



San Diego Chapter  
*Serving the Environment in San Diego and Imperial Counties*

August 5, 2015

San Diego County Planning Commission  
Attention: Lisa Fitzpatrick, Secretary  
Attention: Mark Slovick,  
Department of Planning and Development Services  
5520 Overland Ave Suite 310  
San Diego, CA 92123

**RE: Accretive Investments/Lilac Hills Ranch Master Planned Community  
Lilac Hills Ranch: PDS2012-3800-12-001 (GPA), PDS2012-3810-12-001 (SP), PDS2012-3600-12-003 (REZ), PDS2012-3100-5571 (TM), PDS2012-3100-5572 (TM), PDS2012-3300-12-005 (MUP), PDS2012-3500-12-018 (STP)**

Dear Commissioners:

## INTRODUCTION

On behalf of Sierra Club San Diego, thank you for the opportunity to comment on the above referenced Project. Sierra Club San Diego's mission is to: *Explore, enjoy, and protect the wild places of the earth; to practice and promote the responsible use of the earth's ecosystems and resources; to educate and enlist humanity to protect and restore the quality of the natural and human environment; and to use all lawful means to carry out these objectives.* It is with those objectives in mind that we have to register our strongest objections to the type of leap frog development into environmentally sensitive habitat that this project represents.

## SUMMARY AND LISTING OF CONCERNS

We would like to express our grave concerns over the Lilac Hill Ranch Project's 1,746 homes proposed on 608 acres of land, 90,000 square feet of commercial space, "open space" area of 174 acres and commercial "village" areas, that clearly is inappropriate land use for an area untouched by development that supports agricultural enterprises, and is currently zoned 1 house per 2 acres.

We strongly support the comments and concerns expressed by the Center for Biological Diversity, the Cleveland National Forest Foundation, the Endangered Habitat League, the League of Women Voters, and the San Diego County Farm Bureau. The concerns raised by these groups are similar to many of the concerns of Sierra Club San Diego.

Sierra Club San Diego asks that you recommend the Board of Supervisors deny this project because it:



- Proposes 1,746 units on land currently zoned for 110 dwellings.
- Is "leapfrog" development disconnected from other significant urban development.
- Is urban sprawl development that would consume acres of productive farm land.
- Is adjacent to wildlife corridors and pre-approved mitigation areas.
- Greatly increases noise and light pollution that will negatively impact the area for wildlife habitat.
- Has 1,746 homes that will each generate an average of 10 car trips per day, per Traffic engineering estimate. At build out this would amount to 17,460 car trips per day or 6,372,900 car trips per year for the 1,746 homes.
- Will require that most residents drive 30 minutes or more between their jobs and their homes.
- Will have little public transportation, and will require building more roads to connect this development with other urban centers for shopping, entertainment etc.
- Will have a poor jobs-housing balance since the 90,000 square feet of commercial (if it is ever really built) will likely produce no more than about 225 jobs (based on estimates of Appendix O's Table of *Modelled Land Use* on Page 60), while the 1,746 homes will produce about 3,492 workers, for a jobs-to-employees ratio of only about 6.5%. This is too low to support a claim of "mixed use."
- Will, due to its inevitable generation of higher-than-average, per-capita vehicle-mile travelled (VMT), make it significantly more difficult for the County's new Climate Action Plan (CAP) to achieve meaningful greenhouse gas (GHG) reduction targets using enforceable measures. The County's previous CAP was rescinded by court order.
- Fails to meet the requirement that any new "village" be supported with necessary services and facilities consistent with the Community Development Model and "designed to meet the LEED-Neighborhood Development Certification or an equivalent." (LU-1.2).
- Conflicts with the County General Plan's Smart Growth Principles, Goals and Policies requiring amendments to the County General Plan and Community Plans of Valley Center and Bonsall;
- Endangers lives as emergency response times will not meet the 5 minute rule as required by the County General Plan;
- Negatively impacts state and federally listed animal and plant species and critical habitat.
- Increases demand on water resources in the region and the project does not demonstrate that adequate potable water supply will be available.
- Could raise existing long-time County residents' property taxes to provide infrastructure supporting this development (roads, sewer and water facilities) and services (police, fire, Emergency Vehicles, libraries, schools, parks etc.)

The County's Land Use Element "provides a framework to accommodate future development in an efficient and sustainable manner that is compatible with the character of unincorporated communities and the protection of valuable and sensitive natural resources."

You will likely hear from the developers that this project will provide jobs in an area of the County that has been slow to recover from the recession. We agree, but, these will be

short-term construction jobs. The negative impacts will be much longer lasting, with the County paying the cost to make up for the lack of infrastructure and services.

## **COMMENTS REGARDING APPENDIX O, GREENHOUSE GAS ANALYSIS**

### Section 1.1, "Understanding Global Climate Change"

Section 1.1, "Understanding Global Climate Change", is particularly important, since this project has the potential to result in a significant increase in GHG gas emissions, compared to the "no project" alternative, which must be considered under CEQA.

Section 1.1 fails to make it clear that the primary cause of our problem is (from Reference 1) that

- Atmospheric CO<sub>2</sub> traps heat,
- This is a significant effect and
- Due to our burning of fossil fuels, we are adding great quantities of CO<sub>2</sub> to our atmosphere.

The fact that we are adding "great quantities" of CO<sub>2</sub> to the atmosphere is made crystal clear in Figures 1 and 2 of Reference 2 of this letter. Reference 2 is a document that was peer-reviewed and accepted for presentation at the Air and Waste Management Association's (AWMA's) 2014 yearly Conference and Exposition. It will also be presented in Chicago, on September 10<sup>th</sup>, at AWMA's Climate-Change Conference.

There is no reason that Section 1.1 does not show the well-known plots, Figures 1 and 2 of Reference 2. These plots are cause for alarm. Consider for example the outrageous nature of our current level of atmospheric CO<sub>2</sub>, which is now over 400 PPM, more than it has been for over 800,000 years. This is shown in Reference 2's Figure 1. Reference 2's Figure 1's left scale is temperature change. It shows that if the atmospheric level of CO<sub>2</sub> is left at 400 PPM, the temperature change from current levels can be expected to increase by over 10 Degrees Celsius, a value that would most certainly end most current life forms living on our planet. The value of 400 PPM is over 43% larger than the pre-industrial level of 280 PPM, as shown in Figure 2 of Reference 2. San Diego County went through a long process of producing, approving, and then attempting to defend in court a Climate Action Plan (CAP) that was ultimately rescinded under court order. This indicates that the County is having trouble understanding the basics of climate, within the structure of CEQA. Appendix O will not fix that problem. These important graphs were included in Appendix A of Reference 3, our original comment letter on the now-rescinded County Climate Action

Section 1.1.2, "Sources of GHG Emissions", does not relate well to the project under consideration, because one of its primary problems is that it will result in too much driving. It would have been much better to have used the locally well-known Energy Policy Initiative Center (EPIC) conclusion that in San Diego County, the top four emitters of GHG are as follows: 41% from cars and light-duty trucks (LDVs); 25% from electricity; 9% from natural gas; and 5% from road users other than LDVs. Clearly, driving is the most significant source of GHG emission and one that is increased by developments that depend heavily on driving, such as the Lilac Hill proposal being considered here.

Section 1.1.3 is an attempt to cover a crucial topic: the potential effects of climate change. We see nothing incorrect in what it says. However, it is unacceptable because of what it fails to say.

To understand, for example, the concern that Governor Brown recently expressed to the Pope about the severity of our GHG problem, Section 1.1.3 would have to explain what “destabilizing the climate” or, “going past the tipping point” means. Briefly, it means that the Earth is warmed enough so that at least one of the climate system’s positive feedbacks takes over, causing climate change to become beyond our control. Positive feedbacks are processes that are sped up by warming and that also create more warming (hence, warming amplifies some source of warming).

Two examples of positive feedbacks are

- The melting of our polar ice caps, because the more they melt, the less that they reflect the sun’s radiation at frequencies that will not be trapped by CO<sub>2</sub>, causing more warming (in other words, the dark ocean is less cooling than the white, reflective ice) and
- The process of melting the permafrost, releasing methane gas, which is itself a powerful GHG that will cause significant warming.

Appendix A of Reference 3 of this letter, on Page 11 says the following (emphasis added):

On Page 6 the Draft CAP, failing to meet S-3-05 is described by saying that “climate change will threaten our economic well-being, public health, and environment”. ***The dangerous and currently out-of-control predicament in fact threatens human extinction.*** A bullet on Page 7 states that local effects could include “the decline or loss of species”, ***but does not reveal that our own species is at risk.***

Section 1.1.3 must include a description of climate stabilization, climate destabilization, and the difference between these two categories of outcomes of our climate crisis. It must state the fact that currently the world is breaking records for yearly emissions of CO<sub>2</sub> meaning that we are on a path towards destabilization. To lead the way to climate stabilization, California must stop expanding our freeway system and stop approving development that is not close to a significant transit hub.

Section 1.1.3 must also include the following information or equivalent:

- First, from Reference 4 (emphasis added), “A recent string of reports from impeccable mainstream institutions—the International Energy Agency, the World Bank, the accounting firm of PricewaterhouseCoopers—have warned that the Earth is on a trajectory to warm by at least 4 Degrees Celsius and that ***this would be incompatible with continued human survival.***”
- Second, from Reference 5, “Lags in the replacement of fossil-fuel use by clean energy use have put the world on a pace for 6 degree Celsius by the end of this century. Such a large temperature rise occurred 250 million years ago and extinguished 90 percent of the life on Earth. The current rise is of the same magnitude but is occurring faster.”

Section 1.1, “Understanding Global Climate Change”, also does not explain what it means to solve the problem. (This information is in Reference 4.) It should, for example, explain the significance of the world emitting at 80% below 1990 values. This value, added to the earth’s background sources of CO<sub>2</sub> production (such as digestion, rotting, and fire) will equal the net natural processes removing atmospheric CO<sub>2</sub>, such as the photosynthesis of plants. That means that if our emissions get to 80% below 1990 values, we are supporting

the capping of atmospheric CO2. The 2005 plan of Executive Order S-3-05 was to cap atmospheric CO2 at 450 PPM by year 450. This would not have solved the problem of attempting to avoid climate destabilization. It is, however, the first step. After that, the emission would need to be reduced further, so that atmospheric CO2 would start to come down. The goal would be to get atmospheric CO2 back to the preindustrial level of 280 PPM, before a positive feedback takes over.

**Failure to Provide Sufficient Background on San Diego County's Current General Plan and the County's Failure to Adopt an Effective, Comprehensive, and Enforceable Climate Action Plan within Six Months of the Approval of the General Plan and its Current Proposal to Not Adopt a New CAP Until as Late as 2018.**

We appreciate the information supplied in Section 3.3.2. However more needs to be said if the decision makers are going to understand the County's position relative to its General Plan and its failure to produce a CEQA-compliant Climate Action Plan (CAP). As you likely know, the Sierra Club challenged the County's original CAP because it was not effective, comprehensive, and enforceable. Both the trial court and the Court of Appeal agreed with us. A new CAP was ordered, but in an interim return to the trial court, the County stated that set "Winter of 2018" as the latest possible date for adoption of the new CAP. This is completely unacceptable. Originally a CAP was supposed to be adopted within six months of the General Plan Update. Although an EIR is now required for the new CAP, it should not take over a year. Moreover, there is NO EVIDENCE that the County is moving on this issue with any sense of urgency. The Sierra Club's repeated offers to meet with the personnel who are currently working on the CAP have not been accepted. The public has not yet been invited to make proposals for the contents of the new CAP. The Court of Appeal's decision setting aside the CAP was rendered in November of 2014. The County should have aggressively begun preparation of the CAP then. Without it, the cumulative impacts of the GHG emissions allowed by the General Plan Update are being ignored.

