



CONGRESSIONAL BUDGET OFFICE
COST ESTIMATE

April 10, 2008

S. 2191

America's Climate Security Act of 2007

*As ordered reported by the Senate Committee on Environment and Public Works
on December 5, 2007*

SUMMARY

S. 2191 would set an annual limit or cap on the volume of certain greenhouse gases (GHGs) emitted from electricity-generating facilities and from other activities involving industrial production and transportation. Under this legislation, the Environmental Protection Agency (EPA) would establish two separate regulatory initiatives known as cap-and-trade programs—one covering most types of GHGs and one covering hydrofluorocarbons (HFCs).

EPA would distribute allowances to emit specific quantities of those gases. Some of the allowances would be allocated to the Climate Change Credit Corporation (the Corporation), an entity created by this bill. The Corporation would auction those allowances and use the proceeds to finance various initiatives, such as developing renewable technologies, assisting in the education and training of workers, and providing energy assistance for low-income households. EPA would distribute the remaining allowances at no charge, to states and other recipients, which could then sell, retire, use, or give them away. Over the 40 years that the proposed cap-and-trade programs would be in effect, the number of allowances and emissions of the relevant gases would be reduced each year.

CBO estimates that enacting S. 2191 would increase revenues by about \$1.19 trillion over the 2009-2018 period, net of income and payroll tax offsets. Over that period, we estimate that direct spending from distributing those proceeds would total about \$1.21 trillion. The additional direct spending would exceed the added revenues by an estimated \$15 billion, thus increasing future deficits (or decreasing surpluses) by that amount over the next 10 years. In addition, assuming appropriation of the necessary amounts, CBO estimates that implementing S. 2191 would increase discretionary spending by about \$3.7 billion over the 2009-2018 period. Most of that funding would be used to support EPA personnel, contractors, and information technology necessary to implement this legislation.

In years after 2018, annual direct spending would continue to exceed the net revenues attributable to the legislation each year, resulting in increased deficits (or decreased surpluses). Pursuant to section 203 of S. Con. Res. 21, the Concurrent Resolution on the Budget for Fiscal Year 2008, CBO estimates that changes in direct spending and revenues from enacting the bill would cause an increase in the on-budget deficit greater than \$5 billion in at least one of the 10-year periods after 2018.

S. 2191 contains several intergovernmental mandates as defined in the Unfunded Mandates Reform Act (UMRA). CBO estimates that, during the first five years following enactment, states would realize a net benefit as a result of this bill's enactment (resulting from the allowances they would receive). Therefore, the annual threshold for intergovernmental mandate costs established in UMRA (\$68 million in 2008, adjusted annually for inflation) would not be exceeded.

S. 2191 also would impose private-sector mandates as defined in UMRA. The most costly mandates would require certain types of private-sector entities to participate in the cap-and-trade programs for GHG emissions created by the bill. CBO estimates that the cost of those mandates would amount to more than \$90 billion each year during the 2012-2016 period, and thus substantially exceed the annual threshold established in UMRA for private-sector mandates (\$136 million in 2008, adjusted annually for inflation).

MAJOR PROVISIONS

S. 2191 would require EPA to establish two cap-and-trade programs aimed at reducing the emission of GHGs in the United States over the 2010-2050 period. A cap-and-trade program is a regulatory policy aimed at controlling pollution emissions from specific sources. The legislation would set a limit on total emissions for each year 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 carbon dioxide 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 allowances among themselves.

One program would cover emissions of carbon dioxide, methane, nitrous oxide, sulfur hexafluoride, and perfluorocarbons—defined in the legislation as group I GHGs. The other program would cover sales of HFCs—defined as group II GHGs. In addition, this legislation would require EPA to establish a cap-and-trade program for importers of certain carbon-intensive goods, such as steel and aluminum, beginning in 2020. Because this program for importers would begin outside the 10-year estimating period, CBO did not include any costs from this program. The details for the other programs are described below.

Cap-and-Trade Program for Group I Greenhouse Gases

Beginning in 2012, facilities covered by the legislation would be required to submit to EPA one emission allowance for each ton¹ of regulated GHGs emitted each year. Based on information from EPA, CBO estimates that between 2,000 and 3,000 facilities would be affected by this requirement. Specifically, covered facilities include the following:

- Any facility that uses more than 5,000 tons of coal each year;
- Plants producing natural gas or any facility that produces natural gas in Alaska or imports natural gas;
- Any facility or entity that produces or imports petroleum or coal-based liquid, or gaseous fuel that, when combusted, emits a group I GHG, assuming no capture and sequestration of that gas;
- Any facility or entity that produces or imports more than 10,000 carbon dioxide equivalents of chemicals that are group I GHGs, assuming no capture and sequestration of that gas; or
- Any facility that emits as a byproduct of the production of HFCs more than 10,000 carbon dioxide equivalents of HFCs.

This legislation would not restrict the types of entities or individuals who could purchase, hold, exchange, or retire emission allowances for this group of GHGs. An unlimited number of allowances obtained in one year could be saved or “banked” indefinitely to be used in future years. Limited borrowing of allowances (that is, the use in one year of an allowance that has been established for use in a future year) also would be permitted. The program would limit domestic U.S. emissions of group I GHGs by covered entities to 5,775 million metric tons of carbon dioxide equivalent in 2012—about 93 percent of the level of such emissions by covered entities in 2005—and the cap would decline by about 106 million metric tons per year, falling to 1,732 million metric tons in 2050.

A portion of an entity’s compliance obligation under the bill could be met by purchasing “offsets.” An offset is created by activities (as certified by EPA) that are not directly related to the emissions of the facilities covered under the bill, but that reduce GHG emissions or increase the amount of such gases that are captured from the atmosphere and stored (known as sequestration). Examples of such activities include reducing emissions from landfills,

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

sequestering GHGs on agricultural and rangelands, altering tillage practices, planting winter crops, and reducing the use of nitrogen fertilizer. Covered entities could also purchase emission allowances through international markets if approved by EPA.

