

March 4, 2010

Hon. Dave Cogdill  
Senator, 14<sup>th</sup> District  
Room 5097, State Capitol  
Sacramento, California 95814

Dear Senator Cogdill:

This responds to your request for an analysis of the net impact on jobs in California that would occur as a result of the implementation of AB 32 (Núñez), the Global Warming Solutions Act of 2006, Chapter 488, Statutes of 2006. In our response below, we briefly summarize the basic provisions of AB 32 and its planned implementation through the California Air Resources Board's (CARB's) Scoping Plan (SP), discuss the avenues by which the SP would potentially affect California jobs, and present the jobs-related effects of the SP as estimated by CARB. We then comment on CARB's analysis and offer our own view about how the SP might affect jobs. Although our response below focuses on jobs because that was the specific nature of your request, you should be aware that employment effects are but one of many ways the SP would affect the economy. Others include impacts on output, personal income, business profits, and consumption and investment spending.

***CARB Is Currently Updating Its Analysis.*** At the outset, we would note that CARB indicated to us several weeks ago that it is in the process of updating its SP economic analysis. At that time, CARB staff thought that they would be able to provide us with some preliminary information as to the results of this updated analysis. However, as of this date, we have not received any such information.

***Principal LAO Findings.*** The effects of the SP on California jobs are difficult to accurately predict but would be mixed, with gains in some occupations and industries (including so-called "green" jobs) and losses in others (primarily involving fossil fuel-related energy production). On balance, however, we believe that the aggregate net jobs impact in the *near term* is likely to be negative, even after recognizing that many of the SP's programs phase in over time. Reasons for this include the various economic dislocations, behavioral adjustments, investment requirements, and certain other factors that the SP would entail. In the *longer term*, its net effect on jobs—potentially either positive or negative—is unknown and will depend on a variety of factors. In a relative sense, however, its effect on jobs in both the near term and longer term will probably be modest in comparison to the overall size of the state's economy. This, in part, reflects the relative role that energy-related inputs and costs play in our economy, as well as the

SP's specific measures. Certain individual businesses and households, however, would be seriously affected.

## **BASIC PROVISIONS OF AB 32**

Assembly Bill 32 requires that California limit its emissions of green house gasses (GHGs) so that, by 2020, California's emissions of GHGs are equal to what they were in 1990. The CARB estimates that this will require a reduction in GHGs by 2020 of about 30 percent below the level that would otherwise exist in 2020 without AB 32 in effect, or about 15 percent below current emissions levels. To this end, AB 32 required CARB to quantify the state's 1990 GHG emissions and to adopt, no later than January 1, 2009, a "scoping plan" that describes the board's plan for achieving "the maximum technologically feasible and cost-effective reductions" of GHG emissions. The CARB adopted its SP on December 11, 2008. The measures proposed in the plan are to be developed over the next two years and be in place by 2012.

## **CARB'S PROPOSED GHG MITIGATION ACTIONS**

As required, the draft SP provided an estimate of California's GHG emissions in 1990, outlined the GHG emissions reduction measures under consideration by CARB, and discussed the preliminary estimates of the costs, savings, and other effects associated with implementation of the plan. The CARB's SP includes a number of different measures to reduce GHGs. These 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 through directly influencing energy costs. As shown in Figure 1 (please see next page), about 85 percent of the required reduction in GHGs mandated under AB 32 is estimated by CARB to be accounted for by six key measures.

We would note that in terms of the package of actions proposed by CARB in the SP, existing statutes and executive orders requiring certain actions (such as the low carbon fuel standard) effectively constrain the way that CARB can implement AB 32.

## **WHY JOB EFFECTS WOULD OCCUR**

There are a variety of avenues by which CARB's proposed GHG mitigation measures would affect jobs, both positively and negatively. Some of these include:

- **Energy Prices.** Measures in the SP directly affecting energy prices, such as a cap-and-trade program, would almost certainly raise the near-term prices of electricity, gasoline, and certain other energy sources. These increased energy prices would, in turn, change the amount and mix of energy used, energy-related jobs, and sales and employment in industries producing goods and services using energy as an input.