Reference 3 shows that the General Plan was approved, based in part on a promise to have a CAP approved in a timely manner. In fact, the understanding was that the CAP would be produced within 6 months, as shown here (from Reference 3):

**THE DRAFT CAP DOES NOT COMPLY WITH THE REQUIREMENTS OF MITIGATION MEASURE CC-1.2 OR AB 32.**

The General Plan EIR identified significant impacts related to GHG emissions and was adopted based on findings that the mitigation measures identified and described therein would be implemented. Specifically, in certifying the General Plan EIR, the Board of Supervisors made findings that Mitigation Measure CC-1.2 would mitigate potentially significant climate change impacts to a level below significance:

**CC-1.2 requires the preparation of a County Climate Change Action Plan within six months from the adoption date of the General Plan Update. The Climate Change Action Plan will include a baseline inventory of greenhouse gas emissions from all sources and more detailed greenhouse gas emissions reduction targets and deadlines. The County Climate Change Action Plan will achieve comprehensive and enforceable GHG emissions reduction of 17% (totaling 23,572 MTCO2E) from County operations from 2006 by 2020 and 9% reduction (totaling 479,717 MTCO2E) in community emissions from 2006 by 2020.**

**Implementation of the Climate Action Plan will contribute to meeting the AB 32 goals, in addition to the state regulatory requirements...**

General Plan EIR, Finding A-37, Attachment H-1, p. 71-72. Mitigation Measure CC-1.2 states as follows, and requires the County to:

**Prepare a County Climate Change Action Plan with an update baseline inventory of greenhouse gas emissions from all sources, more detailed greenhouse gas emissions reduction targets and deadlines; and a comprehensive and enforceable GHG emissions reduction measures that will achieve a 17% reduction in emissions from County operations from 2006 by 2020 and a 9% reduction in community emissions between 2006 and 2020. Once prepared, implementation of the plan will be monitored and progress reported on a regular basis.**

However, the courts found the County failed to provide “comprehensive and enforceable measures.”

Note that, from Reference 3:

Proposed mitigation measures are required by law to be “fully enforceable.” Cal. Pub. Res. Code § 21081.6(b); Guidelines § 15126.4(a)(2). Mitigation measures must be definite and defined so that their effectiveness is ascertainable. *See, e.g., San Franciscans for Reasonable Growth v. City & County of San Francisco*, 151 Cal.App.3d 61, 79 (1984).

Given this situation, it makes no sense to amend the General Plan to allow more GHG emissions, from more driving, because there is no guarantee that the County will be able to approve a sufficient number of enforceable measures to achieve meaningful targets as it is, let alone after making that task more difficult by weakening the General Plan by allowing more sprawl development.

**Failure to Explain San Diego County’s Primary Responsibility in the Climate Action Plan that It Is Legally Required to Produce**

Reference 2 specifies a set of LDV efficiency requirements and driving-reduction measures. LDV efficiency requirements are the responsibility of the state of California. However, feasible measures to reduce driving are the County’s responsibility, whenever you consider significant projects that clearly have the potential to increase driving in San Diego County.

**The Failure of Section 6.2.2, SB 375 and SANDAG 2050 RTP/SC, to Fully Explain and Account for the Fact that SANDAG’s 2050 RTP/SCS Has Lost on Most Legal Challenges in the Appellate Court and the GHG Issue Is Currently Before the California State Supreme Court.**

We appreciate the information supplied in Section 3.2.4. However, Section 6.2.4 needs to either include the same information or reference the reader back to Section 3.2.3. Specifically, 6.2.4 needs to explain that SANDAG’s 2050 RTP/SCS has lost on most legal challenges in the appellate court and is currently being litigated in California State Supreme Court. Most importantly, it was found to not be in support of the state’s climate mandate, S-3-05. The SB 375 2035 target of only 13%, quoted in Section 6.2.2, is not sufficient to support S-3-05, given our state’s current clean car mandates. This is shown on Pages 5 through 9 of Reference 2, where it is concluded that a reduction of 35.1% would be

needed. If the County thinks it can approve more development, it needs to first show how it is going to achieve the reductions that SANDAG failed to achieve. Reference 2 is an example of such work. However the County has done nothing comparable. What set of state car-efficiency measures and what set of enforceable measures to reduce driving could the County adopt to achieve the support of S-3-05 and the more difficult 2030 target of Executive Order B-3-15?

**Objection to Use of the County’s So-Called “2015 GHG Guidance” Which is In Fact an Improperly Adopted Significance Threshold.**

On Page 78 of Appendix O, it says:

In accordance with CEQA Guidelines section 15064.4(b)(2)-(3), this section analyzes whether the project’s GHG emissions are significant under the County’s 2015 GHG Guidance, which requires the “mitigated” project to achieve at least a 16 percent reduction in GHG emissions from the “unmitigated” condition for impacts to be less than significant.

The CEQA Guidelines refer to a legally adopted Significance Threshold, not the County’s “2015 GHG Guidance.” A significance threshold must be adopted following a process that includes public notification and testimony. The 16% reduction with respect to the same project that has no mitigations makes no sense from several standpoints. In the first place, we need to reduce our emissions and this is net emissions, not per-capita reductions. Any increase in population will have to be offset by a larger per-capita reduction. This does not mean that development must stop. We are in favor of more development that will reduce emissions. For example, housing in a jobs-rich area can reduce driving, even though it is more development. Likewise, offices in a housing-rich area can reduce driving, even though it is more development. We are also in favor of development in a municipality that can show that the development is part of a plan that will achieve the needed net reduction in emissions, by the use of a set of enforceable measures. This is why the development community needs to partner with use to get such a plan in place for the County, as soon as possible. Instead, the County is constantly ignoring feasible mitigations. Reference 2 is full of feasible mitigations to reduce driving. Many of them were included in Appendix A of Reference 3, which was sent to the County over 3 years ago. For example, for this proposal, the apartments could have had their parking cost unbundled, but there is no mention of that; likewise for the offices and schools. Even this would be unacceptable, unless the County had a plan to enforce such mitigations all over the County, starting with parking for their own employees.

**Failure to Explain LEED ND and How This Project Would Be “Equivalent.”**

Regarding the information on Page 82 of the Appendix, LEED ND (LEED Neighborhood Development) accounts for the fact that where a building is situated can reduce its negative environmental impacts. It is about in-fill development, smart growth, mixed use, and improving a jobs-housing balance. We do not see those characteristics in this proposal.

**Confusion of the Role of Executive Orders in a CEQA Process.**

Page 89 of Appendix O should be corrected. CEQA is about the physical world and the negative environmental consequences in the physical world. There is no worse environmental outcome than climate destabilization. Simply put, destabilizing the climate has to be a negative environmental impact, under CEQA. Using the concept of “Cumulative Impacts” no project or municipality can be declared that they are too small to have to

achieve climate-stabilizing targets. Clearly, if all projects achieved the targets and the municipality had a plan to ensure that existing projects will also achieve the targets, then we will be successful. The Executive Orders are related in some way to climate stabilization. However, municipalities have a responsibility to determine what targets will in fact be climate stabilizing. Page 9 of Reference 2 shows an example.

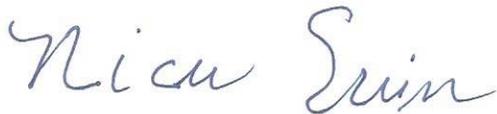
CEQA requires that negative impacts be described. This is why climate destabilization must be described. Since this impact is so severe, it is then required to show how it could be avoided. This is no more than a requirement to *fully consider* negative impacts. Therefore, a list of enforceable measures to achieve the climate-stabilizing targets must be identified. The local measures must be adopted and the state of California then needs to hear strongly that the municipality and developers are counting on them to do the measures that are appropriate at the state level.

## CONCLUSION

We urge you to make the politically difficult decision and deny the project and adhere to the principles and guidelines of the General Plan and the common sense placement for urban densities in urban areas.

The impacts of this project on the environment and the County's General Plan are unacceptable.

Thank you for your consideration.



Nick Ervin, Conservation Chair, Sierra Club San Diego



Debbie Hecht, Chair, Steering Committee Sierra Club San Diego  
8304 Clairemont Mesa Blvd, Ste 101  
San Diego, CA 92111

## REFERENCES

- 1 Tarbuck, E.; Lutgens, F.; *Earth Science*; Tenth Edition, published by Prentice Hall, 2003, page 539
- 2 Bullock, Mike R; *The Development of California Light-Duty Vehicle (LDV) Requirements to Support Climate Stabilization: Fleet-Emission Rates & Per-Capita Driving*, Paper 30973-AWMA, from the Air and Waste Management Association's

107<sup>th</sup> Annual Conference and Exhibition; Long Beach, CA, June 24-27, 2014; available on request from [mike\\_bullock@earthlink.net](mailto:mike_bullock@earthlink.net)

- 3 Stump, John; *Comments Regarding the Draft Climate Action Plan and Related Documents*; March 10, 2012
- 4 Hertsgaard, M; *Latino Climate Solution, the Nation*, Dec. 24/31, 2012.
- 5 Whitney E.; *How to Meet the Climate Crisis, UU World*, Volume XXVI No. 4, Winter 2012
- 6 Vespa, M.; *Comments on Survey of CEQA Documents on Greenhouse Gas Emissions Draft Work Plan and Development of GHG Threshold of Significance for Residential and Commercial Projects*, Letter from Center for Biological Diversity to Elaine Chang, Deputy Executive Officer of Planning, Rule Development, and Area Sources of the South Coast Air Quality Management District; dated April 15, 2009. [http://www.aqmd.gov/docs/default-source/ceqa/handbook/greenhouse-gases-\(ghg\)-ceqa-significance-thresholds/year-2008-2009/ghg-meeting-10/ghg-meeting-10-cbd-comment-letter.pdf?sfvrsn=2](http://www.aqmd.gov/docs/default-source/ceqa/handbook/greenhouse-gases-(ghg)-ceqa-significance-thresholds/year-2008-2009/ghg-meeting-10/ghg-meeting-10-cbd-comment-letter.pdf?sfvrsn=2)



San Diego & Imperial Counties Chapter  
8304 Clairemont Mesa Blvd., Ste 101  
San Diego, CA 92111  
<http://www.sandiego.sierraclub.org>  
858-569-6005

March 19, 2012

**VIA HAND DELIVERED and EMAILED TO: (Anna.Lowe@sdcountry.ca.gov)**

Anna Lowe, Department of Planning and Land Use  
County of San Diego  
5201 Ruffin Road, Suite B  
San Diego, CA 92123-1666

Re: Comments Regarding the Draft Climate Action Plan and Related Documents

Dear Ms. Lowe:

The San Diego & Imperial Counties Chapter of the Sierra Club (the “Sierra Club” or the “Chapter”) respectfully requests that the Draft County of San Diego Climate Action Plan (“Draft CAP”), the Draft Guidelines for Determining Significance: Climate Change (“Draft Significance Thresholds”), and the Draft Report Format and Content Requirements: Greenhouse Gas Analyses and Reporting (“Draft GHG Report Requirements”) be returned to staff for revisions and subsequent recirculation before presentation to the Board of Supervisors for consideration at a public hearing.

In failing to require greenhouse gas (“GHG”) reductions past 2020 projections, the County Draft CAP, Draft Significance Thresholds, and Draft GHG Report Requirements, if adopted, will themselves contribute to the ultimate human catastrophe: climate destabilization.

Additionally, the County has failed to keep its own promises to the people – promises made just last year in the 2011 County of San Diego General Plan Update Environmental Impact Report (“General Plan EIR”).

As set forth below, the Draft CAP does not meet its stated goals of (1) complying with General Plan EIR Mitigation Measure CC-1.2 or Assembly Bill 32 (“AB 32”); or (2) mitigating the impacts of climate change consistent with the reduction requirements contained in Executive Order S-3-05 (“the Executive Order”).<sup>1</sup>

To make matters worse, and instead of contributing to the solution, the Draft Significance Thresholds and the Draft Report Requirements serve to further exacerbate the devastating impacts of climate change by purporting to limit California Environmental Quality Act (“CEQA”) review – and therefore consideration of mitigation measures and alternatives - based on thresholds that do nothing to avoid dangerous anthropogenic interference (“DAI”) within the climate system.

