Allocating Emissions Allowances Under California's Cap-and-Trade Program

Recommendations to the California Air Resources Board

From the Economic and Allocation Advisory Committee

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1 Introduction

1.1 Climate Change, AB 32 and Cap and Trade

California's diverse population, geography, and economy will experience a range of impacts of climate change. These impacts include more, longer, and hotter heat waves, less water storage in snow pack and more-frequent droughts, greater damage from fires, and increases in sea level and coastal erosion.

Spurred by the threats to the economy, public health, and environment, as well as opportunities that come from early efforts to address a global problem, California has made strong commitments to reduce the global warming pollution that is causing climate change. One milestone has been the enactment of the California Global Warming Solutions Act of 2006, also known as AB 32. The Act set a binding emissions target of 1990 levels by 2020. It also authorized the Air Resources Board (ARB) to determine what policies would be enacted to achieve that target, and to publish a Scoping Plan detailing those policies. ARB approved the Scoping Plan in December 2008, identifying 73 measures.

Among the policies in the Scoping Plan is a cap-and-trade program, a program that engages market forces to achieve desired emissions reductions. There are three key components of cap and trade.

First, the regulatory authority specifies the total quantity of allowances to be distributed in given periods to participants in the program. Each allowance entitles the holder to emit a certain quantity of emissions of a given pollutant. In the case of a climate policy cap-and-trade program, an allowance entitles the holder to a given quantity (usually one metric ton) of greenhouse gases in carbon dioxide equivalents[1] (CO_2e). The number of issued allowances can decline over time; in this case overall emissions decline through time as well. When implemented, California's cap-and-trade program would cover about 85% of the state's emissions.

Second, the regulatory authority needs to distribute (put into circulation) the emissions allowances. The allowances can be given out through free allocation, by selling them, or through some combination of the two.

[1] Some greenhouse gases (GHGs) have a greater climate effect than carbon dioxide (CO_2); for example, methane is about 25 times as potent (Intergovernmental Panel on Climate Change Fourth Assessment Report, 2007, Working Group I Report, p. 212). To treat emissions uniformly, GHGs are referenced to their carbon dioxide equivalent, CO_2e.

The third key component is the provision for trading of allowances. The ability to purchase or sell allowances lies behind cap and trade's potential to achieve emissions reductions at low cost to the overall economy. Emitters will generally consider their costs of reducing emissions to the level required by their current holdings[2] of allowances, and compare this with the market price of allowances. For emitters with especially high costs of emissions reductions, the market price will be less than this abatement cost. In this case, the emitter will benefit by purchasing additional allowances instead of taking on additional abatement cost. For emitters with especially low abatement costs, the market price will be greater than this cost. In this case, the emitter benefits by selling some of its allowances; although this obliges the emitter to reduce emissions even further, the proceeds from the sale will more than offset the additional abatement costs. The trading of allowances thus results in more of the emissions-reduction being undertaken by facilities that can do it most cheaply. Buyers and sellers both benefit, yet the trading leads to no change in overall emissions: the number of allowances in circulation does not change.

1.2 Connections with Other U.S. Cap-and-Trade Programs

The Scoping Plan calls for linkages between California's cap-and-trade program and the cap-and-trade programs of other jurisdictions participating in the Western Climate Initiative (WCI). The WCI is a collaboration of seven US states (including California) and four Canadian provinces to reduce greenhouse gas emissions.[3] The Partner jurisdictions' design for a cap-and-trade program allows the jurisdictions that implement it to link, forming a regional program. Linkage involves reciprocal agreements to accept allowances issued by another jurisdiction for compliance in one's own. Linkage can reduce the overall cost of meeting an emissions target by increasing the breadth of reduction opportunities available.

The introduction of a federal cap-and-trade program would have important implications for a California or Western-regional program. For example, the American Clean Energy and Security Act (HR 2454, passed by the House of Representatives in June, 2009) would introduce a national cap-and-trade program and preempt any state or regional cap-and-trade program for six years.[4] Even if a federal proposal did not involve direct preemption, the emergence of a national cap nonetheless would affect the price of allowances in state programs. It might also affect the environmental integrity of state programs because a national cap could mean that any emissions reduction in one state would enable an emissions increase in another state without changing overall national emissions, as long as total national emissions remain under the national cap. It is impossible to predict the specific nature of future regional programs, or whether and how a national program will emerge. This makes it important for California to design its own cap-and-trade program in a way that will promote the state's environmental goals under a range of future scenarios.

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[2] The current holdings will be the number received free or purchased through an auction, plus any allowances previously purchased from other emitters.

[3] The WCI's U.S. member states are Arizona, California, Montana, New Mexico, Oregon, Utah and Washington. The participating Canadian provinces are British Columbia, Manitoba, Ontario, and Quebec.

[4] Ten northeastern states initiated a cap-and-trade program known as the Regional Greenhouse Gas Initiative in 2009, aimed at reducing emissions from the electricity sector.

1.3 Significance of Allowance Allocation

The more allowances that a given facility owns, the less it must reduce emissions to be in compliance with the program. Firms generally are be willing to pay a significant amount to lessen the extent to which they must reduce emissions, particularly if the cap-and-trade program calls for significant overall reductions. Thus the market price of allowances can be significant, as well as the total allowance value (the market price times the quantity of allowances in circulation). As discussed later in this report, the total allowance value under California's cap-and-trade program is likely to be several billions of dollars in each year of the program.

ARB must make critical decisions affecting the allocation of this value. As mentioned, it can initially distribute this value through free allocation, through the auctioning of allowances and distribution of the proceeds, or both. The provision of free allowances need not apply solely to the emitters covered under a cap-and-trade program. Other parties (for example, groups of consumers) could receive free allowances and then sell them to the emitters that must submit allowances. Thus, emitters are not the only parties that could benefit from the receipt of free allowances.

If allowance value is monetized through a sale, the allocation of allowance value will depend on the distribution of proceeds from the sale. Auction revenue could be used for a variety of purposes: providing revenue to offset or prevent potential adverse impacts of AB32 to certain parties, directing the value to citizens as "dividends",or via reductions in California income taxes, and financing various investments or other public expenditures.

Thus, ARB's allocation of allowance value will reflect the relative reliance on free allocation and auctioning and the distribution of free allowances and auction proceeds to various parties.

1.4 Establishment and Role of the Economic and Allocation Advisory Committee

The Economic and Allocation Advisory Committee (EAAC) was established May 22, 2009 by ARB and the California Environmental Protection Agency. As the Committee's name suggests, the EAAC has two main roles:– providing input on the evaluation of economic impacts of AB 32, and offering recommendations regarding the allocation of allowance value. These two roles are in keeping with the ARB's resolution in its Scoping Plan, which committed the ARB to solicit "input from experts to advise ARB on its continuing evaluation of the economic effects of implementing AB 32, including identification of additional models or other ongoing analysis tools that could be used in the ongoing economic analysis," as well as to solicit "expert input on key questions related to the distribution or auction of allowances and the use of revenue."

1.5 This Report

This report documents the EAAC's work relating to its allocation role. It articulates the Committee's findings as to the nature of the various options for distributing allowance value. It also presents the potential attractions and limitations of each option, and offers the Committee's recommendations as to which set of options seems best for California.

In evaluating alternative allocation options and arriving at its recommendations, the Committee employed four criteria: fairness, cost-effectiveness, environmental effectiveness, and simplicity. These four criteria encapsulate requirements throughout AB 32 to, for example, "minimize costs and maximize the total benefits to California," "consider…localized impacts in communities already adversely impacted by air pollution," and "minimize the administrative burden of implementing and complying with these regulations."

2 Mechanisms for Allowance Distribution

2.1 The Main Alternatives: Free Allocation and Auctioning of Allowances

In designing a cap-and-trade system, policy makers need to make important decisions about how to distribute emissions allowances. One of the most fundamental is whether the state should give allowances away for free or sell them via an auction. The two alternatives are not mutually exclusive. As mentioned in the introduction, 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 distributed to various industrial or commercial entities, to households, or to the public Treasury.[5]

This section 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 Distribution Mechanisms and the Ultimate Receipt of Allowance Value

Free allocation is often viewed as a mechanism for distributing allowance value to *compliance entities*—the parties required to submit allowances. However, free allocation also can be employed to provide allowance value to other parties; these parties can subsequently convert this allowance value into cash by selling the allowances to the compliance entities. For example, in a cap-and-trade system in which the compliance 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 that subsequently can be sold.

In principle, nearly all entities that could obtain allowance value by receiving free allowances could also obtain such value as proceeds from an auction. Under each of these

[5] As discussed below, it is also possible to employ auctioning subsequent to an initial free allocation: the state could freely allocate allowances and allow recipients to sell the allowances into the market through an auction.

distribution mechanisms, allowance value can be conferred to serve a number of purposes. We examine these alternative potential uses of allowance value in chapters 4 and 5.

Although both free allocation and auctioning are alternative mechanisms for distributing allowance value to almost any potential recipient, the two mechanisms can have different consequences. Awarding allowance value to certain parties might be simpler, or face fewer institutional challenges, under one mechanism than under the other. Also, the choice between the two approaches can have implications for the overall economic cost of the cap-and-trade program, and in some circumstances can influence the extent to which the program achieves its environmental goals. In the subsections below we examine these issues.

2.1.2 Some General Considerations

As mentioned, the options for allowance distribution are not simply 100 percent auctioning or 100 percent free allocation. Mixed approaches are also possible, with some portion of allowances being given for free and some auctioned, and that ratio may shift over time.

The relative attractiveness of free allocation or auctioning can depend on whether a regional or national cap-and-trade program is put into place. As discussed below, the prospect of "emissions leakage" can be invoked to justify a certain form of free allocation. Yet the extent of emissions leakage depends directly on the presence or absence of a regional or national cap-and-trade program. Given the uncertainties, it is important for the ARB to develop distribution strategies that are flexible, so that the reliance on one or another form of allowance distribution can easily be changed as the regional or national policy environment changes.

2.2 Rationales for Free Allocation and Auctioning

2.2.1 Rationales for Free Allocation

Direct Provision of Compensation

Many view free allocation as a particularly expedient way to provide compensation 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, compliance 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. For firms with exceptionally limited cash reserves or ability to borrow in order to finance the purchase of auctioned allowances, receiving allowances free will be much more attractive than receiving proceeds from an auction after having had to purchase allowances. However, in most cases, the economic evidence suggests a large majority of the cost of allowances will be passed on to consumers. In such cases firms will be able to recover the cost of allowance purchases even before the firms are actually required to obtain allowances for surrender at the end of a compliance period. Also, while free allocation might be relatively expedient when used to confer allowance value to compliance entities, it may be more cumbersome when used to provide allowance value to other entities. For example, when free allocation is used to grant allowance value to non-compliance entities such as local governments or community based organizations, or

to individuals directly, there is an added transaction cost imposed on these parties (relative to the case where the parties receive auction proceeds) since they would subsequently need to sell the allowances to convert them to cash. One solution to this problem would be for the state to organize a double auction, which enables sellers and buyers to offer to sell or buy allowances. The liquidation of allowance value through a double auction could be the default outcome if allowances were granted to non-compliance entities.

Automatic Adjustment of Value in Line with Compliance Costs

Free allocation has another potential attraction as a device for offering compensation. The value of allowances given for free would adjust automatically when allowance prices change. If the goal is to compensate impacted parties for their increased costs arising from climate policy, this automatic adjustment might be an advantage because compliance costs tend to be closely related to allowance prices; hence when compliance costs rise, so wil the amount of compensation. On the other hand, such adjustments in value might be a disadvantage if the goal is to fund purposes not directly linked to the cost of compliance, such as investments in research and development.

Addressing Emissions Leakage

Introducing an environmental regulation in one jurisdiction can cause production costs and prices in that jurisdiction to increase relative to other jurisdictions that do not introduce comparable regulations. This can precipitate a shift in demand away from goods produced in the first jurisdiction and toward goods produced elsewhere. As a result, the reduction in production and emissions in the first jurisdiction is offset by increased production and emissions elsewhere. The offsetting increase in emissions is called *emissions leakage*.

A particular form of free allocation – output-based, updated free allocation -- has the potential to mitigate such leakage by helping keep prices low for firms within the first jurisdiction and thereby helping those firms maintain a share of the larger market. Output-based, updated allocation offers firms free allowances as a function of their levels of production in the current or in a recent time period. As discussed in <2.2.2> below, it is in effect a subsidy to production. As a result, it can help in-state firms maintain their output levels and thereby retain market share.

Leakage may be especially of concern for firms with production processes involving intensive use of carbon-based fuels and with significant market competition from producers outside of the state. The carbon intensity of these firms suggests relatively large cost-increases as a result of the higher fuel prices brought about by cap and trade, while the trade-exposure suggests that as these firms aim to pass through these costs to consumers, they would lose considerable market share to non-California-based competitors. Hence considerable leakage would result. Industries with such firms were termed "energy-intensive trade-exposed" industries in the American Clean Energy and Security Act.

However, it may be possible to address leakage through another mechanism – border adjustments. An example of a border adjustment in the electricity sector is the identification of compliance entities as the "first deliverers" of electricity into California. This includes entities that import electricity from out of state that are responsible for surrendering allowances equivalent to the emissions used in producing the electricity. This approach can readily be extended to cover liquid fuels imported to California. A border adjustment can work well in protecting against leakage in the production of goods used or consumed in California. In subsection <2.3> we discuss

the relative merits and limitations of border adjustments and output-based updated free allocation as mechanisms for confronting leakage.