The cap for the group I GHGs cap-and-trade program would take effect in 2012. Of the emission allowances established for this program (5,775 million metric tons of carbon dioxide equivalent), 21.5 percent would be offered for sale that year to covered industries and other entities that wish to purchase them. Some allowances would be available for sale as early as 2009 as part of an early auction. The percentage of emission allowances auctioned each year would increase steadily, reaching about 70 percent around 2030, and would remain at that level through 2050, the last year of the program. Emission allowances not auctioned would be distributed free of charge to covered entities, states, and other specified recipients, who could then retire, sell, or use such allowances to meet the annual obligation for their own covered emissions.

Cap-and-Trade Program for Group II Greenhouse Gases

Beginning in 2010, producers and importers of HFCs would be required to submit to EPA a consumption allowance for each carbon dioxide equivalent ton of HFC produced or imported in the United States during the preceding calendar year. This program would only cover HFCs, which under this legislation would be measured in terms of carbon dioxide equivalents as reported in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

Beginning in 2012, EPA would be permitted to issue destruction allowances to producers and importers of HFCs that perform, or arrange for, the recovery and destruction of HFCs from products or equipment already in place. Such destruction allowances—the functional equivalent of offset allowances for group I GHGs—could be used by producers and importers to satisfy a portion of the submission requirement for consumption allowances. Similar to the group I GHGs program, this program would permit unlimited banking and limited borrowing of consumption and destruction allowances, though the lifetime of an allowance for HFCs would be no more than five years after the calendar year in which the allowance is allocated. In contrast to the group I program, only those entities that produce and import HFCs would be permitted to hold, sell, transfer, exchange, and retire consumption or destruction allowances.

Of the consumption allowances established for the group II program, 5 percent would be auctioned to importers and producers of HFCs in 2010. The percentage auctioned would increase steadily in subsequent years, reaching 100 percent by 2031 and continuing at that level through 2050, the last year of the program. Those consumption allowances not

auctioned would be distributed to importers and producers of HFCs free of charge, and could then be retired, sold to other producers or importers of HFCs, or used to meet their annual obligations.

ESTIMATED COST TO THE FEDERAL GOVERNMENT

The estimated budgetary impact of S. 2191 is shown in Table 1. The costs of this legislation fall within budget functions 300 (natural resources and environment), 270 (energy), and 050 (defense). For this estimate, CBO assumes that S. 2191 will be enacted by the end of fiscal year 2008, that the amounts necessary to implement the bill will be appropriated each year, and that outlays will follow historical spending patterns for similar programs.

BASIS OF ESTIMATE

CBO estimates that implementing this legislation would result in additional revenues, net of income and payroll tax offsets, of \$304 billion over the 2009-2013 period, and about \$1.19 trillion over the 2009-2018 period. We estimate that direct spending would increase by \$281 billion and about \$1.21 trillion over the same periods, respectively. Those changes in revenues and direct spending would stem almost entirely from the process of auctioning and freely distributing allowances under the cap-and-trade programs established under this legislation. In addition, CBO estimates that enacting this legislation would increase discretionary spending by about \$3.7 billion over the 2009-2018 period, assuming appropriation of the estimated amounts.

TABLE 1. ESTIMATED BUDGETARY IMPACT OF S. 2191

	By Fiscal Year, in Billions of Dollars											
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2009-2013	2009-2018
CHANGES IN REVENUES												
Auction of Allowances	1.0	3.2	5.7	26.5	31.9	37.9	43.1	47.1	51.4	57.7	68.3	305.5
Free Allocation of Allowances	0	1.4	4.5	119.0	111.0	117.4	124.1	131.1	138.5	141.7	235.9	888.6
Other Revenues	<u>0</u>	<u>*</u>	<u>*</u>	<u>*</u>	<u>*</u>	<u>*</u>	<u>*</u>	<u>0.1</u>	<u>0.1</u>	<u>0.1</u>	<u>0.1</u>	<u>0.3</u>
Total Estimated Revenues	1.0	4.6	10.2	145.5	142.9	155.3	167.2	178.2	189.9	199.5	304.3	1,194.4
CHANGES IN DIRECT SPENDING												
Spending from Auction Proceeds												
Estimated Budget Authority	1.3	4.3	7.6	35.3	42.5	50.6	57.4	62.8	68.5	77.0	91.0	407.3
Estimated Outlays	0.1	0.4	1.4	10.2	18.8	28.1	38.6	47.9	55.5	62.3	30.9	263.3
Spending from Freely Allocated Emission Allowances												
Estimated Budget Authority	0	1.4	4.5	125.8	118.2	125.0	132.2	139.6	147.5	151.2	250.0	945.5
Estimated Outlays	0	1.4	4.5	125.8	118.2	125.0	132.2	139.6	147.5	151.2	250.0	945.5
TVA and Other Spending												
Estimated Budget Authority	0	*	*	*	*	*	0.1	0.1	0.3	0.5	*	1.0
Estimated Outlays	0	*	*	*	*	*	0.1	0.1	0.3	0.5	*	1.0
Total Changes												
Estimated Budget Authority	1.3	5.7	12.1	161.1	160.8	175.6	189.7	202.5	216.3	228.7	341.0	1,353.7
Estimated Outlays	0.1	1.8	6.0	136.1	137.0	153.1	170.9	187.6	203.3	214.0	280.9	1,209.7
NET CHANGE IN THE BUDGET DEFICIT OR SURPLUS FROM CHANGES IN REVENUES AND DIRECT SPENDING												
Impact on Deficit/Surplus ^a	0.9	2.8	4.3	9.4	5.9	2.2	-3.7	-9.4	-13.3	-14.5	23.4	-15.4
CHANGES IN SPENDING SUBJECT TO APPROPRIATION												
Estimated Authorization Level	0.2	0.3	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	1.7	4.1
Estimated Outlays	0.1	0.2	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.5	1.3	3.7

Notes: * = less than \$50 million;; TVA = Tennessee Valley Authority.

Components may not sum to totals because of rounding.

a. Positive numbers indicate decreases in deficits (or increases in surpluses); negative numbers indicate increases in deficits (or decreases in surpluses).

