LAO
65 YEARS OF SERVICE

June 16, 2010

Hon. Dan Logue
Assembly Member, Third District
Room 2002, State Capitol
Sacramento, California 95814

Dear Assembly Member Logue:

This responds to your request that we provide an evaluation of the updated economic analysis prepared by the California Air Resources Board (ARB) of its Scoping Plan (SP) for implementing AB 32 (Núñez). Specifically, you have asked us to: (1) reassess the economic and fiscal validity of the SP; (2) identify shortcomings in the data and other information available for analyzing the SP and discuss the fiscal implications of proceeding with the SP given such shortcomings; (3) outline the forthcoming regulatory and cap-and-trade (C&T) program "decision milestones" that will be important for legislative oversight of AB 32 and the SP; and (4) critique a study prepared by Charles River Associates (CRA) on AB 32 and the SP.

In our response below, we:

- Provide brief background information on AB 32 and the SP.
- Summarize the key elements of ARB's updated economic analysis of the SP and how it differs from ARB's original analysis.
- Briefly review our previous findings regarding ARB's original analysis and discuss the extent to which its updated analysis addresses the problems we previously noted and contains any additional shortcomings.
- Comment on the analysis of the SP conducted by CRA.
- Identify and discuss key AB 32 SP policy-decision milestones important for legislative oversight.

Principal LAO Findings

New Analysis Is Improved but Problems Remain. Although ARB's updated economic analysis represents a credible effort and an improvement over its initial economic analysis issued in September 2008, the revised version still exhibits a number of significant problems and deficiencies that limit its reliability. These include shortcomings in a variety of areas including modeling techniques, identification of the relative marginal

costs of different SP measures, sensitivity and scenario analyses, treatment of economic and emissions leakages, identification of the market failures used to justify the need for the regulations selected, analysis of specific individual regulations to implement certain SP measures, and various data limitations.

The SP May Not Be Cost-Efficient. Given these and other issues, it is unclear whether the current mix and relative importance of different measures in the SP will achieve AB 32's targeted emissions reductions in a cost-efficient manner as required.

Legislative Oversight and Policy Direction for AB 32 Implementation. We have identified a number of opportunities for the Legislature to exercise oversight and provide policy direction as the administration moves forward with implementation of the SP. Specifically, the Legislature should consider holding hearings to direct ARB to fill the most crucial information gaps in its economic analyses supporting the SP. Legislative evaluation of the quality and comprehensiveness of statutorily required economic and fiscal analyses for major AB 32 regulations would also prove useful. Based on the results of further analysis conducted at the Legislature's direction, the Legislature could potentially direct that changes be made to individual AB 32 regulations (modifications or even repeal) and to the SP's mix of measures. The goal of such direction would be to improve the overall effectiveness and cost-efficiency of AB 32 implementation.

We also discuss various opportunities for the Legislature to provide its policy direction with respect to ARB's development of the C&T regulation. The design of the C&T regulation involves numerous policy choices that, depending on how exercised, can significantly impact the costs of compliance. These policy choices—many of which serve to contain costs—include such issues as the allocation of emission allowances, the timing of compliance requirements, the use of offsets, the banking and borrowing of allowances, allowance price ceilings and floors, and linkages between California's C&T system and similar systems in other jurisdictions.

BACKGROUND

AB 32 and the SP

Assembly Bill 32, enacted in 2006, established the goal of reducing statewide greenhouse-gas (GHG) emissions in California to 1990 levels by 2020. It also charged the ARB with monitoring and regulating the state's sources of GHGs and identified a timeline by which ARB is to complete specified AB 32-related implementation actions. This included developing an SP encompassing a set of measures that, taken together, would enable the state to achieve its 2020 GHG-reduction target. A draft of the resulting SP containing a set of 72 proposed measures and regulations was released in June 2008, an initial economic analysis of the SP was released in September 2008, a proposed SP was released in October 2008 that modified the earlier draft SP, and the final SP was adopted

by ARB in December 2008. Lastly, in June 2010, an updated economic analysis of the SP was released by ARB.

Key Components of the SP

The ARB's March 2010 updated economic analysis assesses the economics-related implications of essentially the same SP measures that it evaluated in its initial economic analysis in September 2008. That is, the SP itself has not substantively changed since it was originally adopted. The SP's measures include a combination of direct regulations and mandated requirements affecting energy efficiency and consumption, along with actions to provide price incentives for energy efficiency and GHG reductions. A majority of the required reduction in GHGs mandated under AB 32 would be accounted for by the following measures:

- Expanding and strengthening existing energy-efficiency programs as well as the standards that apply to buildings and appliances.
- Achieving a statewide renewable-energy contribution share of 33 percent.
- Developing a C&T program and regional market trading system.
- Establishing targets for transportation-related GHG emissions for regions throughout California.

In terms of shares of AB 32-related targeted GHG reductions under the SP, 37 percent is estimated to come from the C&T, with the remainder from direct regulatory requirements, referred to as "complementary" measures.

Implementation Progress to Date

To date, ARB has adopted its required regulations as well as a number of early-action measures to reduce GHGs, whereas various other regulations associated with the SP are currently still in the process of being adopted or developed (such as rulemaking for a C&T program). The ARB released a preliminary draft of its C&T regulation in November 2009 and intends the regulation to become effective in January 2012, once it has been appropriately reviewed and revised, gone through the hearing process, and been adopted by ARB. (For further discussion about AB 32's implementation to date, see our brief entitled *Implementation of AB 32—Global Warming Solutions Act of 2006,* April 14, 2010.)

LAO Analyses

In November 2008, after the SP and its initial economic analysis were released by ARB, our office prepared a critique of both documents at the request of Assembly Member Niello, which he subsequently made public. Given that ARB has now released an updated economic analysis of the SP, our response below both updates our previous report and addresses new issues that have since come to light.

ARB's Updated Economic Analysis

Summary of ARB's Key Findings and Conclusions

The ARB's "bottom line" finding from its revised economic analysis is that the SP's measures can be implemented to reduce GHGs without adversely affecting the growth in California's economy over the next decade. This is due to both increased energy efficiencies associated with the SP, and ARB's view that the "driver" of California economic growth can be shifted from polluting energy sources to clean energy and efficiency technologies with little or no economic penalty. The ARB also concludes that the SP is unlikely to have a significant adverse or disproportionate effect on California's small businesses, and in some cases will benefit them, due to increased consumer demands for more efficient appliances and technologies.

These general findings are similar in principle to those contained in ARB's initial economic analysis of the SP.

Analytical Approach and Results

The results contained in ARB's updated economic analysis have been largely developed using two economic models—namely, the Energy 2020 model and the Environmental Dynamic Revenue Assessment Model (E-DRAM). In using these models to predict the effects of the SP, ARB incorporated future forecasts about the energy sector and such economic variables as California output, income, and jobs from the California Energy Commission. The board used California Department of Finance data for population forecasts. The ARB's staff also modified the above models to reflect the SP's individual GHG-reducing measures by incorporating their provisions into various model equations, parameters, and elasticities.

