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TO: Winston Hickox, Chair, Market Advisory Committee
Lawrence Goulder, Vice-Chair, Market Advisory Committee

FROM: Robert Stavins*

DATE: June 15, 2007

RE: ***Comments on the Recommendations of the Market Advisory Committee to the California Air Resources Board, "Recommendations for Designing a Greenhouse Gas Cap-and-Trade System for California"***

The Market Advisory Committee (MAC) deserves tremendous credit for having given careful consideration to many of the key issues associated with the design and implementation of a greenhouse gas (GHG) cap-and-trade system for California pursuant to the goals of Assembly Bill 32, the Global Warming Solutions Act of 2006.

The recommendations by the MAC can offer a valuable foundation for future consideration of how best to design such a system. In its draft report, the MAC has identified many of the key elements of the design of an effective cap-and-trade system for GHG emissions. In addition, it has identified some (though not all) of the key issues that arise from the system's geographically limited scope.

The comments I offer in this memorandum on the MAC's recommendations are limited to the issues listed below. In many cases, I agree with the MAC's recommendations, and offer comments in order to contribute to broader debates about climate policy design in California, which will continue for years to come. There are also instances where I disagree with the MAC's conclusions or believe the MAC failed to consider an important factor that may alter its recommendations.

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Topics Covered in These Comments

1. The value of a market-based approach for achieving California's climate policy objectives
2. The role of environmental justice concerns in shaping climate policy
3. The trajectory of emissions targets before 2020
4. The choice between an upstream and downstream point of regulation
5. The scope of coverage of a cap-and-trade system, and whether and how to include the transportation sector
6. The broader importance of leakage beyond that in the electricity sector
7. Banking and borrowing of allowances
8. Protection against cost uncertainty
9. Creation of a stable regulatory environment for cost-effective emission reduction investments
10. The environmental and social cost implications of the initial allocation of allowances
11. The distributional consequences of an allowance auction
12. Early-action emission reductions
13. The role of offsets

Due to time constraints in compiling my comments, I have not fully documented the extensive support that exists for my conclusions. I plan to submit a revised version of these comments in the near future in which I will provide a complete set of appropriate citations and references. In the meantime, I will be happy to address any questions that may emerge from the review of these comments.

1. The Value of Adopting a Market-Based Approach in California Should Not Be Underestimated

Although no individual policy instrument is the best option for all environmental problems, in the case of greenhouse gas emissions (in particular, carbon dioxide (CO_2) emissions), a cap-and-trade system stands out as an approach that can provide a level of environmental integrity and cost savings that conventional source-specific regulations simply cannot match.

California has established a statewide emissions target for 2020. Under a standards-based approach, the government would need to piece together a broad and complex patchwork of regulations to achieve this statewide target. It is inconceivable that such a set of technology standards and conventional, uniform performance standards could provide the economy-wide coverage that is called for in the case of CO_2 emissions reductions. Such regulation would inevitably focus on a limited set of emissions sources, leaving many sources and sectors outside

of the regulatory framework. In addition, standards typically focus on requirements for *new* emissions sources, but do not address emissions from existing sources. Examples include GHG standards for new cars, and standards setting maximum emissions rates for new power plants. And even among new sources, standards cannot possibly regulate all of the millions of sources of GHG emissions.

Standards cannot offer a high level of certainty regarding emissions levels, because standards cannot address numerous factors that influence statewide emissions, leaving resulting statewide emissions highly uncertain. For example, under a standards-based regime, statewide emissions will depend on emissions from unregulated existing sources and from those new sources that are not subject to standards. Statewide emissions will also depend on how quickly the existing capital stock is replaced with new equipment that is subject to the standards, and on how much growth there is in the number of emission sources, such as the number of cars on the road. Finally, standards often regulate emission rates for particular equipment, such as GHG emissions per mile driven, rather than regulating total emissions. As a result, statewide emissions will also depend on how intensively emissions-generating equipment is used.

The implementation of standards would lead to unintended consequences that affect emissions. Indeed, experience has shown that standards give rise to some very unfortunate and very important unintended consequences. For example, energy-efficiency standards reduce the cost of operating regulated equipment, and thereby can cause that equipment to be used more often. Thermostats are adjusted and air conditioners are run more often. This is the so-called "rebound effect" that reduces the emission reductions that result from standards. Similarly, by making new equipment more costly to purchase, standards on new emission sources encourage *delays* in the replacement of existing equipment. This likewise diminishes the effectiveness of standards at achieving emission reductions, as has been documented with vehicle fuel economy standards, new source emission standards for power plants, and other regulations. In addition, standards can encourage consumers to shift among regulated activities in ways that run counter to the standards' very objectives. One example of this is the shift from cars, which have more stringent fuel economy standards, to SUVs, which face weaker standards.

Many of these unintended consequences result from the *problematic incentives* that standards create, compared with the *efficient incentives* introduced by cap-and-trade systems. For example, as I described above, standards discourage replacement of existing capital equipment with new lower-emitting equipment, and thereby may *delay* such replacement. On the other hand, by covering emissions from both new *and existing* sources, a cap-and-trade system *encourages* firms to replace existing equipment with more efficient new equipment, and can thereby *speed up* such replacement.

As the MAC report describes, a cap-and-trade approach offers an opportunity to guarantee that regulated entities achieve the aggregate emissions target. Moreover, by implementing an "upstream" cap on the aggregate carbon content of fossil fuels consumed in California, as I discuss below, a cap-and-trade program can guarantee achievement of an aggregate emissions target from nearly all sources of fossil-fuel related CO_2 emissions in the State, covering emission from far more sources than could be targeted through conventional

standards alone. Thus, not only will a cap-and-trade program guarantee achievement of real emission reductions, it can bring about emission reductions that simply could not be achieved through standards.

As is well known and as the MAC report notes, another key argument in favor of a cap-and-trade system is its ability to achieve a given aggregate emissions target at lower cost than conventional policy instruments, such as technology or uniform performance standards. Importantly, the cost savings from a cap-and-trade approach would be substantial. When leaded gasoline was phased out of the market in the United States in the 1980s, it was done through the U.S. Environmental Protection Agency's lead rights trading program, getting the job done faster than anyone had anticipated and at a savings of approximately $250 million per year. More recently, the ongoing sulfur dioxide (SO_2) allowance trading program has achieved cost savings of $1 billion per year, representing a savings of 30% to 50% or more, relative to the cost of conventional standards.

The cost savings from a cap-and-trade system for GHG emissions would be even greater. This is because of the magnitude of the program and because of the tremendous diversity (cost heterogeneity) of the individual emission sources. Conventional standards would require that California devote more of its scarce resources toward achieving a given amount of emission reductions—resources that could be put toward achieving *more* emission reductions. Also, given the ambitious nature of California's AB 32 targets, the difference in cost between the two approaches could determine whether or not Californians ultimately perceive the economic consequences of the climate policy to be acceptable or not.

This is not to say that the choice is necessarily between an exclusively market-based approach and an exclusively standards-based approach. I agree with the MAC that certain emission sources ought not be regulated under a cap-and-trade system because of monitoring difficulties. Such sources may be better addressed through complementary standards. But a cap-and-trade approach should cover as many sources as can be practically included under it.

For some sources that can be covered by a cap, there may be legitimate policy justifications for particular source- or sector-specific standards, apart from the direct and immediate GHG emission reductions they offer. In this case, it is better to view a cap-and-trade program as an umbrella under which limited additional standards could be imposed for reasons apart from their direct emission reduction benefits. But, as I describe below, in some cases standards can interact with a cap-and-trade system in problematic ways that interfere with the system's cost-effectiveness. In these cases, very careful thought must be given to whether both regulatory approaches should be employed simultaneously on relevant sources, and whether the design of either approach must be modified to reflect the other's presence.

