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Allocating Allowances in a Greenhouse Gas Trading System

National Commission on Energy Policy

A STAFF PAPER FROM THE NATIONAL COMMISSION ON ENERGY POLICY

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Disclaimer

This white paper was prepared by the staff of the National Commission on Energy Policy and aims to promote a better shared understanding of the issue of allocation. While this paper was drafted with the assistance of a sub-group of NCEP Commissioners, the views expressed here do not necessarily reflect those of each of the Commissioners of the National Commission on Energy Policy.

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Letter from NCEP Co-Chairs

Dear Colleagues,

One of the most important recommendations in our 2004 report, *"Ending the Energy Stalemate: A Bipartisan Strategy to Meet America's Energy Challenges,"* was a proposal that the United States implement a mandatory, economy-wide program designed to slow, stop, and eventually reverse the growth of energy-related greenhouse gas emissions. Since we published that recommendation, our conviction that a response to global climate change must be part of any sound, long-term national energy strategy has only strengthened. More importantly, the same view is increasingly shared in corporate boardrooms and statehouses across the country, and in the U.S. Congress, where the Senate in 2005 passed a groundbreaking resolution expressing its support for a comprehensive policy that would limit emissions without harming the U.S. economy, while also encouraging comparable action by other nations.

As policy-makers, business leaders, and environmental advocates turn from the question of whether we need to address climate change to how we should go about it, more attention is being focused on the nuts and bolts of designing an effective, market-based program for reducing greenhouse gas emissions. In that discussion, the question of allocation—that is, how government distributes emissions permits or allowances under a trading program—emerges as one of the most critical and contentious of many design issues.

Recognizing the importance of allocation, the Commission has engaged in extensive further analysis and discussion of this topic over the last year. The results of that exploration are reflected in this staff White Paper, which aims to promote a better shared understanding of allocation: what it is, why it matters, and how policy-makers might go about designing an approach that is not only politically viable, but that fairly distributes the net burdens of regulation and seeks to maximize benefits to stakeholders and society as a whole. We are well aware that reaching a consensus on allocation will not be easy—the subject is inherently complex and many of the decisions involved are fundamentally distributional in nature, making them difficult to adjudicate in a manner that satisfies all parties. Moreover, allocation debates are easily confounded by misperceptions, common among many stakeholders, about how allocation decisions do and do not affect the way an emissions trading program works in practice.

It is our hope that this White Paper will help to clear up some of those misperceptions and provide the foundation for a new way of thinking about allocation. And as always we look forward to working with you, the reader, as this important debate evolves in the months ahead.

Sincerely,

John P. Holdren | William K. Reilly | John W. Rowe

Executive Summary

In 2004, the bipartisan National Commission on Energy Policy (NCEP) released a comprehensive set of energy policy recommendations that called for the adoption of an economy-wide, market-based program to begin slowing the growth of U.S. greenhouse gas emissions. Since the Commission's report was released, the impetus for mandatory national-level action on climate change has continued to build. Anticipating that a trading program will likely be adopted to limit domestic greenhouse gas emissions, interested stakeholders are increasingly focused on the specifics of designing and implementing such a program. Among the most important and contentious of many practical details to be addressed is the issue of allocation—that is, how should government distribute emissions permits or allowances under a trading program?

The question is contentious precisely because allowances represent a valuable financial asset. How this asset gets divided up among different interests and claimants turns out *not* to matter much, if at all, in terms of the environmental results or overall societal costs of the proposed policy. But political dynamics are rarely governed by aggregate considerations: specifically, who pays and who benefits and whether the outcome seems generally fair to most parties matters a great a deal. And in this regard, the importance of allocation can hardly be overstated.

Commission staff prepared this White Paper to help inform the ongoing debate about allocation by elucidating some of its less obvious but critically important aspects. Along the way, the Paper attempts to correct a number of common and persistent misperceptions that often get in the way of advancing the debate and to provide a theoretical and empirical foundation for the Commission's own evolving views. The results reflect further analysis conducted since the release of the Commission's 2004 report, as well as input gathered at a series of Commission-sponsored workshops on allocation and other critical program design issues in late 2005 and at a conference convened by the Senate Energy and Natural Resources Committee in April 2006 to explore many of the same questions.

These discussions and other recent developments—notably the European Union's (EU) experience with implementing an Emissions Trading System (ETU) for power plants and other large industrial emitters—have challenged certain

long-standing assumptions about allocation. In particular, they challenge the presumption that most allowances should be allocated for free to those industries that are directly regulated under a greenhouse gas trading program. As Senators Pete Domenici and Jeff Bingaman, then Chairman and Ranking Member of the Senate Energy and Natural Resources Committee, put it in a joint letter summarizing the common themes that emerged from their Committee's 2006 conference: "Allowances should not be allocated solely to regulated entities because such entities do not solely bear the costs of the emissions trading program."

Explaining why this is so and how one might design an allocation approach guided by equity considerations, in which the distribution of allowances roughly reflects the distribution of actual cost burdens under a greenhouse gas trading program, is the subject of this White Paper. As a starting point, several key points about allocation must be widely understood:

(1) **Allocation affects the distribution of benefits and burdens among firms and industry sectors; it does not change program results or overall costs.** Under a trading program, using an allowance is always costly—even for a firm that got the allowance for free—because it means giving up an asset that could otherwise be sold in the marketplace. Thus the incentive to reduce emissions is the same for all firms, regardless of allocation. Since allowances have real monetary value, they can be used to compensate firms or consumers without changing how different entities respond to the policy or what measures are taken to reduce emissions going forward.

(2) **The sum value of allowances is not a measure of the program's cost to society.** Under the original NCEP proposal, the market value of allowances in circulation in the early years of the program would total $30–$40 billion annually, while the costs incurred by society to actually reduce emissions would be much less (on the order of $4 billion per year). This is simply because the emissions target is relatively modest: the number of tons being reduced is much smaller than the number of tons for which allowances are issued. Trade in allowances generates costs for allowance buyers, but equal and offsetting gains for allowance sellers. It does not represent a cost to society.

(3) **The economic burden imposed on a particular firm or industry sector under a greenhouse gas trading program is not a direct function of its emissions or fossil-fuel throughput.** Rather, the burden depends on a number of factors, including ability to pass through costs, emission reduction opportunities, and elasticity of consumer demand for the firm's or sector's output in response to higher prices. Available analyses suggest that consumers and businesses at the end of the energy supply chain will bear the largest share of costs under a trading program, while primary producers or suppliers of fossil fuels (oil, coal, and natural gas) will bear a smaller share. Certain firms or industry sectors, however, may encounter more difficulty than others

in passing through costs and may bear a disproportionate burden as a result (examples might include firms that compete with foreign suppliers who do not face similar emissions constraints).

(4) Because they do not bear most of the cost, allocating most allowances for free to energy producers creates the potential for large windfall profits. Economic analysis and experience with Europe's trading system suggests that energy companies can and will pass most program costs through to consumers and businesses at the end of the energy supply chain. If the same companies get a large allocation of free allowances, the value of those allowances is likely to substantially exceed any actual net costs they incur as a result of the policy.

(5) Allocation decisions in the electric power sector are complicated by variation in the regulatory structures that govern this industry. Specifically, the co-existence of largely competitive wholesale markets and various forms of cost-of-service price regulation in different parts of the country could distort price signals in ways that blunt incentives to reduce end-use demand and lead to an inequitable distribution of cost burdens across consumers and companies in different regions. One concern is that program costs would be largely passed through to customers in competitive retail markets (allowing generators to "keep" most of the asset value of a free allocation), while companies operating in regulated markets could be required by regulators to use free allowances to offset price impacts. Since retail markets in the most coal-intensive regions tend to be regulated, this creates the potential for a perverse outcome in which consumers that rely on a more carbon-intensive generation mix see a weaker price signal than consumers that rely on a lower-carbon mix. Thus, policy makers will need to pay close attention to allocation decisions within the electric sector and should consider a variety of options to ensure rational and equitable results.

(6) Allocation provides an opportunity to advance equity and other broad societal interests without diminishing the price signal necessary to elicit cost-effective, economy-wide emissions reductions. A trading program works by creating market incentives—effectively attaching a price to every ton of carbon emitted. Giving away allowances won't shield firms or consumers from this price signal—indeed, that would not even be desirable. For the program to be effective, all energy producers and users must face the same incentive to reduce emissions. But allowances *can* be used for a variety of productive purposes: to compensate those who bear a disproportionate burden under the policy, to advance other public-policy objectives (such as supporting energy R&D), or to provide broad societal benefits (for example, making it possible to cut taxes on income or investment).

(7) A mixed approach, which combines some free allocation with a partial auction, may offer significant benefits. Giving away all (or nearly all) allowances to the energy companies that are directly regulated under the program would have the effect of transferring wealth from consumers to

> *"A 50 percent free allocation—from the total pool of allowances available on an economy-wide basis—would provide enough free allowances to substantially compensate adversely affected industries for un-recovered costs under an emissions trading program."*

those companies and would tend to produce large net profits for some firms. The opposite approach—auctioning all allowances and using the revenues for socially productive purposes—is far preferable from the standpoint of maximizing overall economic efficiency, but could leave some carbon-intensive industries with significant net costs.

All of the above points are discussed in some detail in the White Paper that follows. Taken together they lead the Commission to conclude that the allocation approach taken in Europe—where national governments distributed nearly all allowances for free to entities directly regulated under the EU trading system—does *not* provide a good model for an economy-wide U.S. program. Rather, to address equity concerns and avoid excessive windfall profits in some industries, a much larger fraction of emissions allowances or permits should be auctioned.

Based on analysis by the Commission, this White Paper concludes that an allocation guided by equity considerations would initially distribute no more than 50 percent of allowances for free to major energy producing or consuming industries, including directly regulated suppliers of primary fuels (coal producers, oil refiners, and natural gas processors), the electric power sector, and energy-intensive manufacturers.[1] This would leave 50 percent of allowances to be directed to public purposes, where public purposes could include mitigating impacts on low-income consumers; investing in low-carbon energy technologies and end-use efficiency; creating incentives for agricultural carbon sequestration; and reducing the federal budget deficit and/or supporting broader tax reforms. Over time, any initial earmarks for specific purposes will need to be re-evaluated, suggesting a finite limit to these expenditures and a transition to general fund contributions.

A 50 percent free allocation—from the *total* pool of allowances available on an economy-wide basis—would provide enough free allowances to substantially compensate adversely affected industries for un-recovered costs under an emissions trading program. *Within* that free allocation, equity considerations argue for distributing shares to individual industry sectors in a manner that roughly reflects the incidence of actual cost burdens. Those cost burdens, as noted above and throughout this White Paper, are not a simple function of emissions or fuel

[1] This figure is far smaller than the 90 percent free allocation to major energy producing or consuming industries contemplated in the Commission's original recommendations. As reflected in this White Paper, the Commission's views on allocation have changed as a result of further exploration and analysis.

> *"Given that cost burdens are not equal, there should be no presumption that different industry sectors are entitled to equal shares of allowances, either in absolute terms or as a fraction of their emissions or fuel use."*

use. Moreover, they are likely to be quite small for some sectors (such as the petroleum industry) that should have little difficulty passing through costs and relatively higher for other sectors (such as the electric power sector and some energy-intensive manufacturers). Given that cost burdens are not equal, there should be no presumption that different industry sectors are entitled to equal shares of allowances, either in absolute terms or as a fraction of their emissions or fuel use.

Since it will not be possible to distinguish winners from losers at the individual firm level, a 50 percent free allocation will undoubtedly result in some overcompensation to firms that will be competitively advantaged under a greenhouse gas trading program. The Commission believes this is an acceptable trade-off in the interests of addressing legitimate cost concerns among some industry stakeholders and to advance the prospects for reaching political consensus. Over time, however, as energy producers and energy-intensive industries have an opportunity to adjust to carbon constraints, the rationale for a free allocation diminishes relative to the considerable advantages of an auction that generates revenues for more productive and widely-shared societal investments. Hence, it would be appropriate to gradually diminish the portion of allowances distributed for free in future years and transition to a more complete auction.

The Commission is well aware that the debate about allocation in the context of a national emissions trading program for greenhouse gases is just beginning in earnest. An important question that will need to be addressed is how to handle allocation to entities *within* different sectors, especially in the electric power sector, which presents unique challenges for the reasons noted above. Here and elsewhere a vigorous debate on the points discussed in this White Paper lies ahead. That debate is likely to be difficult at many points since, as the Commission has repeatedly cautioned, there is no approach to allocation that can hold harmless all stakeholders or render entirely costless a policy for reducing greenhouse gas emissions; nor will there always be a clear objective basis for choices that are fundamentally distributional and political in nature. Nevertheless, it is the Commission's hope that this effort to clarify some of the key issues surrounding allocation will help to promote a foundation of shared understanding for future discussions.

