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Testimony

Statement of
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Implications of a Cap-and-Trade Program for Carbon Dioxide Emissions

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Chairman Baucus, Senator Grassley, and Members of the Committee, thank you for the invitation to discuss the implications of cap-and-trade programs that are designed to reduce U.S. emissions of greenhouse gases, most prominently carbon dioxide (CO_2).

Global climate change is one of the nation's most significant long-term policy challenges. Human activities are producing increasingly large quantities of greenhouse gases, particularly CO_2. The accumulation of those gases in the atmosphere is expected to have potentially serious and costly effects on regional climates throughout the world. The magnitude of such damage remains highly uncertain, but there is growing recognition of the risk that the damage may be extensive and perhaps even catastrophic.

The risk of potentially catastrophic damage associated with climate change can justify actions to reduce that possible harm in much the same way that the hazards we all face as individuals motivate us to buy insurance. Reducing greenhouse-gas emissions would help limit the degree of damage associated with climate change, especially the risk of significant damage. However, decreasing those emissions would also impose costs on the economy—in the case of CO_2, because much economic activity is based on fossil fuels, which release carbon in the form of carbon dioxide when they are burned. Most analyses suggest that a carefully designed program to begin lowering CO_2 emissions would produce greater benefits than costs.

One option for reducing emissions is to establish a "cap-and-trade" program. Under such a program, policymakers would set a limit on emissions and allow entities to buy and sell rights (referred to as allowances) to emit CO_2. In designing a cap-and-trade program to achieve emission reductions, policymakers would face a number of critical decisions, including whether to limit fluctuations in the price of allowances and whether to sell the allowances or give them away. If the government chose to sell them, decisions would also have to be made about whether to use the resulting revenue to offset other taxes, to assist workers or low-income households that might be adversely affected by the emission cap, to support other legislative priorities, or to reduce the deficit. My testimony makes the following key points about those issues:

- Market-oriented approaches to reducing carbon emissions (such as a cap-and-trade program or a carbon tax) are much more efficient than command-and-control approaches (such as regulations that require across-the-board reductions by all firms). The reason is that the market-oriented approaches create incentives and flexibility for emissions reductions to occur where and how they are least expensive to accomplish.

- Within the relatively efficient category of approaches that rely on the power of markets, a tax on emissions is generally more efficient than a cap-and-trade system. The reason is that although both a tax and a cap-and-trade system

encourage firms to find the lowest-cost reductions at a particular point in time, a tax provides greater flexibility over time, allowing firms to achieve reductions when they are least expensive. In particular, a tax encourages firms to make greater reductions in emissions at times when the cost of doing so is low and allows them leeway to lessen their efforts when the cost is high. A cap-and-trade program can be designed to capture many of those time-related efficiencies by incorporating design features that prevent large fluctuations in the price of allowances (for example, a floor and a ceiling on allowance prices).

- A cap-and-trade program, like a tax on CO_2 emissions, could raise a significant amount of revenue because the value of the allowances created under such a program would probably be substantial. For example, in 2012, the value of the emission allowances that would be issued under S. 2191 would be roughly $145 billion, CBO estimates. As the cap that is included in that legislation became more stringent over time, the value of the allowances would grow. A key decision for policymakers is whether to sell emission allowances, thereby capturing their value in the form of federal revenue, or give them away.

- Under a cap-and-trade program, firms would *not* ultimately bear most of the costs of the allowances but instead would pass them along to their customers in the form of higher prices. Such price increases would stem from the restriction on emissions and would occur regardless of whether the government sold emission allowances or gave them away. Indeed, the price increases would be essential to the success of a cap-and-trade program because they would be the most important mechanism through which businesses and households would be encouraged to make investments and behavioral changes that reduced CO_2 emissions.

- Policymakers' decisions about whether to sell or give away the allowances could significantly affect the overall economic cost of capping CO_2 emissions and the way gains and losses from such a program were distributed among U.S. households. A policy of giving away rather than selling a large share of the allowances could be more costly to the economy and impose disproportionately large burdens on low-income households.

  - Evidence suggests that the cost to the economy of a 15 percent cut in U.S. emissions (not counting any benefits from mitigating climate change) might be more than twice as large if policymakers gave allowances away than if they sold them and used the revenue to lower current taxes on capital that discourage economic activity.