The ARB's Macroeconomic Results. Figure 1 summarizes ARB's estimated effects of the SP on selected key economic variables for its updated economic analysis and compares those to the results from its initial economic analysis.

Figure 1

Key Economic Effects of ARB's Initial Versus Updated Economic Analysis of the Scoping Plan

	Original		Updated	
2007 Dollars	2020 Business as Usual Reference Case	Scoping Plan Case	2020 Business as Usual Reference Case	Scoping Plan Case (Case 1)
Gross state product (in billions)	$2,586	$2,593	$2,502	$2,498
Personal income (in billions)	2,093	2,109	2,027	2,029
Income per capita (in thousands)	—	—	46.06	46.09
Labor demand (millions of jobs)	18.41	18.53	18.41	18.42
Percent Change From Reference				
Gross state product		0.3%		-0.2%
Personal income		0.8		0.1
Income per capita		—		0.1
Labor demand		0.7		0.1
Annual Average Growth (2007 through 2020)				
Gross state product	2.8%	2.8%	2.4%	2.4%
Personal income	2.8	2.8	2.4	2.4
Income per capita	—	—	1.2	1.2
Labor demand	0.9	0.9	0.9	0.9

- ***Small Overall Impact Predicted.*** The ARB projects that the SP would have essentially no effect on the average annual rate of growth in California gross state product (GSP), personal income, per capita income, and jobs over the period 2007 through 2020. Although the levels of these variables would differ slightly by 2020 because of the SP, the difference is very small, especially relative to the size of the California economy.
- ***Fewer Job Gains and Less Output Expected.*** The ARB has revised downward its estimated benefits of the SP on variables like jobs and income, and increased its estimated reduction in GSP. For example, in its previous analysis, ARB projected a gain of roughly 120,000 jobs due to the SP but has now reduced that figure to about 10,000 jobs. Again, however, these estimated job gains are very small relative to total California employment.

The ARB's More Detailed Results. The ARB's updated economic analysis also includes more detailed and disaggregated estimates of the effects of the SP. These include job impacts on individual industry sectors for large versus small businesses, reductions in energy use by general type of business activity, changes in fuel prices by fuel type, and distribution of investments required under the SP by consumers versus businesses. For example, manufacturing employment is estimated by ARB to decline under all five

of the scenarios it examined, compared to growth in manufacturing employment which ARB estimated in its initial SP economic analysis.

What's New?

As discussed later, ARB's updated SP analysis has addressed some of the deficiencies we previously identified and is generally more complete than its previous economic analysis. Improvements include the following:

- The ARB's baseline of what the economy would look like without AB 32 is now more accurate because it incorporates certain actions that had previously been inappropriately attributed to AB 32 and the SP. This had overstated the effects of AB 32. These actions include the 20 percent Renewable Portfolio Standard (RPS), federal device standards, federal renewable fuel standards, and the "Pavley I" (Chapter 200, Statutes of 2002 [AB 1493]) vehicle emissions standards.
- The ARB has collaborated with certain other climate-change modelers to improve its modeling, validate its outcomes, and get a better feeling of how different modeling approaches affect the estimated economic impacts of the SP.
- The ARB's modeling is more clearly explained than before.
- How energy demand is affected by various economic factors is better modeled than before.
- Many complementary policies are modeled and explained separately and in more detail than before.
- Within the C&T program analysis, offsets and banking are considered in more detail.
- The analysis of impacts on small businesses is better.
- Scenario analysis has been added. Namely, in addition to analyzing the economic impacts of the full SP, ARB's updated analysis has evaluated the impacts of four alternative SP-related scenarios to see how different the modeling results are to different policy-related assumptions.

The Economic Allocation Advisory Committee (EAAC). It also should be noted that ARB's updated economic analysis incorporates input from EAAC, a 16-member entity appointed by the Chair of ARB in June 2009. The EAAC was assigned two primary roles. The first was to provide advice to ARB regarding allocating emissions allowances under the SP's C&T program. The second was to assist ARB in its economic analysis of the SP. To accomplish the latter, EAAC formed an Economic Impacts Subcommittee comprised of various economic and energy experts.

Scenario Characteristics and Outcomes

Figure 2 summarizes the key economic results from ARB's scenarios. These scenarios include both: (1) achieving the SP's targeted GHG reductions with an alternative design of the C&T program, and (2) realizing less emissions reductions from the complementary policies.

Figure 2
Key Economic Effects for Alternative Scoping Plan Scenario

2007 Dollars	2020 Business As Usual Reference Case	Scoping Plan Case (Case 1)	No Offsets in C&T (Case 2)	Reduced Transportation (Case 3)	Reduced Electricity/ Natural Gas Measures (Case 4)	Combined Reduced Measures (Case 5)
Gross state product (in billions)	$2,502	$2,498	$2,480	$2,477	$2,483	$2,467
Personal income (in billions)	2,027	2,029	2,018	2,011	2,019	2,003
Income per capita (in thousands)	46.06	46.09	46.00	45.84	46.00	45.79
Labor demand (millions of jobs)	18.41	18.42	18.19	18.27	18.22	18.09
Percent Change From Reference						
Gross state product	—	-0.2%	-0.9%	-1.0%	-0.8%	-1.4%
Personal income	—	0.1	-0.4	-0.8	-0.4	-1.2
Income per capita	—	0.1	-0.1	-0.5	-0.1	-0.6
Labor demand	—	0.1	-1.2	-0.8	-1.0	-1.7
Annual Average Growth (2007 Through 2020)						
Gross state product	2.4%	2.4%	2.3%	2.3%	2.3%	2.3%
Personal income	2.4	2.4	2.4	2.3	2.4	2.3
Income per capita	1.2	1.2	1.2	1.2	1.2	1.2
Labor demand	0.9	0.9	0.8	0.9	0.8	0.8

No Offsets Allowed. The first of the alternative scenarios examined is an alternative design feature within the SP's proposed C&T program. Referred to by ARB as Case 2, this "no offsets" scenario considers the effects of not allowing offsets under the C&T program. Offsets are credits for emissions reductions that can be achieved by outside sources. (We discuss offsets further below.) This case does not allow any available lower-cost offset credits to substitute for the emission-reduction options otherwise available to entities regulated under the C&T. Because the price of allowances should in theory reflect the cost of the most expensive emissions reductions needed to meet the emissions cap, not allowing offsets has a large effect on increasing allowance prices. As Figure 2 shows, ARB estimates that offsets can help contain costs within the C&T pro-

gram and prevent higher energy prices under AB 32 for California's businesses and residents, thereby reducing impacts on economic growth under the SP.

Less Emissions Reductions From Complementary Measures. The other three alternative ARB scenarios examine the impacts on California's economy should the complementary measures provide fewer reductions than assumed in the SP. Specifically:

- Case 3 assumes that the SP's transportation-related measures are less effective than assumed under the SP baseline case.
- Case 4 assumes less-successful implementation of the SP's electricity and natural gas sector measures.
- Case 5 considers the effects of both Case 3 and Case 4 combined.

