

CRS Report for Congress

Emission Allowance Allocation in a Cap-and-Trade Program: Options and Considerations

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Prepared for Members and
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Emission Allowance Allocation in a Cap-and-Trade Program: Options and Considerations

Summary

When designing a cap-and-trade program, one of the more controversial and challenging questions for policymakers is *how, to whom, and for what purpose* to distribute the emission allowances. Regarding the *method* of distribution to covered sources, policymakers could (1) sell the allowances through an auction process, (2) allocate the allowances at no cost to covered sources, (3) provide allowances to non-covered sources who would, in turn, sell them to covered sources, or (4) use some combination of these methods. Although the emission allocation method *would not* affect the environmental integrity of the cap-and-trade program, the selected allocation strategy could have considerable consequences.

Using auctions as a distribution method could avoid certain concerns that are likely to occur if covered sources receive all (or most) of the allowances at no cost: (1) consumers in different electricity markets may face inequitable price increases; (2) a weak price signal for electricity may be sent in areas with the most carbon-intensive fuel portfolios; and (3) no-cost allowances may overcompensate covered sources. In addition, auction revenues offer a unique opportunity to reduce the overall costs of the emissions program. Several economic studies indicate that if used in the most efficient manner, overall costs could be minimized by almost 50%.

A greenhouse gas (GHG) emission cap-and-trade program would create a valuable new commodity: the GHG emission allowance. EPA estimates that allowance value could potentially account — in aggregate — for tens or hundreds of billions of dollars each year. When distributing this value, policymakers would face a choice between minimizing the costs imposed on the entire economy, minimizing the expected burden on specific parties, or supporting a range of climate- or non-climate-related policy objectives.

For example, Congress may consider providing transition assistance to carbon-intensive industries. Studies have estimated profits could be maintained in the energy production and electricity generation sectors, if approximately 20% of allowances were provided to those sectors at no cost. Members may also consider allotting allowance value to consumers, particularly low-income households, who are expected to bear the majority of the compliance costs via higher energy prices. Another option would involve distributing the allowance value to support various objectives: technology development, energy efficiency improvements, biological sequestration, climate change adaptation efforts, or non climate-related purposes, such as deficit reduction. Of these objectives, technology advancement is arguably the most crucial in terms of mitigation. Moreover, deployment of new technologies could potentially lower the overall costs of the program.

Although many of the proposals in the 110th Congress (e.g., S. 2191, S. 1766, and S. 3036) would employ an auction to some degree, none of the bills specifies the design of the auction. Congress may want to consider including specific design elements in legislative text, particularly auction frequency and whether or not the auction should have a reserve price, and if so, at what level.

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Emission Allowance Allocation in a Cap-and-Trade Program: Options and Considerations

Introduction

Climate change issues have generated interest and debate over the past two decades. In 1992, the United States ratified the United Nations Framework Convention on Climate Change (UNFCCC). Arguably, in recent years the primary issues under debate have shifted from science — such as the role of greenhouse gas (GHG) emissions from human activities¹ — to policy. For instance, a 2005 Sense of the Senate Resolution on climate change² stated:

It is the sense of the Senate that Congress should enact a comprehensive and effective national program of mandatory, market-based limits and incentives on emissions of greenhouse gases that slow, stop, and reverse the growth of such emissions at a rate and in a manner that, No. 1, will not significantly harm the U.S. economy and, No. 2, will encourage other action and key contributors to global emissions.

In the 110th Congress, Members have introduced several bills that would establish a market-based,³ mandatory GHG emission reduction program.⁴ Most of these proposals would establish some type of cap-and-trade system to regulate GHG emissions.⁵ For a brief primer on cap-and-trade systems, see **Appendix A**.

¹ The Intergovernmental Panel on Climate Change (IPCC) concluded in 2007 that “most of the observed increase in globally averaged temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations” (emphasis added). IPCC Working Group I, *Climate Change 2007: The Physical Basis* (Cambridge, UK: Cambridge University Press, 2007). See CRS Report RL34266, *Climate Change: Science Update 2007*, by Jane Leggett.

² Senate Amendment No. 866 to H.R. 6 (109th Congress), passed by voice vote June 22, 2005. A motion to table the amendment was rejected by a roll call vote (44 - 53).

³ The policy alternative to a market-based approach would likely require specific emission limits or particular technological controls for specific emission sources.

⁴ See CRS Report RL34067, *Climate Change Legislation in the 110th Congress*, by Jonathan L. Ramseur and Brent Yacobucci.

⁵ Another market-based approach would entail a carbon tax. Some of the cap-and-trade proposals include elements (e.g., safety-valve) that are akin to a carbon tax. These proposals are often described as hybrid approaches. See CRS Report RL33846, *Greenhouse Gas Reduction: Cap-and-Trade Bills in the 110th Congress*, by Larry Parker and Brent D.

(continued...)

In designing a cap-and-trade program, one of the more controversial and challenging questions for policymakers is how, to whom, and for what purpose to distribute the emission allowances. Concerning the question of how to distribute allowances, policymakers could (1) sell the allowances through an auction process (2) allocate the allowances at no cost to covered sources, (3) provide allowances to non-covered sources, who would, in turn, sell them to covered sources via the emissions trading market, or (4) use some combination of these methods.

Regardless of the method of distribution, emission allowances would have monetary value in a carbon-constrained regime, such as a cap-and-trade program. If an auction is used, policymakers could distribute auction revenues to a wide range of parties to support various policy objectives. Likewise, policymakers could allot allowances at no cost to non-covered entities — e.g., federal or state agencies, among others — to promote the same (or different) objectives.

By addressing the question of how, to whom, and for what purpose to distribute the emission allowances, policymakers would craft an allocation strategy. The strategy *would not* affect the environmental integrity of the emissions cap.⁶ In addition, covered entities would generally face the same emission reduction decisions under either allocation strategy.⁷ A “common misconception” is that if covered sources receive allowances at no cost, the sources would behave differently from sources who purchased allowances through an auction.⁸ Economists point out “free allowances”⁹ have value, and when covered entities submit an allowance for compliance purposes, the entities forgo the opportunity¹⁰ to sell the unused allowance in the emissions trading market.¹¹

The first two sections of this report discuss the primary emission allowance distribution *methods*: auctions and no-cost distribution to covered sources. These

⁵ (...continued)
Yacobucci.

⁶ U.S. Environmental Protection Agency (EPA), Office of Air and Radiation, *Tools of the Trade: A Guide To Designing and Operating a Cap and Trade Program For Pollution Control* (2003).-B-03-002.

⁷ There are two noteworthy exceptions: electric utilities operating in a price-regulated market (discussed below) and facilities that receive allowances based on an output-based distribution system. Robert Stavins, *A U.S. Cap-and-Trade System to Address Global Climate Change* (2007), The Hamilton Project, Brookings Institution.

⁸ Congressional Budget Office, *Trade-Offs in Allocating Allowances for CO2 Emissions* (2007), Economic and Budget Issue Brief.

⁹ Like there is no free lunch, free allowances are not really free. However, this report uses the phrase “distribution at no cost” and “free allowances” interchangeably.

¹⁰ In economics parlance, this is referred to as a firm’s “opportunity cost.”

¹¹ See National Commission on Energy Policy, *Allocating Allowances in a Greenhouse Gas Trading System* (2007); Congressional Budget Office, *Trade-Offs in Allocating Allowances for CO2 Emissions* (2007), Economic and Budget Issue Brief; Dallas Burtraw, *Cap, Auction, and Trade: Auctions Revenue Recycling under Carbon Cap and Trade* (2008), Testimony Prepared for the House Select Committee on Energy Independence and Global Warming.

sections examine the potential benefits and concerns of these allocation mechanisms. The final section identifies different options and policy considerations for Congress when determining to whom and for what purpose to distribute the value of the emission allowances. The allocation strategy would have substantial consequences for the cost of the cap-and-trade program and how the costs are apportioned.

Auctions

In recent years, the use of auctions to allocate emission allowances has generated considerable interest.¹² Several of the cap-and-trade proposals from the 110th Congress — including S. 2191, which was reported from the Senate Environment and Public Works Committee on May 20, 2008 — would use auctions to allocate an increasing percentage of the cap's emission allowances.¹³

This section describes the potential benefits that auctions may provide, if used to distribute allowances to covered sources in a cap-and-trade program. In addition, this section discusses auction design issues and considerations for policymakers.

Implementation Benefits

In general, the *concept* of an auction is relatively simple to understand.¹⁴ Auctions would allow the market to determine which entities receive emission allowances and at what price: parties placing the highest value on the allowances would receive them. With this allocation method, policymakers would be relieved of the responsibility to make distribution decisions, a process that might be described as picking winners and losers.¹⁵ For this reason, auctions are generally considered to be the most transparent mechanism for distributing allowances.

In addition, in a free allocation format parties would have strong incentives to seek increasing shares of the overall allowance allotment.¹⁶ Parties with resources

¹² The 10 states participating in the Regional Greenhouse Gas Initiative (RGGI) have agreed to auction at least 25% of their allowances, and several of the RGGI states intend to auction almost 100% of their allotments. See CRS Report RL33812, *Climate Change: Action by States To Address Greenhouse Gas Emissions*, by Jonathan L. Ramseur.

¹³ For a comparison of the cap-and-trade bills see CRS Report RL33846, *Greenhouse Gas Reduction: Cap-and-Trade Bills in the 110th Congress*, by Larry Parker and Brent D. Yacobucci.

¹⁴ The logistics of establishing and running an auction are more complicated. This issue is discussed below.

¹⁵ U.S. Environmental Protection Agency (EPA), Office of Air and Radiation, *Tools of the Trade: A Guide To Designing and Operating a Cap and Trade Program For Pollution Control* (2003).