---

<sup>1</sup> In addition, the Draft CAP does not mitigate the impacts of climate change consistent with the California Environmental Quality Act (“CEQA”) Guidelines, allow lead agencies to adopt a plan or program that addresses the cumulative impacts of a project, or provide a mechanism that subsequent projects may use as a means of addressing GHG impacts under CEQA.

For this reason, adoption of the Draft Significance Thresholds and the Draft Report Requirements themselves would have adverse environmental impacts that have not been analyzed by the County as required by CEQA.

**I. THE DRAFT CAP DOES NOT COMPLY WITH THE REQUIREMENTS OF MITIGATION MEASURE CC-1.2 OR AB 32.**

The General Plan EIR identified significant impacts related to GHG emissions and was adopted based on findings that the mitigation measures identified and described therein would be implemented. Specifically, in certifying the General Plan EIR, the Board of Supervisors made findings that Mitigation Measure CC-1.2 would mitigate potentially significant climate change impacts to a level below significance:

**CC-1.2 requires the preparation of a County Climate Change Action Plan within six months from the adoption date of the General Plan Update. The Climate Change Action Plan will include a baseline inventory of greenhouse gas emissions from all sources and more detailed greenhouse gas emissions reduction targets and deadlines. The County Climate Change Action Plan will achieve comprehensive and enforceable GHG emissions reduction of 17% (totaling 23,572 MTCO<sub>2</sub>E) from County operations from 2006 by 2020 and 9% reduction (totaling 479,717 MTCO<sub>2</sub>E) in community emissions from 2006 by 2020. Implementation of the Climate Action Plan will contribute to meeting the AB 32 goals, in addition to the state regulatory requirements...**

General Plan EIR, Finding A-37, Attachment H-1, p. 71-72. Mitigation Measure CC-1.2 states as follows, and requires the County to:

**Prepare a County Climate Change Action Plan with an update baseline inventory of greenhouse gas emissions from all sources, more detailed greenhouse gas emissions reduction targets and deadlines; and a comprehensive and enforceable GHG emissions reduction measures that will achieve a 17% reduction in emissions from County operations from 2006 by 2020 and a 9% reduction in community emissions between 2006 and 2020. Once prepared, implementation of the plan will be monitored and progress reported on a regular basis.**

General Plan EIR, p. 7-80.

The Draft CAP is not the County Climate Change Action Plan contemplated by Mitigation Measure CC-1.2. As set forth below, the Draft CAP: (A) does not provide an updated baseline inventory; (B) does not provide detailed reduction targets and deadlines; (C) does not contain “comprehensive and enforceable GHG emissions reduction measures”; (D) does not “achieve a 17% reduction in emissions from County operations from 2006 by 2020 and a 9% reduction in community emission between 2006 and 2020”; and (E) precludes meaningful monitoring and reporting.

**A. THE DRAFT CAP DOES NOT PROVIDE AN UPDATED BASELINE INVENTORY.**

Mitigation Measure CC-1.2 required that County “Prepare a County Climate Change Action plan with an update baseline inventory of greenhouse gas emissions from all sources...” but the Draft CAP does not provide such an updated inventory. Instead, the Draft Cap appears to use 2005 and 2006 baselines that were already in existence at the time Mitigation Measure CC-1.2 was adopted.

**B. THE DRAFT CAP DOES NOT PROVIDE MORE DETAILED REDUCTION TARGETS AND DEADLINES.**

Mitigation Measure CC-1.2 required that the County “Prepare a County Climate Change Action plan with...more detailed greenhouse gas emissions reduction targets and deadlines...” but the Draft CAP in fact provides *less* detailed targets and deadlines than provided in AB 32 and the Executive Order.

The Draft CAP appears to ignore certain requirements of AB 32 as interpreted by the County’s own data. For example, the County’s position is that, “To achieve AB 32’s 2020 target, community-wide emissions would have to be reduced by 479,717 MT CO<sub>2</sub>e from 2006 levels. **A 9% reduction from 2006 levels is necessary to achieve 1990 levels...**” General Plan EIR, CEQA Findings Regarding Significant Effects, Attachment A, p. 2. The Draft CAP does not distinguish between community emissions reductions and County emissions reductions and omits any reference to the 9% community reductions set forth in Mitigation Measure CC-1.2.

Instead, the entirety of the established targets and deadlines appears to be “15% below 2005 levels by 2020.” Draft CAP, p. 20. The Draft CAP in fact recognizes that to be on track to meet the goals of the Executive Order emissions reductions would have to be 49% below 2005 levels by 2035; and that the Draft CAP does not meet that goal. Draft CAP, p. 49.

As if an excuse, the Draft CAP states that only “current technology and existing state and federal regulations” are considered. Draft CAP, p. 49. Notwithstanding that there is no excuse for contributing to climate destabilization, the Draft CAP makes inaccurate assumptions and statements with respect to currently available solutions. For example, in assuming it cannot meet the Executive Order requirements, the Draft CAP must be presuming it will not meet the regulatory goals already established by the California Public Utilities Commission. If the County were to meet the already established California Energy Efficiency Strategic Plan goals for 2020, GHG emissions from stationary electricity usage would drop 50% by 2020 compared to a 2008 baseline year. See Attachment 1. The GHG reduction would exceed 80% by 2030 if the same pace of zero net energy building retrofits is assumed in the 2020-2030 timeframe. See Attachment 2. Currently available transportation related GHG reduction solutions are presented in the Appendix. See also Attachments 5-7.

**C. THE DRAFT CAP DOES NOT PROVIDE COMPREHENSIVE AND ENFORCEABLE GHG EMISSIONS REDUCTION MEASURES.**

It was no mistake that Mitigation Measure CC-1.2 used language like “comprehensive,” “enforceable,” and “will achieve.” Proposed mitigation measures are required by law to be “fully enforceable.” Cal. Pub. Res. Code § 21081.6(b); Guidelines § 15126.4(a)(2). Mitigation measures must be definite and defined so that their effectiveness is ascertainable. See, e.g., *San Franciscans for Reasonable Growth v. City & County of San Francisco*, 151 Cal.App.3d 61, 79 (1984).

Instead of “achieving” the reductions set forth in Mitigation Measure CC-1.2 and required by law, the Draft CAP concedes that it “does not ensure reductions...” Draft CAP, p. 69. In addition, the Draft CAP uses language such as “addressing,” “informing and inspiring meaningful GHG reductions,” and “Allow lead agencies to adopt a plan or program that addresses the cumulative impacts of a project.” These vague statements should be replaced with mandatory requirements that actually produce results.

The CAP provides seventeen GHG reduction measures that the drafters conclude will allow the County to achieve the goal of reducing emissions to 15% below 2005 levels by 2020. Draft CAP, p. 22. However, the measures do not explain the strategies that will be implemented, they do not provide cost breakdowns, they do not describe any incentives, they do not set forth specific mechanisms for monitoring each measure, and they do not explain the role of each implementation partner listed.

For example, measure E1, Energy-Efficient New Development, states that the County will “use incentives to encourage builders to exceed current energy efficiency standards by 15%.” Draft CAP, p. 29. What incentives? It then states there are also educational programs that “will create the educated and experienced workforce that is needed to take advantage of the County’s Green Building Incentive program.” *Ibid.* Where is the description of the County’s Green Building Incentive program? Who will participate in the educational program? How will the program be implemented or monitored? E1 also neglects to explain the likelihood of securing funding from the listed “Potential Funding Sources” and how instrumental are each to the success of the measure. *Ibid.* In addition, the measure does not indicate the roles of each implementation partner. *Ibid.* Without this important information, how could the County accurately determine the GHG reductions anticipated from this measure or the participation rate? All these things must be considered in order to provide full information and demonstrate enforceability to achieve acceptable mitigation under CEQA.

The Draft CAP concedes that some of the strategies provided in will not yield quantifiable emissions reductions. Draft CAP, p. 22. The strategies that will not yield quantifiable emissions reductions are not, and must be, identified. There is no information about the percentage of reductions that do not yield quantifiable emissions reductions, and there is therefore no way to analyze their effect on the requirements of Mitigation Measure CC-1.2.

In summary, the Draft CAP does not provide comprehensive and enforceable mechanisms that will actually reduce GHG emissions. With inadequate reduction measures it is far from clear whether or not the Draft CAP will achieve the County GHG emissions reduction target of 15% below 2005 levels by 2020. Further, with an ambiguous reduction target, it is not possible to determine that such a target will be sufficient even to comply with AB 32.

**D. THE DRAFT CAP DOES NOT PROVIDE COMPREHENSIVE REDUCTION MEASURES THAT WILL ACHIEVE A 17% REDUCTION IN EMISSIONS FROM COUNTY OPERATIONS AND A 9% REDUCTION IN COMMUNITY EMISSIONS.**

Mitigation measure CC-1.2 requires the CAP to achieve a 17% reduction in emissions from County operations from 2006 by 2020 and a 9% reduction in community emissions between 2006 and 2020. As set forth above, the Draft CAP does not actually achieve *any* emission reductions. In addition, the CAP only gives one emissions reduction target - 15% below 2005 levels by 2020.

Nowhere in the Draft CAP is there a reference to reducing “9% community emissions between 2006 and 2020.” Moreover, the terms “County” and “community” are used in the General Plan EIR, “municipal” and “community” are used in Attachment A to General Plan EIR Attachment H-1 (“Attachment A”), and just “County” is used in the Draft CAP. See e.g. Attachment A, p. 3. The inventory update in Attachment A says the *community* baseline year is changed to 2005, however, the 2005 baseline year used in the Draft CAP is for the *County*. No explanation is provided for the absence of the “9% reduction between 2006 and 2020” requirement of Mitigation Measure CC-1.2 in the Draft CAP.

#### **E. THE CAP MONITORING PROGRAM PRECLUDES EFFECTIVE IMPELEMENTATION.**

The Draft CAP also fails to provide for effective implementation. Mitigation Measure CC-1.2 requires that, “Once prepared, implementation of the plan will be monitored and progress reported on a regular basis.” The inadequate Draft CAP itself concedes that, “it is imperative to monitor progress toward the goals set in CAP and to revisit and update the CAP periodically.” Draft CAP, p. 69. However, the proposed monitoring tool that can “track progress between inventories and examine effectiveness of specific measures” and is contemplated to be “revisited periodically to reflect any changes in emissions projections or reduction potential,” neglects to define “periodically.” *Ibid.* In addition, the monitoring section of the CAP does not explain how the County will “coordinate monitoring efforts at the community and local government levels,” which seems to be the key to the success of the program. *Ibid.* Without full participation and information from those implementing the Draft CAP, as well as those affected by the Draft CAP measures, the monitoring system will not receive the necessary and relevant information to make an assessment about the progress of implemented measures.

#### **II. THE DRAFT CAP DOES NOT COMPLY WITH THE EXECUTIVE ORDER**

The Governor’s Executive Order S-3-05 states:

**[T]he following greenhouse gas emission reduction targets are hereby established for California: by 2010, reduce GHG emissions to 2000 levels; by 2020, reduce GHG emissions to 1990 levels; by 2050, reduce GHG emissions to 80 percent below 1990 levels**

The CAP acknowledges the targets established in the Executive Order and the developed emissions forecasts for 2035 necessary to reach 2050 GHG emissions reductions. Draft CAP, p. 20. The Draft CAP explains that reductions “would need to reach 49% below 2005 levels by 2035, based on emissions forecasts for 2035 and 2050 under BAU conditions, to meet the 2050 goal.” *Ibid.* However, after expressing dedication to meeting legislative goals and the need to look beyond 2020 deadlines, and determining reduction targets for 2035 and 2050, the CAP stops short. Draft CAP, p. 49, 52. The Draft CAP utilized the same measures developed for 2020 scenario for the 2035 scenario, with the only change being an increase in rates of participation. Draft CAP, p. 49. This planning only yields a potential reduction of 13.7% below 2005 levels by 2035 and “does not achieve the 49% reduction target.” *Ibid.*

The scientific community recognizes that DAI within the climate system will not be avoided by 2020 reductions alone. See Attachments 3, 4. As set forth above, the Draft CAP inaccurately states that “current technology and existing state and federal regulations” are considered. Draft CAP, p. 49. Regulatory goals already established by the California Public Utilities Commission provide current solutions and guidance to achieve 2035 and 2050

reductions. See Attachments 1, 2. Similarly, currently available transportation related GHG reduction solutions are presented in the Appendix, in which specific comments are provided and inadequacies explained. See also Attachments 5-7.