Successful implementation of the complementary measures means that fewer emissions reductions need to be found through the C&T mechanism than would otherwise be the case. The ARB finds that less effective implementation of these complementary measures results in a somewhat greater negative effect on the economy through both increased allowance prices and lack of cost savings. The board concludes that these findings show the importance of successful implementation of the complementary measures, and they also emphasize the need for design features and market-stability mechanisms in the C&T program so that costs can be contained and allowance prices can be kept at a moderate level.

LAO ASSESSMENT OF ARB'S UPDATED ECONOMIC ANALYSIS

The ARB's revised economic analysis is an improvement over its initial economic analysis issued in September 2008. As noted above, its latest analysis fills in many informational gaps. However, it still has a number of significant problems and deficiencies that limit its reliability. Some of these shortcomings involve things that we previously identified that have not been addressed by ARB in its revised economic analysis, while others are new issues that have come to light.

Brief Review of Previous Shortcomings

In our review of ARB's initial SP economic analysis, we identified a variety of deficiencies. In particular, in terms of the more important shortcomings, we noted that:

- The ARB's economic modeling used to evaluate the SP could be significantly improved.
- Evaluation of the costs and savings associated with some SP measures is incomplete.
- The ARB did not satisfactorily explore the implications of alternate basic assumptions.

- The ARB's economic analysis does not effectively address the phenomenon of economic leakages.
- An inconsistent approach was used with respect to the central issue of market failures.

Extent to Which Previously-Noted Problems Were Addressed

Despite improvements in the revised economic analysis, significant deficiencies still exist with regard to many of the areas we previously identified.

Economic Modeling Still Could Be Improved. There continue to be ways that the ARB's economic modeling could be improved to make it more useful and informative for designing and evaluating the SP's provisions and reliably projecting its impacts. These include better incorporation of international, multiregional, and interstate trade effects; incorporating capital stocks of different vintages and other ways the economy changes over time; improved handling of technological change; doing model runs with different combinations of SP provisions so as to better isolate the impacts of individual provisions; developing improved modeling of how individual SP provisions interact and impact the economy; and inclusion of implications for California of possible regional and national climate-related policies that the SP anticipates.

To address such issues, most academic modelers agree it is important to use multiple models that each focus on different aspects of the analysis, given the complexities involved. Also, ARB could have done more with the models it has if Energy 2020 and E-DRAM had been better integrated. Like all modelers, ARB had to strike a balance between sophistication and manageability, but we think ARB did not hit the right balance and that a more complete modeling approach would have been appropriate. The practical implications of ARB's modeling limitations include the following:

- The models ARB uses are not sufficiently well-developed to analyze important policy design options. For example, complex systems to allocate allowances over time based on output, C&T programs with price floors and ceilings, or links and interactions between alternate policies all would seemingly be difficult to model well with the models in use.
- Although computable general equilibrium (CGE) models like E-DRAM are well-accepted analytical tools among economists for some purposes, the E-DRAM also has certain characteristics and inherent limitations that restrict its ability to accurately predict a GHG-reducing regulation's impacts. These CGE models are large macroeconomic models whose strength is their ability to capture interactions among different broad economic sectors, industries, consumer groupings, and labor markets. In contrast, the ability of CGE models to fully capture behavioral responses of households and firms to policy changes is more limited.

- Additionally, because the data in such CGE models are highly aggregated, they capture at best the behavioral responses of hypothetical "average" households and firms, and do not score well in capturing and predicting the range of behavioral responses to policy changes that can occur for individual or sub-groupings of households or firms. As a result, for example, the adverse jobs impacts—including job losses associated with those firms that are especially negatively impacted by a regulation—can be hard to identify since they are obscured within the average outcomes.

Evaluation of the Costs and Savings of Some SP Measures Still Is Incomplete. While there have been improvements in the evaluation by ARB of the costs and savings of some SP measures, this work is still incomplete and suggests that there may be issues with the design of the SP's proposed policies. For example, the vehicle-miles-traveled (VMT) reduction measure is modeled as if it will be costless. This is not a reasonable assumption. Another issue is that ARB's costs for the "Pavley II" measure may be too low, as noted by EAAC. The ARB continues to work on these issues.

The ARB Still Has Not Satisfactorily Explored the Implications of Alternate Basic Assumptions. The ARB's economic analysis findings are highly dependent upon certain key assumptions. These include the price of biofuels, how likely California businesses and consumers are to buy goods and services from other states, the lack of changes in climate policy at the regional and national levels, and how costly complementary measures will be. The ARB in its revised SP economic assessment still has not performed analyses to determine how sensitive its bottom-line economic findings are to changes in its key assumptions in these areas.

Analysis Still Does Not Effectively Address Leakages. When the relative costs of doing business in California change compared to those in other states and nations, businesses take this into account in making their decisions about where to locate their activities. Specifically, when the costs of doing business in California rise, certain firms may decide to relocate outside of California, not expand in California, or make other similar types of adjustments. This is referred to as "economic leakage." Because implementation of the SP is expected to cause energy prices in California to rise and firms to face certain investment requirements, the costs of doing business in California will increase and cause such economic leakage to occur. Economists who study climate policies have emphasized the potential for leakage in designing such policies and determining their potential downsides when applied with limited geographic coverage. There are two reasons for this. First, the greater the amount of economic leakage that occurs, the greater will be the net adverse economic impacts of a policy on the adopting governmental jurisdiction. Second, economic leakage may lessen the net amount of GHGs reductions a given climate policy generates, since the economic activity that is shifted will also generate GHGs.

Inadequate treatment of economic leakage still exists in ARB's updated economic analysis. Unfortunately, ARB's models are not able or well-suited to capture how California policies might cause firms to alter behavior in ways that lead to leakage, including impacts by individual industries and sub-industries. This limits ARB's ability to use objective, data-driven evaluation to determine a sector's leakage sensitivity and which sectors, if any, might warrant special treatment.

Instead of addressing the issue of leakages in the updated analysis, ARB indicates that it hopes the leakage problem will be minor or temporary, and simply defaults to the assumption that the potential for leakage to occur will be reduced or eliminated by actions of the Western Climate Initiative or the federal government. Work in this area is ongoing at ARB. Specifically, we understand that ARB is doing various analyses related to leakage, but these have not yet been completed.

Certain Inconsistencies Still Exist Between the CGE Approach and ARB's Assumption About Market Failures. At a fundamental level, CGE models like E-DRAM inherently assume the economy is optimized—that is, that markets work well. In turn, this implies that consumers and businesses have taken advantage of available opportunities to maximize their well-being and profits. In contrast, ARB's economic analysis relies heavily on the assumption that the economy is not optimized—that is, certain market failures lead consumers and businesses not to make the best choices. This philosophic inconsistency, with which other energy economists also have struggled, raises certain concerns about ARB's underlying modeling approach and its findings.