¹⁶ This behavior is described as “rent-seeking” in economic contexts. Dallas Burtraw, Prepared Testimony before the House Select Committee on Energy Independence and Global Warming, January 23, 2008.

available for such efforts may have an advantage. An auction system would eliminate this behavior.

Polluter Pays Principle

Requiring emission sources to purchase emission allowances would support the “polluter pays” principle. In a general environmental policy context, the polluter pays principle holds that pollution costs should be borne by the polluting facility or industry, not society at large. To accomplish this objective, pollution costs should be included in the overall price of a good. Proponents of the polluter pays notion would likely argue that if products are priced to reflect environmental costs — air pollution, land use, GHG emissions — demand for these products may decline.

Advocates of polluter pays maintain that the environment and the services it provides are a shared public good. Under this framework, facilities should have to pay for the right to pollute (i.e., emit GHGs). If allowances are provided at no cost to emission sources, the polluter pays principle would be violated.

Potential Minimization of Costs on Society

If Congress decides to use an auction to distribute emission allowances to covered sources — as opposed to providing allowances to covered sources at no cost — the auction revenues could be used to substantially minimize the overall costs on society of the cap-and-trade program.

Economic studies have found that, if revenues are used *in the most economically efficient manner*, the overall costs imposed by a cap-and-trade program could be reduced by approximately 50%.¹⁷ Economists maintain that the most economically efficient application of revenues would be to offset reductions in taxes on desirable activities, such as employment or personal income.¹⁸ The opportunity to use allowance value in this manner and thus minimize overall costs to this extent is unique to the auction mechanism.¹⁹ However, many observers argue that applying auction revenues in this fashion is politically unlikely.²⁰ Other potential uses of the

¹⁷ This cost savings estimate is based on an analysis that simulated a cap-and-trade program with a 22% emission reduction between 2000 and 2080. Lawrence H. Goulder, *Mitigating the Adverse Impacts of CO₂ Abatement Policies on Energy-Intensive Industries* (2002), Resources for the Future Discussion Paper.

¹⁸ See e.g., Goulder (2002); Anne E. Smith and Martin T. Ross, *Allowance Allocation: Who Wins and Loses Under a Carbon Dioxide Control Program?* (2002), Charles River Associates; Dallas Burtraw, et al., *The Effect of Allowance Allocation on the Cost of Carbon Emission Trading* (2001), Resources for the Future.

¹⁹ A carbon tax system, which is not within the purview of this report, could achieve the same result, if carbon tax proceeds were applied in a similar manner.

²⁰ See e.g., Robert W. Hahn, *Greenhouse Gas Auctions and Taxes: Some Practical Considerations* (2008), AEI Center for Regulatory and Market Studies; Robert Stavins, *A U.S. Cap-and-Trade System to Address Global Climate Change* (2007), The Hamilton (continued...)

auction revenues may or may not generate *overall* economic cost savings. These options are discussed later in this report.

Avoidance of Economic Concerns from No-Cost Distribution

Auctions would avoid several of the undesired economic effects that are likely to occur if allowances are provided to covered sources at no cost. These concerns are discussed in greater detail later in the no-cost distribution section. In brief, they include:

- Inefficient and inequitable price signals in the electricity sector;
- Potential overcompensation to covered sources; and
- Challenges with allotting allowances to new and retiring sources.

Auction Design Issues

Although many of the cap-and-trade proposals in the 110th Congress would employ an auction to some degree, none of the bills specifies the design of the auction. A recent study that examined auction design issues for the Regional Greenhouse Gas Initiative (RGGI) found that “careful attention to auction design can be critical to an auction’s success in achieving the goals specified for the auction.”²¹

Design Considerations. The success of an auction is typically measured by both its efficiency and revenue generation.²² In an emission auction context, efficiency is achieved when the parties that receive the allowances are the parties that place the most value on the allowances. Other attributes of an auction that may be used to measure its success include:

Price discovery. In a cost-effective emissions trading program, the allowance price should mirror (or closely follow) the marginal cost of emission reduction — i.e., the cost of reducing the last, most expensive ton. An effective auction should help identify the allowance price that is near to the marginal cost of reduction.²³

Protection against market manipulation. Auctions should discourage or prohibit bidding behavior that would create inefficient outcomes in the market. For example, collusion among bidders may artificially lower the allowance price. Another concern is hoarding, in which one party makes speculative bids above the competitive price, in order to capture a disproportionately large percentage of the allowances.

²⁰ (...continued)
Project, Brookings Institution.

²¹ Charles Holt *et al.*, *Auction Design for Selling CO2 Emission Allowances Under the Regional Greenhouse Gas Initiative* (2007), prepared for RGGI Working Group staff..

²² Holt *et al.* (2008).

²³ Note that this value will fluctuate daily with changes in fuel prices and energy demands.

Minimize transaction costs. Substantial administrative or transaction costs could reduce the cost-effectiveness of using an auction. Moreover, high transaction costs could place smaller firms at a disadvantage.

Transparency and fairness. The rules should be readily available to all parties and should not favor certain participants.

Design Options. Certain auction designs may provide advantages or disadvantages, depending on the auction's primary objective. For example, some auction designs in certain contexts may favor revenue generation; others may be more efficient in terms of matching the market price.

Policymakers may undertake further study before specifying the particular auction logistics. Although economic studies have examined the performances of different auction formats in other contexts, "relatively few papers have examined the relative merits of each of these auction forms in multi-unit [e.g., emission allowances] auctions."²⁴ One option for Congress would be to direct an implementing agency to devise the most appropriate auction format, based on the ranking of objectives provided by Congress.

Policymakers may consider various auction designs. In general, auction designs are distinguished by (1) the number of rounds for bidding — generally one round (often called "sealed bid") versus multiple rounds; and (2) whether there is a uniform price or individual price ("discriminatory" price) for each buyer. Examples of auction designs with different combinations of these two characteristics include the following:

Discriminatory Price, Sealed-Bid Auction. This type of auction is used in EPA's SO₂ emission trading program.²⁵ In this system, parties submit a sealed bid, containing multiple offers to purchase a set number of allowances at certain prices. The implementing agency opens the bids and distributes allowances, starting with the highest offer, until the supply is exhausted. For example, consider a hypothetical auction, in which the supply of allowances is 20 units and the highest bidder offered \$100 per allowance for 15 allowances, and the second highest bidder offered \$90 per allowance for 10 allowances: the highest bidder would receive 15 allowances for \$100/allowance; the second highest bidder would receive 5 allowances at \$90/allowance.

Uniform-Price, Sealed-Bid Auction. This type of auction is similar to the above format — discriminatory price, sealed-bid — with one major difference: the price paid by all bidders is the highest rejected bid (i.e., the second-highest bid). Using the above scenario, the highest bidder would receive 15 allowances at \$90/allowance, and the second-highest bidder would receive 5 allowances at

²⁴ Holt *et al.* (2008).

²⁵ More information on EPA's SO₂ emission trading auction is at [<http://www.epa.gov/airmarkets/trading/factsheet-auction.html#how>].

\$90/allowance. Ireland used this design to implement its auction for the EU ETS.²⁶ In addition, in a study prepared for RGGI officials, researchers recommended using this approach.²⁷

Uniform-Price, Multi-Round (English Clock) Auction. In an emission allowance auction using this format, the auctioneer would post a allowance price and parties would offer the quantity they are willing to buy at the posted price. The first posted price would be set at a low level, so that demand would exceed supply. The auctioneer would continue posting higher prices at set time intervals, until demand is less than (or equal to) the allowance supply. The posted price that produces this outcome would become the allowance price for all bidders. Virginia used this auction type to sell nitrogen oxide emission allowances pursuant to the “NO_x SIP Call.”²⁸

Reserve Price. One issue that arguably transcends auction design considerations is whether or not the auction should have a reserve price, and if so, at what level. In an auction, a reserve price is a price set by the seller, below which the seller refuses to part with the item for sale. In a large volume, multi-unit auction that is expected to have substantial participation (i.e., high demand for the items for sale), a reserve price would all but guarantee a revenue stream. In a cap-and-trade allowance emissions auction, a reserve price would operate much like a minimum tax or price floor.

A reserve price may address certain logistical concerns, such as bidder collusion, that are often associated with auctions. In addition, a reserve price may provide assurance to parties making emission reductions that the reductions will have some value in the allowance market. For example, if a covered source can expect a reserve price to be set at a certain level (e.g., \$10/ton), and the source makes multiple reductions, each at a per-ton cost below the expected reserve price, the source can have confidence that its efforts will be cost-effective.

The authors of the RGGI auction study recommended that RGGI participants set a reserve price when conducting allowance auctions, concluding:

A compelling justification for a reserve price can be found in the academic literature and from previous experience with auctions, and the reserve price would help the auction achieve the criteria [e.g., the design criteria discussed above] set out in this report.²⁹

²⁶ Ken Macken (Ireland Environmental Protection Agency), Presentation for RGGI Auction Workshop, March 2006, at [<http://www.rggi.org/documents.htm>].

²⁷ Holt *et al.* (2008).

²⁸ For more information about Virginia’s auction, see William Shobe, Presentation for RGGI Auction Workshop, March 2006, at [<http://www.rggi.org/documents.htm>].

²⁹ Holt *et al.* (2008).

Because a reserve price (if established) could influence revenue flows from an auction, Congress may consider addressing this issue specifically in legislative text, rather than leave this matter open for interpretation to an implementing agency.

Auction Frequency. EPA's SO₂ emissions trading program holds annual auctions to distribute a small percentage of allowances. Likewise, S. 2191 would direct the implementing agency to conduct annual auctions. However, policymakers may consider holding more frequent auctions (e.g., every quarter).

More frequent auctions could provide several benefits, both for covered sources and to the efficiency of the program. More auctions would give covered sources more flexibility to incorporate unanticipated events — e.g., higher electricity demand due to warmer than expected temperatures. If auctions were held more frequently, the allowances sold would be in smaller lots. This may help facilities, particularly smaller operations, maintain cash flow.