<b>Figure 1 Proposed Measures to Reduce Greenhouse Gasses (GHGs)</b>	
<b>Type of Measure</b>	<b>Percent Share Of Total Reduction<sup>a</sup></b>
Cap-and-trade program	19.8%
Light-duty vehicle GHG emission standards <sup>b</sup>	18.2
Energy efficiency (including relating to buildings and heating)	15.1
Renewables portfolio standard (33 percent by 2020) <sup>c</sup>	12.1
High global warming potential gas measures	11.6
Low carbon fuel standard <sup>d</sup>	8.6
All other <sup>e</sup>	14.6
<b>Total</b>	<b>100.0%</b>

<sup>a</sup> Reduction from 2020 level that would exist if AB 32 were not in place.  
<sup>b</sup> Reflects impact of Chapter 200, Statutes of 2002 (AB 1493, Pavley).  
<sup>c</sup> Reflects Executive Orders S-14-08 and S-21-09.  
<sup>d</sup> Reflects Executive Order S-01-07.  
<sup>e</sup> Includes, among others, sustainable forest measures, regional transportation-related targets, other vehicle efficiency measures, and efficiencies in the movement of goods.

- **Types of Energy Used.** Measures directly affecting the mix of energy used, such as the renewables portfolio standard, would also affect production costs, the aggregate level and mix and average earnings of employment in the energy sector, and sales and jobs in industries producing goods and services using energy as an input and their supplier industries.
- **Vehicle Fuel Standards.** Mandated improvements in vehicle fuel efficiency standards would both increase the prices of cars, reduce their operating costs, and change the total amount and mix of spending on vehicles. In turn, this would affect employment in the vehicle production, sales, and servicing industries, and indirectly, the demand for other goods and services and their associated employment levels.
- **Non-Vehicle Energy Efficiencies.** Mandated improvements in non-vehicle energy efficiency, such as building and heating standards, would reduce household and business utility costs, thereby freeing up resources for other spending priorities that have their own job impacts. Innovation induced by SP actions could also lower energy costs.
- **Energy-Related Investments.** In order to achieve energy efficiencies, investments in various energy-saving capital equipment are required. The need for

such investments creates job opportunities in industries producing the equipment. However, it also requires financial capital which can reduce household disposable income and business profits, thereby reducing spending and hurting employment in other areas. These investments may also change the economy's overall capital-to-labor ratio, and thus demand for labor.

- **Trade Flows.** Changes in energy-related prices, the mix of energy consumed, and energy-efficient investments can change the amount of spending, production, and related employment that occurs within California versus in other states.
- **Business Expansions, Contractions, and Relocations.** The GHG mitigation measures that raise costs for certain forms of energy use in California can, especially in the near term, reduce the rates of return for certain business enterprises, impairing their profitability and, at the extreme, even inducing them to relocate or expand elsewhere.
- **"Green Technology" Economic Development and Leadership.** Some parties argue that AB 32's implementation through the SP could lead to California becoming a national and global leader in a new and growing sector of the economy, similar to what occurred with the computer industry during the 1980s and 1990s. If this occurs, it could stimulate California employment independent of the impacts on jobs of the SP's proposals to mitigate GHGs in California.
- **Regulatory-Related Compliance Costs.** The expenses businesses face in complying with new regulations are a form of business costs, and can affect profits and business activity, including jobs.

## **THE CARB'S ESTIMATED JOB IMPACTS OF THE AB 32 SP**

**Modest Net Gain Projected.** California's current total wage and salary employment level is roughly 16 million, and CARB's projection for 2020 absent AB 32 is 18.4 million. The CARB estimates that its proposed GHG mitigation measures would have a modest positive net impact on jobs in California by 2020 compared to the level of employment that would occur in the absence of these measures (the latter is referred to as the business-as-usual scenario, or BAU). Specifically, CARB estimates that there would be a net increase in the level of employment in 2020 due to AB 32's SP of roughly 120,000 persons (a 0.7 percent gain).

