Greenhouse Gas Emissions Allowance Allocation

This policy brief outlines various options for distributing greenhouse gas emission allowances under a cap-and-trade program. Allowances represent a significant source of value and can be used to compensate firms or individuals affected by climate change policy or to raise funds for other socially desirable policy objectives. The basic allocation decision involves whether to freely allocate emission allowances, and if so, to whom, and whether to auction allowances, and if so, how to distribute the revenues. A number of recent cap-and-trade proposals begin with a combined approach that provides some allowances for free and auctions the rest, with the share of auctioned allowances rising over time. If free allocation is chosen, the basis for distribution must be determined. Options include granting allowances based on historical emissions ("grandfathering"), on levels of an output or input, or on an environmental performance "benchmark;" each has implications in terms of who benefits from the value of the allowances. If allowances are auctioned, in addition to deciding how the revenue generated by the auction will be used, policymakers will need to determine the type and frequency of the auction. Many of the same objectives can be met using either auction revenues or free allocation, including easing transition for affected firms and consumers and supporting new technologies. However, allocation decisions will sometimes entail trade-offs among the competing goals of achieving an equitable distribution of economic impacts, ensuring political feasibility, and minimizing overall program cost. Allowance allocation presents both a challenge and an opportunity: no allocation formula will satisfy everyone, yet allocation decisions can be made in ways that ease the transition to a low-carbon economy and enhance the likelihood of meaningful action on climate change.

An important component of any national policy to address climate change will be to establish mandatory limits on greenhouse gas (GHG) emissions. This can be accomplished most cost-effectively by harnessing market mechanisms—such as a cap-and-trade program—to establish a price on GHG emissions and spur reductions. Under a cap-and-trade system, a limit is placed on the overall emissions from covered sources and these sources must hold "allowances" for any GHG emitted. An allowance is typically defined as the right to emit one ton of carbon dioxide (CO_2) or its equivalent in other GHGs. Some method for initially distributing allowances is determined, and a market is created by allowing sources to buy and sell allowances.

A key question that must be answered is whether allowances should be given away for free, sold via an auction, or distributed using some combination of the two. If policymakers decide to provide a substantial free allocation, it will be necessary to specify who will receive these allowances and on what basis (e.g., past or current emission levels, some benchmark performance standard, or another basis). If the allowances are auctioned, decisions must be made regarding the type of auction that will be conducted and how the funds generated will be used. If a combined approach is utilized—with some allowances given away and the rest auctioned—policymakers will face all of these decisions.

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As part of the implentation of AB32, the Market Advisory Committee to the California Air Resources Board recommended a set of principles to be followed in distributing allowances.[1] These principles include the following:

- reduce the cost of the program to consumers, especially low-income consumers;
- avoid "windfall" profits where such profits could occur;
- mitigate economic dislocation caused by competition from firms in uncapped jurisdictions;
- promote investment in low-GHG technologies and fuels (e.g., energy efficiency); and
- help to ensure market liquidity.

California is working closely with other members of the Western Climate Initiative (WCI) on the design of a regional cap-and-trade system.

The U.S. Climate Action Partnership (USCAP)—a group of leading companies and non-governmental organizations working to advance U.S. climate policy—developed its own guidance regarding the allocation of allowances under a national cap-and-trade program:

> *An emission allowance allocation system should seek to mitigate economic transition costs to entities and regions of the country that will be relatively more adversely affected by GHG emission limits or have already made investments in higher cost, low-GHG technologies, while simultaneously encouraging the transition from older, higher-emitting technologies to newer, lower-emitting technologies.*[2]

A comprehensive cap-and-trade program generally can achieve key environmental and economic objectives regardless of how allowances are allocated.

While such principles are valuable in helping to guide allocation decisions, it is important to remember that a comprehensive cap-and-trade program generally can achieve key environmental and economic objectives regardless of how allowances are allocated. Because total emissions are capped, the allocation of allowances does not affect the environmental integrity of a cap-and-trade program. However, a federal cap-and-trade program will create a valuable new commodity estimated to be worth tens to hundreds of billions of dollars annually, depending on the stringency of the cap.[3, 4] Decisions about the allocation of allowances represent a large distributional equity issue and will result in competing claims, thus allocation is largely a question of equity and compensation, not environmental- or cost-effectiveness (although various complexities emerge in "real world" applications).[5] Allowance allocation presents both a challenge and an opportunity—no allocation formula will satisfy everyone and yet allocation itself can be used to ease the transition to a new program. Freely allocated allowances or the revenues from auctioning some portion of the allowances can be used for a variety of purposes including addressing or adapting to climate change.