One claimed drawback of free allocation is that it reduces firms' incentives to reduce emissions. However, except in cases where firms can influence their receipt of allowances in the future by producing or emitting more in an earlier year (cases which we discuss below), the number of allowances a firm receives does not reduce incentives to abate emissions or to invest in new, low-emissions technologies. Firms minimize their costs by reducing emissions up to the level where the incremental cost of further emissions abatement just equals the allowance price. This level is largely unaffected by the number of allowances the firm receives for free.[6]

2.2.2 Rationales for Auctioning

Auctioning has been employed as a method of allowance value in several cap-and-trade systems. The Acid Rain Program, a sulfur dioxide emissions trading program established under the Clean Air Act Amendments of 1990 distributed the value of emissions allowances to emitters based on their historical heat input (fuel use) multiplied by an emissions rate—that is, it employed grandfathering. But the program also employs a small annual revenue-neutral auction with proceeds returned to emitters on a proportional basis. 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, 1993 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.[7] 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.

Transparency

One attraction of auctioning is that it may make the assignment of allowance value more transparent than the administrative approaches that have traditionally been used to allocate

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[6] Whenever a firm reduces by one ton its emissions, the firm either reduces the number of allowances it needs to purchase (assuming its allocation of free allowances was less than what it needed) or increases the number of allowances it can sell (assuming its allocation of free allowances was more than what it needed). In either case, the gross value (the value exclusive of abatement costs) to the firm of reducing its emissions by one unit is the same: it is the market price of an allowance.

At the same time, the number of allowances a firm receives for free does affect its 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.

[7] See Ellerman et al. 2000 and Holt et al. 2008.

emission allowances or other types of valuable licenses. Administrative approaches can involve complicated formulas that mask the true recipients of the value and the magnitude of the value being distributed. The assignment of value raised through an auction could be made just as complicated, but it is likely to be more accessible to observers because it would involve a direct transfer of dollar value. Under an auction, the government still needs to decide to which parties the proceeds will be allocated, but that is a more familiar public process.

Opportunities for Reduced Tax System Costs

Another important attraction of auctioning is that it opens up opportunities to reduce the costs of the tax system – opportunities not available under free allocation. 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. 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 substantially, compared to an approach that distributes allowances for free.[8]

Easier Treatment of New Entrants

A system in which all compliance entities must obtain allowances through 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.

Price Discovery

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 the market price for allowances) and ensure that at least some allowances will be available to program participants who need to buy them.

Two additional arguments in favor of auctioning are often made. These arguments deserve careful qualification. One argument is that auctioning is preferable to free allocation because auctioning will reward 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. In contrast, free allocation may fail to reward the more innovative firms; in fact, it could offer more allowances to firms that have relatively high emissions intensities compared with the competition. This is in fact an argument against a particular form of free allocation: namely, freely allocating allowances simply according to historical emissions levels. Allowances need not be freely allocated on this basis. As discussed below, many existing cap-and-trade programs with free allocation are designed so as to avoid rewarding firms that have failed to make earlier investments in cleaner production methods.

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[8] See, for example, Parry, Ian W.H. and Wallace E. Oates, 2000. "Policy Analysis in the Presence of Distorting Taxes." *Journal of Policy Analysis and Management* 19(4):603-14, and Sanstad, Alan H and Wolff, Gary H., *Tax Shifting and the Likelihood of Double Dividends: Theoretical and Computational Issues*, (January 2000).

A second argument is that auctioning provides a better signal of firms' costs of abatement than does free allocation. When allowances are introduced through a competitive auction, the market price of allowances indicates the costs that firms bear, at the margin, to reduce emissions. Under certain forms of free allocation involving updating of allocation over time, this may not be the case.

2.3 Alternative Methods of Free Allocation

In fact many types of free allocation are possible. Each of the variants has attractions and drawbacks relative to others. We examine these specific forms of free allocations in this subsection.

Two general categories of free allocation are *fixed* allocation approaches, on the one hand, and *contingent or updated* allocation approaches, on the other. Under fixed allocation, the allowances given are not adjusted in response to current or future behavior. Under contingent or updated allocation, the allowances offered adjust over time in response to behavior and market conditions.

2.3.1 Fixed Allocation

Fixed allocation establishes the distribution of allowances in ways that are independent of the actions of consumers or firms with compliance responsibilities within the cap and trade program. The *grandfathering* approach is a specific case of fixed 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 fixed, the baseline period must precede the date when the cap-and-trade program and the allocation were anticipated by those eligible to receive allowances.

A main attraction of fixed allocation is that it is not expected to cause unproductive changes in the abatement decisions of firms. If firms' allotments of free allowances are fixed, they will have no reason to alter their behavior as an attempt to influence this allotment. A system in which firms believe their behavior can influence future allocations is likely to lead to additional costs for the program overall and various unintended consequences.[9] As a result, a fixed allocation scheme has traditionally been viewed as the most economically efficient form of free allocation, at least with regard to the costs of complying with the emissions cap.

Fixed allocation draws criticism, however, because it is perceived to be unfair. Under a strictly fixed allocation scheme, the number of allowances a firm receives does not depend on whether it continues its operations. This is the case under the U.S. sulfur dioxide emissions trading program, where 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. Furthermore, even if firms have received allowances for free, their use has an opportunity cost because they could be sold into the market. Consequently firms are expected to include the value of emissions allowances as a cost of

[9] For example, the European Union's Emissions Trading Scheme included adjustments to allocations to accommodate new sources or sources that retired. These features gave incentives that changed the investment ordering, and in some cases caused coal-fired generation to be favored over natural gas. Åhman et al. (2007), Åhman and Holmgren (2006).

doing business, and to include their cost in the price of their product. If the allowances were originally obtained for free, this can lead to windfall profits. In Europe, grandfathering has led to profits of several billion euros.[10]

Finally, fixed allocation is sometimes criticized as being unnecessarily rigid. Fixed allocation can tie the hands of regulators, who would be unable to respond to unexpected outcomes in the market by revising an allocation approach.[11] 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.

2.3.2 Updated Allocation

Updated allocation refers to any system that gives regulators the ability to revise the allocations in response to economic or allowance market conditions. For example, the entry and exit of facilities is sometimes treated as the basis for updating the allocation. 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. Although this practice seems intuitive, it creates inefficiencies because as firms take the effect on allocation into account it distorts their decisions about methods and levels of production away from the cost minimizing outcome.[12] Nonetheless, updating has two attributes that explain its appeal. One is that an updating free allocation may lead to a smaller change in the product prices than would an efficient policy. A second is that updating allocation can help reduce leakage of emissions from the program.

Output-based Updating

A typical approach to updating will base allocations in a future period upon the level of production of a plant in the current period. This approach is usually called *output-based updating.*[13] In the electricity context, for example, this means each firm receives an allocation proportional to the electricity it generates, measured in megawatt-hours (MWh), while holding the overall emissions cap intact.[14] A main insight from recent research[15] is that output-based updating is in effect a production subsidy: firms are rewarded, in the form of valuable allowances, for each additional unit of output. This subsidy induces firms to increase output relative to the level that they would choose under fixed allocation or allocation via an auction. The subsidy also reduces the variable cost of production and thereby helps keep product prices of these firms from rising as

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[10] References

[11] 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 a fixed "grandfathering" approach (North Carolina v. EPA, 531 F.3d 896 (D.C. Cir. 2008)).

[12] Ahman 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.

[13] An alternative approach would base future allocation on the current emissions of a facility, 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 CO_2 from the emissions of a facility, the energy input and fuel type will determine its emissions. The obvious criticism of emissions based allocation is that it rewards firms for producing the very thing that the regulation is trying to reduce.

[14] When dealing with industries other than electricity, some proposals call for "value added" as a financial measurement alternative to physical units of output.

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

much as they would under other forms of allocation; however, insofar as the dampening of the price signal results in fewer reductions in emissions associated with these products, the result is greater reductions and higher price increases in other sectors in order to meet the overall emissions cap.

One possible justification for output-based updating is to improve environmental performance when there is the possibility of emissions leakage. As mentioned above, introducing environmental regulation in one jurisdiction can cause emissions increases in other jurisdictions that offset the decreases in the original jurisdiction. This will be most important for industries where two conditions hold: they use relatively more energy in production ("energy intensive") and they are exposed to unregulated competition in their export or import markets ("trade exposed").[16] To remedy this, the leading federal proposals dedicate a share of allowances to be returned to so-called "energy-intensive, trade-exposed" industries based on output-based updating calculations. The policy works like a rebate of the allowance costs embodied in the direct energy use or electricity purchases by these firms.[17] The policy mitigates leakage because the allocation is received in proportion to the level of production; if production levels change, so does the value received. The rebate is intended to level the field with imports that are not subject to the regulation. However, because a rebate leads to lower product prices, investors and consumers will have less incentive to find substitutes for these products, and it will lead to greater emissions by the subsidized industries. Hence, although the policy mitigates leakage of emissions to other jurisdictions, to maintain the cap the policy creates the need for more emissions reductions from other covered sectors, which raises the cost of the program.

An alternative to output-based updating allocation to the energy intensive, trade exposed industries is to implement corrections at the border so that imported goods face the same change in costs associated with their embodied CO_2 emissions as goods produced in California.[18] By analogy, this is the approach used in the first-deliverer method of accounting for out-of-state

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[16] Under H.R. 2454, a formal regulation to be issued by the Administrator of the U.S. Environmental Protection Agency, with the precise list of eligible industries derived from data at the 6 digit level of the North American Industry Classification System (NAICS) every four years. The definitions of a trade intensity = (value of imports + value of exports) / (industry total value of shipments + value of imports). Energy intensity = (fuel and electricity costs) / (industry total value of shipments). Value of shipments corresponds to industry output. To qualify, firms must meet two tests: trade intensity of 15 percent and energy intensity of 5 percent. A second, alternative standard in H.R. 2454 that can be used in place of energy intensity is greenhouse gas intensity. An industry qualifies if it has (an energy intensity or a GHG intensity of at least percent) and a trade intensity of at least 15 percent. GHG intensity = (20*(number of tons of CO2 equivalent GHG emissions)) / (industry total value of shipments). Here the emissions include direct combustion emissions, process emissions, and indirect emissions from electricity. Industries can qualify for rebates under H.R.2454 even if they do not meet the trade intensity part if an industry, but has energy intensity larger than 20 percent. The justification in the absence of trade intensity is unclear.

Data used for the energy and trade calculations are the Census Annual Survey of Manufactures and the U.S. International Trade Commission international trade data. At this juncture, there does not appear to be a designated approach for dealing with imports in determining trade intensity values. The question is whether to use customs value of imports or the more inclusive price that incorporates both transportation and insurance costs. The more inclusive price will result in more industries qualifying for rebates than the former and may be better represent the price firms are faced with.

[17] In principle this could be achieved either with free allowances, or with cash rebates.

[18] At the international level, a border correction is more likely to be found to violate World Trade Organization than output-based updating allocation, according to most observers. However, the test for California with respect to goods produced in other states would be the Commerce Clause of the Constitution.

emissions associated with electricity generation. It can also be applied in a straight-forward manner for liquid fuels by accounting for imported refined products at the terminal rack, and imported natural gas either at the facility level (for large point sources taking their deliveries directly from interstate pipelines) or by regulating natural gas local distribution companies. An advantage of this approach is that it would maintain the price signal reflecting the scarcity value of CO_2 emissions under the cap and trade program, at least with respect to imported goods. One should note that identifying the emissions associated with production of some goods could be difficult, especially where there is a supply chain that involves many inputs from various sources.

For product originating in California for export out of state, relief from the compliance burden associated with the cap-and-trade program is the primary way to avoid leakage. In this case, output-based updating free allocation and a border adjustment are effectively the same approach.

Benchmarking

Often an updating allocation formula will address differences among industries, technologies or fuels. For example, the California Public Utilities Commission's recommendation on the distribution of emissions allowances suggested an output-based, updating approach that would distribute emissions allowances at a different rate for coal-fired and gas-fired generation (e.g., coal plants would receive more allowances per MWh than gas plants) and would exclude non-emitting sources from an allocation.[19] This approach is called *benchmarking* because it is usually tied to best practice emissions rates for the given entity. Under this approach, the regulator establishes a baseline emissions rate for an industry (e.g., cement) or process (e.g., coal-fired electricity generation) and awards allowances to all facilities in that industry according to the "benchmark" GHG content of their output. [20] However, this makes compliance by switching from coal to gas less attractive, as it would result in a lower allocation.[21] Simulation research indicates that benchmarking may not be as effective at mitigating leakage in electricity generation in California as output-based updating.[22] This results because emission rates for electricity generation from outside the state are greater than for generation inside the state. By differentiating the allocation among sources according to fuel use, it reduces the allowance-based advantage to maintain generation inside the state. [23]

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[19] Final Opinion on Greenhouse Gas Regulatory Strategies, Rulemaking 06-04-009 (Decision 08-10-037, October 16, 2008). The recommendation would phase out the allocation to generators over four years. Both the American Clean Energy and Security Act (H.R. 2454) and the proposals of the Western-Climate Initiative (WCI) also feature fuel-differentiated benchmarking approaches to updating.

[20] Sometimes the benchmarking approach resembles an intensity (performance) standard whereby changes in aggregate emissions vary with the level of economic activity. The benchmark emissions rate can be 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.

[21] 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.

[22] Bushnell and Chen (2009).

[23] This result is mitigated somewhat by existing state legislation (SB 1368, 2006) that prohibits new long-term contracts for electricity supply from uncontrolled coal-fired power plants. Hence, the net effect of differentiating by fuel would be to account for existing power-purchase agreements with coal-fired power plants, rather than to provide an incentive for new investment.