**III. THE DRAFT SIGNIFICANCE THRESHOLDS AND THE DRAFT REPORT REQUIREMENTS, AS DRAFTED, WILL CONTRIBUTE TO CLIMATE DESTABILIZATION AND ARE SUBJECT TO CEQA.**

Instead of trying to avoid DAI within the climate system, the Draft Significance Thresholds and Draft Report Requirements serve to further exacerbate the devastating impacts of climate change.

The CEQA Guidelines explained that lead agencies may adopt thresholds of significance for use in environmental review but that the thresholds must be supported by substantial evidence:

- (a) Each public agency is encouraged to develop and publish thresholds of significance that the agency uses in the determination of the significance of environmental effects. A threshold of significance is an identifiable quantitative, qualitative or performance level of a particular environmental effect, non-compliance with which means the effect will normally be determined to be significant by the agency and compliance with which means the effect normally will be determined to be less than significant.
- (b) Thresholds of significance to be adopted for general use as part of the lead agency's environmental review process must be adopted by ordinance, resolution, rule, or regulation, and developed through a public review process and be supported by substantial evidence.
- (c) When adopting thresholds of significance, a lead agency may consider thresholds of significance previously adopted or recommended by other public agencies or recommended by experts, provided the decision of the lead agency to adopt such thresholds is supported by substantial evidence.

CEQA Guidelines § 15064.7. Here, there is no substantial evidence that supports adoption of the Draft Significance Thresholds and Draft Report Requirements which do not even purport to provide for emissions reductions past 2020 targets. The scientific of climate change reveals that 2020 targets are insufficient to avoid DAI within the climate system. Adoption of the Draft Significance Thresholds and/or the Draft Report Requirements will therefore themselves adversely impact the environment. An EIR would be required before either or both could be adopted.

CEQA Guideline section 15064.4, entitled, Determining the Significance of Impacts from Greenhouse Gas Emissions, provides additional guidance for determining GHG impact significance:

- (a) The determination of the significance of greenhouse gas emissions calls for a careful judgment by the lead agency consistent with the provisions in section 15064. A lead agency should make a good-faith effort, based to the extent possible on scientific and factual data, to describe, calculate or estimate the amount of greenhouse gas emissions resulting from a project. A lead agency shall have discretion

to determine, in the context of a particular project, whether to:

(1) Use a model or methodology to quantify greenhouse gas emissions resulting from a project, and which model or methodology to use. The lead agency has discretion to select the model or methodology it considers most appropriate provided it supports its decision with substantial evidence. The lead agency should explain the limitations of the particular model or methodology selected for use; and/or

(2) Rely on a qualitative analysis or performance based standards.

(b) A lead agency should consider the following factors, among others, when assessing the significance of impacts from greenhouse gas emissions on the environment:

(1) The extent to which the project may increase or reduce greenhouse gas emissions as compared to the existing environmental setting;

(2) Whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project.

(3) The extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of greenhouse gas emissions. Such requirements must be adopted by the relevant public agency through a public review process and must reduce or mitigate the project's incremental contribution of greenhouse gas emissions. If there is substantial evidence that the possible effects of a particular project are still cumulatively considerable notwithstanding compliance with the adopted regulations or requirements, an EIR must be prepared for the project.

Again, as set forth above, there has been no effort based on existing scientific and factual data to calculate the GHG emissions that would result from adoption of the Draft Significance Thresholds or the Draft Report Requirements. To the contrary, existing scientific and factual data reveals that thresholds that do not meet 2035 requirements are insufficient. See Attachment 3, Minutes for the GHG CEQA Significance Threshold Stakeholder Working Group Meeting #15, p. 2. As set forth and referenced in the attached letter from the Center for Biological Diversity, not even compliance with the Executive Order will avoid dangerous anthropogenic interference with the climate system. See Attachment 4. Failing to address emissions reductions past 2020 necessarily renders the Draft Significance Thresholds and Draft Report Requirements insufficient.

I have attached an appendix and seven (7) documents, which are incorporated by reference as part of our comments on the County's proposed plan. This letter, its appendix and the incorporated documents must be included in any review of your plan. We request written responses to each and every comment made in this submission. Please notice our organization at the above address of any further processing of this plan or meetings on this plan.

Thank you for your fine staff work and including us in this process.

Respectfully submitted,

/s/ John Stump

John Stump, Chair  
Chapter Executive Committee

- cc. Ms. Malinda Dickensen, Chapter Vice Chair
- Ms. Mollie Bigger, Chapter Conservation Chair
- Mr. Mike Bullock, Chapter Transportation Chair
- Ms. Masada Disenhouse, Chapter Climate Chair

Enclosures (7)

**Attachment 1** – California Energy Efficiency Strategic Plan, January 2011 Update

**Attachment 2** – California Energy Efficiency Strategic Plan Zero Net Energy Action Plan: Commercial Building Sector 2010-2012

**Attachment 3** – Letter from Center for Biological Diversity to Elaine Chang, Deputy Executive Officer of Planning, Rule Development, and Area Sources of the South Coast Air Quality Management District; *Comments on Survey of CEQA Documents on Greenhouse Gas Emissions Draft Work Plan and Development of GHG Threshold of Significance for Residential and Commercial Projects*, dated April 15, 2009.

**Attachment 4** – Minutes for the GHG CEQA Significance Threshold Stakeholder Working Group #5, dated September 28, 2010

**Attachment 5** – Letter from Sierra Club Transportation Chair to SANDAG Board, *California Air Resources Board (CARB) Greenhouse Gas (GHG) Reduction Targets, Issued to SANDAG, in Accordance with SB 375, for the Year 2035*, dated April 20, 2011

**Attachment 6** – M. Bullock & J. Stewart, *A Plan to Efficiently and Conveniently Unbundle Car Parking Costs*; Paper 2010-A-554-AWMA, from the Air and Waste Management Association's 103<sup>rd</sup> Annual Conference and Exhibition; Calgary, Canada, June 21-24, 2010