Budgetary Treatment of the Activities of the Climate Change Credit Corporation

The Corporation created by this legislation would be responsible for auctioning the allowances created by the federal government and for spending the resulting proceeds on various initiatives, including research and development to support renewable energy technologies, workforce development programs, wildlife adaptation programs, and programs providing financial assistance to low-income energy consumers. The Corporation effectively would be part of the federal government, and the cash flows associated with auctioning the allowances and spending the proceeds should be recorded in the federal budget. Those auctions would be carried out as part of an exercise of the government's sovereign power. Consequently, CBO would consider the funds generated from the annual sale of emission and consumption allowances to be federal revenues and the spending of the auction proceeds to be federal outlays.

Budgetary Treatment of Freely Allocated Allowances

The value of the group I allowances created and then given away at no charge should also be recorded in the budget as revenues and outlays, in CBO's view. 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. The allowances would trade in a liquid secondary market since firms or households could buy and sell them, and thus they would be similar to cash. CBO estimates that the value of the market created by the group I cap-and-trade program would be large, exceeding \$100 billion in 2012. Therefore, CBO considers the distribution of such allowances at no charge to be functionally equivalent to distributing cash.

That type of scoring approach 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 that were issued at no charge as both a revenue and an outlay would mean that those two equivalent transactions were reflected in parallel ways in the scoring process.

In contrast, the proceeds associated with the allowances allocated for free to producers and importers of HFCs should not be recorded on the budget in CBO's view, primarily because we expect that the market created for such allowances would be relatively small and illiquid. This legislation would limit the entities that could hold, sell, retire, or use consumption

allowances to the importers and producers of HFCs covered under the bill. Based on information from industry representatives, CBO estimates that fewer than 30 entities would be considered covered entities. Given the estimate of the price for consumption allowances, which is described below, CBO expects that the size and value of the overall market created by the cap-and-trade program for HFCs would be small—less than \$2 billion annually in most years. Therefore, unlike the allowances for group I GHGs, these allowances would not be sufficiently cash-like to merit inclusion in the federal budget, in CBO’s view.

Revenues

The impact of S. 2191 on federal revenues would largely be determined by the value of allowances created by the bill. Penalties for noncompliance and fees collected to administer the legislation would add a very small amount to total revenues. The following sections discuss how CBO estimated the auction prices for group I and group II allowances.

Estimating the Prices for Emission Allowances for Group I GHGs. CBO estimates that the auction price of emission allowances for the group I GHGs would rise from about \$23 per metric ton of carbon dioxide equivalent (mt CO₂e) emissions in 2009 to about \$44 per mt CO₂e in 2018. (In 2006 dollars, the auction price per mt CO₂e would rise from about \$21 in 2009 to \$35 in 2018.) Covered emissions of group I gases would decline by 7 percent in 2012 and by 17 percent in 2018 from base-case emissions; over the entire 2012-2050 period, they would decline by 42 percent from the base case. Table 2 provides CBO’s estimates of annual allowance prices for group I and group II cap-and-trade programs.

TABLE 2. ESTIMATED ALLOWANCE PRICES

	By Fiscal Year, In Dollars									
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Estimated Emission Allowance Price (Group I)	23	24	26	28	30	33	35	38	41	44
Estimated Consumption Allowance Price (Group II)	n.a.	7	7	8	8	9	9	9	9	9

Note: n.a. = not applicable.

Estimating the price for those allowances required several steps:

- A forecast (or base case) of GHG emissions expected in the United States in the absence of any federal policies to control them, as well as projections of future prices of fossil fuels, electricity, and other products and services closely associated with such emissions;
- An estimate of how firms and households would respond to increases in prices for fossil fuels and other sources of GHG emissions. CBO used those estimated responses to determine the changes in prices that would be required to induce firms and households to change their behavior and reduce their demand for electricity and other energy-intensive goods and services sufficiently to meet the proposed caps on GHGs; and
- An evaluation of provisions that would influence the market-clearing price of allowances, notably the opportunity for firms to bank allowances in one year and use them in another.

Base Case. For its base case, CBO relied primarily on projections of energy use, fossil fuel prices, and GHG emissions from the *Annual Energy Outlook 2007* (AEO 2007) and *Annual Energy Outlook 2008* (AEO 2008) published by the Energy Information Administration (EIA). CBO adjusted those projections to align them with estimates of historical emissions published by EPA, and extended the projections from 2030 to 2050.² We also adjusted the projections to take into account recent changes in how emissions of non-carbon-dioxide gases are measured in terms of carbon dioxide equivalents.³

Under current law, CBO projects that, over the 2009-2050 period, total U.S. emissions of GHGs covered under group I would increase by 42 percent, from 6,274 mmt CO₂e⁴ to about 8,900 mmt CO₂e.

Responses by Firms and Households. CBO drew from a variety of sources to estimate the responses of firms and households to changes in fossil fuel prices. To estimate how much firms and households would reduce their use of fossil fuels and fuel-intensive products under different allowance prices, CBO reviewed economic models currently used in the United

2. See U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005* (EPA 430-R-07-002, April 2007). CBO also used information provided by EPA to project the consumption of HFCs.

3. EPA's current practice, consistent with international treaty, is to use the carbon dioxide equivalent measures of the warming potential of other gases from the Second Assessment Report of the Intergovernmental Panel of Climate Change, published in 1996. By 2012, however, it is very likely that the relevant domestic and international agencies will adopt the updated measures reported last year in the Fourth Assessment Report.

4. mmt CO₂e = a million metric tons of carbon dioxide equivalent.

States to analyze energy use and GHG emissions, including models used by EIA and EPA as well as those used by academic researchers.⁵ The sensitivity of energy use by households and businesses to changes in the price of fossil fuels varies significantly among the models. Three factors influence that price sensitivity: the long-run ability of businesses to substitute low-carbon fuels for high-carbon fuels; the long-run sensitivity of energy usage to higher energy prices; and the speed at which those long-run responses unfold.