Free Allocation to Local Distribution Companies

Heretofore this discussion has addressed free allocation to emitters, but another approach that has been considered is free allocation to local distribution companies (LDCs). These companies are regulated by the CPUC or are public utilities. Consequently, allowances (or allowance value) they receive can be directed to the benefit of their consumers. This is the approach identified by the CPUC for the electricity sector after a rapid phase out of output-based, updating allocation to emitters.

As a result of allocation to LDCs, these companies would be expected to sell or auction the allowances and use the revenue to offset a large part of the increase in electricity prices that would occur under cap and trade. Although this may be politically popular with electricity consumers, it has disadvantages also. Free allocation to entities in any one sector has a high opportunity cost, because it diverts allowance value away from other possible uses including the possibility of returning the value to households. It also is likely to undermine the program by distorting the relative prices of goods and services away from a uniform accounting for the cost of CO_2 emissions.

Various possible justifications have been suggested for free allocation. One is that households and businesses need time to turn over their energy-using equipment, and can do little to respond to changes in prices in the short run. However, if the purpose of free allocation is to provide capital for investment or to compensate for changes in prices in the short run, this can be effectively provided by returning allowance value to households.

Another possible justification is the existence of long-term contracts and/or ownership in out-of-state coal-fired electricity supply by LDCs. These entities and their customers have enjoyed relatively low electricity prices heretofore due to their electricity supply portfolio. Although these LDCs may experience larger changes in absolute prices relative to LDCs with lower emitting supply, generally they start out with prices that are less.

If an effort is made to soften the change in electricity prices through free allocation to LDCs, that allocation should be rapidly phased out. Phase out within ten years of passage of AB32 would ensure that the implicit subsidy to electricity consumption associated with the allocation was ended by the time transportation was brought into the program in 2016.

2.4 Alternative Auction Designs

Many types of auctions are 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, 2002).[24] Therefore, the selection of an auction design for a cap-and-trade system should be based on attribtues of an allowance market. Among the most important aspects of this context is recognition that the auction will distribute not just a single

[24] 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.

item (as in an art auction) but multiple items (allowances). In addition, the allowances are identical goods, e.g. each emissions allowance with a common vintage is of equal value.

2.4.1 Criteria for Choosing among Auction Designs

The choice among auction designs can be helped by criteria that may be important to state agencies, the compliance 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. A concern of many parties may be the assurance that the auction is robust against potential attempts to manipulate the price, although there is no empirical evidence for manipulation in previous allowance auctions. Also, the design of the auction (such as inclusion of a reserve price) may help minimize price volatility in the auction and the secondary market. In addition, entities will want to ensure the auction design is compatible with existing electricity and energy markets.

Another criterion is concern about uncertainty in the market. As described above, the values are common to all who purchase them. Anyone who buys an allowance could resell it at the market price in a secondary market. There is initial uncertainty as to what the value of an allowance will eventually be, which is the precondition for what is known as the "winner's curse," where the highest bidders are usually the ones with the most extreme estimates of future allowance values. However, an active secondary market causes uncertainty and the risk of the winner's curse to nearly vanish Some authors have asserted that in the presence of uncertainty, a multi-round auction where bidders can adjust their estimates of allowance values in response to the actions of other bidders is an appropriate design.[25] However, there is no empirical literature that finds that a multi-round auction actually does better than a sealed bid auction in avoiding the winner's curse, and multi-round auctions may raise the possibility for collusion in the auction.[26]

Ultimately, an important criterion for the design of an auction will be its transparency and how well its operation can be understood by participants. Sophisticated or large firms have the ability to understand and participate in complicated auction environments, but many compliance entities may not have the ability to do that. Since the auction would distribute access to a public good (e.g. emissions into the atmosphere) the operation of the auction will be of interest to a broad class of parties.

2.4.2 The Alternatives

There are four general choices of auction design that determine how the clearing price is determined and the auction outcome is achieved. These four choices are defined over two main features. One choice is between a single round (sealed bid), or multiple round auction wherein participants can revise their bids. Multi-round auctions are sometimes called *clock* auctions because the bid price moves up or down like the hands on a clock until supply equals demand. The

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[25] The intuition is that when bidders are allowed to adjust their estimates of allowance values in response to the bidding behavior of others, they have less fear of the winner's curse and are less likely to "shave" their bids downward, and also that the auction price more closely resembles the true market value. (Milgrom, "Auctions and Bidding: A primer" *Journal of Economic Perspectives*. 1989 vol. 3 (3) pp. 3-22).

[26] The intuition is that a multi-round platform gives participants a better chance to coordinate bids. Burtraw, Goeree, Holt, Myers, Palmer and Shobe (2009), Collusion in Auctions for Emissions Permits: An Experimental Analysis, *Journal of Policy Analysis and Management*, 28(4): 672–691.

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 northeastern Regional Greenhouse Gas Initiative CO_2 program, where nearly 90 percent of the emissions allowances are distributed through an auction. A discriminating price, sealed bid auction is used for allocating a small portion of the allowances under the Acid Rain Program. A uniform price multi-round auction was used by the State of Virginia to auction its emissions allowances in the NO_x budget program in the eastern U.S. A discriminatory price multi-round auction is used by the Federal Communications Commission to distribute licenses for broadcast rights.

Among these types, the uniform price, sealed bid auction is the simplest design and the easiest to understand. It is easy to develop a bidding strategy for this design, and the operations and outcome of the auction are transparent to participants and observers. It also conveys a sense of transparency about the overall operation of the market. This makes it an accessible auction institution for participants, non-experts and the public. These attributes can be expected to help build public trust in the allowance market. Hence, in the absence of other compelling arguments, the uniform price, sealed bid auction type is a reasonable choice.

One other important aspect of how the auction will function concerns the role of sellers other than the government. A double (two-sided) auction provides for buyers *and* sellers to bid into the auction. This is a feature of the auction in the Acid Rain Program. This could be especially valuable if the state were to distribute allowances for free to local governments, other organizations, or directly to households, who then could liquidate their holdings through the auction.

2.4.3 Other Features of the Auction

In addition to the two main choices that identify the way that the market-clearing price is determined in the auction, there are a number of other subordinate 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 (where the auction will occur and who will run it)
- Eligibility rules and financial prequalification
- Passive bid provisions for small entities so they can be guaranteed a small quantity at the market clearing price
- Market monitoring and oversight (to ensure against manipulation of the auction)
- Disclosure of beneficial interests by bidders
- Limitations on acquisition by single parties
- Information from the auction to be revealed to the public

There is ample experience to draw on for choosing the design of these features. In addition to a voluminous literature and the on-the-ground experience in other jurisdictions, various authors have recommended the use of laboratory experiments to "stress test" the auction design to examine its performance according to criteria that are identified as important. In a laboratory setting, often the unexpected will occur. With a modest reward, participants (typically university students) can be motivated to search earnestly for ways to profit by taking advantage of the

auction design, and they are likely to identify vulnerabilities in the design if there are any. Second, conducting laboratory experiments forces the precise definition of many features of the auction and related rules. This will help the agency finalize its plan for the operation of the auction.

Finally, in all previous emissions allowance auctions in the U.S., a third party vendor has successfully run auctions on behalf of federal or state agencies at low cost. This is a sound approach for the state to consider. A bidding process could be run by the state to select a vendor to run the auction.

3 Total Allowance Value

3.1 General Issues

3.1.1 Significance of Total Allowance Value and Its variability

It is important to assess the likely magnitude of total allowance value, since this influences how this value might be used. Some uses will have higher priority than others, and depending on total allowance value certain lower-priority uses may or may not be advisable.

It is also helpful to understand the variability of allowance value 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 What Determines Allowance Value?

The figure below offers a stylized representation of California's marginal costs of reducing emissions. This is a marginal abatement cost curve, labeled "MAC." It represents the change in abatement costs associated with each additional unit reduction in emissions. Marginal abatement costs increase as emissions are reduced. The vertical line (e_1) is the aggregate emissions cap. The aggregate value of allowances is determined by the quantity of emissions that are enabled (e_1) and the price of allowances (p), where the latter depends on the marginal costs of abatement at the emissions quantity e_1.

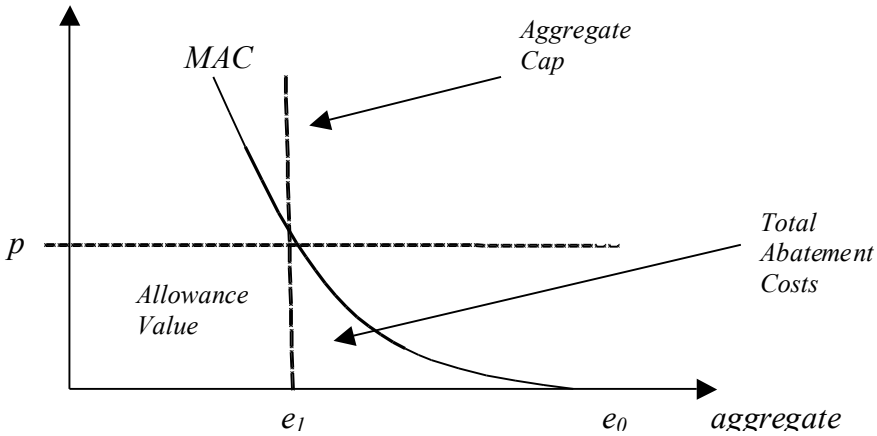

Figure 1

The above figure helps identify the information needed to estimate the allowance value that would become available by introducing a price on CO_2. In particular, we would need to have estimates of the marginal costs of abatement associated with the cap-and-trade system's cap for particular years. This would give us the price of allowances in each year. We would then apply this price to the level of "residual" emissions (e_1) expected each year to obtain total allowance value.

As indicated in the figure, 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. The allowance price depends on the emissions target and the cost (at the margin) of reducing emissions from their business-as-usual level to achieve that target. As discussed below, for the first couple decades of a program in California the value of emissions allowances (the rectangle in the figure) can be expected to increase in real terms as the overall cap becomes more stringent.

The marginal cost of reducing emissions or, equivalently, the allowance price, is influenced by a range of factors, including the design of the emissions market. The next section describes factors that influence the marginal cost of achieving emissions reductions in the short run and in the long run. The discussion includes attention to 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

The marginal costs of reducing (or abating) emissions depend on technological, behavioral, and policy-related factors. Compliance entities and consumers are likely to make a variety of adjustments to reduce emissions. The marginal abatement costs depend on the ease with which these adjustments can be made.

Fuel-Substitution and Opportunities for Process Change

Firms can reduce emissions by substituting low-GHG fuels for other fuels, or by undertaking other changes in the methods of production. In the short run, opportunities for fuel-substitution may be limited because of the type of production capital in place; however, in the longer run the opportunities can be considerable.

Consider in particular the incentives for fuel substitution among fossil-fired power plants. With price of zero on CO_2 emissions, coal plants have lower marginal costs than natural gas plants, but as the price on CO_2 increases, the marginal cost for coal increases faster than for natural gas because coal has roughly twice the emissions per kilowatt-hour of generation.

Table 1 illustrates the "flipping point CO_2 price" (expressed in terms of dollars per million British thermal units of fuel input at a plant) at which where substitution of natural gas-fired generation for coal-fired generation at existing plants would occur.[27] For example, if natural gas were trading at $5 per 10,000 million British thermal units (mmBTU) and coal were trading for $2.25 per mmBTU, an allowance price of $49 would equate the marginal cost of coal and natural gas generation. In other words, the allowance price would have to be $49 before there would be an important reduction in emissions achieved through fuel switching in the short run in the electricity sector.

Reduced Output

Another way to reduce emissions is to reduce the 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 demanded for these products, leading to a reduction in greenhouse gas emissions.

The extent to which output is reduced will vary with time. In the short run, 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 vehicle miles traveled through carpooling, trip collection, and better engine and tire maintenance.

If greenhouse gas reductions only came from demand reductions in the short run, allowance prices would be high. For example, allowance prices would have to be roughly $115 per ton of CO_2e to reduce electricity consumption, and thus greenhouse gas emissions from the electricity sector, by 15%. Even higher allowance prices would be required to reduce gasoline and natural gas consumption by 15%.[28]

What is the portfolio of responses that are likely to occur in the short run? We conduct a simple back-of-the-envelope calculation allowing for both reductions in consumption within the electricity, natural gas and transportation fuels sectors and fuel switching in electricity generation. This suggests an allowance price of roughly $70 is required to achieve a 15% reduction in greenhouse gases in the short run, before capital adjustments can occur.

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[27] The example pertains to plants operating at heat rates of 11.1 and 11.3 for coal and natural gas plants, respectively. These represent the average heat rates for coal and natural gas plants within the western region.

[28] Dahl (200X) summarizes the short-run elasticities for a variety of energy-intensive products, reflecting the percentage reduction in demand for a one percent increase in price. She finds that the elasticity for electricity and natural gas is roughly 0.20, while the elasticity for gasoline is 0.26.

Capital adjustments may begin quickly that lead to larger reductions in output in response to increased prices. Over the medium term of 2-10 years, consumers have the ability to identify and use substitutes. Consumers' adjustments might include replacing inefficient air conditioners, hot water heaters or automobiles.

Developing New Technologies

Over the long term capital adjustments can occur in the electricity supply technology and other production activities. Pricing GHG emissions incentivizes firms to invest more in research and development in GHG reducing technologies. Absent a price on emissions, advances in GHG-reducing technologies must rely on "piggybacking" 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 GHG emissions, but without pricing GHGs, 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. Also, over the longer term demand side improvements such as improved building shells and changes in land use patterns are likely to emerge. These changes are expected to achieve greater emissions reductions at a given CO_2 price, and to help bring down the price.

