2. Mechanisms for Allowance Distribution

2.1 The Main Alternatives: Free Allocation vs. Auctioning of Allowances

In designing a cap-and-trade system, policy makers need to make important decisions about how to distribute emissions allowances. Perhaps the most fundamental decision is whether to give allowances away for free or sell them to sources via an auction. The two alternatives are not mutually exclusive. Some allowances can be freely allocated, and the rest auctioned. Also, the split between free allocation and auctioning can change over time.

Both free allocation and auctioning provide allowance value to various entities. Free allocation offers this value directly to the recipients. Auctioning is an alternative conduit for allowance value, as the proceeds from an allowance auction can be recycled to various industrial or commercial entities, to households, or to the public Treasury.

This chapter discusses free allocation and auctioning as mechanisms for allowance distribution. It describes basic rationales for each of the approaches, indicates specific forms that each of these approaches can take, and discusses some potential advantages and drawbacks of each approach.

2.1.1 Rationales for Free Allocation

Analysts often refer to free allocation to regulated entities (the parties required to submit allowances to validate their emissions) . However, allowances can be freely provided to other recipients who can subsequently sell the allowances to the regulated entities. These other entities can convert this allowance value into cash by selling the allowance to regulated entities. Thus, in a cap-and-trade system in which the regulated entities include electricity generators and refiners, allowance value could be offered to industrial users of electricity and refined fuels in the form of free allowances which they can subsequently sell. This allowance value could compensate for higher energy costs and helping to address concerns about regional or international competitiveness. Allowances could also be given to state or local government agencies, trust funds, or other intermediaries who would sell them to covered sources and generate revenue for specific public policy objectives. The funds could be used to lessen the burden of higher energy costs on consumers and low-income households, ease the transition for displaced workers and their communities, or address the consequences of climate change.

Some claim that free allocation is a particularly expedient way to provide such value to firms, since it does so directly rather than by returning auction revenue. There can also be political advantages to providing allowance value through allowances rather than in the form of a cash payment of proceeds from an auction. A cash payment may be considered a more visible (and thus more contentious) form of value-transfer.

Interested parties have suggested that free allowances should be provided mainly to regulated entities on the grounds that these entities will incur the bulk of the costs of regulation. However, the actual economic burden of a cap-and-trade program does not necessarily fall solely—or even primarily—on the regulated entity. The burden of regulation can be shifted from a regulated entity forward to a firm's industrial, commercial, or residential customers; and it can be shifted backward to the firm's suppliers. While there may be reasons to use free allocation to reduce the cost-burden to regulated entities, it is not necessarily the case the these entities face the principal burden. This should be taken into account in determining the allocation of allowance value.

It is sometimes claimed that free allocation reduces firms' incentives to reduce emissions. However, except in cases where firms can influence their receipt of allowances by producing or emitting more (cases which we discuss below), the number of allowances a firm receives is unlikely to reduce incentives to abate emissions or to invest in new, low-emissions technologies. Firms minimize their costs by reducing emissions up to the point where the incremental cost of further emissions abatement just equals the allowance price. This point is largely unaffected by the number of allowances the firm receives for free.[1]

Some special considerations arise in the electricity sector. Although some advocate allocating free allowances to electricity producers, producers in electricity markets will generally be able to pass along much of the compliance cost to their customers. One alternative suggestion (incorporated into federal proposals as well) is to provide free allowances to local distribution companies (LDCs)—entities that deliver electric power to end-users. In California, these entities either are regulated by the state public utility commission or are publicly owned and managed companies <check legal definition>, and they can be expected to act as trusties on behalf of energy consumers. The value of these allowances would be used to lower electricity rates, put towards cost-saving investments in energy efficiency or potentially returned as a fixed rebate to consumers. This approach requires determining the appropriate basis for apportioning the allocation among the LDCs in the state. Also, to the extent that the LDCs used the allowance value to lower electricity rates it would increase overall program costs by dampening the price signal to consumers. If allowances are distributed to LDCs, separating the payments to consumers

[1] At the same time, the number of allowances a firm receives for free does directly affect a firm's profit. Suppose that the amount of emissions consistent with equating marginal abatement costs with the market allowance price is X. Then each additional free allowance that a firm receives reduces costs or adds to revenue either by (a) reducing the number of additional allowances the firm must purchase in order to have allowances sufficient to justify emissions of X, or (b) increasing the number of allowances the firm can sell in order to reduce its holdings of allowance to the amount just sufficient to justify X. Either way, additional allowances allow the firm to retain more revenue.)

from their energy bill would increase the likely success of the price signal while achieving the goal of providing funds generated by the program to consumers. Nonetheless, a variety of implementation issues complicate this as a strategy.

Free allowances could also be provided to industrial users of electricity and fuels, compensating them for higher energy costs and helping to address concerns about regional or international competitiveness. The chemical, aluminum<is there aluminum in California?>, and cement industries are often cited as examples of sectors that would be potentially vulnerable to out-of-state competition due to increasing energy costs and the cost of meeting their own obligations for reducing GHG emissions from their manufacturing processes. Higher costs could lead such energy-intensive manufacturers to leave California -- potentially yielding even higher GHG emissions in other regions (i.e., "emissions leakage"). An allocation to these firms covering some portion of direct and indirect emissions under the cap-and-trade program is one means of alleviating these concerns, but the way that this type of allocation is delivered to firms will determine whether the allocation has its desired effect, as discussed below.

Allowances could also be given to state or local government agencies, trust funds, or other intermediaries who would sell them to covered sources and generate revenue for specific public policy objectives. These include the development and deployment of technologies aimed at reducing greenhouse gases, capturing and storing carbon, and improving energy efficiency. The funds could also be used to lessen the burden of higher energy costs on consumers and low-income households, ease the transition for displaced workers and their communities, or address the consequences of climate change. Note that the same government programs could be funded by auction revenues as described in the next section. While similar objectives may be achieved through distributing "allowance value" by either mechanism, providing free allowances to entities without a compliance obligation blurs the distinction between freely allocated and auctioned allowances. Nonetheless there may be a distinction with respect to who bears the cost of fluctuations in allowance value due to fluctuations in allowance price. If the state allocates allowance value through fixed amounts to other entities, the state would be the residual party that would absorb the unpredictable changes in allowance value over time. If the state allocates allowances to these parties, then they would bear the risk associated with changes in allowance value.

2.1.2 Rationales for Auctioning

In principle, the same distribution of allowance value to various entities can be achieved under auctioning as under free allocation. The same entities that would receive allowance value in the form of free allowances could in principle receive that value in the form of recycled auction revenue. Hence, the various objectives listed under free allocation above could be served via the disposition of auction revenue. These objectives include providing compensation for affected industry sectors and consumers, and funding for research and development to accelerate the deployment of clean energy technologies and improvements in energy efficiency. In addition, funding could be used to address climate impacts, provide job training in new clean energy industries for displaced workers. There appears to be increasing

interest in directing a meaningful portion of the auction proceeds to consumers.[2] This could take many forms. Such programs could direct assistance to low- and moderate-income consumers. As noted by the Congressional Budget Office and others, there will be a significant and regressive impact of a carbon price on consumers, particularly if the auction allowances are used to reduce corporate income taxes.[3]

In much of the public discussion of free allocation and auctioning, it is assumed that under free allocation the free allowances would go to the regulated entities, and that under auctioning little or no auction revenue would be recycled to these entities. This particular form of auctioning is in keeping with the "polluter pays" principle – the idea that the burden of pollution regulation should be borne by the polluters. There is public sensitivity to the notion of granting allowances gratis to corporate polluters at a time when governments and the general public need support for a variety of policy objectives, including those related to the goals of the program. Moreover, research indicates that granting a large share of allowance values to firms in the form of free allowances would generate windfalls – that is, firms' profits would be raised relative to the situation with no regulation.[4] This is of particular concern in competitive markets for electricity and transportation fuels where the value of emission allowances will likely be passed through to consumers as higher prices, whether allowances were freely allocated or purchased.[5]

In some instances, there might be practical or administrative advantages to conferring allowance value in the form of auction revenue rather than free allowances. Some would argue that allocating allowance value through an impersonal market mechanism – the auction – is less cumbersome and less likely to run into administrative logjams than accomplishing this through free allocation. Also, auctioning allowances yields cash that can be used directly by various parties. In contrast, free allocation requires the recipient to convert the allowances to cash through subsequent sale. Hence it may be administratively easier to subsidize research and development by giving innovative firms cash proceeds from an auction than by giving these firms emissions allowances.

A potentially important attraction of auctioning is that it opens up opportunities to reduce the costs of the tax system. The government could use auction revenue to reduce existing taxes on productive resources like labor and capital that are widely believed to inhibit economic efficiency.

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[2] *See*, e.g., Boyce, James and Matthew Riddle, "Cap and Dividend: A State-By-State Analysis" published by Political Economy Research Institute, Univ. of Mass. Amherst (August 2009).

[3] Congressional Budget Office, "Implications of a Cap-and-Trade Program for Carbon Dioxide Emissions" testimony of Peter Orszag, Director, before the Senate Finance Committee (April 24, 2008), available at http://www.cbo.gov/ftpdocs/91xx/doc9134/04-24-Cap_Trade_Testimony.1.1.shtml.

[4] *See* Goulder, Lawrence H., Hafstead, Marc A. C. and Dworsky, Michael, "Impacts of Alternative Emissions Allowance Allocation Methods Under a Federal Cap-and-Trade Program" (August 18, 2009) available at SSRN: http://ssrn.com/abstract=1457155.

[5] Burtraw, Dallas and Karen Palmer, 2008. "Compensation Rules for Climate Policy in the Electricity Sector," *Journal of Policy Analysis and Management,* 27 (4):819-847.

Economists have indicated that using auction revenues to lower pre-existing taxes on desirable activities could reduce the overall cost of a cap-and-trade program compared to an approach which distributes allowances for free.[6]

Another rationale for an auction is that it rewards firms that have already reduced their emissions through investment in cleaner fuels or lower carbon technologies, since they will have to purchase relatively fewer allowances compared to firms that have not made these investments. Low- or zero-carbon electricity generators are likely to realize gains regardless of which fuel is on the margin and whether or not allowances are auctioned. An auction thus addresses concerns about whether and how to give credit for early action to those firms that have already made these investments.

An auction also eliminates the need to adjust the allocation scheme to deal with sources entering and exiting the market. New entrants would see the same cost as their competitors when entering the market and those exiting would simply stop purchasing allowances.

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

2.1.3 Design Issues

The choice of policy design is not simply the choice between a system with 100 percent auctioning or 100 percent free allocation. Hybrid approaches are also possible, with some portion of allowances being given for free and some auctioned, and that ratio may shift over time. For example, it may be desirable to use free allowances to ease the transition for regulated entities in the early years of the program (especially those facing international competition and leakage), but to shift to a larger portion auctioned over time as greater parity in requirements among competing firms develops. Such an approach would be similar to those outlined in recent federal cap-and-trade proposals.[7]

Moreover, free allocation can take several forms, as can the method of auction. For example, free allocation can be granted based upon historical emissions (favoring current heavy emitters) or

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[6] *See* Sanstad, Alan H and Wolff, Gary H., *Tax Shifting and the Likelihood of Double Dividends: Theoretical and Computational Issues*, (January 2000) for a discussion of this theory and possible limitations available at http://www.rprogress.org/publications/2000/ets_doublediv.pdf. More recent studies have shown that a lump-sum rebate is more progressive because consumers face similar costs from a cap-and-trade policy across income groups. Burtraw, Dallas, Richard Sweeney, and Margaret Walls, *The Incidence of U.S. Climate Policy: Alternative Uses of Revenues from a Cap-and-Trade Auction,"* National Tax Journal, LXII (3):497-518.

[7] *See* "The American Clean Energy & Security Act" (H.R. 2454, or "ACES") (2009); and "Clean Energy Jobs and Amewrican Power Act" (S. 1733) (2009).

another basis such as market share or output (favoring less-carbon-intensive emitters), or based on a combination of considerations. Another issue is whether to have a constant baseline for allocation, or instead to update the baseline over time. Updating allows for new circumstances including firm exits and entrances, however, some argue it could create perverse incentives to maximize emissions in order to qualify for a larger allocation later. Similarly, auctions can differ according to eligibility for bidding, the mechanism for and rounds of bidding, and whether a minimum price is set. The rules established for conducting auctions can also affect behavior, impact market liquidity and transparency, and influence other objectives of the emissions reduction program. These and other design considerations are discussed in more detail in the following sections of this report.

2.2 Alternative Methods for Free Allowance Allocation

Although the allocation of allowances may seem like a simple process, there is a wide variety of approaches that have been considered. A key distinction to make is between *exogenous* allocation approaches, e.g., approaches that do not depend on current or future behavior, and *contingent* or *updated* approaches, e.g., approaches that adjust over time in response to behavior and market conditions.