Following that review, CBO developed its own assessment of the sensitivity of carbon dioxide emissions to changes in the price of allowances.⁶ The price sensitivities that CBO used in this analysis reflect those in the reviewed models, with adjustments to assumptions about the pace at which the energy-using capital stock is likely to be replaced. CBO concluded that the response to price increases would rise substantially over time as firms and households replace existing vehicles, equipment, structures, and electricity-generating capacity with newer items that use less energy or emit smaller quantities of GHGs.

According to CBO's estimates, in 2015, a 10 percent increase in the average price of end-use energy produced from fossil fuels would induce about a 5 percent reduction in CO₂ emissions. With sustained increases in allowance prices over time, however, by 2025, a 10 percent increase would result in a nearly 9 percent reduction in emissions, with the sensitivity continuing to increase over time at a gradually decreasing rate.

Response to Opportunities for Banking of Emission Allowances. If covered entities were required to use all of their emission allowances in the year for which they were originally designated, the inflation-adjusted price of allowances would rise at a rate that is significantly greater than CBO's estimate of the expected long-run inflation-adjusted rate of return to capital in the U.S. nonfinancial corporate sector (5.8 percent). As a result, banking as allowed under S. 2191 would create opportunities for covered entities to earn greater-than-normal profits by undertaking extra GHG mitigation efforts in the initial years of the program when the prices were relatively low, banking the additional allowances, and submitting those allowances in later years, when the increasing stringency imposed by the program's declining caps would drive prices considerably higher. CBO assumed that investing in allowances would have roughly the same risk characteristics as typical investments in the U.S. nonfinancial corporate sector and that, as a consequence, covered

5. The models analyzed include the EIA's National Energy Modeling System (NEMS), the Emissions Prediction and Policy Analysis (EPPA) Model used by climate researchers at the Massachusetts Institute of Technology, the Applied Dynamic Analysis of the Global Economy (ADAGE) Model developed at RTI International and used by EPA, the Second Generation Model (SGM) and MiniCAM models developed and used by the Joint Global Change Research Institute, the Model for Evaluating the Regional and Global Effects of GHG Reduction Policies (MERGE) developed by Stanford University and EPRI, and the Multi-region National-North American Electricity and Environment (MRN-NEEM) Model developed and used by CRA International.

6. For a more detailed discussion of the techniques CBO used to develop this assessment, see Mark Lasky, *The Economic Costs of Reducing Emissions of Greenhouse Gases: A Survey of Economic Models*, CBO Technical Paper (May 2003).

entities would bank allowances up to the point at which the expected rate of return for doing so—that is, the expected rate of increase of mitigation costs over time—was equal to the expected rate of return from firms’ alternative investment opportunities in that sector (5.8 percent).

In the early years of the program, the opportunity for banking allowances would have a significant impact on the amount of emissions reduced, and thus on the emissions allowance price. CBO estimates that by 2018, covered entities would undertake significantly more mitigation than necessary to meet their annual emission caps, banking about 1.3 billion mt CO₂e of allowances and raising the allowance price by about 27 percent, compared with a policy that prohibited banking. Assuming that covered entities bank allowances in such a way as to have no allowances left at the end of 2050—the last year of the program—banked allowances would be roughly equivalent to the annual emissions cap for group I gases for much of the 2030s.

Response to Offsets. CBO assumed that covered entities would take as full advantage of opportunities to obtain domestic offsets as is economically sensible, with a significant effect on allowance prices. We also assumed that the opportunity to obtain international emission allowances from markets of “comparable stringency” would not influence the price of domestic allowances. CBO is uncertain at this time about whether comparable markets would exist over the next 10 years, whether EPA would determine that any other markets for GHG emission allowances were of “comparable stringency,” or whether allowance prices in such markets would be higher than, similar to, or lower than the price of domestic allowances at any given time.

Estimating the Price of Consumption Allowances for HFCs. CBO estimates that the auction price of consumption allowances for HFCs would be in the vicinity of \$7 per mt CO₂e beginning in 2010. The cap would reduce group II emissions by about 40 percent in 2015, from about 450 mmt CO₂e to about 270 mmt CO₂e. For this estimate, CBO constructed a base-case projection of HFC production similar to a base case produced by EPA and consulted with industry sources, including a manufacturer and a recycler of HFCs. Based on information provided by those sources, CBO concluded that the price for the allowances is likely to be driven by responses to increasing prices of HFCs, by prices paid for the recycling of HFCs, and, over time, by prices of less harmful substitutes.

By restricting the domestic supply of new HFCs below demand, the cap would tend to raise the price of HFCs, reducing the quantity demanded. CBO assumed that in the short term, demand for HFCs would be roughly as responsive to price increases as the demand for gasoline is, but that demand would become increasingly responsive over time as alternatives became available and equipment was replaced. Higher prices also would encourage recyclers to meet some of the demand by removing existing HFCs from older products, processing them, and making them available for sale. Over time, the cap for HFCs also would

encourage the development and deployment of new types of HFCs and products designed around them. However, such innovations would take time to penetrate markets, and it is difficult to estimate the extent to which they are likely to displace the demand for existing products over the next decade. Thus, CBO anticipates that in the early years of the program, importers and exporters of HFCs would most likely turn to recycling their HFCs—currently costing roughly \$8 per pound—as a primary means of meeting the restrictions imposed by the cap set under this legislation. In later years, alternative products of roughly similar costs would likely displace the supply for HFCs in new equipment. Given the likely price trajectory for HFC allowances, CBO did not find that it would be profitable for firms to bank allowances for future use.

Net Revenue Calculation. Based on the estimated auction price of allowances discussed above for both cap-and-trade programs, we estimate that auctioning the allowances would generate revenues net of income and payroll tax offsets of about \$68 billion over the 2009-2013 period and \$306 billion over the 2009-2018 period. In addition, creating and freely distributing the emission allowances for the group I GHGs to various recipients would generate revenues, net of income and payroll tax offsets, of about \$236 billion and \$889 billion over the same periods, respectively, by CBO's estimate.

