

# REVIEW OF THE CLIMATE ACTION TEAM'S ECONOMIC ASSESSMENT OF CLIMATE CHANGE EMISSION REDUCTION STRATEGIES

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## PHASE I, PRELIMINARY CRITICAL REVIEW

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# Review of the Climate Action Team's Economic Assessment of Climate Change Emission Reduction Strategies

## Review Background

SEE California engaged the Sacramento Regional Research Institute (SRRI) to critically review the *Climate Action Team Report to the Governor and Legislature*, focusing on the January 12, 2006 draft of the Climate Action Team (CAT) Economic Assessment (Chapter 8) that looked at the macroeconomic impacts associated with climate change emission reduction strategies. This preliminary review was conducted similar to an academic peer review, suggesting ways to improve the report and identifying shortcomings. SRRI's team produced three independent reports in the preliminary review phase (attached) and the following summary is based on the findings from those reports.

## Summary of Review Findings

The review found that the CAT Economic Assessment lacks the documentation and transparency in its assumptions, economic inputs, and methodology to convincingly come to its conclusion that greenhouse gas emission reduction programs will create economic benefits for the state.

The CAT Economic Assessment could be improved by addressing the following issues:

- 1. The CAT should suspend making conclusions on the economic impacts of potential emissions reductions strategies when the basis for its Economic Assessment is admittedly changing and incomplete.**

While there does appear to be an overly optimistic conclusion in the Economic Assessment, it would be acceptable if the evidence were convincing. Documentation and convincing evidence are critical elements in a report of this nature and accepting the findings of this report without greater transparency in the analysis would not be prudent.

- 2. The CAT Economic Assessment does not provide an adequate analysis of whether Executive Order S-3-05 will generate a net cost or benefit to the state.**

Considering the potential economic impacts of greenhouse gas emissions reduction strategies, EOS-3-05 should be subject to a full benefit-cost analysis, utilizing standard, economic-based practices. Implementation of the strategies without knowledge of the true costs would be unwise. There are a number of aspects to consider in utilizing a benefit-cost analysis that should be adopted to strengthen the Economic Assessment, including:

- The analysis should establish a clear “baseline” or “business as usual assumption” to demonstrate what California’s economy would look like in the

absence of the strategies and accurately measure the incremental costs and benefits of the strategies to the citizens of the state.

- The full range of costs and benefits should be accounted for in the analysis. Every effort should be made to capture relevant costs including hidden costs and public sector implementation, monitoring, compliance, enforcement, and other administrative costs. Hidden costs might include regulatory inefficiencies, rent seeking behavior, and loss of consumer and producer surplus.
  - The analysis should include all strategies underway and necessary from Tables ES-2 and ES-3 since they are all deemed important in reaching the desired outcome and have not been fully captured in the CAT Economic Assessment.
  - Similarly, the widest set of benefits should be accounted for in the benefit-cost analysis.
  - If possible, the costs and benefits of the potential effects of climate change should also be captured in the analysis. This aspect should take into account the effects of policies in other states and at the national level, which could create free-rider issues, impact emissions, and generate costs to California firms.
  - The costs and benefits for each strategy should be presented separately and aggregated to demonstrate the net effect.
- A range of values should be offered for the costs and benefits, rather than a single “best” estimate, to account for uncertainty in the underlying assumptions.
- A year-by-year impact measurement should be implemented to allow for accurate discounting of costs and benefits and illustrate the net effects throughout the target periods.

**3. The findings in the Economic Assessment are not convincing due to a general lack of documentation and transparency in the analysis.**

While the report’s analysis could be improved in many regards, there is a pressing need to incorporate transparency into the assumptions and analysis irrespective of the choice of analysis methodology. Every effort should be made to be more explicit in the assumptions behind the analysis, provide deeper analysis and explanations throughout, and present a clearer evidence trail to help the readers understand the assumptions, methodology, and findings. Without this, even the highest quality analysis can be deemed deficient and not credible.

**4. Uncommon findings and critical questions should be addressed up front.**

The CAT Economic Assessment includes a number of findings based on assumptions that require further explanation. A few questionable areas that were identified in the review of the CAT Economic Assessment include the concept that private, profit-maximizing firms are not currently pursuing available efficiency programs that would reduce emissions and lower operating costs; the unclear accounting of a loss in consumer welfare; the unexplained accounting of net costs and savings; and the premise that all emission reduction targets will be realized.

**5. There are aspects of the report that would act as good building blocks for generating a more complete and convincing analysis.**

The use of a computable general equilibrium model is a standard practice in impact analysis since it allows for a more thorough accounting of economic activities. Also, in general, the energy price inputs appear reasonable (although the natural gas price for 2010 might be low). Similarly, the related savings factor input assumptions appear relatively accurate. It is important to note, however, that like all other elements of the report, these building blocks should be fully documented and explained.