		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

Table 1

3.3 Policy Factors That Influence Allowance Prices

Several policy factors can influence the allowance price, either by altering firms' production incentives or by establishing links in abatement costs across regions or across time. We discuss these factors here.

Free Allocation with Output-Based Updating

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, output-based updated free allocation tends to increase the allowance price compared to fixed free allocation or auctioning. This form of free allocation implicitly subsidizes output and thereby leads to a higher demand for allowances and higher allowance prices.[29]

Linkage with Larger CO_2 Markets

[29] For similar reasons, *emissions*-based updated free allocation also leads to higher allowance prices.

It is reasonable to expect that a California cap-and-trade system will be connected in some way with a broader, regional market or with other established GHG allowance markets. If California's system is linked with other systems, then the price of allowances would reflect marginal abatement costs not only in California but in the entire system. Linking various systems introduces more opportunities to exploit especially low-cost abatement opportunities through trades in allowances across regions.

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 California allowance prices will largely be determined by those in other regions.[30] Futures prices in these markets give some signal of future prices in California. The current EU ETS price for a 2012 delivery futures contract is 17.42??update?? euro per metric ton CO_2 on the European Climate Exchange.

Availability (and Price) of CO_2 Offsets

In many CO_2 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 CO_2 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, their ultimate availability and their price 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 allowance 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 Scoping Plan proposes an offset quantity limit of no more than 49% of emissions reductions.

Banking and Borrowing Provisions

Banking and borrowing provisions introduce flexibility as to the timing of when allowances are used. A banking provision enables firms to use a current-year allowance for compliance in some future year. A borrowing provision enables a firm to use a future-year allowance to comply in the present.

These provisions give firms more options as to the number of allowances they will use in any given period of time. As a result, the provisions affect the time-profile of allowance prices. The prices in any given year will still reflect the marginal cost of emissions reduction in each period, but because the number of allowances used will change, so will the extent of abatement, the abatement costs, and the allowance prices.

Firms are likely to bank or borrow allowances in order to minimize the net present value of compliance. Other things being equal, the opportunity for banking and borrowing will lead to smooth changes in allowance prices over time.[31] Provisions for banking or borrowing also play an

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

[31] If markets are competitive and banking and/or borrowing is allowed and utilized, then the value of an emissions allowance is expected to increase at the same rate over time as the opportunity cost of capital to the private sector. If it were to differ from that rate, for example if allowance prices grew faster than this rate, then investors

important role in determining the volatility of prices, because the pool of allowances "in the market" at any one point in time is larger if it includes allowances that will be issued in other time periods. 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 Scoping Plan proposes implicitly allowing for borrowing, within a three-year "compliance period." It would allow for unlimited banking. This means that prices in near-term years should be influenced by prices in later 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 may not exist 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.[32]

Impacts of Complementary Policies <here>

Under AB 32, allowance trading is only one element of a broad set of policies aimed at reducing CO_2 emissions. In the projections of the scoping plan, complementary policies are expected to account for about 80% of overall required abatement and XX% of abatement from sectors covered under the allowance trading program.

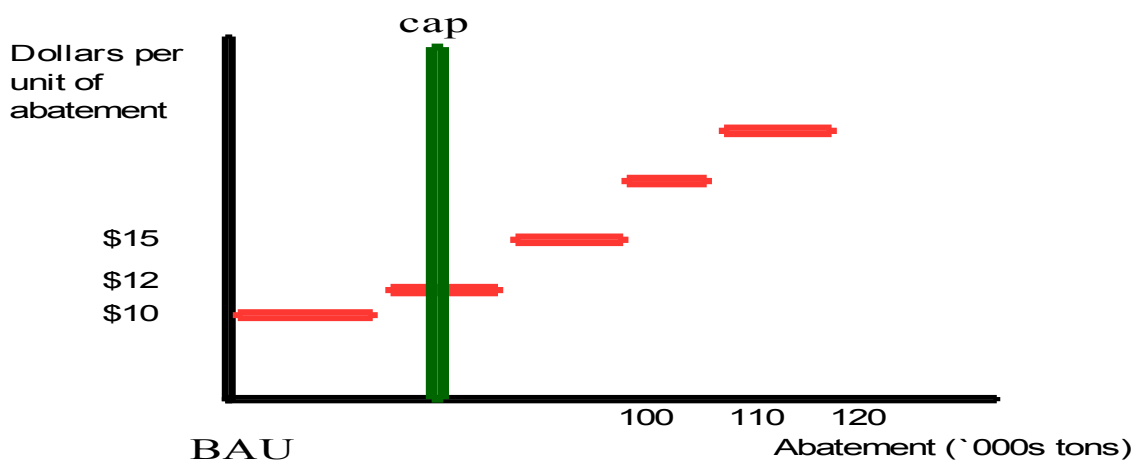

Figure 2: Supply and Demand for Abatement

would take money out of other investments and buy allowances causing the price of allowances to adjust accordingly.

[32] 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.

If one considers all mitigation options as forming a "supply curve" of CO_2 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.

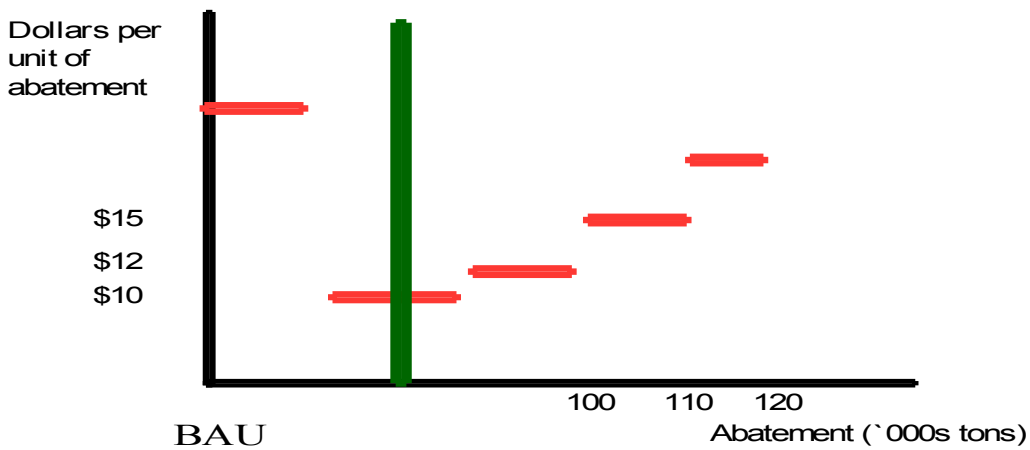

Figure 3: A High Cost Option Is Mandated

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 or reshuffling. To the extent that it is cheaper to produce a product in a region where it is not covered by the cap 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. Another possible outcome is reshuffling, which represents selling more of a low-carbon variety of a product (e.g., cellulosic ethanol) in California and more of the high carbon variety (e.g., corn ethanol) outside of California without changing overall greenhouse gas emissions. If these events were to occur, emissions inside California will be reduced and the demand for actual abatement inside California will go down, as will allowance prices. However, emission leakage would undermine the environmental integrity of the program and 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. However, the degree to which such changes occur hinges on whether decision makers think the differential in costs will persist. If decision makers expect other regions or the

nation to take strong steps toward reducing CO_2 emissions then they will factor this into future capital investment.

The electricity sector has been identified as particularly vulnerable to leakage, and special provisions to combat leakage through a "first jurisdictional deliverer" approach 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. Elsewhere in this report we discuss policies including approaches to allocation that might help reduce leakage.

Summary

Policy variables exert impacts on allowance prices in various ways.

The approach to allocation will affect allowance prices. 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.

Linking provides a way to reduce overall costs across different regulatory programs, but the program with relatively lower marginal cost would be pulled into making additional emissions reductions, which would raise the allowance price for that program while lowering the allowance price in the other program.

Banking and borrowing provide opportunities to find least cost ways to reduce emissions across time periods, which would lower the cost of the program. However, this flexibility over time causes there to be a relation across the allowance prices in different periods. Borrowing could lower the allowance price in the near term (compared to the absence of borrowing). On the other hand, banking could 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.

Offsets and complementary policies reduce the need for emissions reductions in the covered sector. Leakage of emission indicates supply of a product outside the regulated region that relieves the demand to incur costs within the region.

Thus, the design of the program is likely to have a great effect on the allowance price.

3.4 Range of Allowance Prices and Values

3.4.1 Allowance Price Range

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, banking of allowances, availability of offsets, and methods of allocation. This brief summary describes several recent studies.

The Air Resource Board's Scoping Plan provides a comprehensive approach for reducing state GHG emissions to the target level defined in AB 32. The Plan proposes a cap-and-trade program, coordinated with the WCI program, along with a broad set of complementary policies, such as a 33% RPS, designed to reduce emissions from specific sources. Using the E-DRAM model, ARB estimated the economic impacts of the Scoping Plan as a whole. This model does not include allowance banking or offsets. For the cap-and-trade program, the modeling results reflect a 2020 allowance price of $10 (in 2007 dollars) per metric ton. Despite this low allowance price, some of the complementary policies are expected to cost much more than this in order to achieve their emission reductions. In fact, the 33% RPS is estimated to have a cost of $133 (2007 dollars) per metric ton. This analysis did not incorporate a link to the WCI partner jurisdictions.

The WCI analysis was performed using the ENERGY2020 model and covered eight of the 11 WCI Partner jurisdictions. All of the cases examined include allowance banking and some complementary policies, but they also include different scopes of coverage, treatments of offsets, and energy prices. In these different cases, the allowance price in 2020 varies from $18 to $71 (2007 dollars) per metric ton. The narrower scope of coverage significantly increases the allowance price, as does prohibiting the use of offsets. The WCI analysis is currently being updated to incorporate all 11 partner jurisdictions and updated assumptions regarding economic growth, complementary policies, and other factors.

Charles River Associates used its MRN-NEEM model to analyze several different policies and targets for emission reductions, none of which allowed for banking of allowances or the use of offsets. All of these policies achieved the target of reducing emissions to 1990 levels by 2020, but the reduction path following this date varies from no additional reductions to 80% below the 1990 level by 2050. Under these different scenarios, the allowance price in 2020 ranged from approximately $60 to $100 (2007 dollars) per metric ton. Another scenario also included a safety valve that allowed additional emissions if allowance prices reached a certain level. This scenario also resulted in an allowance price of about $60 (2007 dollars) per metric ton, but it did not achieve the same emission reductions. The documentation for this study does not specify if the model included complementary policies or if a link to the larger WCI region was considered.

David Roland-Holst's analysis used the BEAR model to examine a wide range of policies to achieve the necessary emission reductions by 2020. All of the cases modeled prohibit banking of allowances and the use of offsets, but they do include all of the complementary policies proposed by CARB. The cases differ based on the effectiveness of these complementary policies, the sectors covered by the cap-and-trade policy, and the level of technological innovation to reduce the cost of energy efficiency. This wide range of cases results in an allowance price in 2020 varying from $8 to $213 (2007 dollars) per metric ton. A more narrow scope of coverage and less effective complementary policies both increase the allowance price, while efficiency innovation reduces the price. The documentation for this study does not specify if the model included a link to the larger WCI region.

Researchers at Resources for the Future used the Haiku electricity model to analyze how different cap-and-trade policies would affect the electricity sector and what the resulting allowance price would be. To do this, they estimated the expected contribution from the electricity sector within an economy-wide cap-and-trade policy, which is an emission reduction of 30% from the baseline in 2020. They modeled policies for both California and the larger WCI, and they allocated allowances through both an auction and electricity local distribution companies. This model assumed no allowance banking or offsets, but it did include a 20% RPS in California and first-deliverer compliance for imported electricity. These different scenarios yielded an allowance price of $21 to $127 (2007 dollars) per metric ton in 2020.

The table below summarizes these studies and the scenarios they modeled, including information on different model assumptions and the allowance prices in 2020. These studies indicate that allowance values in 2020 could extend over a wide range, depending on critical features of the program design.

Author **Region**	**Scenario**	**Additional Policies**	**Allowance Price in 2020[1]**
CARB (EDRAM)			
California	Scoping Plan	Vehicle standards, 20% RPS, etc.	$10
WCI (Energy 2020)			
WCI	Stationary Sources	Limited amount of offsets, banking allowed, current RPSs	$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 (MRN-NEEM)			
California	Binding Reductions[2]	No offsets, no banking	$60 - $1003
California	Safety Valve	Safety valve[4]	$60
Roland-Holst (BEAR)			
California	Economy-wide[5]	No banking, no offsets, all CARB policies	$23 - $214
California	20% Cap-and –Trade[6]		$23 - $179
California	20% with Efficiency Innovation[6]		$8 - $161
Palmer et al. (Haiku - electricity sector only)[7]			
California	Auction	20% RPS, no offsets, no banking, first-deliverer compliance	$58
California	LDC Allocation		$127
WCI	Auction		$21
WCI	LDC Allocation		$26

Notes:

[1] All prices are in 2007$/metric ton CO_2e. CARB and CRA do not specify year for dollars, so we assume their dollars are for the year preceding the year in which the study was released - 2007$ 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).

In a memo to the EAAC, the Cal/EPA and ARB EAAC Policy Team summarized the assumptions and allowance prices of several studies by saying:

> "All the studies . . . include numerous assumptions about program design, fuel prices, economic growth, complementary policies, technologies, and other factors. . . Nevertheless, despite the differences in approaches and assumptions used in the studies, the review of allowance price estimates shows that allowance prices are most often estimated to be in the range of roughly $20 to $60 per metric ton of emissions in 2020."