Policymakers will ultimately have to weigh important and sometimes competing objectives. One goal is to minimize the overall economy-wide costs of the cap-and-trade program. Another objective concerns the equity of the cap-and-trade program and its economic impacts on different

segments of society—in other words, which groups will bear the economic burden of the transition to a low-carbon economy. Another concern is the degree of political feasibility and the desire to build a broad consensus across society that supports taking action to combat climate change. Allocation decisions will affect outcomes in all of these areas.

This Pew Center Congressional Policy Brief discusses key decisions regarding the distribution of GHG emission allowances and their implications.

Free Allocation vs. Auction of GHG Emission Allowances

One of the most fundamental allocation decisions facing policymakers is whether to give allowances away for free or sell them to sources via an auction. Recent trends in existing and proposed cap-and-trade programs illustrate that the choice does not have to be a mutually exclusive one. Instead, the outcome may be a combined approach that gives some share of allowances away for free and auctions the remainder, perhaps changing the ratio over time. Even so, it is helpful to understand the reasons why one approach may be preferred over the other in order to determine the relative proportion of each.

Allowances represent a significant source of value that can be given directly to recipients to be used or sold, or allowances can be auctioned and the revenue channeled to a variety of groups and uses. As such, many of the same kinds of questions will arise under either free allocation or auction approaches. If allowances are given away for free, who will receive them using what formula, and what will be their share of the allowance pool? If allowances are auctioned, who will receive the ensuing revenues? There remain some important differences, however, involving the choice to freely allocate or auction allowances.

The next sections outline the rationale for and implications of various approaches to the initial distribution of allowances.

Why might allowances be given away for free?

A system in which regulated sources are given allowances free of charge is similar in practice to traditional "command-and-control" environmental regulation that allows sources to emit up to a permitted level for free. This is the case, for example, under the Clean Air Act's New Source Performance Standards. Free allocation of allowances has also been the chosen approach under emissions trading programs established in the past. For instance, under the successful emissions trading component of the U.S. Acid Rain Program, SO_2 allowances are distributed for free to emitters based on a combination of historical heat input and emission performance benchmarks. To some, charging firms upfront for their emissions (by way of auction) would in effect take away a presumed property right to an environmental service that they have always used for free.

Some argue that free allowances should be provided to regulated entities (entities that would be required to hold GHG allowances) in a national GHG cap-and-trade system because these firms may incur significant costs in changing

their equipment and practices to comply with the new GHG regime. In this sense, freely allocated allowances would serve to compensate firms for the potential losses—such as those associated with having to prematurely retire long-lived capital investments—they could experience in adjusting to the new policy.

However, the actual economic burden of a cap-and-trade program does not fall solely—or even primarily—on the regulated entity. While the point of regulation can be either upstream on primary fuel suppliers, or further downstream on electric power producers and other energy-intensive manufacturers, the distribution of the cost burden up and down the energy supply chain will be independent of this decision. Ultimately, policymakers may want to design an allocation approach that distributes allowances to mitigate the actual cost burdens resulting from the cap-and-trade program, wherever those costs fall.[6] In general, the burden will fall on end-use consumers and those firms unable to pass along the higher costs of fossil fuels and electricity. For firms, this will depend on a variety of factors, some of which will affect the broad industry sectors to which firms belong and some which are specific to firms themselves. These factors include regulatory and market conditions, emission abatement options, and the price sensitivity of demand for firms' products.

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Some special considerations arise in the electricity sector, which is regulated differently across states, and ranges from full cost-of-service (regulated markets) to full retail competition (deregulated markets) with a number of variations in between.[7] In deregulated electricity markets, electric power producers will generally be able to pass along more of their compliance costs and the value of GHG allowances to their customers, increasing electricity prices (see below for exceptions). This will be the case whether they purchased their allowances outright, incurring a direct cost, or received them for free, incurring an opportunity cost if they were used to cover emissions and not sold. In regulated markets, the allocation approach will produce a different outcome on electricity prices. This is because regulators do not allow utilities to count allowance value as a "cost" to pass along if they received these allowances for free. If they must purchase allowances, they would be able to count them as costs and electricity prices would be higher.

For this reason, some argue that providing free allowances to regulated utilities would be an effective way of shielding large numbers of consumers from electricity price increases. However, this approach would contribute to a regional disparity in electricity prices, with consumers in deregulated markets paying higher prices than those in regulated markets. This disparity may inspire its own set of objections on grounds of fairness. Furthermore, in both regulated and deregulated markets, compensation to help generators retire their existing capital stock in favor of lower-emitting alternatives may be in order.