The SP's various proposed policies should in theory be intended to address various types of market failures that ARB believes necessitate the need for some type of regulation or policy intervention in the first place. The ARB's analysis continues to be deficient in terms of identifying the specific market failures that the SP's individual policies are intended to address. By failing to identify the market failures that necessitate public intervention, the ARB has missed an opportunity to attempt to better maximize the cost-effectiveness of the measures included in the SP.

Conclusion. Given the above and other issues, ARB's updated economic analysis, despite being an improvement over its initial economic analysis, still does not effectively address most of the previous shortcomings we identified. Thus, significant problems in these areas still remain.

Other Related Problems and Additional Shortcomings

Weaknesses Identified by the EAAC. The EAAC's evaluation of ARB's revised economic analysis has identified the following shortcomings, many of which overlap those noted above. Specifically, the EAAC noted that:

- Only limited sensitivity analyses were performed for key parameters that determine the costs of various elements of the SP, and such analyses are crucial

for revealing the full range of uncertainties regarding the impacts of the SP. This includes analyses for the supply costs of alternative fuels and energy-efficiency improvements, technology costs, and demand-side responses to price changes.

- The ARB's assumed costs for individual SP complementary policies are low compared to those projected by certain other studies.
- Reducing VMT is the most important contributor to cost savings under the SP. However, ARB does not provide satisfactory information regarding how its assumed VMT reduction would be achieved or the cost of doing so. In addition, the costs of the Pavley II automotive fuel standards appear optimistic.
- An improved model that integrates detailed energy modeling with macroeconomic modeling of the economy would yield superior economic projections under the SP for such things as output, incomes, jobs, and energy prices.
- Both economic and emissions leakages outside of California are inadequately addressed.

The EAAC has also identified two factors it believes would on their own lower the SP's estimated costs from what ARB reports. These factors are ARB's exclusion of environmental co-benefits of the SP and the possible use of C&T auction revenues to benefit the state.

Data and Information Shortcomings. You have asked us specifically to discuss the issue of data and information gaps in analyzing the SP. We believe that there are certain key data and information gaps associated with the SP that impair ARB's ability to keep costs down and achieve AB 32's GHG emissions reductions in a cost-efficient manner. For example, if ARB had a better sense of the answers to the following questions when creating and reviewing the SP and drafting its regulations, those products would have been improved and, in some respects, likely quite different. Key questions that need answering include:

- ***What are the market imperfections or failures or other policy targets that justify each measure in the SP?*** The answers to this question need to be more than merely a nonspecific default reason such as "to reduce CO_2 emissions." The implications of possible mismatches between the measures as being implemented and their justifications are further discussed below.
- ***How important and how well understood are those market imperfections or failures?*** This question needs to be answered to ensure that ARB is not creating unnecessary or counterproductive regulations. We agree with the EAAC when it notes that the quantitative significance of many of the market failures involved remains uncertain, and thus for most of the complementary SP policies considered by ARB it is difficult to tell whether its modeling assumptions

are reasonable given the lack of significant empirical evidence to support them. As discussed below, however, we believe that ARB has the capacity to advance general understanding of these issues.

- ***For the major SP measures, what would their marginal abatement costs be under a very wide range of different design features?*** If a more rigorous analytical justification were provided, the cost-effectiveness requirement of AB 32 would lead to ARB relying more heavily on those measures characterized as having the lowest marginal net abatement costs. This, in turn, would reduce the costs of achieving AB 32's GHG reduction targets.

  — Consider the Low Carbon Fuel Standard (LCFS) measure. The LCFS stipulates a drop of 10 percent in the carbon intensity of transportation fuel used in California by 2020. Analyses of the cost of the final emissions reduction under alternate 2020 goals (such as 5 percent and 15 percent) would help ARB and the Legislature determine what targeted carbon intensity reduction should be incorporated as part of a cost-effective implementation of AB 32.

  — Similarly, consider the SP overall. Complementary policies that achieve emissions reductions can reduce allowance prices by reducing demand for allowances. This reduction in allowance prices potentially comes at significant costs to the economy to the degree those complementary policies limit options to comply with AB 32 goals at least cost.

  — Similarly, consider the transportation sector, which is affected by several SP measures. The ARB's updated economic analysis says that the transportation sector is responsible for 32 percent to 43 percent of the total emissions reductions in the SP. We asked ARB staff if this was because marginal abatement costs are relatively low in the transportation sector. The ARB staff replied that emissions from the transportation sector are the largest single source of emissions in the state, so it is not unreasonable for this sector to make up a substantial share of the reductions and, in fact, it would be highly unlikely that the AB 32 target could be reached if a significant share of the reductions do not come from transportation. The extent to which this may or may not be true, however, depends on the relative marginal cost of abatement in various sectors, which ARB has not analyzed well.

- ***What would the LCFS, VMT measures, and Pavley II actually cost?*** These costs are important to know because these measures are major parts of the SP. The analyses of these measures' costs, however, are incomplete or have raised substantial concern among various parties reviewing the SP, including our office.

- ***What objective, data-driven evaluation systems could be used to determine a sector's economic leakage sensitivity, and which sectors, if any, might warrant a degree of special treatment (such as special C&T allowance allocations) because of their relatively high exposure to leakage or importance to the economy?*** This information is critical in order to minimize the economic cost to the state.

As discussed below where we evaluate the CRA study and the C&T program specifically, other questions involving data and information needs include:

- ***To what degree could complementary policies in the SP that reduce allowance prices (by reducing demand for allowances) increase overall costs to the economy? Further, has ARB considered this trade-off when designing the SP's programs?***
- ***How reliable are the offsets that might be used? And, if they are relatively reliable, it is possible that more offsets should be considered?***

Issues Associated With Analyzing and Modeling Specific SP-Related Regulations. Regulations can be modeled in different ways within a CGE framework. In talking with different economists about using a CGE modeling approach, some concerns were expressed about the appropriateness of the ARB's CGE approach versus alternative approaches. Various specific SP regulations could have been modeled differently in the CGE framework than in fact was done. For example, a new, low-carbon transportation sector could have been added to E-DRAM. We do not know how the model's results would differ if this alternative suggested approach were used, but this might be worth exploring.

Regulations with which we have additional concerns include VMT and Pavley II, as mentioned above. Additionally, alternate ways of implementing the C&T that are discussed in the final section of this letter should have been modeled. Finally, we have various concerns with the LCFS, which we discuss now.

Certain market failures or barriers are associated with transportation fuels. Thus, there are some legitimate justifications for government involvement in helping to change the structure and GHG emissions of the transportation sector. The question is: *What form and degree of intervention is appropriate?* The LCFS was not based on an adequate analysis of market failures, their relative importance, and choosing specific policy options tailored to address each important failure.

There are several areas where ARB's regulatory cost estimates related to the LCFS standard may be substantially understated. One of these involves the full economy-wide costs of transitioning into the different scenarios considered. For example, we believe that the number of alternative-fuel vehicles purchased may be lower than ARB assumes, which would increase compliance costs.