2. Adjustments to a Cap-and-Trade System on the Grounds of Environmental Justice Should Be Based on Evidence of Adverse Consequences, Not Speculation

It is clear from the MAC report that environmental justice concerns, that is, impacts on low-income populations, are playing a very significant role in influencing the debate about California climate policy. While concerns about environmental justice are certainly understandable, there is a real risk that the translation of such concerns into guidance for climate change policy may be misguided.

Although it is common knowledge, it bears repeating that climate change is a long-term global commons problem. As a result, nearly all of the benefits from California's actions will be enjoyed by future generations in other states and other countries of the world. Likewise, any climate change protection benefits enjoyed within California will be the same no matter where in the world emission reductions are achieved. Therefore, there are no grounds for environmental justice concerns on the basis of benefits from GHG emission reductions themselves. Any concerns about environmental justice must relate to the effects of California's climate policy on so-called "correlated pollutants." In this respect, it should be acknowledged that climate policy is a terribly blunt instrument to use in trying to achieve reductions in non-GHG emissions.

Favoring a standards-based approach over a cap-and-trade system on the grounds of environmental justice would invariably increase the costs of achieving California's climate policy objectives. Therefore, it is important to compare the benefits of such an approach, from an environmental justice standpoint, with its costs. In this context, a number of points merit consideration.

First, limiting the flexibility offered by a cap-and-trade approach not only would increase costs to Californians as a whole, but it would disproportionately increase costs for the low-income households of greatest concern from an environmental justice perspective. Regardless of what approach is taken to reduce emissions, climate policy will increase the cost of energy and energy-consuming durable goods. Such increases in costs are regressive—meaning that they disproportionately burden low-income households—because low-income households allocate a greater share of their income and expenditures to energy purchases.

Second, a cap-and-trade system for GHG emissions would not supplant existing local air quality regulations. If a firm's actions in engaging in an emission trade would violate local air quality regulations for, say, NO_x emissions, those actions would be illegal and disallowed no matter how many GHG emission allowances were to be obtained. Thus, a cap-and-trade system for GHG emissions would not interfere with local air quality regulations—only legal trades would be legal. This is an important point that the MAC report has not emphasized.

Third, it is far from clear that the emissions trading that yields cost savings in a cap-and-trade context would have any adverse consequences from an environmental justice standpoint. Trading displaces the highest-cost emission reductions that would otherwise occur with lower cost emission-reduction measures. Some of those expressing concerns about environmental justice have apparently assumed that those high-cost reductions would be from sources with high

emissions in low-income communities. But the high-cost emission reductions may be located in areas *without* air pollution problems. Indeed, the shifting of emission reduction efforts that occurs under a cap-and-trade system, relative to a standards-based approach, may very well achieve *more* emission reductions in areas with the greatest local air quality problems. For example, the MAC report notes (at p. 9) that, under the SO_2 allowance trading program, the greatest emission reductions occurred in areas with the highest emission levels. Therefore, there is a real risk that modifications to the design of a cap-and-trade system arising from environmental justice concerns would be based only on speculation, and may actually negatively affect low-income households.

As a result of the above considerations, I strongly support the MAC's suggested approach of carefully monitoring impacts of a GHG cap-and-trade system on local air quality, and making any mid-course corrections that appear to be necessary based on that monitoring. This approach is far more sound than limiting the flexibility offered by a cap-and-trade system at the outset based on speculation about the consequences of a more flexible system, particularly given that local air quality regulations will remain in effect with or without a cap-and-trade system.

3. A Gradual Departure from Business-as-Usual Emissions Leading Up to 2020 Is Appropriate

Anthropogenic contributions to climate change will depend on *cumulative* emissions of GHGs over decades, not emissions in any one year. As a result, when evaluating whether a climate policy is cost-effective (that is, whether it achieves the environmental objective at least cost), it is essential to consider whether emission reductions in a given year could be achieved at lower cost in a later or earlier year. In light of this, I strongly agree with the MAC's recommendation that emission caps prior to 2020 should gradually—rather than suddenly—depart from business-as-usual levels. While such an approach should generally be favored in any climate policy, it is particularly desirable given the regulatory schedule for implementing AB 32.

Most cost-effective emission reductions will require changes in California's energy-consuming capital stock—that is, cars, trucks, industrial equipment, and power plants. Relatively few reductions can be achieved cost-effectively through changes in the use of the existing capital stock. While much progress likely will be made through the changing capital stock by 2020, it is exceptionally costly to force such changes overnight—as it would require the premature retirement of existing investments. Thus, given that the final details of a California cap-and-trade system may not be established until 2011, anything other than a gradual departure from business-as-usual emission levels beginning in 2012 may cause significant and ultimately unnecessary economic disruptions.

4. The MAC Report Understates the Advantages of an Upstream Point of Regulation and Overstates the Advantages of Downstream Regulation

An exceptionally important design issue for a climate change cap-and-trade program is the point of regulation, that is, the point in the chain of activity from fossil fuel extraction to energy consumption which is directly targeted for regulatory compliance. Some prior cap-and-trade systems, such as the SO_2 allowance trading program, have enforced compliance with an emissions cap through downstream regulation of emissions from regulated sources. But in the context of climate change policy, the direct relationship between fuel consumption and CO_2 emissions presents the opportunity to broaden the scope of emissions covered by a cap while reducing implementation costs through upstream regulation of the carbon content of fuels supplied in California. While an upstream approach may be less familiar to some stakeholders, it is by no means without precedent in the United States. For example, an upstream approach was used in the 1980s with great success to cap and phase-out lead emissions from motor vehicles by regulating the lead content of gasoline. It was also employed in phasing out the use of ozone depleting substances in the 1980s and 1990s, by regulating their production and import, rather than the emissions that result from their actual use.

The MAC report presents two options for the scope of a cap's coverage and its point of regulation. Option A would retain downstream regulation of medium and large point sources throughout the lifetime of the program, and would slowly adopt upstream regulation of transportation fuels and small residential, commercial, and industrial sources. Option B would begin from the outset with upstream regulation to cover fossil-fuel related CO_2 emissions from all sources covered by the cap.

In evaluating the choice between upstream and downstream regulation, the MAC report unfortunately understates the advantages of an upstream approach and overstates the advantages of a downstream approach.

Upstream Regulation Offers Broader Coverage while Regulating Fewer Sources, Expanding Effectiveness, Reducing Emission Reduction Costs, and Reducing Administrative Costs. An upstream cap-and-trade approach can be used to cover all fossil-fuel related emissions of CO_2. This broader coverage achieves real reductions in the cost of achieving California's emissions targets by broadening the scope of low-cost emission reductions that can be realized under the cap. And, as the MAC report identifies, this broader coverage can be achieved at far lower administrative costs—requiring regulation of just 50 sources, rather than 450 to 490 or more.

Upstream regulation can still allow for the exclusion of certain sources of fossil-fuel-related CO_2 emissions if that is necessary because of practical constraints, such as leakage. For example, particular downstream (or upstream[1]) sources could be monitored and given allowances for each ton of emissions generated from fossil fuel use associated with an exempted activity.

[1] Exemption of jet fuel from an upstream cap could be achieved by adjusting the allowance requirements that refineries would face under upstream regulation.