It is important to note that the ability of electricity producers in deregulated markets to pass through all costs, including the cost of any allowances, may be constrained. Pass through will depend on the type of fuel (e.g., coal or natural gas) that is "running on the margin" and setting the actual price in each market. For example, if natural gas is on the margin, it has a lower carbon content and therefore the increase in electricity prices will be lower than the increase that would occur if coal, with a higher carbon content, were on the margin. As a result, coal-fired generators in this market may not be able to fully pass on the value of allowances (whether they purchased them or received them for free). In other words, market conditions may already reduce the likelihood of "windfall" gains for certain electricity producers, even if they operate in competitive markets.

In competitive markets for electricity and transportation fuels… the value of emission allowances will likely be passed through to consumers as higher prices, whether allowances were freely allocated or purchased.

While some transition assistance may be in order, shielding consumers from higher electricity prices reduces the cost-effectiveness of a cap-and-trade system because it does not encourage potentially low-cost behavioral changes on the part of consumers. As a result, those foregone emission reductions will have to occur elsewhere in the economy, raising the overall program cost to the economy. Nevertheless, lower electricity prices may be deemed a worthwhile outcome for political and transitional reasons, especially in the early phase of a cap-and-trade program.

In both the electricity sector and other sectors, an alternative approach to providing free allowances at the point of regulation is to provide allowances for those affected by the program in addition to—or instead of—directly regulated entities. For example, while electric power generators are entities likely to be covered by the cap-and-trade program, some portion of allowances could be directed to their customers to provide relief from higher electricity costs. These include residential energy consumers and energy-intensive industries. One suggestion is to give allowances at no cost to load serving entities (LSEs)—entities that provide electric power to end-users and wholesale customers—on behalf of energy consumers. The value of these allowances would be used to lower electricity rates or put towards cost-saving investments in energy efficiency. While this approach would address concerns about regional price disparities, it would raise questions about the appropriate basis for allocation to LSEs and would increase overall program costs by dampening the price signal to consumers.

Free allowances could also be allocated to industrial users of electricity and fuels, compensating them for higher energy costs and helping to address concerns about international competitiveness. The chemical, aluminum, and cement industries are often cited as examples of sectors that would be potentially vulnerable to competition from firms in countries or regions without similar climate policies (see Pew Center Congressional Policy Brief on international competetiveness). Domestic price increases could lead to movement overseas of energy-intensive manufacturing and yield higher GHG emissions in other regions

(i.e., "emissions leakage"). An allocation to these firms for direct and indirect emissions covered by a cap-and-trade program is one means of alleviating these concerns.

Allowances could also be given to states, trust funds, or other intermediaries who would sell them to covered sources and generate revenue for specific public policy objectives. These include the development and deployment of technologies aimed at reducing greenhouse gases, capturing and storing carbon, and improving energy efficiency. The funds could also be used to lessen the burden of higher energy costs on consumers and low-income households, ease the transition for displaced workers and their communities, or address the consequences of climate change. Note that the same government programs could be funded by auction revenues as described in the next section and that providing free allowances to states and others without a compliance obligation blurs the distinction between freely allocated and auctioned allowances.

Table 1 lists some of the potential recipients of free allowances and possible implications.

Why might allowances be auctioned?

Auctioning allowances is in keeping with the "polluter pays" principle (depending on the point of regulation) and there is precedent for the government to charge for certain goods and services previously provided without charge. Some point to leases on federal lands for natural resources or licenses for radio frequency; however, it is important to note that there were no incumbents using the resources prior to these auctions as there is with GHG emissions.[8]

One of the arguments most often heard in favor of an auction is the possibility of using the auction revenues for specific public policy objectives. These objectives include those listed in the previous section, such as providing compensation for affected industry sectors and consumers. Other suggested uses of auction revenues include funding for research and

Table 1 *Options for Free Allocations*

Recipient	Implications
Emitters only	• Consistent with goal of free allocation to address compliance costs
Affected entities	• Could allocate to affected entities, such as electricity and gas users or their proxies (e.g., load serving entities and local distribution companies)
All product generators or producers	• Benefits lower-emitting facilities, providing a subsidy for what may be an expensive, but cleaner technology choice • Not all non-emitters are in need of additional subsidies as some pass on increased costs to the market in the form of higher prices
Local, state, or federal government funding for public policy objectives (Allowances are subtracted from the pool)	• Can be used to help alleviate electricity/product price impacts of program • Could provide source of funds for end-use efficiency and other public benefit programs • Creates additional administrative burden associated with distributing benefit to non-emitters (public) • Benefits public with expense borne by industry • May not pursue most cost-effective reductions or pick winning technologies

development to accelerate the deployment of clean energy technologies and improvements in energy efficiency. Funding could also be used to address climate impacts, provide job training in new clean energy industries for displaced workers, and/or promote changes in consumer behavior. Incentives for the latter can include investment in mass transit systems and rebates for energy-efficient appliances, building construction, and vehicles.