I. Introduction

In December 2004, the bipartisan National Commission on Energy Policy (NCEP) released a report outlining a comprehensive set of recommendations for national energy policy (NCEP, 2004). Prominent among these recommendations was a proposal that the United States implement a mandatory, economy-wide program of tradable permits or allowances to limit greenhouse gas emissions. Subsequent to the release of the Commission's report, the U.S. Senate, in June 2005, adopted a resolution expressing its sense "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 (1) will not significantly harm the United States economy; and (2) will encourage comparable action by other nations that are major trading partners and key contributors to global emissions."

Before and since the adoption of the Senate resolution, discussions among policy-makers and interested stakeholders have increasingly focused on the specifics of designing and implementing a market-based approach to reducing greenhouse gas emissions. Draft legislation considered by the Senate Energy and Natural Resources Committee in the final weeks of debate around the 2005 Energy Policy Act, as well as several subsequent proposals—including a House bill recently introduced by Representatives Mark Udall and Thomas Petri (H.R. 5049)—have featured a program design similar to that outlined in the Commission's 2004 recommendations. Other recent developments—notably California's decision to require significant, state-wide emissions reductions by 2020 and efforts by several northeastern and mid-Atlantic states to cap regional power-sector emissions—suggest that momentum for mandatory climate programs is growing. As state and federal policy-makers grapple with the practical details of crafting an equitable and effective approach, allocation—that is, how government distributes emissions permits or allowances under a trading program—emerges as one of the most important and contentious of many program design questions.

This White Paper is about allocation: what it is, why it matters, and how policy-makers might go about designing an approach that is not only politically viable, but that fairly distributes the net burdens of regulation and seeks to maximize benefits to stakeholders and society as a whole. It begins by situating the allocation debate in the context of recent developments, including the results of a conference on climate-change program design issues held by the Senate Committee on Energy and Natural Resources in April 2006 and earlier Commission-sponsored work on related topics. Subsequent sections review the basics of allocation, including its relationship to incentives and costs, as well as the pros and cons of different allocation options. Having laid the groundwork for a more nuanced understanding of these issues, the White Paper goes on to describe a general approach to allocation that addresses disproportionate cost burdens while also creating a reasonable transition period for capital- and energy-intensive sectors like the electric-power industry. The conclusion provides specific recommendations based on the Commission's further exploration and current thinking on this critical topic.

II. Overview and Context

Recognizing the practical and political importance of allocation decisions, the Commission has, since the release of its 2004 report, devoted additional study to this specific issue and engaged numerous stakeholders in an intensive dialogue about the merits of different options. In late 2005, the Commission joined with the Edison Electric Institute (EEI) to sponsor a series of four workshops on allocation and other program design issues for market-based greenhouse-gas reduction strategies. These workshops were attended by an average of 130 participants representing non-governmental organizations, academic institutions, various industries, and government, and each featured multiple expert presentations. Drawing on the results of these workshops, Cambridge Energy Research Associates (CERA) prepared an in-depth report for the Commission on allocation and other key design questions in February 2006 (CERA, 2006).

Following release of the CERA report, the Commission participated in a conference, held by the Senate Energy and Natural Resources Committee on April 4, 2006, to explore critical issues for the design of a mandatory greenhouse-gas program. The Senate conference was attended by more than 300 people and elicited detailed written comments from over 160 organizations and individuals, including NCEP (GPO, 2006). On June 22, 2006, Senators Pete Domenici and Jeff Bingaman, then Chairman and Ranking Member, respectively, of the Senate Energy and Natural Resources Committee, released a statement indicating that they were encouraged—as a result of the conference—about the prospects for fashioning "reasonable policy solutions" to the problem of climate change (Senate Energy Committee, 2006). The statement also summarized key themes that had emerged at the conference and in related submissions to the Committee.

On the subject of allocation, in particular, Senators Domenici and Bingaman identified several emerging principles. First, that allowances should be allocated "in a manner that recognizes and roughly addresses the disparate costs imposed by the program." Second, that allowances should not be allocated solely to the companies that are directly regulated under a trading program because those companies "do not solely bear the costs" of the program. A third principle was that a portion of available allowances should be auctioned (or used for set-aside programs) to generate revenues for "climate-related policy goals or for other public purposes." The final principle identified by Senators Domenici and Bingaman was that an allocation approach should transition gradually over

time from a largely free distribution of allowances to use of an auction "as the predominant method" for distributing allowances.

The Commission's own thinking on the subject of allocation has evolved as a result of further study and evidence emerging from real-world experience with implementing greenhouse-gas trading programs, including recent developments in Europe. In fact, the Commission's current view accords closely with the general principles articulated by Senators Domenici and Bingaman in the foregoing excerpt from their joint statement. The remainder of this White Paper attempts to establish the theoretical and empirical basis for those principles and to explore their specific implications for future allocation decisions.

A. ALLOCATION: WHAT IT IS AND WHY IT MATTERS

Market-based environmental regulatory programs have become increasingly popular since 1990, when the United States first adopted a "cap and trade" approach to reduce national sulfur dioxide (SO_2) emissions. The same regulatory model has since been used to address other pollution problems and has emerged as a common design feature in nearly all recent proposals to mandate greenhouse-gas reductions. The basic mechanics are easy to describe: government introduces a new kind of currency in the form of allowances or permits[2] that entitle the holder to release a given quantity of the substance being regulated. Emitters must surrender to the regulator a sufficient number of allowances to cover their emissions in a reporting period. Entities either buy or are given allowances. They can "use" (and eventually surrender) those allowances to cover their emissions and they can sell any unused allowances to others or (in many cases) bank them for future use. In the case of a program to regulate greenhouse gases, allowances or permits would most likely be issued in tons of carbon-dioxide-equivalent emissions. Future emissions are then constrained by limiting the pool of available allowances.[3]

Once underway, a trading program—by definition—leaves entities free to buy and sell emissions allowances or permits as suits their individual best interests. But someone needs to decide how to distribute this new currency at the outset. Will the government sell allowances or give them away, or some combination of both? To the extent that some allowances are distributed for free, which entities get them? How many allowances does each entity get and how is this determined?

All of these questions are subsumed under the topic of allocation. How they are decided can be highly consequential in terms of the political viability of a particular proposal, even though—for reasons discussed at length in later sections of this paper—allocation decisions typically have little bearing on ultimate program outcomes or on the costs incurred by society to limit emissions. In any mandatory program, permission to emit—precisely because it is limited—has value. The more stringent the program, the more the pool of available allowances is constrained, and the more valuable each allowance becomes. Potential recipients have a direct financial stake in how this finite pool of new assets is to be distributed, both in terms of whether allowances will be given away vs. sold to the highest bidder and in terms of the share of total allowances available to a particular sector or individual firm. Any group or entity directly or indirectly affected by greenhouse-gas regulation can (and likely will) argue that it should be compensated in the form of free allowances: the list of potential claimants is diverse and virtually endless, but at a minimum is likely to include fossil-fuel producers, energy-intensive industries, electric-power producers, workers in affected industries (e.g., coal miners), states and local communities, consumers, and poor and minority households, among others.

[2] The term "allowance" was introduced in the SO2 program to avoid confusion with the term "permit," which has a well-established but somewhat different meaning in environmental law (where it is generally used in the more typical sense of written permission for a specific entity to undertake a specific action). Both terms are used interchangeably in the economics literature and in this Paper to denote permission to emit a defined unit of the substance being regulated in the context of an emissions trading program.

[3] In the case of the original NCEP proposal and subsequent draft legislation considered by the Senate Energy and Resources Committee, emissions technically are not capped. Rather, the price of allowances is capped via a safety-valve mechanism designed to make additional allowances available when the per-ton price of emissions reductions rises above a threshold level.

Allocation is likely to be politically fraught not only because so many interests have a stake in the outcome but because the sum value of assets involved is also large. Modeling analyses of the program design first outlined by the Commission in its 2004 report suggest that the total value of emissions allowances during the first phase of program implementation is on the order of $30–$40 billion each year; over a 10-year period, the sum value of allowances would be in the hundreds of billions of dollars. Under a program design with more stringent emissions targets and/or higher price caps, the cumulative value of allowances would be even higher. Importantly, however, the sum value of allowances does *not* equal the cost of the trading program to society, which, in the case of the NCEP proposal, is much less—about $4 billion per year.

> *"Clearly, requiring emitters to submit allowances and then limiting the pool of available allowances has the effect of attaching value to every ton of emissions avoided."*

The crucial distinction between allowance costs—which largely represent a transfer of wealth between holders and buyers of allowances—and societal program costs, which are the costs incurred to achieve actual emissions reductions, is discussed in the next section. That discussion also helps to elucidate why the sum value of allowances in any program designed to achieve relatively modest reductions will far exceed the total societal cost incurred to achieve those reductions.

B. THE DIFFERENCE BETWEEN ALLOCATIONS COSTS AND PROGRAM COSTS

One of the most important misperceptions that arises in many allocation discussions is the assumption that allowance values correspond to program costs. Clearly, requiring emitters to submit allowances and then limiting the pool of available allowances has the effect of attaching value to every ton of emissions avoided. And at first glance, the requirement to submit an allowance for each ton of emissions might seem to constitute a pure cost. But that is a private cost to the emitter and, because it generates an equal source of income for the allowance seller, not a cost to society as a whole.

A Short Lexicon of Key Terms

Allowance or **permit:** A kind of currency that entitles the holder to emit a defined quantity of the substance being regulated. Allowances or permits are typically valid for a specified year, but many program designs allow them to be saved or "banked" for future years. Each allowance or permit has the same market value, which is determined by the marginal cost of achieving the next ton of emissions reduction.

Allocation: The method used to distribute allowances. Often also used to mean the share of allowances that is awarded for free to particular firms or sectors.

Auction: A mechanism for distributing allowances (or permits) in which entities bid to purchase allowances. The government can auction allowances instead of giving them away for free, thereby generating revenues for the public treasury. Other entities that are not directly regulated under the program but that receive an allocation of free allowances on behalf of consumers or for other purposes can also use an auction mechanism to convert those allowances to cash.

Free Allocation: A method of allocation in which government gives allowances or permits for free to affected entities. The use of historic data (e.g. past output, emissions, or fuel-input) to distribute free allowances to existing entities is often called "grandfathering."

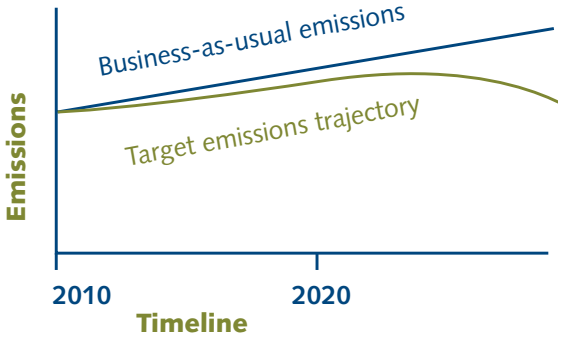
Point of Regulation: Where in the chain of energy production, distribution, and end use the requirement to submit allowances or permits is imposed.

Cost: Means different things in different contexts. Cost to society equals actual cost of mitigation efforts undertaken in response to the policy. Cost to individual firms or industry sectors equals program or compliance costs—including the cost of mitigation efforts, as well as purchased allowances or higher energy costs—that cannot be recovered from customers. From a societal point of view, expenditures to purchase allowances or to cover higher energy prices represent a *transfer* of wealth to the original allowance holder or upstream energy provider, not an actual cost to society.

Opportunity Cost: Revenues foregone as a result of using an allowance or permit that could otherwise be sold to someone else.

Safety Valve: A government-established limit on the maximum market price of allowances or permits (typically achieved by making an unlimited number of additional allowances available from the government at a fixed price). Used in some recent proposals to cap the overall economic costs of a trading program.

Figure 1. Allowances Available for Allocation in Relation to Emissions Mitigation



This is not hard to see in the case where government distributes allowances for free at the outset. Suppose the distribution is such that all firms find it efficient to set emissions equal to the allowances they have been issued. In this case, allowances are not bought or sold and the only cost to firms is what they spend to reduce emissions to a level equal to the allowances they receive. Allowances still have value, of course, and firms must surrender these valuable assets when they emit, but these submissions involve no cash cost: firms are simply handing back to the government assets that the government gave out in the first place. The same conclusion holds for firms in aggregate whenever allowances are distributed for free: even if those allowances are subsequently bought and sold, buyers' outlays become sellers' receipts. In short, when allowances are distributed for free, firms in aggregate are given a new asset that is equal (but for transaction costs, if any) to their new obligation to submit an allowance for each ton of emissions. As before, the only net cost imposed on these firms as a group is the cost of reducing aggregate emissions to the target level of the policy.