The receipts from selling or giving allowances away would be indirect business charges that reduce the federal tax base for income and payroll taxes. Except in certain cases, CBO estimates that a portion of the gross gain to the federal government from such receipts would be offset by reductions in those other revenues; we assume that offset totals 25 percent—an approximate marginal tax rate on overall economic activity.

That longstanding methodology is widely used in the federal budget process to estimate the effects of legislation and assumes that overall economic activity (GDP) is held constant. Under that assumption, higher amounts of indirect business charges reduce other income in the economy. For example, if firms that must purchase allowances would be unable to pass those costs along, their profits would fall. More likely, some substantial portion would be passed along to others in the economy, such as consumers and employees, and other income would fall. Either way, the result would be lower taxable income in the economy, which would reduce federal revenues from income and payroll taxes.

For this estimate, CBO did not apply the 25 percent reduction to all of the gross revenues, however, depending on how those revenues would be used. To the extent that the revenues would be used in ways that would generate new taxable income, such uses would offset the loss of income and payroll taxes that would result from the initial purchase of allowances. Therefore, CBO did not apply the 25 percent reduction to any revenues that would be used to make transfer payments to taxable entities without any conditions placed on the recipient regarding the use of those payments. While such transfer 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 generates additional federal revenue that would essentially offset the 25 percent reduction in revenue collections. Most of the estimated revenues from allowances given away under S. 2191 would be used for such purposes.

CBO also did not apply the 25 percent reduction in revenues to any allowances that would be given away under the bill and would not be immediately taxable to the individuals or businesses that receive them, but would generate taxable income when they were used or sold to others. Such allowances include those given away to facilities that generate electric power from fossil fuels and to facilities that produce or import petroleum-based fuel.

In contrast, we applied 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) because such government spending would substitute for other economic activity (under the assumption that GDP is unchanged by the bill). As a result, revenue used in this way would not generate any new taxable income. All of the proceeds from the auction of allowances would be used for those purposes.

Other Revenues. Under S. 2191 civil penalties would be assessed at \$25,000 per day for those owners and operators who fail to meet the reporting requirements for the federal registry established under this legislation. Penalties also would be assessed at the greater of \$200 or three times the market rate for an emission allowance for those owners and operators who fail to submit the adequate number of allowances for the pollutants covered under the bill. Because those fees would be substantial, we would expect most firms to comply with the requirements of the bill. However, the number of entities covered by this legislation is large and thus it is likely that some noncompliance would occur. Penalties collected on emissions of sulfur dioxide and nitrogen oxides in excess of submitted allowances under EPA's Acid Rain Program, a similar program, are usually small, though there have been two large collections over the past few years, totaling about \$4 million. Based on those factors, CBO estimates that penalty collections under S. 2191 would total between \$25 million and \$50 million dollars annually, beginning in 2012.

This legislation also would establish a Carbon Market Efficiency Board, which would be responsible for monitoring the emissions trading market, periodically reporting to the President and the Congress on its operations, and implementing cost-relief measures, such as increasing the amount of allowances that covered entities may borrow and lengthening the payback period of such loans, to ensure that the market for allowances is stable, functioning, and efficient. The board would consist of seven members appointed by the President with the advice and consent of the Senate, and would have the authority to levy on owners and operators of covered facilities an assessment sufficient to pay the board's estimated expenses, including the salaries of the board members. CBO estimates that over the next 10 years, the

board would levy assessments totaling \$2 million to \$4 million annually; those amounts would be recorded on the budget as revenues.

Direct Spending

CBO estimates that enacting this legislation would increase direct spending by \$1.2 trillion over the 2009-2018 period. Outlays would stem from both spending of auction proceeds on several ongoing government programs and new federal initiatives that would be established by the legislation and from giving allowances to states and other entities free of charge. The components of the estimated direct spending are discussed below.

Spending of Auction Proceeds. Revenues from the auction of emission allowances for the group I GHGs would be deposited into seven funds established by the Department of the Treasury. Spending from those funds would not require any further appropriation action. CBO's estimate of direct spending by funds over the 2009-2018 period is as follows:

- The Energy Assistance Fund (\$64 billion) would support various energy assistance programs for low-income persons and other initiatives;
- The Climate Change Worker Training Fund (\$12 billion) would primarily support training programs for workers;
- The Adaptation Fund (\$31 billion) would primarily support research and education activities by the Department of the Interior to assist fish and wildlife in adapting to the impacts of climate change;
- The Climate Change and National Security Fund (\$16 billion) would finance steps to implement recommendations stemming from the International Climate Change Adaptation and National Security Program established under this legislation;
- The Bureau of Land Management Emergency Firefighting Fund (\$2 billion) would support fire suppression activities on federal wildlands;
- The Forest Service Emergency Firefighting Fund (\$6 billion) would support fire suppression activities on federal wildlands; and
- The Energy Independence Acceleration Fund (\$6 billion) would support research activities by the Department of Energy.

In addition, auction proceeds would be allocated to the Energy Deployment Program, and the Corporation would have the authority to spend a specified percentage of the auction proceeds on that program without further appropriation action. CBO estimates that spending for that program would total about \$123 billion over the next 10 years. In total, CBO estimates that spending from those funds and on the Energy Deployment Program would increase direct spending by about \$30 billion over the 2009-2013 period and by about \$260 billion over the 2009-2018 period. In addition, some proceeds would be deposited into the Climate Security Act Management Fund; however, spending from this fund could not occur without further appropriation action.

Revenues from the auction of consumption allowances for the group II GHGs also would be spent by the Corporation without further appropriation to support various initiatives. Those initiatives would include efforts to recover and destroy the maximum economically recoverable amount of chlorofluorocarbons and halons from existing and obsolete equipment and products and a program to provide incentives for consumers to purchase refrigeration and cooling equipment that contains refrigerants with no or low global-warming potential. We estimate that those provisions would increase direct spending by about \$400 million over the 2009-2013 period and by about \$3 billion over the 2009-2018 period.