This would effectively offset the impact of the upstream allowance requirement on the cost of their fossil fuel use. Such an approach, which would require monitoring the few exempted sources or fuel uses, would likely be far less administratively costly than having to monitor downstream emissions from all included sources just in order to exempt a few. Likewise, upstream regulation would include programs to credit particular "end-of-pipe" emission reductions, such as carbon capture and storage. However, such emission reductions would be achieved at relatively few emission sources, so monitoring those specific sources in addition to upstream sources would be less costly than monitoring *all* downstream sources simply to account for the few that undertake such specialized end-of-the-pipe reductions.

A Full Upstream Program Likely Would Provide Earlier Certainty About the Stringency of the Cap. The sooner that a cap is established for 2012 and the sooner that the stringency of that cap is known (relative to business-as-usual levels), the sooner will firms and households begin to make investments to prepare for the cap, and thereby the lower will the cost of meeting the cap be. It is clear that volatility in the downstream EU Emissions Trading Scheme was directly related to uncertainty about emissions from regulated sources that was still present even after the program went into effect. An upstream approach would allow regulators to develop a cap earlier than a downstream approach—providing greater certainty to the market.

In order to set an emissions cap, regulators will need to know the recent emissions from capped activities in order to understand the implicit stringency (and cost) of the cap they are setting.[2] To estimate these emissions, regardless of whether upstream or downstream regulation is adopted, regulators will need to develop methods of measuring either emissions (under a downstream approach) or fuel supply (under an upstream approach) from all regulated sources. The advantage of upstream regulation in this regard is that monitoring practices must be developed for far fewer sources—just 50, compared with the 450 medium and large downstream emission sources (with the exception of electric generators that already have monitoring in place). Moreover, what would need to be monitored from these 50 sources is the core focus of their business activity—that is, the fuel that they supply.

By contrast, a downstream approach requires the development of monitoring methods for what was previously a peripheral byproduct of regulated sources' business activity—that is, their emissions. Both the number of sources regulated under an upstream approach and the nature of the activity being monitored indicate that developing specific monitoring protocols will be far easier for an upstream program. Moreover, while emissions from large point sources may nonetheless be included in the California Air Resources Board's (CARB's) mandatory reporting program, determination of an appropriate cap for an upstream program could go forward regardless of whether there are delays in the development of emissions reporting methods for each downstream source. The same is not true for a downstream approach.

[2] Ideally, regulators would evaluate *expected business-as-usual* emissions from regulated sources in setting the cap in the early years of the program. This is because the cap's stringency depends on the level of the cap, relative to this business-as-usual level. But knowing recent emissions from those sources would provide at least a starting point for evaluating the cap's stringency.

An Upstream Cap-and-Trade System Would Provide a Better Model for a National Program. One of California's goals is to lead the way in the development of national climate policy. At the national level, it is clear that an upstream approach is far preferable to a downstream approach. Thus, adopting a fully upstream approach would set a better example for national policy development. Indeed, adopting a downstream approach would create a problematic precedent for a national program.

Many Arguments In Favor of a Downstream Approach Do Not Withstand Scrutiny. Despite the clear and substantial environmental and cost-saving advantages of adopting a broader upstream cap-and-trade system at the outset, the MAC report offers several arguments in favor of Option A and its associated downstream approach. Many of these arguments do not withstand scrutiny.

The MAC report indicates that implementation of a downstream program for medium and large emission sources could begin "in the very near future," seemingly suggesting (although not explicitly stating) that an upstream program could not be implemented as quickly. As described above, it is not at all clear that the key details of a downstream cap—most importantly the level of the cap itself—could be ironed out more quickly than the specifics of an upstream cap. The MAC report needs to provide much better support for this argument than it currently offers.

The MAC report suggests that "serious" problems of double counting could arise from linking an upstream California cap-and-trade system with other downstream cap-and-trade systems, but that depends completely on the nature of the markets being linked. For example, it is not at all clear that double counting concerns would arise from linking an upstream California program with a downstream RGGI program.

The MAC report expresses the view that people will be more likely to reduce emissions if they have to hold allowances. There is no basis in economic theory nor any empirical evidence whatsoever for this proposition. On the contrary, the strong financial incentives for emissions reductions are identical with an upstream system, as powerful price signals are sent throughout the economy. Furthermore, the MAC ignores the fact that California will have mandatory emissions reporting for large sources. Given this mandatory reporting requirement, it is even more difficult to picture any incremental effect due specifically to the need to surrender allowances. Finally, some have argued that the plant engineers who make decisions about pollutant emissions levels will react to the physical necessity to hold allowances, but not the economic incentive to minimize costs. This ignores the dramatic change that was anticipated and that has indeed been observed in the SO_2 allowance market, namely that with the implementation of market-based instruments for environmental regulation, the point of decision-making on pollution control in regulated firms moves upward from plant engineers to financial decision makers. This was anticipated by the program's designers and has been validated both by casual observation and empirical research.

5. Scope of Coverage: More Thought Is Required to Determine How to Regulate Transportation Sector Emissions, Including Whether to Include Them under the Emissions Cap

The MAC report recommends that "the cap-and-trade program start out with the broadest coverage consistent with the exclusion of entities that pose serious administrative costs or monitoring difficulties" (p. 23). Two factors stand out as additional considerations in determining the appropriate scope of coverage that deserve explicit mention in this overarching recommendation. First, little is gained by extending the cap-and-trade system to sources for which leakage would be a significant issue (a topic I address below). For example, the MAC has sensibly recommended that a California cap not include emissions from jet fuel consumption, given the ease with which airlines could transfer much of their refueling out-of-state. Second, interactions between a broad-based cap-and-trade system and pre-existing or planned sector-specific regulations must be carefully considered. This issue is most prominent in considering whether to include the transportation sector under the cap. The MAC's efforts represent just the beginning of the thought that needs to be given to how transportation sector emissions should be addressed, as I explain below.

As the MAC report acknowledges, most studies find that a cost-effective set of emission reductions across the economy would involve relatively small reductions in emissions within the transportation sector, because it is simply less costly to reduce emissions from other sources. But for policy reasons beyond the achievement at minimum cost of CO_2 emission reductions, California is pursuing two transportation-sector policies that, if implemented, will achieve much greater emission reductions from that sector at much greater costs than would be incurred under a cost-effective economy-wide policy. Specifically, California is in the process of developing a Low-Carbon Fuel Standard (LCFS) for the transportation sector, and has finalized a motor vehicle GHG emission standard, which may or may not ultimately be implemented.

These two transportation-sector policies raise important questions about whether that sector should also be included under a broader cap-and-trade system, and/or whether those sector-specific policies need to be adjusted to make them complementary with a broader cap-and-trade system. The MAC has concluded that these additional regulations do not make that sector's inclusion under a cap-and-trade system "superfluous." The MAC may have arrived at the right answer to the wrong question. As I describe below, much more consideration needs to be given to how to regulate transportation sector emissions.

While the cap-and-trade system may create "different incentives and constraints" than these two transportation-sector policies, interactions between the cap-and-trade system and these two policies may move California even further away from a cost-effective set of emission reduction efforts.

A cursory analysis suggests that from the standpoint of overall social costs a cap-and-trade system may usefully complement the GHG emission standards for motor vehicles, achieving cost-effective emission reductions that could not be achieved by those standards alone. With or without the cap-and-trade system, consumers will be required to purchase more

expensive, more fuel-efficient vehicles as a result of the GHG emission standards. However, absent the cap, the higher cost of these vehicles would encourage consumers to hold on to their existing vehicles longer, delaying the achievement of emission reductions. Inclusion of the transportation sector under the cap may counteract this perverse effect of the standards by encouraging consumers to turn in their existing vehicles for more fuel-efficient models. Moreover, the cap may encourage low-cost emission reductions from changes in driving habits that the GHG emission standards cannot achieve.