It is also the case that the cost of allowances is not a cost to society as a whole, however, when the government chooses to auction all allowances instead of giving them away for free. In that instance, resulting revenues are returned to the federal Treasury and become available to reduce the deficit, offset other taxes, or fund additional public spending. (This is similar to the familiar point that the cost to society of a tax is not measured by the revenues it yields the government but by the distortions it imposes on the economy.) Either way, allowance transactions represent a transfer of wealth from the allowance buyer to the allowance seller, but do not equal a net cost to society.

Limiting emissions does impose a real cost on society, of course, but that cost is equal to the cost of actual mitigation measures undertaken as a result of the policy and is generally far smaller than the face value of allowances. In the case of the Commission's original proposal, actual emissions-mitigation costs are estimated to average roughly $4 billion per year over the first ten-year implementation period, or roughly one-tenth of the estimated $30-40 billion allowance value associated with the trading program.

Given that mitigation costs, at the margin, determine the price (or value) of each allowance, the mismatch between aggregate allowance value and aggregate mitigation costs might seem counter-intuitive. In fact, however, this mismatch is a simple function of the fact that the number of tons being reduced under the policy is much smaller than the number of tons that continue to be emitted (and for which allowances are issued). Figure 1 helps to illustrate this point in very general terms: the area between the business-as-usual emissions trajectory and

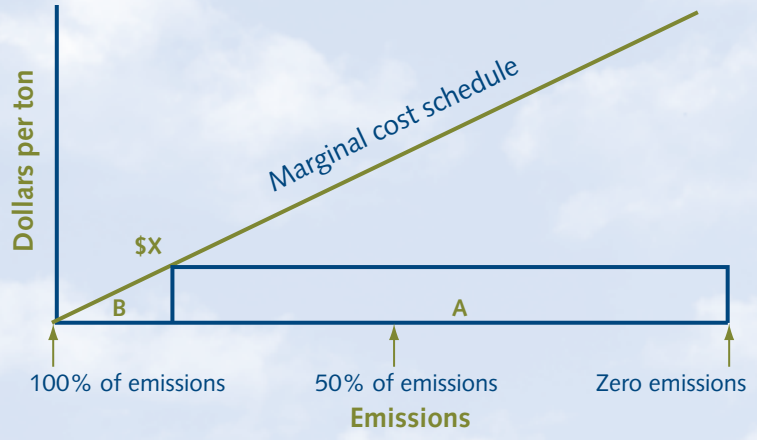
> *"It must be emphasized that the actual cost of the NCEP proposal to the U.S. economy is very small."*

the target emissions trajectory is much smaller—especially in the early years of program implementation—than the area below the target emissions trajectory. The original Commission proposal, for example, is designed to generate a $7-per-ton incentive on roughly 6 billion tons of carbon in order to stimulate roughly 200 million tons of reductions (at a per-ton cost at or below $7) in its first year. As a result, the value of allowed emissions—which is also the value of the allowance market—is roughly $42 billion ($7/ton x 6 billion tons). Meanwhile, since many of the reductions taken as a result of the policy cost less than $7 per ton, aggregate mitigation costs are well below $1.4 billion ($7/ton x 200

"…firms will be equally motivated to reduce emissions because foregoing the opportunity to sell a free allowance creates exactly the same economic incentives as being required to buy an allowance one doesn't have."

Allowance Value and Mitigation Cost

The graph below serves to illustrate why there is likely to be a large discrepancy between cumulative allowance value and actual mitigation cost in the early years of any program to reduce CO2 emissions. In the graph, the market price of an allowance, based on the marginal cost of reductions at the emissions target, is $X per ton.* The total face value of available allowances equals the area of rectangle A (that is, remaining emissions multiplied by $X/ton). Total mitigation cost, is equal to the area of triangle B because it includes all reductions available further down the marginal cost curve (that is, for a per-ton cost less than $X). In fact, regardless of the allowance price $X,** the sum value of allowances available for allocation will always be greater than the costs incurred for mitigation *as long as the number of tons still being emitted is greater than the number of tons being reduced (i.e., target emissions reduction is less than 50 percent).*



* *In reality, the marginal cost schedule is likely to follow a curve, but for purposes of this explanation costs are assumed to rise in a linear fashion. Note also that in a program design like that proposed by NCEP, the final allowance price $X is limited by the safety valve mechanism rather than by a given emissions target.*

** *Except in the extreme case where program targets are so weak that, in effect, no reductions are required. In that case, allowance supply exceeds demand and (provided companies do not engage in hoarding behavior) allowances have zero market value. Of course, in that case mitigation costs incurred are also zero.*

million tons). A more general, theoretical discussion of this point is provided in the text box at left.

It must be emphasized that the actual cost of the NCEP proposal to the U.S. economy is very small. In fact, the U.S. Energy Information Administration (EIA), in a comparative analysis of several legislative proposals, one of which closely followed the NCEP recommendations, found that such a program would have "no meaningful impact" on the nation's future economic growth. EIA reached that conclusion on the basis of modeling estimates indicating that the total impact of the program would be on the order of a few tenths of a percent of GDP, compared to projected GDP growth on the order of 60 percent, over the next 15 years (EIA, 2005). This finding is not surprising, given that the actual emissions reductions achieved by the policy (relative to a business-as-usual trajectory) are also small over the same time period. As discussed at length in its 2004 report, the Commission deliberately designed an approach that was initially modest and protective of existing investments in long-lived capital assets to overcome the cost and competitiveness objections that have so far stymied efforts to reach consensus on a mandatory national climate policy. Accordingly, it recommended a policy framework designed first to slow emissions growth—undertaking more substantial reductions only later if called for—and to limit overall costs to the economy.

C. HOW ALLOCATION AFFECTS EQUITY AND INCENTIVES

Any regulatory system, however modest or aggressive, will create winners and losers. One of the significant advantages of an emissions-trading program is that it separates distributional issues from efficiency issues. Efficiency requires that all emitters face the same price per carbon-equivalent ton of emissions **at the margin**. This creates an equal incentive to reduce emissions across all affected sectors and leads to cost-effective system-wide reductions. Permits or allowances can be allocated any number of ways, but as long as each ton of emissions must be covered by an allowance, emitters will have an incentive to implement all reductions available at a per-ton cost below the allowance price. If a firm receives an allocation

"Free allowances are most appropriately viewed as the equivalent of an up-front, lump-sum payment: in effect, handing out free allowances is the same as handing out money."

less than its total emissions, it can either reduce its emissions or pay the market price for the additional allowances it needs. But even a firm that receives a quantity of free allowances in excess of its total emissions can—by reducing emissions—increase the number of unused permits it has available to sell at the market price.

In other words, both firms will be equally motivated to reduce emissions because foregoing the opportunity to sell a free allowance creates exactly the same economic incentives as being required to buy an allowance one doesn't have. The magnitude of that incentive is the same for all firms and is entirely driven by the price of allowances, which in turn is a function of the overall stringency of the program relative to the cost of available emission-reduction opportunities throughout the economy.

In sum, allocation decisions should have no impact on incentives, on the amount of emissions reductions achieved as a result of the policy, on where emissions reductions occur, or on who bears the cost of implementing them.[4] (A more complete explanation for this somewhat counterintuitive finding is provided in Section IV of this report, which describes how the costs of regulation are passed through the energy supply chain.)

Rather, free allowances are most appropriately viewed as the equivalent of an up-front, lump-sum payment: in effect, handing out free allowances is the same as handing out money. Exactly how that's done obviously matters a great deal to individual firms and to other potential recipients, even if it doesn't change underlying costs or aggregate program outcomes. For policy-makers, however, the relevant point is that allocation offers an opportunity to offset some of the economic burden of regulation for different stakeholders—and in particular to partly compensate those who bear a disproportionate share of that burden.

The Relationship Between Allocation and Incentives

Consider two profit-maximizing firms, Firm A and Firm B. Both emit 100 tons of CO_2. The market price of CO_2 allowances is $7/ton. Both firms can avoid 20 tons of emissions at a cost of $5/ton. The remaining 80 tons would cost more than $7/ton to avoid.

Firm A receives no free allowances. Firm A will go ahead and pay $5 per ton to avoid 20 tons of emissions since each avoided ton saves $2 (the difference between the $7/ton allowance price and $5/ton reduction cost). Compared to leaving its emissions unchanged, Firm A saves $40. To buy the remaining allowances it needs, Firm A spends $560 (80 tons x $7/ton) to buy allowances, so its total (private) cost is $660.

Firm B receives 100 free allowances. Firm B is also motivated to avoid 20 tons at a cost of $5/ton because it can sell any allowances it doesn't use for $7/ton. Each allowance sold nets Firm B $2/ton—again for a total gain of $40 compared to leaving its emissions unchanged. Firm B uses its remaining allowances to cover its remaining emissions and by doing so foregoes the $560 it could have gained by selling those allowances in the market place. Firm B's total (private) cost is $100 to reduce emissions minus $140 from the sale of allowances, for a net (private) gain of $40.

Both firms reduce emissions by exactly the same amount (20 tons) and both gain exactly $40 by doing so (compared to not reducing emissions). Obviously, Firm B is much better off for having received free allowances. (The difference between Firm A's cost and Firm B's gain is $700, exactly the market value of B's free allocation.) But the incentive to avoid emissions is driven by the $7/ton price of allowances and is the same for both firms.

[4] Important caveats to this general rule may apply in the case of allocations to regulated utilities and in other situations where market prices are not determined by competition. See further discussion in Section IV and in text box on page 18.

III. Options for Allocation

Emissions permits or allowances can be allocated through a variety of mechanisms. In the federal Acid Rain Program, almost all SO_2 allowances were allocated at no charge to emitters—in this instance primarily regulated, investor-owned or public utilities—mainly on the basis of historic data. A small pool of allowances, 2.8 percent of the total, was set aside to be auctioned annually by the U.S. Environmental Protection Agency.[5] The SO_2 auction is non-revenue-raising, however, in the sense that proceeds are returned to the entities from which auctioned allowances were withheld in the original allocation. In large part, the auction was created to assure potential buyers—including new market entrants—that they would be able to obtain allowances, and to aid in price discovery. That is, the auction assured market participants that there would be allowances for sale and that prices would not be artificially inflated if firms with excess allowances were initially reluctant to sell for some reason. Though such artificial shortages have occurred in the European Union trading program (discussed in later sections), SO_2 allowance markets in the United States have proven to be fairly liquid and new entrants have not had difficulty obtaining allowances.

Although a similar mechanism could be used to allocate allowances under a greenhouse gas program, equity considerations are likely to argue for a different approach. For reasons that are explored in detail in later sections, awarding most allowances for free to entities that are directly regulated under the program will produce large windfall profits for those entities at the expense of consumers and other energy end-users. When the Acid Rain Program was adopted there were widespread worries about the workability of what was then an extremely novel and untested form of environmental regulation. At a time when SO_2 emitters feared substantial cost increases, mention of possible windfall profits would have been met with incredulity, if not laughter.

In any case, the equity implications of allocating primarily to emitters in the SO_2 context were not as troubling as they would be in the context of an economy-wide greenhouse gas program. First, the sum value of allowances under the Acid Rain Program was much smaller: on the order of $1-$2 billion per year compared to a combined allowance value on the order of tens of billions of dollars per

[5] The auction itself is conducted by the Chicago Board of Trade.

year under a greenhouse-gas trading program such as the Commission has proposed. As a result, the potential for windfall profits and for large wealth transfers from electricity consumers to producers was also smaller. In addition, the electric power sector was subject to comprehensive regulation at the time the Acid Rain Program was adopted, which meant that economic regulators could—at least in theory—exercise some control over the ultimate distribution of allowance value among industry participants and other stakeholders.

The fact that an economy-wide greenhouse-gas trading program involves much larger allowance assets and would reach beyond the electric power sector further complicates its distributional impacts and bolsters the rationale for departing from past approaches, which have tended to favor a mostly free allocation to those industries most directly affected by regulation. The primary alternative to a free allocation is an auction, in which government simply sells available allowances or permits to the highest bidder.[6] This approach has several important advantages. First, it avoids the need for government to develop and implement a methodology for allocating to individual firms. Second, it ensures that allowances or permits are available for trade and gives all participants equal access to them, putting new entrants on the same footing as existing emitters. Third, and most important, an auction can generate significant revenues that can then be directed to other public purposes: to reduce other taxes; cut the deficit; fund R&D programs; and/or compensate industries, workers, and consumers who bear a disproportionate share of regulatory costs.