  - In addition, providing allowances free of charge to energy producers and energy-intensive firms could create "windfall profits" for relatively high-income shareholders of those companies, even though the emission cap would be likely to cause price increases that would disproportionately affect

people at the lower end of the income scale. Further, allocating allowances without charge would not prevent the loss of jobs in affected industries because such firms would probably reduce their output in response to higher prices for carbon-intensive goods and services. Those job losses, in turn, would impose concentrated income losses in some households and communities. In contrast, if the government chose to sell emission allowances, it could use some of the revenue from those sales to offset the disproportionate economic burden that higher prices would impose on low-income households and to provide transitional assistance to dislocated workers.

- CBO has concluded that the federal budget should record the value of allowances that are given away by the government if the recipients of the allowances could readily convert them into cash. In particular, the budget should record the value of those allowances, when they are distributed, as both revenues and outlays. That procedure, which CBO has already applied in its estimates for S. 2191, underscores that giving away allowances is economically equivalent to auctioning the allowances and then dedicating the proceeds to the recipients.

Flexibility in the Timing of Emission Reductions

Incentive-based approaches, which create financial incentives for firms and households to cut their greenhouse-gas emissions, are a lower-cost approach to reducing emissions than more restrictive command-and-control approaches, which would mandate how much such entities could emit or what emission-reduction technologies they should use. The lower cost of incentive-based approaches stems from the flexibility they provide as to where and how emission reductions are to be achieved. Either a tax or a cap-and-trade program would offer such flexibility at a given point in time:

- Under a tax, policymakers would levy a fee for each ton of CO_2 emitted or for each ton of carbon contained in fossil fuels. The tax would motivate entities to cut back on their emissions if the cost of doing so was less than the cost of paying the tax. As a result, the tax would place an upper limit on the cost of reducing emissions, but the total amount of CO_2 that would be emitted in any given year would be uncertain.

- Under a cap-and-trade program, policymakers would set a limit on total emissions during some period and would require regulated entities to hold rights, or allowances, to the emissions permitted under that cap. (Each allowance would entitle companies to emit one ton of CO_2 or to have one ton of carbon in the fuel that they sold.) After the allowances for a given period were distributed, entities would be free to buy and sell the allowances. The trading aspect of the program could lead to substantial cost savings relative to command-and-control approaches: Firms that were able to reduce emissions most cheaply could profit from selling allowances to firms that had relatively high abatement costs.

Cap-and-trade programs can vary substantially in the amount of leeway that they provide regulated entities in the timing of emission reductions. Designs that allow for more timing flexibility are generally more cost-effective.

Potential Savings in Costs as a Result of Timing Flexibility

In its most inflexible form, a cap-and-trade program would require that a specified cap on emissions be met each year. That lack of flexibility would boost the cost of achieving any long-term goal because it would prevent firms from responding to year-to-year differences in conditions that affected emission reduction costs, such as fluctuations in economic activity, energy markets, the weather (for example, an exceptionally cold winter would increase the demand for energy and make meeting a cap more expensive), and the technologies available for reducing emissions. In contrast, the benefits of meeting inflexible annual emission targets are unlikely to be significantly different from the benefits of achieving the same long-term reductions but allowing firms to reduce their emissions by more than a given target in some years and by less in others. That insensitivity of benefits to patterns of annual emissions is a result of the long-term nature of climate change. Limiting global temperature increases would entail making substantial reductions in the amount of greenhouse gases that accumulate in the atmosphere over the next several decades. However, the benefits of doing so are largely independent of the annual pattern of those reductions.[1]

Available research suggests that a tax on CO_2 emissions (which would provide firms with maximum flexibility in how they undertook emission reductions over time and could keep the cost of reductions in line with anticipated benefits) could achieve a long-term target at roughly one-fifth the cost of the most inflexible type of cap-and-trade program (that is, one with no leeway in the timing of emission reductions). No existing policy proposals envision such an inflexible cap, however. Among recent proposals for a cap-and-trade program, the amount of timing flexibility that firms are allowed would vary depending on the program's specific design features.