The same complementarity of a cap-and-trade system is not necessarily present, however, with respect to the LCFS. The ultimate design of the LCFS is uncertain, but a possible design would be similar to a renewable fuel standard. Under such an approach, for every gallon of gasoline a refiner sells, it would need to obtain credits associated with the sale of a sufficient volume of lower-carbon fuel so that the average carbon intensity of that refiner's sales meets a particular standard.[3] Such credits would be very similar to the allowances that a refiner would be required to surrender under an upstream cap-and-trade system: both would be required for every gallon of gasoline, and both would effectively increase the cost of marketing each gallon of gasoline. Therefore, if an upstream cap-and-trade system were layered on top of the LCFS, together the two programs might encourage far more costly emission reductions associated with reduced gasoline consumption than would be encouraged through either the LCFS or the cap-and-trade system on its own. Importantly, these reductions would be more costly than opportunities in other sectors covered by the cap. As a result, the interaction of the two policies would increase the cost to California's economy associated with meeting its emissions target, relative to implementing only the LCFS or only the cap-and-trade system within the transportation sector.

Here is a simple numerical example of what would happen if California were to pursue a broad cap-and-trade system that included upstream regulation of transportation-sector emissions, and refiners had to obtain allowances for each gallon of gasoline that they produce for consumption in California.[4] Assume that the pre-tax cost of producing gasoline before the cap is implemented is $1.50 per gallon and that the value of allowances that must accompany a gallon of gasoline is equivalent to 50 cents per gallon. This roughly equates to an allowance price of $50 per ton of CO_2. As a result of this allowance requirement, all emission reductions from gasoline consumption that could be achieved at an incremental cost of less than $50 per ton of CO_2 would be achieved.[5] Likewise, in the rest of the economy covered under the cap-and-trade system (and thereby facing the same allowance price) all emission reductions at a cost of less than $50 per ton of CO_2 would also be achieved. As a result, no opportunities would remain to reduce costs by shifting emission reductions among sectors under the cap.

[3] The refiner might create these credits through its own sales, or purchase credits from other marketers of low-carbon fuels.
[4] Actual regulation might be further upstream, such that refiners would have to obtain allowances for each barrel of oil that they process, but the economic effects would be the same.
[5] Note that the full cost of such reductions would be greater still, because of pre-existing taxes on gasoline, but I ignore this issue here for simplicity.

With the cap-and-trade system in place, the cost of producing gasoline (including the allowance value) would be $2.00 per gallon ($1.50 plus $0.50). Now, assume that an LCFS is implemented and there is only one low-carbon fuel that is, in fact, a no-carbon fuel. Also assume that this no-carbon fuel costs $2.50 per gallon to produce. Further assume that the LCFS is set at a level such that one gallon of the no-carbon fuel must be sold for every gallon of gasoline that is sold. Given the cost of this no-carbon fuel and the presence of the previously described cap-and-trade system, the market price of low-carbon fuel credits would be $0.25 per gallon of gasoline sold. At this price, the cost of gasoline production (including the CO_2 allowance requirement) would rise from $2.00 to $2.25, and the cost of producing the no-carbon fuel would drop from $2.50 to $2.25 (an amount equal to the value of the credit), making the no-carbon fuel sufficiently competitive to be sold on the market.

While the LCFS would still be met with the cap-and-trade system in place, the combined effect of the LCFS and the cap-and-trade system would increase the cost of producing gasoline by $0.75 (from $1.50 to $2.25). As a result, in addition to achieving the LCFS goals, the interaction of these two regulations would encourage emission reductions from reduced gasoline consumption that cost as much as $75 per ton of CO_2—reductions that would be 50 percent more costly than reduction opportunities that would still remain untapped in other sectors covered by the cap-and-trade system, indicating a departure from cost effectiveness, that is, an unnecessary increase in aggregate costs for what is achieved.

While the interactive effects of these two regulations will obviously be complex and will depend on the specific design of the LCFS, it is clear from this simple example that imposing both regulations on the transportation sector may increase the social cost of achieving California's climate policy goals. In light of this, more analysis is needed to determine whether the transportation sector should be included under a cap-and-trade system if the LCFS is implemented, whether the LCFS should be implemented if a cap-and-trade system covers transportation, and, if so, how the LCFS should be designed to avoid adverse implications for the cost of California climate policy.

6. Leakage Beyond That in the Electricity Sector May Be a Much More Significant Issue than the Report Implies, Particularly in the Petroleum Sector

Because of the narrow geographic reach of any California climate policy, emissions leakage is a serious concern. While the MAC generally gave the issue of leakage very careful consideration, it makes one statement that warrants correction because it inappropriately understates the importance of leakage in *any* state-level climate policy, including a cap-and-trade system. At page 10 of its draft report, the MAC states, "it should be noted that leakage is more likely under conventional, less flexible regulation [than under a cap-and-trade approach], because leakage depends on the costs in California relative to other states—and the state's costs would be higher if the state relied entirely on conventional regulation."

It is certainly true that the *social* costs of conventional, less flexible regulation would be greater than the social costs of a cap-and-trade approach, and for this reason a cap-and-trade

approach should be favored. However, leakage will not depend on the statewide social costs of a policy instrument. Rather, leakage will depend on the *firm-level* opportunity cost that the chosen policies impose on firms operating in the state. For a leakage-prone sector or activity, under a cap-and-trade approach these firm-level opportunity costs may be *either greater or less than* costs under a conventional regulation—even though the overall social cost of the cap-and-trade approach is unambiguously lower. There are at least two reasons for this. First, while the only costs that a firm faces under conventional regulation are the costs of actual emission reductions, under a cap-and-trade approach a firm also faces the opportunity costs of the allowances that it must surrender to cover its emissions (regardless of whether those allowances are freely allocated or auctioned). Thus, for a given firm, the total firm-level opportunity costs (including allowance costs) associated with a cap-and-trade approach may be greater than the costs under a conventional regulation *even if the firm's emission reduction costs themselves are lower*. Second, while a cap-and-trade approach will lower the overall social cost of meeting a given emissions target, it may impose greater or lesser costs than would a conventional regulation on any given sector under a broad cap. The lesson from this is not that a cap-and-trade approach necessarily leads to greater leakage. It may not. Rather, it should be recognized that leakage is a serious concern under any climate policy. It is essential to consider the incentives that any given policy creates for leakage in leakage-prone sectors.

While the MAC report gives detailed consideration to the potential for leakage in the electricity sector, leakage will also be a serious concern in other sectors. In particular, the potential for leakage in the petroleum sector deserves much more attention.

There are two important dimensions to leakage in the petroleum sector. First, there may be leakage in the production of crude oil and petroleum products (and alternative fuels). That is, a California climate policy may encourage out-of-state shifts in the production of the petroleum and petroleum products that are ultimately consumed in California. I discuss this type of leakage further below. Unfortunately, such a policy also may encourage shifts towards alternative fuels that arise because emissions associated with the production (and consumption) of those alternative fuels are not regulated on an equal playing field with petroleum and petroleum products—and not because of the effects of such shifts on emissions.

Second, there may be leakage in the point of purchase of petroleum products. That is, those who purchase petroleum products may simply shift much of their purchases out-of-state. The MAC report recognizes that this is a serious issue with respect to jet fuel consumption. In its final report, the MAC should offer an opinion on whether it believes this point of purchase leakage is a significant issue that needs to be addressed for other transportation fuels, such as highway diesel fuel and locomotive fuel, or if it has evidence to indicate that such leakage will not be significant.[6]

[6] A significant problem in predicting the potential for this type of leakage is uncertainty about the allowance price that will emerge from a cap. Presumably interstate truckers' refueling behavior will be significantly different if allowance prices are \$80 to \$90 per ton of CO_2—with corresponding effects on fuel prices—than if allowance prices are just \$10 to \$20 per ton of CO_2.