> *"The specific benefits of an auction approach, and how those benefits are distributed throughout society, depend on how auction revenues are used."*

The latter point is the strongest argument for an auction approach and bears emphasizing. Indeed, the economics literature consistently favors auctioning emission allowances and using the resulting revenues to reduce other distortionary taxes because this significantly reduces net social costs compared to giving allowances away for free. In general, economic theory favors shifting from taxes on desirable activities or things (like income, savings, or investment) to taxes on undesirables (like pollution or energy consumption). In effect, implementing a greenhouse-gas trading program, auctioning emissions allowances, and recycling the revenues to provide tax relief could accomplish just such a shift. By contrast, any methodology that gives allowances away "for free" is more costly because it forgoes the opportunity to put auction revenues to more productive uses. One paper finds, for example, that the benefits—in terms of improving overall economic efficiency—of using auction revenues to reduce personal income taxes would offset the actual costs society incurs to reduce emissions under a greenhouse-gas trading program by as much as 50 percent (NCEP, 2004).

As discussed later in this section, most current proposals for regulating greenhouse gas emissions through a trading program combine some elements of auction and free allocation. The next section reviews the characteristics of each approach, along with the merits of a mixed approach.

A. AUCTION VS. FREE ALLOCATION

As noted above there is strong agreement in the economics literature that auctioning allowances and using the proceeds to reduce other taxes is strongly preferable to a free allocation. The specific benefits of an auction approach, and how those benefits are distributed throughout society, depend on how auction revenues are used. If auction revenues are

[6] The term "auction" has been used in some contexts to describe a situation where the government allocates free allowances to a non-emitting entity (such as a consumer organization or distribution utility) with the understanding—or the requirement—that proceeds generated by auctioning those allowances will be used for a specific purpose (such as for low-income or energy-efficiency programs). In this way, revenues can be directed to various programs or organizations without the government being in the position of first collecting and then re-distributing those revenues.

used to reduce payroll taxes or are rebated directly to households in the form of lump-sum payments, they can help offset the regressive impacts of energy-price increases resulting from emissions constraints.[7] If, on the other hand, auction revenues are used to reduce taxes on capital gains or corporations, total societal costs are still lower, but the benefits flow primarily to wealthier households.[8] Finally, if auction revenues are instead used to support new government spending for other purposes, the social-welfare impacts depend on the merits and efficiency of that spending.

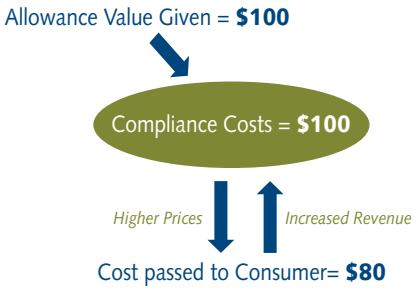
> *"Many firms—if they receive free allowances in proportion to their emissions—will not only be effectively compensated for their costs, but can expect to realize substantial profits."*

While an auction approach has the potential to provide the largest net social benefits, those benefits are, by nature, diffuse. Cost impacts under an auction approach, on the other hand, tend to be concentrated in those industries that are most strongly affected by the emissions control program. This produces a political dynamic that generally favors free allocations over auctioning approaches. There is no reason in principle, of course, that auction revenues could not be used to offset costs for disproportionately affected interests. But the industries most directly affected by regulation typically exert strong pressure to be compensated in the form of free allowances instead, based on the (probably correct) assumption that they are likely to fare much better competing for allowances versus competing for federal dollars. First, a transfer of free allowances is likely to be more politically secure than government promises of compensation from auction revenues. More importantly, many firms—if they receive free allowances in proportion to their emissions—will not only be effectively compensated for their costs, but can expect to realize substantial profits.

This crucial point has until recently not been well understood by policy-makers, regulators, and the public. It becomes more obvious when one looks closely at how costs are imposed under a market-based trading program and how the market and individual companies respond—a topic taken up later in this White Paper. In simple terms, however, the argument goes as follows: under a greenhouse-gas trading program, the market price of goods and services throughout the economy will rise to reflect the value being placed on carbon emissions. That is because, for every ton of emissions released, some entity somewhere in the energy chain[9] will have to submit an allowance that has real monetary value. That monetary value (or price) is set by the market in response to the marginal—or most expensive—ton of reductions being implemented as a result of the policy. All energy producers—*whether they received free allowances or not*—will receive additional revenues as a result of higher prices. If the same companies

Figure 2. Free Allowances as a Source of Profit

Firm A needs $100 in allowances to cover emissions. Higher prices allow Firm A to pass $80 of this cost on to consumers, so actual losses under the program total $20. If Firm A gets $100 worth of free allowances, it will realize $80 in profits.



[7] As has already been noted, energy prices will increase to reflect the carbon price signal created by the trading system even if all allowances are given away for free. Economists generally do not favor these kinds of giveaways because they too forego the efficiency-enhancing benefits of using auction revenues to reduce distortionary taxes. From a political standpoint and as a means of addressing regressivity concerns, however, the lump-sum payment approach could have distinct advantages.

[8] Auction revenue could also be used to meet other federal budget priorities (for example, addressing unfunded liabilities related to the retirement of the baby boom generation). Implicit in this, however, is that revenue is being used to avoid a tax increase; in this way, it is the same as the preceding cases.

[9] Which specific entities are required to submit allowances depends on where the regulatory obligation is imposed. Point-of-regulation is a separate but also important issue and is discussed in a later section of this White Paper.

also receive large, up-front payments in the form of free allowances, those payments can easily exceed any net costs that companies experience as a result of implementing emissions reductions and charging higher prices. *In other words, firms that receive free allowances and experience increased revenues from higher prices get reimbursed twice—once by government and once by the consumer.* This point is illustrated by Figure 2 and by a hypothetical example in the text box to the right.

As one analyst puts it "because allowances are worth money, distributing them *gratis* amounts to the government distributing money to private interests, but without a transparent cash transfer" (Climate Policy Center, 2003).[10] When scaled to a carbon-dioxide allowance price of $20 per ton, modeling results summarized in Goulder (2003) indicate that coal-industry profits could quadruple if allowances under a greenhouse-gas trading program are grandfathered to coal producers based on coal's share of aggregate emissions, even if as in this example, coal production would be expected to fall by 10–15 percent.[11] Recent experience with the Emission Trading System (ETS) now being implemented by the European Union (EU) suggests that the potential for windfall profits, far from being purely hypothetical, is borne out by empirical evidence, with utility companies that received free allocations under the EU program having realized substantial gains (see further discussion at Section III.C). Given that both energy producers and the general public bear some burden under a greenhouse-gas trading program, an allocation approach that auctions all allowances and recycles the proceeds in the form of tax relief will have the overall effect of transferring some wealth from energy producers to the broader public (in this case taxpayers). Conversely, an allocation approach that gives all allowances for free to directly affected industries will have the overall effect of transferring some wealth from the broad public (in this case consumers) to those industries.

An allocation that does a little of both, on the other hand, could end up leaving both groups roughly equally well off. In other words, compared to either a pure auction or pure grandfathering, a mixed strategy—in which some allowances are auctioned and others are given away for free—may create opportunities to realize broader public benefits while also addressing legitimate industry concerns about

Costs, Allocation, and Windfall Profits

Consider a refinery that produces 1000 gallons of gasoline. Based on the carbon content of its gasoline, it must submit one CO_2 allowance for every 100 gallons of gasoline it produces. Each CO_2 allowance costs $7. Thus, the requirement to submit allowances effectively increases the production cost of every gallon by 7 cents. This is true even if the refinery receives free allowances: in that case using an allowance is like dipping into company savings—it means taking something of value out of the company's pockets and foregoing the opportunity to convert it into cash by selling it.

The effect of the allowance requirement is therefore exactly analogous to the effect of any other increase in production costs. In the case of a refinery, it is similar to a 7 cent per gallon increase in the cost of crude oil inputs. Experience indicates that refineries can and will usually pass such cost increases directly through in the price of finished products. Assuming all refiners (and importers of refined products) are subject to the same policy, gasoline prices will rise by 7 cents per gallon to reflect the opportunity cost of using allowances.

When gasoline prices rise, refineries can expect to sell less product and—if the demand reduction is sufficiently large—may experience lower profits. In fact, any demand reduction caused by a 7 cent-per-gallon price increase would likely be minimal. But for illustrative purposes, assume the refinery's sales decline by 50 gallons and assume that this causes a $10 loss in profits.

If the refinery starts with no free allowances it will charge the market price (now 7 cents per gallon higher to reflect allowance costs). The added per-gallon revenue (7 cents) will be just enough to buy the allowances it needs to cover its compliance obligations (7 cents per gallon times 950 rather than 1000 gallons of sales, or $66.50). Its net profit loss is thus $10.

Instead, suppose the refinery receives 10 free allowances at the outset—exactly enough to cover its compliance obligations based on its historic output of 1000 gallons. Prices still rise by 7 cents per gallon, the refinery still experiences a 50 gallon reduction in sales, and it still loses $10 in profits on those 50 gallons as a result. And the refinery again collects $66.50 in extra revenue and (because of the 50 gallons it didn't sell) has the equivalent of one-half an allowance (worth $3.50) available to sell. In other words, the refinery gains $70—exactly the market value of its initial allocation—minus the $10 in losses it experiences because of lower sales. It thus realizes a net gain (or windfall profit) of $60.

[10] Goulder (2003) notes that "By introducing a permits program, the government in effect encourages producers to behave like a cartel in restricting their output. Under a system of auctioned permits what would be cartel profits or rents are collected by the government. In contrast, under a system of freely allocated permits, these rents are retained by producers. Thus freely allocating 100% of the permits causes profits to rise in the fossil fuel industries."

[11] The finding that fossil-fuel industry profits actually increase under an emissions trading program with grandfathering raises an obvious question: why have most industry actors nevertheless been strongly opposed to such programs in the past, even with free allocation? Lane (2003) offers a number of possible explanations, including the *ex ante* uncertainty for individual firms in terms of how their specific competitive position will be affected; fear that more stringent control requirements will follow in time; opposition to emission controls in principle, etc.

cost impacts. Moreover, a phased approach, wherein a substantial portion of allowances is grandfathered in the early years of program implementation but that share gradually diminishes in subsequent years to allow for a larger auction, may offer particular advantages in terms of creating a transition period for energy-intensive industries (especially those with a long-lived capital assets), while eventually securing the social welfare and efficiency-maximizing benefits of an auction.[12] Recent U.S. proposals to implement cap-and-trade-style programs for greenhouse gas emissions, including the Udall-Petri bill noted in the Introduction and the Regional Greenhouse Gas Initiative discussed in later sections, have increasingly featured a mixed approach where some share of allowances is still grandfathered, but a significantly larger share of allowances than in past programs is auctioned or otherwise set aside for public purposes.

B. USE OF ALLOCATION TO ADVANCE OTHER POLICY OBJECTIVES

Although free allowances have generally been awarded to directly affected industries in past emissions trading programs, allowances can also be allocated directly to other stakeholders or to promote specific activities or investments. In the U.S. Acid Rain program, for example, a small portion of allowances was set aside to reward energy-efficiency and renewable-energy programs that reduced SO_2 emissions. Various proposals for a national-level greenhouse-gas trading program have contemplated using a portion of the available allowance pool to promote energy technology research and development, support agricultural and other carbon offsets (including carbon capture and sequestration projects), support energy-efficiency programs, provide credit for early reductions, support technology transfer and other initiatives in developing countries, help consumers and low-income households, and provide transition assistance to workers in affected industries.

As a practical matter, allocating to groups or individuals (such as consumers) who are not likely to participate directly in allowance markets, or to support specific activities such as technology research and development, will require some mechanism to convert allowances into disbursable revenues. Such a mechanism might function very much like—or in fact be equivalent to—an auction. The Climate Stewardship Act, introduced by Senators John McCain and Joseph Lieberman in 2003, proposed to create a non-profit corporation for the purpose of selling permits and refunding the proceeds to consumers, although the bill did not specify the amount to be auctioned.

"If cost equity is a primary consideration, a strong rationale exists for allocating allowances to (or on behalf of) energy end-users (including both energy-intensive businesses and households) and not just to directly regulated entities."

If cost equity is a primary consideration, a strong rationale exists for allocating allowances to (or on behalf of) energy end-users (including both energy-intensive businesses and households) and not just to directly regulated entities. As discussed extensively in Section IV of this White Paper, the net social costs imposed by a trading program are generally unaffected by where in the energy-supply chain the compliance obligation is imposed. Available analyses indicate that much of the cost of using emissions allowances—including both costs incurred to purchase allowances and the opportunity cost of using (rather than selling) allowances that were received for free—will be passed to consumers and other energy end-users, no matter which entities are actually required to submit allowances. In fact, modeling results indicate that roughly one-third of the total market value of allowances will be passed directly through to households in the form of higher energy prices. Moreover, households are likely to bear additional, indirect costs as businesses attempt to pass at least some of their added energy costs through in the form of higher prices for energy-intensive goods and services.