**Effects by Industry Vary.** Consistent with the variety of different avenues noted above by which the SP would impact jobs, CARB's net employment effect reflects job gains in some industries and occupations, and reductions in others. In particular, CARB projects job losses in the broad utilities sector, reflecting reduced electricity generation and natural gas consumption. In contrast, it projects other broad sectors to experience

net job gains—led by the services sector and followed by agriculture, retail trade, and manufacturing—reflecting primarily energy efficiency gains along with various factors.

***Basis for the Estimate.*** The CARB studied the impacts of each major action proposed in the SP. The CARB then aggregated those impacts in what is called a computable general equilibrium (CGE) model to compare the level of California jobs and certain other economic variables that would exist in 2020 both with and without the SP in place. The specific CGE model used is a large-scale complex model with hundreds of equations called the Environmental Dynamic Revenue Assessment Model (E-DRAM). The model includes 120 industry sectors, input markets for labor and capital, and various subsectors for consumption, household behavior, investment spending, government, and trade. The model attempts to track how policy changes in one part of the economy might ripple throughout the rest of the economy by affecting such economic variables as: the prices of different goods and services; the costs of different inputs including energy; the volume and mix of productive activity; consumption; investment activity; and the total level and characteristics of jobs. The model is intended to provide “snapshot” views of what the California economy would look like both with and without AB 32’s SP policy changes in place, once the effects of such policies have completely worked their way throughout the entire economy and the economy is in “equilibrium.”

## **CHALLENGES IN MAKING SP JOBS ESTIMATES**

At the outset, it is important to understand that there are a great many uncertainties that inherently face anyone who attempts to make jobs-related estimates for the SP. This is particularly so given that the implementation of AB 32 through the SP is still developing. Examples of key uncertainties in estimating jobs effects include:

- Energy-related technological changes that might occur over the forecast period, including higher- or lower-than-expected rates of return on energy efficiency investments.
- Changes in federal policies regarding climate change, fuel standards, and other energy-related issues.
- How specifically a state cap-and-trade program is structured by the Legislature, including how any revenues collected might be used to support programs or reduce taxes in a way that could lead to job growth.
- Decisions by other states regarding their own climate-related policies, which can affect the cost-effectiveness of AB 32’s SP measures due to spillovers and leakages (such as a polluting firm relocating to another state from California).
- Employment forecasts in response to policy changes can be especially difficult because they tend to be “one step removed” from the economic variables

- more directly affected—like production. Put another way, there is generally not a simple relationship between policy changes and jobs per se.

## **LAO ASSESSMENT OF CARB'S JOBS ESTIMATE**

In addition to the uncertainties noted above, there are a variety of factors that lead us to question the reliability of CARB's 2020 jobs estimate. We discuss these in detail below.

### **Basic CGE Modeling Issues**

*CGE Models Have Inherent Limitations.* Although CGE models are well-accepted analytical tools amongst economists for some purposes, the E-DRAM also has certain characteristics that limit its ability to accurately predict the SP's jobs impacts. The CGE models are large macroeconomic models whose strength is their ability to capture some interactions among broad economic sectors, industries, consumer groupings, and labor markets. In contrast, the ability of CGE models to adequately capture behavioral responses of households and firms to policy changes is more limited.

Additionally, because the data in such 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 subgroupings 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 the SP—can be hard to identify since they are obscured within the average outcome.

*Does E-DRAM Accurately Portray the Economy's Current Structure?* Due to data limitations, E-DRAM's industrial sector data are not based on California-specific information but rather on national-level data periodically collected from surveys of United States companies. Various adjustments are then made to apply the data to California. Thus, the model attempts to approximate but does not exactly reflect California's industrial economy, including how its industrial productivity differs from the rest of the nation. In addition, again due to data limitations, E-DRAM's overall underlying structure of the state's economy, including the interrelationships between its sectors, is calibrated to 2003 as the base year. Thus, its calibration is a bit dated and does not reflect underlying changes in the California economy's structure that have occurred during the recent severe recession, ongoing housing market turbulence, and restructuring of the financial markets.

*Certain Inconsistencies Exist Between the CGE Approach and CARB'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, CARB's economic analysis of the

measures included in the SP 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, which other energy economists also have struggled with, raises certain questions about CARB’s underlying modeling approach and its findings.