In terms of efficiency, smaller, more frequent auctions would likely reduce the potential for parties to manipulate the market (e.g., from speculative hoarding). More auctions may increase market liquidity by making allowances available for purchase in more frequent intervals.

The potential downside to having multiple auctions per year is that covered sources may face additional transaction costs. However, the authors of the RGGI auction study stated:

past experience suggests that a significant proportion of the administrative cost of holding auctions is related to the initial set-up ... and that incremental costs of repeating a particular auction type will be low in comparison to these initial costs.³⁰

After considering the “costs, risks, and benefits,” the study authors recommended that participating RGGI states use a quarterly auction to allocate emission allowances.³¹

³⁰ Ibid.

³¹ Ibid.

No-Cost Distribution to Covered Sources

Emission trading programs, in the United States³² and abroad,³³ have generally distributed the vast majority of allowances at no cost to sources directly subject to a cap. In recent years, however, support for auctions has gained momentum. This momentum likely reflects a better understanding of the benefits of using auctions, as well as increased scrutiny of the effects of distributing allowances at no cost.³⁴ This section discusses the potential benefits and concerns of allotting allowances to covered sources at no cost.

Potential Benefits

Mitigation of Disproportionate Costs. The primary argument in support of no-cost distribution is that carbon-intensive industries are expected to face disproportional costs under a carbon-constrained system. These industries maintain they should receive compensation (i.e., free allowances) for the financial losses imposed by the cap-and-trade program. The financial losses may lead to loss of jobs in particular industries. The compensation may be considered a form of transition assistance for industries and industry employees most impacted by a GHG emissions cap.

This argument is perhaps stronger for industries that may have a more difficult time including the costs of emission reduction in the price of their products. For example, certain U.S. industries may be more vulnerable to foreign competition, especially if their competitors are located in nations without GHG emissions caps. For these industries, increasing the price of their materials (to reflect the cost of emissions abatement) may entail a comparative disadvantage. Moreover, if foreign competitors in these industries increase their market share as a result of a U.S. cap-and-trade program, the foreign facilities (in uncapped economies) are likely to increase their GHG emissions. This potential scenario is described as emissions leakage, a constant concern in climate change policy.

In other economic sectors, particularly the electricity generation sector, that do not face foreign competition, facilities are expected to pass along the vast majority of the emission reduction costs. This would entail higher prices for consumers,

³² Although EPA annually auctions a small percentage of the allowances in its sulfur dioxide (SO₂) cap-and-trade program (pursuant to Title IV of the 1990 Clean Air Act Amendments), most of the allowances are provided at no cost to emission sources, based on their historical emissions. See CRS Report RL34235, *Air Pollution as a Commodity: Regulation of the Sulfur Dioxide Allowance Market*, by Larry Parker and Mark Jickling.

³³ The European Union's (EU) Emissions Trading Scheme (ETS), a CO₂ cap-and-trade program that applies to power plants and certain carbon-intensive industries, allowed countries (between 2005-2008) to auction up to 5% of allowance allocations. Only 4 of 25 countries used auctions at all, and only Denmark auctioned the full 5%. See CRS Report RL34150, *Climate Change: The EU Emissions Trading Scheme (ETS) Enters Kyoto Compliance Phase*, by Larry Parker.

³⁴ See e.g., Cameron Hepburn, *et al.*, "Auctioning of EU ETS phase II allowances: how and why?" (2006) *Climate Policy* 6(1): 137-160.

which includes businesses and households. However, price increases would likely reduce consumer demand,³⁵ potentially lowering the profits of carbon-intensive industries.³⁶

Political Feasibility. Cap-and-trade programs, both domestic and international, have usually provided allowances to covered sources at no cost; this free allocation to covered sources is arguably a means to garner support for an emissions reduction program. Moreover, industries may prefer to receive allowances at no cost rather than compete for a share of auction revenues: a transfer of free allowances may be more “politically secure than government promises of compensation from auction revenues.”³⁷

Concerns

Undesirable Effects in the Electricity Sector. As the electricity sector accounts for the largest percentage (34% in 2006)³⁸ of GHG emissions in the United States, it would play a major role in the effectiveness of a cap-and-trade program. There is concern that if allowances are distributed to electric utilities at no cost, the electricity consumers who purchase electricity under a price-regulated structure would receive a price signal that is weaker than the signal received by consumers in unregulated (or competitive) markets.³⁹ In contrast, an auction distribution system would enable electricity generators, in both price-regulated and competitive markets, to send a comparable price signal to consumers.⁴⁰

In the United States, the price consumers pay for electricity may be determined by a state regulatory body — often described as cost-of-service regulation — or the price may be subject to market forces — often described as deregulated or competitive. In general, the regulatory structure varies by the type of facility and/or the state in which the electricity is generated. In 2007, the more traditional, price-regulated electric utilities generated approximately 60% of the total net electricity generated in the United States.⁴¹ The remaining 40% of electricity was generated by

³⁵ This may vary by the product sold and the level of price increase. Some products may display a relatively inelastic price/demand relationship. This discussion is beyond the scope of this report.

³⁶ For industry-specific estimates, see e.g., U.S. EPA, *EPA Analysis of the Lieberman-Warner Climate Security Act of 2008* (2008).

³⁷ National Commission on Energy Policy, *Allocating Allowances in a Greenhouse Gas Trading System* (2007), p. 10.

³⁸ U.S. EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006* (2008), Table ES-7, at [<http://epa.gov/climatechange/emissions/usinventoryreport.html>].

³⁹ See e.g., National Commission on Energy Policy, *Allocating Allowances in a Greenhouse Gas Trading System* (2007).

⁴⁰ Dallas Burtraw, Prepared Testimony before the House Select Committee on Energy Independence and Global Warming, January 23, 2008.

⁴¹ The above percentages are calculated by CRS with data from the Energy Information (continued...)

facilities that are unregulated in terms of their ability to set a price for the electricity they generate.

A comparison between **Figure 1** and **Figure 2** demonstrates the difference in price signals that the two regulatory frameworks would send.⁴² These figures present a distribution of electricity price changes that consumers could expect under a cap-and-trade system that included the electricity sector.⁴³ For example, under an auction system (**Figure 1**), a large percentage of consumers would face an increase of \$8/Mwh; approximately equal numbers of consumers would face either higher or lower prices.

In **Figure 1**, the change in electricity price for both “regulated” and “competitive” regions is fairly symmetrical. The (rise-and-fall) shape of the column heights, which is generally identical for both the price-regulated and competitive regions, reflects the different electricity-generating fuel portfolios that exist throughout the country. Regions with higher carbon content fuel portfolios⁴⁴ are expected to experience higher electricity prices under a cap-and-trade system.

⁴¹ (...continued)

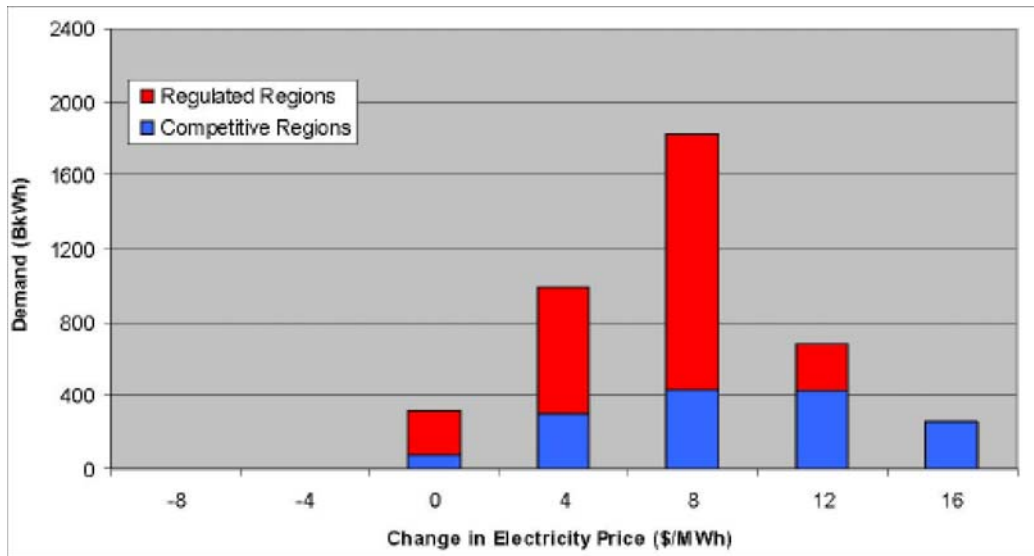
Administration’s 906/920 database, available at [http://www.eia.doe.gov/cneaf/electricity/page/eia906_920.html].

⁴² These figures are from Dallas Burtraw, Prepared Testimony before the House Select Committee on Energy Independence and Global Warming, January 23, 2008. This testimony cites the author’s more in-depth study: Dallas Burtraw and Karen Palmer, *Compensation Rules for Climate Policy in the Electricity Sector* (2007), Resources for the Future Discussion Paper.

⁴³ These figures are provided for illustrative purposes only.