Different but also compelling arguments may justify the use of some portion of available allow-

[12] In its 2004 report, the Commission proposed that 5 percent of available allowances be auctioned initially, with the auction expanding gradually thereafter to a maximum of 10 percent of allowances. As discussed in later sections, the Commission's views on the latter point have evolved; NCEP now supports the concept of a gradual transition to a much larger auction.

ances to support technology development and other activities. As the Commission emphasized in its 2004 report, the near-term price signal generated by any politically viable greenhouse-gas trading program is likely to be relatively small and will probably be inadequate, by itself, to promote the widespread adoption of new technologies, let alone stimulate the research and development investments required to achieve fundamental advances in energy use and production. Generally, innovative firms are unable to appropriate the full gains associated with their efforts, leading to an inadequate incentive to develop new technologies.

Similarly, the trading program by itself may not provide sufficient incentives for certain types of emissions-reduction or adaptation measures (such as geological or terrestrial carbon sequestration) that would be worthwhile from a societal point of view, particularly where such opportunities exist in sectors like forestry and agriculture that are not directly covered by the trading program.

> *"Future allocation debates in the United States are likely to be influenced by the experience of other countries that are implementing market-based greenhouse-gas reduction programs."*

A report recently released by the Congressional Budget Office (CBO) finds that a combination of market signals and R&D investments is likely to be the most cost-effective long-term strategy for achieving carbon-dioxide reductions (CBO, 2006). Auctioning some share of allowances and using resulting revenues to support technology initiatives would produce exactly the combination of market pull and market push recommended in the CBO report. In sum, allocation methodologies that promote a wider array of emissions-reduction options for the future could provide a cost-effective and ultimately efficiency-enhancing way to advance national climate-policy objectives and reduce the costs associated with meeting potentially more stringent carbon reduction targets in the future.

C. ALLOCATION IN EXISTING PROGRAMS AND RECENT PROPOSALS

As noted in the foregoing discussion, the presumption that most allowances should be allocated for free to those entities that are directly regulated under a trading program appears to be changing. The joint statement issued by Senators Domenici and Bingaman in June 2006 concerning emerging themes for the design of a future climate policy reflects this shift, as do several other recent greenhouse-gas trading proposals that have already been mentioned. Indeed, even earlier evidence for a changing view of allocation can be found in the Bush Administration's original Clear Skies proposal for reducing national power sector emissions of conventional air pollutants. That proposal called for a gradual transition, over a period of roughly 50 years, from a 100 percent grandfathered allocation to a 100 percent auction.

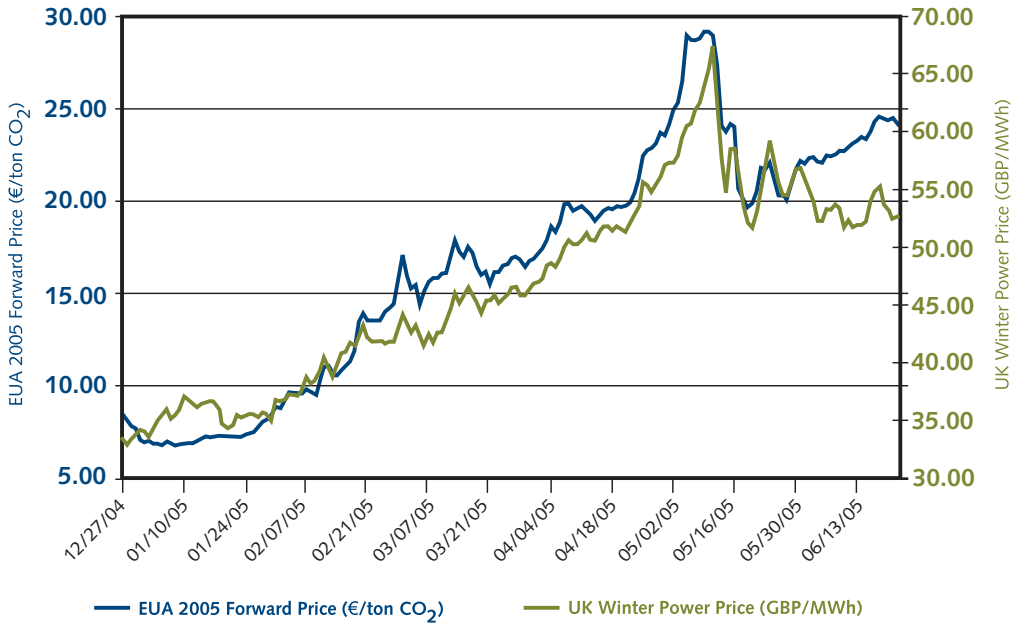
Future allocation debates in the United States are likely to be influenced by the experience of other countries that are implementing market-based greenhouse-gas reduction programs. Of particular interest in this regard is the EU ETS, which affects nearly 12,000 installations in five major industrial sectors. Under the EU program, each member state develops its own National Allocation Plan (NAP) subject to guidelines established by the European Commission. The guidelines require at least 95 percent of all permits to be allocated to industry for the first compliance period (2005–07), with a maximum of 5 percent of the total pool held back for public auction. For this phase, most EU members chose to allocate all available permits for free to affected industries, although a few countries included a small auction.[13] For the second compliance period (2008–12), EU guidelines call for each member to allocate at least 90 percent of its permit allocation for free, leaving up to 10 percent of permits available for auction. Of the 19 EU member states that have publicly announced their Phase II allocation plans, eight are currently proposing to auction some allowances (they include the Flan-

[13] Specifically, Denmark auctioned 5 percent of permits, Hungary auctioned 2.5 percent, Lithuania auctioned 1.5 percent, and Ireland planned a small auction of 0.75 percent of available permits to raise revenues to administer the trading program.

The European Experience with Allocation

The EU ETS offers an unprecedented opportunity to observe the real-world political and economic dynamics of allowance allocation under a broad-based greenhouse-gas trading program. As noted in the main text, most EU member states have allocated all or nearly all allowances for free to regulated entities. This practice has become increasingly controversial, however, as evidence has emerged that electric-power producers realized windfall profits as a result of free allocations, while still—as the figure below indicates and as economic theory would predict—passing the opportunity costs of using allowances on to consumers in the form of higher electricity prices. A report commissioned by the Dutch government found that a significant percentage of the value of allowances allocated to the power sector was passed through in the price of electricity, with the result that some companies' profits increased substantially. The authors of the study suggested that auctioning a larger share of allowances could address these distributional issues. A study for the U.K. government reached similar conclusions, finding that the overall profitability of U.K. power producers grew by approximately £800 million over the first phase of the ETS.

UK power prices and EU allowance prices have shown a strong correlation.



Data provided by Barbara Buchner, Fondazione Eni Enrico Mattei (FEEM)

The behavior of EU stock markets provides additional evidence for the link between free allocations and power-company profits. When allowance prices in the ETS plunged suddenly at the end of April 2006, stock prices for some of the largest power companies in Europe also fell. Intuitively, a lower allowance price should signal lower mitigation costs and lower profit losses. But in a world where opportunity costs are passed through and companies receive free allowances, a lower allowance price means *reduced* profits.

Some EU member states have begun to address the windfall issue as they release their proposed NAPs for Phase II of the ETS. For example, the UK has proposed auctioning 7 percent of its total allocation, with the additional portion auctioned being taken out of the allocation for the electric power sector. The Netherlands has proposed to reduce allowance allocation to the electric power sector by 15 percent. Two-thirds of these allowances would instead be auctioned, with the proceeds going to low-volume electricity consumers. The remaining third would be allocated to industrial participants in the EU ETS. Meanwhile, as noted in the main text, the German government's Cartel Office recently concluded that utilities should be allowed to pass at most 25 percent of the opportunity cost of using free allowances along in the price of electricity.

> *"Firms would be required to demonstrate that they qualify for these allowances based on several criteria, including expected higher costs as a result of the carbon cap, high energy-intensity, and significant international competition for their products."*

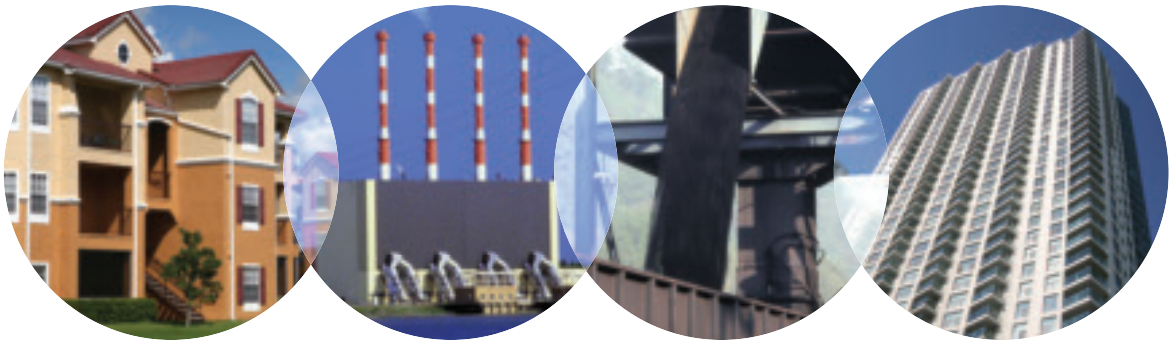
ders region of Belgium, Ireland, Italy, Lithuania, Luxembourg, the Netherlands, Poland, and the United Kingdom). So far, the UK has proposed the largest auction (7 percent of allowances). Germany has already indicated its intent to allocate 100 percent of permits at no cost to emitters in the second period as well, but its Cartel Office recently announced that utilities could pass at most 25 percent of the opportunity cost of using free allowances through to consumers (see further discussion in text box on page 14).

Two other recent initiatives—a regional carbon cap-and-trade program within the United States and a similar proposal in Australia—depart more dramatically from the traditional model of (mostly) free allocation. The Regional Greenhouse Gas Initiative (RGGI) is an effort by seven northeastern and mid-Atlantic states to cap regional power-sector carbon emissions.[14] The program is scheduled to go into effect in 2009. Initially, power-sector emissions will be capped at approximately current levels; starting in 2015, the cap begins to decline with the aim of reducing emissions to 10 percent below current levels by 2020. A Memorandum of Understanding (MOU) signed by RGGI participants gives each state broad discretion over how its allowances will be distributed; however it also requires each state to allocate 25 percent of its allowances to a public benefit fund that will be used to mitigate impacts on electricity consumers or to promote low- or no-carbon technologies. States may opt for an even larger public benefit pool; New York, for example, recently proposed to auction 100 percent of its state-wide allowance allocation under the program. Several RGGI states have already indicated that funds generated by the auction—which will be carried out by an entity that receives the "consumer allocation" rather than by the state itself—will be used for demand-side programs to mitigate the impact of higher electricity prices. To implement the public benefit set aside, RGGI states are exploring the use of a joint regional auction.

Australia's states and territories are likewise considering a cooperative cap and trade program that would be similar in governing structure to RGGI. This initiative, which is currently being developed by a National Emissions Trading Task Force, would also cover the power sector. In August 2006, the Task Force released a white paper that proposed several design elements for a national trading program, including a three-part allocation scheme. The first portion of the allocation would be distributed for free to generators that are most adversely affected by the cap (i.e., coal-fired power plants) based on projections of lost operating profits. The second portion of allowances would go to trade-affected, energy-intensive industries. Firms would be required to demonstrate that they qualify for these allowances based on several criteria, including expected higher costs as a result of the carbon cap, high energy-intensity, and significant international competition for their products. The paper gives several examples of industrial sectors that would be expected to qualify including steel, aluminum and other non-ferrous metals, newsprint manufacturing, and some activities in the chemicals and plastics industries. The third portion of the allocation would be auctioned with revenues administered by each state or territory to address impacts on households, regions, and small businesses.

[14] The seven states are Maine, Vermont, New Hampshire, Connecticut, New York, New Jersey, and Delaware. An eighth state, Maryland, has adopted legislation requiring the state to join RGGI by June 2007.

IV. Cost Equity as a Basis for Allocation



If allocation approaches are to be designed to promote more equitable outcomes and ameliorate disproportionate burdens on particular entities or stakeholders, it is necessary to begin by understanding how regulatory burdens under an emissions trading program are distributed throughout the economy. This section explores in some detail how firms respond to the price signals created by regulation and how, as a result, costs are transmitted through the supply chain from energy producer to end-user. A key finding—one that is somewhat counter-intuitive, but that has important implications for allocation decisions—is worth underscoring at the outset:

Even leaving aside any offsetting gains from free allocation, the costs imposed on a particular entity under a trading program are **not** a simple function of how many permits or allowances that entity requires to cover its emissions.