**Attachment 7** – Letter from M. Bullock to the Honorable President Richard Holober and Members of the Board of Trustees, San Mateo County Community College District; *An Updated Parking Policy, in Light of the Controversy Surrounding the Removal of Building 20, Greenhouse, and Gardens, to Add Parking*, dated July 27, 2011

~~~~~

**The San Diego Chapter of the Sierra Club is San Diego's oldest and largest grassroots environmental organization, founded in 1948. Encompassing San Diego and Imperial Counties, the San Diego Chapter seeks to preserve the special nature of the San Diego and Imperial Valley area through education, activism, and advocacy. The Chapter has over 14,000 members. The National Sierra Club has over 700,000 members in 65 Chapters in all 50 states, and Puerto Rico.**



## **APPENDIX**

### **Summary**

Improvements to Chapters 1 and 2 are given. Chapter 2 suggestions include computing the driving reductions needed to achieve the S-3-05's trajectory by 2035. Feasible mitigation measures would eliminate congestion, improve air quality, increase social equity, and empowering people to make meaningful decisions both about methods of transit and how to spend their hard earned dollars.

### **Qualifications**

Understanding the relationship between global warming and transportation requires mathematics. The Chapter Transportation Chair, Mike Bullock, a contributor to this letter and drafter of this Appendix, has a BSEE degree and a Masters of Science, Engineering (MSE) degree. He worked for 36 years at Lockheed Martin, in Sunnyvale. For the last 20 years there, he worked as a satellite-systems engineer. One of his responsibilities was to develop equations and methods to measure and then compensate out, through satellite database upload, the misalignments of the key antennas on the MILSTAR communication satellite.

### **Specific Comments on the Draft CAP**

#### **1.1 Comments on the Draft CAP's Purpose**

The Attorney General Office's (AG's) excellent letter found at [http://ag.ca.gov/cms\\_attachments/press/pdfs/n2056\\_santa\\_clarita\\_letter.pdf](http://ag.ca.gov/cms_attachments/press/pdfs/n2056_santa_clarita_letter.pdf) compels a high standard of specificity. This CAP must identify the needed GHG reductions and show how those needed reductions will be achieved.

The words, "informing and inspiring meaningful GHG reductions" should be replaced with "achieving meaningful GHG reductions."

The first sentence on the top of the right column should include the *regional* level. SANDAG's RTP2050 is a \$214B dollar plan, with direct impacts on GHG emissions. SANDAG's work should not be ignored.

Table 1.1 should be labeled so the reader understands the year of the reductions. If the year is 2020, a similar table is needed for 2035.

#### **1.3 Comments on the Greenhouse Effect**

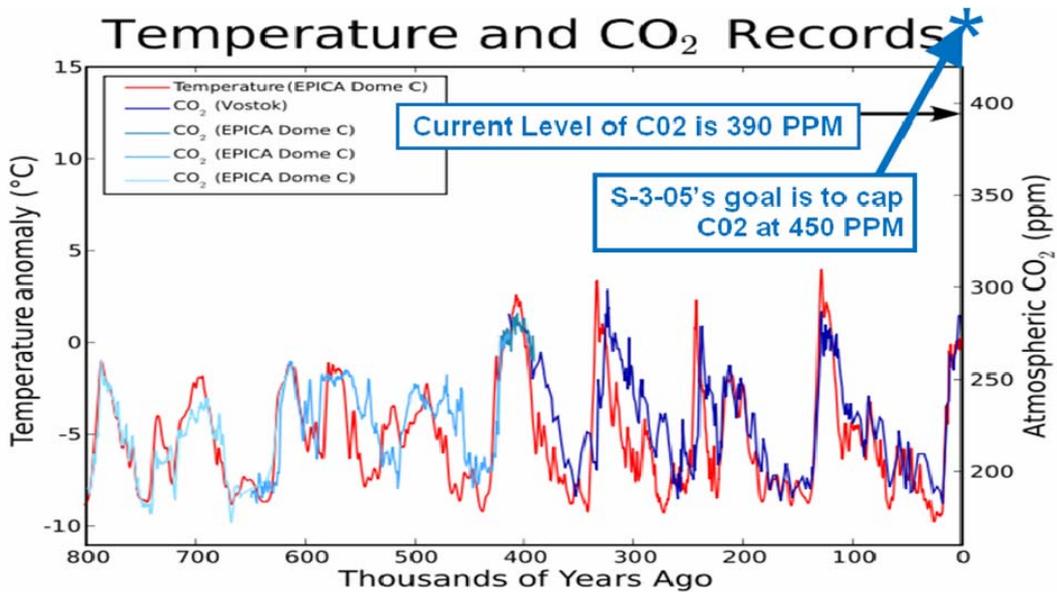
This section fails to inform the reader of the urgency and extreme danger posed by our climate crisis. The June 2008 issue of *Scientific American* (*The Ethics of Climate Change*, by Professor John Broome) reports that the levels of GHG expected in 20 years will result in a 5% chance of a 14.4 degree Fahrenheit increase in the earth's temperature and this would be an "utter catastrophe" and create the possibility of a "devastating collapse of the human population, perhaps even to extinction".

The plot shown on Page 6 fails to show the historic temperature profile. For that information, it is necessary to also show Figure 1 and 2. They are well known. Note that the 450 PPM value is shown. That would be the peak level of atmospheric CO<sub>2</sub>, if the world achieves the S-3-05 trajectory. That peak value would occur in year 2050 and then the atmospheric level of CO<sub>2</sub> would gradually be brought down to less-dangerous levels.

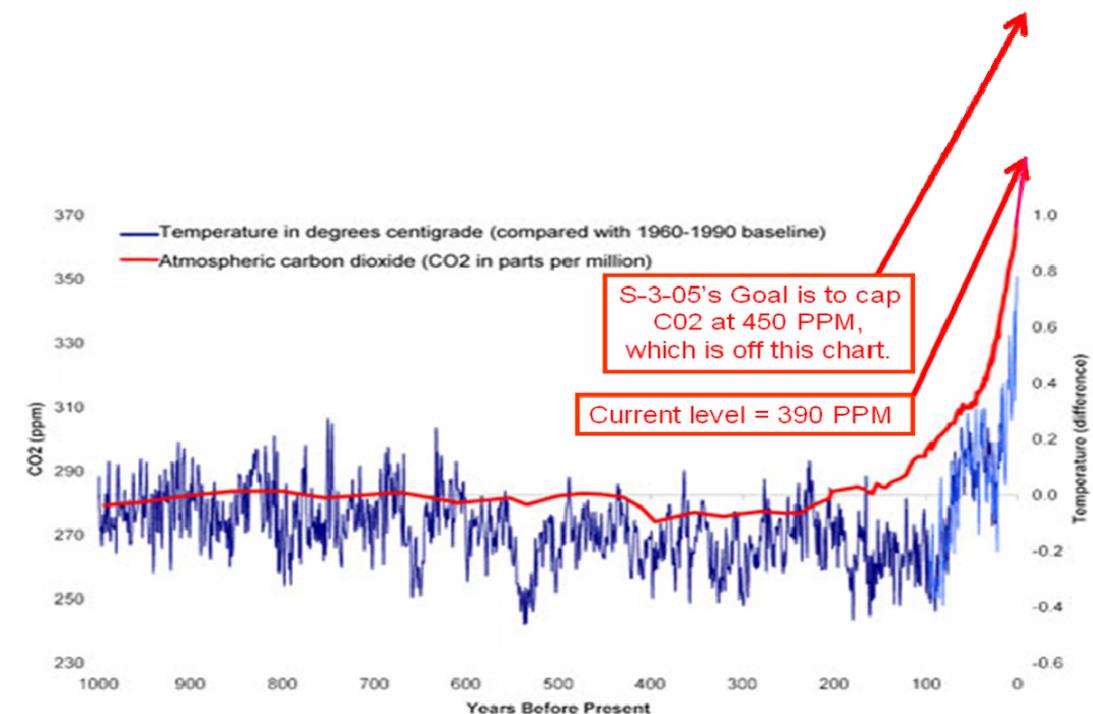
Figure 1 shows that the CO<sub>2</sub> levels shown on your Page-6 plot, which are 400 PPM up to 1000 PPM, correspond to temperatures of well over 10 degrees Centigrade. Such temperatures would risk a catastrophic collapse of the human population, to include the eventual extinction of our species. There are no adaptation strategies that could deal with such an event.

Figure 2 clearly shows that, although the temperature rise is somewhat masked by solar activity, underneath that relatively high frequency temperature variation, the temperature rise, which is due to the trapped heat caused by the higher-than-normal CO<sub>2</sub>, is already taking place. The trapped heat's effect on our atmosphere will be delayed as it melts ice and warms the ocean. We must at least achieve the S-3-05 trajectory.

**Figure 1 Atmospheric CO<sub>2</sub> and Mean Temperature, 800,000 Years Ago, with 450 PPM CO<sub>2</sub> Shown**



**Figure 2 Atmospheric CO2 and Mean Temperature, Over the Last 1,000 Years**



Attachment 3, also available at <http://www.aqmd.gov/ceqa/handbook/GHG/2009/april22mtg/CBDcomments.pdf>, has descriptions of the likelihoods of various S-3-05 outcomes, first in terms of temperature rise. Even if we achieve S-3-05, there is a 50% chance that the temperature rise will exceed 2 Degrees Centigrade. A 2 degree Centigrade rise in temperature would have very serious negative consequences, as described. There is a 30% chance that the temperature change would exceed 3 Degrees Centigrade, which is described as “exponentially worse” than the 2-Degrees-Centigrade outcome. And so on. Going above 500 PPM is unthinkable and yet that seems to be exactly what we are doing.

On Page 6 the Draft CAP, failing to meet S-3-05 is described by saying that “climate change will threaten our economic well-being, public health, and environment”. The dangerous and currently out-of-control predicament in fact threatens human extinction. A bullet on Page 7 states that local effects could include “the decline or loss of species”, but does not reveal that our own species is at risk. This sort of over sight continues throughout Pages 8 and 9.

On Page 9 it says, “The extent to which these changes produce negative impacts will depend on actions taken today to ensure resilience in the face of climate change and, where necessary, adaptation to its impacts”. This ignores our responsibility to limit our GHG emissions and the fact that without sufficient and timely limitations, adaptation will not be possible.

#### **1.4 Comments on the “Local Effects of Climate Change” and “Potential Climate Change Health Effects” Sections**

These sections do not describe the severity of our climate crisis.

#### **1.5 Comments on the “Relationship to Other State and County Documents”**

It is crucial that the Draft CAP require strategies that will reduce emissions to levels at least as low as the S-3-05 trajectory.

Table 1.2 is valuable but must be improved in at least the following ways.

The description of S-3-05 needs to contain the following additional sentence: “These targets must be considered as points that define straight-line trajectories. It should also be understood that world-wide emission levels must at least stay beneath these straight lines. The net emissions, over the years, must be limited. The net emission is proportional to the area under these straight lines. Any year that emissions are above the lines creates a surplus that then requires years beneath the lines. The world is currently emitting at levels well above the line between the first two points.

The SB 375 description is incorrect because what the Metropolitan Planning Organization (MPOs) must achieve is GHG reductions that do not include reductions from state programs of cleaner cars and cleaner fuels. This means that the reductions can only be achieved by driving reductions, or, in other words, reducing vehicle miles travelled (VMTs). Therefore, it would be more accurate to simply change the “GHG emissions” words to “VMTs”, to say “VMTs from passenger vehicles must be reduced . . .”

#### **1.6 Comments on the “Scope and Content of the CAP”**

The bullet “Community Measures and Actions” should identify Table 3.2, since it provides the estimated GHG emissions. For example, T2, shown on Page 41, gives the results as a “50% increase in bicycle and pedestrian facilities”; T3 gives “50% of employers using TDM. It is not until Table 3.2 that the reader learns of the GHG reductions. Besides this, the estimated GHG reductions (only from VMT reductions, for cars and light-duty trucks) need to be for years 2035 and 2050, not just 2020 as stated in that bullet.

### **2.0 Comments on the Draft CAP’s Chapter 2**

#### **2.1 Comments on the “Business-as-Usual Projections”**

Regarding the transportation sector; cleaner cars, cleaner fuels, and other state-transportation programs are out of the County’s direct control but the County can play an important role by seeking improved legislation and rule making. The County’s primary role, in terms of transportation, however, is to reduce VMT. Table 2.3’s BAU should therefore assume the state’s transportation programs will perform as currently estimated but assume VMT will be “BAU”, meaning as currently projected with no county or regional programs to reduce driving.

#### **2.2 Comments on the “GHG Emissions-Reduction Targets”**

We appreciate your recognition of the critical need to meet S-3-05. Given the dire predictions as set forth in Attachment 3 and reference materials therein <http://www.aqmd.gov/ceqa/handbook/GHG/2009/april22mtg/CBDcomments.pdf>, compliance with S-3-05 should be stated as the *minimum* to be accomplished.

The computation of the critical value of 49% below the 2005 value by 2035 should be set forth. This value means that the 2035 emissions need to be  $(.51) \times (2005 \text{ emissions})$ . In Attachment 5, letter from Sierra Club to SANDAG, April 20, 2011, *California Air Resources Board (CARB)*

*Greenhouse Gas (GHG) Reduction Targets, Issued to SANDAG, in Accordance with SB 375, for the Year 2035*) the computation was .525, instead of .51.

Driving reductions needed to achieve 2020 or 2035 reductions are not met. This calculation can only be done by assuming some achieved improvement from cleaner cars and cleaner fuels. The work shown here will repeat the process shown in Attachment 5.

**Overview of Relationships and Derivation of Key Formula**

The S-3-05 net reduction in GHG emissions, from cars and light-duty trucks, expressed as a fraction of 2005 emissions, is obtained by multiplying four factors together. The definitions of Table 1 apply.

**Table 1                      Factor Definitions, with Respect to Year 2005**

| <b>Factor Definitions</b>                                                                                                                         |                                                                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| <i>All are for for the year of interest, with respect to year 2005 values.<br/>Except for Population, all are for cars and light-duty trucks.</i> |                                                                          |
| <b>f</b>                                                                                                                                          | <b>net factor of the emissions of Greenhouse Gas</b>                     |
| <b>f_Pavley</b>                                                                                                                                   | <b>factor of the average statewide mileage</b>                           |
| <b>f_Fuel</b>                                                                                                                                     | <b>factor of the reduction of GHG due to fuels that burn less carbon</b> |
| <b>f_Population</b>                                                                                                                               | <b>factor of the population in the region of interest</b>                |
| <b>f_PerCapitaVMT</b>                                                                                                                             | <b>factor of per capita driving</b>                                      |

The following equations apply.

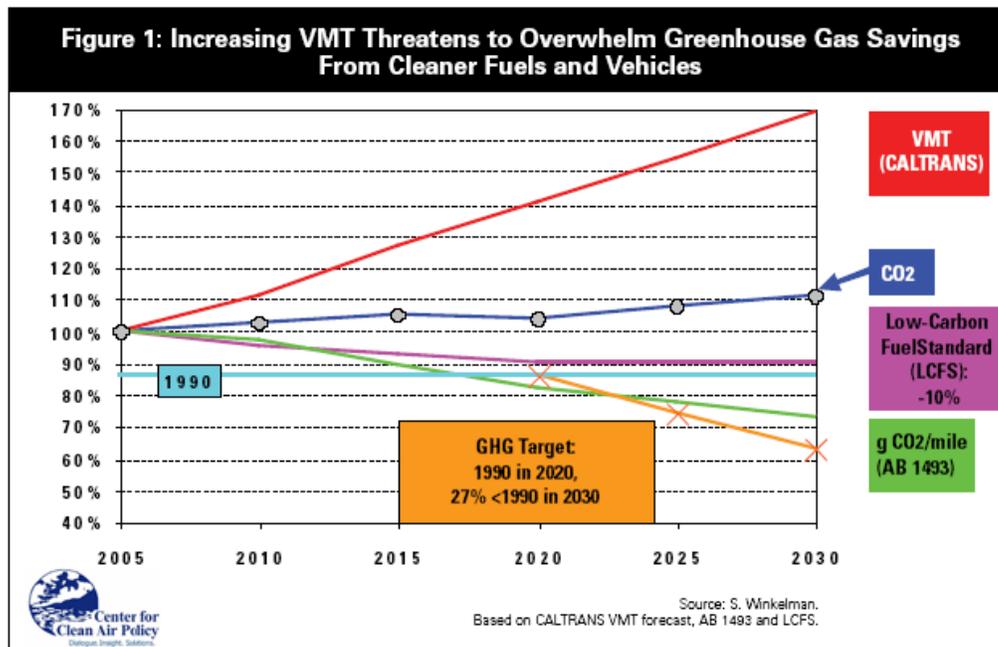
**Eq. 1**     $f = f\_Pavley \times f\_Fuel \times f\_Population \times f\_PerCapitaVMT$

Eq. 2 is derived from Eq. 1.

**Eq. 2**     $f\_PerCapitaVMT = f / (f\_Pavley \times f\_Fuel \times f\_Population)$

Figure 3 is from <http://www.nrdc.org/globalWarming/sb375/files/sb375.pdf>, a widely-respected report on SB 375. Note that all of its values are in the units of factors (same as fraction) of their values in year 2005. Figure 3 will supply all of the needed values, except for the factor of population. (Neither the red line nor the blue line are used.) Its gold line is the S-3-05 trajectory. (CARB ignored this line when it issued the MPO driving-reduction values for year 2035.)

**Figure 3** GHG Reductions from Pavley (AB 1493, in Green); the Low Carbon Fuel Standard (in Purple); the Predicted Driving (VMT, in Red); the Net Result of GHG (CO2, in Blue); and & the S-3-05 Trajectory (in Gold)



**Getting the Net Factor of the Emissions of Greenhouse Gas in 2035, with Respect to 2005 Values**

To get the net factor of the emissions of GHG, for year 2035, with respect to year 2005, it is necessary to extrapolate the Governor’s Executive Order target values (the gold line of Figure 1), out to year 2035. The gold line shows that this factor is 0.87 in 2020 and is 0.64 in 2030. Therefore, in year 2035, the factor will be

$$0.64 + [(.64 - .87) / (2030-2020)] * (2035-2030) = 0.525$$

However, as stated above, the value of .51 will be used, to correspond to your “.49 down” value.

**Getting the Factor of the Average Statewide Mileage in 2035, with Respect to the 2005 Value**

To get the Pavley reduction factor, for Year 2035, it is necessary to extrapolate the average statewide mileage factor data, which is Figure 1’s green line, out to Year 2035. It is 0.82 in 2020 and it is 0.73 in 2030. Therefore, in year 2035 the statewide mileage factor data will be

$$0.73 + [(.73 - .82) / (2030-2020)] * (2035-2030) = 0.685$$

Pavley 1 ends in Year 2017. It is widely assumed that it will be replaced by what is often called “Pavley 2”. The extrapolation computed here is based on the assumption made by the author of Figure 1, as shown in the slope of the green line from year 2020 to 2030. Based on the authoritative credentials of the authors of Figure 1, this is the best assumption that can be made. Assuming that the California fleet will continually get