**6. The CAT should release the information required to complete a more comprehensive critical review.**

In order to fully understand the potential economic impacts of greenhouse gas emission reduction strategies as well as to properly assess the findings of the CAT Economic Assessment, the following information is required and should be provided to the public:

- Documentation of the E-DRAM model.
- Notes/minutes from input review workshops (mentioned on p. 2 of the Documentation of Inputs).
- Detailed information on “baseline” or “business as usual” assumptions.
- Detailed listing of income and employment impacts for each strategy (documentation of Tables 8-1 and 8-2).
- More comprehensive details on the inputs for all Investor-Owned Utility strategies from Table 5-2.
- More comprehensive details on the inputs for the Forest Management strategy from Table 5-2.

- Clarification on whether the Energy Prices (outlined on p. 3 of the Documentation of Inputs) are wholesale or retail prices.
- Clarification on whether the natural gas prices in the Energy Prices (outlined on p. 3 of the Documentation of Inputs) are wellhead or customer delivered prices.
- *California Climate Leadership: Strategies to Reduce Global Warming Emissions* report from the Tellus Institute.
- Detailed accounting of what was changed to simulate a California economy under the executive order as compared to one without it.
- Breakdown of years leading up to 2010 and 2020 and information about at which point a positive net impact begins.
- Information on how consumer and producer surplus is accounted for.
- Information on how indirect costs to consumers and businesses are accounted for.
- Details on the expected taxes and fees in each year.

Again, the CAT Economic Assessment could be strengthened by providing a convincing analysis of whether EOS-3-05 will generate a net cost or benefit to the state based on well-documented and transparent assumptions, inputs, and methodology.

**Preliminary Critical Review of *Climate Action Team Report to the Governor and Legislature*, Economic Assessment**

**Stephen Perez, Ph.D.**

**Economist, Sacramento Regional Research Institute and Associate Professor of Economics, California State University, Sacramento  
and**

**Ryan Sharp**

**Director, Sacramento Regional Research Institute**

**February 14, 2006**

The Sacramento Regional Research Institute (SRRI) has been asked to conduct a peer review of the Climate Action Team Report to the Governor and Legislature, specifically focusing on the draft Economic Assessment, dated January 12, 2006. This brief review will first address the report in general and then the overall findings of the economic analysis. The Economic Assessment looks at the effects of implementing the measures to reduce greenhouse gas emissions outlined in Executive Order S-3-05 and discusses the costs and benefits of these measures. Our reading of the report is as a cost-effectiveness assessment, assuming that EOS-3-05 will be implemented. Such an assessment comprises of looking at the cost-effectiveness of each strategy and whether there is merit in conducting such an assessment. If done well, it would provide a full range of possible measures to be undertaken to achieve the reduction in greenhouse gases in California and the associated cost-effectiveness of each measure. However, a relevant question is whether EOS-3-05 is a net benefit to the state.

We strongly recommend that a full benefit-cost analysis methodology be utilized in the Economic Assessment and supplemented with a cost-effectiveness approach. While a cost effectiveness analysis attempts to determine which practices create a desired outcome for the lowest cost, a benefit-cost analysis accounts for the value of the benefits of a course of action and subtracts the costs associated with it. A benefit-cost analysis can determine whether a course of action produces a net cost or a net benefit—therefore, a relevant benefit-cost analysis of the EOS-3-05 strategies would determine the net cost or benefit to the citizens of California. Such an assessment should follow established practices in the field and use the citizens of California as the relevant stakeholders.

The Economic Assessment incorporated a high level and incomplete benefit-cost analysis and discusses the desire to explore cost effectiveness in the future (p.1). We believe that in the case of climate change emission reduction strategies, an adequate benefit-cost analysis must account for all costs including hidden costs such as regulatory inefficiencies (regulations other than broad market incentives may cause lowest costs methods to be ignored); rent seeking behavior by potential winners and losers (given that there will be winners and losers from policies enacted, private firms will expend resources, lobbying for example, to attempt to be one of the winners); and loss of consumer and producer surplus from changing behavior (given that people have chosen their current locations and form of transportation, for instance, they must be made worse

off by forcing a change in behavior). Additionally, the Economic Assessment should fully account for the public sector implementation, monitoring, compliance, enforcement and other administrative costs. Similarly, the widest set of benefits should be accounted for in the benefit-cost analysis. Implementation of the strategies without knowledge of the true costs would be unwise.