The ARB considered few alternatives to the LCFS. Considering the wide array of choices ARB had to make to finalize the LCFS, it is surprising that few alternatives were presented. This raises some fundamental questions:

- On what basis was the specific LCFS proposed by ARB chosen?
- Should other alternative forms of a LCFS be considered as well?
- What would be their economic effects?
- Would not some of the types of changes incorporated in the LCFS eventually occur anyway in the absence of the regulation, given that ARB is assuming these changes make economic sense from a business perspective? If so, are ARB's baseline assumptions about such things as uses and mixes of fuels and investments correct?

No Analysis Done of the Impacts of Possible National Programs. The ARB ideally would have done more modeling regarding the impacts of national programs. For example, ARB could have modeled cases in which a national C&T program phases in and possibly preempts some of the SP's policies. These cases are important to explore because a transition from California policies to any adopted national policies could lead to substantial disruptions if not anticipated and handled well.

LAO's Bottom-Line Assessment

Given these and other shortcomings associated with ARB's updated economic analysis, the state cannot be assured that ARB will implement AB 32 in a cost-efficient manner through the SP or will reliably identify the full range of its likely impacts. The implications of this are that, the costs to California's households and businesses of achieving AB 32's GHG reduction goals will be higher than they need to be.

CRA'S ANALYSIS OF THE SP

The ARB and California Environmental Protection Agency (CalEPA) arranged with CRA to conduct a collaborative modeling exercise to analyze the impacts of the SP on the California economy. We appreciate that ARB collaborated with CRA because it is valuable to have multiple views on key issues and because CRA's involvement may have led ARB to take a harder look at some of its analyses.

The CRA released its study entitled *Analysis of the California ARB's Scoping Plan and Related Policy Insights* on March 24, 2010. The funding for this work was provided by BP North America, Chevron, ConocoPhillips, Pacific Gas & Electric, Sempra Energy, and Southern California Edison. It should be noted that these companies have strong business-related interests in how the SP is implemented.

Basic Approach Used

According to its updated report, ARB provided CRA with the following information:

- A common set of assumptions and inputs for the analysis such as energy-related prices and economic growth.
- A common set of GHG-reduction policies to examine. These included vehicle standards, RPS, energy efficiency measures, the LCFS, and the C&T program.
- A baseline reference case set of conditions against which the effects of the SP's policies would be evaluated.
- Different policy scenarios to evaluate relative to the reference case.
- Economic impacts of interest, such as effects on state output, income, energy prices, and jobs.

CRA's Modeling

To carry out its modeling of climate policy, both for this project and for other projects, CRA integrated two individual models: the Multi-Region National Model (MRN) and the North American Electricity & Environment Model (NEEM). Such integration is valuable because each of these individual models has certain unique strengths that a complete analysis of climate policies benefits from. Regarding these models:

- The MRN is a CGE model of the U.S. economy. In the model, the economy is approximated by a limited number of firms and people, and goods are exchanged in simple markets. The MRN is used for analyzing all sectors except for the utility and coal supply sectors. This model, like other CGE models (including ARB's state-level E-DRAM discussed above), allows production and consumption patterns to change in response to policy changes. The model also identifies how such variables as output and labor demand change both for individual sectors and the economy as a whole.
- The NEEM is a model of how the North American electric sector meets its various goals and constraints. It is used for the utility and coal supply sectors. The NEEM simulates key decisions within the electric sector to derive plausible outcomes in competitive electricity markets.

The Resulting Integrated CRA Model. The CRA's model solves for the overall best possible economic conditions in incremental five-year periods between 2010 and 2050. The model is based on assumptions about how, for example, investment in one period is allowed to affect the capital stock in future periods.

Other characteristics of the CRA model and CRA's analysis of the SP using it are:

- The model includes multiple interacting jurisdictions. These include California, the rest of the electrical grid of which California is a part, the rest of the United States, and the rest of the world. Modeling such multiple jurisdictions allows CRA to explore economic leakage issues to some degree. (In contrast, E-DRAM models only California and the rest of the world and so cannot explore economic leakage as effectively.)
- On the negative side, the impacts of the recent recession and rising unemployment generally are not included in the CRA model, and the model has fewer, more aggregated industries and a less complete model of California's government sectors and state tax code than E-DRAM does.
- The CRA did perform sensitivity analyses involving the costs of alternative fuels and on economic growth assumptions for the state. However, more sensitivity analyses—on other parameters and on policy design and implementation—would greatly increase the reliability of the CRA's model results.
- The model tracks capital stock for each sector but does not track the stocks of vehicles of different vintages and pollution profiles.
- The NEEM captures fewer details of California's energy sector than Energy 2020 does. This decreases the reliability of CRA's analysis.

Key Findings of CRA's SP Analysis

Results Similar to ARB in Some Cases. The ARB and CRA find similar costs of the SP to the California economy under the ARB scenario that has the fewest emissions reductions caused by complementary measures. Across all 12 of the scenarios CRA analyzed, different outcomes demonstrate the wide variability in effects that the SP could have.

Deep Uncertainties Remain About Reliability of Estimates. The CRA finds different economic forecasts have substantial effects on model outputs. For example, costs are about half as much under the *Integrated Energy Policy Report 2009* forecast than under the 2008 SP, which used the *Integrated Energy Policy Report 2007*. This illustrates the large sensitivity of model results to key economic assumptions.

Relationship Between Allowances Prices and Overall Costs. The CRA finds that situations with low allowance prices can have high overall costs to the economy. For example, CRA finds ARB's Case 1—with all complementary measures—has nearly the highest total costs to the economy, despite having the lowest permit prices. Conversely, pure C&T scenarios—without complementary measures—have the lowest total costs to the economy despite having the highest allowance prices. Given this, as noted below,

the Legislature may wish to consider providing guidance to ARB on the relative importance of allowance prices and overall costs to the economy.

Allowing Offsets Leads to Significant Cost Reductions. If offsets were allowed at 15 percent levels, and not the 4 percent levels ARB determined, CRA estimates that the SP's overall cost could be 40 percent less. Because offsets could only be used for C&T compliance, offsets are more useful when more of the SP reductions are made via C&T. Given this, the Legislature may wish to have ARB further study offsets. (This is discussed more below.)

LCFS Issues. The CRA makes a general argument that the LCFS keeps market forces from determining where the cheapest emissions reductions would otherwise occur. The CRA expects higher costs than ARB assumes to procure and deliver fuels and higher costs to deal with blending high levels of ethanol with gasoline than does ARB. While there may be issues with CRA's analysis, we agree that ARB's assumption that low carbon fuels will only be 10 percent more expensive than other fuel may be significantly understated.

Complementary Measures Are Expensive Ways to Meet GHG Goals. The CRA finds excluding complementary measures could lower costs of achieving goals by about 40 percent. The most costly of the complementary measures are the 33 percent RPS and the LCFS. The CRA further notes that maintaining complementary measures under a national program like Waxman-Markey has a minimal effect on emissions but raises costs to California by more than 50 percent.