Although the studies examined here have a larger range of prices, $8 to $214 (2007 dollars) per metric ton, due to some sensitivity analyses, the general conclusion is the same: allowance price is highly dependent on the specific parameters of the policy. Based on the studies summarized here, it appears allowance prices on the lower end of the range are due to the use of complementary policies to assist a cap-and-trade program in reducing emissions, the use of emission offsets, and the inclusion of California in a larger WCI-wide policy. The presence of allowance banking and the method of allowance allocation also have an impact on the allowance price.

3.4.2 Allowance Value Range

As mentioned, the allowance value created under the cap-and-trade program hinges on two numbers, the quantity of emissions allowances introduced under the cap and the price of allowances. The table below provides an example of plausible allowance values based on a combination of an example emission budget and expected allowance prices.

The emission budget is calculated using a constant rate of emission decline for each of two program phases: 2012 – 2014 and 2015 – 2020. The sources covered in the first compliance period start at their projected emission level in 2012 and follow a linear emission trajectory so as to meet their expected contribution to the emission target in 2020. Beginning in 2015, when more sources are covered for the first time, a new rate of emission decline is assumed in order for all of the covered sources to reach the reduction target in 2020.

The expected range of allowance prices is based on the analysis of the Cal/EPA and ARB EAAC Policy Team that finds a plausible range of allowance prices of $20 to $60 (2007 dollars) per metric ton in 2020. As an example, when the example budget is combined with an assumed allowance price of $35 (2007 dollars) per metric ton in 2020, this yields a total allowance value of $4.4 billion in 2012, $11.0 billion in 2016, and $12.8 billion 2020 (all in 2007 dollars).

As stated previously, the allowance price will be highly dependent on several design parameters of the cap-and-trade policy, so the allowance value will also be dependent on these factors. The studies we reviewed previously indicate that inclusion of complementary policies, offsets, allowance banking, and a link to WCI states and provinces, as well as allocating allowances through an auction rather than to local distribution companies, all appear to yield lower allowance prices. Consequently, these factors will lead to allowance values closer to the lower end of the range shown in the table below.

Year	Example Budget (MMTCO2e)	Illustrative 2020 Allowance Prices and Total Value of Allowances							
		$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 2: 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 the alternative purposes to which allowance value can be directed. Below we distinguish four general ways that allowance value can be used. The first two can be characterized as means to spend allowance value while the second two can be characterized as means of returning value to California citizens.

4.1.1 Prevention of Adverse Impacts

Allowance value can be employed to prevent adverse impacts that might otherwise occur to various parties as a result of the implementation of AB 32.[33]

Climate policy will benefit individuals and businesses in many ways, especially by preventing serious environmental damages. At the same time, such policy could potentially place burdens on some individuals or firms. AB 32 is likely to raise prices of fuels and energy, and these price increases will be reflected in higher prices of consumer goods. The 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. Climate policy also can negatively affect businesses, particularly businesses whose production products are highly energy-intensive and who face substantial competition from out-of-state enterprises. This impact may in turn prompt changes in employment. While climate policy yields new types of jobs and new opportunities for employment, it may cause distress by displacing some workers. 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 address adverse impacts on communities where such increases occur.

Prevention of adverse impacts is motivated by considerations of fairness. In addition, providing allowance value to energy intensive, trade exposed industry would serve to reduce leakage.

[33] This report focuses on methods for distributing and employing allowance value from a cap-and-trade system. However, in considering preventing adverse impacts, it takes account of impacts that derive not only from the cap-and-trade component of AB 32 but from the overall AB 32 effort.

4.1.2 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. It can be used to finance expenditures dedicated to environmental remediation; including biological carbon sequestration. In addition, it can be used to finance adaptation projects, that is, projects to plan for and adapt to climate change.[34]

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. For similar reasons, fairness considerations also support the use of allowance value to finance adaptation projects, or 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.

4.1.3 Dividends to the Public

Another potential use of allowance value is to provide the general public a "dividend" related to the public's having granted firms the right to make use of the waste-disposal 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 alternative 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 environmental services of the atmosphere. Requiring emitters to pay for the use (or alteration) of these services is a way of upholding this right.

4.1.4 Tax Reduction

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 (such as income and sales taxes) to meet given expenditure needs.

Using allowance value to cut tax rates has attractions in terms of economic efficiency. Most existing taxes lead to inefficiencies by discouraging work effort, saving, and investment. The inefficiency is represented by the fact that the reduction in private-sector income from these taxes

[34] Climate change poses both immediate and long-term threats to California communities, natural resources, and economic sectors. These changes can already be seen in the increased magnitude and frequency of events including heat waves, droughts and floods, increases in coastal sea-levels and land erosion, declines in drinking and irrigation water supply and quality, increases in the severity and frequency of wildfires, loss of biodiversity, and impacts to other state natural resources.

exceeds the amount of revenue that they bring in. By lowering the rates of existing taxes, California would enjoy an efficiency gain: the increase in income to the private sector would exceed the avoided tax payments.

4.2 Legal Issues

There are several significant legal and political issues that bear on the distribution of allowance value.

First, there are certain to be legal challenges to the collection of allowance value based on claims that this action violates Proposition 13[35]. Proposition 13, passed by voters in 1978, requires any tax increase to be approved by a two-thirds vote of the state Legislature. Because AB 32 was majority vote legislation, there is a strong case that it does not qualify as a general tax.

However, there are potentially at least three cases in which allowance value could be collected and distributed under current California law. The first case involves allowance value collected as part of the regulatory approach to reducing greenhouse gases contained in AB 32 and is based on the 1997 Sinclair Paint Company court case,[36] which distinguished between general taxes and regulatory fees. In this case, allowance value collected would be considered fees rather than taxes. Two additional conditions would apply. First, any allowance value collected directly by the state must be reasonably related to the costs of regulation. Additionally, any resulting program must be directly related to the regulatory purpose. Because AB 32 provides broad authority for greenhouse gas reduction programs, allowance values could be used for a number of programs cited in AB 32. This distribution of allowance value would require future legislature action, as provided for in AB 32[37].

In the second case, allowance value could be collected as long as it is offset by a corresponding *decrease* in general taxes. This revenue neutral approach would require a majority vote by the legislature with linkage between the allowance value collected and tax cuts.

In the third case, the ARB could provide allowances freely to utilities, refiners, et alia for the benefit of their customers who will ultimately bear the cost of GHG controls. A third party could conduct auctions to generate allowance value, which could then be used for a range of greenhouse gas reduction programs.

The EAAC decided not to limit its recommended policies to those that are allowed by existing legal rules. In some cases, it will recommend changes to existing rules in order to make possible some allocation designs that the Committee believes are beneficial to the state and serving the main objectives of AB 32.

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.

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[35] California Constitution, Article XIII (Prop. 13).

[36] *Sinclair Paint Co. v. State Bd. Of Equalization*, (1997) 12 Cal.4th 866,875

[37] AB 32, Section 38597.

5 Making Use of Allowance Value: Examining the Alternatives

5.1 Prevention of and Compensation for Adverse Impacts

5.1.1 Preventing Disproportionate Impacts on Low-Income Households

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.

[insert graph here showing estimates of price increases from AB 32; also insert graph showing impacts on real household income absent compensation. (Currently available graphs show impacts after some form of compensation.)]

The results shown in the lower figure above indicate that the higher prices have a regressive impact: as a percentage of their incomes, they will hit low-income households harder than upper-income households. This result 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.

From a fairness standpoint, there is a case for preventing this adverse impact on low-income consumers. This impact could be prevented in a number of ways. One is the use of allowance value to finance subsidies that prevent energy prices from rising. (We discuss this below in the context of electricity prices. A difficulty with this approach is that it works against the environmental integrity of AB 32 because it eliminates incentives for consumers to reduce energy consumption. An alternative is to use allowance value to finance cash transfers. Such transfers could provide compensation without reducing incentives to conserve energy.

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

A precedent for monetary compensation is the American Clean Energy and Security Act (H.R. 2454), 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.

There are also other existing programs to assist low-income consumers, such as low-income energy efficiency programs, transit passes, rate assistance, and commuter checks that could be used as vehicles for compensating disproportionately impacted consumers.

It may be noted that the allocation of allowance value to dividends (see section 5.3) would reduce or eliminate the need for compensation to low-income consumers, as they stand to receive the largest net benefits (dividends minus costs from higher fuel prices) from a cap-and-dividend policy.

5.1.2 Preventing Price Increases to Electricity Consumers

A main way that consumers can be affected is through changes in electricity prices. The magnitude of these changes in price will vary geographically across the state, reflecting differences in producers' reliance on lower- or higher-carbon fuels for power generation. In some service territories, consumers rely to a greater extent on high-emitting out-of-state generation sources due to previous investments or long-term power purchase agreements that lock in the purchase of this power for years into the future. Historically, these agreements have delivered relatively low-cost power to these customers and in so doing have reduced their incentive to invest in efficiency. In other regions, customers have invested aggressively in energy efficiency. Consequently, the introduction of a price for CO_2 could cause changes in electricity prices that vary geographically across the state and affect households in different ways, especially in the near term before new sources of supply are identified and brought on line and additional investments in energy efficiency are realized.

The regional disparities in price changes might be mitigated through compensation that takes the form of allocation of allowance value to electricity local distribution companies (LDCs) that are public utilities or privately-owned utilities regulated by the CPUC. In either case the LDCs would act as trustees on behalf of consumers with respect to the disposition of free allowances or allowance value they receive. This approach is embodied in the CPUC/CEC Joint Decision Recommendation[38]. The same approach could be extended to natural gas consumers who receive supplies from an LDC. Local government agencies and community based organizations might also serve as trustees of allowance value if they are delivering efficiency services to consumers.

There are serious potential disadvantages to this approach. First, it is crucially important that the program provide strong price signals to encourage the rapid replacement of inefficient capital. To preserve the incentive to rapidly transition to more efficient capital the CPUC/CEC recommended a four-year phase out of this allocation approach.

Second, the natural way for LDCs to pass on allowance value to their consumers is to reduce electricity prices, but this reduces the information that consumers receive about the need to change habits. An alternative would be to apply the allowance value to reduce the fixed portion of customers' electricity or natural gas bill that deals with the distribution network; however, bills are not organized in a way that separates the fixed portion from the energy use portion. Some have suggested lump-sum payments back to customers in a separate envelope, but that could invite a proliferation of customer accounts to receive additional payments and it is not obvious how to address multi-unit buildings. These disadvantages need to be balanced against the advantages of free allocation to LDCs.

Third, customers in regions that already have reduced their energy use should not be penalized for their efforts. Moreover, most households in regions that are expected to experience

[38] Citation

relatively greater changes in electricity prices reside in regions with relatively lower demand for home heating and they will face lower changes in those costs. Hence the net effect on households should be taken into account, rather the effect with respect to one particular type of energy use.[39]

5.1.3 Preventing Losses to Stockholders

Which Firms Are Burdened Most?

Some firms are likely to experience a reduction in profits as a result of AB 32. This burden depends on the extent to which costs rise and the extent to which firms can pass these cost increases forward to consumers. The increase in cost will be positively related to the energy-intensity of production, as well as the ease with which firms can switch to production processes involving lower energy intensity.

Some interested parties have suggested that allowance value should be provided mainly to compliance 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 compliance entities. 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.[40] Thus, it is not necessarily the case that compliance entities face the principal burden.[41]

The ability to pass forward the cost increases depends on supply and demand. The less responsive demand was to a change in price, the greater the ability of industry to pass changes in

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[39] If there were to be an allocation of allowance value to LDCs, an important question is how that allowance value would be apportioned among LDCs. Three ways are possible: on the basis of population, consumption or emissions embodied in energy use. The leading federal climate proposals (H.R.2454 and S.1733) propose apportionment among electricity LDCs according to a formula that provides 50 percent weight on emissions in a historic base period and 50 percent weight on consumption updated each year. This formula has won widespread support from diverse interests in the electricity industry nationally, but it has the disadvantage that it rewards consumption at the expense of investments in energy efficiency. An improvement might be to include avoided energy consumption achieved through energy efficiency ("nega-watt hours") to the consumption basis of the calculation.

[40] The ability of regulated entities to shift the burden of regulation forward is primarily determined by whether entities are legally permitted to raise prices (i.e., regulated entities), and by the elasticity of demand (sensitivity of demand to a change in price) in the affected markets (i.e., the less that consumer demand changes in response to price increases, the more that covered entities can shift the burden of compliance to customers). The ability of regulated entities to shift the burden of regulation backward to suppliers is primarily determined by the market power of covered entities as input purchasers.

[41] Studies of a potential U.S. cap-and-trade system suggest that regulated entities would absorb less than 20 percent of the burden of such policy. *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*;* Smith, Anne E., Ross, Martin T., Montgomery, David W., "Implications of Trading Implementation Design for Equity-Efficiency Trade-offs in Carbon Permit Allocations" (December 2002) available at http://www.crai.com.au/uploadedFiles/RELATING_MATERIALS/Publications/Consultant_publications/Smith,_A/files/carbon-permit-allocations.pdf; and for a detailed examination of the U.S. electricity sector see Burtraw and Palmer (2008), Compensation Rules for Compensation Rules for Climate Policy in the Electricity Sector, *Journal of Public Policy Analysis and Management,* 27(4): 819-847.

costs on to consumers would be. This would occur because consumers would bear the burden of a higher price and not change their purchase decisions significantly. The greater the responsiveness of supply is, the smaller the profit loss to the firm would be. The elasticity of supply is closely related to the ability of physical capital to be redirected to other uses. An industry with flexible capital can avoid the costs of the program by transferring its capital to other uses. Both these characteristics would imply that such firms would suffer relatively less harm than firms with immobile capital and customers whose purchasing habits are sensitive to price increases from the program. In addition, a firm with many options for abatement would incur lower costs, implying less cost for both consumers and producers.