Rather, the burden imposed on different firms depends to a great extent on each firm's ability to pass through costs. In an upstream system where fossil fuel producers or suppliers are required to submit allowances, economic analysis and available empirical data indicate that most costs will be passed through to downstream energy users—accordingly, many of the entities that are directly regulated can expect to bear only a relatively small fraction of the program's real cost despite, in some cases, being required to submit large volumes of allowances. This point is illustrated by way of a concrete example involving a refinery in the text box on page 11. It also applies, however, to other firms in the energy supply chain.

A. DETERMINANTS OF COST INCIDENCE

Allocation decisions in past emissions trading programs, like the U.S. Acid Rain Program and the more recent EU ETS, seem to reflect a presumption that directly regulated entities—that is, those firms on which the obligation to submit permits or allowances is imposed—shoulder most of the economic burden of regulation. This presumption, while understandable when emissions trading is unfamiliar, fundamentally misunderstands the way that emissions trading programs work in practice. A corollary presumption—that giving most allowances for free to regulated entities indirectly protects consumers by making it unnecessary for those entities to raise prices—is also wrong (the latter finding is currently creating some consternation among European policy-makers, as discussed in the text box on page 14).

To understand why this is so, it is necessary to return briefly to a point raised in the first sec-

tion of this White Paper: namely, that allocation generally affects neither the price signal created by a greenhouse gas trading program nor firms' motivation to pass that price signal through to their customers. Even for a firm that receives free permits or allowances *in excess* of its compliance obligations, every permit or allowance used to cover emissions means foregoing the opportunity to sell an unused allowance in the market place. Thus using a permit or allowance is always costly, whether a firm already holds the allowance or has to go out and buy it. This is true for every firm in a market, including the marginal producer whose costs set the market price. Whether and to what extent individual firms in a given industry sector can pass the cost of using allowances to customers depends on the influence of the marginal producer on market prices (which in turn depends on competition from international suppliers and/or from less costly domestic substitutes), but *not* on the allocation.

Moreover, cost pass-through is important to the efficacy of the policy as a whole, since the key to eliciting a full range of efficient responses throughout the economy is for the carbon price signal to be transmitted all the way down the supply chain from fuel producers to end-use consumers. As a result, the (again understandable) desire by many regulators and policy-makers to minimize cost-pass-through is misplaced. Allocation and other means of recycling revenues from the trading program should be understood as a means of ameliorating disparate impacts without masking the price signals required to maximize program efficacy, not as a means of shielding consumers from the price signals needed to stimulate desired behavioral responses throughout the economy.

Ultimately, the economic burden imposed any given firm or industry sector will depend on two key determinants:

- Firms' ability to pass costs associated with fossil-fuel use backwards and forwards in the energy chain.
- Product demand reductions experienced as a result of higher prices for fossil fuels and fossil-fuel-intensive products.

How these determinants play out for broad industry sectors, let alone for individual firms, is not always obvious since a variety of factors are involved.[15] Important variables are likely to include market conditions, the regulatory environment, and the elasticity of demand for particular goods or services. A hypothetical and highly simplified example of cost pass-through, described in the text box on page 17 serves to illustrate these points.

The Dynamics of Cost Pass-Through

Suppose under a greenhouse gas trading program, coal producers must submit carbon dioxide allowances. The cost of allowances translates to $10 per ton of coal; as a result, the market price of coal rises from $20 per ton to $30 per ton.

Now consider two coal users: Manufacturer A and Manufacturer B. Each makes different products, but both use 100 tons of coal each year. As a result of the change in coal prices their coal costs initially rise by $1000 per year (from $2000 to $3000).

Confronted with higher energy prices, Manufacturer A realizes he can cut his coal use by 30 tons per year if he spends $750 on efficiency improvements. Manufacturer A makes the efficiency investment and absorbs an extra $700 in higher prices for his remaining coal consumption of 70 tons. His coal-related expenses under the trading program come to $2850 ($750 for mitigation measures plus $30 per ton on his remaining 70 tons of consumption). Compared to his previous expenses ($2000 per year at the old coal price), the incremental costs impose by the program total $850. Taking into account competition for his product, Manufacturer A can pass through $700 of these new expenses by raising prices. Thus he incurs a net loss of $150 as a result of the trading program.

Manufacturer B can reduce his coal consumption by the same amount as Manufacturer A and for the same cost. Like Manufacturer A, he makes the efficiency investment and incurs a total of $850 in incremental costs because of the program. But Manufacturer B is in a different situation than Manufacturer A: because he faces stiff competition from foreign suppliers he can pass through only $300 of his new expenses by raising prices. Thus, Manufacturer B incurs a net loss of $550—much more than Manufacturer A.

If one were trying to use allocation to compensate these firms, Manufacturer B should receive a larger share of free allowances than Manufacturer A even though their coal use at the outset and their abatement opportunities are exactly the same. (Presumably one would also seek to compensate coal producers for the profit losses they incur as a result of losing a combined total of 60 tons per year in sales to Manufacturers A and B.)

[15] The extent to which costs are passed through to consumers depends upon producers' ability to raise prices without reducing demand for the product. For a recent analysis of the distributional impacts of a tradable permits program, see Bovenberg, A Lans and Lawarence H. Goulder. "Neutralizing the Adverse Impacts of CO2 Abatement Policies: What Does It Cost?" in C. Carraro and G. Metcalf, eds., *Behavioral and Distributional Effects of Environmental Policies,* University of Chicago Press, 2001.

Before delving further into a discussion of cost and cost pass-through, however, it is worth emphasizing again the key distinction between "private costs"—that is costs imposed on individual firms or industry sectors—and societal cost. Private costs include costs to purchase allowances, to mitigate emissions, and transaction costs (if any), while societal costs are limited to costs for emissions mitigation (since opposing costs and revenues for allowance transactions and as a result of changing prices "net out" from an aggregate perspective). In an upstream system, where the obligation to submit allowances is imposed on fuel producers or suppliers, the vast majority of participants in the economy (from manufacturers to individual consumers) will experience private costs in the form of higher prices for energy and for energy-intensive goods and services. Many firms, in turn, will be able to pass those costs through as prices throughout the economy rise in response to the carbon price signal. In the end—as borne out by the modeling analyses discussed below—"the buck stops" at consumers, who ultimately shoulder most of the burden of regulation.

"Some firms or industry sectors, however, may encounter more difficulty than others in passing through costs and may bear a disproportionate burden as a result."

Some firms or industry sectors, however, may encounter more difficulty than others in passing

Allocation to the Electric Power Sector

The electric power sector accounts for nearly 40 percent of the nation's total energy-related greenhouse gas emissions; as such it has an enormous stake in the design of a national greenhouse gas trading program generally, and in allocation decisions specifically. These decisions are likely to be especially complicated in the electric-sector context, where the co-existence of largely competitive wholesale markets and various forms of cost-of-service price regulation in different parts of the country could profoundly affect the cost and equity implications of different allocation approaches.

For reasons discussed in the main text, the economic burden imposed on the electric power sector under a greenhouse-gas trading program is independent of whether the industry itself is directly regulated by that program. Whether the obligation to submit allowances falls on electricity generators, distribution companies, or upstream fuel suppliers, the price of electricity should rise to reflect the costs of allowances required to cover associated greenhouse gas emissions. Increased costs and higher electricity prices will lead to some demand reductions, but companies with a less carbon-intensive portfolio should be competitively advantaged relative to companies with a more carbon-intensive portfolio.

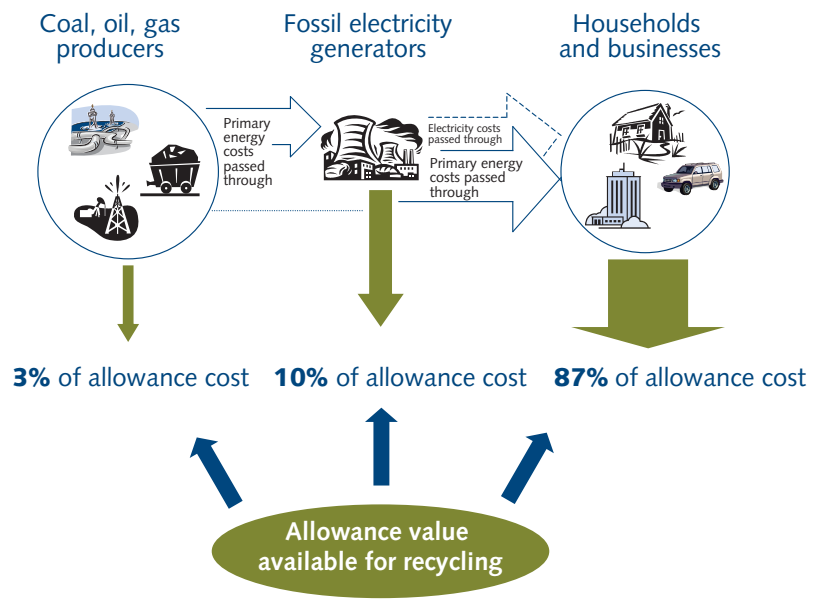
Whether individual companies and the industry as a whole experience net gains or losses depends, of course, on how emissions allowances are allocated. Here two distinct but related concerns arise. The first is that free allocations to the electric power sector in the EU ETS have produced large windfall profits for generators and resulted in very little of the allowance value being passed through to benefit consumers. This outcome, while entirely consistent with economic theory and with the achievement of the trading program's environmental objectives, is obviously troubling from an equity perspective. A second and in some ways obverse concern is that in states where electricity prices are set by regulators rather than by markets, regulators—in an effort to prevent windfall profits and shield consumers from rate impacts— could prevent utilities from passing through any opportunity costs associated with the use of grandfathered allowances. This would have two undesired effects. It would undermine program efficacy by blocking the price signal needed to stimulate efficient responses on the part of end-users. It could also create large unintended inequities between consumers in different regions, who might experience very different rate impacts depending on whether they live in traditionally regulated regions or not, and between firms in the business of supplying electricity, depending on where they operate. Moreover, since retail markets in the most coal-intensive regions tend to be regulated, the potential exists for a perverse outcome in which consumers that rely on a more carbon-intensive generation mix see a weaker price signal than consumers that rely on a lower-carbon mix.

In response to these concerns, some have proposed allocating directly to electric distribution companies (and providing explicit guidance to state regulators about the proper treatment of those allowances), rather than allocating directly to generators. In this way all electric sector allocations would come under the purview of economic regulators—state public utility commissions in the case of investor-owned utilities and local boards in the case of publicly owned utilities and cooperatives. Proponents argue that these authorities are in the best position to sort out the equity implications of different allocation schemes, direct appropriate levels of compensation to adversely affected firms, and ensure that end-use customers, who bear the largest share of program costs, receive an equitable share of the asset value associated with free allowances.

through costs and may bear a disproportionate burden as a result. Firms that compete with foreign suppliers who do not face similar emissions constraints, for example, could fall in this category. The situation may be even more complicated for utility companies that are subject to price regulation. Public utility commissions may limit these companies' ability to pass through costs, especially if the utilities receive an allocation of free or grandfathered allowances (see text box on page 18). By contrast, some sectors responsible for a large share of emissions—such as the petroleum industry—may experience only minimal profit losses because they face few constraints in passing through costs and because demand for their product is quite inelastic for the sorts of price signal generated by greenhouse-gas trading programs under discussion. Finally, some sectors—despite generating emissions and increasing product prices to cover the cost of using allowances—can experience net *gains* in profitability if regulation confers competitive advantages. In the case of the natural gas industry, for example, modeling suggests that added demand for lower-carbon fuels under a trading program would more than offset any profit losses suppliers might incur as a result of meeting their compliance obligations and charging higher prices.