Outlays Associated with Emission Allowances Freely Allocated. CBO estimates that direct spending would increase by about \$250 billion over the 2009-2013 period and by \$946 billion over the 2009-2018 period when the government distributes the emission allowances free of charge to various recipients, beginning in 2010.

Spending by the Tennessee Valley Authority (TVA) and Other Outlays. Implementing this bill would increase net direct spending by TVA by about \$1 billion over the 2009-2018 period, but CBO estimates such spending should have no net impact on the budget over time. TVA is one of the nation's largest electricity marketers and currently accounts for about 5 percent of the country's coal-generation capacity. For this estimate, CBO assumes that TVA would retire existing coal plants faster than under current law, possibly replacing about 10 percent of its coal capacity by 2020. Given the time needed to plan and build new plants, we assume that such investments would begin after 2013 and total about \$1 billion over the 2013-2018 period. TVA is required to recover all of its costs over time through proceeds from electricity sales and typically recovers the cost of such capital investments over a 30-year period after the plant goes into service. Thus, CBO estimates that the additional capital spending necessary to comply with this bill would have no net effect on direct spending over time. Similarly, we estimate that purchases of allowances would have no net impact on TVA's direct spending because such operating expenses should be recovered immediately through higher receipts from sales of electricity.

CBO estimates that direct spending by the Carbon Market Efficiency Board would total about \$17 million over the 2009-2013 period and \$37 million over the 2009-2018 period. Such spending would stem from the fees collected by the board to cover its administrative costs.

Budgetary Impact After 2018

After 2018 and through 2050, annual direct spending would continue to exceed net revenues attributable to this legislation, CBO estimates. Consequently, in each of the three 10-year periods after 2018, the difference between revenues and direct spending would cause an increase in the on-budget deficit greater than \$5 billion. The estimated on-budget deficits after 2018 stem from the budgetary consequences of auctioning allowances and spending the proceeds on government activities. As discussed in the earlier section entitled Net Revenue Calculation, net receipts to the government from those auctions, after accounting for their impact on receipts from income and payroll taxes, would equal about 75 percent of the amounts paid for the allowances that are auctioned. At the same time, the legislation would specify the spending of 100 percent of those proceeds. Thus, new direct spending under the legislation would exceed new revenues attributable to its enactment.

Spending Subject to Appropriation

Assuming appropriation of the necessary amounts, CBO estimates that implementing this legislation would increase discretionary spending by about \$3.7 billion over the 2009-2018 period.

Funding for the Environmental Protection Agency. S. 2191 would authorize the appropriation of whatever amounts are necessary from the Climate Security Act Management Fund established by the legislation for EPA to implement the bill's requirements, beginning in 2012. EPA could also distribute funds to various federal agencies that would help administer the proposed cap-and-trade programs.

Based on our analysis of how similar large government programs have been implemented, CBO estimates that implementing S. 2191 would require the appropriation of \$200 million in 2009 and \$1.7 billion over the 2009-2013 period. Such funding would primarily cover costs associated with hiring up to 400 additional personnel, developing rules, implementing programs to monitor air quality programs, and reporting to the Congress on the pollution control programs that would be established by the bill.

Funding for the Department of Energy. Under this legislation, the Department of Energy (DOE) would establish standards for increasing the energy efficiency of certain appliances, products, and buildings. In coordination with other federal agencies, DOE would also be required to assess the feasibility of constructing pipelines and other facilities related to the sequestration of carbon dioxide. Assuming appropriation of the necessary amounts, CBO estimates that those activities would cost \$2 million in 2009 and \$10 million over the 2009-2013 period, particularly for the cost of providing financial and technical assistance to states to update and enforce building codes. That estimate is based on historical costs for similar DOE activities.

Funding for the Department of the Interior. Section 8002 would require a national assessment by the U.S. Geological Survey of geological formations in the United States and their potential capacity for storing carbon dioxide. Section 8003 would require the Secretary of Energy, in coordination with other agencies, to conduct a study to assess the feasibility of constructing pipelines to transport carbon dioxide for the purpose of sequestration or enhanced oil recovery. CBO estimates that carrying out the studies would cost \$31 million over the 2009-2013 period.

ESTIMATED IMPACT ON STATE, LOCAL, AND TRIBAL GOVERNMENTS

S. 2191 contains several intergovernmental mandates as defined in the Unfunded Mandates Reform Act. CBO estimates that states would realize a net benefit as a result of the bill's enactment and that the threshold for intergovernmental mandates established in UMRA (\$68 million for intergovernmental mandates in 2008, adjusted annually for inflation) would not be exceeded.

Specifically, the bill would require covered facilities, including electric power plants, to participate in a cap-and-trade program for GHGs. State and local governments own roughly 10 percent of those electric power facilities and would be required to:

- Submit an emission allowance to EPA for each metric ton of carbon dioxide equivalent produced, imported, or emitted;
- Reduce emissions of GHGs annually through 2050;
- Participate in the Federal Greenhouse Gas Registry by submitting periodic reports to EPA, including annual and quarterly data regarding GHG emissions and production; and
- Provide information to EPA to verify the accuracy of data on fossil fuels and GHGs.

As part of the requirement to submit emission allowances, the bill would give state, local, and tribal governments free allowances to offset the costs associated with the bill. CBO estimates that the number of allowances given to those governments collectively would exceed the amount they need to satisfy the requirements under the cap-and-trade program. In addition, states would be allowed to sell the surplus allowances at market value. CBO estimates that the proceeds from selling excess allowances would more than offset the costs of the mandates and would result in a net benefit to state, local, and tribal governments totaling approximately \$33 billion from fiscal year 2012 (the first year the mandates are effective) through fiscal year 2016.

Although the bill would result in a net benefit to state, local, and tribal governments, variations among regions and among levels of government are likely. Utilities in some parts of the country rely more on technologies that emit high levels of carbon than those in other regions. In those cases, publicly owned power plants would face higher costs and might not have excess credits to sell. Similarly, local governments are more likely than state governments to own and operate utilities. Consequently, they could face costs while the benefits would accrue to state governments. Nationwide, however, state, local, and tribal governments would receive a net benefit from enacting the bill.