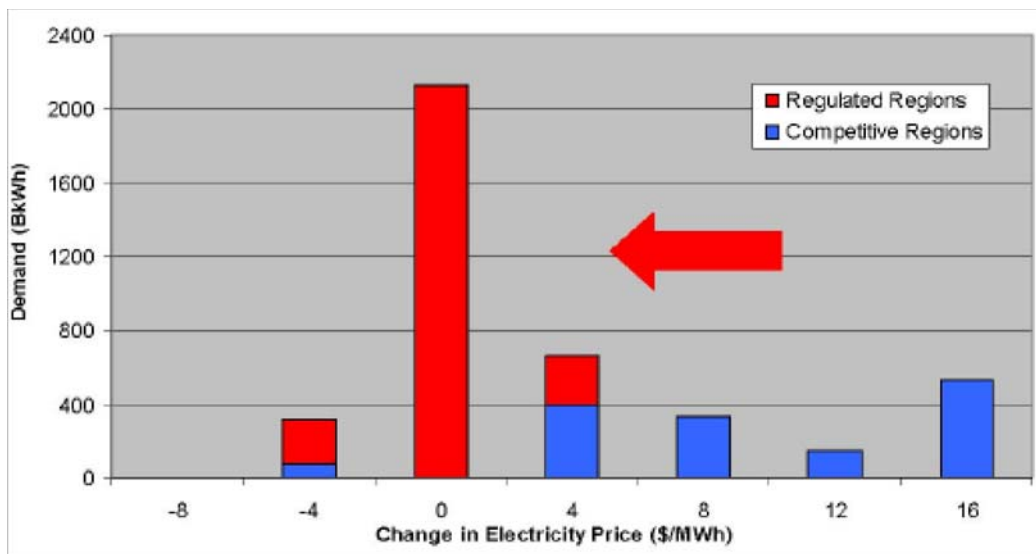
⁴⁴ For example, electricity in some states or regions may use higher percentages of coal or renewable energy than other areas. See CRS Report RL34272, *State Greenhouse Gas Emissions: Comparison and Analysis*, by Jonathan L. Ramseur.

**Figure 1. Change in Electricity Price by Region:
Allowances Distributed to Covered Sources with Auction**



Source: Dallas Burtraw (Resources for the Future), Prepared Testimony before the House Select Committee on Energy Independence and Global Warming, January 23, 2008.

**Figure 2. Change in Electricity Price by Region:
Allowances Distributed to Covered Sources at No Cost**



Source: Dallas Burtraw (Resources for the Future), Prepared Testimony before the House Select Committee on Energy Independence and Global Warming, January 23, 2008.

However, when covered sources receive allowances at no cost (**Figure 2**), consumers in price-regulated and competitive regions experience dramatically different price changes. Note the asymmetrical shape of the columns, as compared to those in the previous figure. In most of the price-regulated regions, the electricity price would remain the same (or decrease), while the price would increase in most of the competitive regions.

The different consumer impacts identified in **Figure 1** and **Figure 2** result from the dissimilar market structures — price-regulated versus competitive — that determine the price of electricity for U.S. consumers. The different impacts reflect the electric-generating facilities' varied abilities to pass through all types of costs to consumers in the form of higher electricity prices. In an auction, the costs to utilities would include both the costs of mitigation and the costs of purchasing allowances. Under a no-cost distribution system, utilities would have mitigation costs and opportunity costs associated with the allowances (discussed above).

If policymakers auction allowances to electric utilities, both price-regulated and competitive-market utilities would include the cost of purchasing emission allowances in the price of electricity. However, if allowances are distributed at no cost to utilities, only competitive-market utilities would be able to pass along their opportunity costs.

Because price-regulated facilities would not be able to pass through the opportunity costs associated with free allowances, consumers in these areas would effectively receive the benefit of the “free” allowances in the form of stable or lower electricity bills (**Figure 2**). Consumers in competitive areas would not receive the benefit of “free allowances” and would thus face disproportionate price increases. This consequence would erode the effectiveness of the cap-and-trade program, because consumers would likely not receive a price signal that is strong enough to encourage conservation or energy efficiency improvements.

The effects of this inefficient outcome may be magnified, because approximately 75% of coal-fired electricity was generated by price-regulated utilities in 2007.⁴⁵ Thus, consumers that utilize more-carbon intensive electricity would face a weaker price signal than consumers using less carbon-intensive electricity.⁴⁶

The price disparities that consumers with comparable fuel portfolios would experience under different electricity regulatory structures would be both unfair and inefficient. An auction would eliminate both of these concerns. Consumers in price-regulated and competitive regions (with similar carbon-intensive electricity profiles) would experience more equitable impacts. Moreover, the costs of the cap-and-trade program would be included in the price of electricity in each market structure. This result is necessary if the carbon price is to modify consumer behavior: e.g., spur energy conservation efforts or the installation of more energy efficient technologies.

Overcompensation to Covered Entities. If covered entities receive, at no-cost, GHG emission allowances in proportion to their emissions, there is concern that the recipients would be overcompensated for the compliance costs imposed by

⁴⁵ Calculated by CRS with data from the Energy Information Administration's 906/920 database, available at [http://www.eia.doe.gov/cneaf/electricity/page/eia906_920.html].

⁴⁶ National Commission on Energy Policy, *Allocating Allowances in a Greenhouse Gas Trading System* (2007).

a cap-and-trade program.⁴⁷ Depending on the percentage of emission allowances auctioned, an auction could avoid overcompensation.

This potential outcome is a function of several factors. First, the aggregate value of the GHG emission allowances is expected to be substantially greater than the aggregate costs of making emission reductions pursuant to the emissions cap.⁴⁸ (See **Figure 3** and surrounding discussion below.) Second, if covered sources receive allowances at no cost, they would retain the benefits of these allowances, which are essentially a form of currency.⁴⁹ Although it may be counterintuitive, covered entities are expected to raise the price of their products, even if entities receive allowances at no cost.⁵⁰ Thus, covered sources would receive the financial benefit of the allowances and the gains associated with higher prices.⁵¹ These benefits are often described as “windfall profits.”⁵²

A windfall profit result has been observed in cap-and-trade models⁵³ and in the largest existing cap-and-trade program: the European Union’s (EU) Emissions Trading Scheme (ETS). The EU ETS established a cap-and-trade program for power plants and certain carbon-intensive industries, allocating virtually 100% of the allowances at no cost to covered entities between 2005 and 2007 (“Phase 1”). One study estimated that power plants in the United Kingdom received windfall profits of 800 million euro (approximately \$1 billion)⁵⁴ per year;⁵⁵ a separate study estimated

⁴⁷ See Lawrence H. Goulder, *Mitigating the Adverse Impacts of CO₂ Abatement Policies on Energy-Intensive Industries* (2002), Resources for the Future Discussion Paper; Anne E. Smith and Martin T. Ross, *Allowance Allocation: Who Wins and Loses Under a Carbon Dioxide Control Program?* (2002), Charles River Associates.

⁴⁸ Compared to other emissions trading programs — namely, the U.S. SO₂ emissions (acid rain) program — the ratio of allowance value to compliance costs is expected to be much greater.

⁴⁹ As discussed above, price-regulated electric utilities represent a critical exception.

⁵⁰ This is due to the opportunity costs that an entity would face if it used (i.e., surrendered to the implementing agency for compliance) its allowances. Instead of using the allowance, the entity could have sold it for its market value.

⁵¹ However, higher prices could reduce consumer demand and potentially lower profits (discussed below).

⁵² U.S. Congress, Senate Committee on Energy and Natural Resources, *Design Elements of a Mandatory Market-Based Greenhouse Gas Regulatory System*, Chairman and Ranking Member Statement: Climate Change Conference (2006), 109th Congress.

⁵³ Goulder (2002) simulated a U.S. cap-and-trade program that would require a 23% emission reduction. In the model’s scenario that distributed allowances at no cost to energy producers (coal, oil, natural gas), the coal sector profits increased by 155% after two years of the program.

⁵⁴ Converted using exchange rate of 1.25 (average rate in 2005), provided by [<http://www.oanda.com>].

⁵⁵ IPA Energy Consulting, *Implications of the EU Emissions Trading Scheme for the UK Power Generation Sector* (2005), Prepared for the United Kingdom Department of Trade (continued...)

windfall profits for power plants in the Netherlands at 300 million to 600 million euro (\$378 million - \$750 million)⁵⁶ per year.⁵⁷ However, the EU ETS Phase 1 allowance price (for reasons beyond the scope of this report) dropped dramatically in April 2006 and never recovered.⁵⁸ Thus, the windfall profits were only generated in the first year (2005) of the program.

Nevertheless, a 2008 study estimated that European power plants are expected to continue to receive windfall profits during the second phase (2008-2012) of the EU ETS. For example, German plants are projected to generate the most windfall profits: between 14 billion and 22 billion euro (\$21 billion - \$33 billion)⁵⁹ over that time period.⁶⁰ In recognition of this projection, the European Commission (EC) has proposed to address this issue, stating: “taking into account their ability to pass through opportunity costs, full auctioning should be the rule from 2013 onwards for the power sector.” In addition, the EC has proposed that free allocation in other sectors would gradually phase out, so that by 2020, auctions would distribute 100% of the allowances.⁶¹

Treatment of New and Retiring Sources. An auction distribution format would address economic inefficiencies and concerns of fairness regarding new emission sources and facilities that are near retirement. A recurrent auction creates a level playing field for these two categories of sources. In contrast, a distribution strategy that allots allowances at no cost based on prior year emissions (“grandfathering”) could provide a considerable advantage to existing facilities. A free allowance effectively subsidizes currently operating facilities, which may be using outdated, inefficient technologies.⁶² Moreover, if entities receive allowances at no cost, the financial gain imparted in the allowance could serve as an incentive

⁵⁵ (...continued)
and Industry.

⁵⁶ Converted using exchange rate of 1.25 (average rate in 2005), provided by [<http://www.oanda.com>].

⁵⁷ Jos Sijm *et al.*, “CO₂ Cost Pass-Through and Windfall Profits in the Power Sector,” *Climate Policy* 6 (2006): 49-72.

⁵⁸ See CRS Report RL34150, *Climate Change: The EU Emissions Trading Scheme (ETS) Enters Kyoto Compliance Phase*, by Larry Parker.

⁵⁹ Using exchange rate of 1.5, provided by [<http://www.oanda.com>].