1. Although costs and benefits are difficult to measure, the long-term cumulative nature of climate change implies that the *benefit* of emitting one less ton of CO_2 in a given year—referred to as the marginal benefit—is roughly constant. In other words, the benefit in terms of averted climate damage from each additional ton of emissions reduced is roughly the same as the benefit from the previous ton of emissions reduced, and shifting the reductions from one year to another does not materially affect the ultimate impact on the climate. In contrast, the *cost* of emitting one less ton of CO_2 in a given year—the marginal cost—tends to increase with successive emission reductions. The reason is that the least expensive reductions are made first and progressively more-expensive cuts would then have to be made to meet increasingly ambitious targets for emission reductions.

Design Features That Provide Firms with Timing Flexibility

When combined, some design features could allow a cap-and-trade program to achieve many of the advantages in efficiency associated with a tax on emissions. One simple way of evaluating how close a cap-and-trade system would come to the efficiency of a carbon tax is to consider how much the price of allowances would fluctuate over time; the less fluctuation, the closer the cap-and-trade system would come to achieving the timing flexibility that is central to the efficiency of a tax. Minimizing price fluctuations requires measures to limit both unintended price increases and unintended price declines.

Keeping Costs from Climbing Too High. Setting a ceiling—typically referred to as a safety valve—on the price of allowances could make a cap-and-trade program more efficient than an inflexible cap. Such a policy could prevent the cost of reducing emissions from exceeding either the best available estimate of the environmental benefits that would result from those reductions or the cost that policymakers consider acceptable. The government could maintain a price ceiling by selling companies as many allowances as they would like to buy at the safety-valve price.

Alternatively, policymakers could allow companies to defer emission reductions to later years by allowing them to "borrow" future allowances for use in an earlier year. Borrowing allowances from future years would tend to reduce allowance prices in the current year but then raise prices in the future (because borrowing would allow smaller reductions now but require greater reductions later). Firms would want to borrow allowances only if they expected the price of allowances in the future to be sufficiently below the current price as to make deferring reductions profitable. That is, borrowing could help deal with temporary spikes in allowance prices but not circumstances in which allowance prices were expected to remain high over the long term. As a result, borrowing is likely to be less effective than a price ceiling in preventing higher-than-anticipated allowance prices.

Keeping Costs from Falling Too Low. Policymakers could prevent the price of allowances from falling too low by setting a price floor. If the government chose to auction a significant share of the allowances, it could specify a so-called reserve price and withhold allowances from the auction as needed to maintain that price. The efficiency advantage that a price floor offers stems from the fact that it can prevent the cost of emission reductions from falling below the benefits that they were expected to produce—or below the level of effort that policymakers intend that emitters should maintain.

Alternatively, policymakers could help keep the price of allowances from falling too low by allowing companies to exceed their required emission reductions in low-cost years in order to "bank" allowances for use in future high-cost years. The additional emission reductions motivated by banking in low-cost years would put upward pressure on the price of allowances in those years. Similar to borrowing,

banking would be most effective in addressing short-term lows in allowance prices rather than in circumstances in which allowance prices were expected to remain low over the long term. As a result, banking is likely to be less effective than a price floor in preventing lower-than-anticipated allowance prices.

The effects of a cap-and-trade system would also depend substantially on whether the allowances were sold or issued at no cost, as discussed below.

The Distributional Consequences of a Cap-and-Trade Program

In establishing a cap-and-trade program, policymakers would create a new commodity: the right to emit CO_2. The emission allowances—each of which would represent the right to emit, say, one ton of CO_2—would have substantial value. On the basis of a review of the existing literature and the range of CO_2 policies now being debated, CBO estimated that by 2020, the value of those allowances could total between $50 billion and $300 billion annually (in 2006 dollars). The actual value would depend on various factors, including the stringency of the cap (which would need to grow tighter over the years to keep CO_2 from continuing to accumulate), the possibility of offsetting CO_2 emissions through carbon sequestration or international allowance trading, and other features of the specific policy that was selected.[2] On April 10, 2008, CBO estimated that the value of the allowances created under S. 2191 would be roughly $145 billion once the proposed program took effect in 2012; in subsequent years, the aggregate value of the allowances would be even greater. (See Box 1 for a short description of CBO's cost estimate for S. 2191.)