It would be prudent to generate assumptions with a range of values, not just a single set of estimates (the “best” values)—this will account for uncertainty in the underlying assumptions. Consideration should be given to the full range of economic impacts, including direct, indirect, and induced activities and calculations should account for impacts on tax revenues in addition to jobs and income. A computable general equilibrium model was used in the Economic Assessment (E-DRAM), a standard practice in economic impact analysis; however, details on the model structure and documentation on its validity should be provided. Further, the analysis should make an attempt to provide some assessment of the 2050 costs and benefits even though it is on the outer limits of reasonable estimate periods to provide context for the full range of emission reduction targets.

The Economic Assessment should account for all strategies, underway and necessary, since they all contribute to the final intended outcome. The report should definitely include analyses of the strategies that were left out of the draft, including Green Building Initiative and Hydrogen Highway from the list of strategies underway (Table ES-2) and Building Energy Efficiency Standards; Alternative Fuels: Non-Petroleum Fuels; Transportation Policy Implementation; Measures to Improve Transportation Energy Efficiency; Smart Land Use and Intelligent Transportation (which is projected to have the largest emission reduction out of all strategies in 2010 and the second-largest in 2020); and Conservation Tillage/Cover Crops from the strategies needed to meet the targets (Table ES-3).

Where possible, a few other aspects should be considered in the Economic Assessment. Linking scientific and policy/economic analyses would allow the costs and benefits of the estimated potential climate change impacts to be accounted for in the assessment. On a localized level, climate change is anticipated to produce a wide range of negative consequences and some analyses have even shown localized benefits. The Economic Assessment can be improved by including some accounting of climate change-related costs and benefits. Within this, the effects of the emissions generated outside of the state should be assessed since other states and the nation overall have not enacted strict climate change policies. Similarly, costs are driven by factors outside the state (such as terms of trade for energy exporters) and they should also be considered in the Economic Assessment where applicable.

A clear “baseline” or “business as usual” scenario should be developed to accurately measure the incremental costs and benefits of the proposal and the scenario should be comprehensively explained. This scenario should include all elements mentioned above in order to paint a clear picture of the potential or likely conditions in the absence of climate change emission reduction strategies. It appears that, to some degree, a baseline

was developed in the Economic Assessment, but its scope seems limited and the assumptions behind it are unclear. Further, the analysis should be done on an annual basis to allow for accurate discounting of costs and benefits.

Although the report is focused on economic impacts, it might be applicable to provide a brief discussion of non-economic benefits of adopting the strategies since the finding of a net cost does not automatically imply that strategies should not be adopted. There could be other mitigating issues related to greenhouse gases. Additionally, many environmental policies have been based on the precautionary principle. Within this, it might be applicable to include a discussion of the nation's rejection of the Kyoto Protocol (especially considering the 2050 emission reduction outlined in the report assumes that all developed nations are participating in a meaningful way [p. 16 of CATR]) and the general pushback to the precautionary principle at the national level, including the perception of exorbitantly high costs and uncertain consequences.

The main finding in the Economic Assessment is that implementation of EOS-3-05 will not result in a net cost to the state, but will instead generate \$4 billion in additional income and 83,000 jobs by the year 2020. The report states, "These favorable impacts on the economy are possible because of the reduced operating costs associated with many of the strategies. The additional job growth is expected to come from a net savings to consumers associated with the implementation of the strategies. The savings will, in turn, promote further business expansion and job creation" (p. 1).

We have several concerns regarding the economic impact analysis that was used to generate this finding as well as the premise behind the conclusion. First, it appears that costs are left on the table by profit-maximizing firms. If there are significant cost savings associated with abatement measures, why haven't firms implemented them to increase profit margins? The reasons behind this behavior need to be described. Next, if net savings to consumers is expected to result in job growth, it must be shown that there is a net increase in consumer spending, or that consumer spending is redirected into sectors with a higher multiplier effect. Third, the model is run assuming a fixed set of costs and savings associated with the strategies, making the entire simulation sensitive to changes in the costs and savings estimates. Since the calculations of costs and savings are viewed as preliminary, the result should also be seen as preliminary. Fourth, the Economic Assessment appears willing to assume that there might be benefits that are not measured in the analysis, but will accrue to other stakeholders (for example, security might be enhanced with less dependence on imported energy). However, there is no mention of possible unmeasured costs such as the loss of consumers of changing behavior and firm rent seeking behavior. Finally, the report is willing to assign a portion of the costs of the strategies currently underway because they might have been pursued by multiple policy objectives—this logic should also be applied to the benefits associated with the strategies.