Even if only medium and large point sources of emissions are included under a cap-and-trade system, such a system will increase the cost of producing petroleum products in California. If transportation fuels are included under an upstream cap-and-trade system, such a system will increase further the cost of producing and using petroleum products.

An upstream cap-and-trade system on the carbon content of petroleum products would have a sufficiently large effect on the cost of those products that such a system's adoption would necessitate imposing allowance requirements on imports (as opposed to just in-state upstream sources), and ensuring that the full "life-cycle" emissions of alternative fuels incorporate an appropriate carbon price. Without such regulatory provisions, there could be significant emissions leakage.

While an upstream cap-and-trade system will have a much greater impact on the cost of petroleum products than would a downstream system on medium and large point sources, it is important to recognize that the latter could still bring about leakage in petroleum production. Back-of-the-envelope calculations suggest that a cap on direct emissions from refining would increase the cost of refining petroleum products by 1.0 to 1.5 cents per gallon under a $10 per ton of CO_2 allowance price. Of course, this cost impact would be 2 to 3 cents per gallon under a $20 per ton allowance price, and so on. Much more analysis is required to refine this estimate and to determine the extent to which it represents an average fixed cost of production, versus a marginal cost—which has implications for leakage incentives. But, the potential for significant leakage becomes apparent when one considers that:

- The recently released EPRI study found that allowance prices under a California cap-and-trade system could reach $100 per ton of CO_2 or higher, translating into a 10 to 15 cent per gallon increase in the cost of refining petroleum products in California.

- The transportation costs of shipping gasoline from Washington state are just 3 to 4 cents per gallon, and the costs of shipping gasoline from the Gulf Coast are 5 to 10 cents per gallon[7]

- Despite these transportation costs, California has long been a net importer of gasoline because of supply conditions in California and the relative cost of refining petroleum products in other states and countries—indicating a greater potential for leakage than suggested by low transportation costs alone.

A cap-and-trade system that covers emissions from crude oil producers in California may also bring about leakage arising from the displacement of some in-state crude oil production with imported crude oil whose production is not subject to the same emissions regulations. In particular, in the face of import competition, certain emissions-intensive in-state production methods—such as enhanced oil recovery—that already have high production costs may be rendered uneconomic (and replaced by imports) when subject to a cap-and-trade system. Like the

[7] U.S. Department of Energy, Energy Information Administration, *2003 California Gasoline Price Study Final Report*, November 2003, Table 2-1.

potential for leakage in the production of petroleum products, the potential for leakage in the production of crude oil under a cap-and-trade system deserves closer study.

The potential for leakage in the petroleum sector highlights an important lesson—the extent of leakage will depend on the allowance price under a cap. While petroleum sector leakage under a California cap-and-trade system may be relatively limited at low allowance prices, it may become much more severe as allowance prices rise to higher levels. This is one of many reasons to favor some mechanism for establishing a maximum cap on allowance prices, a design element I discuss below in Section 8 of my comments. Specifically, a maximum cap on allowance prices would not only reduce cost uncertainty, it would also limit undesirable emissions leakage in the event that costs turn out to be higher than expected. Moreover, a maximum cap on allowance prices can relieve the obligation that regulators otherwise would face to evaluate the potential for leakage under a wide range of allowance prices.

While I have focused my comments in this section on leakage in a cap-and-trade system, it is important to reiterate that the potential for leakage in the petroleum sector—or in any other sector—may be just as severe or more severe under conventional regulation.

7. Expectations of a Federal Climate Policy May Discourage Allowance Banking in California, Increasing the Value of Allowance Borrowing

California's contribution to mitigating climate change will depend on its *cumulative* emission reductions over *decades*, and so cost-effective climate policy should be designed to take advantage of temporal flexibility regarding when emission reductions are achieved. A climate policy cannot be cost-effective in mitigating climate change if it requires emission reductions in one year that could be achieved at lower cost in an earlier or later year. It is for this reason that I agree with the MAC's endorsement of banking and a multi-year compliance period.

Given the MAC's recommendations' reliance on banking as a key mechanism for reducing cost uncertainty, I urge the MAC to consider what may be a significant disincentive for banking in a California cap-and-trade system. Although many observers, including myself, are of the view that when and if a meaningful Federal cap-and-trade program is established, the California program should be melded into the Federal program and discontinued as an independent regulatory system, it is conceivable that there will be forces within the state that will want to maintain the state's own program. In that case, upon implementation of a market-based Federal policy that includes California emission sources, the value of California emissions allowances will be reduced—potentially substantially so. This is because, with a Federal policy in place, the incremental incentive (the California allowance price) necessary to bring California emissions in line with its cap will be lower than if there were no Federal policy in place.[8]

[8] Specifically, before the introduction of a Federal policy, the price of a California allowance will equal the marginal cost of emission reductions necessary to meet the California cap. If the California cap-and-trade system remains in place after the introduction of a Federal policy and is, in effect, layered on top of that Federal policy as an additional requirement, the California allowance price will fall to a level equal to the marginal cost of emission reductions necessary to meet the California cap (which may remain unchanged) *minus* the Federal allowance price.

This anticipated reduction in the value of California allowances at an unknown time by an unknown magnitude will create significant disincentives for banking California allowances. Few would want to hold allowances when there is a compelling reason to believe that their value will depreciate. More generally, regardless of whether and how a California cap-and-trade system is integrated into a future Federal policy, expectations that such a Federal policy will eventually come into effect will introduce significant uncertainty regarding the value of banking California allowances. Before issuing its final report, the MAC should evaluate this issue's implications for the MAC's recommendation that California not adopt either borrowing or a safety valve—two other valuable cost-containment mechanisms.

I urge the MAC to reconsider its choice against endorsing any borrowing provisions, given the cost savings that can be achieved through intertemporal flexibility in emission reductions, and given that banking may offer significantly less cost protection than originally anticipated. Of course, unlike banking, borrowing presents risks of non-performance on a future commitment by the entity that borrows allowances. But such risks are routinely managed in the financial and energy sectors. Moreover, borrowing can achieve substantial cost savings in a variety of situations. Unexpected conditions could cause a shortage in the allowance market, leading allowance prices (and marginal emission reduction costs) to spike—a spike that may only be partially mitigated by the use of banked allowances, just as petroleum stocks cannot fully mitigate oil price spikes. Under such circumstances, borrowing would offer cost savings if less costly offsetting emission reductions could be realized in the near future, such as by increasing planned investments in emission reductions.

Given that mechanisms are available for managing non-performance risk in allowance borrowing and the potentially significant cost savings that borrowing would offer, the MAC should recognize and attempt to reconcile the inconsistent position it is taking on borrowing relative to that which it has adopted on offsets (see below). Like borrowing, offsets present substantial opportunities for cost savings that are accompanied by undesirable, but manageable risks. In the case of offsets, the risk is that emission reductions from offsets are not truly "additional." But, unlike with borrowing, the MAC has recommended allowing for offsets *as long as appropriate standards and safeguards are in place* to mitigate risks. Surely, similarly stringent standards and safeguards could be designed to allow for borrowing.