Policymakers would need to decide how to allocate the allowances that corresponded to each year's CO_2 cap. One option would be to have the government capture their value by selling the allowances, as it does with licenses to use the electromagnetic spectrum. Another possibility would be to give the allowances to energy producers or some energy users at no charge. The European Union has used that second approach in its 2-year-old cap-and-trade program for CO_2 emissions, and nearly all of the allowances issued under the 13-year-old U.S. cap-and-trade program for sulfur dioxide emissions (which contribute to acid rain) are distributed in that way. Whether policymakers decided to sell the allowances or give them away would have significant implications for the distribution of gains and losses among U.S. households and for the overall cost of the policy.

The ultimate distributional impact of a cap-and-trade program would be the net effect of two distinct components: the distribution of the costs of the program

2. Carbon sequestration is the capture and long-term storage of CO_2 emissions underground (geological sequestration) or in vegetation or soil (biological sequestration). For more information, see Congressional Budget Office, *The Potential for Carbon Sequestration in the United States* (September 2007).

(including the cost of paying for the allowances) and the distribution of the allowances' value. (Because someone will pay for them, someone will benefit from their value.) Market forces would determine who bore the costs of a cap-and-trade program, but policymakers would determine who received the value of the allowances. The ultimate effect could be either progressive or regressive, imposing disproportionately large burdens on high-income or low-income households, respectively.

Market Forces Would Determine Who Bore the Costs of a Cap

Obtaining allowances—or taking steps to cut emissions to avoid the need for such allowances—would become a cost of doing business for firms that were subject to the CO_2 cap. However, those firms would not ultimately bear most of the costs of the allowances. Instead, they would pass them along to their customers (and their customers' customers) in the form of higher prices. By attaching a cost to CO_2 emissions, a cap-and-trade program would thus lead to price increases for energy and energy-intensive goods and services, the production of which contributes the most to those emissions. Such price increases would stem from the restriction on emissions and would occur regardless of whether the government sold emission allowances or gave them away. Indeed, the price increases would be essential to the success of a cap-and-trade program because they would be the most important mechanism through which businesses and households would be encouraged to make investments and behavioral changes that reduced CO_2 emissions.

The rise in prices for energy and energy-intensive goods and services would impose a larger burden, relative to income, on low-income households than on high-income households. For example, without incorporating any benefits to households from lessening climate change, CBO estimated that the price increases resulting from a 15 percent cut in CO_2 emissions would cost the average household in the lowest one-fifth (quintile) of all households arrayed by income slightly more than 3 percent of its income; such increases would cost the average household in the top quintile just under 2 percent of its income (see Table 1).[3]

The higher prices that would result from a cap on CO_2 emissions would reduce demand for energy and energy-intensive goods and services and thus create losses for some current investors and workers in the sectors of the economy that supply such products. Investors might see the value of their stock decline, and workers could face the risk of unemployment as jobs in those sectors were cut. Stock losses would tend to be widely dispersed among investors, because shareholders typically diversify their portfolios. In contrast, the costs borne by existing workers

3. Those numbers are based on an analysis that CBO conducted using 1998 data; see Congressional Budget Office, W*ho Gains and Who Pays Under Carbon-Allowance Trading? The Distributional Effects of Alternative Policy Designs* (June 2000). CBO is in the process of updating those figures, using recent data on households' expenditures and income.

Box 1.

CBO's Cost Estimate for S. 2191

On April 10, 2008, the Congressional Budget Office (CBO) issued a cost estimate for S. 2191, the America's Climate Security Act of 2007, as ordered reported by the Senate Committee on Environment and Public Works in December 2007. CBO also issued a cost estimate for a slightly amended version of the legislation that was transmitted by the committee on April 9.

The legislation would create a cap-and-trade system for carbon dioxide and other greenhouse gases. (The bill actually calls for two separate cap-and-trade programs—a bigger one covering most types of greenhouse gases and a smaller one covering hydrofluorocarbons.) Some of the emission allowances would be auctioned—through a new entity, the Climate Change Credit Corporation; the remaining allowances would be distributed at no charge to states and other recipients. Over the roughly 40 years that the proposed cap-and-trade programs would be in effect, the number of allowances—and thus the emissions of relevant gases—would be reduced each year.

On the basis of an analysis of the results of several economic models, CBO estimates that if the legislation was enacted, the auction price of emission allowances for those gases would rise from about $23 per metric ton of carbon-dioxide-equivalent (mt CO_2e) emissions in 2009 to about $44 per mt CO_2e in 2018.[1] (In 2006 dollars, the auction price per metric

1. A carbon dioxide equivalent is defined for each greenhouse gas as the quantity of that gas that makes the same contribution to global warming as one metric ton of carbon dioxide, as determined by the Environmental Protection Agency.

would probably be concentrated among relatively few households and, by extension, their communities.