2.2.1 Exogenous Allocation

Exogenous allocation fixes the full schedule of allocation before the regulation is implemented. The *grandfathering* approach is a specific case of exogenous allocation. Under grandfathering, the allocation is based upon a metric such as the emissions or activity levels of firms or sectors during a previous baseline period. To be truly exogenous, the baseline period must be before the cap-and-trade program, as well as the allocation, were anticipated by those eligible to receive them.

A strong appeal of exogenous allocation is that it is not expected to have an impact the abatement decisions of firms. If the firm's allotment of free allowances is believed to be exogenous, firms have no reason to alter their behavior as an attempt to influence this allotment. As a result, an exogenous allocation scheme has traditionally been viewed as the most efficient form of free allocation, at least with regards to the costs of complying with the emissions cap.

Exogenous allocation has its critics, however. One criticism stems from the perception that it is unfair. Under a strictly exogenous allocation scheme such as that used for the U.S. sulfur dioxide emissions trading program, firms continue to receive allowances even if they close their facilities. Also, the particular case of grandfathered allowances is sometimes viewed as inequitable on the grounds that it "rewards" the largest emitters with the largest allocations.

Exogenous allocation is sometimes criticized as being unnecessarily rigid. Exogenous allocation can tie the hands of regulators, who would be unable to respond to unexpected outcomes in the market by revising an allocation approach.[8] In the face of these criticisms, many existing allowance-trading programs employ some form of updating of the rules used for the allocation of emissions allowances. Taken literally, "updating" means simply that the regulators reserve some ability to revise the allocations in response to economic or allowance market conditions. In practice, allowance updating has followed specific rules that are understood in advance by the market participants.

2.2.2 Updated Allocation

The key design element in allowance updating is the criterion that forms the basis for changing the allocations. The entry and exit of facilities is sometimes treated as a cause for updating. For example, the closure of a plant could be a basis for forfeiting future allocations, while the construction of a new plant could trigger a new allocation.[9] More generally, some allocations systems have based allocations in a future period upon the production of a plant in the current period. This approach is usually called *output-based updating.* An alternative approach would base future allocation on the current emissions of a facility. This is usually called *emissions-based updating.* A similar approach is *input-based updating,* which would base future allocation on the current input of energy at a facility. It is similar to emissions-based updating because in the absence of post-combustion controls to remove CO2 from the emissions of a facility, the energy input and fuel type will determine its emissions. In multi-industry settings, such as allowance trading for CO_2, a hybrid approach is often discussed that would allocate allowances to facilities in a given industry based upon the output of that facility and a benchmark emissions rate for all facilities in that industry. We will refer to this approach as *benchmarking*.

Before discussing the important differences between updating approaches, it is important to highlight the key feature shared by all updating schemes. Because allocations are tied to ongoing behavior, the allocation scheme affects the operation and abatement decisions of firms. Hence, the updating approach provides incentives that influence these decisions. This is the fundamental difference between updating and exogenous allocation.

Output-based Updating

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[8] This issue was one of the ones identified by the DC Circuit Court when it vacated and subsequently remanded to the EPA the Clean Air Interstate Rule because the rule would affect the allocation of SO2 emissions allowances that had been set in statute using an exogenous "grandfathering" approach (North Carolina v. EPA, 531 F.3d 896 (D.C. Cir. 2008)).

[9] Åhman et al. (2007) show that removing allocations to sources that close or granting allocations to new sources can alter investment incentives in a way that increases the profitability of relatively less efficient (dirtier) sources.

Under output-based updating, each firm receives an allocation of allowances that is proportional to its total production of goods or services. In the electricity context, for example, this means each firm receives an allocation proportional to the MWh it generates. The effects of output-based updating have been a subject of much research.[10] The main insight is that output-based updating is a form of production subsidy where firms are rewarded, in the form of valuable allowances, for each additional unit of output. The effect of the production subsidy would be to increase output from eligible firms compared to a grandfathering approach or an auction. In this way, output-based allocation can help mitigate leakage because firms have an incentive to expand output. However, if firms outside the regulated region qualify for a share of the production subsidy this will erode or potentially reverse the incentive for "domestic" firms to expand production.[11] Output-based updating is also widely believed to result in lower product prices than alternative forms of allocation, again because the production subsidy inherent in output-based updating lowers the variable cost of production leading firms to increase output over levels that would arise without the subsidy.

These two effects of output-based updating --- mitigating leakage and product price increases --- form the basis of its appeal as well as the main concerns with it. The American Clean Energy and Security Act (HR 2454) includes "rebates" for ``energy-intensive, trade-exposed" industries that are in effect updating, output based allocations. Updating mitigates leakage because the allowances are *not* awarded to imports, and because the subsidy is related to the level of overall production. The production subsidy in the form of the allowance value partially offsets the incremental impact of CO2 prices on domestic firms, thereby leveling the playing field with imports that were not subject to the regulation. However, if the production subsidy affects only a portion of the regulated industries covered by the emissions cap, the subsidy will lead to relatively more emissions from this sector of the economy, causing there to be a need for more emissions reductions at higher costs from other sectors. Output-based allocation also mitigates the increase in prices for products such as electricity and therefore mitigates the impacts of GHG regulation on consumers. However, ``lower'' prices can lead to inefficient over-consumption because it removes the price incentive for consumers to implement energy efficiency measures.[12]

There is a concern that output-based updating, if applied symmetrically to all producers, would exacerbate equity concerns with respect to the distribution of costs within the regulated industry. For example, there is a fear that low-carbon producers will experience a ``windfall'' under output-based allocation, while high-carbon producers will suffer most of the cost impacts of GHG regulations. This is because output-based allocation favors cleaner producers, which are rewarded for production, and

[10] See Jensen and Rasmussen (2000), Fischer (2003), and Fischer and Fox (2007)

[11] The difference between the emissions rates of the "foreign" and "domestic" facilities is one of the factors that determine whether the production subsidy is reversed. If foreign facilities have a higher emissions rate than domestic facilities, then the domestic facilities will receive a relatively favorable allocation that encourages expanded production.

[12] See Burtraw, Palmer, and Kahn (2005).

penalized for emissions. Further, it is not straightforward to compare units of ``output'' (e.g. a ton of cement or a MWh of electricity) across industries. Some proposals call for "value added" as an alternative to units of output.

Emissions-Based Updating

An alternative approach to updating that addresses these concerns would be to allocate allowances based upon the *emissions*. For example, a plant may be allocated 1 ton in allowances for each 2 tons of emissions it produces. In this way facilities are all awarded allowances in equal proportion to their direct costs of the GHG regulation. The obvious criticism of emissions based allocation is that it rewards firms for producing the very thing that the regulation is trying to reduce.

With each of these approaches there is a fundamental tension between subsidizing the output of polluting facilities while simultaneously trying to reduce overall emissions in a region. The aggregate impact on the environment can still be limited by fixing the cap, and awarding "shares" of the available allowances according to output or emissions-based updating.[13] This combination of simultaneously rewarding and punishing similar behaviors can result in inflating the allowance prices.[14] If the updating allocation is awarded to just a portion of the regulated firms, then the firms that do not receive an allocation will face higher allowance prices and greater compliance costs. Also, because updating can lower product prices below efficient levels, the "over-consumption" of products such as electricity can increase the overall cost of abating emissions to stay below the cap relative to an exogenous allocation scheme.

In practice, the obvious conflicts inherent in emissions based updating reduce its appeal, and the practical considerations make purely output-based updating rare. Instead, it is more common for output-based allocations to be based upon some kind of emissions benchmark.

Benchmarking

Benchmarking is an intuitive way to normalize the allocation of allowances across differing industries. In practice, this approach would establish a baseline emissions rate for an industry (e.g. cement) or process (e.g. coal generation) and award allowances to all facilities in that industry according to the "benchmark" GHG content of their output. Benchmarking combines attributes of both output-based and emissions-based updating.[15] Although firms are explicitly rewarded for output, not

[13] If the output-based allocation were not combined with a strict aggregate cap, the result would be very similar to an intensity standard, such as the Low Carbon Fuel Standard. Firms would have an incentive to produce their products in a low-carbon fashion, but less incentive to limit overall production levels.

[14] Bohringer and Lange (2005) study a "closed" cap-and-trade system where all firms receive allocations equivalent to a portion of their emissions. The results are identical to an exogenous allocation scheme except that allowance prices rise proportionally to the "rebate" implied by the allocation.

[15] One difference is that the benchmarking approach often resembles an intensity (performance) standard whereby changes in aggregate emissions vary with the level of economic activity. The benchmark emissions rate can be

emissions, this only makes a difference if there are practical low-carbon methods for making those products. To the extent that the carbon intensity of output for a firm or industry cannot be changed, output-based updating closely resembles emissions based updating. The only way to reduce emissions is to reduce output.

It is important to emphasize that emissions-based and output-based allocations can produce very different implications for the markets they are applied to. Theory would predict emissions based allocation would put more inflationary pressure on allowance prices, and it does not appear to be as effective as output-based at mitigating leakage. To the extent a benchmarking approach takes on emissions-based characteristics, it can therefore undermine some of the important benefits of updating.[16]

Both the Federal ACES Act and the proposals of the Western-Climate Initiative (WCI) feature fuel-differentiated benchmarking approaches to updating.[17] The WCI proposal would apply updating only to the electricity sector, but generation from different fuel sources would receive allowances according their carbon intensity (e.g. coal plants would receive more allowances per MWh than gas plants). Among other implications, this makes compliance by switching from coal to gas less attractive, as it would result in a lower allocation.[18]

Complicating matters for California and the WCI is the interaction of allocation policy, the "first-deliver" point of compliance, and legal constraints such as the Interstate Commerce clause of the constitution. One way to interpret the legal constraints is that non-CA suppliers must be treated no worse than CA suppliers. If the point of compliance is where emissions occur (as it will for electricity under ACES, and other industries under AB 32) updating only "domestic" output can be justified as a way to only partially offset the additional costs placed on domestic producers by the cap. However, under a first-deliverer system, the cap in theory applies to purchases of imports as well. This means that these import purchases need to be eligible for updated allocations in order to maintain the symmetric treatment of domestic and imported production. This was the conclusion of the CPUC and CEC when they formulated a recommendation to apply fuel-based updating to both sources within CA and first-deliverers receiving power from outside CA. Unfortunately, this legal constraint may compromise one of the key benefits of updating, its ability to limit leakage. If imported power as well as CA power are both eligible for updating, then there can be less of an allowance-based advantage to maintain production inside CA. In a first-deliver system, "fuel-based" or "emissions-based" updating could limit reshuffling of sources, but its overall effects are difficult to predict.

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adjusted over time to achieve the aggregate emissions target, or else other regulated sectors not subject to a benchmarking allocation would be required to achieve emissions reductions at a level that balances with the cap.

[16] See Bushnell and Chen (2009).

[17] <We need to clarify what is in the WCI proposal vs. the recommendation of the joint agencies for California.>

[18] Åhman and Holmgren (2006) show that fuel-based benchmarking for new sources in the EU ETS can change the order of investments, leading to a substitution toward higher-emitting technology.

2.3 Alternative Auction Designs

Auctions are an increasingly common way to deliver resources and other goods to markets. One reason for their popularity is their ability to direct goods to their highest valued use in an efficient manner. There are many types of auctions in use today; they can be tailored to match the circumstances of specific goods or the needs of sellers and buyers. An important lesson from the economic literature on auctions is that one size does not fit all, but rather auctions should be designed for specific situations (Binmore and Klemperer, 200X). There is an expansive economic literature applying analytical, empirical and experimental methods that can inform the design of an auction. In addition to collective experience with auctions generally, over the last couple decades there has been experience with auctions for emissions allowances in particular that provides the basis for designing a potential auction in California.

2.3.1 General attraction of auctioning

Auctions offer several attractions in the context of emissions allowance markets. The sulfur dioxide trading program established under the 1990 U.S. Clean Air Act amendments distributed the value of emissions allowances to incumbent emitters, so called "grandfathering," but it also has an auction that is held annually that was important in the development of the allowance market (Ellerman et al 2000). Initial bilateral trades (between two parties) revealed a wide distribution of prices for emissions allowances, reflecting uncertainty about the cost of emissions reductions among compliance entities and about the functioning and liquidity of the emerging market. The first auction in <April 1994 check> cleared at a price that was well below most of the previous trades, and the second auction a year later did so again. While some observers doubted the performance of the auctions at the time, within weeks of the second auction the price for trades in the market fell to the level observed in the auction and since then the auction has tracked the market, and vice versa, very closely. Unlike a bilateral trade that brings forward the information available to two parties, the auction process brings into play the collective information of all the participants in the market and it organizes that information to reveal the marginal cost of emissions reductions for the market as a whole.

