Kevin Kennedy, Chief
Program Evaluation Branch
Office of Climate Change
Air Resources Board
1001 "I" St. P.O. Box 2815
Sacramento, CA 95812

June 2, 2008

Re: Accounting for Co-Benefits in AB 32's Cost-effectiveness Framework

Dear Mr. Kennedy,

We appreciate the efforts of the California Air Resources Board (CARB) to develop economic frameworks and tools for the package of policies necessary to implement California Global Warming Solutions Act of 2006 (AB 32) and meet the requirements of the law. These comments are submitted in response to the April 25, 2008 Economic Analysis Technical Stakeholder Working Group meeting – which focused on frameworks for analysis of emissions, air quality, public health, localized and cumulative benefits and impacts related to AB 32 implementation – and in anticipation of the June 3, 2008 meeting, which will focus on the framework for analysis of cost-effectiveness as it relates to AB 32 implementation.

As CARB develops the "scoping plan" to implement AB 32 by the end of this year, it must develop a framework for determining the cost-effectiveness of regulations. We are concurrently submitting a separate letter to CARB with recommendations on the cost-effectiveness framework generally.

An important element of CARB's cost-effectiveness framework is the incorporation of "co-benefits." This letter recommends approaches for two main types of regulations that will be included in the scoping plan: (1) regulations that would be

adopted under AB 32's authority that provide "co-benefits" in addition to greenhouse gas (GHG) emission reductions, and (2) regulations adopted pursuant to authority other than AB 32 that also result in reduced greenhouse gas emissions. These recommendations, described in more detail below, are summarized here:

1. Co-Benefits from AB 32 Regulations

Pursuant to AB 32, CARB must adopt regulations "to achieve the maximum technologically feasible and cost-effective reductions in greenhouse gas emissions," and consider numerous factors, including "additional environmental and economic co-benefits for California" and "reduc[ing] other air pollutants, diversification of energy sources, and other benefits to the economy, environment, and public health." Health and Safety Code §§ 38501(h), 38562(b)(6). When considering these co-benefits as part of the cost-effectiveness analysis, NRDC recommends that, depending on the availability of reliable data, the Board should:

(a) **monetize** the value of the co-benefit and subtract it from the cost of the regulation;

(b) **quantify** the co-benefit, if it cannot be monetized, or

(c) **qualitatively describe** the co-benefit, if it cannot be quantified or monetized.

When considering the cost of regulations, it is important to recognize that *no single factor is sufficient to determine whether a regulation should be implemented*. The Board must make its ultimate policy determination of which regulations to adopt after consideration of all AB 32 factors, including, but not limited to, calculations of cost-effectiveness (including co-benefits).

2. Regulations Adopted Pursuant to Authority other than AB 32

A number of regulations adopted pursuant to authority other than AB 32 will also reduce GHG emissions. As CARB incorporates these emission reductions in the scoping plan and cost-effectiveness framework, we recommend that CARB use the following three approaches:

(a) All regulations that reduce GHG emissions, whether or not enacted pursuant to AB 32, **will help the state reach its 2020 emission limit and should be included in the scoping plan.**

(b) All laws and regulations that result in significant greenhouse gas emission reductions are **relevant to the AB 32 cost-effectiveness range**.

(c) **CARB should provide guidance for other agencies** that adopt non-AB 32 regulations on how to account for the benefits of any associated greenhouse gas emission reductions.

The remainder of this letter details these recommendations.

1. CO-BENEFITS FROM AB 32 REGULATIONS

CARB must consider many factors when adopting regulations pursuant to AB 32.[1] No single factor is independently sufficient to determine whether a particular regulation should be adopted. Instead, AB 32 requires that the Board consider *all* of the factors identified in AB 32 during its decision-making process. AB 32 requires CARB to adopt regulations "to achieve the maximum technologically feasible and cost-effective reductions in greenhouse gas emissions," and further requires CARB to consider the "co-benefits" of a regulation. These co-benefits include the "overall societal benefits including reductions in other air pollutants, diversification of energy sources and other economic, environmental and public health benefits."[2]

This memo recommends how to incorporate co-benefits into CARB's cost-effectiveness analysis, such that the value of these co-benefits is recognized. Accurate calculation and accounting will allow CARB, when appropriate, to prioritize regulations with significant environmental and other co-benefits.