Difficulty of Identifying the Affected Stockholders

A challenge in compensating the owners of publicly-held firms is the difficulty of matching the recipient and the person originally harmed. The harm to shareholders occurs when the market recognizes the new cost of a regulation and anticipates the change in profits that are likely to result, a process that is likely to have begun with the passage of AB 32 in 2006 in California, if not long before. In the intervening period, shares in the firm change hands. The owners today are not the same persons who owned the firm in the past. Unless the market in 2006 anticipated free allocation, owners suffered a loss then that would not be directly compensated by the decision to direct free allocation to these firms today.

A related issue is that many of the owners of California-based firms do not reside in the state or even in the U.S. According to the U.S. Treasury, over 10 percent of securities in U.S. firms are foreign held, meaning that compensation to the owners of the firms would go overseas. It is likely that U.S. citizens living outside California own a substantial majority of securities of firms doing business in California. Consequently, directing allowance value to compensate owners of firms is not necessarily linked to new investment in California.

5.1.4 Offering Transition Assistance to Displaced California Workers

Owners of California businesses are not the only ones concerned about possible impacts of AB 32. Employees also worry that their firms will shrink or close down their California operations to reduce or avoid these impacts. Fairness considerations suggest using allowance value to fund worker transition assistance (WTA) for California firms' employees who lose their jobs [or their full-time status] due to the AB 32 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 (DoL) 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. 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.

A California agency housed in the California Workforce Development Agency could be established to determine eligibility. ARB would provide specialized technical expertise as required.

5.1.5 Compensation for Adverse Environmental Impacts

A final candidate for consideration is communities, if any, that experience adverse environmental impacts as a result of AB 32 implementation. Although AB 32 will reduce aggregate emissions of CO_2 and the associated co-pollutants, it is conceivable that without countervailing policy measures pollution burdens could increase in specific localities. For example, this result could occur if implementation leads to the substitution of in-state natural gas-generated electricity for out-of-state coal-generated electricity.

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." For the state as a whole, AB 32 will reduce not only GHG emissions but also various "co-pollutants" that result from the same processes that generate GHG emissions. Co-pollutants include reactive organic gases, carbon monoxide, nitrogen oxides, sulfur oxides and particulate matter. Even so, it is conceivable that as GHG emissions are reduced statewide, some localities will experience increased emissions of GHGs and the associated co-pollutants. 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 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. Such environmental compensation would be distinct from and additional to the provision of allowance value for investment in disadvantaged communities, discussed in section **Error! Reference source not found.**. 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).[42]

[42] 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.

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 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). For example, ARB could direct a portion of the allowance value to finance energy efficiency improvements in these areas. Since the extent of such claims cannot be known in advance, this can be regarded as a contingent use of allowance value.

5.2 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 the AB 32 emissions limits, as well as help achieve the other goals of AB 32. Investments could be put toward a number of different areas, such as existing greenhouse gas emission reduction programs; efforts to adapt to future climate change; 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 first offers general rationales for devoting auction revenues toward investments or other public expenditure, and then examines key market barriers to achievement of AB 32 GHG reduction goals and investments that could be made to reduce those barriers. It then considers other potential public investments. It concludes with a brief discussion of how to compare investment options.

5.2.1 Rationale for Investments

Because of market barriers, the price signal introduced by cap and trade plus the complementary policies of AB 32 are not sufficient to trigger all of the cost-effective and socially beneficial investments or other public expenditures that could help achieve the environmental goals of AB 32. Allowance value could be used to finance these beneficial investments or expenditures.

As the Scoping Plan[43] and McKinsey & Company report[44] on GHG reductions illustrate, there are many negative-cost opportunities to reduce GHG emissions. (See figures 3 and 4). The fact that these cost-saving opportunities already exist and remain untapped, however, suggests

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

[44] 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

that they face non-price market barriers.[45] 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.

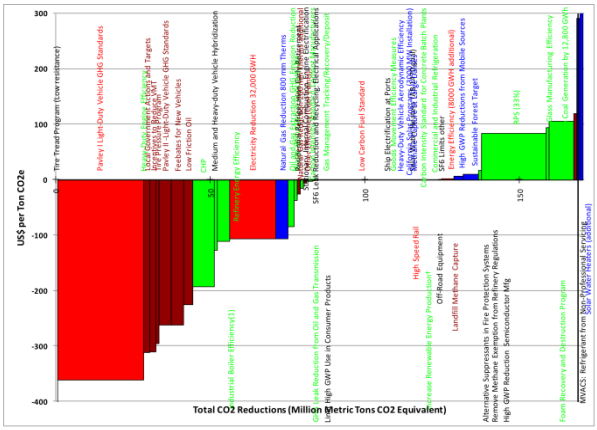

Figure 4: ***Scoping Plan Marginal Abatement Cost Estimates***[46]

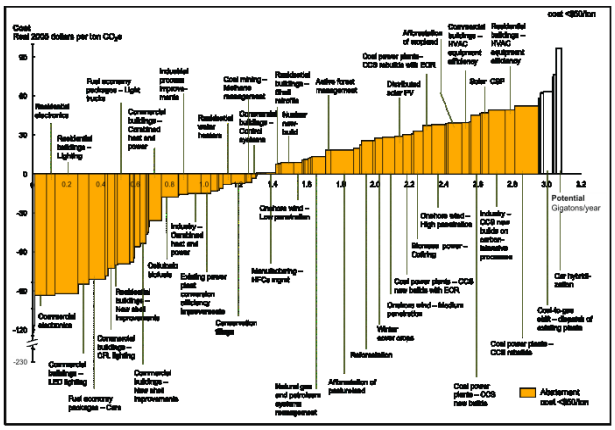

Figure 5: McKinsey's "Mid-Range Case" U.S. Cost Curve

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[45] 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

[46] 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

In addition to market barriers, externalities offer a second reason why markets may fail to bring about certain investments that are highly beneficial to society. Some investments yield significant external benefits in the form of environmental improvements – benefits not reflected in the private returns. While the external benefits associated with GHG emissions are addressed through the cap-and-trade provisions and complementary policies of AB32, there remain other external benefits that are not. This provides an additional rationale for directing some allowance value toward certain investments.

5.2.2 Sources of Underinvestment

Here we briefly describe the factors that lead to underinvestment.

Market Barriers to Investments in Energy Efficiency[47]

Energy efficiency is a low-cost emission reduction opportunity that faces numerous non-price market barriers, including:[48]

- **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).[49]
- **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).[50]
- **Informational barriers:** Potential purchasers of energy efficient products often lack of knowledge about what energy efficiency options are available to them[51], how their life-

[47] 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.

[48] See Appendix for additional market barriers facing energy efficiency measures.

[49] 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.

[50] 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

[51] 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).

cycle costs compare to less efficient options,[52] and how the different technologies are expected to perform.

- **Transaction costs:** time and effort required to analyze alternative projects and to install energy efficiency measures.

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.[53]

Credit Constraints and Spillovers Associated with Investments in New Technologies

Private companies under-invest in RD&D for new low- and zero-carbon technologies for a number of reasons.[54] Several studies suggest that obtaining funding is particularly difficult for projects in the development and demonstration phase. Economists often refer to knowledge spillovers as a main source of under-investment in R&D or innovation – that is, entrepreneurs underinvest because they cannot appropriate all of the social return from their efforts – some of the knowledge they generate spills over to and benefits other parties.

Outdated Zoning Rules, Fiscal Constraints, and Investment in Land Use Planning

The market for innovative emission reduction solutions associated with land use is currently impeded by outdated zoning restrictions and general plans in local communities across California. For example: 55 percent of California general plans have at least one mandatory element that is more than ten years out of date. In many cases the market would support higher density, mixed use projects as individuals seek ways to reduce the time and money they spend just getting around. But outdated, unrealistic zoning prevents developers from building to the market demand. The most urgent need is to fund local governments to update their general plans and zoning codes to be consistent with the SB 375 regional Sustainable Communities Strategies (SCS) approved by CARB to meet their GHG reduction targets.

The long time horizon for paybacks on land use changes make it difficult to motivate cities to take action. It also makes it all the more critical to make these changes during the early years in order to reap the full benefits, both in terms of quality of life for Californians and reductions in GHG emissions, over time.

5.2.3 Using Allowance Value to Overcome Market Barriers

CARB estimates that implementing the energy efficiency measures called fir in the Scoping Plan saves $109-$190 per ton[55]. Numerous other studies confirm the payback, both in cost-savings, job creation, and environmental co-benefits, that investments in energy efficiency can bring. A recent UC Berkeley analysis, for example, found that california's energy efficiency

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[52] See id.

[53] 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).

[54] See Appendix

[55] See Scoping Plan, Appendix G, at: http://www.arb.ca.gov/cc/scopingplan/document/appendices_volume2.pdf

investments from 1972 to 2006 provided $56 billion in savings and created about 1.5 million full-time equivalent jobs with a payroll of $45 billion[56].

Allowance value could be channeled into programs and policies targeted at overcoming the market barriers impeding private investment in RD&D.[57] 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.[58] Private investors may be less willing to invest in technologies as they advance from invention to commercialization because of the difficulty of managing market, regulatory, and other risks.[59] At this point, when return on investment cannot be readily projected, additional funding is necessary to see if the technology has commercial promise.[60]

Several analyses indicate that investing in land use planning is highly cost-effective. The Sacramento Area Council of Governments, for example, spent $3-4 million on developing a long-term Regional Transportation Plan that is projected to save $16 billion in infrastructure and mitigation costs over the life of the plan, while preserving open space and reducing greenhouse gas emissions by 15%[61]. The McKinsey Curve[62] also found that reductions in vehicle miles traveled will save $90 per ton while Moving Cooler, a publication of the Urban Land Institute, found that a bundle of land use and transit mitigation measures strategies achieve net savings of $532 per ton[63].

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, and utilities and agencies need to continue to expand their energy efficiency efforts to reach that goal, there may be an important role for third party groups to deliver efficiency investments to underserved communities.[64] Auction revenue could be used to supplement existing funding sources to expand efficiency efforts.[65]

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[56] Roland-Holst, D., Energy Efficiency, *Innovation and Job Creation in California*, UC Berkeley (October 2008). Available at:

[57] See Appendix for list of existing institutions currently working on clean-tech RD&D

[58]] 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.

[59] 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).

[60] [section in progress] Id.

[61] See http://www.sacregionblueprint.org/sacregionblueprint/home.cfm

[62] Supra note 1.

[63] Prepared by Cambridge Systematics, and sponsored by partners such as the Federal Highway Administration, Shell Oil and the Federal Transit Administration. Available at: http://www.movingcooler.info/ p. 52

[64] 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).

[65] See Appendix

5.2.4 Other Potential Investments

Investments in Job Training

Job training can be justified as another type of investment financed by allowance value. Such an investment would help ensure the state has an adequate supply of trained workers to staff the new jobs opening up in the green economy.

More than 100,000 California workers were employed in the "green economy"[66] in 2007, and the number of green jobs is expected to grow rapidly, boosted by federal stimulus spending and the new opportunities created by AB 32 related programs and regulations. It is 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.

Investment in Disadvantaged Communities

AB 32 specifically directs ARB to consider the needs of disadvantaged communities.[67] 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.[68] 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 transit, and land use planning. More could be done by directing targeting a portion of allowance value specifically to these communities.

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.[69]

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[66] 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.

[67] 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).

[68] 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).

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

Public Transit and Land Use Planning

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.[70] Recent State budget cuts and sharp declines in sales and property taxes have taken a severe toll on California's transit agencies.[71] 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.

Similarly, 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. Outdated and unwieldy local plans often block the market demand for high density, which would in turn lead to reduced greenhouse gas emissions and a variety of other benefits. Using allowance revenue to allow regions to create SCS plans and local governments to update their general plans and zoning to implement the SCS plans can remove these barriers and ensure that developers can create communities that reduce per capita transportation related greenhouse gas emissions. To ensure consistency in application of funds to implementation of SB 375, such use of allowance value should be consistent with SGC guidelines and RTAC recommendations.

Financing Agencies to Ensure That They Can Fully Implement AB 32

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.

First, ARB could use additional laboratory/technical support to implement its heavy-duty diesel equipment rules.[72] 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.

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[70] 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

[71] 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.

[72] Cleaner diesels trucks, locomotives, and construction equipment produce substantially less CO_2 than gasoline and clean diesel cars are an increasing share of the market and a plausible bridge to hybrid and fuel cell vehicles. ARB certifies new engines but knows very little about in-use emissions performance. The lab could also support an increasing ARB focus on black carbon, which is a large fraction of the soot in diesel exhaust and a short-lived but very potent GHG.

Second, a substantial portion of the carbon reductions that are included in the AB 32 Scoping Plan is within the CPUC's jurisdiction.[73] Yet the CPUC has been unable to increase AB 32 staff support positions over the last three state budget cycles. This leaves the CPUC 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).

Third, 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.

Finally, 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.[74]

Investment in Adaptation

Many in the state's public and private sectors are or will be affected by climate change over the coming decades. For example, the state is the world's 5th largest supplier of food and agricultural commodities, representing over $36 billion in revenues (2007) for the state.[75] Other key affected sectors include: construction, coastal and land management, education, public health, emergency management and public safety services, energy, engineering services, forestry, fisheries, parks and recreation, insurance, healthcare and health related services, real estate, textiles, tourism, transportation, telecommunications, utilities, water management, and more.