Generally, auctions are cited for their transparency and administrative simplicity relative to other mechanisms for distributing government-created licenses and property. Perhaps unfairly, administrative decisions about the distribution of such valuable assets inevitably convey a sense of special dealing. Even when explicit criteria are offered for determining the distribution of such assets, the outcome is determined by subjective evaluation of how parties conform to the criteria. The value that is assigned through such a process can be substantial and is likely not to be known in the decision making process because it occurs prior to the maturation of the market where the value of the asset is determined. Consequently the administrative allocation can overshoot or undershoot the goals embodied in its criteria. In the largest emissions allowance in existence, the CO2 emissions trading program in the EU,

several formal ex post investigations determined that the value of the emissions allowances that were distributed for free far exceeded the cost that was incurred by the regulated entities that received the allowances, leading to billions of dollars in windfall profits. This revelation led the European Commission to overhaul the allocation approach initiating a transition to a full auction by 2020.

2.3.2 Alternative auction designs

The widespread use of auctions in various forms can leave the impression that auctions are complex. The reason there are many types of auctions is that there are many types of goods and services distributed through auctions. An allowance auction would distribute multiple, identical goods, e.g. each emissions allowance with a common vintage is of equal value. This simplifies the potential design of an auction compared to one where each good has a different but correlated value.

There are two main choices that fundamentally determine the design of auction to be used for emissions allowances. One choice is whether the outcome of the auction is determine in a one-shot process, sometimes called a “sealed bid” auction. The alternative is an auction with multiple rounds in which bidders can revise their bids, sometimes called a “multi-round” or “clock” auction because the bid price moves up or down like the hands on a clock until supply equals demand. The second choice is whether bidders pay the amount they individually bid, called a “discriminating price” auction, or if all bidders pay the same “uniform price.”

One can find examples of each type of auction in practice. A uniform price, sealed bid auction is used in the Regional Greenhouse Gas CO2 program, where nearly 90 percent of the emissions allowances are distributed through an auction. A discriminating price, sealed bid auction is used for the SO2 program. A uniform price multi-round auction was used by the State of Virginia to auction its emissions allowances in the NOx budget program. A discriminatory price multi-round auction is used by the Federal Communications Commission to distribute licenses for broadcast rights.

After the two main choices are made to determine the design of an auction, there are a number of other features that should be considered, including:

- Frequency of the auction (e.g., quarterly)
- Allowance vintages to be auctions (e.g. current year and/or future year vintages)
- Use of a reserve price (a minimum price in the auction)
- Auction platform (how the auction will occur)
- Market monitoring (to ensure against manipulation of the auction)
- Eligibility rules and financial prequalification
- Information from the auction to be revealed to the public

2.3.3 Criteria for choosing among auction designs

The choice among auction designs can be helped by criteria that may be important to state agencies, the regulated entities and the public. These include the administrative costs for the state and transaction costs for the bidders. Also, various designs may be perceived as more fair or understandable to participants and the public. The academic literature can inform how well each design performs in assigning the allowances to those who value them most.

Although there is no evidence for this in empirically for emissions allowances, another concern of many parties may be the assurance that the auction is robust against potential attempts to manipulate the price. Also, the design of the auction may help minimize price volatility in the auction and the secondary market. Raising reasonable revenues from the sale of the valuable emissions allowances is likely to be a concern. In addition, entities will want to ensure the auction design is compatible with existing electricity and energy markets.

There is ample experience to draw on in determining the auction design. In addition, various authors have recommend the use of laboratory experiments to "stress test" the auction design examine its performance according to criteria that are identified as important, and to make sure that it is robust when faced with various types of potentially unpredictable behavior and market circumstances.

2.4 Advantages and Disadvantages of Free Allocation Relative to Auctioning

As mentioned, any desired distributional outcome in principle can be realized either through free allocation of allowances or by allotment of auction revenues. In practice, however, the different ways in which these two approaches are implemented can lead to differential impacts on the incentives of affected parties.

One of the attractions of free allocation is its ability to provide compensation directly to regulated entities. The compensation comes in the form of (valuable) free allowances. In contrast, when all allowances are auctioned, providing compensation to regulated entities involves both an auction and a subsequent recycling of auction revenue to these entities. Because the process involves two steps, regulated entities might feel that obtaining allowance value through recycling of auction revenue carries greater risk than obtaining such value in one step through receipt of free allowances.

A related potential attraction relates to perception. Free allocation confers value through allowances, and this form of value-transfer might not be as visible as the transfer that would occur through a cash payment of auction proceeds. <clarify>

A principal attraction of auctioning is its potential to achieve greater economic efficiency. As indicated earlier, the revenues from an auction can be used to finance reductions in existing taxes, thus avoiding some of the distortions or "excess burden" from these taxes. Note, however, that this advantage is only realized if auction revenues are used to finance reductions in tax *rates.* If, instead, the revenues are recycled in a lump-sum manner (e.g, through rebate checks), there is no efficiency gain.

Second, auctioning provides a clear and easily observed indication of the marginal cost of reducing GHG emissions. This price signal will be propagated through electricity, fuel and other related markets, leading to more efficient prices throughout the economy, at least relative to many types of free allocation. Surfacing this information also supports development of a regulatory program that minimizes the social cost of GHG reduction by providing a benchmark against which the cost of mandatory measures may be gauged.

A third attraction is administrative simplicity. A limited number of up-front decisions must be made regarding matters such as auction design, frequency and participation. In determining how to distribute auction revenues, policy-makers must still weigh stakeholders' competing claims for compensation, but these choices are decoupled from the allowance allocation process. In contrast, distribution of allowance value is integral to the free allocation approach. Complicated approaches such as updating may provide desirable distributional outcomes at the expense of creating perverse incentives that introduce distortions into energy markets.

Even when distributional outcomes are equivalent among different approaches to distributing allowances, public perceptions of the different methods may differ. Free allocation may be perceived as more prone to political maneuvering, even though the disposition of revenues from an auction might involve similar politicking to that surrounding how to allocate free allowances. Also, auctioning is widely perceived to imply higher product costs and prices to consumers, even though free allocation and auctioning can be expected to have similar, if not identical, impacts on allowance prices and the prices of firms' products.

3. Total Allowance Value

3.1 General Issues

3.1.1 Why is the allowance value important?

The value of allowances under the cap and trade program represents a new intangible asset that will be distributed through free allocation and/or through the assignment of revenues from an auction to entities in the California economy. The value of the asset is substantial. Moreover, how it will be distributed will have a bigger effect on households than will the actual level of the emissions cap. That is because the value of emissions allowances is actually greater than the resource costs that will be incurred to achieve emissions reductions. Households in California will have to pay for both under a cap and trade program, but while resource costs are a real cost the allowance value is pecuniary measure and that value does not disappear. Rather, the allowance value is available to be directed to a variety of possible purposes, which is the subject of this report.

<Could insert marginal abatement cost curve, rectangle and triangle if not already used in Section 1.>

Some of the potential uses for allowance value may invite a limited amount of funds, such as investment in a certain type of technology or research, or infrastructure improvement. Other potential uses such as providing rebates back to households or communities, or directing funds to reduce preexisting tax burdens, seem like they could have an endless appetitive for revenue. In establishing priorities and recommendations over the set of possible ways that funds could be used it is important to have a sense of the magnitude of funds that will be available. It is also helpful to understand the variability of those funds over time, because some potential uses of the funds may be more vulnerable to fluctuations in the availability of funds. If this is the case, the state might identify these potential uses as having first claim, but perhaps a limited claim, on allowance value. Even if allowance value fluctuates, the potential uses with a primary claim would have relative assurance that funding would be stable. Secondary claims on allowance value might be identified that could benefit if allowance value is available and that have greater resilience to variability in the allowance value that is received.

3.1.2 How is the Allowance Value Determined?

This section describes the factors that will determine allowance value that could be available under the cap and trade program. Allowance value is the product of two factors, the quantity of emissions allowances that are introduced in the system and their price. The allowance quantity is a policy choice representing the state's commitment to achieving emissions targets over a specific time schedule.

Allowance price is strongly influenced by the emissions target and the cost of reducing emissions from their business-as-usual level to achieve that target. The cost to the economy integrates the costs of individual behavioral changes and investments that will unfold over time. Also important are policy variables that determine the design for the emissions market and the role of other policies that will affect that market.

The next section describes factors that influence the marginal cost of achieving emissions reductions in the short run and in the long run. Next, we discuss policy variables that have a strong bearing on the cost of emissions reductions. We use this information to report a range of probable allowance values, based on information available to the committee, and an estimate of the value of allowances that would be available for the state to direct to various purposes.

3.2 Factors Determining Abatement Costs

3.2.1 Technological and Behavioral Factors

Total allowance value in a given year is the product of the quantity and price of allowances. While the former is set by policy makers, the latter reflects regulated entities' marginal costs of reducing (or abating) emissions. This latter cost depends on technological, behavioral, and policy-related factors.

Here we concentrate on the technological and behavioral factors that influence marginal abatement costs. The marginal abatement costs depend on the ease with which regulated entities can utilize various channels for abatement. California's cap and trade program will reduce greenhouse gases through a number of channels. The channels vary in terms of the length in which the behavioral changes from either firms or consumers will take place; some of the channels will operate immediately, others will take a number of years to occur.

Reduced Output

One important channel through which firms can reduce emissions is a reduction in output of the good that is being produced. Pricing greenhouse gases will increase the prices consumers pay for

greenhouse-gas-intensive products. These higher prices will elicit a reduction in the quantity demand for these products, leading to a reduction in greenhouse gas emissions.

The extent to which output is reduced may vary with time. The "short-run demand elasticity" is the key parameter that expresses how much demand (and output) will fall in the short run in response to an increase in the firm's output. For electricity consumers, these reductions represent changes in consumer behavior such as increasing thermostat settings during the summer or switching to compact fluorescent lighting. Reductions in natural gas demand may come from reducing thermostat settings in the winter or adjusting hot water heater temperatures. Behavioral changes that reduce gasoline demand include reductions in VMT through carpooling, trip collection, and better engine maintenance.

A variety of studies have estimated the short run demand elasticity for greenhouse gases intensive products. For example, XX (XXXX) estimates that short run demand electricity to be XX; XX (XXXX) estimates short run elasticities for natural gas of XX. XXCheck Jim Boyce's citeXX Recently, Hughes, Knittel and Sperling (2008) estimate the short demand elasticity for gasoline to be roughly 0.07.

Over the longer term, there are likely to be larger reductions in output in response to increased prices. This reflects the increases ability of consumers to identify and use substitutes with the passage of time. Consumers' adjustments might include replacing inefficient air conditioners, hot water heaters or automobiles. These changes take place in the "medium term" of 2-10 years.

Fuel-Substitution and Opportunities for Process Change

Firms can also reduce emissions by lowering the amount of emissions per unit of produced output. They can do this either by substituting low-GHG fuels for other fuels, or by undertaking other changes in the methods of production. Opportunities for fuel-substitution and process-change may be relatively limited in the very near term, but can be considerable over the longer term. Consider in particular the incentives for fuel substitution by electric power generators. While at a zero greenhouse gas price and existing natural gas and coal prices, coal plants have lower marginal costs than natural gas plants of the same heat rate, as the price for greenhouse gases increase, coal marginal costs increase faster than natural gas marginal costs. Switching from coal to natural gas generation can have large effects on greenhouse gas emissions. Coal fired power plants produce roughly twice the greenhouse emissions than a comparable natural gas plant.

Table XX below illustrates the "flipping point" (the point at which fuel-substitution would be economic) for a variety of coal and natural gas prices (expressed in terms of $ per mmBTUs) for plants operating at a heat rate of 10 (expressed in mWh per mmBTU) XX CHECK UNITS OF HEAT RATE XX. For example, natural gas is currently trading at roughly $5 per 10,000 million British thermal units (mmBtu); coal, on the other hand, sells for roughly $2.25 per mmBTU.[19] At these prices, a permit price of $49

[19] http://www.eia.doe.gov/cneaf**/electricity/epm/epm_sum.html.**

would equate the marginal cost of coal and natural gas, for a power plant with a heat rate of 10. XX GET DISTRIBUTION OF HEAT RATES BY FUEL FROM JIM XX.

Developing New Technologies

Pricing greenhouse also incentivizes firms to invest more in research and development in greenhouse gas reducing technologies. Absent a price on greenhouse gases, advances in greenhouse gas reducing technologies must rely on "piggy backing" off of cost reducing advances that also reduce greenhouse gases. For example, automobile firms have an incentive to invest in energy efficiency because consumers value fuel efficiency. These advances also reduce greenhouse gas emissions, but without pricing greenhouse gases, firms and consumers have too little of an incentive to invest in energy efficiency. This suggests that rates of technological progress are likely to increase under a cap and trade system.