Figure 3 illustrates, again in simple schematic form, how private costs (that is, the sum of mitigation costs, allowance costs, and transaction costs) are passed through the energy supply chain in a greenhouse-gas trading program. The "allowance cost" percentages shown in the figure are based on the results of a cost-incidence analysis of the original NCEP proposal that is discussed in the next section; essentially they assume that all allowances are auctioned at the outset. The chief point of the figure, however, is that (a) most private costs are passed through the energy supply chain to end-users and (b) these private costs are not net social costs: the program that creates them also creates a new asset in the form of allowance value that is available to be re-distributed to offset costs

Figure 3. Schematic of Cost Pass-Through Assuming All Allowances Are Initially Auctioned*



** Note that the percentages indicated in the figure are from an EIA analysis of cost incidence under the Commission's original program proposal. The results of that analysis are discussed in the next section of this paper.*

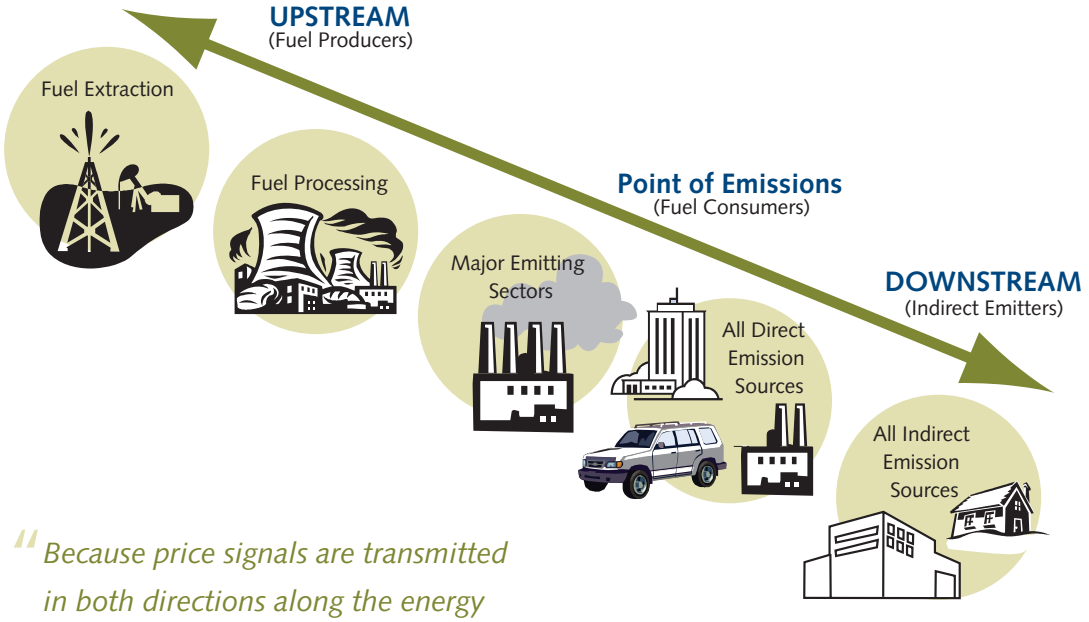
or for other purposes. In the end, of course, the *net* burden imposed on any one sector depends to a large extent on how that pool of allowance value is distributed back to various stakeholders.

B. RELATIONSHIP OF ALLOCATION TO POINT OF REGULATION

It should be evident from the foregoing discussion that if all allowances are auctioned, the distribution of burdens under a greenhouse-gas emissions trading program (leaving aside any offsetting benefit from a free allocation) is largely independent of where the obligation to submit allowances or permits is imposed.[16] Because price signals are transmitted in both directions along the energy supply chain, net costs for firms and consumers should be the same regardless of which entities in the supply chain are regulated. For example, once a market incentive exists to reduce carbon emissions, demand for coal should decline by the same amount (relative to a business-as-usual base case) regardless of

[16] It is worth noting that carbon dioxide is somewhat unique in terms of lending itself to regulation at different points in the energy supply chain. Many other types of emissions need to be regulated at the point where they are generated or released to the atmosphere because that is (a) the only place where they can accurately be measured and (b) where all the opportunities for abatement exist. Energy-related carbon dioxide emissions, by contrast, can be calculated on the basis of fuel throughput; moreover most of the opportunities for reducing emissions exist elsewhere up and down the supply chain rather than at the actual point of fuel combustion.

Figure 4. Possible Points of GHG Regulation in the Energy Supply Chain



> *"Because price signals are transmitted in both directions along the energy supply chain, net costs for firms and consumers should be the same regardless of which entities in the supply chain are regulated."*

whether coal suppliers or downstream electricity generators are required to submit allowances.[17] The net impact on the coal industry therefore depends not on whether the industry is directly regulated, but on whether it receives a free allocation of allowances—or compensation in some other form—to offset its unrecovered costs.

If cost incidence is largely unrelated to point-of-regulation, (again, leaving aside any offsetting benefit from free allocation), it follows that an allocation policy designed to address disproportionate cost impacts should also be considered independent from point-of-regulation. In other words, there is no equity basis for presuming that the entities directly regulated under the program should be entitled to a larger share of free allowances than any other entity in the energy supply chain. Decisions about point-of-regulation are, of course, extremely important from the standpoint of program design and implementation. Among other things, the choice of where to regulate is likely to bear directly on the complexity and hence the cost (to society and individual firms) of administrating and enforcing the program,[18] on program coverage, and on the potential for emissions "leakage." It could also affect the politics of gaining support for a particular proposal, especially if some industries are more comfortable with regulation than others. Finally, while cost pass-through is theoretically unaffected by point-of-regulation, in reality imposing the compliance obligation on primary fuel producers or suppliers rather than on entities further down the energy supply chain could facilitate efficient cost pass-through in a way that improves overall program efficacy. Indeed, all of these considerations taken together are, in the Commission's view, grounds for a strong presumption in favor of an upstream system.

Nevertheless, where to regulate and how to allocate are separable questions. Economic analysis shows that, neither will appreciably affect the magnitude of emissions reductions achieved by a particular program, the costs incurred to implement

[17] Experts in the coal and electricity industry have expressed concern that the point of regulation could matter for coal and electricity pricing due to non-competitive situations.

[18] Directly regulated entities will, of course, bear the largest share of administrative costs under a trading program. In a well-designed program, however, these costs should be very small (on the order of tenths of a percent) compared to the allowance value available for allocation.

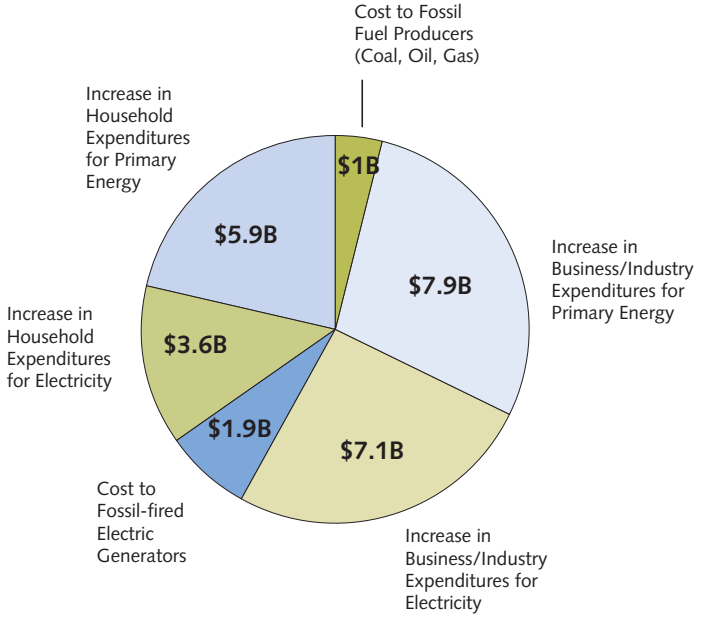
emission-reduction measures, or the incentives faced by individual firms and consumers to reduce emissions.

C. COST INCIDENCE UNDER THE NCEP PROPOSAL

EIA has analyzed sector-level changes in revenues and costs under a greenhouse-gas trading program modeled on the Commission's recommendations (EIA, 2006). In general, the results indicate that the net burden imposed on upstream fossil fuel producers is small under such a policy, regardless of whether they are the entities regulated. Specifically, EIA's analysis suggest that fully compensating primary fuel (i.e., coal, oil, and natural gas) producers for their unrecovered costs under this type of program would require only about 10 percent of available allowances, leaving roughly 90 percent of the allocation available for distribution to energy users further downstream. The electric power sector, by contrast, incurs significantly higher costs than all of the primary fuel producers combined.

Figure 5 summarizes the estimated distribution of net costs to different sectors taking into account the ability of energy suppliers (coal, oil, and gas producers as well as electricity generators) to pass their costs along to energy users. The figures shown are based on data from an EIA analysis of the Commission's original proposal. It is important to stress that the figure does not account for any offsetting income from allowance allocation. In other words, it represents the estimated distribution of net private costs if government were to auction all allowances and throw away the revenues. In reality, of course, nearly all of the "cost" shown in the pie chart (approximately $32 billion per year) would instead be transferred back to households and businesses, either through the recycling of revenues generated by a government auction or by the direct transfer of free allowances to affected entities. As a result, the sum of "costs" shown in the figure far exceeds the cost of the program to society, which, as emphasized throughout this White Paper, corresponds to the cost of emission reduction measures undertaken and is far smaller (on the order of $4 billion per year) than the sum value of allowances in circulation under the program.

Figure 5. Approximate Distribution of Private Costs[19] *Before* any Offsetting Gain from Allocation, Under the Original NCEP Proposal*



** In other words, this estimates the theoretical distribution of net private costs if all allowances were auctioned and none of the revenues were recycled.*

The cost estimates shown in Figure 5 are nevertheless useful as a guide in designing an allocation approach that attempts to distribute the asset value of allowances in proportion to actual cost burdens. For one thing, the pie chart indicates that energy end-users bear a much larger share of costs (again, prior to any offsetting benefits from allocation) than energy producers or suppliers. In fact, the final household share is likely to be even larger than the figure implies because most business end-users will pass some of their costs along in higher prices for goods and services.

[19] Assuming all allowances are auctioned and no revenues are recycled, net private costs for coal, oil, and gas producers and for fossil electricity generators will consist of unrecovered costs to purchase allowances and implement mitigation measures, plus any losses from reduced sales as a result of charging higher prices. For business and household end-users, private costs consist of higher energy costs plus the costs of any measures undertaken to reduce energy consumption.

D. IMPLEMENTATION ISSUES

Cost analyses like those described above provide a useful starting point in designing an allocation scheme consistent with the objective of promoting cost equity. At best, however, they provide only approximate guidelines and leave a number of important implementation issues still to be resolved. One issue is that even within sectors, certain industries and firms will confront a relatively higher burden than others. In other words, to fully compensate fossil electricity producers as a group may, in theory, require a relatively small share (roughly 10 percent) of the total allowance pool, based on that group's share of overall costs as shown in Figure 5. Given that fossil electricity production accounts for approximately 30 percent of national energy-related carbon emissions, this would imply that the industry as a whole should get free allowances equivalent to roughly one-third of its actual emissions. This type of sector-wide estimate, however, masks the fact that some individual power producers—those with significant coal-based generating assets, for example—could require an allocation equivalent to substantially more than one-third of their emissions to be fully compensated for expected profit losses under a greenhouse-gas trading program. Others, by contrast—such as companies with a generating portfolio tilted toward less carbon-intensive generating assets such as natural gas, nuclear, or renewable plants—might require substantially fewer allowances. Similarly, among business end-users, some types of firms—notably those with energy-intensive production processes, such as steel, cement, and aluminum manufacturers—could face substantially higher costs than others.

An allocation methodology that attempted to precisely assess economic burdens at the individual-firm level would, of course, be far too unwieldy and contentious to be practically feasible. In addition it is likely to be extremely difficult—if not impossible—to extract from firms that face lower-than-average costs the surplus needed to compensate firms that face higher-than-average costs. Instead, the likelier outcome—especially in the initial years of program implementation—is that policymakers and regulators will need to expand the share of free allowances allocated to some sectors to provide adequate compensation for those most disadvantaged under the policy. Researchers at Resources for the Future (RFF) have examined the implications of using different decision rules to allocate allowances to the electric utility industry in the context of the northeastern states' RGGI program, which aims to cap regional power-sector carbon emissions (Burtraw et al., 2006). They find that if it were possible to identify all winners under the policy (that is, companies whose profits actually increase as a result of increased demand for lower-carbon electricity) and compensate only those firms that lose value, 34 percent of all available allowances would need to be allocated for free to fully maintain the market value of all companies that generate electricity in the RGGI region. This would leave two-thirds of allowances available for compensation to other affected parties or for other public purposes.

The RFF researchers also explored allocation options where it is not possible for regulators to identify winners and losers at the level of individual firms. Specifically, they attempted to define some simple decision rules for allocating to firms on the basis of their generating portfolio (i.e., their mix of fossil and non-fossil assets) and historic output and emissions, with the aim of maintaining at least a break-even value for all individual firms while still maximizing the number of allowances that remain available for public purposes. In this case a substantially larger share of allowances—77 percent—is allocated for free, leaving 23 percent of the allocation for other purposes. By fully compensating losers without seeking to identify and exclude winners, this approach allows many individual firms—and the industry as a whole—to realize substantial gains in value. Those gains come at the expense of other stakeholders, including electricity consumers and the broader public, to whom a smaller share of the overall allowance pool remains available.