Policymakers Would Determine Who Received the Value of the Allowances

Although the price increases triggered by a cap-and-trade program for CO_2 emissions would be regressive, the program's ultimate distributional effect would depend on policymakers' decisions about how to allocate the emission allowances. As noted above, those allowances would be worth tens or hundreds of billions of dollars per year. Who received that value would depend on how the allowances were distributed.

Box 1. Continued

CBO's Cost Estimate for S. 2191

ton of CO_2e would rise from about $21 in 2009 to $35 in 2018.) Measured relative to base-case emissions (that is, those that would occur under current law), emissions of the main greenhouse gases covered by the programs would decline by 7 percent in 2012 and by 17 percent in 2018; over the 2012–2050 period, emissions would decline by a total of 42 percent relative to the base case.

Enacting S. 2191 as it was ordered reported would increase revenues by about $1.19 trillion over the 2009–2018 period, CBO estimates. Direct spending from distributing those proceeds would total about $1.21 trillion over the period. The net effect of the original legislation (as ordered reported) would be to increase the deficit (excluding any effects on future discretionary spending) by an estimated $15 billion over the next 10 years. The effect of the amended version, in contrast, would be to reduce the deficit (again excluding any effects on future discretionary spending) by roughly $80 billion over the same period. In addition, if policymakers appropriated the amounts necessary to implement S. 2191, discretionary spending would increase over the 2009–2018 period, CBO estimates, by about $4 billion under the original legislation and by about $80 billion under the amended version.

The cost estimates for the two versions of the bill differ because the amendment would increase the proportion of allowances that would be auctioned, deposit some of the auction proceeds in a Climate Change Deficit Reduction Fund, and make spending from that fund subject to appropriation.

Lawmakers could more than offset the price increases experienced by low-income households or the costs imposed on workers in particular industrial sectors by providing for the sale of some or all of the allowances and using the revenue to pay compensation. For example, CBO examined the ultimate distributional effects of a cap-and-trade program that would reduce CO_2 emissions in the United States by 15 percent, and it concluded that lower-income households could be better off (even without including any benefits from reducing climate change) as a result of the policy if the government chose to sell the allowances and use the revenue to pay an equal lump-sum rebate to every household in the United States. In that case, the size of the rebate would be larger than the average increase in low-

Table 1.

Effects on U.S. Households of the Higher Prices Resulting from a 15 Percent Cut in CO_2 Emissions

	Average for Income Quintile				
	Lowest	Second	Middle	Fourth	Highest
Annual Cost Increase in 2006 Dollars	680	880	1,160	1,500	2,180
Annual Cost Increase as a Percentage of Income[a]	3.3	2.9	2.8	2.7	1.7

Source: Congressional Budget Office, *Who Gains and Who Pays Under Carbon-Allowance Trading? The Distributional Effects of Alternative Policy Designs* (June 2000).

Notes: These numbers do not reflect any of the benefits from reducing climate change.

The policy examined here is a cap-and-trade program designed to lower U.S. carbon dioxide (CO_2) emissions by 15 percent from 1998 levels. (CBO performed the analysis in 2000 and used 1998 emission levels so that the distributional effects could be based on actual, rather than projected, data on consumer spending and taxes.) CBO assumed that the full cost of cutting emissions would be passed along to consumers in the form of higher prices and that the price increase for a given product would be proportional to the amount of CO_2 emitted from the fossil fuels used in its production.

These numbers reflect data on each quintile's cash consumption and estimates of cash income. (A quintile contains one-fifth of U.S. households arrayed by income.) Because of data limitations, the numbers should be viewed as illustrative and broadly supportive of the conclusions in this analysis rather than as precise estimates.

a. The cost increases are equivalent to percentage declines in households' after-tax income.

income households' spending on energy and energy-intensive goods.[4] Such a strategy would increase average income for households in the lowest income quintile by about 2 percent (see the top panel of Figure 1). At the same time, average income for households in the top quintile would fall by less than 1 percent, CBO estimates.