Overall, an effort should be made to fully document the analysis. Within this, the costs and benefits of each strategy should be clearly identified alongside the costs and benefits of "business as usual" in order to generate a fully explained net effect. Some effort was made to provide background information in the Documentation of Inputs, but this is

inadequate for a report of this nature. Moreover, the report should avoid making conclusions on the economic impacts of the strategies when the basis for the findings is changing and incomplete (p. 1 of Economic Assessment). Due to the insufficient documentation and explanation in the report, it is difficult to fully evaluate the merits of the analysis. We believe that the report could be improved in many areas, but the most pressing is the need to provide deeper analysis and explanation throughout, as well as a clearer evidence trail to help readers understand the assumptions, methodology, and findings.

## ***Evaluation of Climate Action Team Report to the Governor and Legislature***

**Robert W. Wassmer, Ph.D.**

**Professor of Public Policy and Economics, California State University, Sacramento**

**February 6, 2006**

I have been asked by the Sacramento Regional Research Institute (SRRI) to review the Climate Action Team Report (CATR) and to: (1) identify issues with the report, (2) identify problems with the analysis, and (3) examine assumptions driving results. SRRI is particularly interested in my opinion on the economic assessment contained in Chapter 8 of this report. After looking over the report, I feel I cannot adequately comment on the contents of the economic assessment without discussing the concerns I have with the entire report.

After reading the CATR, my overriding concern is what exactly it set out to accomplish. In particular, was it meant to contain a benefit-cost assessment of Executive Order S-3-05 which calls for a reduction in future greenhouse gases emitted in California? Or does it assume that a full benefit-cost assessment of EOS-3-05 is not necessary and what are needed instead are cost-effectiveness assessments of the strategies underway/proposed to meet it and an impact study of the effect of EOS-3-05 on the California economy?

This report does not contain an adequate cost-benefit assessment of EOS-3-05 and instead substitutes in Chapter 2 a very “loose” description of the costs that Californians can expect to endure if nothing is done about global climate change. From the perspective of a policy analyst I am not comfortable with this because it reads like advocacy for the executive order. If the report accepts Governor Schwarzenegger’s statements (“I say the debate is over. We know the science. We see the threat, and we know the time for action is now.”), then it should clearly state such and set out to measure the most cost effective ways of achieving the governor’s goals and the impact these goals will have on the California economy.

If a goal of the CATR is in part to convince Californians that greenhouse gases in California needs to be reduced – and the debate is not over just because the Governor says it is – then I would strongly prefer that EOS-3-05 be subject to a full, economic-based, benefit-cost assessment of its desirability to Californians. Such an assessment should follow common, well-established practices in this area and state who has “standing” in the study, what is the “baseline” that the policy’s incremental benefits and costs will be calculated from, and “discount” future benefits and costs appropriately to ones experienced in the present. Since Californians will overwhelmingly be bearing the costs of EOS-3-05, it is my opinion that they should be given standing in such a study and only their benefits and costs counted. If there are benefits of reducing greenhouse gases generated in the state that go to people and businesses who live outside the state (as there very likely is), these need to be totaled in a separate accounting and also described. Thus, even if the cost of the executive order exceeds the benefit to Californians, residents

can evaluate whether the additional benefit to the rest of the world justify their undertaking actions to reduce state generated greenhouse gases.

Though for political reasons I fully understood why the just described cost-benefit may not want to be done. The discipline of policy assessment also accepts cost-effectiveness analysis as an alternative to benefit-cost assessment. A cost-effective analysis assumes that there are more than economic efficiency (benefits>costs) reasons for pursuing a policy. These reasons can include doing what is “fair”, “equitable,” and just the plain “right” thing to do. In the case of EOS-3-05, the CATR often cites the environmental leadership role that the state and its residents have previously desired to take in the United States. Thus a greenhouse gas reduction policy does not need to pass a benefit-cost assessment to determine, given that it is going to be done, what is the most cost effective way of doing it. The current cost-effective analyses in this report are largely preliminary and deserve further refinement before they can be suited for making policy recommendations. Some recommendations on how to do this are offered below.