		Natural Gas Price ($/mmBTUs)											
		$ 2.00	$ 2.50	$ 3.00	$ 3.50	$ 4.00	$ 4.50	$ 5.00	$ 5.50	$ 6.00	$ 6.50	$ 7.00
Coal Price ($/mmBTU)	$ 1.50	$ 9	$ 18	$ 27	$ 36	$ 45	$ 54	$ 63	$ 72	$ 81	$ 90	$ 99
	$ 1.75	$ 4	$ 13	$ 22	$ 31	$ 40	$ 49	$ 58	$ 67	$ 76	$ 85	$ 94
	$ 2.00	$ -	$ 9	$ 18	$ 27	$ 36	$ 45	$ 54	$ 63	$ 72	$ 81	$ 90
	$ 2.25	$ (4)	$ 4	$ 13	$ 22	$ 31	$ 40	$ 49	$ 58	$ 67	$ 76	$ 85
	$ 2.50	$ (9)	$ -	$ 9	$ 18	$ 27	$ 36	$ 45	$ 54	$ 63	$ 72	$ 81
	$ 2.75	$ (13)	$ (4)	$ 4	$ 13	$ 22	$ 31	$ 40	$ 49	$ 58	$ 67	$ 76
	$ 3.00	$ (18)	$ (9)	$ -	$ 9	$ 18	$ 27	$ 36	$ 45	$ 54	$ 63	$ 72

3.2.2 Policy-Related Factors

In addition to the fundamentals influencing the marginal costs of abating CO2 within the sectors covered under California's cap, there are several other factors that will strongly influence the price of allowances. Many of these factors relate to details of the design of allowance market and related policies, some of which have yet to be determined. For guidance on many of these points, we reference the guidelines of the WCI as the California guidelines are expected to share many of these elements.

Free Allocation

As discussed in Section 2, the way that emissions allowances are initially distributed is a key policy variable that can have an important effect on the price of allowances. In particular, updating approaches that award allowances in response to production or emissions will tend to increase the allowance price compared to grandfathering or an auction.

Linkage with Larger CO_2 Markets

It is reasonable to expect that a level of reciprocity with other established GHG allowance markets will be allowed. Given that California GHG emissions would constitute only a fraction of total emissions in all these markets, a high degree of linkage with other markets would imply that CA allowance prices will be tied to those in other regions.[20] Futures prices in these markets give some signal of future prices in CA. The current EU ETS price for a 2012 delivery futures contract is 17.42??update?? euro/ton on the European Climate Exchange.

Banking and Borrowing Provisions

Rules on the inter-temporal usage of allowances play an important role in determining the volatility of prices. These rules include the degree to which firms can use a current-year allowance for compliance in latter years through "banking" emissions reductions, and the extent to which a firm can use a future-year allowance for compliance in the current year through "borrowing." In general borrowing is more controversial as it implies a delay in overall abatement. Also, there are concerns about the credibility of enforcement in the face of large-scale borrowing. In other words, borrowing constitutes a promise to reduce emissions disproportionately in future years, and its effectiveness depends upon holding firms to that promise.

The WCI guidelines implicitly allow for borrowing only within a 3 year compliance window. They allow for unlimited banking. If this framework is extended to California, this means that prices in near-term years should be influenced by prices in latter years if, as expected, the cost of abatement is higher in those later years due to more stringent caps in those years. Under those conditions, with unlimited banking the price in 2012 should equal the price in 2020, discounted for expected interest earnings.

However, some important considerations could limit the use of banking. A firm that chooses to bank a California allowance will have to consider the possibility that a California program many not exist

[20] California's capped sectors would amount to about 1/10th of that in 2012.

in 2020, or may look very different. In particular, the prospect of federal legislation pre-empting California's emissions market at some point over the next decade could limit the expected future value of California allowances.[21]

Availability (and price) of CO_2 Offsets

In many CO2 markets, firms have the option to comply with the cap through the purchase of carbon "offsets" from industries or regions beyond the scope of the cap-and-trade system. Usually this involves paying firms to take actions that reduce carbon emissions from their activities, or sequester CO2 from the atmosphere. The exact cost and availability of offsets will largely depend upon the criteria that are established for California's allowance trading system. The stringency of the certification process for offsets will determine the extent to which they can influence the overall price of allowances.

To the extent that sufficient offsets are available and allowed by the rules for compliance, their price can form an upper bound on the price. If the cost of direct mitigation rises above the cost of offsets, firms will utilize the offsets as their compliance strategy. If the amount of offsets allowed for compliance is limited, and this limit is binding, then offset prices would no longer establish an upper bound on allowance prices. The WCI guidelines propose up to 49% of total allowance requirements could be procured through offsets, but many California stakeholders view this limit as too high.

Impacts of Other Directed Policies

Under AB32, allowance trading is only one element of a broad set of policies aimed at reducing CO2 emissions. In the projections of the scoping plan, directed policies are expected to account for about 80% of overall required abatement and XX% of abatement from sectors covered under allowance trading.

[21] Although there are provisions in the currently proposed federal bills that would compensate firms for the value of banked state allowances, these provisions are ambiguous.

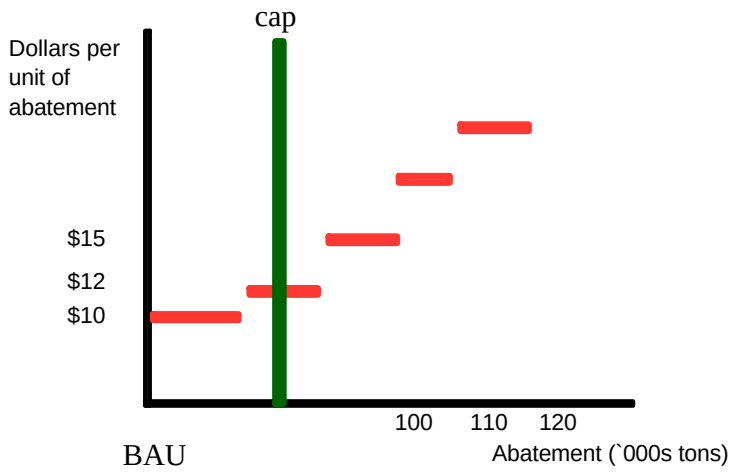

Figure 1: Supply and Demand for Abatement

If one considers all mitigation options as forming a "supply curve" of CO2 reductions, then the cap can be thought of as setting the "demand" for reduction. The directed policies will have the effect of specifying some of the compliance options firms must undertake. The reductions accounted for under the directed programs in effect reduce the "demand" for reductions under the cap. They also remove those directed options from the supply curve of remaining mitigation options. To the extent these mandated options would have been chosen under allowance trading system even without the mandate, this will not impact the allowance price, as illustrated in Figure 1. However if some of these options can be thought of as coming from higher up in the mitigation cost curve, they can actually reduce the equilibrium allowance price, even though they may raise the overall cost of the regulatory effort. Thus the "marginal" cost of abatement – the cost of the "last" ton of abatement - may not necessarily be the highest-cost option, as illustrated in Figure 2. It is the marginal cost – the cost of the last unit of abatement – that will determine the price of allowances, however.

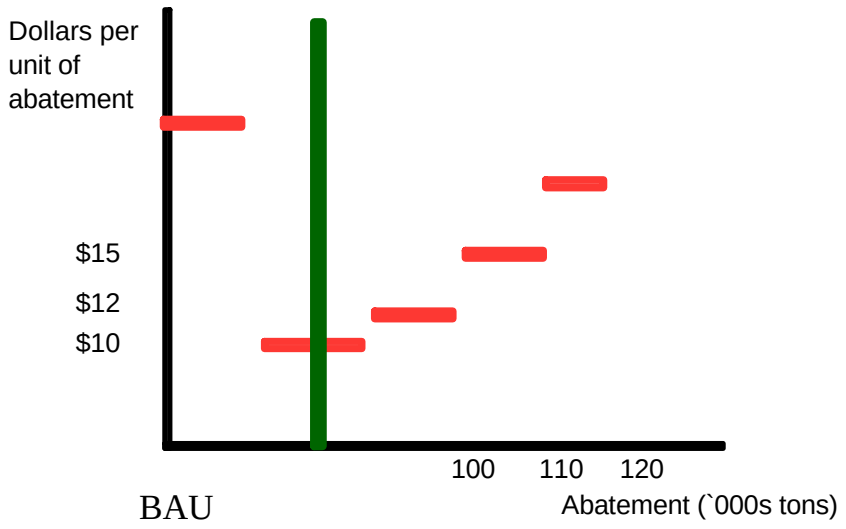

Figure 2: A High Cost Option is Mandated

Leakage and/or Reshuffling

Another important factor to consider in predicting an allowance price is the extent to which "compliance" will be obtained through leakage of production – or of demand for production – to other regions outside the cap. To the extent that it is cheaper to produce a product and import it into California than it would be to either abate CO2 emissions or purchase an allowance *inside* California, there will be a migration of production to other regions. In this way, emissions inside California will be reduced and the demand for actual abatement inside California will go down, as will allowance prices. However, if there is some degree of emission leakage total regional emissions will not be reduced by as much as the observed emissions reduction in the state. A similar, but less direct form of leakage could arise if firms who consume CO2 intensive products, such as electricity, themselves move to uncapped regions. Again consumption of CO2 inside California would decrease, but regional emissions probably would not.

In this way, the extent of leakage from California to uncapped regions could play a significant role in determining allowance prices. The electricity sector has been identified as particularly vulnerable to leakage, and special provisions to combat leakage through a "first deliverer" design have been developed to mitigate it. However, some leakage from electricity is a strong possibility and there are no specific policies yet in place to combat leakage in other sectors. Some forms of updating allocation may reduce leakage but they also bring other considerations, as suggested elsewhere in this report.

Summary

These policy variables have differing affects on allowance price. Linking provides a way to reduce costs across different regulatory programs, but the program with relatively lower marginal cost will be pulled into making additional emissions reductions, and that will raise the allowance price for that program while lowering the allowance price in the other program.

Banking and borrowing provides an opportunity to find least cost ways to reduce emissions across time periods. That will lower the cost of the program. However, the this flexibility over time causes there to be a relation across the allowance prices in different periods. Borrowing will lower the allowance price in the near term (compared to the absence of borrowing). On the other hand banking will raise the allowance price in the near term because firms will capture early reduction opportunities in order to bank allowances for use in the future.

Free allocation with an updating approach provides a subsidy to production or consumption of a good, leading to more of the activity and an associated higher demand for emissions allowances, which raise their cost. Even grandfathering may increase allowance price if it occurs in a sector subject to cost of service regulation because allowances received by firms would be treated at original (zero) cost by the regulator and therefore lead to smaller retail prices than under an auction, and that would constitute a subsidy to consumption relative to an auction.

The presence of the other policy variables would lead to a lower allowance price. Offsets and other directed policies reduce the need for emissions reductions in the regulated sector. Leakage of emission indicates supply of a product outside the regulated region that relieves the demand to incur costs within the region.

In summary, the design of the program is likely to have as great or greater of an effect on the allowance price as does the level of the emissions cap. Program various choices for the design could cause allowance prices to vary by multiple times.

3.3 Plausible Range of Allowance Prices <what follows for this subsection is largely a placeholder>

3. Total Allowance Value

3.3 Range of Allowance Prices

Several studies have reported an estimated allowance price for compliance with a cap and trade program under various scenarios that vary assumptions about coverage of the cap, underlying technological progress, emissions trajectory beyond 2020, availability of offsets, and methods of allocation.

<Narrative in preparation provides a description of the studies. The committee received a helpful memo from the Cal/EPA and ARB EAAC Policy Team (October 20, 2009) that provides background information.>

The table below summarizes many of the studies and the scenarios they modeled. The table indicates that allowance values in 2020 could extend over a wide range, depending on critical features of the program design.

Scenario			Additional Policies	Allowance Price in 2020[1]
CARB			Vehicle standards, 20%	
	California	Scoping Plan		$10
WCI			Limited amount of offsets, banking allowed, current RPSs	
	WCI	Stationary Sources Only		$71
	WCI	Economy-wide		$24
	WCI	Economy-wide - High Energy Prices		$18
	WCI	Economy-wide - Low Energy Prices		$56
	WCI	Economy-wide - High Natural Gas Prices		$20
	WCI	Economy-wide - No Offsets	No offsets	$63
Charles River Associates (EPRI)			No offsets, no banking	
	California	Binding Reductions[2]		~$60 - ~$100[3]
	California	SV_LCA	Safety valve[4]	~$60[3]
BEAR (Roland-Holst)			No banking, no offsets, all CARB policies	
	California	Economy-wide[5]		$23 - $214
	California	20% Cap-and -Trade[6]		$23 - $179
	California	20% with Efficiency Innovation[6]		$8 - $161
Haiku (electricity sector only)[7] (Palmer et al.)			20% RPS, no offsets, no banking, first-deliverer compliance	
	California	Auction		$58
	California	LDC Allocation		$127
	WCI	Auction		$21
	WCI	LDC Allocation		$26

Notes:

[1] All prices are in 2007$/metric ton CO2e. CARB and CRA do not specify year for dollars, so we assume their dollars are for the year preceding the year in which the study was released - 2007$ for CARB and 2006$ for CRA.