It is worthwhile noting that entities engaging in banking and borrowing do not have to be the same entities that are required to surrender allowances. Indeed, financial firms could serve a valuable role in a cap-and-trade system by engaging in banking and borrowing of allowances even though they do not, themselves, have any obligation to surrender allowances. Therefore, in addition to the companies directly regulated under a cap-and-trade system, there would be other firms that could meet the most stringent capital requirements that may be desired to ensure performance on future obligations associated with borrowing.

While borrowing would be a valuable feature of a California cap-and-trade system, regulators would need to consider the likely creation of a mandatory Federal climate policy when designing borrowing standards. Because a Federal policy may devalue California allowances, as

described above, obligations for repayment of emission allowances may need to reflect this in order to establish appropriate incentives. Similarly, if the mandatory Federal policy is a nationwide cap-and-trade system, cumulative nationwide emissions would *increase* if a California allowance were surrendered *after* the nationwide cap's implementation in return for borrowing a California allowance *before* that nationwide cap is implemented. Both issues could be addressed by requiring allowance borrowers to surrender an offsetting California allowance in a future year if a Federal policy is not yet in effect, or to surrender an offsetting California allowance *and* a Federal allowance if a Federal policy has gone into effect.

8. An "Alternative Compliance Fee" Should Be a Part of a Cap-and-Trade System to Protect Against Cost Uncertainty

While AB 32 requires that CARB establish a statewide GHG emissions limit equal to California's 1990 level, to be achieved by 2020, it also requires that CARB "adopt rules and regulations in an open public process to achieve the maximum technologically feasible and cost-effective greenhouse gas emission reductions from sources." Others have noted that these two requirements may be inconsistent with one another. But, contrary to the MAC's conclusion, these two requirements can provide consistent support for a cost-containment mechanism often referred to as a "safety valve" *as long as revenues from the use of that safety valve are put toward achieving emission reductions*. From this point forward I refer to this specific type of mechanism as an "alternative compliance fee" to reflect the fact that it would simply provide another avenue toward meeting California's emissions cap, rather than an off-ramp.

In describing its decision not to recommend the adoption of a safety valve, the MAC stated (at p. 63) that "the issuance of allowances [at a predetermined price] that authorize emissions to exceed the cap would run counter to [AB 32's mandate]." However, as the MAC makes clear, AB 32 will not cover all GHG emission sources in California (even if it covers most sources of CO_2 emissions). Therefore, an alternative compliance fee that allows capped sources to buy additional allowances at a predetermined price may meet *both* of the above-described requirements of AB 32. That is, as long as this predetermined price is set *sufficiently high* and *revenues* from this alternative compliance fee are *put toward reducing uncapped emissions*, the use of this alternative compliance fee can facilitate the achievement of AB 32's emissions target *and* ensure that GHG emission reductions required under the cap are cost-effective.

In particular, as long as California climate policy is originally designed in a manner that is *expected* to achieve emission reductions cost-effectively and the alternative compliance fee is set sufficiently high, the use of the alternative compliance fee would only occur when emission reduction costs in the capped sector are considerably higher than expected. Of course, it is precisely these times when it is likely that revenues from that fee could be used to achieve reductions more cost-effectively outside the capped sector than they could be achieved inside the capped sector.

While an alternative compliance fee could be consistent with both AB 32's 2020 emissions target and its requirement that emission reductions be cost-effective, the alternative

compliance fee's importance is made all the more apparent when one focuses on the cost-effectiveness requirement and considers the long-term nature of the climate change problem. As I described above, because of the long-term nature of the climate change problem, the choice of whether to require emission reductions in a given year should be informed by cost-effectiveness considerations. A reduction in GHG emissions cannot be considered cost-effective if it could be achieved at lower cost in a later year. As long as the alternative compliance fee is set sufficiently above expected allowance prices, its use would necessarily imply that emission reduction costs at that time are higher than expected. Unless emission reduction costs in *all* future years are higher than expected, it would necessarily not be cost-effective to require emission reductions at that time under those unexpectedly high costs, compared with achieving additional reductions in a later year. By capping allowance prices and thereby emission reduction costs, while serving as a source of funds for investments in future emission reductions, an alternative compliance fee can limit the extent to which unexpectedly high emission reduction costs are incurred in one year when lower cost reductions can be achieved in a later year.

Finally, in evaluating the potential adoption of an alternative compliance fee in a cap-and-trade system, it is important to recognize that leakage will only increase with higher allowance prices. Therefore, excluding an alternative compliance fee from a California cap-and-trade system may increase California's contribution to global GHG emissions, not keep it in check.

I have sought to demonstrate how an alternative compliance fee can offer valuable cost protection that is consistent with AB 32's requirements. Even if the MAC chooses not to pursue this idea, I believe it is important for the MAC to assess carefully the cost uncertainty that will be present in the absence of an alternative compliance fee or safety valve. This is particularly important given the disincentives I identified above for banking California allowances. Indeed, the very challenge of meaningfully describing this uncertainty may help highlight the value offered by a safety valve or alternative compliance fee.

9. A California Cap-and-Trade System Should be Designed to Create a Stable Environment for Investment in Cost-Effective Emission Reductions

Cost uncertainty not only implies that a cap-and-trade system could expose the economy to unexpectedly and unnecessarily high emission reduction costs, it can also increase the costs of the emission reductions themselves. This is because significant new capital investments must play an important role in achieving long-range emission targets, but uncertain economic conditions can cause firms to delay making such significant capital investments. In the face of uncertainty, there is an option value associated with delaying an investment, rather than making it and risking that it will turn out to be economically unviable. As a result, firms will favor more costly, but less capital-intensive, emission reduction measures.

While such delays in capital-intensive investments are desirable in the face of irreducible and real economic uncertainty, they are undesirable if the uncertainty leading to those delays is instead the result of poor policy design. Indeed, uncertainty about future emission caps in the

European Union Emissions Trading Scheme (EU ETS) has apparently caused firms to postpone investment decisions that could have helped achieve cost-effective emission reductions.

California can reduce the uncertainty affecting capital-intensive investment decisions through two design features. First, it should establish a long-term trajectory of emissions caps at the outset of the cap-and-trade system (as the MAC appears to recommend). Second, a key risk facing firms contemplating capital-intensive investments is that allowance prices will turn out to be lower than expected, and insufficient for them to recover the costs of their investments. This can be addressed by establishing an allowance price floor, which increases over time, implemented through a guarantee that CARB will purchase and retire allowances whenever allowance prices fall below the indicated floor. Given an expected allowance price, a price floor at some level below this expected price would give firms greater certainty that the value of investments in emission reduction measures will not turn out to be much lower than expected.

This price floor provision could be paired with the alternative compliance fee, which I previously described, to set a band within which the market would determine allowance prices. Together, the two provisions could have a number of desirable effects, apart from those of the alternative compliance fee alone. First, if some members of the MAC are concerned about California's ability to meet its statewide emissions target if the alternative compliance fee is triggered, this can be partially offset by the ability of the price floor to achieve additional cost-effective emission reductions if costs in the capped sector turn out to be lower than expected. Second, firms may be more inclined to invest in capital-intensive emission reduction measures that, in the long-run, are less costly than less capital-intensive measures. The MAC report noted that some are concerned that a cap on allowance prices—like that which would be established by an alternative compliance fee—would limit incentives for investments and innovation. Any such adverse effects can be minimized if the allowance price cap is set sufficiently high, and any remaining effects can be more than offset by the beneficial effects of the price floor on firms' investment incentives.