Finally, it is reasonable and desirable to try and measure the economic impact in California jobs and income of implementing EOS-3-05. It appears that the Climate Action Team has chosen an appropriate model to do this, but I must raise some concerns over the specific methodology used. Specifically, there needs to be a clearer baseline established (and described in the report) of what the California economy is expected to look like in all years from the present to 2020 if the executive order never existed. Using these baseline assumptions, the model is then run for each year and predicted baseline values (as if the implantation of EOS-3-05 never occurred) of income and employment are derived for each year. In doing this, the modelers need to be more explicit regarding their assumptions about what is going to be done in each year between now and 2020 to get to emission levels that are at 1990 levels. (I do not think it is even reasonable to consider projecting this to 2050, as the executive order dictates, and thus agree with the current assessment to only 2020.) Some things that need to be known for each year is the amount of taxes, fees, and user charges imposed upon the California private economy to implement the specific policies and how each sector in the simulated economy is expected to be affected by the specific regulations, taxes, and subsidies being imposed. These estimates should be done using a range of possible values and not just the single “best” estimates currently used. I call for this year-by-year economic impact measurement because I fear that the costs of implementing EOS-3-05 will be much greater in the near future, while the benefits of doing it will occur in the more distant future. The current method is likely biased because it only looks at only two future years (2010 and 2020) and finds that income and employment is slightly higher in these years. But I expect that the dollar flow out of the private sector to implement this policy and the regulatory burden on the private sector is more likely to occur in the years immediately following its implementation, while the benefits will not have fully kicked in until these later years.

Understanding these three primary concerns, in the remainder of this evaluation I will point out some particular issues (both positive and negative) in the order that they arise in the report. These are noted by the page number of the Climate Action Team Report

([http://www.climatechange.ca.gov/climate\\_action\\_team/reports/2005-12-08](http://www.climatechange.ca.gov/climate_action_team/reports/2005-12-08)) and the final draft of “Chapter 8: Economic Assessment” ([http://www.climatechange.ca.gov/climate\\_action\\_team/reports/2006-01-12](http://www.climatechange.ca.gov/climate_action_team/reports/2006-01-12)).

### Climate Action Team Report

p. iii – Why not tax emissions of vehicles instead of taxing gallons of gas used?

pp. vi and vii, Tables ES-2 and ES-3– Need better documentation on where emission reductions listed came from. I would prefer a range of feasible reductions rather than just one value. What is meant by “potential” emission reduction? Is that at high or low end of feasible reduction?

p. ix – Only the possible “bads” of climate change listed here. Would not a fair summary also list possible “goods” (i.e., increased productivity of agriculture, lower heating bills in winter, etc.).

p. x – Some form of cap and trade option is also what most economists would suggest.

p. xi – Like the stated weakness of the cap and trade program, there needs to be more discussion of the desirability of California taking a policy course to reduce greenhouse gases alone. What about the “free riding” that rest of U.S. can enjoy if CA reduces greenhouse gases. Then other states do not need to, or need to reduce by as much and still enjoy the benefits of CA actions.

p. 5 – I would like to see mention of what percentage of U.S. and world-generated greenhouse gases comes from California.

p. 8 – Compare Figure 2-3 to a similar figure generated for rest of U.S. and world. How is California different?

p. 13 – What is the best current estimate regarding the likelihood that accelerated climate change could happen?

p. 15 – The total potential emission reduction of 68 listed in Table 3.1 is different than supposed same figure of 67 given in Table ES-2 in executive summary.

p. 16 – Here is the point in which to discuss whether this is a cost-benefit or a cost-effectiveness study. There is a general assumption in the report that the rest of U.S. and world will follow if California adopts. I would like to see a discussion of U.S. experience with Kyoto Accord and overwhelming rejection of it by President and Senate. Does this support that assumption?

p. 21 – Do all Californians “experience the worst air quality in the nation” or is it in just certain urban areas in the state?

p. 23 – What about the less natural gas and electricity needed by Californians in the winter months if warming occurs? This is never mentioned in report, though greater electricity required for cooling is continually mentioned.

pp. 25 and 31– Can new reservoirs be built to store water that would collect water in the way that Sierra snow pack now does? Would these not also generate greater hydroelectric electricity for the state than currently produced? Would winter recreation in Sierra be replaced with other moderate climate forms of recreation and would the loss not be the full value of the ski industry?

p. 26 – Would not the critical chill hours be reduced under warming? How much are crop yields/changes built into the later economic impact model?

p. 32 – Are there not any potential positives to list in Figure 4.8 that contains projected impacts of warming?

p. 33 – But warming would entail less spent on a “cold emergency action plan”? There must be some cities in state that has such?

p. 34 – Should \$24 million read \$24 billion?

p. 35 – The greater reservoir capacity in California required by global warming could actually reduce flood risk (e.g. Auburn Dam).

p. 36 – More realistic to talk of a range of millions of tons of CO<sub>2</sub> reduced by different emission strategies than just giving one point estimate. I would call for greater documentation on where these numbers came from. To complete the desired cost effective analysis of each of these strategies researchers need to describe direct dollar costs of implementing them and perhaps even more importantly, the indirect costs imposed upon consumers and business by having to make the changes that they entail. This needs to be listed explicitly in a table. There is a real lack of these indirect costs in these reports. These include for consumers such things as buying a more fuel efficient car, moving closer to where they work, living in smaller homes, suffering through warmer interior temps in the summer and cooler temps in the winter, etc. For business it may be scrapping existing production equipment and/or structures, buying different vehicles, producing entirely new products, going out of business, etc.