The California Resources Agency and eight other state departments spent almost a year compiling what is now the California Climate Adaptation Strategy Discussion Draft,[76] providing the best available science and recommendations for state agencies to address climate change impacts to seven of the state's sectors (agriculture, biodiversity, forestry, oceans and coastal, public health, water, and transportation and energy infrastructure). The report promoted planning to adapt to changes anticipated from climate change. For example, assuming a 55-inch rise in sea levels, the report identified nearly half a million people, $100 billion in property, and $46 billion in the coastal-dependent economy would be at risk.[77] However, the relevant agencies lack the necessary funding to actually implement the report's recommendations. Additionally, adaptive actions are needed from entities other than state departments or agencies, including local governments and communities, the

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[73] 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.

[74] 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.

[75] California Department of Food and Agriculture, Agricultural Statistical Review for 2007, http://www.cdfa.ca.gov/statistics/files/CDFA_Sec2.pdf

[76] California Natural Resources Agency, California Climate Adaptation Strategy Discussion Draft ("California Adaptation Strategy"), posted August 3, 2009, http://www.energy.ca.gov/2009publications/CNRA-1000-2009-027/CNRA-1000-2009-027-D.PDF.

[77] California Adaptation Strategy, p.64.

private sector, and individuals. In addition, solutions and support for adaptation efforts across the state will not come exclusively from the state government, but from academia, other states and countries, the private sector and other public and non-profit entities. Resources are needed to provide more localized science and modeling tools on impacts, sector-specific and cross-sector applied research, technology and innovations for solutions to mitigate impacts, tools for adaptation planning and ongoing learning, and the expertise required to analyze, develop, implement and/or monitor adaptive options. There is also a need to coordinate activities across the state's agencies as well as across sectors and regions within the state.

In addition to adaptation to the effects of climate change, allowance value could be invested in the provision of ecological services including biological carbon sequestration. This would provide a way to support agricultural, forestry and soil conservation practices that reduce net GHG emissions by removing carbon dioxide from the atmosphere, without necessarily relying on offsets to fund these investments.

5.2.5 Vehicles for Supporting Investments

Allowance value could support investment either through direct grants. Another is an investment tax credit, where the credit is allowed for specified types of investment.

An investment tax credit (ITC) granted to firms that invest in new equipment that reduces greenhouse gas emissions can be justified as an "investment" use proposed for the allowance value created by California's cap and trade program.

- By reducing the net after-tax capital costs incurred, the ITC would help all California businesses that utilize the credit to finance their investment in new technologies.
- This would be especially helpful in situations where there are split incentives to make such investments. For example, the ITC would encourage owners of residential, commercial and industrial space to make their buildings more energy efficient even though their tenants stand to benefit through reduced energy bills.
- Also, making an ITC available in the early years of the AB 32 regulatory regime would incentivize businesses to adopt the new technologies sooner than might otherwise be the case.

Except for the state's energy utilities, little information is publicly available as to the estimated gross initial capital expenditures California businesses will be required to make under the AB32 implementation plan. However, there is great concern among businesses throughout the state, especially small businesses, that these costs will be very large and burdensome. A significant targeted investment tax credit would help to reduce initial capital costs and relieve some of these concerns.

As part of their demand management programs, several of the state's energy utilities offer discounts and rebates to their commercial and industrial customers against the purchase of specified energy-saving equipment or building improvements. Because they reduce the net cost of acquiring such equipment, these programs are the functional equivalent of targeted tax credits. However, they are typically special-purpose offerings and not available to all businesses in all industries for all types of emission-reducing equipment or structural building improvements.

5.2.6 Evaluating Investment Alternatives

CARB and the Advisory Board should use the following criteria when evaluating proposals for investment of allowance value:

Aggregate Social Net Benefit (Efficiency)

This criterion integrates attention to cost-effectiveness and environmental effectiveness. It focuses on the full social return from the investment – including the environmental and other external benefits – net of the cost of the investment. As mentioned, many promising investments are not made because the external benefits are not considered by the potential investor. The full net social return accounts for these external benefits. It is the private benefit plus the external benefit, minus the investment cost.

In general, the ranking of investments according to this criterion will not match the ranking implied by the location of an investment on the McKinsey Curve. This is the case for two reasons: (1) the McKinsey Curve doesn't indicate the cost of overcoming the market barrier, (2) it doesn't indicate the net external benefits associated with the various options. The criterion of aggregate social net benefit accounts for both the cost of overcoming the market barrier and the external benefits.

Fairness

In addition to considering the social net benefits in the aggregate, CARB and the ARB should consider investments warranted by justice considerations. For example, it is appropriate to assign extra weight to investment proposals that will help disadvantaged communities. AB 32 clearly aims to help these communities while reducing GHG emissions[78].

Simplicity

CARB and the ARB should give priority to established programs that already have experienced staff and administrative mechanisms in place. They should also look for programs that have an educational and training component to ensure there will be continued human capital to carry out cost-effective GHG reductions in the future.

In addition, it is important that CARB and the ARB avoid "crowding out" the private market. Cap and Trade is designed to put a price on carbon and then let the market efficiently. It is important to focus on those areas where markets are imperfect but otherwise stand out of the way.

[78] Id. at §§ 38562 (a)(2); 28565; 38570(b)(1).

5.3 Dividends to the Public

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, leaving decisions on the final use of the money to the public. The rationales advanced for this policy include:

- *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.
- *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 receive a tangible payment that reminds them of the benefits of the policy, without negating the clear price incentive to reduce their consumption of fossil fuels.

The size of the dividend paid to each California resident would depend on: (i) the total allowance value and (ii) the percentage of allowance value allocated to dividends. Table 5.1 {see below} shows annual per capita dividends for the years 2012-2020 based on a 2020 allowance price of $40/ton (the middle of the range reported in the Cal EPA/ARB EAAC Policy Team Memorandum "Estimates of Allowance Prices," dated October 20, 2009) with different percentages of total allowance value allocated to dividends. Dividends rise over these years (holding their percentage of allowance value constant); for example, with 60% of allowance value allocated to this use, the per capita dividend rises from $77 to 2012 to $207 in 2020.

Table 5.1: Dividend per capita with different percentages of allowance value allocated to dividends, 2012-2020[79]

(annual dividends, based on 2020 allowance price of $40/ton CO2)

Year	Estimated allowance value (millions)	Projected population (millions)	Percentage of allowance value allocated to dividends				
			100%	80%	60%	40%	20%
2012	$5,016	38.90	$129	$103	$77	$52	$26
2013	$5,184	39.32	$132	$105	$79	$53	$26
2014	$5,354	39.74	$135	$108	$81	$54	$27
2015	$12,102	40.16	$301	$241	$181	$121	$60
2016	$12,576	40.58	$310	$248	$186	$124	$62
2017	$13,062	41.00	$319	$255	$191	$127	$64
2018	$13,564	41.42	$328	$262	$197	$131	$66
2019	$14,078	41.83	$337	$269	$202	$135	$67
2020	$14,600	42.25	$346	$276	$207	$138	$69

There are several precedents for this approach. One 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 (H.R. 2454), 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.[80] If the Act becomes law, disbursements are expected to amount to roughly 50% of allowance value from 2030 onwards.

In terms of environmental considerations, dividends forego possible gains from using auction revenue to achieve deeper GHG emission reductions in locations with high co-pollutant burdens unless the use of the dividend is constrained to, for example , specified home energy efficiency investments. From an efficiency standpoint, dividends also forego possible additional gains (above and beyond those resulting from carbon pricing alone) via use of revenue for tax shifting (see below). However, from a fairness standpoint, dividends have two main attractions. First, they offer universal coverage based on the principle of common ownership of nature's

[79] *Sources:* The estimated allowance value is in the middle of the range (based on 2020 allowance prices of $20-$60/ton) shown in Exhibit 5 of "Estimates of Allowance Prices," Memorandum from Cal EPA/ARB EAAC Policy Team to EAAC Members, October 20, 2009 (available at http://www.climatechange.ca.gov/eaac/documents/state_reports/Allowance_Prices--Memo_from_State_Staff.pdf).

Projected population is from U.S. Census Bureau," State Interim Population Projections by Age and Sex: 2004 – 2030, Table 1," available at http://www.census.gov/population/www/projections/projectionsagesex.html.

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

wealth. Second, they have a progressive effect on the income distribution because 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.

The net benefit to any given household will depend on (i) the size of the dividend and (ii) the impact of higher fossil fuel prices that result from the emissions cap. Households that consume less carbon (directly via energy consumption and indirectly via consumption of other goods and services that are produced or distributed using fossil fuels) will be less impacted by higher prices and hence receive bigger net benefits; those households that consume more carbon will receive lower net benefits. Figure 5.1 shows how the percentage of California households receiving positive net benefits varies with the percentage of allowance value allocated to dividends.[81] For example, with 60% of allowance value returned to households as dividends, 54% of households would see positive net benefits.[82]"

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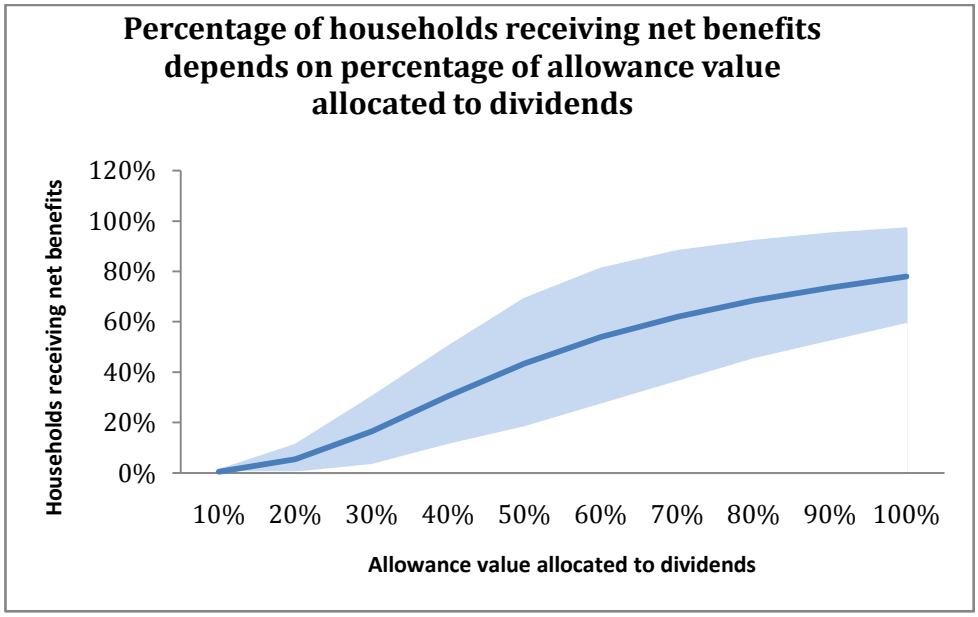
[81] Figure 5.1 is based on California household consumption data from the American Community Survey and the Consumer Expenditure Survey; for details, see memorandum to EAAC from Cathy Kunkel and Daniel Kammen of the University of California, Berkeley, dated November 9, 2009. The fraction of households receiving net benefits shown here is the average of two estimates reported in Table 5 of the Kunkel-Kammen memorandum: the first excludes indirect carbon consumption (i.e., other goods and services apart from direct energy use); the second includes all indirect carbon consumption. The former underestimates costs to households by omitting non-energy consumption; the latter overestimates costs because not all other goods and services consumed by California households are produced in state. The shaded area in the figure shows the range between these upper and lower bounds.

[82] See the Kunkel-Kammen memorandum for an analysis of regional variations in the percentage of households receiving net benefits, accounting for regional variations in electricity emissions and consumption of gasoline and natural gas.

Figure 5.1: Percentage of California Households Receiving Net Benefits[83] from Alternative Allocations to Dividends



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 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. At a carbon price of \$30/tCO_2, the following table shows the estimated state government revenue in 2020 from taxing dividends given to adults in CA. This table assumes an average income tax rate of 5.6%.[84]

[83] *Note:* "Net benefit" = dividends received by the household minus the amount paid by the household due to higher fossil fuel prices as a result of the introduction of cap-and-trade provisions of AB 32.

Source: Kunkel-Kammen EAAC memo, November 9, 2009, Table 5 (average of percentages of California households receiving net benefits calculated with and without the indirect component of carbon consumption).

[84] Franchise Tax Board, http://www.ftb.ca.gov/aboutFTB/Tax_Statistics/Reports/Personal_Income_Tax/AGIC_Tables/2006/PDF/2007_Comparison_By_Tax_Years.pdf

Table 3

Fraction of auction revenue returned as dividends		.9	.8	.7	.6	.5	.4	.3	.2	.1
State Income tax revenue (million $)	$440	$400	$350	$310	$260	$220	$180	$130	$88	$44
State and Local Sales Tax Revenue ($ MM)	$275	$250	$219	$194	$162	$138	$112	$81	$55	$28

For some households that are severely constrained by the cost of living, dividends may in effect be spent before they are received. However, for the majority of households, dividends would not necessarily be allocated to particular expenditures before they are received. This provides an opportunity for the state agencies or private business to develop programs to encourage households to allocate these funds to program-reinforcing investments in their own homes, or to invest funds in program-related trust funds that might be established to promote an energy transition in California. The state could amplify these opportunities by designating dividends directed to specific types of program-reinforcing expenditures to be tax free, and perhaps even qualifying for additional incentive programs.