The total value of allowances in a GHG cap-and-trade program will be far greater than past emission trading programs.

Auction revenues could also be used to minimize the impact of a cap-and-trade program on low- and moderate-income consumers. As noted by the Congressional Budget Office and others, there will be a significant and regressive impact of a carbon price on consumers.[9] Allocating allowances freely to firms (and ultimately their shareholders), especially in unregulated markets, will only compound this regressive impact on consumers. Possible approaches to provide relief to these consumers using auction revenues include a revenue-neutral, progressive tax rebate or direct distribution to households.[10]

Alternatively, the government could use auction revenue to reduce existing taxes on productive resources like labor and capital that are widely believed to inhibit economic efficiency. Numerous studies have indicated that using auction revenues to lower pre-existing taxes would reduce the overall cost of a cap-and-trade program compared to an approach which distributes allowances for free. Auction revenue could also be used to pay down the national debt, reducing the need to raise future taxes. Use of auctioned allowance revenue in one of these manners would, in principle, reduce the economy-wide cost of a cap-and-trade program. However, such use would forego the opportunity to use revenues for other socially desirable objectives, including those related to climate change, and could also have potentially regressive impacts on households.[11] In addition, achieving significant changes in the tax structure in combination with climate policy to gain such efficiencies may prove very difficult in practice.[12]

The total value of allowances in a GHG cap-and-trade program will be far greater than past emission trading programs. A number of studies have suggested that it would be possible to overcompensate firms through free allowance allocation because many will be able to pass their costs of compliance through to their customers.[13] This is of particular concern in competitive markets for electricity and transportation fuels where the value of emission allowances will likely be passed through to consumers as higher prices, whether allowances were freely allocated or purchased. Different sectors (and even different firms within a sector) can have significantly different abilities to pass along costs of purchasing allowances to consumers, so consideration of the market conditions is important.

Even though this would constitute an economically rational decision on the part of producers, the resulting increase in profits could be viewed as windfall gains. Some have suggested that these windfall gains could be minimized with a significant allowance auction, or by applying allocation formulas that are specific to particular market conditions.

An auction rewards firms that have already reduced their emissions through investment in cleaner fuels or lower carbon technologies, since they will have to purchase relatively fewer allowances compared to firms that have not made these investments. Low- or zero-carbon electricity generators are likely to realize gains regardless of which fuel is on the margin and whether or not allowances are auctioned. An auction thus addresses concerns about whether and how to give credit for early action to those firms that have already made these investments. In addition, an auction eliminates the need to adjust the allocation scheme to deal with sources entering and exiting the market. New entrants would see the same cost as their competitors when entering the market and those exiting would simply stop purchasing allowances.

Most policy discussions see a role for at least some percentage of auctioning in ensuring the smooth functioning of the market, particularly when the market is in its infancy. As with the Acid Rain Program, even a small auction can help with price discovery (providing information on what allowance price the market will bear) and ensure that at least some allowances will be available to program participants.

Is a combination of free allowances and auctioned allowances the best approach?

A combined approach of allocating some allowances for free and selling the rest through auction could be a pragmatic alternative, and is gaining traction in proposals both in the U.S. and abroad. Using a combination of free allocation and auctioning of GHG emission allowances would involve making the determination as to what percentage of allowances should be auctioned versus allocated for free.

A combined approach of allocating some allowances for free and selling the rest through auction could be a pragmatic alternative.

Free allocation provides a straightforward means to compensate affected entities and thus can help achieve buy-in to a cap-and-trade system. However, the greater the ability of firms to pass along the additional cost of the allowances, the smaller the need for compensation. A high share of free allocation could be seen as giving firms too much of a valuable commodity and create the potential for windfall profits. Determining the appropriate amount of free allowances needed to compensate firms for their additional costs could be very difficult. In fact, it is unlikely that any approach will perfectly compensate all parties as such an objective would have informational requirements that are impossible to satisfy.[14] For some, this reality underscores the need for a generous approach to industry compensation, especially in the early years of the transition.[15]

Providing at least some allowances through auction can increase the scope of socially desirable objectives that can be pursued. Options for the use of funds generated through auction include reducing distortionary taxes or the federal debt (something that is not achievable through free allocation); minimizing the cost of a cap-and-trade program on affected sectors, consumers, households, and workers; and funding technology and adaptation initiatives that will help ease the transformation to a low-carbon economy and help address the impacts of climate change. Shifting to a greater share of auctioning over time (and announcing it ahead of time) would send a signal that free allocation is a transition strategy for affected firms and other entities.