p. 42 – Does Table 5-2 list all the possible strategies needed to achieve desired greenhouse gas reduction? Can some be pursued further to achieve greater reduction than listed? Where do these numbers explicitly come from? Again, better to use a range of possible reductions.

p. 45 – Need some description of the benefits that these policies could yield and not just the costs.

p. 58 – A crucial point is that if California chooses to reduce greenhouse gases through a form of taxes, fees, or regulation, it will drive some firms to produce products outside of California. I would like to see assumptions made in this regard for the economic impact study.

p. 66 – Can an “assessment of the relative likelihood of any of these three approaches being adopted nationally..” be drawn from the experience Presidential Candidate Al Gore had when he suggested similar measures. It should be at least talked about.

p. 67 – It would be better to auction off allowance distribution because revenue can be used to fund under greenhouse house gas mitigation activities.

p. 68 – Have the administration and enforcement costs of the cap and trade program been built into cost effective assessment of it and/or the economic impact study?

p. 75 – I disagree that public goods charges applied to all other energy sources in state have been relatively “benign”. It has raised the price that consumers pay for these energy sources and caused them to consume less electricity (resulting in a loss in consumer surplus). I also doubt that the 30% less per capita electricity consumed in California is due only to public goods charge. It is likely due to more moderate temperatures in the state than rest of U.S.

p. 76 – An additional \$2.57 per gallon gas tax is very large. Is this politically acceptable? Why not think about an emissions tax that is based upon miles driven and the expected amount of greenhouse gases coming out of the cars that you own?

p. 77 – CAT is calling for an overall economic assessment here. Does this entail a full benefit-cost assessment or just affect on income and employment through CGE model?

p. 78 – Does environmental justice mean that all income groups suffer pollution equally, or do the poor suffer less of it? Need to know belief if going to work toward it.

p. 83 – Keep mentioning that households save \$1,000 per household annually through energy efficiency programs, but what costs do they bear to achieve these savings? A public goods tax on petroleum would be regressive (the poor would devote a greater percentage of their income to it). Thus how can it be considered “fair”?

#### Chapter 8 Economic Assessment

p. 1 - As discussed earlier, the economic impact should be assessed for each year. I would like to see more detail on how the costs to consumers and business of implementing the executive order are accounted for in the model of the economy. Need to make cost side as explicit as the benefit side now is.

p. 3 – As shown in Figure 3, this model allows for the negative impacts of taxes and fees into the California economy. The report needs to make explicit the expected taxes and

fees in each year to make sure they are appropriately accounted for in the model. Also, how are the indirect costs to consumers and business of implementing greenhouse gas reduction built into model? Again, be explicit in explanation to reader.

p. 4 – Changes in behavior result in a loss in consumer welfare (or consumer surplus as defined by economists). How is this accounted for?

p. 5 – Hard to judge the validity of findings in Tables 5 and 6 without an accounting of what was changed to simulate a California economy under the executive order as compared to one without it. What are the costs of each program?

p. 6 May be a positive net impact in 2010 and 2020, but what about years leading up to 2010?

p. 8 – How are the net costs and net savings for strategies in Tables 5-1 and 5-2 calculated? Need a table listing exactly what they are if I am to evaluate whether they are appropriate or not.

**Peer Review of *Documentation of Inputs to Macroeconomic Assessment of the  
DRAFT Climate Action Team Report to the Governor and Legislature***

**Preliminary Assessment**

**Joshua Cunningham  
Independent Energy Consultant**

**February 14, 2006**

Scope of the Peer Review

On December 8, 2005, the California Environmental Protection Agency (CalEPA) released for public comment the Climate Action Team (CAT) Report to the Governor and Legislature (ref 1). The report was prepared based on the request of the Governor to provide a feasibility study and cost/benefit analysis for his climate change initiative announced in June of 2005. Chapter 8 of this report (ref 2) describes the macroeconomic model and the preliminary results. A supplement to this report is the Documentation of Inputs to the Macroeconomic Assessment (ref 3) of the main CAT report.

The scope of this peer review is limited to Chapter 8 of the main CAT report, and specifically to the Documentation of Inputs supplement (ref 2 and 3, respectively). The majority of the inputs for emission reduction measures will be evaluated, including nearly all of the transportation, buildings, and utility measures, as well as a few of the forestry measures. However, there are a few inputs that will not be reviewed. This preliminary review will provide a general perspective on the CAT analysis, and will outline requests for additional documents and data to help make the peer review more thorough.