[2] Multiple scenarios that meet the goal of 1990-level emissions in 2020 but vary for 2020-2050 (no reduction from 1990 emissions to 80% reduction from 1990 emissions by 2050).

[3] Values approximate because estimated from a figure.

[4] Safety valve allows additional emissions and breaks the cap.

[5] Economy-wide scenarios that vary in the effectiveness of complementary policies.

[6] Sectors covered by the cap-and-trade policy vary.

[7] Emissions targets for the electricity sector derived from the assumed contribution of the electricity sector within an economy-wide policy, assuming a linear emission path to 2020, where emissions are 30% below the 2020 baseline (64 million short tons in 2020).

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3.4 Plausible Range of Allowance Values Created under the Cap-and-Trade Program <what follows is largely a placeholder>

The allowance value created under the program hinges on two values, the quantity of emissions allowances introduced under the cap and the price of allowances. Assuming the plausible range of allowance prices is from $20 to $60, as suggested by the Cal/EPA and ARB EAAC Policy Team, the allowance value would range from $7.3 billion to $21.9 billion in 2020 (2007 dollars).

Year	Example Budget (MMTCO2e)	Illustrative 2020 Allowance Price							
		$20.00		$35.00		$45.00		$60.00	
		Price ($/ton)	Value (mill.)	Price ($/ton)	Value (mill.)	Price ($/ton)	Value (mill.)	Price ($/ton)	Value (mill.)
2012	200	$12.54	$2,508	$21.96	$4,392	$28.23	$5,646	$37.65	$7,530
2013	195	$13.29	$2,592	$23.28	$4,540	$29.92	$5,834	$39.91	$7,782
2014	190	$14.09	$2,677	$24.68	$4,689	$31.72	$6,027	$42.30	$8,037
2015	405	$14.94	$6,051	$26.16	$10,595	$33.62	$13,616	$44.84	$18,160
2016	397	$15.84	$6,288	$27.73	$11,009	$35.64	$14,149	$47.53	$18,869
2017	389	$16.79	$6,531	$29.39	$11,433	$37.78	$14,696	$50.38	$19,598
2018	381	$17.80	$6,782	$31.15	$11,868	$40.05	$15,259	$53.40	$20,345
2019	373	$18.87	$7,039	$33.02	$12,316	$42.45	$15,834	$56.60	$21,112
2020	365	$20.00	$7,300	$35.00	$12,775	$45.00	$16,425	$60.00	$21,900

Budget: Illustrative California cap-and-trade program emission allowance budget in millions of metric tons of carbon dioxide equivalent ($MMTCO_2e$).

Price: Illustrative emission allowance price in each year in dollars per metric ton. The price trajectory is computed assuming a 6% annual price increase, resulting in the 2020 price noted in the table.

Value: Illustrative allowance value in millions of dollars, equal to the allowance price times the allowance budget.

Table prepared by Cal/EPA and ARB EAAC Policy Team (October 20, 2009). Values are 2007 dollars.

4. Making Use of Allowance Value – General Considerations

4.1 The Alternatives

Section 2 contrasted the two main mechanisms for distributing allowance value – free allocation and auctioning. This section and the one following it concentrate on alternative uses of allowance value – alternative potential recipients of this value. Below we distinguish four general ways that allowance value can be used.

4.1.1 Compensation

Allowance value can be employed to provide compensation to parties adversely affected by AB 32.[22] Among such parties are owners of firms whose profits are adversely affected from California's climate policy. Climate policy can also place burdens on consumers: such policy can be expected to raise prices of fuels, and these price increases will be reflected in higher prices of consumer goods. These higher prices can be especially burdensome to low-income households, for which purchases of energy-intensive goods and services represent an especially large share of the household budget. In addition, climate policy also prompts changes in employment. While it yields new types of jobs and new opportunities for employment, it also displaces some workers. Allowance value could be employed to compensate displaced workers, that is, to provide income relief while such workers make the transition to other employment. AB 32 is likely to change the geographical pattern of emissions greenhouse gases and of local pollutants. Some have suggested that the initiative could in fact lead to an increase in emissions in certain areas. To the extent that this in fact happens, allowance value could be used to compensate communities where such increases occur.

[22] This report focuses on methods for distributing and employing allowance value from a cap-and-trade system. However, in considering compensation, it takes account of impacts that derive note only from the cap-and-trade component of AB 32 but from the overall AB 32 effort.

Fairness considerations offer support for devoting allowance value to compensation. It may seem only fair to compensate parties that, in the absence of compensation, would endure disproportionate burdens from AB 32.

4.1.2 Dividends to the Public

Another potential use of allowance value is to provide it to the general public as a "dividend" related to the public's having granted firms the right to disrupt the climate-regulating services of the atmosphere through their emissions. If the general public is viewed as having ownership of these climate-regulating services, then it might seem appropriate to devote allowance value to the general public – in effect, this corresponds to having emitters of greenhouse gases pay the general public for the right to have access to, or to disrupt, these services. This use of allowance value resembles using allowance value to compensate households for adverse impacts of climate policy. However, the basis for supplying allowance value as a dividend is different: in this case it is a payment for a service rendered rather than compensation for an adverse impact (such as higher consumer good prices).

Support for this use of allowance value stems from the idea that the general public has a right to ownership of climate-regulating services of the atmosphere. Requiring emitters to pay for the use (or alteration) of these services is a way of upholding this right.

4.1.3 Financing Investments and Other Government Expenditures

Allowance value can be used to finance government expenditures of various kinds. It can be used to help industry make adjustments to adopt cleaner production processes, or to support private efforts to invent new technologies that involve lower emissions. It can also be used to finance other types of investment, including investments in education or in job-training, or in various community development projects. And it can be used to finance expenditures dedicated to environmental remediation <example>.

Considerations of fairness or justice can support this use of allowance value. The support of new, cleaner technologies may be viewed as a matter of equity, since it helps avoid climate-related or other environmental assaults that current production activities might otherwise impose on current or future generations. Justice considerations can support efforts to remediate environmental problems in disadvantaged communities. Cost-effectiveness considerations may apply as well. Allowance value can be used to promote public efforts to overcome market barriers to the development of cost-effective new technologies.

4.1.4 Tax Reduction

Finally, allowance value can be used to finance reductions in taxes. To the extent that California's treasury receives revenue from auctioning emissions allowances, the state will not need to rely as much on other taxes to meet given expenditure needs. Revenue from an allowance auction can finance cuts in current taxes or, alternatively, can be used to reduce current deficits. The latter implies reductions in future taxes, since a lower deficit reduces the debt and lowers the interest paments that must be made on that debt. This reduces the need for future taxes to finance the interest payments.

Fairness considerations can support using allowance value to achieve a reduction in the deficit. This can be considered a matter of intergenerational equity: avoiding leaving a large tax-burden to future generations. Using allowance value to cut tax rates also has attractions in terms of economic efficiency. This reduces the government's reliance on ordinary taxes and thus reduces the economic distortions or "deadweight losses" produced by the tax system.

We now proceed to discuss in more detail the implications of using allowance value in each of these alternative ways. This will help guide the recommendations in Section <6> as to how to allocate allowance value across the alternative uses.

5. Making Use of Allowance Value – Weighing the Needs and Claims

5.1 Compensation

5.1.1 Compensation to Industry *<this subsection to be provided. Below are some of the issues to be considered (taken from draft outline)>*

- What industries likely to be most affected?
    - High elasticity of demand (e.g., highly trade-exposed industries)
    - High intensity of carbon fuel use, combined with significant difficulty of fuel-substitution
    - Lack of access to capital (to finance adjustments)
- Difficulties in targeting compensation
    - Assessing trade-vulnerability difficult
    - Some shareholders already suffered losses (prior stock sales) and disappeared
    - Compensate Californians? Or shareholders to CA industry?
- To what extent is compensation the goal, as opposed to helping firms make the transition to a lower-GHG economy?
- Findings on relative impacts across industries, absent compensation

    (fixed dollar fees and small businesses)

[indicate which industries most affected, and why. We will be getting information from ARB on this. Perhaps we can get info from other sources as well -- Haiku, Energy 2020, and EDRAM models; possibly from CRA and BEAR models as well. Please confer with Jim Bushnell re Econ Impacts Subcommittee info on this. We should indicate which small businesses, if any, are especially affected.]

5.1.2 Compensation to Displaced Workers

California businesses are not the only ones concerned about possible impacts of the AB 32 . Employees also worry their firms will shrink or close down their California operations to reduce or avoid these impacts. Compensating the workers most severely impacted by AB32 would be a fair use of allowance value. Such value could be used to fund worker transition assistance (WTA) for California firms' employees who lose their jobs [or their full-time status] due to the AB32 greenhouse gas reduction program. The assistance would be designed to give these displaced workers the time and resources to carry out a job search and, if necessary, the training to find a new job in another industry.

A model for this type of program already exists. The federal Trade Adjustment Assistance (TAA) program provides such assistance to workers who lose their jobs or their full-time status, either because the firm's customers switched to foreign suppliers or because the firm relocated the production facility to a foreign location. The federal process appears to be simple, though in practice it can take a good deal of time. A brief review of the TAA process follows:

- First, a two-page petition must be filed--by a group of affected workers, a union official, a representative of the local One Stop Career Center, or an officer of the company. The petition will be administered by the Department of Labor in Washington and a local TAA coordinator (the local Workforce Investment Board or One Stop Career Center).
- The company will be asked to provide pertinent information about its business and its customers. The firm's customers also may be asked to provide information. Important note: the whole process moves faster if this information is supplied promptly. The DoL will not certify the petition until after it has received satisfactory responses to its requests for information.
- TAA benefits can include cash transition payments, job search assistance, relocation allowances, and trade training.

5.1.3 Compensation to Disproportionately Affected Consumers

California households will have face higher prices directly for electricity, natural gas, and gasoline, and indirectly as businesses pass costs for GHG reduction on to consumers. [ADD: reference to estimates of likely price increases from Economic Analysis chapter?]

These higher prices can be expected to a regressive impact: as a percentage of their incomes, they will hit low-income households harder than upper-income households. This is because a larger fraction of the budget of low-income households is spent on relatively carbon-intensive goods (such as

household fuels), whereas upper-income households generally spend a larger fraction on other goods and services.[23]

From a fairness standpoint, there is a case for compensating low-income consumers for the impact of higher energy prices on their real incomes. From an efficiency standpoint, however, it would be costly to blunt or negate the impact of the newly introduced price signals by subsidizing energy use. Cash transfers could provide compensation without reducing incentives for to conserve energy.

From an administrative standpoint, allocating allowance value to compensation for low-income consumers would require the development of criteria and procedures for "means testing" to determine eligibility.

A precedent for such compensation is the American Clean Energy and Security Act (Waxman-Markey bill), passed by the U.S. House of Representatives in June 2009, which allocates 15% of allowance value to relief for low-income households. Under this bill, eligible households (with incomes at or below 150 percent of the official poverty line) would receive a monthly refund via the Electronic Benefit Transfer (EBT) cards that states already use to deliver food stamps and other benefits, or via an increase in the Earned Income Tax Credit.

5.1.4 Environmental Compensation

A final candidate for compensation may be communities that experience adverse environmental impacts as a result of AB 32 implementation.

Section 38570(b) of AB 32 mandates that "to the extent feasible" ARB shall consider "localized impacts in communities that are already adversely impacted by air pollution" and "design any market-based compliance mechanism to prevent any increase in the emissions of toxic air contaminants or criteria air pollutants."

Nevertheless, it is conceivable that even as GHG emissions are reduced statewide, some communities will experience increased emissions of GHGs and the associated co-pollutants, including reactive organic gases, carbon monoxide, nitrogen oxides, sulfur oxides and particulate matter. Such increases would be of particular concern if they happen in disadvantaged communities that are already overburdened by disproportionate exposure.

It is not possible for the ARB or EAAC to ascertain in advance whether or to what extent AB 32 implementation will be accompanied by the emergence of "hot spots" where co-pollutant damages do, in fact, increase. Should this occur, however, such communities could have a claim for compensation.

[23] See also the Appendix to this Report on "Dividends."

Any such environmental compensation would be distinct from and additional to the provision of allowance value for investment in disadvantaged communities, discussed in section [x] below.