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It will, however, be important to design a well-functioning auction to ensure that those that need allowances as a course of business will be able to get them in a timely manner and that other key objectives are met. Moreover, just as with decisions concerning the equitable distribution of free allowances to covered entities, the challenge of how to distribute the revenue generated by the auction will involve difficult political trade-offs.

Recent domestic proposals that combine free allocation and auctioning of emissions allowances include the following:

- USCAP recommends initially distributing a significant portion of allowances for free to capped entities and economic sectors particularly disadvantaged by the secondary price effects of a cap, including providing transition assistance to adversely affected workers and communities. USCAP also recommends that free allocations to the private sector should be phased out over a reasonable period of time.[16]

- The National Commission on Energy Policy (NCEP) proposes an initial 50/50 split between free allocation and auction, with the number of allowances given at no cost diminishing in favor of a more complete auction over time. The Commission believes that allocating emissions in this manner will effectively direct substantial resources to aid in the transition to a low-carbon economy and at the same time fairly compensate major affected industries for short-term economic dislocations incurred as a result of the policy.[17]

- The Market Advisory Committee to the California Air Resources Board recommended that auctioning should be a key part of allowance allocation under the cap-and-trade program, but that the state should retain flexibility to allocate a share of allowances for free to certain sectors.[18]

- National cap-and-trade legislation introduced in the 110th Congress included proposals for distributing allowances using both an auction and free allocation. Table 2 provides more detailed descriptions of the allocation approaches in selected legislative proposals.

- All of the states in the Regional Greenhouse Gas Initiative (RGGI)—a cooperative effort by ten Northeast and Mid-Atlantic states to design a regional cap-and-trade program—have chosen to auction the vast majority of their allowances. As part of its model rule, RGGI included the requirement that at least 25 percent of a state's allowance value be dedicated to strategic energy or consumer benefit purposes, such as energy efficiency, new clean energy technologies and ratepayer rebates. Power plants in RGGI can also purchase these allowances for their own use and the funds generated from these sales will be used for beneficial energy programs.[19]

Distribution of allowances in the initial trial phase (2005-07) of the EU Emissions Trading Scheme (EU ETS) was based on historical emissions and

Table 2 *Selected Allocation Approaches Proposed in the 110th Congress*

Boxer-Lieberman-Warner
S. 3036—Lieberman-Warner Climate Security Act of 2008
Substitute amendment to S. 2191 considered by full Senate in June 2008

Free Allocation
- 18% to fossil-fuel fired electric power generating facilities based on 3-year average annual emissions (transitions to zero in 2031)
- 11% to energy-intensive manufacturers based on category of facility, energy use, emissions, and number of employees with a set-aside for new entrants (transitions to zero in 2031)
- 12.25% for states (4% to states that are leaders in reducing emissions, 3% to states that rely heavily on manufacturing and coal, 3% to states for adaptation activities, and 2.25% to states for energy efficiency activities) (total percentage to states increases to 20.25% by 2032)
- 9.5% to energy consumers through electricity local distribution companies (LDCs) (increases to 10% by 2026)
- 5% for early action (transitions to zero in 2026)
- 4.25% for domestic agriculture and forestry (increases to 4.5% by 2031)
- 4% bonus allocation for renewable energy technology (transitions to 1% in 2031)
- 3.25% to energy consumers through natural gas LDCs (increases to 3.5% by 2026)
- 3% bonus allocation for carbon capture and sequestration (transitions to 1% in 2031)
- 2% to facilities that produce or import petroleum-based fuel (transitions to zero in 2031)
- 1.5% for cellulosic biofuels and clean commercial electricity fleets (transitions to zero by 2031)
- 1% to international forest protection
- 0.75% to natural gas processors (transitions to zero in 2031)

Auction
- 24.5% in 2012, rising to 58.75% in 2032
- Auction proceeds to be used for energy technology deployment, mitigating effects on energy consumers, adaptation for natural resources, and energy independence and security activities

Bingaman-Specter
S.1766—Low Carbon Economy Act

Free Allocation
- 53% to industry, declining 2%/year in 2017 and phased out by 2043
- 9% to states
- 8% for carbon capture and geological sequestration prior to 2030, available for first 10 years of production and phased out by 2040
- 5% of allowances set-aside for agricultural
- 1% for those registering GHG reductions prior to enactment and phased out by 2020