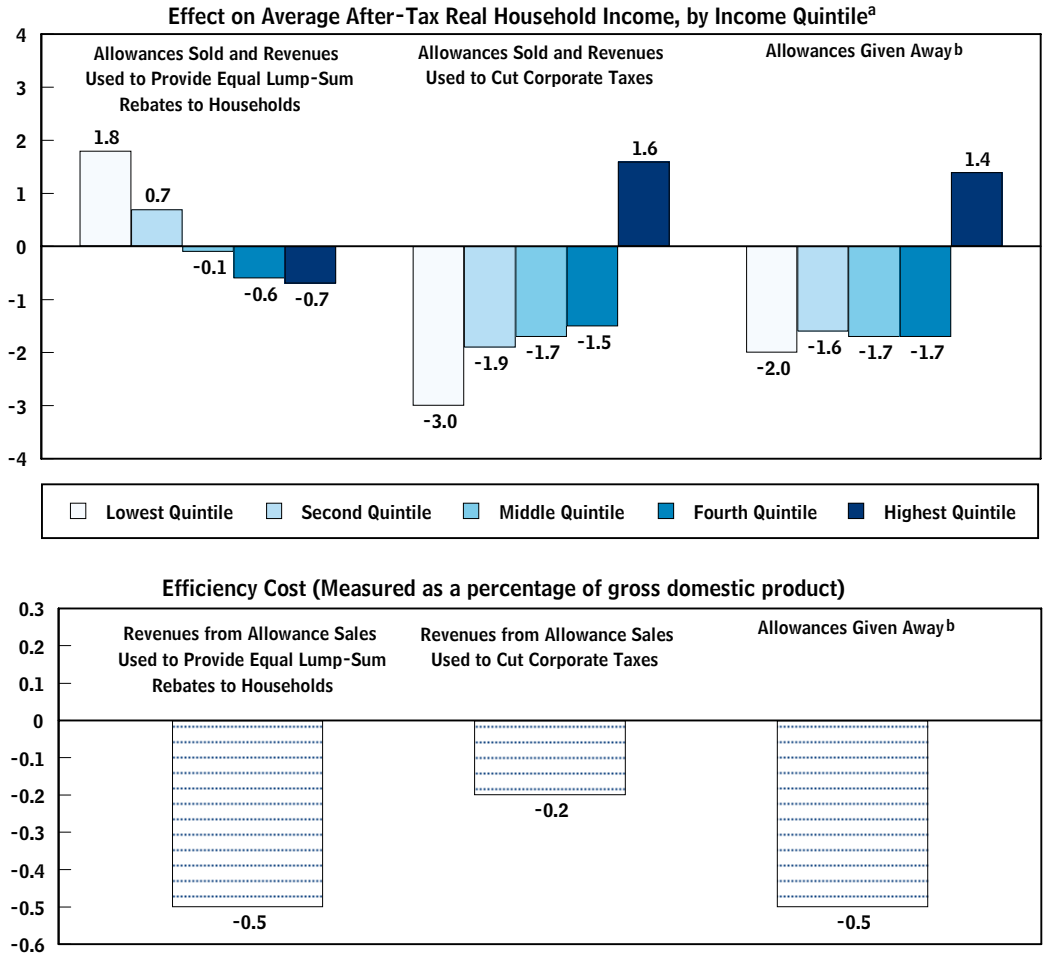
In contrast, if lawmakers chose to use the allowances to decrease corporate income taxes, the effect would be significantly more regressive than the initial price increases. Because low-income households pay relatively little in corporate taxes, the cut in corporate tax rates would not offset their increased spending on energy and energy-intensive goods. Households in the top income quintile, however, would experience an increase in after-tax income as a result of the policy. Should policymakers decide to use the revenue from selling allowances to decrease

4. One researcher has suggested that an environmental tax credit based on earnings could offer another means of reducing the regressive effects of the price increases that would result from a tax or cap on CO_2 emissions. See Gilbert E. Metcalf, *A Proposal for a U.S. Carbon Tax Swap* (Washington, D.C.: Brookings Institution, October 2007).

Figure 1.

Effects of a 15 Percent Cut in CO_2 Emissions, with the Allowances' Value Used in Various Ways

(Percentage change)



Sources: Congressional Budget Office (top panel); Terry M. Dinan and Diane Lim Rogers (bottom panel), "Distributional Effects of Carbon Allowance Trading: How Government Decisions Determine Winners and Losers," *National Tax Journal*, vol. 55, no. 2 (June 2002).