⁶⁰ Point Carbon Advisory Services, *EU ETS Phase II — The Potential and Scale of Windfall Profits in the Power Sector* (2008), Prepared for World Wildlife Fund.

⁶¹ Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading system of the Community (January 23, 2008), at [http://ec.europa.eu/environment/climat/emission/ets_post2012_en.htm].

⁶² In some cases, where the firm might shift these operations to a foreign, unregulated country, such incentives might make sense. Raymond J. Kopp, 2007, *Allowance Allocation, Resources for the Future*.

to extend the facility's operation beyond a time that would otherwise be efficient to cease operations.⁶³

Distribution of Allowance Value: Options and Considerations

By limiting the annual number of emission allowances available for compliance purposes, a cap-and-trade system creates emission allowances. Emission allowances would become a valuable new commodity, potentially accounting — in aggregate — for tens or hundreds of billions of dollars (**Table 1** and surrounding discussion). To whom and for what purpose the value of allowances is distributed would affect (1) the overall cost to society of a cap-and-trade program and (2) which parties bear the costs of the program. Policymakers would face a choice between minimizing the costs imposed on the entire economy (society's costs) or using the allowance value for other purposes.⁶⁴ The latter choice covers a range of options. Congress could choose to provide assistance to specific industries or groups, or choose to distribute the allowance value to support various objectives. To provide an example, **Appendix B** of this report identifies the allowance and auction revenue distribution strategies proposed by S. 2191.

The first part of this section provides an overview of some key concepts and an estimate of the total allowance value that may be available for distribution in a cap-and-trade program. The second part examines the range of options for distributing allowance value. This is followed by a discussion of policy considerations.

Overview and Estimate of Allowance Value

Compliance Costs Versus the Value of Emission Allowances. A cap-and-trade program would impose costs: covered entities would comply by reducing their own emissions, purchasing emission reductions (credits) from other covered entities, or (if allowed) buying offsets from non-covered sources that have reduced, avoided, or sequestered emissions.⁶⁵ The combined costs of these activities are the “compliance costs” of the cap-and-trade program.⁶⁶

The compliance costs are different from the aggregate value of emission allowances. In the early years of a cap-and-trade program, the aggregate value of allowances would likely dwarf the costs of making (or finding) emission reductions.

⁶³ Markus Ahman *et al.*, “A Ten-Year Rule to Guide the Allocation of EU Emission Allowances,” *Energy Policy* 35 (2007):1718-1730.

⁶⁴ However, some objectives, if met — namely, technology advancement — may also reduce the overall costs of the program. This is discussed below.

⁶⁵ See CRS Report RL34436, *The Role of Offsets in a Greenhouse Gas Emissions Cap-and-Trade Program: Potential Benefits and Concerns*, by Jonathan L. Ramseur.

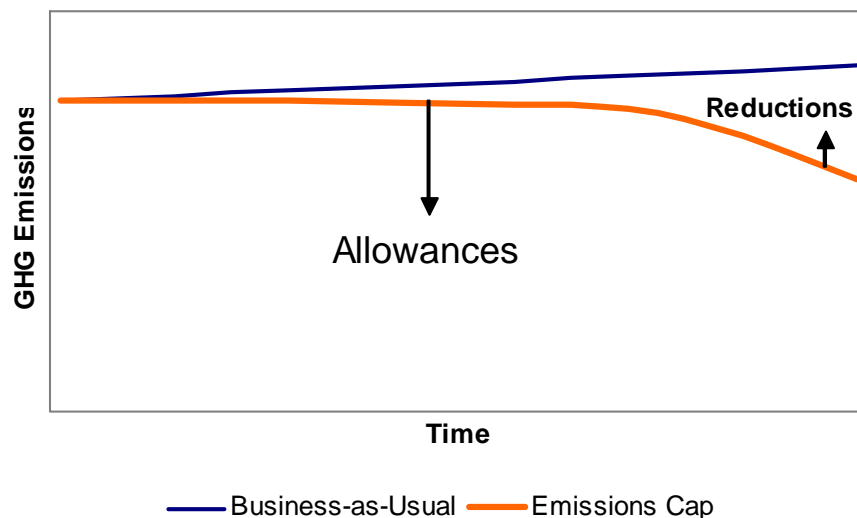
⁶⁶ These costs may be described with different terms in different publications: e.g., program costs, mitigation costs, or economic costs.

Figure 3 depicts this contrast: the area under the emissions cap curve represents the number of allowances; the area between the emissions cap curve and the business-as-usual curve represents the required reductions. The former area will be larger as long as the emission reduction target is less than 50% of the emissions baseline.⁶⁷

The compliance costs represent the sum of the costs of each ton of reduction, and the cost of each reduced ton will vary. For example, some projects may present “low-hanging fruit” reduction opportunities, whereas investments in extra capital (e.g., carbon capture technology) may represent a more expensive reduction option.

Consider a simplified example:⁶⁸ policymakers set a 7-ton cap on an economy that currently emits 10 tons. The 3 tons that must be reduced cost \$1, \$5, and \$10, respectively. The cost of the last, most expensive ton — the marginal cost — is \$10. Because the marginal cost largely establishes the market price of emission allowances in a cap-and-trade, each emission allowance has a value that is approximate to the marginal cost.⁶⁹ Therefore, in this example, the value of the allowances would equal \$70, but the compliance costs would be only \$16.

Figure 3. Number of Allowances vs. Number of Reductions



Source: Prepared by CRS. The concept for the figure comes from National Commission on Energy Policy, *Allocating Allowances in a Greenhouse Gas Trading System* (2007).

⁶⁷ For the more stringent cap-and-trade proposals in the 110th Congress, this threshold would not be reached until approximately 2040. See CRS Report RL33846, *Greenhouse Gas Reduction: Cap-and-Trade Bills in the 110th Congress*, by Larry Parker and Brent Yacobucci.

⁶⁸ Raymond J. Kopp, *Allowance Allocation* (2007), Resources for the Future.

⁶⁹ The option to bank emission allowances would likely alter this calculus. In anticipation that allowance prices will increase in subsequent years, covered sources would likely purchase more allowances than are needed for compliance purposes in the early years of the program.

Estimates of Allowance Value. Whether or not Congress sells the allowances through an auction (and generates revenues) or distributes the allowances at no cost, the allowances would have monetary value.

To put the allowance value in context, consider the Lieberman-Warner Climate Security Act of 2008 (S. 2191), an “economy-wide”⁷⁰ cap-and-trade proposal that was reported out of the Senate Environment and Public Works Committee May 20, 2008. At the request of Senators Lieberman and Warner, EPA prepared an economic analysis of provisions of S. 2191.⁷¹ One of the primary results of the analysis is the estimated price range for emission allowances. From these price estimates, potential auction revenues can be identified, because the legislation specifies the percentage of allowances to be auctioned in each compliance year. **Table 1** lists the estimated annual action revenues that would be generated under provisions of S. 2191. In addition, the table provides an estimate of revenues that would be generated if 100% of the emission allowances were auctioned. This latter estimate represents an approximation of the aggregate value of the emission allowances in a given year.

Table 1. Estimates of Auction Revenue under the Framework of the Lieberman-Warner Climate Security Act of 2008 (S. 2191)

Year	S. 2191				S. 2191 w/ 100% Auction
	Total Allowances Available (mtCO ₂ -e)	Percentage of Allowances Auctioned	Estimated Emission Allowance Price Range (\$/mtCO ₂ -e)	Estimated Annual Auction Revenue (\$ billions)	Estimated Annual Auction Revenue (\$ billions)
2015	5,456	29.5%	\$29 - \$40	\$47 - \$64	\$158 - \$218
2020	4,924	36.5%	\$37 - \$51	\$67 - \$92	\$182 - \$251
2025	4,392	48.5%	\$48 - \$65	\$101 - \$139	\$211 - \$285
2030	3,860	62.8%	\$61 - \$83	\$147 - \$201	\$235 - \$320
2035	3,328	69.5%	\$77 - \$106	\$179 - \$245	\$256 - \$353
2040	2,796	69.5%	\$98 - \$135	\$191 - \$263	\$274 - \$377
2045	2,264	69.5%	\$125 - \$173	\$197 - \$272	\$283 - \$392
2050	1,732	69.5%	\$159 - \$220	\$192 - \$265	\$275 - \$381

Source: Prepared by the Congressional Research Service with estimates of annual emission allowance prices provided by U.S. EPA, *EPA Analysis of the Lieberman-Warner Climate Security Act of 2008* (2008), p. 27.

Note: The price range represents the results of two separate models. For more information, see Appendix 1 of EPA’s analysis of S. 2191. In addition, the figures in the “Total Allowances Available” column are from the reported version of S. 2191 (May 20, 2008) and do not include proposed changes for deficit reduction purposes.

⁷⁰ Typically, “economy-wide” proposals would cover the vast majority of the nation’s GHG emissions by capping electricity generation, carbon-intensive industries, and the transportation sector. Depending on the design of the program, some sectors (e.g., agricultural or residential) may be excluded from the cap.

⁷¹ U.S. EPA, *EPA Analysis of the Lieberman-Warner Climate Security Act of 2008* (2008).

To put the auction revenues/allowance value in context, consider the federal net tax revenue from the three largest revenue sources for Fiscal Year 2007:⁷²

- individual income tax: \$1,118 billion;
- employment taxes: \$838 billion;
- corporate income taxes: \$368 billion.

Options for Allowance Value Distribution

Provide Transition Assistance to Carbon-Intensive Industries.