more efficient, in terms of CO2 per mile driven, relies on an assumption that a significant fraction of our car owners will be able to purchase newer-model cars.

### **Getting the Factor of the Reduction of GHG Due to Fuels that Burn Less Carbon**

Looking at the purple line of Figure 1, it is clear that this factor will be 0.9 in 2035.

### **Getting the Factor of the Increase in Population**

The factor for population in San Diego County is computed using the populations estimated in CARB's <http://arb.ca.gov/cc/sb375/mpo.co2.reduction.calc.pdf>, namely 3,034,388 people in 2005 and 3,984,753 people in 2035. So the factor, from 2005 to 2035 is  $3,984,753/3,034,388 = 1.313$ . Note that this number will be different for the unincorporated area. If the unincorporated value is larger, the per-capita factor will be smaller and so the needed per-capita reduction in driving will be larger. If the unincorporated value is smaller, the per-capita factor will be larger and so the needed per-capita reduction in driving will be smaller. The net driving change compared to 2005 will be unchanged, regardless of what population growth is assumed.

### **Computing the Required Driving Reduction, for 2035**

The 4 values computed above are used in Eq. 2 to compute the required factor.

$$\text{Eq. 3 } f_{\text{PerCapitaVMT}} = .51 / ( .685 \times 0.9 \times 1.313 )$$

Therefore,  $f_{\text{PerCapitaVMT}} = .630$ . **This corresponds to a 37.0% reduction in per-capita driving, in year 2035, compared to year 2005.**

It is also important to compute the net driving factor and the net driving reduction. The net driving factor is the per-capita driving reduction factor (.630) multiplied by the population factor (1.313).

$$\text{Eq. 4 } f_{\text{netDriving}} = .630 \times 1.313 = .827.$$

**This means that even with more efficient cars, cleaner fuels, and a larger population; the net driving in San Diego County will have to be 17.3% less than in year 2005.**

Therefore, there is absolutely no reason to add highway capacity. The only rational course of action is to shift all the currently-allocated-highway-expansion money to transit expansion.

Please add these important calculations and conclusions to your GHG Emissions-Reduction Targets section.

## **3.0 Comments on the Draft CAP's Chapter 3 Land Use and Transportation Community Measures and Actions, for Year 2035**

Given the large role that the driving of cars and light-duty trucks plays in emitting GHG, the CAP must achieve the year 2035 driving reductions shown at the end of this letter's Section 2.0. This is a per-capita driving reduction of 37.0% and a net driving reduction of 17.3%. Both of these values are with respect to year 2005. Given the large change needed, LU1, T1, T2, and T3 will be insufficient. At least two more transportation "Measures and Actions" will be required.

### **3.1 Comments on LU 1**

This section should be improved. "Near existing and planned transit corridors" should say "Within walking distance of existing and funded transit stops on transit lines with service at or above levels shown to significantly reduce driving reductions and car ownership for those living

within walking distance of its stops.” The “25% of new development” shown in Table 3.2 should be at least 75%. As soon as possible, California needs to implement an equitable and environmentally-sound road use fee pricing system that will unbundle the costs of building roads, of maintaining roads, and of the external economic losses road use imposes on society in general, such as environmental and health costs. This will cause the market to support so-called “smart growth”, mixed-use development over urban sprawl. The County needs to seek legislation to help make this happen.

“Smart” should be defined as “VMT-reducing”. This will allow strategies that are proposed or required at such developments to be evaluated for value. Unbundling the cost of parking should also be developed and required, as described in Reference 3 (Reference 3 was presented by our Transportation Chair in Calgary, Canada, at the Sustainable Land Use and Transportation Session of the Air and Waste Management Association's 103rd Conference and Exposition, in the summer of 2010. It is therefore published and peer reviewed.) This will give consumers, residents and employees more control over their money. It will also reduce driving, as shown in Reference 3's Table 1.

Zoning within the qualifying areas should eliminate density and height limitations, as well as minimum parking requirements. Investors will respect the market limitations as there will be poor demand for developments that don't work for those that buy, rent or lease in such developments. Besides this, when projects are proposed, good modeling will determine functionality. Meeting the relaxed zoning does not have to mean automatic approval. The political process will litigate the tension between neighborhood concerns and the need to reduce driving. The off-street parking ordinance should require that the parking costs are unbundled, using either the method of parking operating as its own profit center or using the methods describe in Reference 3.

### **3.2 Comments on T 1, “Increase Transit Use”**

Many of the comments of Section 3.1 apply. Given that the CAP must achieve the year 2035 driving reductions shown at the end of this letter's Section 2.0; in particular, a net driving reduction of 17.3%, compared to year 2005; the TransNet tax money allocated to highway expansion needs to be reallocated to transit. Although this is a SANDAG Board decision, it should be pointed out by our County Board at every opportunity. However, it is still doubtful that great transit service can be expanded out to cover all of the unincorporated areas, and the unbundling proposals are important.

### **3.3 Comments on T 2, “Increase Walking and Biking”**

Most of this section is valuable. However, its reliance on the regional plans, including the Regional Bicycle Plan, should be reduced and the need to improve those plans should be stated. The primary problem with these plans stems from the reluctance of the SANDAG Board to require that expenditures be ranked on their estimated ability to decrease driving. The ranking should be based on driving reduction per dollar spent. This point has been made many times by our Transportation Chair and it has been ignored by the SANDAG's Board and Executive Director.

### **Education and Projects to Support Bicycle Transportation**

As stated, the criteria for spending money for bicycle transportation should be to maximize the resulting estimated reductions in driving. The following strategies will probably do this.

## Projects

Each of SANDAG's smart growth place types, both existing and planned, shown on SANDAG's well-documented Smart-Growth Concept Map, should be checked to see if bicycle access could be substantially improved with either a traffic calming project, a "complete streets" project, more shoulder width, or a project to overcome some natural or made-made obstacle. These projects should be prioritized using a cost/benefit ratio metric.

It is hereby assumed that 80% of the money available for the Regional Bicycle Plan (over a billion dollars) should be used to fund the projects. They should be selected for implementation, from top of the list (lowest cost/benefit ratio) down, until the money is used up. An example of one of these projects, for the proposed town center near the corner of I-5 and SR-78, is to devise a method to restore the shortest-distance route from Vista Way to Vista Way, which is currently broken by Interstate 5. This would connect a large South Oceanside coastal neighborhood with a regional shopping center, which includes a large grocery store, avoiding a circuitous and hilly current route.

Building recreational bike paths is generally not a cost-effective expenditure. It sends a message that bikes do not belong on the road.

## Education

The remaining 20% of the money should be used to do the following.

1.) Teach interested adults about bicycle accident statistics (most serious injuries occur to cyclists in accidents that do not involve a motor vehicle), car-bike accident statistics (most are caused by wrong-way riding and errors in intersections; clear cut hit-from-behind is rare), and how to ride in all conditions, to minimize problems.

2.) Teach riding-in-traffic skills and how to ride in other challenging conditions, by having the class members and instructor go out and ride in real conditions, until proficiency is achieved.

Students that pass a rigorous written test and demonstrate proficiency in traffic and other challenging conditions are paid for their time and effort.

These classes should be based on the curriculum developed by the League of American Bicyclists and taught by instructors certified by the League.

Assuming a class size of 3 riders per instructor and that each rider passes both tests and earns \$100 and that the instructor, with overhead, costs \$500 dollars, for a total of \$800 for each 3 students, means that \$200M (computed as 20% of \$1B) could educate  $\$200M/\$800 = 250,000$  classes of 3 students, for a total of 750,000 students, out to year 2050. This is about 20% of the population of San Diego County.

### **3.4 Comments on T3, "Increase Ridesharing"**

By taking the position that transportation demand management must only be programs that reduce driving, the CAP is helping to foster the widespread belief that driving levels are the result of free economic choice, and that this free choice must be made less likely by offering some new incentive to not drive or causing drivers to suffer some sort of punitive measure when they insist on driving. That approach to TDM is conventional but it is also misleading.

To engender objectivity, please generalize the concept and go beyond the conventional. More specifically, please state that TDM is the adoption of policies that affect the amount of driving. These 3 classifications of TDM are suggested in Reference 3:

- "Positive", which reduces driving, such as charging for parking at a higher rate than what is justified by its cost,
- "Zero", which is neutral in its effect on driving, such as charging for parking at the rate which is justified by its cost, and
- "Negative", which increases driving, such as charging for parking at a lower rate than what could be justified by its cost.

It should then be pointed out that so called "free parking" is a widespread form of a (significantly) negative TDM. The only way to make this TDM more negative would be to pay people for parking their car.

This treatment will increase objectivity towards the idea of "TDM". After all, who really wants their demand for anything to be "managed". However, many current policies manage demand for driving by encouraging driving. If we could just get all the "levers" adjusted to "Zero TDM", all of our congestion and driving-related climate destabilization problems would be greatly reduced. Besides this, there is a basic fairness issue. Having at least "Zero TDM" should be the law of the land. This is true, even without the challenge and mandate of climate stabilization. One of the best TDM measures would be to unbundle the cost of parking in all locations, as explained in Reference 3. After these systems are installed, it would be possible to adjust the charge above the zero TDM level. It is important to note that the earnings go back to those for whom the parking is built. This makes the positive TDM more popular since everyone likes getting monthly earnings.

### **3.5 Comments on T4, "Alternative Fuel Vehicles"**

This is a state program. The county should urge CARB to take actions to increase the GHG reductions it can achieve. It is also correct to work for enough charging stations. However, the estimate derived from Figure 3's green line is all that can be assumed at this time. If at some later time CARB believes that it can do better than Figure 3's green line, then at that time, perhaps the calculation shown in Section 2.2 can be updated. However, there is nothing wrong with achieving more GHG reductions than what is required by the S-3-05 trajectories. Most of the driving reductions will come from increased equity, in any case.

### **3.6 Comments on an Additional "Community Measure and Action"**

In Section 2.2 it was shown that the per-capita driving needs to be at least reduced by 37.0% by 2035. Reforming transportation to increase economic equity should not wait. For these reasons, LU-1, T-1, T-2, and T-3 are insufficient. This measure is needed as soon as it can be developed and instituted.

### **Unbundling the Cost of Car Parking**

For the vast majority of destinations in California, the cost of car parking is hidden within other costs. This has serious consequences. For example, at most places of employment, parking costs reduce the wages that can be paid to all the employees, even those that never use the parking. Similarly, at most apartment complexes, bundled parking costs increase the rent and this is true, even for families that do not own a car. Bundled parking costs routinely increase the costs of goods, such as groceries, for all customers. Again, this is even true for those that do not drive. Since governments require businesses to provide minimum levels of parking, they are involved in this economic discrimination towards those that drive less.

Driving less is, to some degree, a lifestyle choice. Since government has no valid reason to encourage driving, the lifestyle choice of less driving deserves constitutional, or at least legal,

protection from any practices that discriminate against it, economically. So far, the County has not taken an active role in educating its citizens on how parking policy effects economic fairness or how parking policies that are more fair could reduce driving.

On June 22<sup>nd</sup> 2010, our Transportation Chair presented a paper on how parking could be operated to unbundle parking costs in a way that supports the sharing of parking. This was at the 101<sup>st</sup> Conference and Exhibit of the Air and Waste Management Association, in Calgary, Canada. The session, *Sustainable Land Use and Transportation*, included the paper, *A Plan to Efficiently and Conveniently Unbundle Car Parking Costs*. The paper was extremely well received. It was published as a proceeding of the Conference. See Attachment 6.