Cost-effectiveness analysis, as distinct from cost-benefit analysis, is comparative rather than absolute. Cost-effectiveness analysis assumes a certain desired outcome and compares different ways to achieve that outcome.[3] In the case of AB 32, the desired outcome is the reduction of greenhouse gases: cost-effectiveness must be expressed as "the cost per unit of reduced emissions of greenhouse gases adjusted for its global warming potential."[4] Thus, AB 32 requires that the cost of regulations be expressed in units of \$/ton CO_2e reduction (or similar units), but it does not set a maximum cost per ton for these regulations.

In addition to reducing greenhouse gas emissions, many of the proposed AB 32 regulations will result in additional environmental, health, and economic co-benefits. For example, cement regulations can reduce mercury emissions and improve the health of Californians, regulations to mitigate forest land loss can reduce greenhouse gas emissions and improve the health and resiliency of California's forests, energy efficiency regulations can reduce consumer energy bills, and reductions in vehicle-miles traveled can reduce emissions of air pollution and improve public health. Other measures related to the protection, restoration and management of our natural systems can also reduce greenhouse gas emissions while simultaneously enhancing the health and sustainability of fish and wildlife habitat.

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[1] Health and Safety Code § 38562(b) (factors include: equity; minimization of costs and maximization of total benefits; encouraging and giving credit for early action; not impacting low-income communities disproportionately; compliance with federal and state air quality standards and reductions of toxic air contaminant emissions; cost-effectiveness; overall societal benefits; administrative burden; leakage of emissions outside of California; and significance of the source's contribution to the state's greenhouse gas emissions).

[2] Health and Safety Code § 38562(b)(6); see also, Health and Safety Code § 38501(h) ("maximizes additional environmental and economic co-benefits for California").

[3] Anthony E. Boardman et al., "Cost-Benefit Analysis: Concepts and Practice," (2nd edition, 2001), pp. 437-438; Office of Management and Budget, "Circular A-4: Regulatory Analysis," (September 17, 2003), pp. 10-12, available at http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

[4] Health and Safety Code § 38505, subd. (d).

Recommendation: Accounting for co-benefits. In order to obtain the most comprehensive assessment of a proposed regulation's cost-effectiveness, NRDC recommends that CARB *monetize* and subtract from a regulation's net costs the value of the co-benefits that will result from the regulation. Such monetization should be done whenever reliable data is available. When data is not available or sufficiently reliable, NRDC recommends that the Board *quantify* or *qualitatively* describe the co-benefits. These three levels of analysis, commonly understood by economists and policy makers,[5] include:

(a) Monetize. Cost-effectiveness analysis monetizes the net costs – or "social costs" – of a proposed regulation, but does not monetize its outcome or unit of effectiveness. The economic definition of cost-effectiveness is:

Cost-effectiveness = net costs (i.e., gross cost – cost savings) / unit of effectiveness[6]

In the case of AB 32, the cost-effectiveness of proposed regulations will be expressed in terms of \$/ton CO_2e reduced. While the definition of "cost-effectiveness" in AB 32 precludes the Board from monetizing the value of greenhouse gas emission reductions in the cost-effectiveness ratio, it does not define or limit what should be included in the "cost" portion of this ratio. We recommend that the value of co-benefits be subtracted from the costs when calculating the regulation's *net costs*.[7] Inclusion of these co-benefits in the "cost savings" element of the above equation will generate the most accurate calculation of a proposed regulation's cost-effectiveness.