Auction
- 24% from 2012-2017, rising to 95% in 2043
- Auction proceeds to be used for technology (12%), adaptation (8%), and low income (4%)

most were freely given to sectors covered under the program (with up to 5 percent auction allowed). Only four member states chose to include any auctioning. Companies that were capable of passing on the full opportunity cost of allowances (such as deregulated electric utilities) experienced windfall profits in the electric power sector in Germany and the UK. In the second phase of the program (2008-12), the EU will have more accurate emissions data and EU member states will be able to auction up to 10 percent of their allowances and more than half plan to auction some amount. For the third phase (2013-20), a full auction for the electric power industry and many other sectors has been proposed by the European Commission.[20]

Many emerging programs provide for a transition from a generous free allocation to a full auction over time. A mixed approach that combines some free allocation and partial (and expanding) auction seems to offer important flexibility in meeting environmental, economic, and political objectives.

Table 2 *Selected Allocation Approaches Proposed in the 110th Congress (continued)*

McCain-Lieberman
S. 280—Climate Stewardship and Innovation Act

Free Allocation
- Encourage investments that increase efficiency of processes generating GHG emissions
- Credit reductions before 2012
- Provide sufficient allocation for new entrants

Auction
- EPA Administrator to determine allocation/auction split considering consumer impact, competitiveness, economic efficiency, etc.
- Auction proceeds to be used for, among other things, development of advanced low- or zero-emission technologies

Kerry-Snowe
S. 485—Global Warming Reduction Act

Free Allocation
- Allowances to be distributed in a manner consistent with the goals of the Act, including mitigating effects on consumers, worker transition assistance, promoting economic growth, etc.

Auction
- Determined by the President and requires unspecified amount of allowances to be auctioned
- Auction proceeds to be used in a manner consistent with meeting the goals of the Act, including reducing GHG emissions

Olver-Gilchrest
H.R. 620—Climate Stewardship Act of 2007

Free Allocation
- Encourage investments that increase efficiency of processes generating GHG emissions
- Credit reductions before 2012
- Provide sufficient allocation for new entrants

Auction
- EPA Administrator to determine allocation/auction split considering consumer impact, competitiveness, etc.
- Auction proceeds to be used for, among other things, development of advanced low- or zero-emission technologies

Waxman
H.R. 1590—Global Warming Pollution Reduction Act

Free Allocation
- Criteria to include transition assistance and consumer impacts

Auction
- Requires unspecified amount to be auctioned

Additional Considerations—Principles for Distributing Free Allocations to Covered Entities

If allowances are to be freely allocated, the basis for providing allowances must be determined. The first phase of the EU ETS used historical emissions ("grandfathering") as the metric for allocating allowances. Another example is the Acid Rain Program, which used a three-year average of historical heat input multiplied by an environmental performance benchmark that varied by fuel type and power plant category as the basis for allowance allocation without any updating. The NO_X Budget Trading Program allowed states to determine the allocation formula; in general, states took a similar approach to the Acid Rain Program, although some states did provide for updating, whereby the allocation formula incorporated newer data over time.

With respect to U.S. climate programs currently under development, under RGGI, the states agreed to apportion the region's emission allowances among the states largely on the basis of each state's total emissions. It is now up to each state to determine how these allowances will be allocated to sources. The program begins in 2009, and thus far all the states are auctioning the vast majority of their allowances.

As these existing and developing programs show, a variety of metrics can be used as a basis for allocation, including historical levels of emissions, output, or input (such as energy, fuel, or labor). These historical input or output levels could also be adjusted by an environmental performance benchmark, such as the emissions rate achieved by a particular production technology or the average emissions rate of the industry. Implications of various approaches are described in Table 3. There may be a variety of acceptable metrics for a sector such as electric power generation that produces a standard product. However, the use of certain metrics such as benchmarking may prove complicated for other manufacturing sectors that do not produce a homogenous good like electricity. As a result, the approach to allocation may vary from sector to sector.

Table 3 *Options for the Metric Used in Allocating Allowances*

Metric	Implications for Affected Entities
Historical emissions	• No reward for cleaner plants • Potential "windfall" if allocation level is too high
Fuel or other input	• Easy to measure • Rewards less efficient plants • Will need to consider implications of different kinds of fuel
Product output (Market share)	• Rewards more efficient and lower-emitting plants • Easy to measure for certain sectors, cumbersome for others • Potential "windfall" if allowances given to non-emitting sources • Cumbersome to address variety of outputs produced
Benchmark (Standard factor based on emission rate multiplied by output or input)	• Rewards more efficient and lower-emitting plants • Flexible—can adjust factor to make easier or harder on various categories of emitters • Cumbersome to address variety of outputs produced

Once the metric for free allocation has been determined, policymakers will need to decide what timeframe to use as the basis for allowance allocation. As part of this determination, one question to ask is whether the metric should be averaged over a period of years or if the maximum over a specific period should be used. Table 4 describes the implications of several options.