Several economic studies have estimated the percentage of allowances (a comparable amount of auction revenues could also be used) that would provide compensation for projected profit losses to specific carbon-intensive industries. The findings include the following:

- Goulder found that 13% of the emission allowances would compensate the *fossil fuel producing industry* (coal mining, oil and natural gas extraction) for lost profits.⁷³
- Burtraw and Palmer concluded that the *electric-generating industry's* estimated profit losses could be offset with 6% of the emission allowances.⁷⁴
- Smith and Ross estimated that 21% of the allowances would compensate the combined losses of primary energy producers and electric utilities (i.e., a combination of the sectors examined in the other two studies).⁷⁵

Although these studies analyzed the net effects to certain economic sectors, there are likely to be winners and losers within the sectors, particularly in electricity generation. For instance, some facilities, such as coal-fired plants, are expected to see greater losses, while others — hydroelectric or renewable energy plants — may see a gain in profits.⁷⁶

The above estimates consider that allowances would be provided to covered sources in perpetuity. However, some cap-and-trade proposals in the 110th Congress (e.g., S. 2191 and S. 1766) would generally phase-out free allocation as the

⁷² U.S. Internal Revenue Service, *Internal Revenue Service Data Book 2007*, Publication 55B, issued March 2008.

⁷³ Lawrence H. Goulder, *Mitigating the Adverse Impacts of CO₂ Abatement Policies on Energy-Intensive Industries* (2002), Resources for the Future Discussion Paper.

⁷⁴ Dallas Burtraw and Karen Palmer, *Compensation Rules for Climate Policy in the Electricity Sector* (2007), Resources for the Future Discussion Paper.

⁷⁵ The authors found a range of 9% to 21%, but noted that the 21% was consistent with the scenario presented in Goulder's study. Anne Smith *et al.*, *Implications of trading Implementation Design for Equity-Efficiency Trade-Offs in Carbon Permit Allocations* (2002), Charles River Associates.

⁷⁶ Dallas Burtraw and Karen Palmer, *Compensation Rules for Climate Policy in the Electricity Sector* (2007), Resources for the Future Discussion Paper.

percentage of allowances to be auctioned increases. As such, the initial percentage of allowances provided at no cost in these bills is higher than estimates that provide for indefinite distribution at a set percentage. For example, during the first five years of the program established by S. 2191, fossil fuel-fired power plants would receive 19% of the emission allowances at no cost.⁷⁷ This percentage would gradually decline to zero by 2031.⁷⁸

Offset Reductions in Distortionary Taxes. Economic theory generally supports a tax policy that would reduce taxes on favored activities (increased employment or personal income) and increase taxes on less desirable behavior (increased pollution).⁷⁹ Auction revenues could be used to offset reductions in the taxes that apply to desirable activities.

Using auction proceeds in this manner has been described as yielding a double-dividend: (1) reduced GHG emissions and (2) reduced market distortions from the taxes on desirable behavior. In the early 1990s, some economists suggested that the double-dividend effect would be strong enough to keep the overall costs to society relatively small or even negative.⁸⁰ However, more recent economic studies indicate that the costs imposed by the cap-and-trade program could act as an additional tax,⁸¹ which would most likely (at least in the United States)⁸² exceed the benefits of revenue recycling.

Several economic studies have estimated the cost savings to society that auction revenues could provide.⁸³ A cap-and-trade program is expected to impose an

⁷⁷ Section 3901 (reported May 20, 2008).

⁷⁸ In addition, note that S. 2191 would not provide allowances directly to the coal industry, although petroleum producers/importers would receive a small percentage (2%).

⁷⁹ The rationale for this policy is that taxes on desirable activities create market distortions, discouraging increased levels of desirable actions. Assuming the same amount of revenue could be collected, economic policy would favor placing the tax on activity that is generally considered undesirable. Further discussion is beyond the scope of this report.

⁸⁰ Ian Parry, "Fiscal Interactions and the Case for Carbon Taxes over Grandfathered Carbon Permits," in *Climate Change Policy* (Dieter Helm, editor), Oxford University Press (2005); Intergovernmental Panel on Climate Change Working Group III, *Climate Change 2001: Mitigation*, (Cambridge, UK: Cambridge University Press, 2001) Chapter 8.

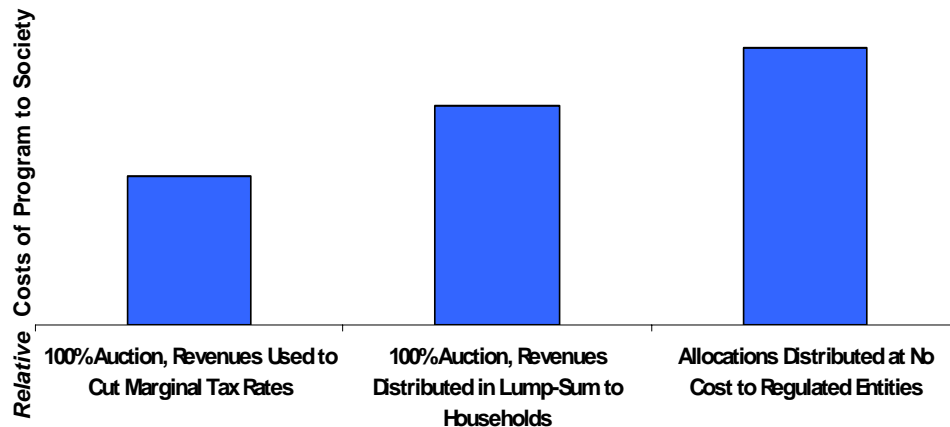
⁸¹ This is referred to as the "tax-interaction effect" in economic literature. See e.g., Ian Parry, "Fiscal Interactions and the Case for Carbon Taxes over Grandfathered Carbon Permits," in *Climate Change Policy* (Dieter Helm, editor), Oxford University Press (2005)

⁸² There is some evidence that the double-dividend benefits are stronger in Europe than in the United States, because the former has a more stringent tax system. Intergovernmental Panel on Climate Change Working Group III, *Climate Change 2001: Mitigation*, (Cambridge, UK: Cambridge University Press, 2001) Chapter 8, citing several studies.

⁸³ See Lawrence H. Goulder, *Mitigating the Adverse Impacts of C)2 Abatement Policies on Energy-Intensive Industries* (2002), Resources for the Future Discussion Paper; and Anne E. Smith and Martin T. Ross, *Allowance Allocation: Who Wins and Loses Under a Carbon Dioxide Control Program?* (2002), Charles River Associates; Dallas Burtraw, et al., *The*

economic cost on society.⁸⁴ A frequently cited study found that auctioning allowances could reduce the projected costs between 21% and 47%.⁸⁵ The range of potential cost savings reflects different uses of the auction revenues. If policymakers were to distribute the revenues to U.S. households in “lump-sum” payments — e.g., increase the standard tax deduction or mail payments to households — the cost savings would be on the lower end of the spectrum. Alternatively, if Congress decided to use the revenues to reduce taxes on labor or investment, society’s costs would be minimized. **Figure 4** shows the *relative* differences in society costs when different allocation strategies are used.

Figure 4. Relative Differences in Cap-and-Trade Program’s Cost to Society with Different Emission Allocation Strategies



Source: Prepared by CRS with data from Lawrence H. Goulder, *Mitigating the Adverse Impacts of CO₂ Abatement Policies on Energy-Intensive Industries* (2002), Resources for the Future Discussion Paper.

Distribution to Non-Covered Entities. Non-covered entities may receive free allowances (sometimes referred to as “set-asides”) or a percentage of the auction revenues. For example, Congress may decide to allot allowance value to electricity consumers, particularly those in low-income households. The rationale for this distribution policy is that specific subsets of society are expected to bear a disproportionate percentage of the costs of a cap-and-trade program.

Whether covered sources receive allowances at no cost or purchase them through an auction, economic principles predict that covered sources would pass along their opportunity costs or purchase costs, respectively, in the same manner as

⁸³ (...continued)

Effect of Allowance Allocation on the Cost of Carbon Emission Trading (2001), Resources for the Future.

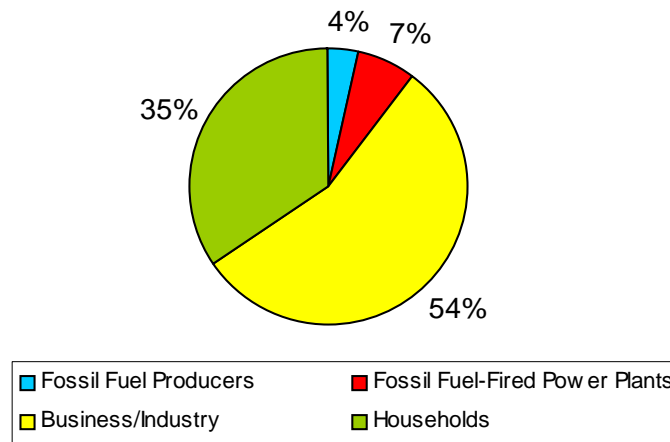
⁸⁴ See CRS Report RL34489, *Climate Change: Costs and Benefits of S. 2191*, by Larry Parker and Brent Yacobucci.

⁸⁵ Goulder (2002). This analysis simulated a cap-and-trade program with a 22% emission reduction between 2000 and 2080.

an actual expense: e.g., installing more efficient technology or switching to more expensive (but less carbon-intensive) fuels. Covered sources have demonstrated this behavior in two cap-and-trade programs, in which the vast majority of allowances was provided at no cost: the European Union’s Emission Trading System (EU-ETS) and the U.S. sulfur dioxide emissions trading program.⁸⁶

Because of cost pass-through, consumers, particularly households, are ultimately expected to bear the majority of the costs associated with a cap-and-trade program. **Figure 5** illustrates the *relative* distribution of costs to different groups in a cap-and-trade program.⁸⁷ The figure is based on a cap-and-trade scenario that would auction 100% of the emission allowances to fossil fuel producers (often referred to as “upstream” sources). Households and businesses experience the vast majority (89%) of the costs. Moreover, the household percentage is potentially understated, because many businesses would likely pass through some of their increased energy/electricity costs in the form of higher prices for their goods and services.⁸⁸

Figure 5. Relative Distribution of Costs Using Upstream Auction (*without Revenue Redistribution*)



Source: Prepared by CRS based on the data from the National Commission on Energy Policy, *Allocating Allowances in a Greenhouse Gas Trading System* (2007).