Notes: These figures do not reflect any of the benefits from reducing climate change.

The policy examined here is a cap-and-trade program designed to reduce carbon dioxide (CO_2) emissions by 15 percent from 1998 levels. (CBO performed the analysis in 2000 and used 1998 emission levels so the distributional effects could be based on actual, rather than projected, data on consumer spending and taxes.) In the top panel, the costs of the cap-and-trade policy are shown as decreases in real household income, measured as a percentage of after-tax income before the policy change. Those numbers reflect data on each quintile's cash consumption and estimates of cash income. (A quintile contains one-fifth of U.S. households arrayed by income.) Because of data limitations, those numbers should be viewed as illustrative and broadly supportive of the conclusions in this analysis rather than as precise estimates.

a. Indicates the net effect of households' increased expenditures because of cap-induced price increases and the income that households would receive as a result of the allowance-allocation strategy.

b. These estimates assume that the government would use any positive net revenue remaining after accounting for ways in which the policy affected the federal budget to provide equal lump-sum rebates to households. The results would be more regressive if the government used any positive net revenue to decrease corporate taxes or payroll taxes.

payroll taxes, the effect (not shown in the figure) would be regressive as well, although less so than for a cut in corporate taxes.[5]

Giving all or most of the allowances to energy producers to offset the potential losses of investors in those industries—as was done in the cap-and-trade program for sulfur dioxide emissions—would also exacerbate the regressivity of the price increases. On average, the value of the CO_2 allowances that producers would receive would more than compensate them for any decline in profits caused by a drop in demand for energy and energy-intensive goods and services whose production causes emissions. As a result, the companies that received allowances could experience windfall profits.

For example, in 2000, CBO estimated that if emissions were reduced by 15 percent, as in the scenario discussed above, and all of the allowances were distributed free of charge to producers in the oil, natural gas, and coal sectors, the value of the allowances would be 10 times as large as coal, oil, and natural gas producers' combined profits in 1998. Profits for those industries have climbed substantially since then, yet the value of the allowances associated with the policy that CBO analyzed would still be large relative to those producers' profits.[6] Because the additional profits from the allowances' value would not depend on how much a company produced, such profits would be unlikely to prevent the declines in production and resulting job losses that the price increases (and resulting drop in demand) would engender.

In addition, those profits would accrue to shareholders, who are primarily from higher-income households, and would more than offset those households' increased spending on energy and energy-intensive goods and services. Low-income households, by contrast, would benefit little if allowances were given to energy producers for free, and they would still bear a disproportionate burden from the price increases that would nonetheless occur. Thus, giving away allowances would be significantly regressive, making higher-income households better off as a result of the cap-and-trade policy while making lower-income households worse off.

Reducing the Overall Economic Impact of a CO_2 Cap

The ways in which lawmakers could allocate the revenue from selling emission allowances would affect not only the distributional consequences of a cap-and-

5. For those results, see Congressional Budget Office, *Trade-Offs in Allocating Allowances for CO_2 Emissions* (April 25, 2007).

6. Specifically, CBO estimated that the value in 1998 of the allowances stemming from the 15 percent reduction in U.S. emissions would total $155 billion (in 2006 dollars). By comparison, profits for U.S. producers of oil, natural gas, and coal totaled $13.5 billion in 1998 (in 2006 dollars). Those companies' total profits have grown substantially—for example, in 2006, they totaled $174 billion.

trade policy but also its total economic cost. For instance, the government could use the revenue from auctioning allowances to reduce existing taxes that tend to dampen economic activity—primarily, taxes on labor, capital, or personal income. As research indicates, a CO_2 cap would exacerbate the economic effects of such taxes: The higher prices caused by the cap would lower real (inflation-adjusted) wages and real returns on capital, which would be equivalent to raising marginal tax rates on those sources of income. Using the value of the allowances to reduce such taxes could help mitigate that adverse effect of the cap. Alternatively, policymakers could choose to use the revenue from auctioning allowances to reduce the federal deficit. If that reduction lessened the need for future tax increases, the end result could be similar to dedicating the revenue to cuts in existing taxes.