The following points, taken from Attachment 6, apply.

- Vehicle miles traveled (VMT) are a major cause of global warming and pollution.
- California's Metropolitan Planning Organizations (MPOs) need to adopt strategies that reduce vehicle miles traveled (VMT), in order to at least meet the S-3-05 trajectory, for years 2020 and 2035.
- The appropriate pricing of parking is one of the least costly tools documented to reduce VMT.
- New technologies, such as sensors feeding computer-generated billing, offer the potential to efficiently bill drivers for parking and alert law enforcement of trespassers.
- Reformed parking policies can increase fairness, so that, for example, people who use transit or walk do not have to pay higher prices or suffer reduced wages, due to parking.
- Methods to unbundle parking cost are inefficient, unless they support the spontaneous sharing of parking spaces. Shared parking, with unbundled cost, would ultimately allow the county to require significantly less parking.
- Typical current systems of timed parking and metered parking are far from ideal. Such parking has no automated record keeping, so it is difficult to know where there is too much or too little parking.
- Good policies will eventually let cities and the county to turn parking minimums into parking maximums.

Less land and resources devoted to parking will support mixed use and make "smart growth" more economically viable. It should therefore be a key ingredient supporting the CAP's LU-1.

Here is a copy of the abstract of Attachment 6.

The *Introduction* shows documented driving reductions due to the pricing of parking. It notes that although the benefits of priced and shared parking are known, such parking has not been widely implemented, due to various concerns. It states that a solution, called "*Intelligent Parking*," will overcome some of these concerns, because it is easy to use and naturally transparent. It asserts that this description will support a "Request for Proposal" (RFP) process. Eight background information items are provided, including how priced parking would help California achieve greenhouse gas reduction targets. A story demonstrates some of the key features of *Intelligent Parking*. Arguments for less parking, shared parking, and priced parking are made. Barriers to progress are identified. The fair pricing of parking is described. New ways to characterize transportation demand management are presented. Seven goals of

*Intelligent Parking* are listed. Eleven definitions and concepts, that together define *Intelligent Parking*, are described. This includes a method to compute a baseline price of parking and how to adjust that price instantaneously to keep the vacancy above 15% (“Congestion Pricing”). An implementation strategy is described.

This abstract aroused enough interest among those responsible for A&WMA’s *Sustainable Land Use and Parking* session that they requested that a manuscript, which was ultimately selected to become part of the written Conference Proceedings and for presentation.

The County could also play a pivotal role by helping to find a demonstration project, probably at a school or an office. Attachment 7 sets forth specific solutions. Attachment 6 describes an implementation strategy in its Implementation Section, on Page 16. The County has the authority, in its off-street parking ordinances, to require cooperation with an agency implementing unbundling and this would be the correct action, after a sufficient number of successful demonstrations have been achieved. “Successful” would need to mean that nearly all stakeholders would be pleased with the program.

If fully implemented, this strategy, by itself, would probably decrease driving throughout California by between 15% and 25%. This is shown in Table 1 of Attachment 6.

Below is an email indicating that the basic features of enforcement, charging, distributing earnings, and sending out monthly statements would not be difficult.

**Email Showing that the Basic Required Technology Could Be Easily Developed**

----- Original Message -----

**From:** [David Carta](#)

**To:** ['Lisa Rodman'](#) ; ['Mark Tanner'](#) ; ['Kelli'](#) ; ['Nicole'](#) ; ['Mark S.'](#) ; ['John'](#)

**Cc:** ['Mike Bullock'](#)

**Sent:** Wednesday, January 13, 2010 5:40 PM

**Subject:** RE: RFID\_ParkingNewCalsbadHS

Dear Carlsbad School Board,

I wanted to send a quick note discussing the technical feasibility of tracking cars into a lot without impacting students or requiring the need for gates. Mike Bullock and I have discussed this project; it can be accomplished straightforwardly by utilizing Radio Frequency Identification and/or Video Cameras integrated with automated license recognition systems. The cars would need to register with the system at the start, but it would be fairly painless for the users after the initial installation. The back end database system can also be implemented both straightforwardly and at a reasonable price.

This is not necessarily a recommendation of the proposal for unbundled parking. Rather it is strictly an unbiased view of the technical feasibility of the proposal to easily and unobtrusively track cars, both registered and unregistered, into a fixed lot.

Best regards,

David R. Carta, PhD  
CEO Telaeris Inc.  
858-449-3454

### **3.7 Comments on an Additional State-Wide “Community Measure and Action”, Unbundling the Costs of Driving and a Summary of Results of All Additions**

This measure would require a state and/or federal government action. Therefore, like advocating for cleaner cars, the role of the County would be to understand the value and then advocate for this measure, at the state and federal level.

#### **Unbundling**

“Unbundling”, in the heading above, denotes that the money collected should be paid out to those that are losing money under the current system. This means, for example, that the money collected to account for increased health-care costs, caused by the air pollution the public must breathe, would go to reduce the cost of health care, not to build or even maintain roads.

#### **3.7.1 A Comprehensive Road-Use-Fee Pricing System**

**Abstract** This section contains a listing of road pricing principles. It provides an example of a road-use fee structure that supports the listed principles. Useful background information is provided. Arguments in favor of the presented example are presented.

**Initial Note** For many reasons, including the climate crisis, a comprehensive road-use fee pricing system is needed. It would be optimal for the state to implement the type of system described in this section. However, the state has a long history of irresponsibility in pricing road use. It is hoped that global warming will change this. Certainly, all the MPO’s in the state should be urging our state government to wake up and take action. If these efforts fail, the MPO’s will have to proceed as best they can to implement as much of these road-use pricing system components as possible.

#### **Road-Use Fee Principles**

1. The first principle is that of “full-cost pricing”. Driving has enjoyed a favored status in this state and in this country, resulting in sprawl, health-damaging pollution, global warming emissions, and congestion. We should advocate for the elimination of that favoritism in California, primarily by adopting this first principle.
2. Secondly, the current economic rewards for good mileage vehicles must not be eroded. Due to global warming, motorists need to “go electric” as soon as possible.
3. In addition, road-wear factors (primarily weight), the noise generated, and the pollution generated by each individual vehicle must be taken into account. This will increase fairness and support a shift to lighter, cleaner, and quieter vehicles.
4. The time and place of travel must be incorporated to reduce congestion.
5. Any road-use fee structure must do no economic harm to low-income drivers.
6. As road-use fee technologies evolve, privacy must be protected at each step.

#### **An Example of a Conforming Road-Use Fee Structure**

##### **Condition 1**

100% of the funding for all of the expenses of public roads, *excluding* those costs associated with future expansion (covered in Condition 3), comes from a road-use fee (that may include a fuel excise tax), that ultimately (as affordable technology can support) would contain the following **Features**:

**1. VMT Fee** A base, per-mile (VMT) component fee paid by all motorized vehicles for road construction and maintenance. It would vary by model so that the incentive to drive efficient vehicles is at least as large as for our current fuel excise tax. This means that a Prius would be much cheaper, per mile, than a Hummer.

**2. Carbon Fee** An additional per-mile carbon component part is computed using an effective fee per gallon that is equal or larger than the fuel tax that this per-mile carbon fee might replace, to correlate with the amount of CO<sub>2</sub> emitted. This could either be charged at the pump, as it is now done, or could be added to the VMT fee by using a price per mile computed by dividing the effective price per gallon by the charged vehicle's (year and model) average mileage, in the units of mile per gallon.

**3. Road Wear Fee** An additional per-mile component part that is proportional to the vehicle's (year and model) average weight, or other road-wear variable of the vehicle being charged.

**4. Air Pollution Fee** An additional per-mile component part proportional to the charged vehicle's (year and model) average pollution level, to be used to compensate people, schools, businesses, governments, and corporations harmed by pollution, with this rate set for full compensation.

**5. Noise Pollution Fee** An additional per-mile component part proportional to the average noise pollution level of the charged vehicle, to compensate people, schools, businesses, governments, and corporations harmed by noise pollution, with the rate set for full compensation.

**6. Congestion Fee** An additional per-mile component part or, alternatively a multiplier, to account for either time and place, or instantaneous traffic flow rate, to reduce or eliminate congestion, with the proceeds of this fee (collection minus collection cost) used for either the expansion or the operation of transit systems that would tend to reduce this congestion.

**7. Low Income Relief** A fractional multiplier that would reduce the total per-mile cost for drivers with a sufficiently low income and a sufficiently high need to drive, but only available for a period of calendar time sufficient for the driver to change their circumstance creating the need to drive, unless this is impossible. Section V's Section 7 has more detail.

**8. Privacy** Privacy protections so that where and when people drive, the vehicle they drive, and any Feature 7 advantage, is fully protected, unless a warrant is issued by a judge in response to substantiated allegations of a serious, felony crime.

## **Condition 2**

The per-mile charges of Condition 1 must be large enough to fund yearly payments to the municipalities having large, limited access roads (AKA "freeways") within their boundaries (thereby keeping land off of their property-tax rolls), with these yearly payments equal to the average yearly property tax per acre of the adjacent land, multiplied by the total acreage covered by the road's right of way, including frontage roads.

## **Condition 3**

No expansion of the system of public roads should be done unless market research and traffic modeling show that the net revenue of the proposed road or additional lanes will fund all the expenses identified in Conditions 1 and 2.

## **Condition 4**

No expansion of the system of public roads should be done unless it is shown that the expansion will not negatively impact the state's AB32 and S-3-05 goals and responsibilities.

### **Condition 5**

The sales tax on gasoline and diesel fuel should remain. Its revenue can be used as is the revenue from any other sales tax that is collected on consumer items.

### **Background Material**

This section provides information about the current level of the fuel tax, the difficulty of raising the fuel tax, the use of the fuel sales tax, lane performance during times of high demand, demand under the condition of "full cost pricing", political "push back" to full cost pricing, other opinions that a pure fuel tax is becoming obsolete, and finally, information indicating that a road-use fee could be raised by a simple majority in the state legislature.

#### **1. Current Level of Fuel Excise Tax**

A full accounting of the fuel excise tax and what it currently pays for is not our responsibility. A significant segment of the population probably believes that current fuel tax rates are high enough. However, a San Diego County newspaper, the North County Times (NCT), in a February 9, 2009 article, reported that the Chair of the California Transportation Commission (CTC) recently wrote that the fuel tax currently contributes nothing to road construction **and only provides half of the money needed annually for repairs:**

<http://www.nctimes.com/articles/2009/02/09/news/columnists/downey/z8591536f3e7332da882575510076fa1e.txt>

Increasing the state gas and diesel taxes, unchanged at 18-cents per gallon since 1994 – when the final one-cent increase mandated by Proposition 111 (June, 1990 that doubled the nine-cent excise fuel tax over a 5-year period) was added, is long overdue.

#### **2. The Difficulty of Raising the Fuel Tax**

To raise the fuel tax would require a 2/3<sup>rd</sup> majority vote of the legislature. In addition, according to a CNN report, <http://www.cnn.com/2009/POLITICS/02/20/driving.tax/>

"Officials including [Secretary of Transportation] LaHood have opposed raising the national gas tax, particularly in the current recession, and have said a new system is needed."

#### **3. Use of the Fuel Sales Tax**

California has a sales tax on all consumer items sold in the state, except food and medicine. The revenues from sales taxes are generally placed in our state's general fund. However, an exception to the general rule has been made for the sales tax on gasoline and diesel. By the conditions of a successful ballot measure, the sales tax on fuel must be used to support roads, which supplements the excise tax on fuel (also known as the "gas tax"), allowing the excise tax to be lower than necessary.