Note: The percentages above do not account for any offsetting income from allowance allocation. The figure illustrates the relative distributions that would occur if allowances were auctioned to fossil fuel producers (“upstream”), without recycling the revenues.

⁸⁶ Congressional Budget Office, *Trade-Offs in Allocating Allowances for CO₂ Emissions* (2007), Economic and Budget Issue Brief.

⁸⁷ This figure is based on a National Commission on Energy Policy (NCEP) proposal that would lead to a relatively modest reduction in GHG emissions compared to those required under current proposals in the 110th Congress. Thus, this figure is illustrative and only useful for comparing relative differences.

⁸⁸ National Commission on Energy Policy, *Allocating Allowances in a Greenhouse Gas Trading System* (2007).

The figure is instructive for the allocation debate, because it shows a starting point for cost distribution. However, the cost percentages depicted in **Figure 5** do not account for distribution of auction revenues. In a real cap-and-trade system that employs an auction, auction revenues would be used to support specific objectives, or allotted to various parties.

Distribution to Support Specific Objectives. Policymakers may also consider distributing a percentage of the allowances or auction revenues to support a range of objectives, including:

- **Technology development:** Promotion of emission mitigation technology is widely recognized as a vital step towards making substantial GHG emission reductions.⁸⁹ S. 2191 would distribute the majority of its auction revenues (approximately 52%) to promote energy-related technologies: low-carbon energy sources, carbon capture and storage (CCS),⁹⁰ and cellulosic biofuels.
- **Energy efficiency:** Improvements in energy efficiency could make considerable contributions in achieving GHG emission reductions. Although energy efficiency may involve technology advancements, new technologies must be used in order to realize the efficiency gains. In some cases, parties may need incentives beyond the efficiency gains to induce behavioral changes. For example, allowance value could be distributed to support efficiency gains at places — residences, commercial buildings — that are unlikely to be covered by an emissions cap.
- **Biological sequestration:** Trees, plants, and soils sequester carbon, removing it from the earth's atmosphere. Allowance values could be allotted to provide financial incentives for landowners to engage in activity — e.g., conservation tillage, reforestation — that would increase sequestration on their land. Although some of these actions may qualify as offsets (if allowed in a cap-and-trade program), some activities may need additional incentives or be unable to satisfy the offset approval process.⁹¹
- **Adaptation efforts:** Some level of global warming (and associated effects) will occur regardless of emission reduction efforts taken today, because previous and current GHG emissions will have long term climate impacts. Therefore, some contend that investment (e.g., allowance value) should focus on preparing communities to adapt to the effects of a changing climate.

⁸⁹ See e.g., CBO, *Evaluating the Role of Prices and R&D in Reducing Carbon Dioxide Emissions*, (2006).

⁹⁰ See CRS Report RL33801, *Carbon Capture and Sequestration (CCS)*, by Peter Folger.

⁹¹ See CRS Report RL34436, *The Role of Offsets in a Greenhouse Gas Emissions Cap-and-Trade Program: Potential Benefits and Concerns*, by Jonathan L. Ramseur.

- Deficit reduction: Another proposal for the use of allowances or auction revenue is to address a budget deficit that may result from a cap-and-trade program. A portion of the allowances or auction proceeds could be set aside to offset projected revenue shortfalls. This option is sometimes described as making the program “revenue-neutral.” In addition, Congress may consider using allowance value to offset shortfalls beyond those that are related to the cap-and-trade program.

Policy Considerations

The distribution of allowance value would present policymakers with a series of trade-offs. The primary options for applying the allowance value involve (1) minimizing the overall costs of the cap-and-trade program imposed on society; (2) alleviating the disproportionate costs borne by subgroups in society; and (3) providing funding to support other policy objectives, such as technological development. Intertwined among these options is a trade-off between regressive or progressive impacts.

Reduce Costs, Alleviate Burdens, or Promote Technology. Economic studies indicate that using auction revenues (i.e., revenue recycling) to offset reductions in distortionary taxes (labor, income) would be the most efficient use of the revenues and yield the greatest benefit to society as a whole. These studies show that if the revenues are used for other purposes, economic efficiency would suffer and the overall cost of the program would be higher (**Figure 4**).⁹²

The opportunity to substantially lower overall costs is a unique attribute of the auction allocation strategy. Some argue that using auction revenues to offset tax reductions is an unlikely outcome.⁹³ In general, when the government obtains new revenue, it tends to fund new or existing programs rather than reduce existing taxes.⁹⁴ Indeed, none of the cap-and-trade bills in the 110th Congress has proposed to use revenues in this manner.⁹⁵

Moreover, the most efficient manner of revenue recycling would generally spread the cost reductions throughout the economy, while certain groups would be expected to bear a disproportionate percentage of the costs of a cap-and-trade program. In particular, industries that cannot pass along their increased costs (for

⁹² However, if additional funding for technology advancement leads to faster development of low-carbon technologies, the cost of the program may decrease (discussed below).

⁹³ Robert W. Hahn, *Greenhouse Gas Auctions and Taxes: Some Practical Considerations* (2008), AEI Center for Regulatory and Market Studies; Robert Stavins, *A U.S. Cap-and-Trade System to Address Global Climate Change* (2007), The Hamilton Project, Brookings Institution.

⁹⁴ Ibid, citing Gary Becker and Casey Mulligan, “Deadweight Costs and the Size of the Government (2003),” *Journal of Law and Economics* 46(2).

⁹⁵ Another obstacle to this approach may concern Congressional committee jurisdiction issues. A cap-and-trade proposal that would restructure elements of the tax code may overlap with multiple committee jurisdictions.

competitive reasons or otherwise) would face higher costs compared to other economic sectors. Ultimately, consumers are expected to absorb the vast majority of the program costs. As discussed above, policymakers may consider compensating — through free allowances or auction revenues — specific industries and/or providing assistance to households that would face higher energy (e.g., electricity and gasoline) prices. Such compensation would forgo the opportunity to reduce the overall cost of the emission program.

Using allowance value for other purposes — e.g., technology development — would impart a trade-off. While such allotments would limit the allowances available for the purposes described above — reduced overall costs or relief for disproportionate impacts — new technologies, in particular, could have a considerable impact on the costs of an emissions reduction program. This is particularly the case if technologies can be commercialized ahead of their projected schedules⁹⁶ or if unanticipated low- or zero-carbon alternatives can be developed.

The amount of funding allotted to technology development under S. 2191 would represent a substantial increase, compared to current federal funding for emission reduction and low-carbon technologies. Although allocating allowance value to technological development could yield considerable gain, the return in terms of additional investment to promote technology improvements remains uncertain.⁹⁷ In a recent study, the author found:

While academics have extensively studied how revenues from auctions can be used to make the tax system more efficient, they have not done much research on examining the impact of using such revenues for retiring debt or increasing government investment.

In short, if allowance value is used to increase funding to existing programs or provide funding for new programs, the return on investment is uncertain. For example, some programs may be operating at full capacity, and additional funding may not provide comparable impacts. Moreover, the marketplace already provides incentive for technological change, and a cap-and-trade program would increase the incentive to develop low-carbon or zero-carbon energy alternatives.

Regressive or Progressive Economic Effects. Another trade-off for policymakers is whether the emission allocation strategy would produce regressive or progressive economic results.⁹⁸ The Congressional Budget Office (CBO) analyzed the distributional effects of a cap-and-trade program under four different scenarios:

⁹⁶ For example, the cost models for S. 2191 make assumptions about the availability of CCS. When this technology actually goes online, it will likely have a substantial impact on the cost of a cap-and-trade program.

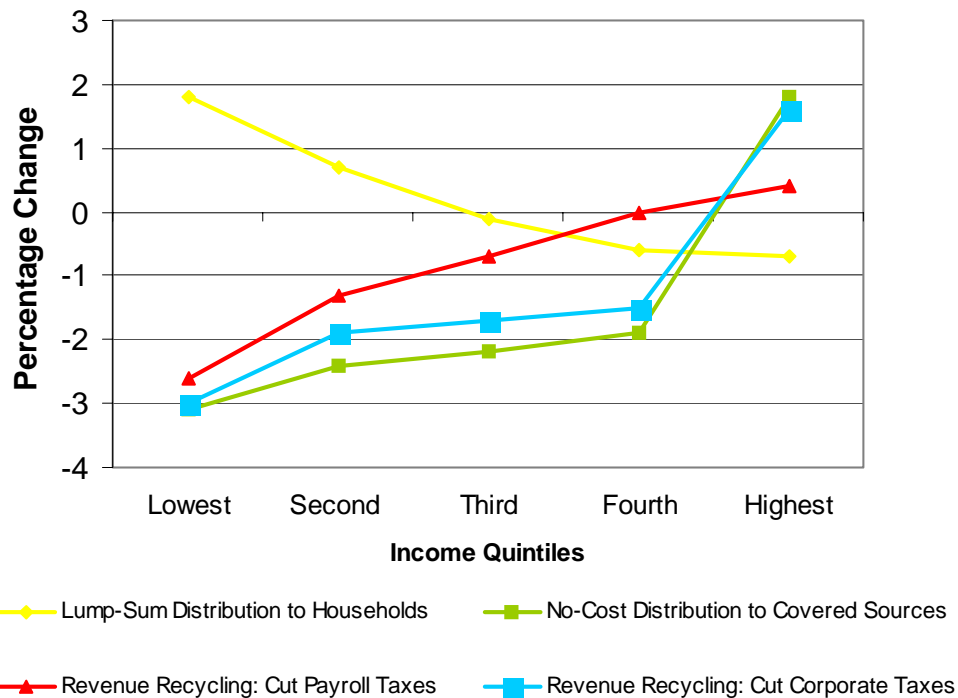
⁹⁷ For more discussion of recent modeling results regarding technological development, see CRS Report RL34489, *Climate Change: Costs and Benefits of S. 2191*, by Larry Parker and Brent Yacobucci.