10. The MAC Can More Clearly Articulate the Implications of the Allowance Allocation Choice on Environmental Effectiveness and Social Cost

As the MAC report describes, California's decision about how to distribute allowances will have a significant economic impact on regulated entities, consumers, and other parties. While the fact that the allowance allocation decision will have distributional implications should be obvious to all, it is important that the MAC report clearly establish what is *and what is not* at stake with this decision. The MAC correctly notes that the allocation choice does *not* affect achievement of the emissions cap by regulated sources. The allocation decision determines *how* allowances will be distributed, *not how many* allowances will be created. In discussions regarding the EU ETS, this seems to be a point of confusion for some, as they express concerns about "over-allocation" of allowances to regulated facilities. To the extent that there was an "over-allocation" of allowances, it resulted from the fact that the EU's decentralized allocation process confounded decision-making about the level of the cap (that is, how many allowances are created) with decision-making about how the limited number of allowances would be

distributed. Presumably California would first set an aggregate cap that it is confident would not involve "over-allocation." That is, it would establish a cap on emissions that is below expected business-as-usual emissions by the desired amount. Only then would it determine how to distribute the limited number of allowances—a decision that would have no implications for the aggregate emissions from capped sources.

Through potential effects on leakage, the allowance allocation process *can* have some implications for California's effect on global GHG emissions, even though aggregate emissions from capped sources remain unchanged. In particular, as the MAC report notes, there are some methods of so-called "updating" allocations that can alter the competitiveness of recipient firms, and thereby influence the level of leakage out of the capped sector. While such approaches can alter leakage, they also create undesirable, distortionary incentives for activity within California. For example, they can encourage old high-emitting plants or equipment to remain in operation, or artificially encourage *excessive* new entry in an industry.[9] In light of this, before adopting any updating allocation approaches, California should carefully consider whether there are more direct mechanisms to address leakage through treatment of imports and exports. Identifying approaches to address leakage that are the most effective, least distortionary, and are consistent with the Commerce Clause of the U.S. Constitution may be exceptionally challenging.

It is also important that the MAC make clear the circumstances under which allocation choices do and do not affect overall social costs. In particular, it is often incorrectly believed that the actual act of auctioning allowances can itself reduce the overall social cost of a cap-and-trade system. In fact, auctioning *per se* does not lower social costs. Rather, if allowances have been auctioned, the specific choices about how to use auction revenue can influence social costs. Most studies finding significant cost savings associated with auctioning assume that auction revenue is recycled to reduce specific distortionary taxes, such as corporate income taxes, capital gains taxes, or marginal income tax rates for relatively high tax brackets. Therefore, it is important to acknowledge that the cost savings in these studies depend on a very specific type of tax reform that happens to be highly regressive. In evaluating potential social cost savings from auctioning, consideration must be given to how likely it is that California would implement the specific tax reforms envisioned by studies finding substantial cost-saving opportunities.

There is a broader lesson from these same studies that should not be lost in the debate. The social cost associated with auctioning allowances, as opposed to freely distributing them, depends fundamentally on how auction revenue is used, not on the choice to auction itself.[10] Some uses of auction revenue may create economic gains that are unachievable in the private sector, such as through tax reform or investment in basic research and development. Some uses

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[9] Markus Åhman, Dallas Burtraw, Joseph Kruger, and Lars Zetterberg (2007), "A Ten-Year Rule to Guide the Allocation of EU Emission Allowances," *Energy Policy* 35(3): 1718-1730.

[10] Similarly, the choice to auction versus freely allocate allowances can indirectly affect the social costs of a cap-and-trade system through its effect on prices set by cost-of-service regulated utilities that may or may not receive free allowances. Yet, here again, any differences in the social costs associated with different allocation approaches actually depend on how regulated utilities would use allocated allowances or pay for auctioned allowances. It is presumably entirely within the control of Public Utility Commissions to set rate structures that would minimize any effect of the allocation choice on marginal electricity or natural gas prices for ratepayers, and thereby minimize the implications of different allocation choices for the social cost of a cap-and-trade system.

of auction revenue may neither create economic gains nor losses, such as uses that simply achieve wealth transfers. In such cases, there would be no difference between the social cost of auctioning and that of freely distributing allowances. Other uses of auction revenue could actually impose economic losses, relative to the free distribution of allowances. This could occur if auction revenues are put toward projects that incur real resource costs in excess of their social value (the metaphorical "bridges to nowhere"). Thus, the social cost implications of a 100 percent auction approach—relative to freely distributing allowances—would depend fundamentally on the ability of the California government to use the significant inflow of auction revenue in a socially productive fashion.

11. The MAC Should Modify Its Recommendation Regarding Allocating Allowances to Electric Generators, Refineries, and Other Firms, Pending Further Study

The MAC report establishes the reasonable principle that allowances should be distributed in a manner consistent with the objectives of cost-effectiveness, fairness, and simplicity. While California is clearly a long way from translating these broad principles into specific allocation approaches, it is important that a few statements in the MAC report which are germane to the fairness principle be clarified. It goes without saying that determination of the appropriate distribution of the value embodied in allowances is fundamentally a political decision. But this decision should be well informed by an assessment of the distributional consequences of alternative approaches.

Most firms, households, and individuals that will be affected by climate policy have historically made investments in physical and human capital before they became aware of the potential for climate policy to affect the value of their investments. By changing the future economic gains from these investments, climate policy can devalue some investments and increase the value of others. A commonly-employed definition of achieving fairness in the development of climate policy is that those who would otherwise suffer significant reductions in the value of their physical and human capital investments as a result of climate policy should be made whole, or partially whole, for their losses. It is for this reason that much of the economic analysis regarding the impacts of climate policy on firms has focused on the ability of firms to pass costs on to their consumers (or back to their suppliers), and thereby mitigate adverse impacts on their investments.

The initial incidence of the burden of a cap-and-trade system is relatively clear. But it is more difficult to evaluate the share of that burden which is ultimately borne by regulated firms—in the form of reduced profitability of existing investments—and what share is passed on to consumers or back to suppliers. In recommending particular allocation approaches, the MAC report appears to have relied on the economics literature to draw conclusions regarding the ultimate distribution of allowance costs. In particular, at page 53 of its draft report, the MAC states that "[t]here should be no free allocation to firms under the cap that are able to pass most of their costs on to consumers. These include electric generators, other first sellers of electricity, oil refineries, and natural gas processors." My view is that given what is known as well as what

is not known about the economic impact of climate policy on firms, this recommendation should be modified in favor of further study.

First, while models suggest that electric generators as a whole will be able to pass most of their costs on to consumers, there will be significant variation in the extent to which individual generators or firms can pass on their costs. For example, in the context of a national cap-and-trade system, while the most efficient natural gas generators may expect to recoup nearly all (or more than all) of their allowance costs in the form of higher electricity prices (revenues), some older coal-fired power plants may be unable to pass on even half of their allowance costs. Moreover, consideration should be given to the implications of long-term contracts for generators' and cogenerators' ability to recover any new allowance costs. More generally, as allocation approaches are considered in more detail, it will be important to account for complexities in the California power market that may cause the ability of participants to recover new costs to deviate from what might be expected in other markets.

Second, more investigation is needed to understand the extent to which refiners will be able to pass on their allowance costs. I am unaware of any direct studies of the pass-through of allowance costs by refiners that are as robust as the assessments of pass-through in the electricity sector. The ability of refiners to pass through the allowance costs from their direct emissions associated with refining *may differ significantly from their ability, under an upstream cap, to pass through the cost of surrendering allowances for the carbon content of petroleum products they supply.*

While the carbon content of gasoline is similar regardless of which refinery produces it, there may be more significant differences in the emissions-intensity of different refiners' production processes. It is this heterogeneity in the emissions-intensity of refiners' production processes that may limit some refiners' ability to recover their allowance costs through higher market prices. Consequently, it is not appropriate to rely on estimates of the pass-through of upstream allowance costs for the carbon content of transportation fuels (the focus of most national studies) to reach conclusions about refiners' ability to pass-through allowance costs from their direct refining emissions. At a minimum, the MAC report should acknowledge that conclusions about the pass-through of allowance costs, particularly in the petroleum sector, will depend on whether a cap includes just refinery emissions, or also the carbon content of transportation fuels.