The decision about whether or not to sell the allowances and use the proceeds in ways that would benefit the economy could have a significant impact. For example, researchers have estimated that the efficiency cost (discussed below) of a 15 percent cut in emissions could be reduced by more than half if the government sold allowances and used the revenue to lower corporate income taxes, rather than devoting the revenue to providing lump-sum rebates to households or giving the allowances away (see the bottom panel of Figure 1). The efficiency cost of a policy reflects the economic losses that occur because prices in the economy are distorted so that they do not reflect the (nonenvironmental) resources used in their production. That cost includes decreases in the productive use of labor and capital as well as costs (both monetary and nonmonetary) associated with reducing emissions. To provide perspective on the magnitude of such efficiency costs, they are depicted as a share of gross domestic product.

Cap-and-Trade Programs and the Federal Budget

A final topic involves the budgetary treatment of cap-and-trade programs. The auctioning of allowances would clearly generate receipts for the federal government, and those amounts would be recorded as revenues.

In some cases, cap-and-trade allowances that are given away by the government should also be reflected in the federal budget, in CBO's view, and the agency used that approach in its treatment of most of the allowances that, under S. 2191, would be distributed at no charge. Specifically, the budget should show, as both revenues and outlays, the value of those allowances distributed at no cost to the recipients. That treatment stems from the fact that the government is essential to the existence of the allowances and is responsible for their readily realizable monetary value through its enforcement of the cap on emissions; it also derives from the fact that once created, the allowances would trade in a liquid secondary market—because firms or households could buy and sell them—and thus would be similar to cash. CBO therefore considers the distribution of such allowances at no charge to be functionally equivalent to the distribution of cash. (In contrast, the proceeds associated with the allowances allocated free of charge to producers and importers

under smaller, more constrained cap-and-trade programs—such as the cap-and-trade program for hydrofluorocarbons proposed under S. 2191—should not be recorded in the budget, CBO believes, primarily because the market created for such allowances would be relatively illiquid and thus the allowances would be less like cash.)

In CBO's view, an approach that reflects the value of free emission allowances in the federal budget best illuminates the trade-offs between different policy choices. Distributing allowances at no charge to specific firms or individuals is, in effect, equivalent to collecting revenue from an auction of the allowances and then distributing the auction proceeds to those firms or individuals. In other words, the government could either raise $100 by selling allowances and then give that amount in cash to particular businesses and individuals, or it could simply give $100 worth of allowances to those businesses and individuals, who could immediately and easily transform the allowances into cash through the secondary market. Treating allowances issued at no charge as both revenues and outlays reflects the equivalency of those two options.

Another cost-estimating issue involves the long-standing methodology used to hold overall economic activity (gross domestic product, or GDP) constant when estimating the effect of legislation on the federal budget. Under such estimating assumptions, higher amounts of indirect business charges reduce other income in the economy. (For example, if firms that must purchase allowances were unable to pass those costs along, their profits would fall. More likely, some substantial portion of those costs would be passed along to others in the economy, such as consumers, in the form of higher prices, and employees, in the form of lower wages. Lower wages would reduce federal revenues from income and payroll taxes. An increase in the price level would reduce income taxes—because the tax system is indexed to prices—and increase expenditures for indexed benefits, such as Social Security. Those changes would offset some of the revenues from the allowances.) The tradition in such estimating is to assume that 25 percent of any change in indirect business charges will be offset by changes in income and payroll taxes (25 percent is an approximate marginal tax rate). In preparing cost estimates for cap-and-trade proposals, CBO does not apply the 25 percent reduction to all of the gross revenues that would be generated but instead applies it on the basis of how those revenues would be used:

- To the extent that revenues would be used in ways that generated new taxable income, those uses would offset the loss of income and payroll taxes resulting from the initial purchase of allowances. Therefore, CBO does not apply the 25 percent reduction to any revenues that would go toward making transfer payments to taxable entities if the policy would impose no conditions on recipients' use of the payments. Although such payments do not directly affect GDP (because they are not made in exchange for goods or services), they are typically taxable. Thus, providing transfers to taxable entities would generate additional federal revenues that would essentially offset the 25 percent reduction applied to revenues from the issuance of allowances.

- In contrast, CBO does apply the 25 percent reduction to any revenues that would be spent by the government on goods and services (for example, on research and development activities). That treatment is used because such government spending would substitute for other economic activity (under the assumption that GDP is unchanged). As a result, revenues used in that way would not generate any new taxable income.