Given these considerations regarding complementary programs based on CRA's modeling as well as our assessment of the LCFS, the Legislature may wish to consider directing ARB to further study or modify the LCFS. Additionally, the Legislature may wish to consider directing ARB to identify important market failures and target the SP's policies more precisely at them, rather than using the exact mix of complementary measures that have been proposed in the SP. These points, and others, are discussed below.

LAO Bottom-Line Assessment of CRA's Analysis

It is very valuable to have both ARB's and CRA's modeling analyses of the SP, in part because they disagree on the role of the complementary policies in complying with AB 32's requirement that GHG reductions be achieved in a "least-cost" (that is, economically efficient) manner. Specifically, different methodological assumptions lead ARB and CRA to reach opposite conclusions regarding the costs of those SP scenarios containing complementary measures. The EAAC has concluded that empirical work has not yet advanced far enough to determine whether the assumptions of the ARB model or those of the CRA model are closer to the truth. It also notes that most analysts agree that other market failures exist beyond those associated with climate change, but the quantitative significance of these market failures remains uncertain. The EAAC thus

concludes that it is important that models introduce a range of assumptions in order to convey the range of potential outcomes of AB 32, depending on the extent and importance of the other market failures. We agree with EAAC's view.

Overall, though the CRA model is not by any means perfect, it has many useful features that ARB's models lack. Unfortunately, because the state does not control it, the CRA model could be expensive to use for policy-design experiments. But based on the results we have seen, we believe the Legislature should consider exploring the extent to which major changes to how ARB plans to implement AB 32 might reduce overall costs to the California economy.

LEGISLATIVE OVERSIGHT AND POLICY DIRECTION FOR AB 32 IMPLEMENTATION

As the administration moves forward with the implementation of the SP, there are two main ways that the Legislature can usefully insert itself into the process. First, given the substantial delegation of authority to ARB under AB 32, there is a greater-than-usual role for legislative oversight regarding the administration's decision making under AB 32. As discussed further below, the Legislature should take the opportunity to oversee AB 32-related regulations of concern, and take steps to fill the gaps in economic analyses supporting the SP and related regulations. Second, we find that ARB's development of the C&T regulation involves numerous policy choices, each with their inherent policy tradeoffs, for which the Legislature's policy direction is crucial. We think that the Legislature's intervention is particularly important because many of these policy choices reflect opportunities to contain the costs associated with implementing a C&T regulation and reduce GHG emissions in an efficient way. As the proposed C&T regulation touches on so many aspects of the economy, it has the potential to cause significant adverse effects if not designed with an eye to cost containment. In this regard, we provide an overview of design features that the Legislature could direct be included in the regulation to further the goal of cost containment.

Legislative Oversight

Oversight of Economic Analyses. As discussed above, we have raised concerns about a number of deficiencies and information gaps in ARB's economic analyses. These deficiencies tend to weaken the reliability of ARB's analytical findings. In addition, we continue to have a significant concern that economic analysis has played a limited role in the development of the SP. For example, the selection of particular measures and the mix of measures appear not to have been directly influenced by cost-effectiveness considerations or macroeconomic analysis. The recently updated economic analysis, while an improvement over the initial analysis, does not appear to have influenced in any significant way the components of the SP.

Going forward, we think that the Legislature, in exercising its oversight role, should consider holding hearings to direct ARB to fill the most crucial information gaps in its economic analyses supporting the SP or AB 32-related regulations. Specifically, as referenced earlier in this letter, the Legislature should seek answers particularly to the following fundamental questions:

- What are the market imperfections or failures or other policy targets that justify each measure in the SP as opposed to other policy options?
- How important and how well understood are those market imperfections or failures?
- For the major SP measures, what would their marginal abatement costs be if a very wide range of different design parameters had been assumed?
- What would the LCFS, VMT, and Pavley II regulations actually cost? (We have identified reliability issues with ARB's cost analyses for these measures.)
- What objective, data-driven evaluation systems could be used to determine a sector's economic leakage sensitivity, and which sectors, if any, might warrant special treatment (such as special C&T allowance allocations) because of their relatively high exposure to leakage or importance to the economy?

Oversight of Regulatory Review Process. Current state law contains multiple provisions that require that certain economic and fiscal impact information be provided when proposals are made to adopt or modify regulations. For example:

- ***Government Code Section 11346.2*** provides that state agencies shall provide (1) the reasons for adopting, amending, or repealing regulations; (2) a description of reasonable alternatives to the proposed change that would lessen its impact on small businesses, and why those alternatives were rejected; and (3) the reason why the proposal would not have an adverse economic impact on business.
- ***Government Code Section 11346.3*** provides, among other things, that state agencies shall consider a proposal's adverse economic impact on California business enterprises and individuals. This includes the unreasonableness of reporting and compliance requirements, impacts on industries, ability to compete with other states, impacts on the creation or elimination of jobs, creation of new businesses, elimination of existing businesses, and expansion of existing businesses.
- ***Government Code Section 11346.5*** provides that, if a proposal may have a significant, statewide adverse impact directly affecting business, it shall identify types of affected businesses, any costs they will incur in compliance, and proposals to exempt or partially exempt certain businesses from compliance.

- ***Government Code Section 11346.9*** provides, among other things, that state agencies shall determine that no alternative to the proposed regulation would be more effective in achieving its objectives, or would be as effective and less burdensome to affected private persons, and an explanation for rejecting any alternative that would lessen the adverse economic impact on small businesses.
- ***Health and Safety Code Section 57005*** provides, among other things, that the CalEPA and its departments shall consider, before adopting any major regulation, whether there is a less costly alternative or combination of alternatives to achieve the same end. This applies to proposals with an economic impact on the state's business enterprises exceeding $10 million.

According to ARB, its AB 32-related economic analysis work has been relatively more in-depth at the regulation development stage as opposed to the economic analysis associated with the development of the SP. For major AB 32-related regulations that are currently under development—such as the C&T and Pavley II regulations—the Legislature might consider holding oversight hearings on the ARB's economic and fiscal impact analyses *prior to* these regulations being adopted. The purpose of such hearings could be two-fold: (1) to enable legislative evaluation of the quality and comprehensiveness of the statutorily required analyses, perhaps leading to direction that additional analyses be conducted, and (2) to provide a basis for legislative policy direction to guide the development of the regulation.

Possible Legislative Action Items. Based on the results of further analysis conducted at the Legislature's direction, the Legislature could potentially direct that changes be made to individual AB 32 regulations (modifications or even repeal) and to the SP's mix of measures. The goal of such direction could be to improve the overall effectiveness and cost-efficiency of AB 32 implementation.

Policy Direction for C&T

SP Includes C&T System

The SP includes a C&T program to achieve about 20 percent of the plan's GHG emissions reductions. The C&T program would apply to four economic groupings which collectively account for more than 80 percent of the state's GHG emissions. Those four areas are transportation, electricity, commercial/residential, and industry. The GHG emissions from each of these four sectors would be "capped" so that, collectively, they could emit no more than a certain level of GHGs in 2020 that works towards meeting AB 32's overall GHG emission reduction target.