We cannot know in advance the extent to which AB 32 implementation will result in the emergence of "hot spots" where co-pollutant emissions increase, even as overall emissions decline statewide. Quantitative information on this issue is expected to be obtained during AB 32 implementation. As the Scoping Plan states:

> *ARB already conducts robust environmental and environmental justice assessments of our regulatory actions. Many of the requirements in AB 32 overlap with ARB's traditional evaluations. In adopting regulations to implement the measures recommended in the Scoping Plan, or including in the regulations the use of market-based compliance mechanisms to comply with the regulations, ARB will ensure that the measures have undergone the aforementioned screenings and meet the requirements established in HSC sec 38562(b)(1-9) and sec 38750(b)(1-3).*[24]

The referenced HSC (Health and Safety Code) sections include AB 32's provisions that ARB shall "ensure that activities undertaken to comply with the regulations do not disproportionately impact low-income communities" and "consider the potential for direct, indirect, and cumulative emission impacts …, including localized impacts in communities that are already adversely impacted by air pollution."

In implementing the cap-and-trade element of AB 32, ARB must collect information to ensure that GHG emissions by regulated entities are within the limits set by the number of permits they hold. This will assist in identifying any localities where GHG emissions (and hence co-pollutants) actually increase.

If the ARB finds increased co-pollutant burdens in some communities, a share of allowance value could be allocated for compensation to these communities (with commensurate reductions in the share of allowance value allocated to other uses). Since the extent of such claims cannot be known in advance, this can be regarded as a contingent use of allowance value.

5.2 Dividends to the Public[25]

The return of carbon permit auction revenues to the public in the form of equal per capita dividends – sometimes called a "cap-and-dividend" policy – transfers allowance value to households,

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[24] ARB, *Climate Change Scoping Plan: A Framework for Change.* Pursuant to AB 32, The California Global Warming Solutions Act of 2006, December 2008, p. 106. Online at http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf.

[25] See also the Appendix to this Report on "Dividends."

leaving decisions on the final use of the money to the public. Three rationales have been advanced for dividends:

1. *The principle of common ownership of nature's wealth:* Cap-and-dividend is founded on the premise that rights to the limited carbon storage capacity of the atmosphere – and hence to share in the "rent" (permit revenue) obtained from its use – belong equally to all.

2. *Protection of household real incomes:* Dividends help to shield household real incomes from the impact of higher fossil fuel prices that result from an emissions cap. The net effect (dividends minus price impacts) on any individual household varies – those with the smallest "carbon footprints" see the biggest gain – but all households have an incentive to reduce consumption of fossil fuels.

There are several precedents for this approach. One is the allocation of revenues to this use is the Alaska Permanent Fund, which recycles oil-extraction royalties to Alaska residents as equal per-person dividends. The Alaska fund affirms the principle of common ownership of nature's wealth, and demonstrates that it is feasible for state government to administer a dividend policy. A second is the American Clean Energy and Security Act (or Waxman-Markey bill), passed by the U.S. House of Representatives in June 2009, which would establish a Climate Change Consumer Refund Account that would provide tax refunds on an equal per capita basis to each household in the United States.[26] If the Act becomes law, disbursements under this account are expected to amount to roughly 50% of allowance value from 2030 onwards.

In terms of environmental and efficiency considerations, dividends forego possible gains from using auction revenue to achieve deeper GHG emission reductions in locations with high co-pollutant burdens. From an efficiency standpoint, dividends also forego possible additional gains (above and beyond those resulting from carbon pricing alone) via use of revenue for public investment or tax shifting. From a fairness standpoint, dividends have two main attractions: first, they offer universal coverage based on the principle of common ownership of nature's wealth; and second, they reduce income inequality since all residents receive the same dollar amount regardless of their income level.

In terms of simplicity, dividends are an exceptionally transparent use of allowance value. The federal American Clean Energy and Security Act proposes to disburse them via tax refunds to all U.S. nationals and legal residents. Alternatively – and more visibly – they could be disbursed by means of ATM cards, similar to those used today to access Social Security payments: at the ATM, individuals could view the auction revenue deposits into their accounts, withdrawing available funds at their convenience.

If dividends are taxable, a fraction of the allowance value distributed through this route ultimately returns to government. This revenue stream becomes available other uses, including tax shifting or defraying the impact of higher fuel prices on government purchasing power. On fairness grounds, larger taxable dividends may be considered preferable to the alternative of withholding an equivalent amount of auction revenue for government and returning smaller non-taxable dividends to

[26] H.R. 2454 as passed by the U.S. House of Representatives, 26 June 2009, Section 789(a).

the public, since the latter would be equivalent to a "head tax" in that it takes an equal dollar amount from each person regardless of income.

5.3 Public Financing of Investments and Other Public Expenditure

Some portion of allowance value can be used to finance investments or other expenditures that would reduce the overall cost to California of meeting AB 32's emissions limits, as well as help achieve AB 32's other goals. Investments could be put towards a number of different areas, such as existing greenhouse gas (GHG) emission reduction programs; research, development and deployment (RD&D) of new clean technologies; capital investments including new infrastructure; job training; and programs or projects centered on disadvantaged communities. Additionally, public expenditures could be used to help fund the efforts of state and local agencies to meet their legislated GHG mandates. This section discusses the rationale for investing auction revenues in general, and several categories of investment in more detail. It concludes with a brief discussion of how to compare investment options.

5.3.1 Rationales for Investments

Investment in cost-effective GHG reductions could save money for California. It could do this in three ways:

1) *Helping to overcome market failures*. Many low-cost opportunities to reduce GHG emissions exist today but are not being implemented because of barriers impeding their adoption in the marketplace. Investment can help mitigate the under-provision of GHG-reducing programs and technologies.
2) *Providing valuable "learning by doing" experience*. Facilitating greater experience with GHG-related programs and technologies can help reduce the cost and increase the efficiency of their installation and operation.
3) *Reducing emissions in the near term*. Investment in GHG reduction now can help avoid the greater cost of more dramatic reductions later.

As ARB's Scoping Plan[27] and McKinsey's report[28] on GHG reductions illustrate, there are many negative-cost opportunities to reduce GHG emissions. (See Figures 1 and 2). The fact that these cost-

[27] California Air Resource Board Scoping Plan (December 2008), available at: http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm

[28] McKinsey & Company, "Reducing Greenhouse Gas Emissions: How Much at What Cost?" (2007), available at: http://www.mckinsey.com/clientservice/ccsi/pdf/US_ghg_final_report.pdf

saving opportunities already exist and remain untapped, however, suggests that they face non-price market barriers.[29] Thus, even though the creation of a cap-and-trade program will help put a price on carbon that spurs beneficial actions in the marketplace, the price signal alone might not be enough to enable California to capture the lowest-cost reduction opportunities.

California should strive to meet the AB 32 emissions limits in the most cost-effective way possible. This means capturing all of the low-cost reduction opportunities on the low end of the cost curves shown in Figures 1 and 2, and only going as high up the marginal abatement cost curves as is necessary to meet the emissions limits. If California cannot overcome all the non-price market barriers to capture the lowest-cost opportunities and instead skips (or under-utilizes) these and implements higher cost measures instead, AB 32 will cost the state more.

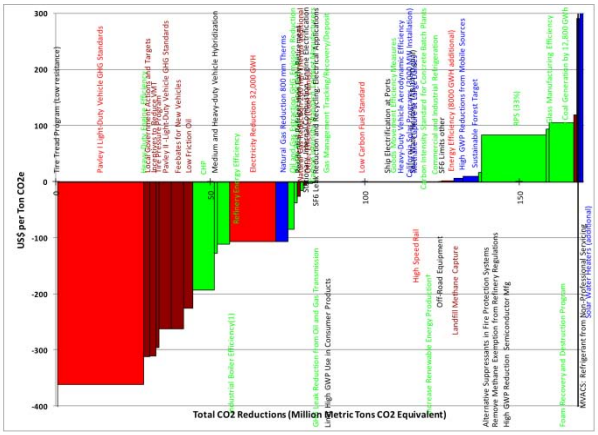

Figure 1: Scoping Plan Marginal Abatement Cost Estimates[30]

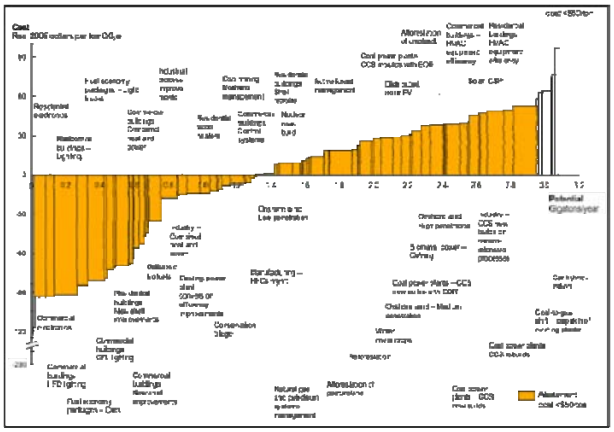

Figure 2: McKinsey's "Mid-Range Case" U.S. Cost Curve[31]

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[29] Much has been written about the pervasive market barriers to adoption of GHG reduction strategies. See, e.g., Marilyn Brown et al., *Carbon Lock-in: Barriers to Deploying Climate Mitigation Technologies*, Oak Ridge National Laboratory, sponsored by U.S. Climate Technologies program, revised January 2008; Golove, W.H. and J.H. Eto, "Market Barriers to Energy Efficiency: A Critical Reappraisal of the Rationale for Public Policies to Promote Energy Efficiency," Lawrence Berkeley National Laboratory, LBL-38059, March 1996, available at: http://eetd.lbl.gov/EA/emp/reports/38059.pdf.; ETAAC Advanced Technology Draft Report for Public Review (Sept. 18, 2009); available at: http://www.arb.ca.gov/cc/etaac/meetings/102909pubmeet/mtgmaterials102909/public_review_draft_ETAAC_advance_tech_update_9-18-09.pdf

[30] Jim Sweeney, Presentation to Economic Modeling Subcommittee, August 13, 2009, available at: http://www.climatechange.ca.gov/eaac/meetings/2009-08-13/presentations/Economic_Modeling_Subcommittee.pdf

[31] McKinsey & Company, "Reducing Greenhouse Gas Emissions: How Much at What Cost?" (2007), available at: http://www.mckinsey.com/clientservice/ccsi/pdf/US_ghg_final_report.pdf

5.3.2 Investment Options

Investment in Energy Efficiency[32]

Market Barriers

Energy efficiency is the cheapest, fastest way to meet our energy needs and reduce emissions, and California has achieved great success in this area over the past several decades. However, huge potential remains and energy efficiency continues to face numerous non-price market barriers, including:

- **Split incentives**: The potential purchaser/owner of the energy efficient product often is not the consumer/user of the energy (e.g., landlords are in a position to buy more efficient air conditioning systems, but it is the tenants that pay the energy bill each month).[33]
- **High upfront costs**: Purchasers of energy efficient products can be dissuaded by their high upfront costs, coupled with a lack of access to capital and the "payback gap" (where potential buyers of efficiency demand a much shorter payback period than do potential builders of new fossil-fuel power plants).[34]
- **Informational barriers:** Potential purchasers of energy efficient products often lack of knowledge about what energy efficiency options are available to them[35], how their life-cycle costs compare to less efficient options,[36] and how the different technologies are expected to perform. Moreover, there are transactions costs associated with obtaining and processing this information.

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[32] The Scoping Plan estimates California will save 4.3 MMTCO2 by 2020 from commercial and residential energy efficiency (measure CR1; see Table 8), with savings of $109 per MTCO2. Note: this measure consists of natural gas reduction programs (800 million therms saved) utility energy efficiency programs, building and appliance standards, and additional efficiency and conservation; none of the measures deal specifically with residential EE. The Scoping Plan does not include mandatory provisions for industrial energy efficiency, so this is potentially ripe for investment.

[33] The ACEEE, for instance, found that split incentives (also referred to as the 'principal-agent problem') affects 40-90% of commercial leased office space energy use. See "Quantifying the Effects of Market Failures in the End-Use of Energy" (2007); available at: http://www.aceee.org/Energy/IEAmarketbarriers.pdf.

[34] See, e.g., ETAAC Advanced Technology Draft Report for Public Review (Sept. 18, 2009); available at: http://www.arb.ca.gov/cc/etaac/meetings/102909pubmeet/mtgmaterials102909/public_review_draft_ETAAC_advance_tech_update_9-18-09.pdf

[35] For example, small businesses generally have fewer resources with which to monitor government policy so are less aware of subsidies, financing schemes, and other policies aimed at implementing clean energy technologies. Id (citing UK study).

[36] See id.

Estimates indicate that these sorts of market barriers cause consumers nationally to use at least 20-40% more electricity than they would in a well-functioning, cost-minimizing market.[37]

Using Allowance Value to Overcome Market Barriers. California's efficiency codes and standards for new buildings and appliances and utility energy efficiency programs have a long history of overcoming market barriers and achieving cost-effective energy efficiency. While the state's desire is to capture all cost-effective energy opportunities, utilities and agencies need to continue to expand their energy efficiency efforts to reach that goal.[38] Auction revenue could be used to supplement existing funding sources to expand efficiency efforts.