Review of the CAT Analysis Methodology

The following comments express my general assessment of the CAT Report and Inputs.

Overall, the methods used in the analysis are not very well defined. The report clearly states that the econometric model used was the Environmental Dynamic Revenue Analysis Model (E-DRAM) from UC Berkeley. However, the report did not specify exactly how the model was used (although I'm confident that the model structure is described in UC Berkeley publications). For instance, in addition to the emission reduction measure inputs listed, are there basic economic assumptions that need to be defined? Are there parameters in the feedback loops that should be described? Additionally, a formal cost/benefit analysis has not been performed for the various reduction measures. The CAT report states that a more detailed economic assessment is to be performed, so I hope a more complete economic assessment will be included.

Relative to the robustness of the preliminary results for 2020 (\$4 billion savings and 83,000 new jobs), I am not confident that all of the emission reduction targets will be realized. This is primarily because the targets are reliant on all of the measures listed

becoming fully successful. This is not realistic. However, it does not mean that the targets should be lowered, it simply means that they are goals that may not be fully achieved. Additional emission reduction measures should be identified if the targets are to be realized.

Although specific assumptions in each emission reduction measure still need to be reviewed (Final Report in this peer review), it is expected that the emission reductions in Table 5-1 will be more accurate than those in Table 5-2 (ref 1, and included below for convenience). The first table addresses measures that are already being enacted, and the second table shows new measures that could be enacted, some of which are not well defined, if at all. Once again, it is fully expected that new policies, such as those in Table 5-2, should be proposed to increase climate change emission reductions. However, the reliability of the reduction predictions for new policies will usually be lower than those of measures already being pursued.

Overall, I was impressed with the amount of emission reduction measures that the CAT included, it showed that there was input from a number of state agencies in the planning process. I applaud them for presenting a wide-range of options such that the most cost-effective measures can be identified. Here is an example of a few preliminary thoughts on the cost savings from specific measures (these will be explored in my Final Report):

- Costs for the “Accelerated Renewable Portfolio Standard (RPS)” do not include all infrastructure costs, nor do they include costs for the Municipal Utility (MU) suppliers. This will make the costs savings optimistic in the CAT report.
- It appears as if the solar initiative may have assumed all 3000 MW (mega watts) of installed capacity will offset 3000MW of fossil fuel electricity. Solar systems do not operate at full capacity, but rather at a fraction of the maximum design levels given the number of hours of sunlight during the day. Results here are probably optimistic, but further review is required to verify if this is the case.

Overall, there does appear to be an overly optimistic conclusion in the CAT assessment. For instance, they conclude that the final economic modeling assessment (not yet completed) is expected to result in net positive savings and additional jobs. This optimism is acceptable, as long as a clear description of the modeling effort is provided (so others can review), and a comprehensive cost/benefit analysis is conducted.

Here are some additional critical questions and comments. These comments are not intended for requesting additional information.

- It was unclear exactly what the baseline emission assumptions were for the future projections. The CAT report first describes how the UN IPCC emission scenarios were considered, and then in a later part of the report they discuss how national EIA inputs were used for historical information and CEC inputs were used for projections. A clear graph with the baseline and then emission reduction cases would be very helpful.

- (UN IPCC = United Nations Intergovernmental Panel on Climate Change; EIA = US Dept. of Energy's Energy Information Agency; CEC = California Energy Commission)
- Has the use of this economic model by other state agencies been documented in terms of any validation in hind-sight, or how effective it was as applied by the state agencies? (E-DRAM model from UC Berkeley). Again, there should be more documentation in the CAT report as to how the model was used, creating "transparency" in the assumptions and methods.
- A more detailed welfare analysis should be conducted to understand which groups of Californians are disproportionately impacted, even if the state benefits as a whole. Hopefully this will be pursued by the CAT in the final economic assessment.

### Assessment of the Energy Prices and Savings Factors Sections (ref 3)

#### *Energy Prices*

Gasoline and diesel prices for 2020 appear to be reasonable assumptions, especially given that predicting fossil fuel market trends that far in the future is very difficult. If anything, the price will go up making the CAT emission reduction savings larger, rendering the current CAT price assumptions conservative.

Oil production, the fossil fuel source for gasoline and diesel, from non-OPEC nations is expected to peak potentially before 2020, which will lead to more world oil coming from OPEC nations (OPEC refers to the Organization of Petroleum Exporting Countries, and is dominated by Middle Eastern nations). This means that consuming countries such as the United States will become even more reliant on imports from foreign oil. However, tar sands oil production, an alternative oil source found largely in Canada, will begin to increase and will help to stabilize the price of oil below \$50/barrel if regular/conventional oil production begins to peak. The International Energy Agency predicts the price of oil to remain below \$40/barrel (2004 \$) through the year 2020, and the EIA projections also show the price to be between \$40 and \$50/barrel. Oil prices are higher than this today, but it is expected that this price will come back down in 1-2 years as more oil production is brought on-line (primarily in Saudi Arabia) and the demand from China begins to stabilize.

