advantageous in other sectors, such as transportation and electricity?
- How would a tax in some sectors interact with other policies to reduce GHG emissions?

End Notes

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