Existing Institutions. The California Public Utilities Commission, the California Energy Commission, and the governing boards of local publicly-owned utilities oversee implementation of energy efficiency programs by the states utilities and implementation of the state's efficiency codes and standards. These institutions could supplement existing funding sources to expand their energy efficiency efforts.

Investment in New Technologies

Allowance value could also be used to invest in research, development and deployment (RD&D) of clean energy technologies. Recent studies show a pervasive decline in private sector investment in energy RD&D, which underscores both the effect of market barriers and the need to combat them with public investment.[39]

Market Barriers. Private companies systematically under-invest in RD&D for new low- and zero-carbon technologies for a number of reasons. Among these include insufficient access to capital

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37 Cavanagh, R., "Energy Efficiency in Buildings and Equipment: Remedies for Pervasive Market Failures," National Commission on Energy Policy, Technical Appendix, Chapter 3: Improving Energy Efficiency; December 1, 2004, http://bipartisanpolicy.org/sites/default/files/TA_C3.pdf (pp.1-5).

[38] See, for example, the California Energy Commission's Draft "2009 Integrated Energy Policy Report" discussing some additional steps needed to reach the state's goal of capturing all cost-effective efficiency (pp. 3-5, available at http://www.energy.ca.gov/2009publications/CEC-100-2009-003/CEC-100-2009-003-CTD.PDF), and the CEC's December 2008 staff report "Achieving Cost-Effective Energy Efficiency for California: An AB 2021 Progress Report" noting that the publicly-owned utilities must continue to significantly expand their programs to achieve their energy saving targets (available at http://www.energy.ca.gov/2008publications/CEC-200-2008-007/CEC-200-2008-007.PDF).

[39] See, e.g., Gregory F. Nemet & Daniel M. Kammen, "U.S. Energy Research and Development: Declining Investment, Increasing Need, and the Feasibility of Expansion" (2007) (finding that private investment in energy R&D, which previously contributed about half of the nation's total investment in energy R&D during the 1980s and 1990s, now accounts for 24%; investments in energy R&D by U.S. companies fell by 50% between 1991 and 2003; and, overall, the U.S. invests about $1 billion less in energy R&D today than it did a decade ago).

to fund the often high upfront capital costs for these technologies, the expectation of high returns on capital investments, the fact that all of the benefits of RD&D investments might not be captured by investors, and the fact that RD&D is an inherently risky undertaking.[40] For example, the "Valley of Death," seen in Figure 3, represents a formidable challenge for private companies to develop and deploy low carbon technologies.[41]

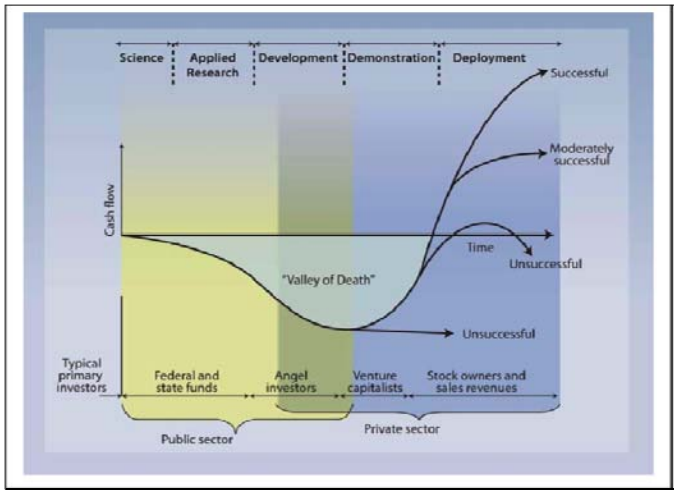

Figure 3: From Innovation to Market: the Valley of Death[42]

Using Allowance Value to Overcome Market Barriers. Similar to overcoming the barriers associated with implementing energy efficiency measures, allowance value could be channeled into programs and policies targeted at overcoming the market barriers impeding private investment in RD&D. In particular, allowance value could be deployed during the technology demonstration/pre-commercialization phase in a product's life cycle, which ETAAC has identified as the critical stage for public financing.[43] As Figure 3 above depicts, investors' often lose their appetite to invest in technologies as they advance from invention to commercialization because of the difficulty of managing market,

[40] [section in progress] ETAAC Draft Final Report: "Technologies and Policies to Consider for Reducing Greenhouse Gas Emissions in California," available at: http://www.arb.ca.gov/cc/etaac/meetings/021108pubmeet/meeting_handouts_and_materials/etaac_final_draft_2-11-08-sc.pdf.

[41] See, e.g., Marilyn Brown et al., "Carbon Lock-in: Barriers to Deploying Climate Mitigation Technologies," Oak Ridge National Laboratory, sponsored by U.S. Climate Technologies program (revised January 2008).

[42] Marilyn Brown et al., "Carbon Lock-in: Barriers to Deploying Climate Mitigation Technologies," Oak Ridge National Laboratory, sponsored by U.S. Climate Technologies program (revised January 2008).

[43]] ETAAC Draft Final Report: "Technologies and Policies to Consider for Reducing Greenhouse Gas Emissions in California," available at: http://www.arb.ca.gov/cc/etaac/meetings/021108pubmeet/meeting_handouts_and_materials/etaac_final_draft_2-11-08-sc.pdf.

regulatory, and other risks.[44] At this point, when return on investment cannot be readily projected, additional funding is necessary to see if the technology has commercial promise.[45]

Existing Institutions. There are several organizations doing excellent work in the area of clean-tech RD&D, including: the Public Interest Energy Research (PIER) program, three California University centers on energy, the California Institute for Climate Solutions (CICS), the Advanced Technology Program (ATP), the California Clean Energy Fund (CalCEF), the California Solar Initiative R&D, the Innovative Clean Air Technologies (ICAT) Grant Program, and the Global Climate and Energy Project (GCEP).

Investments in Job Training

Job training can be justified as an "investment" use proposed for the allowance value created by California's cap and trade program. This would ensure the state has an adequate supply of trained workers to staff the new jobs opening up in the green economy.

According to research carried out by Collaborative Economics for Next 10 and the California Economic Strategy Panel, the Green Economy consists of fifteen segments ranging from energy generation, storage, and infrastructure to energy efficiency to specialized manufacturing, advanced materials, green building, and finance and investment. More than 100,000 workers were employed in these sectors in 2007.

The number of green jobs is expected to grow rapidly in California, boosted by federal stimulus spending and the new opportunities created by AB32 related programs and regulations. It's important that the state's workforce be prepared to take on the new green jobs when the openings arise. Such timeliness will hasten reductions in the state's greenhouse gas emissions.

Other Investments

As Figures 1 and 2 above show, there are many cost-effective GHG reduction opportunities that are blocked by market barriers, and will not be captured by a price signal alone. Below is a discussion of the key considerations for some of these opportunities.

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[44] Marilyn Brown et al., "Carbon Lock-in: Barriers to Deploying Climate Mitigation Technologies," Oak Ridge National Laboratory, sponsored by U.S. Climate Technologies program (revised January 2008).

[45] [section in progress] Id.

1. Public Transit

Expanding both the extent of public transit systems and the frequency and reliability of public transit are beneficial for meeting California's climate goals. Public transit, like all aspects of our transportation system, does not rely entirely, or even significantly, on the private market. Transit is a public service, not a private industry.

The overwhelming majority of transit operating funding comes from local sales and parcel taxes (roughly 60%) and fare box revenues (roughly 20%). Federal grants make up some of the difference. The Legislature recently completely eliminated the State Transit Assistance program, which also contributed to operations.

Recent State budget cuts, and sharp declines in sales and property taxes have taken a severe toll on California's transit agencies.[46] Despite increasing ridership, transit agencies are forced to cut service and raise fares, both of which dissuade transit riders and limit transit's potential to address climate change.

a) Market Barriers

If left entirely to the market, there are only two potential sources of increased funding: a) higher fare box intake and b) indirect funding from higher property valuations and sales taxes in areas that have transit funding measures in place. Neither source is sufficient to increase transit availability, and may not even maintain current service levels. Indeed, if fare box revenues come from higher fares, as opposed to more riders, ridership decreases, as do environmental benefits.

b) How revenue can overcome market barriers

Transit systems devote significant portions of their operating budgets to fuel and utility costs. If these costs were to rise after the establishment of a cap and trade system, transit agencies could be made eligible for appropriate compensation. Transit systems themselves could also be funded to become more energy efficient, through, for example, updated rolling stock, fuel-efficient buses, or energy- and water-efficient facilities.

In any event, current service levels are likely inadequate to offer true alternatives to car travel. Transit systems could be expanded, both with regards to frequency within existing systems and by increasing the geographic reach of existing systems.

c) Existing Institutions

There are currently more than 40 individual transit agencies that offer bus, rail, and paratransit services to Californians throughout the state.

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[46] Transportation for America, et al, "Stranded at the Station, The Impact of the Financial Crisis in Public Transportation, August 2009, http://t4america.org/resources/stranded/. California Transit Association, STA Program Aftermath, http://tiny.cc/xBwzW.

2. Land Use Planning: Regional and Local Implementation of SB 375[47]

Investing in land use planning and implementation of CARB-approved SB 375 Sustainable Communities Strategies (SCS) could allow local governments to structure communities more efficiently, for example by better integrating residential and commercial zoning to reduce the amount of driving necessary to access daily needs. By considering the region as a whole, MPOs can help to reduce the need for driving by planning for more housing near transit and near jobs.

a) Market Barriers

Market distortions can lead instead to planning that separates uses, and encourages low density, auto-oriented design, forcing people to waste precious time and gas money getting from one place to another. Insufficient planning funding means that 55 percent of California General Plans have at least one mandatory element that is more than 10 years out of date. The plans that do exist are often unrealistic, including far more tax-revenue generating land uses (i.e. hotels, shopping centers) than the market will support, and frequently do not include enough land to satisfy medium and long term housing demand[48]. In addition, these plans frequently separate uses, forcing residents to travel too far to access daily needs. This means that while in many cases the market would support higher density, mixed use projects, developers are unable to build to the market demand because of antiquated, unrealistic zoning. The broader market failure is that insufficient funding exists to create good local and regional plans that reduce GHG emissions because the market doesn't properly value carbon.

b) How Can Funding Overcome Market Barriers

By creating sufficient funding both for regions to create SCS plans and local governments to update their general plans and zoning to implement the SCS plans, this program can ensure that developers can both build communities that meet the rising market demand for mixed-use, walkable, transit served communities, and create communities that reduce per capita transportation related greenhouse gas emissions.

c) Existing Institutions

Metropolitan Planning Organizations are responsible for creating the SB 375 Sustainable Communities Strategies that will be approved by CARB. Local governments will then implement the plans through approving the projects called for in the SCS.

Investment in Job Training

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[47] The Scoping Plan estimates California will save 5 MMTCO2 by 2020 from local land use changes (measure T3-Regional Transportation-Related Greenhouse Gas Targets), with savings of $311per MTCO2. Note: estimate is not the SB375 regional target; that data not yet available (see n. 39).

[48] Governor's Office of Planning and Research, Planners Book of Lists, 2009

Job training can also be justified as an investment use proposed for the allowance value created by California's cap and trade program. This would ensure the state has an adequate supply of trained workers to staff the new jobs opening up in the green economy.

According to research carried out by Collaborative Economics for Next 10 and the California Economic Strategy Panel, the Green Economy consists of fifteen segments ranging from energy generation, storage, and infrastructure to energy efficiency to specialized manufacturing, advanced materials, green building, and finance and investment. More than 100,000 workers were employed in these sectors in 2007.

The number of green jobs is expected to grow rapidly in California, boosted by federal stimulus spending and the new opportunities created by AB32 related programs and regulations. It's important that the state's workforce be prepared to take on the new green jobs when the openings arise. Such timeliness could hasten reductions in the state's greenhouse gas emissions.

Market Barriers. The state's workforce development community is today working feverishly to identify the skills that will be required in a green economy and to develop new training programs to meet those needs. Thus, a failure in this segment of the labor market seems unlikely *unless* the state's budget problems prevent the new training programs from receiving adequate funding. In that case, auction revenues might be needed as a substitute for the ARRA (American Recovery and Reinvestment Act) grants currently being used.

Using Allowance Value to Overcome Market Barriers. Demand for workers with green skills will surely grow in coming years. Venture capital firms are investing sizeable amounts in clean tech and similar business proposals. More business opportunities could arise out of the research and development activities financed by the investment of auction allowance revenues. Thus, the returns to additional investment in green job training financed through auction allowance revenues likely would be positive.

Existing Institutions. Several programs are currently under way or starting up to train California workers for future job opportunities in the green/clean industries.