5.4 Tax Rate Reduction

Another potential use of proceeds from an allowance auction is to finance cuts in existing California tax rates—in particular the rates of income or sales taxes. This alternative effectively substitutes auction revenue for other taxes as a way of meeting the state's spending needs.

Like the cap-and-dividend option described in the previous subsection, this is a way to provide allowance value to households. However, while cap and dividend offers allowance value as a lump sum or rebate, this approach offers such value through cuts in marginal tax rates.

A principal attraction from using auction revenue to cut marginal rates is the ability to lower the costs of a cap-and-trade program. Income and sales taxes lead to reduced production and incomes 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 magnitude of the distortion increases with the tax rate. 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.[85] Using auction revenue to finance cuts in the marginal rates of these

[85] 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,

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. [86,87]

The cost savings under California's cap-and-trade system could be substantial. This total saving is equal to the avoided excess burden, which is net reduction in collections from existing taxes times the marginal excess burden of those taxes. Table 2: Prepared by Cal/EPA and ARB EAAC Policy Team (October 20, 2009). Values are 2007 dollars.Table 2 offered estimates of total allowance value from an AB 32 cap-and-trade program. For the year 2015, the estimates ranged from $6 to $18 billion. Suppose that the auctioning of emissions allowances were to bring in net revenue of $10 billion. [88] Based on the estimates for marginal excess burden immediately above, devoting this net revenue to cuts in income tax rates would save between $2 and $10 billion in that year— a very large share of the allowance value. These would be real savings in income to Californians.

Using allowance value to finance tax reductions mainly serves cost-effectiveness objectives. On its own, or in its simplest form, it would not serve some other important goals. In particular, if allowance value were used to cut the rates of income taxes, then households that are already exempt from income taxes (perhaps because of very low incomes) would not benefit from the rate cuts. This raises equity concerns. However, not all allowance value needs to be devoted to tax rate cuts. This approach does not preclude other uses of allowance value, including the targeting of some allowance value to compensate low-income households, as discussed in subsection 5.1. A hybrid program in which allowance value is used both for tax-rate reduction and targeted compensation is an attractive way both to achieve considerable cost-savings while accomplishing fairness goals in a targeted way.

Some interested parties express doubts as to whether the state could be counted on to use the proceeds from an allowance auction will indeed be accompanied by tax rate cuts. They may fear that the proceeds would be devoted to unproductive increases in government spending. However, the state could explicitly commit to linking allowance proceeds to tax rate cuts. British Columbia recently provided such linkage in requiring that the net proceeds from its recently passed carbon tax be devoted to income tax cuts, and it has followed through on its commitment.

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.)

[86] Another option, applicable in other settings, is to use auction proceeds to finance reductions in the 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. It therefore yields cost-savings much like cuts in current tax rates do. However, since California law requires the state to balance its budget, the deficit-reduction issue does not apply here.

[87] Many analysts have supported the idea of "green tax reform" – the substituting of environmental taxes such as carbon taxes or gasoline taxes for ordinary taxes such as income or sales taxes. <cites> Such reform causes the tax system to apply more to "bads" like pollution and less to "goods" like work effort, saving, or investment. Using auction proceeds is like green tax reform in that it substitutes This would cause the taxes t system to do more to discourage "bads" like pollution and less to

[88] We refer to *net* revenue because the relevant value is gross auction revenue minus the change in tax revenue associated with changes in the tax base. To the extent that AB 32 reduces (increases) state income, the income tax base will fall (rise), and revenues from other taxes will fall (rise) as well.

6 Recommendations *[Note: These are preliminary and tentative]*

6.1 Allowance Distribution Method

1. The Committee recommends that ARB rely principally, and perhaps exclusively, on auctioning as the method for distributing allowances.

   As indicated in Section 2 above, auctioning has several attractions, including price discovery in the market and transparency in the assignment of allowance value. In addition, nearly every objective or conferral of allowance value sought through free allocation of allowances can be achieved through auctioning and the associated use of auction proceeds.

2. The Committee finds only one purpose for which free allocation seems advisable: to address emissions leakage problems associated with energy-intensive, trade-exposed industries. However, even for this purpose, in many instances an alternative approach not involving free allocation – namely, the use of border adjustments – is preferable.

   As discussed in Section 2 above, there are two main ways to address potential emissions leakage. One is through border adjustments, according to which the emissions associated with imported fuels or other products are considered part of the cap-and-trade system. This eliminates incentives to escape the regulations through increased imports. The other way is the awarding of free, output-based allowances. As indicated in Section 2, border adjustments are a better approach because they do not promote inefficient increases in output. However, in some instances it will be difficult to obtain the information needed to introduce border adjustments effectively. In those circumstances, free, output-based allocation appears appropriate.

3. The Committee's initial finding is that addressing leakage through free allocation would require a very small share of allowance value.

The Committee arrives at this conclusion based on three observations. First, the industries with both high energy-intensity and substantial trade-exposure represent a very small share of California production (see Section 5). Second, in many cases, border adjustments (a more cost-effective option) are feasible. Third, the problem of leakage – which provides the main potential basis for free allocation – would be substantially reduced with the arrival of a regional or national-level cap-and-trade policy.

4. The Committee advises the ARB to address leakage in a way that promotes flexibility, so that if the emergence of regional or federal policies eliminates most of the leakage problem, California's allocation efforts can easily be adjusted accordingly.

5. A uniform price, sealed bid (single round), double auction is a strong candidate for the choice of auction design, and it is a good default choice in the absence of compelling reasons for choosing an alternative. Resolution of ancillary design features that EAAC identifies, including more detailed rules governing the auction, should be considered through subsequent analysis sponsored by the ARB. Laboratory experiments are recommended to test the auction design and guide decisions about subordinate auction rules. The state may want to conduct a bidding procedure to select a third-party vendor to run the auction.

As discussed in Section 2, the uniform price, single-round auction is the simplest design and the easiest to understand. It is easy to develop a bidding strategy for this design, and the operations and outcome of the auction are transparent to participants and observers. It also conveys a sense of transparency about the overall operation of the market. This makes it an accessible auction institution for participants, non-experts and the public. These attributes can be expected to help build public trust in the allowance market. Consequently, the uniform price, sealed bid auction is a strong candidate for the default choice of an auction design unless other attributes of the market or commodity provide a compelling reason for a different choice. We do not find evidence of a reason to substitute away from this design.

A double auction, with sellers as well as buyers able to participate, provides assurance to many parties that there will be a low-cost way to participate in the market and there will be a liquid market.

6.2 Provision of Allowance Value

6. The Committee recommends that the ARB devote allowance value to several different purposes, including preventing adverse impacts, the financing of various investments, and the returning of residual value to households in the form of dividends or marginal tax rate reduction.

7. The Committee recommends that sufficient allowance value be conferred to low-income households to avoid disproportionate adverse economic impact of AB 32 on such households.

Such conferral should be accomplished through rebate checks rather than through subsidized energy prices.

This is in keeping with the language of AB 32, requiring that the law be implemented in a way that "ensures that compliance with the regulations does not disproportionately impact low-income communities." The Committee's rough estimate is that providing <xx-xx> in allowance value would offset potential adverse impacts to households in the lower 20 percent of the state's income distribution. This could be accomplished through rebate checks directed to such households. The alternative of dividends to the public would also serve as means of distributing value that could offset the negative impact of AB32 on low-income households.

Rebate checks prevent disproportionate impacts on household incomes without eliminating consumers' incentives to conserve energy and thereby reduce their contributions to GHG emissions. Subsidized prices remove such incentives, thus contravening a main objective of AB 32. They undermine the program by distorting the relative prices of goods and services away from a uniform accounting for the cost of CO_2 and other GHG emissions.

8. While the Committee supports using allowance value to protect incomes of low-income households, it recommends against the additional conferral of allowance value to electricity consumers (whether directly or indirectly through provision to local distribution companies).

It is often pointed out that the effects of AB 32 are likely to be expressed significantly in the form of higher electricity prices. While this is correct, the Committee believes that preventing increases in electricity prices would undercut a main purpose of AB 32: to provide incentives for reduced electricity consumption (and associated emissions reductions). We believe that it is appropriate to prevent low-income households from experiencing significant adverse impacts, and that the most effective and environmentally responsible way to do this is through the direct transfer of allowance value to households via rebate checks (as discussed in Recommendation 7 above) rather than through cuts in electricity rates.

Another concern is that some electricity consumers will face higher price increases than others as a result of AB 32. This is indeed possible. In particular, consumers in Southern California may experience larger electricity price increases because of the greater dependence of Southern California utilities, through long-term contacts, on out-of-state, coal-fired generation. However, as detailed in Section 5, up to now Southern Californians have tended to enjoy lower electricity prices because coal-fired generation has been an especially low-cost source of electricity. As a result, electricity prices faced by Southern California consumers are unlikely to be any higher than those faced by other consumers after AB 32.

9. If, contrary to the recommendation in 8 above, the ARB elects to allocate allowance value to the electricity consumers, this should be phased out within ten years of passage of AB32 and should be accomplished only through local distribution companies. In this case, ARB and its partner agencies should provide direction on how funds sent to the LDCs should be used.

Phase out within ten years of passage of AB32 would ensure that the implicit subsidy to electricity consumption associated with the allocation was ended by the time transportation was brought into the program in 2016.

10. The Committee finds little reason to support industry profits with allowance value, except when this is an indirect result of efforts to prevent potential leakage.

AB 32 can cause reductions in profits of some industries, and this can be reflected in lower stock prices. It is sometimes claimed that allowance value should be used to compensate stockholders for the losses associated with the reductions in stock prices. The Committee felt that this argument is problematic, for two reasons. First, to a significant extent, stock prices already have been affected by the anticipation of AB 32. Many stockholders have already sold their shares at a loss. Awarding allowance value to affected industries will not benefit the stockholders that no longer own shares in these industries. Second, it is not clear that the state should absorb the risk associated with stock purchases by buttressing stock prices. It seems reasonable to expect individuals that purchase stock to recognize the potential impacts of future energy or environmental policies. Indeed, the anticipation of these risks has put downward pressure on stock prices historically; this implies that many current shareholders have benefited by being able to purchase shares in these industries at relatively low prices.

11. The Committee recommends that ARB devote a significant share of allowance value toward financing of public and private investment oriented toward achieving emissions reductions, adaptation, and environmental remediation. The price signal provided by the price of emissions allowances, along with the complementary policies included within AB 32, will help achieve the goals of the legislation. However, as discussed in sections 4 and 5, because of market barriers there are some important forms of investment and related environmental efforts that will not be triggered by these two elements.

12. The ARB's selection among alternative investments to be financed through allowance value should be based on considerations of economic efficiency (aggregate social net return) and fairness, as well, as considerations of what is specifically required under AB 32.

As discussed in Section 5, the criterion of aggregate social net return integrates attention to environmental effectiveness and cost. It accounts for the external benefits from various investments as well as the cost of the investments.

13. The Committee recommends that CARB have final authority over decisions as to the specific investments to which allowance value can be devoted. As the primary state agency entrusted with ensuring California meets its AB 32 reduction target, CARB is in an excellent position to ensure allowance revenue is invested in accordance with AB 32-based criteria identified below. CARB, in conjunction with the Investment Advisory Panel described below, would identify investment options that achieve cost-effective reductions that the private market is not capturing. CARB would direct these funds to state, regional, and local agencies as well as private entities to carry

out reduction projects. CARB has experience in administering funds, having overseen the Carl Moyer Memorial Air Quality Standards Attainment Program since 1998[89]. Utilizing an existing institution like CARB further ensures that the maximum amount of allowance revenue flows back into the economy, not into the administrative costs of creating an entirely new state agency[90]. EAAC also recommends CARB establish an independent Investment Advisory Board to provide CARB with expert input. CARB and the Advisory Board in partnership with other state, regional, and local agencies, should identify potential investments that meet the recommended criteria. CARB should then direct funds to the appropriate agencies to invest the emission reduction projects. CARB should also solicit proposals from state, regional, and local agencies and private parties for investment programs. The Advisory Board and CARB should devise a standardized investment application form that is simple to fill out and that makes the evaluation criteria (see below) clear to all applicants. A streamlined process will limit waste and will not disadvantage local agencies and smaller groups with limited staff. CARB and the Advisory Board should evaluate applications against the criteria below, and pick those that most closely meet the criteria. This should be done on a rolling basis, as allowance value becomes available. CARB and the Advisory Board should issue a quarterly report describing where the funds are being invested, what agency is in charge of each emission reduction program, and how each program meets the criteria below. This will make the process public to engender confidence in the useful investment of allowance value, and to help future applicants improve their applications.

14. The Committee supports the return of the residual allowance value to individuals either through fixed rebates (as under the "cap and dividend" proposal) or through cuts in individual income tax rates.

> The Committee did not reach full agreement as to which of these two approaches should be adopted. As indicated in Section 5, an attraction of the cap-and-dividend approach is that it is relatively transparent and would not require changes to the tax system. Many are attracted to the fact that it can simultaneously protect incomes of low-income households while also benefiting middle-and-upper income households. An attraction of tax cuts is that, by reducing existing tax rates, they enable the state's economy to operate more efficiently and thereby lead to increases in private income (to low-, middle- and high-income individuals) over and above the increases directly associated with the tax cuts. Supporters of this option favor its use in conjunction with the direct transfers to low-income households discussed in Recommendation 7 above; this two-pronged approach -- the combination of transfers and tax cuts – is seen as a more flexible way to meet the two objectives of fairness and economic efficiency.

[89] Details here.

[90] Details here.

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