The Economic Theory of C&T

Assembly Bill 32 authorizes the use of market-based compliance mechanisms, such as a C&T system, to meet the bill's GHG emission reduction targets. In contrast to direct regulatory measures, market-based compliance mechanisms provide economic incentives to achieve emissions reductions, without specifying how emissions sources are to achieve those reductions.

Under a C&T program, the regulator issues allowances for each ton of emissions permissible within the regulated sectors. A regulated source must possess an allowance for each ton of the regulated emission it produces within the period of compliance or face penalties. Because the amount of allowances issued is eventually less than the amount of emissions that would otherwise be produced, the effect of the allowance system is lower overall emissions. As these allowances can be viewed as something akin to an asset or property right that has value, policy choices made with respect to them can affect the amount of this value and who receives it.

The rationale in economic theory behind use of market-based mechanisms such as C&T is that, when compared to command-and-control measures, they can achieve the same quantity of emissions reductions but at a potentially lower cost. This is because the focus of market-based mechanisms is the amount of emissions placed into the atmosphere from various sources combined, not the amount of emissions attributable to any individual emissions source. So long as they comply, sources can decide to increase or reduce their emissions or buy or sell allowances based on the price of allowances and their own costs of emission reductions.

Compliance Costs Under C&T Ultimately Determined by Market …

The cost of complying with a C&T regulation is determined, in effect, through trading of emissions allowances. In this way, a market determines the price of an emissions allowance. Regulated sources in the trading program must decide whether an activity that produces emissions makes economic sense, after accounting for the cost imposed by the C&T system. Firms that can reduce their emissions at a cost per ton below the trading price of a ton of emissions allowances will do so, thereby allowing them to sell any excess allowances to other sources that need or want them. By allowing sources that can reduce emissions most cheaply to do the reducing, a C&T program achieves, in theory, emissions reductions at the least cost possible.

It should be noted that the trading market referred to is one that would be created by government. To work robustly, the market requires a clear set of rules to guide its operation and sufficiently stringent enforcement of these rules. The design of the market involves many policy choices that can significantly drive outcomes.

… But Policy Choices Can Fundamentally Impact C&T Costs

The market ultimately determines the price of allowances under a C&T system. However, there are various policy choices involved in the design and implementation of such a system that, depending on how exercised, can substantially impact this price as well as other costs of compliance, either positively or negatively. As a general rule, the more compliance flexibility granted, the lower will be the overall costs of compliance.

In the following section, we discuss a number of the key policy choices involved in the design and implementation of a C&T system, including the tradeoffs involved. We provide our thoughts on which issues it would be appropriate for the Legislature to provide its policy direction. As we discuss, there are various design features that could be included in a C&T system that offer the opportunity to contain costs. Due to concerns expressed about the potential adverse economic impacts of a C&T system, these cost containment measures warrant policy consideration by the Legislature. While some of these design features have relatively greater tradeoffs and pose more risk than others, such as the borrowing of allowances and the use of offsets, we think that it is appropriate that all cost containment opportunities be evaluated by the Legislature.

Major Policy Choices in C&T Design and Implementation

Allocation of Emission Allowances: Auctioning and Free Allocation. A critical design feature of a C&T program—which involves a number of major policy choices—is the means by which emission allowances are allocated, both initially and over time. In general, the way in which allowances are initially allocated will not affect the emission reductions achieved by a C&T program. However, it may affect the way in which a program's costs are distributed and can affect overall program costs. There are two basic approaches to allowance allocation: some form of free allocation or auction. A combination of the two, or a shift from one to the other over time is also possible. A gradual shift from an initial free allocation to auctioning in later compliance periods may make sense if the policy goal is to provide "transition" assistance to regulated entities as the new program ramps up and to give time for technological innovation to develop so as to lower compliance costs.

Several types of free allocation exist. For example, allowances could be given away based on participating entities' historical emissions (a method also known as "grandfathering"). Output-based methods of allowance allocation are based on the emissions from production in a given sector. For example, allowances might be allocated based on megawatt-hours generated or tons of a product manufactured. Benchmarking, or setting a level of emissions (in the form of allowances) per unit, can be applied based on input or output. Allowance allocations may also be updated over time as emissions change.

The Legislature will want to consider the tradeoffs between simplicity and other policy objectives if allowances are allocated for free. For example, basing allocation on his-

torical emissions is relatively simple; however, the Legislature may want to consider providing some form of credit for early action in order to ensure that firms that took voluntary measures to reduce their emissions before the base year are not penalized for doing so. Updating may have the advantage of adjusting an initial allocation to changing circumstances.

As an alternative to free allocation, allowances can be auctioned. Auctioning generates revenue to the state, which could be used to provide financial assistance for compliance, mitigate higher energy costs, or fund complementary policies, among other uses. The use of auction revenues would be up to the Legislature in exercising its appropriations authority. For example, the Legislature could decide to use auction revenues to reduce other taxes in an effort to stimulate economic growth. However, there are tradeoffs involved with auctioning allowances. The cost impact on a given firm depends on the competitiveness of the industry in which the firm operates as well as the industry's regulatory environment. For example, auctioning may be seen as disadvantaging covered entities that lack the access to funding necessary to purchase allowances and cannot pass on some or all of the costs of their allowances to consumers.

Regardless of the allocation method used, opportunities exist to mitigate adverse economic impacts or to incentivize a desired activity. For example, allowances could be allocated for free (or at a lower cost) to emitters that are competitively disadvantaged by emission caps or to entities undertaking energy efficiency projects. Similarly, auction revenues could be used to provide tax relief or to incentivize research, development, demonstration, and deployment of low-carbon technologies.

Compliance Timing Issues. Providing greater flexibility in the timing of compliance under a C&T system helps to control compliance costs. A compliance period is the length of time that covered entities have to submit to the regulator emission allowances commensurate with emissions in that period. By allowing extended compliance periods (for example, a three-year compliance period as opposed to a one-year compliance period), covered entities are provided more compliance flexibility that lends itself to greater cost containment potential.

A similar consideration should be given to the rate at which entities become covered by a C&T program. By identifying and phasing in more slowly sectors which are most susceptible to dramatic cost increases due to a C&T program, regulators and policymakers may allow for greater cost containment.

Compliance timing is a crucial cost factor in large part because of the timing of technological innovation that serves as a cost-effective means of compliance. Such technologies may not be as readily available at the onset of the C&T program or the beginning of a compliance period. As time progresses, it is more likely that technological innovation comes about to lower compliance costs.

In order to contain costs, the Legislature may wish to address both the length of compliance periods as well as the timing at which specific sectors become subject to the cap. While phasing in the inclusion of sectors subject to the cap and providing for extended compliance periods may serve to contain costs, there is a trade-off in that there is less certainty of environmental outcomes. A risk exists that the overall emission reduction targets may not be achieved in the desired timeframe.