- **California Employment Training Panel (CA ETP)**. Housed in the California Labor and Workforce Development Agency, CA ETP training programs are designed by private-sector employers (and sometimes labor unions) and carried out by pre-approved training organizations selected by the applicant. Once approved and funded, employers match the ETP grants they receive, usually by paying their workers' wages during the period of training. Normally, ETP funds its programs out of revenues from the state's Employment Training Tax, currently 0.7% of the first $7,000 of earnings. However, ETT revenues are running well below expectations and need, and the ETP is seeking other funding sources.

  Jointly with the California Energy Commission, the ETP is starting up a new Clean Energy Workforce Training Program using $5 million in funds from the federal ARRA (American Recovery and Reinvestment Act). The funds will be distributed in two-year performance based contracts,

typical of existing ETP contracts. Training is to targeted at "job skills in energy efficiency, water efficiency, and renewable energy."

- **California Workforce Investment System (CA WIBs)**. Also housed in the California Labor and Workforce Development Agency, the Workforce Investment System is federally funded. Local Workforce Investment Boards (WIBs) administer the workforce development programs in their respective Local Workforce Investment Areas (LWIAs).

  Most services are provided at One-Stop Career Centers. Services to businesses seeking workers include: accepting job orders and providing referrals, referring employee training organizations, and accessing labor market information and data.

  For new and incumbent workers seeking jobs, the One-Stop Centers provide several different services depending on need. Most jobseekers receive an initial assessment, job search and placement assistance, and career counseling. Some receive additional training as needed to "reach self-sufficiency." Like the ETP, WIA subsidized training programs are carried out by "Eligible Training Providers," who have been approved by the local WIB to receive WIA funds for the training programs they offer.

- **California Clean Energy Workforce Training Program (CEWTP)**. This new program is being funded jointly through the federal ARRA and various state Workforce Investment Act monies. The first set of 34 contract awards—worth $27 million and expected to train 5,600 workers—was announced in early October. Workers will be trained for a variety of clean energy jobs ranging from solar panel installation and electric vehicle maintenance to researching fuel cell technologies.

Investment in Disadvantaged Communities

AB32 specifically directs CARB to consider the needs of disadvantaged communities.[49] These communities also frequently bear disproportionate air pollution impacts, and AB 32 specifically directs CARB to maximize co-benefits of GHG emission reduction and complement state efforts to improve air quality.[50] Allowance value could be used to reduce emissions of GHGs and co-pollutants while simultaneously achieving California's goals of assisting disadvantaged communities. Some opportunities to do this are encompassed in the categories above of low-income energy efficiency programs, public

[49] For instance, AB32 requires CARB, to the extent feasible, to "direct public and private investment toward the most disadvantaged communities in California," Cal. Health and Safety Code §38565; "ensure that activities undertaken to comply with the regulations do not disproportionately impact low-income communities," Cal. Health and Safety Code §38562(b)(2); and consider "direct, indirect, and cumulative impacts from these mechanisms, including localized impacts in communities that are already adversely impacted by air pollution;" Cal. Health and Safety Code § 38750(b)(1).

[50] AB 32 requires CARB to design GHG reduction measures in a manner that "maximizes additional environmental and economic co-benefits for California, and complements the state's efforts to improve air quality." Cal. Health and Safety Code §38501(h).

transit, and land use planning. More could be done by directing targeting a portion of allowance value specifically to these communities.

Investment in these communities would address environmental, efficiency, and fairness considerations. From an environmental standpoint, reducing emissions of co-pollutants generated along with GHGs by the use of fossil fuels is a longstanding objective of CARB. From an efficiency standpoint, policies should aim to secure greater GHG reductions where the co-benefits from reductions in co-pollutants are largest. From a fairness standpoint, policies should aim to achieve environmental improvements in communities that have been historically overburdened by air pollution.[51]

Market Barriers. Investment in disadvantaged communities is hindered by multiple market barriers. Chronically low levels of investment in these communities in turn help to perpetuate their disadvantages. These market barriers include:

- Poor transportation and communication infrastructure.
- Environmental contamination and brownfields.
- Weak fiscal bases of local governments.
- Inadequate workforce skills of residents.
- Fear of crime.
- Interactive "neighborhood effects" of these and other barriers.

Using Allowance Value to Overcome Market Barriers. Allowance value could be channeled into Community Benefit Funds (CBFs) that support reductions in emissions of GHGs and co-pollutants, investment in adaptations to climate change, and other environmental improvements in disadvantaged communities. The identification of eligible communities can build upon CARB's work to develop measures of cumulative environmental impacts and community vulnerability. An additional source of revenue for CBFs could be created by introducing a co-pollutant surcharge on GHG emissions in communities heavily burdened by air pollution, a step that would also strengthen incentives for emission reductions in these locations.[52]

AB 1405, a bill before the California legislature, proposes to dedicate 30% of revenues generated under AB 32 to CBFs for environmental investments in the state's most impacted and disadvantaged communities. Uses of these funds would include:

- Reducing emissions of GHGs and co-pollutants;
- Minimizing health impacts caused by global warming;
- Energy efficiency upgrades for schools, senior centers, and low-income housing;
- Improvements to public mass transit, including fare subsidies to commuters.

Financing Agencies To Ensure That They Can Fully Implement AB 32

[51] See Appendix to this Report on "Investment in Disadvantaged Communities."

[52] See Appendix to this Report on "Investment in Disadvantaged Communities."

Another way in which allowance value could be used to quickly capture low-cost reduction opportunities is to ensure that state, regional, and local agencies have the staff resources they need to effectively implement all of the reduction strategies described in the Scoping Plan. The Scoping Plan recognizes that there are many cost-effective opportunities to reduce GHG emissions, and lays out various regulatory strategies for capturing them. However, some of the agencies tasked with implementing these strategies might be understaffed, and auction revenue could ensure that they have the resources they need.

3. California Air Resources Board

For example, ARB could use additional laboratory/technical support to implement its heavy-duty diesel equipment rules. Cleaner diesels trucks, locomotives, and construction equipment produce substantially less CO2 than gasoline and clean diesel cars are an increasing share of the market and a plausible bridge to hybrid and fuel cell vehicles. CARB certifies new engines but knows very little about in-use emissions performance. The lab could also support an increasing CARB focus on black carbon, which is a large fraction of the soot in diesel exhaust and a short-lived but very potent GHG.

The agency might also benefit from having a Chief Economist (parallel to its Chief Counsel), to reflect the significance of economic criteria in meeting its AB 32 responsibilities.

4. California Public Utilities Commission

A substantial portion of the carbon reductions that are included in the AB 32 Scoping Plan is within the CPUC's jurisdiction. These include energy efficiency, renewables (including the solar initiative), and combined heat and power policy. Together this represents about 40% of the reductions in the Scoping Plan. Cap-and-trade, which will be dominated in the early years at least by the electric and gas sectors, accounts for an additional 20%. This leaves the CPUC with significant oversight and implementation responsibilities for more than half of the anticipated reductions in California's greenhouse gas emissions.

Yet the CPUC has been unable to increase AB 32 staff support positions over the last three state budget cycles. This leaves the California PUC today with fewer staff dedicated to clean energy initiatives (35) than the New York Public Service Commission (40), even though California's initiatives are more than double the size of New York's as measured in dollars and megawatt-hours (and the CPUC total staff of about 1000 is two and a half times New York's 400).

5. Local and Regional Agencies

a) Building Codes

California has a strong statewide building code that sets minimum efficiency levels for new construction. However, the code is enforced by local agencies that often do not have sufficient capacity. Ensuring that these agencies are fully staffed and that the state is simply meeting the codes that are already in place could result in significant cost-effective savings.

b) Implementing SB 375

According to a League of California Cities survey of likely SB 375 implementation costs, regions will need $20 to $60 million over the first 2-3 years of implementation to improve models, run alternative development scenarios, fund public participation and other activities. The California Council of Governments estimates the costs to regions at $10 million annually after this start up period. The League of California Cities' survey estimated the cost of bringing all California general plans up to date and consistent with the SCS at $500 million, with an additional $50 million required annually for ongoing updates.

5.3.3 Comparing the Investment Options

Investment options should be compared and prioritized based on how well they meet the objectives of AB 32. EAAC has identified four criteria for evaluating the use of allowance value that are rooted in the language of AB 32 as follows:

- **Cost-effectiveness:**
  - "shall . . . achieve the maximum technologically feasible and cost-effective greenhouse gas emission reductions" (§38562(a))
  - "encourage early action to reduce greenhouse gas emissions" (§38562(b)(1))
- **Fairness:**
  - "equitable" (§38562(b)(1))
  - "do not disproportionately impact low-income communities" (§38562(b)(2))
  - "direct public and private investment toward the most disadvantaged communities in California and provide an opportunity for small businesses, schools, affordable housing associations, and other community institutions to participate in and benefit from statewide efforts to reduce greenhouse gas emissions." (§38565)
- **Environmental effectiveness:**
  - "complement the state's efforts to improve air quality" (§38501(h)) and "reduce toxic air contaminant emissions" (§38562(b)(4); see also §38570 (b)(2))
  - "minimize costs and maximize the total benefits to California" (§38562(b)(1); see also §38501(h))
  - "maximize additional environmental and economic co-benefits for California" (§38501(h) and 38570 (b)(3))
- **Simplicity:**
  -

Figure 4 below uses the EAAC criteria and the language of AB 32 to rate and compare the above investment options. The table makes clear that many of these investment options meet all four criteria.

Figure 4: Evaluating Investment Options

Evaluating Investment Options	Cost-Effectiveness		Fairness		Environmental Effectiveness		Simplicity	
	Non-price Market barriers?	Spurs early action?	Equitable?	Lessens impact on low-income?	Improves local air quality?	Other envt'l and economic co-benefits?	Agency has existing program?	Able to use more funds?
Public Transit	**high**	**high**	**high**	**high**	**high**	**high**	City and county	**high**
Implementation of Regional Plans	**high**	**high**	**high**	**high**	**high**	**high**	City and county	**high**
Disadvantaged Communities	**high**	**high**	**high**	**high**	**high**	**high**	Local jurisdictions	**high**
Low-Income EE	**high**	**high**	**high**	**high**	med	med	CPUC / CEC / POUs	med
Industrial EE	med	med	low	low	**high**	med	*CARB (voluntary) / CPUC*	med
Green Jobs Training	low	med	**high**	**high**	low	**high**	Comm'ty Colleges	**high**
RD&D	**high**	low	low	low	low	**high**	PIER / University Centers	low

5.4 Tax Reduction

One of the potential uses of the proceeds from an allowance auction is to finance cuts in existing California taxes or to reduce the state's future taxes by reducing its budget deficit. Reducing the budget deficit implies lower future taxes because it leads to lower debt and lower interest payments that must be financed through future taxes. If the state uses its auction revenue to cut taxes, it effectively substitutes auction revenue for other taxes as a way of meeting the state's spending needs.

Two types of argument can be invoked to support the use of auction revenue to finance cuts in current or future taxes. One is fairness. The state's current budget deficit imposes a tax burden on future generations. It may seem equitable to reduce that burden.

The other main argument for using auction revenue this way is efficiency. Income and sales taxes lead to reduced overall output by reducing work incentives as well as incentives to save and invest. In economics lingo, these are "distortionary" taxes – taxes that cause the overall economy to shrink (even after recycling the tax revenue or devoting the revenue toward public spending). The "marginal excess burden" from these taxes has been estimated to fall in the range of $.20 to $1.00 – which means that, for every extra dollar collected from these taxes, the loss of value created by the private sector (before returning the tax revenue) is between $1.20 and $2.00.[53] Using auction revenue to finance cuts in the marginal rates of these existing taxes enables the state to avoid this excess burden. In effect, by using auction revenue to finance tax cuts, California relies on a non-distortionary source of revenue – the proceeds from allowance auction – as a substitute for distortionary taxes such as income and sales taxes.

The impact on the costs of a California cap-and-trade system could be substantial. To our knowledge, no study has directly calculated the cost-savings from devoting allowance value to tax-reduction as opposed to other purposes. However, a study by Goulder, Hafstead, and Dworsky (2009) of of a potential cap-and-trade system at the national level offer some clues as to the potential cost-savings. This study compares the costs of a federal cap-and-trade policy under two scenarios. In one, the auction revenues are devoted to cuts in marginal income tax rates. In the other, the revenues are returned lump-sum to households – there are no cuts in tax *rates*. The economy-wide costs are more than 50 percent lower in the former case than in the latter.

[53] See, for example, Stuart (1984), Browning (1987), and Jorgenson and Yun (1991). (References cited: Browning, Edgar, K., 1987. "On the Marginal Welfare Cost of Taxation." American Economic Review 77: 11-23. Jorgenson, Dale and Kun-Young Yun, 1991. "The Excess Burden of the US Tax System." Journal of Accounting, Auditing, and Finance 6: 487-509. Stuart, Charles, 1984. "Welfare Costs per Dollar of Additional Tax Revenue in the United States." American Economic Review 74: 352-62.)