⁹⁸ Analogous to a regressive tax policy, a regressive allocation strategy would disproportionately impact lower income households. In contrast, in a progressive distribution scheme the ratio of cost to income would increase as income rises.

- Allowances auctioned and auction revenues distributed to households in a lump-sum payment;
- Allowances provided to covered sources at no cost;
- Allowances auctioned and revenues are used to cut corporate income taxes; and
- Allowances auctioned and revenues used to cut payroll income taxes.

The results are presented in **Figure 6**. As the figure indicates, an auction that distributed the revenues to households in a lump-sum payment would yield the most progressive results. In contrast, the most regressive result occurs when allowances are provided to covered sources at no cost. The two other options that would cut tax rates would also produce regressive results. However, these two strategies would substantially lower the overall cost of the cap-and-trade program, a result not captured by **Figure 6**.

Figure 6. Comparison of After-Tax Household Income Changes (by Quintile) Imposed by Emissions Cap, Using Different Emission Allocation and Revenue Distribution Strategies



Source: Prepared by CRS with data from the CBO: the no-cost distribution scenario data are from CBO, *Who Gains and Who Pays Under Carbon-Allowance Trading? The Distributional Effects of Alternative Policy Designs* (2000); the other three scenario data are from CBO, *Trade-Offs in Allocating Allowances for CO₂ Emissions* (2007), Economic and Budget Issue Brief.

Appendix A. What Is a Cap-and-Trade System?

A cap-and-trade system would create an overall limit (i.e., a cap) on GHG emissions from the emission sources covered by the program. Cap-and-trade programs can vary by the sources covered. The covered sources are likely to include major emitting sectors (e.g., power plants and carbon-intensive industries), fuel producers/processors (e.g., coal mines or petroleum refineries), or some combination of both.

The emissions cap is partitioned into emission allowances. Typically, one emission allowance represents the authority to emit one (metric) ton of carbon dioxide-equivalent (tCO₂-e). The “equivalent” is necessary, because GHGs other than CO₂ — methane, nitrous oxide, sulfur hexafluoride, hydrofluorocarbons, and perfluorocarbons — vary in their global warming potential (GWP).⁹⁹ Thus, GHG emissions are presented in a standard form of measure (CO₂-e).

In general, policymakers may decide to distribute the emission allowances to covered entities at no cost (based on, for example, previous years’ emissions), sell the allowances through an auction, or use some combination of these strategies. This report examines issues associated with these allocation options.

Covered entities that face relatively low emission-reduction costs would have an incentive to make reductions beyond what is required, because these further reductions could be sold (i.e., traded) as emission credits to entities that face higher emission-reduction costs. Other mechanisms, such as banking or offsets, may be included to increase the flexibility of the program.

At the end of each established compliance period (e.g., a calendar year), covered sources would be required to surrender emission allowances to cover the number of tons emitted. If a source did not have enough allowances to cover its emissions, the source would be subject to penalties.

For more information, see U.S. Environmental Protection Agency (EPA), Office of Air and Radiation, *Tools of the Trade: A Guide To Designing and Operating a Cap and Trade Program For Pollution Control* (2003); CRS Report RL33799, *Climate Change: Design Approaches for a Greenhouse Gas Reduction Program*, by Larry Parker.

⁹⁹ GWPs are used to compare gases to carbon dioxide, which has a GWP of 1. For example, methane’s GWP is 25, and is thus 25 times more potent a GHG than CO₂. GWPs are typically based on estimates provided by the Intergovernmental Panel on Climate Change (IPCC).

Appendix B. Allowance Allocation Strategy under S. 2191 (as Reported)

Table 2. Emission Allowance Allocation under S. 2191

	2012	2015	2020	2025	2030	2035	2040	2045	2050
Allowances Sold through an Auction									
Early Auction	5%								
Auction	21.5%	29.5%	36.5%	48.5%	62.8%	69.5%	69.5%	69.5%	69.5%
Allowances Distributed at No Cost									
	2012	2015	2020	2025	2030	2035	2040	2045	2050
States									
Energy Savings	2%	2%	2%	2%	2%	2%	2%	2%	2%
Building Efficiency	1%	1%	1%	1%	1%	1%	1%	1%	1%
Programs that Exceed Fed. Targets	2%	2%	2%	2%	2%	2%	2%	2%	2%
General Allocation - by LIHEAP Share	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
Population Share	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
Fossil Production CO ₂ Share	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
Mass Transit	1%	1%	1%	1%	1%	1%	1%	1%	1%
Transition Assistance									
Fossil Fueled Electric Plants	19%	19%	16%	10%	1%				
Rural Electric Cooperatives	1%	1%	1%	1%	1%				
<i>Pilot Program for VA and MT</i>	0.2%	0.2%	0.2%	0.2%					
Energy-Intensive Manufacturing	10%	10%	8%	4%					
Petroleum Production/Importers	2%	2%	2%	1.00%	0.25%				
HFC Producers/Importers	2%	2%	2%	1.00%	0.25%				
Other Purposes or Recipients									
Early Action	5%	2%							
Tribal Communities	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Low/Middle-Income Electricity Consumers	9%	9%	9%	9%	9%	9%	9%	9%	9%
Low/Middle-Income Natural Gas Consumers	2%	2%	2%	2%	2%	2%	2%	2%	2%
Carbon Capture and Sequestration	4%	4%	4%	4%	4%				
Domestic Agriculture and Forestry	5%	5%	5%	5%	5%	5%	5%	5%	5%
International Forest Protection	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Landfill and Coal Mine CH ₄ Reduction	3%	3%	3%	3%	3%	3%	3%	3%	3%

Source: Prepared by CRS.

Table 3. Auction Revenue Distribution under S. 2191

Off-the-Top Allocation of Auction Revenues (in \$1,000s)									
	2012	2015	2020	2025	2030	2035	2040	2045	2050
BLM Emergency Firefighting Fund	\$150	\$150	\$150	\$150	\$150	\$150	\$150	\$150	\$150
Forest Service Emergency Firefighting Fund	\$430	\$430	\$430	\$430	\$430	\$430	\$430	\$430	\$430
Climate Security Act Management Fund	\$1,071	\$1,211	\$1,393	\$1,586	\$1,776	\$1,950	\$2,086	\$2,149	\$2,092
Percentage Allocation of Remaining Revenues									
	2012	2015	2020	2025	2030	2035	2040	2045	2050
Technology Deployment									
Zero- or Low- Carbon Energy Technology	16.6%	16.6%	16.6%	16.6%	16.6%	16.6%	16.6%	16.6%	16.6%
Advanced Coal and Sequestration Technology	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%
Fuel from Cellulosic Biomass	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%
Advanced Technology Vehicles Manufacturing	6.2%	6.2%	6.2%	6.2%	6.2%	6.2%	6.2%	6.2%	6.2%
Sustainable Energy Program	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%
TOTAL	52.0%	52.0%	52.0%	52.0%	52.0%	52.0%	52.0%	52.0%	52.0%
Energy Assistance Fund									
LIHEAP	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%
Weatherization	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
Rural Energy Assistance	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
TOTAL	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%
Climate Change Worker Training Fund									
DOE University Programs	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%
TOTAL	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Adaptation Fund									
DOI - Wildlife Conservation and Restoration	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%
DOI - Adaptation Activities	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%
DOI - Cooperative Grant Programs	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%
DOI - Tribal Wildlife Grants	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Land and Water Conservation Fund									
<i>DOI LWCF Sec. 6 Grants</i>	<i>0.3%</i>	<i>0.3%</i>	<i>0.3%</i>	<i>0.3%</i>	<i>0.3%</i>	<i>0.3%</i>	<i>0.3%</i>	<i>0.3%</i>	<i>0.3%</i>
<i>DOI LWCF Sec. 7 Acquisitions</i>	<i>0.6%</i>	<i>0.6%</i>	<i>0.6%</i>	<i>0.6%</i>	<i>0.6%</i>	<i>0.6%</i>	<i>0.6%</i>	<i>0.6%</i>	<i>0.6%</i>
<i>USDA Forest Legacy Program Sec. 7 Acquisitions</i>	<i>0.3%</i>	<i>0.3%</i>	<i>0.3%</i>	<i>0.3%</i>	<i>0.3%</i>	<i>0.3%</i>	<i>0.3%</i>	<i>0.3%</i>	<i>0.3%</i>
<i>USDA LWCF Sec. 7 Acquisitions</i>	<i>0.6%</i>	<i>0.6%</i>	<i>0.6%</i>	<i>0.6%</i>	<i>0.6%</i>	<i>0.6%</i>	<i>0.6%</i>	<i>0.6%</i>	<i>0.6%</i>
SUBTOTAL	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%
Forest Service Adaptation Activities	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%
EPA Adaptation Activities	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%
Army Corps of Engineers Adaptation Activities	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%
Department of Commerce Adaptation Activities	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%
TOTAL	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%
Energy Independence Acceleration Fund	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Climate Change and National Security Fund	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%

Source: Prepared by CRS.

Notes: CRS estimates of off-the-top revenues based on allowance price projections from the EPA/ADAGE-TECH scenario in U.S. EPA, *EPA Analysis of the Lieberman-Warner Climate Security Act of 2008* (2008). Higher allowance price estimates would lead to higher auction proceeds. CRS estimates of firefighting fund requirements based on historic data. Estimate of administration cost (“CSA Management Fund”) based on EPA’s estimate of 1% of total allowance value.