Use of Offsets. Another means of containing costs under a C&T system is to allow a regulated source (a California firm subject to C&T) to buy offsets. An offset is a tradable credit that is created when a regulated source, in lieu of making a GHG emission reduction on its own, pays a non-regulated source (an individual or business) to make a GHG emission reduction. For example, a California firm subject to C&T could make a payment which is used by a dairy farmer in Wisconsin to install equipment that traps the release of methane gas. A properly structured offset program would be created and operated within the regulatory regime of a C&T program. The regulatory system could potentially approve offsets from sources outside the state or even outside the country. By providing potentially low-cost reductions and easing allowance price pressure when targets and timetables are stringent, offsets represent a significant means to control costs associated with a C&T program.

An issue that has arisen with respect to offsets is the need to establish eligibility criteria to help ensure that offset projects are verifiable, quantifiable, enforceable, and permanent. Furthermore, the offset should be an additional action or project than what was already required by law or regulation or would otherwise have occurred. Not establishing such criteria could reduce program effectiveness. The use of offsets requires a transparent system with proper oversight and enforcement. If the Legislature authorizes offsets as part of the California program, it might want to consider establishing statutory penalties for non-compliance with offset criteria.

The SP contains a provision that would allow for the use of offsets within a C&T system, but limits the use of offsets to no more than 49 percent of the GHG emission reductions planned to come from compliance with the C&T regulation. In 2009, the Legislature passed AB 1404 (De Léon)—subsequently vetoed by the Governor—which would have limited the use of offsets to no more than 10 percent of C&T reductions. Within the limited amount of offsets permitted, the bill imposed further limitations to the use of offsets by including a provision giving priority to California offset projects. The intent of such a provision was to maximize environmental and public health benefits within the state. The policy trade-off with allowing offsets from out-of-state is a potential reduction in economic and environmental co-benefits of in-state GHG emission reductions, weighed against the potential benefit of reducing GHG emissions at lower cost.

Banking and Borrowing of Emission Allowances. In general, banking refers to the ability of an entity to carry over or "bank" any excess allowances for future use. Banking provides covered entities a greater degree of flexibility and can reduce allowance price volatility because it allows firms to better cope with uncertainties and unexpected circumstances that may lead to high allowance prices at a future date. In addition, the ability to bank allowances may provide an incentive to make early reductions since a declining emissions cap could push allowance prices higher over time. Banking has proven to be an important contributor to the success of past emissions trading programs and is considered a generally accepted design component of a C&T system.

Borrowing refers to a provision which allows covered entities to use in the current compliance period allowances that will be issued in a future period, under the condition that they will pay back the borrowed allowance, perhaps with interest. While borrowing may provide a greater degree of compliance flexibility (and, with that, a greater potential for cost containment), concerns have been raised regarding the risks associated with such activity in terms of program effectiveness. The Legislature might want to consider whether allowing borrowing is worth the potential risk that firms may not be able to meet the agreed upon emission reductions that become pushed into the future. If the Legislature considers the inclusion of borrowing as a means of cost containment in a C&T system, it may wish to reduce the potential risk by limiting the amount that could be borrowed or by setting sufficiently high penalties for non-compliance with statutory criteria authorizing its use.

Advanced Cost Containment Mechanisms: Safety Valves, Strategic Reserves, and Price Collars. Advanced cost containment mechanisms in the design of a C&T program are relatively sophisticated features intended to prevent against extreme upward or downward price pressure on allowance prices. These mechanisms include *safety valves*, which serve as an allowance price ceiling. Under this approach, allowances are made available to the market in the amount necessary to maintain the price at or below the ceiling.

An alternative to a strict price ceiling is a *strategic reserve*. Under this approach, allowances from the cap are set aside in a fund and made available to the market through a supplemental auction with a set minimum selling price (the reserve price). The reserve price is meant to reflect a high-end allowance price estimate. If the market price is driven towards or beyond the upper price estimate, the reserve mechanism provides a tranche of allowances which would be offered at the reserve price. If this satisfies demand, the market will settle. However, if demand exceeds the quantity offered, then buyers may bid up the reserve price. Therefore, a maximum price cannot be guaranteed because reserve permits are finite in number. This is in contrast to a safety valve price cap, which offers an unlimited quantity of allowances at a target price. The lack of an absolute price ceiling is the primary criticism of the strategic reserve approach.

A *price collar* is a cost containment mechanism that serves to bookend allowance prices by establishing an allowance price ceiling *and* floor. Economists believe such a mechanism serves to better protect against price volatility than a price ceiling or price cap alone. While the potential for allowance prices to increase dramatically needs to be considered, the possibility of very low allowance prices can also be problematic as such could threaten the emission reduction goals of the program by reducing the incentive to replace emission intensive equipment and to invest in cleaner energy technologies. A price floor has the attraction of giving investors certainty that the price of emission allowances would never fall below a specified level. A floor could be established by instituting a reservation (or floor) price in an auction for emission allowances. A price floor would reduce the risk of various emission reduction investments.

Linking to Other C&T Systems. California's C&T program can and should, from an economics perspective, be designed to link to other state, regional, national, and international programs provided that these other programs are substantially similar in design and at least as stringent in terms of desired environmental outcomes. Linking programs provides the advantage of expanding more low-cost opportunities to reduce emissions than would otherwise be the case. As such, we think that the Legislature should provide for the coordination of the state's C&T program with out-of-state programs. While ARB is developing the state's C&T regulation in concert with the Western Climate Initiative (a consortium of western states which have agreed to coordinate the development and implementation of a C&T program), it will be important for ARB to include in the regulation a means by which this program could be linked to a federal program, should one be established and the state not be pre-empted from operating its own program. In addition, if a federal program were created, the Legislature would want to consider the policy merits of continuing to operate its own program.

As stated above, linking with other systems is achieved more easily if the design features in each system are similar. For example, monitoring requirements across systems should be equally rigorous, as enforcement levels otherwise default to the lowest common denominator among linked systems. Design features that promote transparency and afford public access to emissions data throughout the linked systems help ensure adequate oversight of the program. Terms for linking with other programs will need to be negotiated individually with other jurisdictions. The Legislature may wish to consider the establishment of an oversight board that (1) evaluates other trading programs on an ongoing basis and (2) monitors changes in linked programs to assess the need for programmatic adjustments in California.

While linking C&T programs produces economic benefits, there are some potential policy trade-offs for the Legislature to consider. The key one relates to where the so-called "co-benefits" of GHG emission reduction—such as air quality-related public health benefits—would accrue. By linking California's program with programs outside

of the state, the co-benefits of California's program would to some degree accrue outside of the state.

Should you have any questions regarding this information, please contact Tiffany Roberts at 319-8309 regarding specifics about AB 32 and the SP, and James Nachbaur at 319-8365 regarding economics-related issues.

Sincerely,

Mac Taylor
Legislative Analyst

cc: Hon. Dave Cogdill
Hon. Robert Dutton
Hon. Roger Niello