In addition, policymakers need to determine if the historical information used in determining the baseline for allocating allowances should be updated going forward based on new information. If historical output levels are updated, this would accommodate output growth of existing firms.

Table 4 *Options for the Time Period to be Used as the Basis for Allocating Allowances*

Time Period	Implications for Affected Entities
Single year	• Any one year will be unfair to someone • Benefits entity with relatively high emissions in that year if allocation is based on emissions or fuel input • Benefits good performers against benchmark that year if allocation is based on benchmark
Average of multiple years	• Evens out unusually high or low years—less chance of picking a good or bad year for any one emitter • Missing data may be difficult to address • Benefits entities with relatively high emissions or relatively good performance in those years
Maximum over a period	• Adjusts for different companies/sectors peaking at different times • Does not reward early reducers • Benefits entities reducing emissions at beginning of time period

In addition, updating would allow the allocation to reflect changes in market conditions, including plant closures and new entrants. Because updating will reward relatively faster-growing entities, it can distort future behavior by encouraging firms to increase output in an effort to obtain a greater share of allowances.[21] This increase in output will lead to lower prices for consumers, which may be appreciated by some, but the resulting increase in consumption will ultimately make achieving the overall emissions cap more costly.[22]

Additional Considerations—Designing an Auction

Auctioning of GHG emission allowances would involve requiring the regulated entities to bid to purchase emissions allowances. An important issue to consider is the design of the auction, including who can and cannot participate in the auction, the type of auction employed, and the frequency with which auctions are held.

The U.S. Environmental Protection Agency (EPA) auctions a small percentage (approximately 2.8 percent) of the allowances it distributes annually to regulated entities under the Acid Rain Program for the purpose of price-discovery and not to generate revenues. Each participant is required to submit a sealed bid containing the number of allowances desired and the purchase price to the EPA in advance of the auction. EPA then distributes the allowances on the basis of bid price, starting with the highest priced bid and continuing until all allowances have been sold or there are no more bidders. EPA does not set a minimum price for allowances.[23]

Important objectives of auction design are to promote competition and to encourage entry into the market. Thus, the widest possible participation from many sectors should be encouraged. In general, the higher the number of bidders, the greater the competition and the larger the auction revenues. On the other hand, small bidders may not participate directly because of high transaction costs, and the regulatory agency will face transaction costs associated with each bidder. This could be addressed by allowing "dealers" to participate in the market on behalf of smaller entities.[24]

There are many types of auctions that could be used to distribute allowances in a cap-and-trade program. The two broad categories that are often discussed are ascending-bid auctions and sealed-bid auctions. Ascending-bid auctions allow bidders to raise their bids during the auction. In a sealed-bid auction, bidders submit final offers only. The bids are submitted confidentially as demand schedules that specify how many permits a bidder would be willing to buy at any given price. The organization running the auction would then add the bids together to form an aggregate demand curve. The market clearing price would be the point where the aggregate demand curve equals the supply of allowances and all bidders above this price would receive allowances.[25]

Determining how frequently to hold the auction will be important as well. An auction that includes all of the allowances but is held infrequently could reduce transaction costs and possibly promote competition between existing firms. However, smaller but more frequent auctions can be more responsive to short-term price fluctuations, provide more immediate information to the market on supply and demand, encourage participation from smaller firms that may not have sufficient funds to purchase several years worth of allowances, and alleviate concerns that a few large firms may buy significant portions of the allowances.[26]

Key Design Questions

Decisions concerning the initial allocation of GHG emission allowances are integral to the design of a cap-and-trade program. These decisions will not affect the environmental effectiveness of the program as they are principally distributional in nature, but some decisions can impact the overall economy-wide cost of the program. Many socially desirable objectives can be achieved either through free allocation or auction of allowances, or through a combination of both. These objectives may include the advancement of new technologies and assistance to affected parties that will help ease the transition to a low-carbon economy. The following key questions are important to consider in determining the initial allocation of allowances:

- What percentage of allowances should be distributed using free allocation vs. auction? Should that percentage change over time?
- What sectors and other entities should receive allowances and through what metric?
- How should the funds generated through the auction be used?
- What timeframe should be used in allocating allowances?
- What type of auction should be employed?