S. 2191 also contains several smaller mandates. Some reporting requirements would begin in 2009, and covered facilities, including those owned and operated by state, local, and tribal governments, would incur costs before the start of the cap-and-trade programs in 2012. According to EPA, the majority of the electric energy sector is already required to report similar data to EPA under the Clean Air Act. In addition, the bill would require each state to certify that it has reviewed and updated the provisions of residential and commercial building codes for energy efficiency. CBO estimates that the costs associated with those mandates would be small.

In addition, S. 2191 would give state governments free allowances in exchange for implementing voluntary regulations, assisting mass transportation systems, and augmenting recycling programs. CBO estimates the value of those additional allowances, which could be sold, would be approximately \$58 billion through 2016.

Finally, the bill would create several grant programs for workforce training, state energy adaptation strategies, and research and development of energy efficiency technologies. Those grant programs would benefit participating state, local, and tribal governments, and any costs would be incurred voluntarily as a condition of receiving federal assistance.

ESTIMATED IMPACT ON THE PRIVATE SECTOR

S. 2191 would impose several private-sector mandates as defined in UMRA. Those mandates would require entities in the private sector to comply with various measures to reduce emissions of GHGs. The most costly mandates would require certain types of private-sector entities to participate in the cap-and-trade programs for GHGs created in the bill. CBO estimates that the direct cost of the mandates in the bill would substantially exceed the annual threshold established in UMRA for private-sector mandates (\$136 million in 2008, adjusted annually for inflation).

Cap-and-Trade Programs

Group I Greenhouse Gases. The cap-and-trade program for group I GHG emissions would require covered facilities to submit one allowance per metric ton of carbon dioxide equivalent emitted beginning in 2012. The direct cost to the private sector would be equal to the cost to covered facilities to acquire allowances beyond the amount allocated to them for free under the bill, to purchase offsets to cover their emissions, and to directly reduce their emissions of GHGs. Based on the estimated allowance prices in Table 2, CBO estimates that the total cost of this requirement would amount to about \$90 billion in 2012 and more in subsequent years. The allowance prices, purchases, and emission reductions used in estimating those costs account for the banking of allowances.

While covered facilities would be responsible for the initial cost, CBO estimates that most of that cost would ultimately be passed on to consumers in the form of higher prices for energy and energy-intensive goods and services.⁷ The bill would create several mechanisms to mitigate some of the costs to consumers. The bill would provide allowances to electricity and natural gas companies that sell to retail consumers to mitigate the costs to low- and middle-income consumers or to promote energy efficiency. States also would receive allowances and could use the funds from the sale of those allowances to lessen the costs to low-income consumers. In addition, funds from auctioned allowances deposited into the Energy Assistance Fund would help mitigate the costs to low-income consumers.

In addition to submitting allowances, covered facilities would be required to report GHG emissions data to the federal registry. Based on information from EPA, CBO expects that the cost to comply with this reporting requirement would be small. Covered facilities also would be required to pay a fee to the Carbon Market Efficiency Board to cover the operating costs of the board. CBO estimates that the fees would total \$2 million to \$4 million annually.

7. See Congressional Budget Office, *Trade-Offs in Allocating Allowances for CO₂ Emissions* (April 25, 2007) and *Shifting the Burden of a Cap-and-Trade Program* (July 2003).

Group II Greenhouse Gases. The cap-and-trade program for HFC consumption would require producers and importers of HFCs to submit consumption or destruction allowances annually, beginning in 2010, for each carbon dioxide equivalent of HFC produced or imported in the United States during the preceding calendar year. The direct cost to the private sector would be the cost to those entities to acquire consumption allowances beyond the amount allocated to them for free, to purchase destruction allowances, and to recycle HFCs. Based on the estimated consumption allowance prices in Table 2, CBO estimates that the cost to HFC producers and importers to purchase the auctioned allowances in 2010 would be about \$100 million and would increase in subsequent years.

Carbon-Intensive Goods. The bill would direct EPA to establish a program for certain carbon-intensive goods that would require importers of those goods, beginning in 2020, to submit international reserve allowances. Specifically, this provision would target carbon-intensive goods imported from countries that do not have equivalent carbon-reduction policies in place. International reserve allowances could be purchased from the federal government or acquired through a trading system if one is established. Importers also could submit approved foreign allowances or credits. Because of uncertainty about the number of allowances that would be required per product and the countries whose goods would be required to be covered by allowances, CBO cannot estimate the cost of this mandate.

Other Mandates

S. 2191 would impose several other mandates on private-sector entities. The bill would direct EPA to regulate the sale, distribution, use, and disposal of HFC refrigerants with a high global-warming potential used in appliances or industrial refrigeration equipment. It also would prohibit the sale of small containers of HFC refrigerants with a high global-warming potential for the servicing of motor vehicle air conditioners except to certified technicians. Based on information from EPA analyses of proposed rules to regulate HFC refrigerants, CBO expects that the cost of each of those mandates would be small relative to the threshold in UMRA.

The bill also would impose a mandate by requiring fuel providers to reduce the average lifecycle GHG emissions in transportation fuel. The cost of that mandate would depend on the method used by EPA to measure lifecycle GHG emissions from all transportation fuels. Lastly, the requirement that state governments certify updates of building codes related to energy efficiency could impose a mandate on developers. Because of uncertainty about the number of buildings affected by those state codes, CBO cannot estimate the cost of that mandate.

COMPARISON WITH OTHER ESTIMATES

Estimates of the cost to purchase allowances created for a program to restrict GHG emissions can vary for many reasons. The most important differences among estimates of the price of those allowances are:

- *Base case projections* of GHG emissions and energy prices;
- The assumed *responsiveness* of households and firms to changes in prices of goods and services associated with emissions;
- The *discount rate* that allowance holders are assumed to apply to decisions about whether to bank allowances and how many to bank. The lower the assumed discount rate, the more emission reductions covered entities are likely to undertake in early years of the program so that they can have somewhat higher emissions in later years. Thus, a lower discount tends to raise the estimated allowance price in early years but lower it in later years;⁸ and
- The *availability of offsets*. The more domestic or international offsets that would be available, and the cheaper those offsets would be, the lower the allowance price would be.