Notably, however, even this approach results in a smaller allocation to regulated industry (and a correspondingly larger allocation for public purposes) than has been typical of most existing emissions-trading programs.

Once the decision has been made to allocate a

"In most existing cap-and-trade programs, historic emissions have been used as the primary basis for allocation to individual firms."

certain share of total allowances to a particular sector, other important implementation issues remain. At a minimum these are likely to involve defining the universe of eligible recipients and identifying metrics to be used in the allocation process. Assuming that it will not be possible to tailor allocation decisions to differentially compensate individual firms, it will be necessary to develop a relatively straightforward and transparent set of rules—using data that are readily available to regulators—for allocating to individual firms or groups from within the pool of allowances reserved for a particular sector. In most existing cap-and-trade programs, historic emissions have been used as the primary basis for allocation to individual firms. Alternative approaches—which some have argued would provide stronger incentives for new technologies and efficiency improvements while avoiding rewards for historically high emitters—involve updating allocations over time and/or awarding free allowances on the basis of output, rather than emissions. For example, allowances could be awarded in proportion to megawatt-hours generated or tons of steel produced rather than on the basis of historic emissions or fuel consumption.

The economic literature is generally critical of these approaches on grounds that any updating system can distort future behavior, while any output-based system could exacerbate windfall gains to firms that are already likely to be competitively advantaged under an emissions trading program (such as utility companies with significant low- or non-carbon generating assets). The concern is that any updating allocation system creates "subsidy effects" that would stimulate some firms to increase their output over the level that would otherwise be economically efficient as a means of capturing a larger future share of allowances. In an updating, output-based allocation system, for example, economic theory suggests that natural-gas-fired electric generators would drop prices and increase output so as to increase their share of future allowances. This in turn would spur increased electricity consumption, reduce incentives to improve end-use efficiency, and drive up demand (and prices) in natural gas markets, creating additional costs. A separate issue, specific to proposals for an output-based method of allocation, concerns the difficulty of establishing simple output metrics for sectors other than the electricity industry.

Updating or output-based allocations do have the advantage that they resolve the conundrum of allocating in perpetuity to firms that have shut down or permanently scaled back their operations (although it should be noted that a gradually expanding auction eventually takes care of this problem as well). Moreover, proponents of updating and/or output-based allocation approaches argue that theoretical concerns about perverse incentives are overstated in the context of real-world regulatory and market constraints that would tend to limit any inefficient subsidy effects. Indeed, recent research suggests that potential distortions produced by an updating approach could be effectively mitigated by updating infrequently and at longer time intervals—for example, once every 10 years based on the previous 10 years of activity or emissions (RFF, 2005). Again, however, the relevance of this debate and the case for considering updating, output-based or other approaches to free allocation will fade over time in the context of any program design that gradually phases these allocations out in favor of a larger auction.

V. Conclusions

Allocation debates are difficult because the issues involved are complex and because parties to these debates often misunderstand, in fundamental ways, how allocation does and does not affect the way an emissions trading program functions. Accordingly, it is worth re-summarizing here, in simple terms, several key points about allocation that emerge from the foregoing discussion:

- Allocation—that is, which entities get allowances, how many allowances they get, and whether allowances are given away for free or auctioned—does **not** change either the cost to society of actual emissions mitigation or the results of the policy in terms of tons of emissions avoided. Allocation can change the *net* cost of the policy to society if it is done in a way that enhances overall economic efficiency, thereby offsetting some of the costs incurred for emissions mitigation (e.g., if government auctions allowances and uses the revenue for efficiency-enhancing tax reforms).

- A greenhouse gas trading program creates a new currency in the form of emission permits or allowances. Because this currency has a real dollar value, debates about allocation are essentially debates about money. *Giving away allowances is like giving away money, in most cases with no strings attached.*

- A firm that receives free allowances has exactly the same incentive to reduce emissions as a firm that receives no free allowances. Using an allowance, regardless of how it was acquired, means giving up something of value (since the firm could otherwise sell the unused allowance in the market place).

- Because free allowances don't change incentives in competitive markets, how allowances are allocated to different entities does not affect where emission reductions occur in the economy or how energy prices change in response to the policy.

- Important caveats to this general rule apply in the electric sector, where a mix of competitive and regulated markets creates the potential for price distortions that could blunt incentives for end-use demand reductions and produce an inequitable distribution of cost burdens across consumers and companies in different regions. One concern is that program costs would be largely passed through to customers in competitive retail markets (allowing generators to "keep" most of the asset value of a free allocation), while companies operating in regulated markets could be required by regulators to use

free allowances to offset price impacts. Since retail markets in the most coal-intensive regions tend to be regulated, this creates the potential for a perverse outcome in which consumers that rely on a more carbon-intensive generation mix see a weaker price signal than consumers that rely on a lower-carbon mix.

- The economic burden imposed on different firms or sectors under a greenhouse-gas trading program is not a simple function of each firm's or sector's emissions or fossil-fuel throughput. Rather, economic burden is a function of ability to pass through costs and other factors.

- To the extent that prices for particular goods or services rise to reflect the value that has been attached to carbon emissions under a greenhouse gas trading program, *all* firms that supply those goods and services will benefit—*whether those firms receive free allowances or not* (in effect, firms that get free allowances will be reimbursed for the opportunity cost of using those allowances). Since individual firms generally cannot set prices, their ability to pass through costs will depend on how markets respond to the policy at the sector or industry level.

- Since giving away allowances is equivalent to giving away money, a free allocation can be used like an upfront payment to compensate entities for their costs under the policy without changing the way entities behave going forward.

- A mixed approach, which combines some free allocation with a partial auction may offer significant benefits over either (a) grandfathering all (or nearly all) allowances or (b) auctioning all allowances. The former approach would have the effect of transferring wealth from consumers to allowance recipients and would generally produce large windfall profits for some firms. The latter would have the effect of transferring wealth from energy producers to taxpayers and would concentrate profit losses in certain carbon-intensive industries.

- Over time, as private firms have an opportunity to adjust their investment decisions to the new incentives created by regulation, the equity rationale for using allocation to avoid economic dislocations in certain industry sectors is likely to diminish. Accordingly, it makes sense to gradually increase the share of allowances auctioned in later years of program implementation to maximize the social efficiency gains available through revenue recycling for tax reform or to support other productive public investments.

The National Commission on Energy Policy has engaged the allocation debate by first articulating some general principles intended to help policymakers navigate the complexities of the issue and adjudicate the multiple competing claims that will inevitably be asserted as any proposal for a broad-based, mandatory greenhouse-gas trading program moves toward adoption. In simple terms, these principles can be summarized as follows:

- Allocation should primarily be used to promote a more equitable distribution of the economic burdens of the trading program, recognizing that the overall burden imposed by regulation is likely to be small in the context of the economy as a whole and that allocation does not affect program incentives or outcomes.

- Some share of available allowances should be used to offset impacts on households, especially low-income households, but without offsetting the price changes necessary to produce efficient emissions reduction.

- Other potential uses of allocation (e.g., technology incentives) should be considered in light of the long-term public benefits they may provide.

- Because allocation is a zero-sum game (there are only so many allowances to give away), policymakers should avoid over-compensating some entities at the expense of others, thereby necessarily diminishing the resources available to advance other important policy objectives.

Combining these broad principles with the results of various cost analyses conducted by the Commission and by EIA suggests that an allocation guided by equity considerations would initially grandfather

no more than roughly 50 percent of the total pool of allowances available on an economy-wide basis to major energy producing or consuming industries, including directly regulated suppliers of primary fuels (coal producers, oil refiners, and natural gas processors), the electric power sector, and energy-intensive manufacturers. This would leave roughly 50 percent of the total pool of allowances to be directed to public purposes, where public purposes could include mitigating impacts on low-income consumers; investing in low-carbon energy technologies and end-use efficiency; creating incentives for cost-effective "off-sector" mitigation activities (such as agricultural carbon sequestration); and reducing the federal budget deficit and/or supporting broader tax reforms. Over time, any initial earmarks for specific purposes will need to be re-evaluated, suggesting a finite limit to these expenditures and transition to general fund contributions.

> *"Given that cost burdens are not equal, there should be no presumption that different industry sectors are entitled to equal shares of allowances, either in absolute terms or as a fraction of their emissions or fuel use."*

Without attempting to distinguish winners from losers at the level of individual firms, this approach should provide enough free allowances to substantially compensate adversely affected industries for their un-recovered costs under the emissions trading program, while also making substantial resources available to provide broader societal benefits. This is a significantly larger share of allowances than has been directed to public purposes in past programs and it reflects the Commission's expectation, again based on available modeling as well as empirical evidence from the EU ETS and other programs, that end-use consumers (households and businesses) will ultimately bear the largest share of program costs and are therefore entitled to a significant portion of the compensation available through allocation.

Within the pool of allowances distributed for free to industry, equity considerations argue for distributing shares to individual sectors in a manner that roughly reflects the incidence of actual cost burdens. Those cost burdens, as noted throughout this White Paper, are not a simple function of emissions or fuel use. Moreover, they are likely to be quite small for some sectors (such as the petroleum industry) that should have little difficulty passing through costs and relatively higher for other sectors (such as the electric power sector and some energy-intensive manufacturers). Given that cost burdens are not equal, there should be no presumption that different industry sectors are entitled to equal shares of allowances, either in absolute terms or as a fraction of their emissions or fuel use.

Among primary fuel producers, for example, available analyses suggest that oil and natural gas producers should be able to fully or almost fully pass through costs with no appreciable demand reductions. Only coal producers could expect to experience more significant profit losses and should be the primary beneficiaries of allocation to fossil-fuel producers (although it is worth emphasizing that overall coal demand continues to grow under the NCEP proposal, just somewhat more slowly than in the absence of a carbon policy).

The other two industry sectors that are most directly affected by greenhouse-gas regulation and should therefore be considered for a share of any grandfathered allocation are energy-intensive businesses (such as steel, aluminum, chemicals, and pulp and paper manufacturers) and the electric power industry. Available modeling analyses suggest that the cost burden imposed on the electric power industry, in particular, is substantially larger than that imposed on primary fuel producers. Given the regulatory complexities and other factors that may affect cost pass-through for this industry, it will be necessary to give especially careful consideration to the incentive and equity implications of different allocation approaches in the electric-sector context. Specifically, policy-makers should explore options that, by reducing the potential for price distortions across regulated versus competitive markets, would promote equitable outcomes for consumers and companies in different parts of the country. How to handle allocation to different entities in the electricity business seems certain to emerge as a critical

> *"…policy-makers should explore options that, by reducing the potential for price distortions across regulated versus competitive markets, would promote equitable outcomes for consumers and companies in different parts of the country."*

question—one that may prove as or more challenging than deciding the question of how to allocate to broad economic sectors out of the available allowance pool as a whole.

The Commission has also come to the view that a strong case exists for a phased approach, in which the share of allowances auctioned expands gradually (and on a known schedule) over time once the program is underway to eventually encompass the great majority of available allowances. The Commission continues to believe, as it did when crafting its original proposal, that allocating a substantial number of allowances for free in the early years of program implementation is pragmatically justified and perhaps politically necessary, even at some risk of overcompensating certain private interests. In fact, it is likely at the outset of any new regulatory regime that corporate interests will be awarded a greater number of free allowances than would be needed if one could precisely match free allocations with the actual incidence of costs. In unvarnished terms, consumers will shoulder more program costs than organized interest groups and shareholders. The Commission believes that this is a reasonable price to pay for establishing a mechanism that begins to reduce the substantial risks of climate change.

Over time, however, the rationale for a free allocation diminishes relative to the considerable societal advantages associated with an auction approach. Simply put, perpetuating an initial allocation that grandfathered most allowances to private interests would compound inequitable outcomes and cannot be justified over the long run. Thus, the Commission no longer takes the view, articulated in its original recommendations, that the share of allowances auctioned should be limited to a maximum of 10 percent.

In closing it is worth cautioning again, as the Commission did in its March 2006 response to a Senate request for input on allocation and other program design issues, that "there is no approach to allocation that can hold harmless all stakeholders or render entirely costless a policy for reducing greenhouse gas emissions." This White Paper has hopefully clarified some important and often counterintuitive aspects of allocation, including the somewhat paradoxical notion that allocation both matters tremendously (from an equity standpoint) and matters hardly at all (from the standpoint of achieving desired environmental objectives). In reality, of course, addressing welfare and equity concerns to the satisfaction of policy-makers and the public is the necessary precondition for achieving real progress toward the environmental objective. As more policy-makers move from the question of *whether* to take action on reducing greenhouse-gas emissions to *how*, equity and welfare are precisely the concerns likely to dominate ongoing debates about future U.S. climate policy.

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