End Notes

[1] The California Global Warming Solutions Act of 2006, or AB32, requires a 25 percent cut in carbon dioxide pollution produced in the state by 2020 in order to bring emissions levels down to 1990 levels. See Market Advisory Committee to the California Air Resources Board, *Recommendations for Designing a Greenhouse Gas Cap-and-Trade System for California*, June 30, 2007.

[2] United States Climate Action Partnership, *A Call for Action—Consensus Principles and Recommendations from the U.S. Climate Action Partnership*, January 2007, found at www.us-cap.org.

[3] See, for example, Kopp, Raymond J., Allowance Allocation, *Assessing U.S. Climate Policy Options*, Resources for the Future, November 2007; Dinan, Terry, *Trade-Offs in Allocating Allowances for CO_2 Emissions*, Congressional Budget Office, April 25, 2007; and Stavins, Robert N., *A U.S. Cap-and-Trade System to Address Global Climate Change*, Brookings Institution, October 2007.

[4] Note that the value of allowances is not equal to compliance costs under the cap-and-trade program. Instead, the value of allowances will be a transfer of wealth from those who ultimately pay higher energy or emissions costs to those who initially receive the allowances. Compliance costs are operating and capital expenditures incurred by covered sources to reduce emissions. These program costs would likely be much smaller than the total value of allowances, especially for moderate reductions in emissions.

[5] For a discussion of the complexities of determining compensation for entities affected by a GHG trading program, see Harrison, David, Per Klevnas, and Daniel Radov, *Complexities of Allocation Choices in a Greenhouse Gas Emissions Trading Program*, NERA Economic Consulting, September 2007.

[6] See National Commission on Energy Policy, *Allocating Allowances in a Greenhouse Gas Trading System*, March 2007.

[7] Williams, Eric. *Greenhouse Gas Allowance Allocation: Cost Pass-Through, Sector Differentiation and Economic Implications*, Nicholas Institute for Environmental Policy Solutions, February 26, 2008.

[8] Market Advisory Committee to the California Air Resources Board, 2007.

[9] Dinan, 2007.

[10] Palmer, Karen L. and Dallas Burtraw, The Electricity Sector and Climate Policy, *Assessing U.S. Climate Policy Options*, Resources for the Future, November 2007.

[11] Dinan, 2007.

[12] For a discussion of the gains that can theoretically be achieved by using auction revenues to reduce existing distortionary taxes, and why achieving such gains may be difficult in practice, see Stavins, 2007, and Nordhaus, Robert R. and Kyle W. Danish, *Designing a Mandatory Greenhouse Gas Reduction Program for the U.S.*, Pew Center on Global Climate Change, May 2003.

[13] For discussions of this issue, see Palmer and Burtraw, 2007, Dinan, 2007, and Stavins, 2007.

[14] For a discussion of the complexities of determining compensation for entities affected by a GHG trading program, see Harrison, et al., 2007.

[15] See Stavins, 2007 and National Commission on Energy Policy, March 2007.

[16] United States Climate Action Partnership, 2007.

[17] See National Commission on Energy Policy, *Energy Policy Recommendations to the President and the 110th Congress*, April 2007.

[18] Market Advisory Committee to the California Air Resources Board, 2007.

[19] See Regional Greenhouse Gas Initiative, *Regional Greenhouse Gas Initiative Model Rule*, January 2007.

[20] For a detailed discussion of the performance of the trial phase of the EU ETS, see Ellerman, Denny A. *The European Union's Emissions Trading System in Perspective*, Pew Center on Global Climate Change, May 2008.

[21] See National Commission on Energy Policy, April 2007.

[22] For a discussion of the potential effects of updating on the cost of achieving the emissions cap, see Harrison, David and Daniel Radov, *Evaluation of Alternative Initial Allocation Mechanisms in a European Union Greenhouse Gas Emissions Allowance Trading Scheme*, NERA Economic Consulting, prepared for the European Commission, March 2002.

[23] For the first 13 years of the SO_2 cap-and-trade program operation, the Chicago Board of Trade (CBOT) performed the auction function for EPA. CBOT is a futures and futures options exchange which has its roots in selling agricultural commodities. There were distinct administrative advantages to having a commodities exchange handle auction functions. In 2006, CBOT declined to run the auction. Since the auction is a simple bid process for a relatively small number of allowances, EPA assumed the responsibility for administering the auction. For more information see the EPA's Acid Rain Program Allowance Auction Fact Sheet, found at http://www.epa.gov/airmarkets/trading/factsheet-auction.html.

[24] Hepburn, Cameron, et al., *Auctioning of EU ETS phase II allowances: How and why?* Climate Policy 6 (2006), 137-160.

[25] Hepburn, et al., 2006.

[26] Hepburn, et al., 2006.

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