CBO is not aware of any published analysis of S. 2191 that presents a 10-year estimated impact on federal revenues and expenditures. Three analyses of S. 2191 as ordered reported by the Senate Committee on Environment and Public Works are currently publicly available. Those studies report different estimates of allowance prices for group I GHGs than does CBO. That allowance price is perhaps the most important determinant of the estimated budgetary impact of the legislation.

One of the analyses, published by the Massachusetts Institute of Technology's (MIT's) Joint Program on the Science and Policy of Global Change, uses the Emissions Prediction and Policy Analysis (EPPA) Model to estimate allowance prices.⁹ The MIT analysis reports an emission allowance price, measured in 2005 dollars, of nearly \$48 per mt CO₂e equivalent for the year 2015. In comparison, CBO's estimate of the allowance price in 2015 is about \$29 in 2005 dollars. The difference in price occurs largely because:

8. All else being equal, changing the assumed discount rate by one percentage point would change CBO's permit price for group I emissions in 2015 by roughly \$6 to \$7.

9. See Paltsev and others (2008), "Appendix D: Analysis of the Cap and Trade Features of the Lieberman-Warner Climate Security Act (S. 2191)," available at http://web.mit.edu/globalchange/www/MITJPSPGC_Rpt146_AppendixD.pdf.

- The MIT analysis assumes higher emissions in its base case than CBO does, requiring higher allowance prices to reach the cap.
- MIT uses a much lower discount rate than CBO, resulting in more banking and thus higher allowance prices in the early years of the program.
- MIT does not allow for the possibility of offsets from domestic agriculture and forestry activities, also resulting in higher allowance prices.

Those differences are partially offset by the fact that the EPPA model used by MIT assumes more price responsiveness among households and firms than CBO's analysis, tending (all else being equal) to reduce the estimated allowance price.

A second analysis, released by EPA, uses several different models to estimate allowance prices, including the Intertemporal General Equilibrium Model (IGEM) and Applied Dynamic Analysis of the Global Economy (ADAGE) models.¹⁰ That analysis reports a wide range of estimates for emission allowance prices in 2015—from \$11 to \$77 per mt CO₂e, measured in 2005 dollars—based on varying assumptions about baselines and the projected availability of technologies and offsets as well as on different models. That range brackets CBO's estimate for 2015 of \$29 per mt CO₂e. Differences between EPA's estimates of allowance prices and those of CBO can be traced to several sources:

- EPA's reference case assumes more emissions than CBO's base case. (For one scenario, EPA assumes an alternative reference case that appears to be roughly comparable to CBO's base case.)
- One of EPA's models (ADAGE) assumes more responsiveness to changes in prices of goods and services associated with emissions than does CBO's analysis, while the other (IGEM) appears to assume less. For any given policy proposal, all else being equal, CBO's estimate of the allowance price should fall between estimates from EPA's models.
- EPA assumes a somewhat lower discount rate than CBO, and that assumption results in more banking and higher allowance prices in the early years of the program.
- For different scenarios, EPA assumes domestic and international offsets ranging from zero to unlimited. In its standard scenarios, EPA assumes that domestic and international offsets can each equal 15 percent of the total number of submitted allowances in each year, tending to moderate the price of emission allowances.

10. See U.S. Environmental Protection Agency, *EPA Analysis of the Lieberman-Warner Climate Security Act of 2008 S. 2191 in 110th Congress* (March 14, 2008). Available at http://www.epa.gov/climatechange/downloads/s2191_EPA_Analysis.pdf.

A third analysis, by the Clean Air Task Force (CATF), uses a version of the National Energy Modeling System (NEMS) to estimate allowance prices.¹¹ That analysis reports an emission allowance price (measured in 2005 dollars) of about \$16 per mt CO₂e for the year, about 44 percent lower than CBO's cost estimate of \$29 per mt CO₂e. That difference in prices largely occurs because:

- CATF uses a higher discount rate than CBO, resulting in no emissions banking before 2018 and much lower allowance prices.
- CATF assumes that domestic and international offsets will each equal 15 percent of the number of emission allowances in each year, also tending to reduce allowance prices.

A fourth analysis, by CRA International, uses the MRN-NEEM Model to estimate allowance prices.¹² The CRA analysis indicates an emission allowance price, measured in 2007 dollars, of about \$50 per mt CO₂e for 2015. In comparison, CBO's estimate of the allowance price in that year is about \$30 in 2007 dollars. The difference in price occurs largely because CRA uses a much lower discount rate than CBO, resulting in more banking and thus higher allowance prices in the early years of the program.

PREVIOUS CBO ESTIMATE

On April 10, 2008, in addition to this estimate, CBO provided a cost estimate for S. 2191 with a proposed amendment transmitted to CBO on April 9, 2008. That amendment would change the allocation of emission allowances that would be auctioned and given away at no charge. Compared with the version of S. 2191 including the proposed amendment, CBO estimates that, over the 2009-2018 period, the reported bill would result in \$15 billion less in revenues, \$79 billion more in direct spending outlays, and \$81 billion less in spending subject to appropriation. Those differences result from provisions in the amendment that would increase the portion of allowances that would be auctioned, deposit a portion of auction proceeds into a Climate Change Deficit Reduction Fund, and make spending from that fund subject to appropriation.

11. See Clean Air Task Force, *The Lieberman-Warner Climate Security Act—S. 2191: A Summary of Modeling Results from the National Energy Modeling System* (February 2008). Available at http://www.catf.us/publications/presentations/CATF_LWCSA_Short_Hill_Briefing_with_CAFE.pdf

12. See Montgomery and Smith (2008), "Economic Analysis of the Lieberman-Warner Climate Security Act of 2007 Using CRA's MRN-NEEM Model," available at http://www.nma.org/pdf/040808_crai_presentation.pdf.

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