The United States Office of Management and Budget's guidance for executive agencies recommends this approach, using the term "ancillary benefits" rather than "co-benefits":

> When you can estimate the monetary value of *some* but not all of the ancillary benefits of a regulation, but cannot assign a monetary value to the primary measure of effectiveness, you should subtract the monetary estimate of the ancillary benefits from the gross cost estimate to yield an estimated net cost. . . . If you are unable to estimate the value of some of the ancillary benefits, the cost-effectiveness ratio will be overstated, and this should be acknowledged in your analysis.[8]

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[5] See, e.g., Krupnick et al., "The Ancillary Benefits and Costs of Climate Change Mitigation: A Conceptual Framework," p. 6, available at: http://www.oecd.org/dataoecd/31/46/2049184.pdf (identifying three types of impacts, those that are "[a]ssessed in monetary terms," "[a]ssessed in physical terms and possibly partly in monetary terms," and "[n]ot assessed, although [believed to be] important"); U.S. EPA, Office of Water, "Economic, Environmental and Benefits Analysis of the Proposed Products & Machinery Rule," (December 2000), p. 12-11 (identifying three levels of analysis for different benefits: "Quantified and Monetized," "Quantified but Not Monetized," and "Qualitative.").

[6] Anthony E. Boardman et al., "Cost-Benefit Analysis: Concepts and Practice," (2nd edition, 2001), pp. 437-438; Office of Management and Budget, "Circular A-4: Regulatory Analysis," (September 17, 2003), pp. 10-12, available at http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

[7] See, e.g., Alan J. Krupnick, RFF Report, "Valuing Health Outcomes: Policy Choices and Technical Issues," p. 22, available at http://www.rff.org/rff/Documents/RFF-RPT-ValuingHealthOutcomes.pdf.

[8] "Circular A-4," *supra* note 6, p. 12.

The Climate Action Team also recommended this approach for including economic and other savings that will result from AB 32 regulations.[9] In order to account for some of the environmental co-benefits, the Climate Action Team explained that the "the value of the avoided criteria pollutant emissions using the criteria pollutant emission factors discussed [in the report]" should be calculated and subtracted from a regulation's costs.[10]

As with any economic calculation, it is important to use the most complete and reliable data available. Thus, not only must CARB account for the co-benefits of reducing criteria pollutants, but of all relevant and identifiable co-benefits.[11] For example, a recent study calculated the benefits of urban forestry, including, in addition to reduced atmospheric carbon dioxide: electricity and natural gas savings, net air quality improvement, stormwater runoff reductions, and property value increases.[12] In order to evaluate such a program accurately and understand its complete social costs, the value of the non-greenhouse gas benefits should be monetized and included in the calculation of net costs per ton of greenhouse gas emission reduction.

When regulations will result in co-benefits that are not within the scope of the Air Resource Board's expertise, the Board should work closely with other agencies and organizations in order to obtain the best available data. CARB should also consult with economic experts on how to monetize co-benefits that are not within the expertise of the Board.[13]

To the extent possible, monetization of a regulation's co-benefits should incorporate analysis of the anticipated distribution of effects (positive and negative) on industry, people, ecosystems, etc., such that the co-benefit monetization better reflects the net impacts on California and its residents. For example, a detailed monetization of the

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[9] Climate Action Team, Economics Subgroup, "Updated Macroeconomic Analysis of Climate Strategies Presented in the March 2006 Climate Action Team Report: Final Report," (October 15, 2007), p. 20 ("[T]he costs and savings associated with a strategy in any given year are equal to the sum of: the levelized capital cost for that year; the operating and maintenance cost in that year; the *value of the energy savings* or costs in that year; and *any other strategy-specific savings* or costs identified for that year. These data are used to estimate the cost effectiveness of each strategy in terms of dollars per ton of emissions avoided." Emphasis added).

[10] *Id*. at pp. 21-22.