I believe the natural gas (NG) price quoted for 2010 looks a little low, with the 2020 price being closer to expectations. NG prices should remain relatively high for the next 3-5 years or so as new infrastructure for transporting the gas is developed. New pipelines are needed in North America to move gas around, primarily from Canada and Mexico into the US. Additionally, the world is seeing increased liquid NG trading as demand increases. This technology has improved and will become a more dominant form of transport. Though this increases the flexibility of moving supplies around the world (from overseas, for instance), there are near-term costs with creating new liquid NG terminals in the US at our coastal city ports. I am assuming the prices in this CAT report are for NG at the "well", not the price as delivered to customer.

Electricity prices look relatively accurate, if it is the retail price (delivered to customer). However, if carbon policies are implemented that affect the means of producing electricity (either with requirements for new renewables or cleaning up CO2 emissions from production facilities), costs could go up. This system feedback should be incorporated into the CAT modeling effort. It is very important to know if they are referring to wholesale or retail prices (this question is included in my list below). Wholesale prices will be lower than retail because they refer to prices at the production facility, before electrical transmission and distribution costs are accounted for.

### *Savings Factors*

With the electricity savings factor, the CO2 emissions are associated with emissions reduced from a natural gas (NG) facility. This assumption is relatively accurate given that reduced electricity from efficiency improvements will reduce NG production (considered a “peak shaving” production source) and “baseload” production will remain in operation (coal and nuclear, for example). Baseload systems refer to power plants that are harder to startup and shutdown, and therefore are used to provide the average power requirements. Peak shaving systems refer to power plants that are easy to ramp up when there are spikes in power demand. This means they are easy to scale back when demand drops down (with energy efficiency, for instance).

The savings factors for the fuels look accurate, although I will re-check the math functions. Once the energy price is set, the savings factor calculations primarily rely on unit conversion and molecular weight calculations.

### Request for Clarification and Information

In order to complete a thorough peer review of the inputs to the macroeconomic assessment, I have the following requests. Any information that can be provided would be helpful.

1. There was little to no information on specific measures in the “Investor Owned Utility (IOU) New Energy Efficiency Measures” category from Table 5-2. I will try to obtain information from the CA Public Utility Commission (CPUC) references.

REQUEST: Please provide any additional information about this category in Table 5-2.

2. “Investor Owned Utility (IOU) Combined Heat and Power” inputs from Table 5-2 were not defined. It is not clear how they arrived at the emission reductions listed. It is possible they are defined in the programs called PUC1 and PUC2, included in a source document called “IOU Additional Energy Efficiency Program”. I will try to obtain it from CPUC.

REQUEST: Is the “IOU Additional Energy Efficiency Program” document available?

3. Source of emission reductions for the “IOU and Municipal Utility (MU) Carbon Policies” inputs are not defined. However, they may be documented in the CEC 2005

Integrated Energy Policy Report (IEPR). I know where to obtain this report and I will investigate it.

REQUEST: If there are additional source reports for the utility carbon policy emission reductions listed here, besides those listed in the CEC IEPR, please provide them.

4. With the “Forest management” inputs, the CAT report discusses the potential use of conserving part of the 4 million acres of privately owned forest property. However, they don’t document how they determined the emission reduction levels for the conservation or management sections. I will investigate the related CAT reports on forestry.

REQUEST: Any information that can be provided regarding the forestry conservation and management emission reductions would be helpful.

5. In the “Energy Prices” section of page 3, there needs to be additional clarification as to what type of prices are referred to.

REQUEST:

- What does the electricity price relate to, wholesale or retail price? I am assuming it is the retail price.
- For the natural gas energy input, is the value quoted the “wellhead” or customer “delivered” price? I am assuming it is the wellhead price.

6. I do not have a copy of the Tellus report that is commonly referenced, although the reference is listed in the Chapter 8 CAT document. I will attempt to obtain the document.

REQUEST: If this document is not readily available, could it be provided for my review?

### References

1. California Environmental Protection Agency (CalEPA), “Climate Action Team Report to the Governor and Legislature, Draft for Public Review,” December 8, 2005.
2. CalEPA, Chapter 8 Supplement to the CAT report in reference 1, January 12, 2006.
3. CalEPA, “Documentation of Inputs to Macroeconomic Assessment of the Draft Climate Action Team Report to the Governor and Legislature,” January 19, 2006.