### **Application and Use of the CGE Model**

*CARB’s Analysis of Vehicle Purchase Decisions Raises Issues.* Another issue echoed by outside economists is the basic approach CARB used—the so-called “lowest net present value life cycle” approach—to analyze the choices consumers make. This enables CARB to sometimes conclude that imposing regulations on producers that in turn raise prices on consumers can, in certain circumstances, make them better off. While this can be true in some cases, such as when “negative externalities” are involved, it also can give the impression that consumers are making “bad” choices. For example, CARB assumes that consumers will benefit from making choices like car purchases using the lowest net present value life-cycle cost criterion, whereas in actuality they might explicitly be choosing more expensive, less fuel-efficient cars for some other reason. If so, imposing regulations can make some consumers worse off. This is because they might not be able to buy less-fuel-efficient cars for other motivations or might have to pay more to continue to buy their less-fuel-efficient cars, even though imposing regulations might improve overall energy efficiency. This raises the fundamental issue of the extent to which households and businesses in the economic marketplace generally make logical least-cost decisions or whether some form of intervention is needed to get them there.

*Scoping Plan Could Have Been Modeled Differently.* We also note that SP measures can be modeled in different ways within a CGE framework. In our discussions with various economists about using a CGE modeling approach, some expressed concerns about the appropriateness of the CARB’s CGE approach versus alternative approaches. For example, one specific suggestion was that CARB build an entirely new stand-alone sector in the E-DRAM that produces fuel-efficient cars with its own interactions with other sectors, including non-fuel-efficient cars. This contrasts with CARB’s approach of trying to integrate more-efficient vehicles into the existing car market by changing its average properties. We do not know how the model’s results would differ if this alternative suggested approach were used.

*Sensitivity and Scenario Analyses Are Lacking.* As CARB itself notes and the E-DRAM’s authors at the University of California Berkeley have previously stressed, the inputs into the model are critical determinants of its outputs. Because of the complex nature of AB 32 and its proposed implementation steps, however, running E-DRAM involves making many judgments and assumptions. Judgments include choosing exactly how to modify the model’s equations and parameters to best capture the SP’s effects. Given this, identifying the sensitivity of the model’s outputs to different alternative reasonable assumptions is important in order to have a full picture of how the

economy, including jobs, might be affected by the SP. Relatively limited analysis of this sort has been completed by CARB, however, including the conditions that might result in significant adverse job impacts.

### **Timing Issues**

*What Will the Transition Years Look Like?* As noted earlier, E-DRAM provides snapshot views of what an economy is estimated to look like under different assumptions at specific points in time. The model does not, however, show what the economy and its individual sectors will look like between these two time points, as it undergoes its transition from the old equilibrium to the new one. This is an important issue in the case of major measures like the SP, because the process of adjustment during the transition period can be difficult and impose significant changes and costs on households and businesses. Even if a business might in theory end up being roughly the same off or even better off than it was originally at the end of the transition period, it may not make it to that point if the transition was too disruptive or financially difficult. For instance, it might go out of business, cut back operations, or choose to relocate elsewhere. Because the E-DRAM does not model transition years and basically provides projections about how an *average* business will fare versus information about how both *winners and losers* fare, it cannot identify the job losses that might be associated with the latter group of firms.

*Employment Adjustments Typically Take Time.* As noted above, it takes time for an economy to make the transition from one equilibrium to another. In terms of jobs, the transition under the SP will involve such things as ensuring that the workforce has the skills needed by the growing new industries and that the state's training and education infrastructure are able to upgrade workers' skills. Because all this takes time, the transition under the SP will involve various labor force dislocations, including temporary job losses and unemployment for some people and permanent employment and income disruptions for others. The CARB's analysis does not identify these.

### **Other Specific Issues**

*Manufacturing Jobs May Be Overstated.* The SP's economic analysis shows that positive job effects in manufacturing would occur. It is our understanding that CARB assumed the SP's measures would cause similar energy-related efficiency gains in industrial sectors as in certain other sectors. We have raised concerns about this employment finding with CARB staff, questioning how significant the as-yet unrealized industrial-related energy efficiencies might be, given that this sector tends to be relatively energy efficient already. We will be waiting to see if CARB's forthcoming update of its SP's economic effects will revise its manufacturing jobs estimate downward.