[11] Likewise, while ancillary benefits will likely far outweigh any possible ancillary costs of a proposed regulation, an accurate accounting of a proposed regulation's cost-effectiveness would also include ancillary costs.

[12] Simpson et al., "San Francisco Bay Area State of the Urban Forest Final Report," (Dec. 2007), p. 23, *available at* http://www.fs.fed.us/psw/programs/cufr/products/2/psw_cufr719_SFBay.pdf.

[13] See, e.g., United States Environmental Protection Agency, "Guidelines for Preparing Economic Analyses" 240-R-00-003 (September 2000), pp. 71-72, available at http://yosemite.epa.gov/ee/epa/eermfile.nsf/vwAN/EE-0228C-07.pdf/$File/EE-0228C-07.pdf (describing mechanisms to measure the value of environmental improvements, including market methods ("benefits of a change in quantity of a good are estimated using data on [] market transactions"), revealed preference methods (recreational demand models, hedonic wage and hedonic property models, and averting behavior models), and stated preference methods (contingent valuation, conjoint analysis, and contingent ranking)); Krupnick, *supra* note 7, p. 26 (describing mechanisms to monetize health benefits, including "measures of what individuals would be wiling to give up to obtain health improvements," "measures of monetary outlays and foregone wage compensation," or the value of jury awards).

health co-benefits related to a refinery regulation should reflect where the affected refineries would be located, what the cumulative health impacts would be in that area, and how many people would benefit from the regulation.

If monetizing the value of a co-benefit is not possible, we recommend one of the following approaches.

(b) Quantify. When it is not possible to monetize the value of a co-benefit, quantifying a co-benefit will provide information that the Board can use to evaluate the benefits of the regulation and provide some context for the regulation's cost-effectiveness. For example, if a regulation will result in protection of wildlife habitat, the number of species protected and the size of the populations should be quantified. Although such quantification cannot be included directly in a regulation's cost-effectiveness ratio, it can indicate the scale of the co-benefit and be used as an important consideration during the Board's prioritization of reduction measures.

(c) Qualitative description. In some cases, it may not be possible to quantify or monetize some of the co-benefits that will result from AB 32 regulations. For example, assigning specific values to certain types of environmental co-benefits, such as scenic beauty or the benefits of energy diversity, can be difficult. If monetization or quantification is impossible, the Board should describe the benefit qualitatively. AB 32 requires the Board to consider "*overall societal benefits* including reductions in other air pollutants, diversification of energy sources and other economic, environmental and public health benefits."[14] Accordingly, the Board must, at a minimum, list and describe qualitatively the co-benefits that will result from a regulation. The Board will make the best policy decisions only if it has the most complete possible view of each regulation's co-benefits.

If the Board uses qualitative descriptions of co-benefits, but anticipates that it may be able to monetize or quantify co-benefits in the future, the Board should state how and on what schedule it may be able to provide more thorough analysis.

Other methods of accounting for co-benefits are not recommended. "Weighting co-benefits" and "dividing costs evenly," described below, are two alternative methods of accounting for co-benefits. However, NRDC does not recommend these approaches because neither is workable in the context of AB 32.

Weighting co-benefits. When calculating the cost-effectiveness of a regulation or policy that will have multiple benefits, it is sometimes helpful to use a formula that "weights" the extent of the negative impacts of different pollutants. For example, such a formula is used to evaluate emissions of ROG, NO_x, and PM_{10} when determining the cost-effectiveness of different projects under the Carl Moyer Program.[15] That is, if a

[14] Health and Safety Code § 38562(b)(6) (emphasis added).