Differences in the ability of electricity generators to pass-through allowance costs can be readily understood given the very different technologies employed in that sector, ranging from coal to gas to non-emitting renewables and nuclear. However, while refineries may appear largely homogeneous, there are actually significant differences in the configuration of refineries, which may differ substantially depending on the type of crude oil they are designed to process most efficiently, and the slate of petroleum products they are designed to produce. While all refineries adopt production strategies to minimize the cost of their petroleum products, these strategies can vary significantly in terms of the types of capital investments made and operating processes.

Therefore, by imposing a price on emissions, the imposition of a climate policy may compromise a refiner's ability to earn the return that it had expected on investments in particular refining capacity. California should carefully consider a climate policy's impacts on refiners' ability to recover the costs of existing investments under different allowance allocation approaches, and the implications that these impacts would have on refiners' future investment decisions. I am not aware of any analysis that has been done of this issue with the level of technological detail that would be required to arrive at robust conclusions. However, if in reaching its conclusion that refiners would be able to pass on most of their allowance costs to consumers, the MAC has performed such an analysis or is aware of one supporting its conclusion, it should indicate so in its final report. Otherwise, the basis for that conclusion is not clear.

While I am unaware of any national studies of refiners' ability to pass on the costs of allowances for direct refinery emissions, the state-level scope of California's policy introduces additional complications that would suggest lower pass-through of allowance costs than would be found in any national study. In particular, unless California is able to impose an allowance requirement on imported petroleum products to account for the emissions associated with their production, California refiners will not be able to recover as much of the costs of allowances for direct refinery emissions as they might under a national climate policy. Indeed, even under a national policy, California refiners would still be subject to import competition.

In discussing impacts on firms in the petroleum sector, it is important to distinguish oil and gas producers from refiners, given the different markets in which they compete. For example, the import competition described above for refiners is even more intense for crude oil producers in California, limiting the ability of those instate crude oil producers to recover any allowance costs that would be associated with their operations. It appears that the MAC may recognize this distinction, given that it did not include upstream oil producers along with refiners in the list of firms that it believes can recover most of their allowance costs.

In considering the economic burdens that climate policy would place on particular firms, it is important to distinguish the share of a policy's costs that can be passed through from the absolute burden of the policy. The California Energy Commission's emissions inventory indicates that direct CO_2 emissions from refineries were about 30 million metric tons in 2002.[11] If allowance prices reached $50 per ton of CO_2 under a California cap-and-trade system, aggregate annual compliance costs for refiners might be on the order of $1.5 billion dollars. As a result, even if refiners could pass through 80 percent of their costs, they would still be left with a net burden of $300 million per year—a substantial sum.

The MAC has recommended that there should be no free allocation to firms that it believes can pass most of their compliance costs on to consumers, including electric generators and refineries. As described above, if it retains this recommendation in its final report, the MAC should provide more support for its conclusion that these firms can pass "most" of their

[11] Gerry Bemis and Jennifer Allen (California Energy Commission), *Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2002 Update*, June 2005, publication CEC-600-2005-025.

allowance costs on to consumers in the context of a California climate policy. Moreover, if the MAC believes that one objective of allowance allocation should be to avoid disproportionately large impacts on the ability of firms to recover the costs of their existing capital investments, all of the above considerations suggest that the MAC should replace this recommendation with a call for further study.

12. The MAC Should Reconsider Opportunities to Promote Early Action

The act of specifying an emissions cap will represent an important first step in encouraging the early adoption of emission reduction measures as firms and households begin to adapt to a carbon-constrained world. But there is a risk that uncertainty regarding the ultimate policy design could discourage early actions to reduce emissions, or at least fail to offer sufficient incentives for cost-effective early actions. The MAC has appropriately recognized the need to avoid allocation approaches that may discourage the early adoption of emission reduction measures before final allowance allocations are determined. In particular, any allocation approach that is influenced by changes in facility-specific characteristics between now and the time that the cap is implemented may discourage early adoption of cost-effective emission reduction measures. As the specific details of a cap-and-trade system are being ironed out, an important first step that the CARB could take to promote early action emission reductions would be to issue a statement that, whatever allocation approach is ultimately adopted, it will not be influenced by any changes in facility-specific characteristics between the time of the statement and the cap's implementation.

In addition to striving not to discourage early-action emission reductions, CARB should also consider whether incentives can be introduced that would actively encourage cost-effective emission reductions. Absent such additional incentives, emission reductions that are less costly than those undertaken in the first year of the cap-and-trade system may nonetheless not be undertaken before the cap is implemented. Given that the MAC is recommending the use of offsets for emission reductions in uncapped sectors achieved after the implementation of the cap, the MAC should offer a clearer explanation as to why that offset program should not be expanded to include early-action measures that can meet the same rigorous standards as other offsets.

13. The MAC's Approach to Offsets is Logical, But the "Devil Is in the Details"

Offset programs have the potential to achieve significant cost savings by tapping low cost emission reductions within and outside of California that are outside of the scope of California's emissions cap. However, because sources that would generate offset credits are not subject to an emissions cap, incorporation of an offsets provision will inevitably raise concerns about additionality. That is, there is a legitimate concern that reported emission reductions that generate offset credits may have occurred even without the incentive offered by the credits, in which case they would not represent real emission reductions. Rather, they would simply be part of the business-as-usual baseline. Indeed, those offsets that are the most attractive—those with

the lowest estimated costs—may be the most prone to this concern. While some parties have suggested placing limits on the quantity or geographic location of offsets because of concern for additionality and other considerations, the MAC has taken the more sensible approach of rejecting such limits, and instead has focused on establishing a set of stringent offset standards that can minimize the risk that offsets are not additional. Needless to say, much work will be required to establish this set of standards.

In addition to legitimate concerns about the quality of offsets, the MAC report indicates that environmental justice issues combined with a desire to capture the co-benefits of GHG emission reductions in-state underlie the desire by some parties to limit offsets, particularly by requiring that all offsets be achieved within California. This would be inconsistent with the MAC's goal of designing a system that can achieve California's AB 32 targets at minimum cost to the people of the state. As I describe above in Section 2 of these comments, such an argument in favor of limiting offsets is based purely on speculation. Offsets will unambiguously reduce the costs to California of meeting its climate policy objectives, including the costs borne by the most disadvantaged households. Therefore, in considering whether to limit offsets to in-state measures, careful consideration must be given to whether the co-benefits of the in-state emission reductions foregone by the use of out-of-state offsets will be outweighed by the cost savings from allowing the use of such offsets. The co-benefits from in-state GHG emission reductions achieved under a cap-and-trade system will vary greatly depending on the location, timing, and type of emission reduction measure. It is by no means clear that the co-benefits from the highest-cost reductions that would be avoided through greater use of offsets justify foregoing the cost-savings offered by those offsets.

Conclusion

In summary, the MAC has done an excellent job – overall – in establishing a foundation for future consideration of how best to design a greenhouse gas cap-and-trade system for California. While there are many points on which I agree with the MAC, there are several points made in the MAC report that are incorrect, need to be reconsidered, or require more compelling justification. I will be pleased to discuss any of these points or others in the future.