*Overall Job Impacts of "Minor" Regulations Unclear.* The CARB's analysis chose to represent what it feels are the "major" SP actions in E-DRAM, as described above. The focus on those actions has some merit because no quantitative model could represent all the SP actions together, including their interactions. However, the SP's other dozen-or-so



proposed actions (including actions involving sustainable forestry, water-use efficiency, commercial recycling, green buildings, and others) will also affect California households and businesses, in some cases materially. It is not clear to us how CARB's analysis handled these effects and their job impacts in its modeling of bottom-line impacts.

***The BAU Baseline Might Be Misleading.*** We have concerns about the accuracy of the projected BAU scenario from which the projected jobs impacts of AB 32's SP are measured. In particular, some aspects of the proposed SP GHG reduction measures involving energy efficiency would occur in future years even in the absence of the SP. For example, CARB itself states in the SP that the BAU represents what California's economy will look like in 2020 if *none* of the recommended measures are implemented, despite noting that a number of the plan's measures would be implemented anyway as a result of various federal and state policies even if AB 32 and the SP had not been adopted. In addition, consumers and businesses might have voluntarily adopted certain energy efficiencies in future years at a faster-than-expected rate because they may make financial sense even in the absence of the SP. To the extent this occurs, the CARB's analysis may overstate the number of jobs attributable to the SP.

***What About the Investment Pathway?*** One specific aspect of the SP transitional period involves households and businesses directly and indirectly making the necessary investments required to achieve mandated GHG reductions and greater energy efficiencies. To make these investments, investors must either tap their own scarce resources or obtain external financing through borrowing. In addition, such energy-related investments usually generate their benefits over a number of years, and thus typically involve up-front costs that are only eventually offset in the future (provided the investments make economic sense) through energy-related savings. Thus, during the early years, businesses can experience cash-flow pressures.

This factor, as well as the problems some firms (especially smaller ones) will experience in obtaining attractive financing, and the fact that SP-related investments could displace certain other higher-return investments, suggest that some firms will be hurt financially during the transition. This could adversely affect their profitability, production levels, jobs, and location decisions. The E-DRAM analysis does not fully incorporate such investment dynamics or their potential adverse impacts on employment.

A final issue involving investment is whether the positive jobs impacts of new investments would occur in California or would occur elsewhere. Certain investment-related leakages are likely. For example, this would be the case if energy equipment were purchased from out of state manufacturers. We are not sure from CARB's analysis, however, how important this leakage problem is, or how effectively the E-DRAM allocates where investment spending related to the SP's measures and their associated jobs impacts will occur geographically.

**The Bottom Line**

In trying to assess the economic impacts of the SP on the California economy, CARB faced a difficult task with many technical complexities. Given the many issues raised about their efforts to date, however, we believe that CARB's current modeling tools and their method of application are not able to provide reliable estimates of the jobs impacts of the SP in 2020. While CARB did not estimate job impacts for other time periods, it seems most likely to us that the implementation of AB 32 through the SP will result in the near term in California job losses, even after recognizing that many of the SP's programs phase in over time. This reflects the various economic dislocations, behavioral adjustments, investment requirements, and certain other factors that the SP would entail. In the longer term, the employment effects in our view are unknown and will depend on a number of yet-to-be determined factors. These include future energy prices, technological developments in the energy area, normal adoption by households and businesses of increasingly efficient energy technologies even without AB 32 in place, legislative actions, how the cap-and-trade program is designed, and the state of California's economy. The effects that do occur may not prove to be particularly large relative to the overall economy, in part reflecting the relative role played by energy costs and the SP's specific measures. Certain individual businesses and households, however, would be seriously affected.

Should you have questions regarding this information, please feel free to contact Mark Newton at (916) 319-8323 regarding the provisions of the AB 32 SP, and David Vasché at (916) 319-8305 regarding economics-related issues.

Sincerely,

Mac Taylor  
Legislative Analyst