[15] "The Carl Moyer Program Guidelines," (Nov. 17, 2005), p. C-1: ("Annual weighted emission reductions are estimated by taking the sum of the project's annual surplus pollutant reductions following formula C-2 below. This will allow projects that reduce one, two, or all three of the covered pollutants to be evaluated for eligibility to receive Carl Moyer Program funding. While NOx and ROG emissions are given

pollutant has more serious negative impacts per unit of emission, that pollutant is assigned more weight in the formula.[16]

Formulas that weight impacts of different pollutants are useful when accounting for the impact of a few relatively comparable pollutants, as is the case with air pollutants under the Carl Moyer Program. AB 32 requires CARB, by contrast, to consider and compare regulations with numerous environmental, health, economic, and other co-benefits. It would be impractical (if not impossible) for CARB to attempt to devise a formula that reasonably weights the vast array of possible co-benefits that would result from all of the potential AB 32 regulations.

Dividing costs evenly. In some situations, it may be appropriate to divide the costs of a program evenly between multiple benefits.[17] For example, if an agency had a mandate and a designated budget for reducing two or three pollutants, it might divide the budget by two or three and assign an equal portion of the budget to each pollutant. However, it would be inappropriate to use this type of analysis to account for the co-benefits of AB 32 regulations. First, and most importantly, many of the proposed regulations will have significantly more than two or three benefits, and it is not likely that all of the many benefits would be of equal value. Dividing the costs of a regulation evenly between all of the benefits would not accurately represent the value of its environmental and other co-benefits. Second, such analysis results in multiple cost-effectiveness ratios for individual programs (a ratio of cost-effectiveness for each pollutant), which is not contemplated by AB 32. And third, there is no legislative or other authority directing the Board to divide costs evenly between benefits.

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equal weight; emissions of combustion PM10 (such as diesel exhaust PM10 emissions) have been identified as a toxic air contaminant and thus carry a greater weight in the calculation."). A weighted formula is also used in determining the cost-effectiveness of regulations under AB 32: the effectiveness of a regulation is the "unit of reduced emissions of greenhouse gases *adjusted for its global warming potential*." Health and Safety Code § 38505(d) (emphasis added). See also, California Air Resources Board, Staff Report, "California 1990 Greenhouse Gas Emissions Level and 2020 Emissions Limit," (Nov. 16, 2007), p. 4.

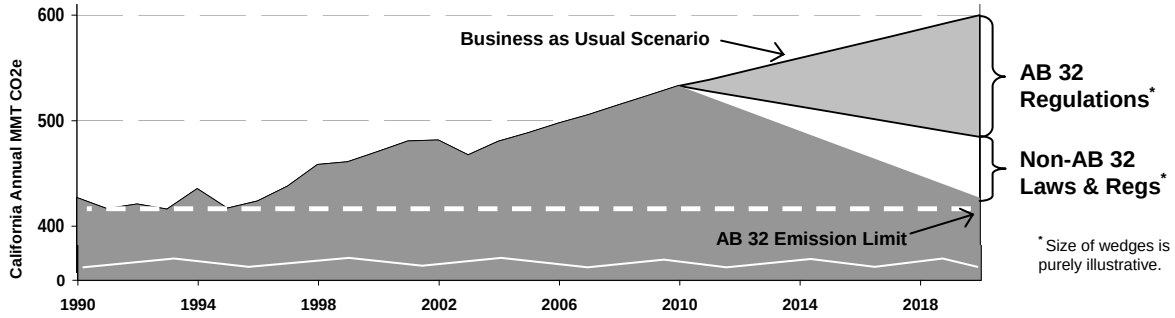
[16] Even for relatively comparable pollutants, such as air pollutants, a weighting approach is arguably less precise than a monetization approach. As noted above, the CAT report recommends monetization of criteria pollutant reduction co-benefits of AB 32 regulations. *Supra* note 9.

[17] See, e.g., Brian Heninger, US EPA, National Center for Environmental Economics "Why a One Dimensional Approach Won't Work for a Multi-Dimensional Problem," symposium presentation, p. 11, available at: http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/CEAforMB.html.

2. REGULATIONS ADOPTED PURSUANT TO AUTHORITY OTHER THAN AB 32

A number of laws and regulations adopted pursuant to authority other than AB 32, including some with purposes other than or in addition to reducing greenhouse gas emissions, will result in such reductions. These include, for example, the California Solar Initiative and AB 1493 (requiring greenhouse gas emission standards for vehicles). Because such laws and regulations will result in multiple benefits, it is useful to address them simultaneously with the issue of how to account for AB 32 co-benefits. As CARB evaluates how to incorporate these emission reductions in the AB 32 scoping plan and cost-effectiveness framework, we recommend that CARB use the following three approaches:

(a) All laws and regulations that reduce greenhouse gas emissions, whether or not enacted pursuant to AB 32, will help the state reach its 2020 emission limit and should be included in the scoping plan. Accordingly, the Board must account for these reductions when calculating how much reduction must be achieved by AB 32 regulations. In order not to overestimate reductions, CARB must be careful to count only those reductions that meet verifiability, additionality, and enforceability standards. The following graph is illustrative of such accounting:



(b) Laws and regulations that result in significant greenhouse gas emission reductions are relevant to the AB 32 cost-effectiveness range.[18] In some regulatory proceedings, the Board compares new regulations to prior and similar regulations in order to determine cost-effectiveness. In the context of AB 32, because CARB must enact regulations in an area and with a scope not previously addressed, it will be hard, if not impossible, to rely solely on previous regulations to show cost-effectiveness. They nevertheless may provide useful points of reference as CARB considers the range of measures that are required to meet the state's 2020 limit. Although laws and regulations enacted pursuant to other authority need not satisfy the requirements of AB 32, such as AB 32's consideration of cost-effectiveness, they will provide further information about the cost-effectiveness of reducing greenhouse gas emissions in California.

[18] As described in detail in the concurrently submitted letter to CARB with recommendations on the cost-effectiveness framework generally, we recommend that CARB define cost-effectiveness under AB 32 as the least expensive bundle of strategies necessary for the state to reduce its greenhouse gas emissions to 1990 levels by 2020. The regulations that are anticipated to be the least expensive and most expensive (the points at the bottom and top of the cost curve) should not be understood to represent firm boundaries of cost-effectiveness. Rather, the range between the anticipated least expensive and most expensive regulations is an *approximate* scope of the regulations that should be considered cost-effective.

(c) CARB should provide guidance for other agencies that adopt non-AB 32 regulations on how to account for the benefits of greenhouse gas emission reductions. In light of the broad statewide goals of AB 32, all agencies should account for the benefits of reducing greenhouse gas emissions when considering and adopting regulations, even when these regulations are not specifically or primarily aimed at reducing these emissions. CARB should provide guidance for other agencies on how to recognize and account for these greenhouse gas emission reduction benefits.

3. CONCLUSION

In order to comply with the requirements of AB 32, we recommend that CARB accurately account for co-benefits in its analysis by *monetizing*, *quantifying*, or *qualifying* the value of these benefits in its cost-effectiveness calculations. When CARB ultimately makes its policy determinations regarding which regulations to adopt, cost-effectiveness is just one of many factors that it must consider.

In addition, all laws and regulations that reduce greenhouse gas emissions help the state reach its 2020 emission limit. These laws and regulations should be included in the scoping plan, in order both to account for the reductions they will achieve and to provide additional points of reference for the cost-effectiveness range. Finally, CARB should provide guidance for other agencies that adopt non-AB 32 regulations on how to account for the benefits of greenhouse gas emission reductions.

Sincerely,

Leah C. Fletcher
Natural Resources Defense Council

Chris Busch, PhD
Union of Concerned Scientists

James Fine, PhD
Environmental Defense Fund

Tim Carmichael
Coalition for Clean Air

Scott Smithline
Californians Against Waste

Rachel McMahon
Center for Energy Efficiency and Renewable Technologies

Nancy Rader
California Wind Energy Association

Michelle Passero
The Nature Conservancy