#### **4. Lane Performance During Times of High Demand**

From the DOT's Freeway Management and Operations Handbook:

[http://ops.fhwa.dot.gov/freewaymgmt/publications/frwy\\_mgmt\\_handbook/fmoh\\_complete\\_all.pdf](http://ops.fhwa.dot.gov/freewaymgmt/publications/frwy_mgmt_handbook/fmoh_complete_all.pdf), Page 1-18, comes the following:

As flow increases from zero, density also increases, since more vehicles are on the roadway. When this happens, speed declines because of the interaction of vehicles.

This decline is negligible at low and medium densities and flow rates. As the density further increases, these generalized curves suggest that speed decreases significantly just before capacity is achieved, with capacity being defined as the product of density and speed resulting in the maximum flow rate. This condition is shown as optimum speed  $S_o$  (often called critical speed), optimum density  $D_o$  (sometimes referred to as critical density), and maximum flow  $V_m$ . (7). In general, this maximum flow (i.e. capacity) occurs at a speed between 35 and 50 mph.

Efficient freeway operation depends on the balance between capacity and demand. In the simplest terms, highway congestion results when traffic demand approaches or exceeds the available capacity of the highway system. As vehicle demand approaches highway capacity, traffic flow begins to deteriorate. Flow is interrupted by spots of turbulence and shock waves, which disrupt efficiency. Then, traffic flow begins to break down rapidly, followed by further deterioration of operational efficiency.

Therefore, when demand is allowed to significantly exceed capacity, the flow rate drops well below optimum. In fact, speed can drop to nearly zero. With no intervention, freeway lanes can be counted on to fail, just when they are needed the most.

### **5. Demand, Under the Condition of “Full-Cost” Pricing**

The price-setting stipulations of “An Example of a Conforming Road-Use Fee Structure”, Features 1 through 6 of Condition 1, in conjunction with Condition 2, could be described as “full cost pricing”. It is not our responsibility to do an analysis to calculate what the average price per mile would need to be or to then determine how much driving would be reduced in reaction to this price. It could be that driving would decrease so much that congestion would disappear and the new problem would be to figure out what to do with the excess land buried under unneeded highway lanes and how to meet the large new demand for transit.

### **6. Political Pushback to the Notion of Full-Cost Pricing**

There are many, well-funded “think tanks” and political figures and institutions that argue against raising the cost of driving. So far they have been largely successful in keeping the taxes on driving low.

### **7. Other Opinions That a Pure Fuel Tax Is Becoming Obsolete**

There are many indications that more decision makers are adopting the view that the fuel tax either needs to be replaced or supplemented. We have undertaken no comprehensive search and evaluation to quantify this. However the following examples are presented, with the first three being taken from the same NCT article identified in Section-1 of this Section.

First the Chair of the CTC pointed out that, “People are driving more-fuel-efficient cars and ones that run on alternative fuels and buying less gas. As a result, they are paying less in gas taxes”. The author of the NCT article states that the CTC Chair and others are calling for “phasing out the gas tax,” in favor of a VMT fee.

Second, Will Kempton, director of the California Department of Transportation, told local officials in Valley Center recently “we need to make a transition to a new way of collecting transportation funds.” Kempton also said the state should consider following the lead of Oregon, which is exploring a tax based on the number of miles a person drives.

Third, Jim Earp, a California Transportation Commission member from Roseville, added, “Either that or we're going to have to jack up the gas tax considerably.”

Fourth, the Christian Science Monitor editorial, February 27, 2009, "A road map to better US roads," says, "Congress should heed a panel that suggests replacing a tax on gas with one on miles driven."

<http://www.csmonitor.com/2009/0227/p08s01-comv.html> It goes on to say, "In Europe, the Netherlands will transition to a VMT by 2014 and Denmark by 2016. Changing behavior is the key to 21st century transport that must unclog crowded highways and reduce dependence on fossil fuels. Taxing miles alerts drivers to the real cost of using roads and can better motivate them to drive less. A VMT (fee) is the more reliable and efficient way to pay for transport. Its time has come."

Finally, according to a CNN report, <http://www.cnn.com/2009/POLITICS/02/20/driving.tax/>, Speaking to The Associated Press, Transportation Secretary LaHood, an Illinois Republican, said, "We should look at the vehicular miles program where people are actually clocked on the number of miles that they traveled."

### **8. Raising a Road-Use Fee Could Be Done By a Simple Majority**

The Sacramento Bee printed an article by Dan Walters, on January 20<sup>th</sup>, 2009, describing a proposal to help close California's budget gap.

<http://www.nctimes.com/articles/2009/01/20/opinion/walters/zd5e9d64561b6efd78825753e006c951a.tx>.

The key elements from the article are as follows.

- 1.) Senate President Pro Tem Darrell Steinberg, the scheme's father, insists that it's legal, basing that assertion on a 5-year-old opinion from the Legislature's legal office.
- 2.) The plan would eliminate excise and sales taxes on gasoline and raise other taxes to help close the budget deficit, then "backfill" the gasoline taxes with a new "fee" that would actually increase the bite on motorists by 50 percent, from 26 cents a gallon to 39 cents. **A "fee" can be imposed by a simple majority vote as long as it relates to actual services rendered by government.**

Note that this fee approach is relatively far from meeting all of the stipulations of this letter. However, it would represent significant progress.

### **Arguments in Favor of Road Use Fees**

This Section provides an analogy demonstrating why roads should be operated for the equal benefit of all. It presents some of the consequences of the current level of our state fuel tax. It argues that a road-use fee should include a vehicle miles traveled (VMT) component and that furthermore, a component should relate to congestion pricing (i.e. needs to account for *specific* time and place of travel). A road-use fee should account for environmental impacts, should protect low-income families, and contain privacy protections. It explains why revenue from a road use fee should be used to pay an effective property tax to municipalities. It argues that this resolution offers methods that would help to alleviate the state's budget problems. It states that it is easier to discuss setting a road use fee than it is to discuss increasing an excise tax on fuel. Finally, it briefly discusses some of the emerging technologies and the relationship between technology and this resolution.

#### **1. Full-Cost Pricing**

Roads should be priced so that they are no longer an economic burden on those that choose to drive less than average. Yet, it is hard to be objective about roads. Here's an analogy.

Assume that California owned a large number of 2-bedroom apartments that it allowed families to live in if they paid a tax of \$500 a month, even though the market rental value of the apartments was \$1000 a month. Clearly, the people living in the apartments are the winners and all the other citizens of California are the losers, because if the state set the price to the market value, it would have additional money that it could either use for the benefit of all citizens or it could return the money to everyone as a tax rebate. Some might note that since there are a large number of these apartments, almost everyone that wants one could get one, so those that don't live in these 2-bedroom apartments are losing out because of their own poor choice. However, since not every citizen wants to live in these apartments, the State's practice is indefensible. The correct thing for the state to do would be to allow low-income citizens to remain in the rental units at the subsidized price of \$500 a month, stop calling the price-per-month a "tax" and instead call the price-per-month a "user fee", and set the price for the families that are not low income to the market value of \$1000 per month. In this case, the low-income families remain winners. Even though all the others are losers, they are losing much less than before. This assumes that the state takes the additional earnings and uses it in a way that benefits all citizens. Buying more 2-bedroom apartments would not qualify. This analogy's original operation is similar to what California does by underpricing road use fees, as described below.

## **2. Consequences of the Current Level of Fuel Tax**

### **a. Economic Inequity**

Because our state fuel tax is too low, funds derived from taxes (and fees) that are not related to the choice of driving a car must be used to support our system of public roads. Examples are our sales tax, our income tax, our property tax, and the development fees that increase many of our costs. In effect what is happening is that money is systematically *being taken* from those that drive less and *being given* to support those that drive more.

This violates a fundamental principle of our free market system. People should pay for what they use and, conversely, people should not be forced to pay for what they do not use. It is true that we often willingly violate this principle, for some higher purpose. Education, mass transit, and Section 8 housing are good examples. However, there is no valid reason to increase driving by making it artificially cheap to drive, or for that matter, to park a car. The facts about global warming suggest quite the opposite.

### **b. Global Warming Threat and the California Example of Road-Use Pricing**

From <http://www.sandiego.edu/EPIC/ghginventory/GHG-On-Road1.pdf.pdf>, we learn that in San Diego County, emissions from on-road vehicles are about 46% of regional GHG emissions. Many world leaders know that many of our citizens have taken all of the time and cost variables into account and then built their life around their automobiles. How can we expect the world to do its part to reduce GHG emissions, if they see us unwilling to reform the way we price the use of roads, so as to conform to the basic free-market principles that we claim to hold dear?

### **c. Other Pollution**

Besides GHG emissions it is well known that on-road transportation contributes significantly (around 50% by some accounts) to our air and noise pollution. Cars cause air and water pollution directly and indirectly. This occurs when they are manufactured, when their fuel is transported and refined (refineries are, by far, the biggest cause of ground-water contamination in California), and when they are driven.

#### **d. Urban Sprawl**

The dominance of the automobile is the primary reason for our sprawling, urban land-use patterns. For example, it is well known that a simple 4-lane freeway, with frontage roads, can consume 26 acres per mile. An acre of land can only park 117 cars. Sprawl has taken valuable farm land, wet lands, and wild-life habitat. It makes it more difficult to walk or to bicycle. It also makes it more difficult to provide or to use transit.

#### **e. Summary Statement**

GHG emissions, urban sprawl and air, water, and noise pollution are made worse by making driving seem artificially inexpensive to the public. Note that for every penny earned by raising the price per mile to drive to its correct value, a penny could be cut from other taxes and fees that are unrelated to driving. Secretary of Transportation Ray LaHood's statement ("we can't raise the gas tax in a recession") shows that he misses this important point. This point has been made by the Sierra Club, as shown in <http://www.sierraclub.org/policy/conservation/trans.aspx>, where it says, of subsidies to driving, "These subsidies should be publicly scrutinized and eliminated by appropriate fuel and carbon taxes, parking and road user charges, . . ."

### **3. The Use of the Gasoline Sales Tax**

As stated in Section III. 3, currently the *sales* tax on fuel must be used for the same purposes as the *excise* tax on fuel. This is contrary to the normal rule for sales taxes, whereby sales taxes are used for general-fund purposes, unrelated to the item sold. For example, the sales taxes from running shoes are not removed from the general fund to be used to build running facilities. Likewise, the sales tax on alcoholic beverages is not separated out to be used to subsidize the building of more drinking establishments. If we are going to end our unfortunate favoritism towards roads, we need to end the practice of using the sales tax from gasoline as if it were an additional fuel excise tax. This practice would be ended if the implied recommendations of this report were enacted. The sales tax on gasoline should continue, but the tax on the sale of gasoline should go to the general fund, as does the tax on the sale of other consumer items.

### **4. Reasons to Adopt a VMT Based, Road-Use Fee**

From a Global Warming perspective, there is a hierarchy of favored transportation modes.

Mode 0: Telecommuting (no need to leave the house)

Mode 1: Walking

Mode 2: Cycling (skate boarding and any other device-aided, non-motorized transportation mode)

Mode 3: Transit

Mode 4: Electric cars or cars that get great mileage

Mode 5: Other cars

In terms of reducing pressure to expand road capacity, Modes 0, 1 and 2 are many times more desirable than even Mode 4, which is many times better than Mode 5. The point here is that as much as we want to see more electric cars and more cars that get exceptional mileage, we should not lose sight of the fact that unless all road users pay their fair share, those people using Modes 0, 1 and 2 are not being fully rewarded for not using road capacity, and this is

poor environmental policy, based on the desirability factors suggested. All cars are large, manufactured devices with a finite life. They promote sprawl. People that routinely use Modes 0, 1 and 2 have often set up their lives so that they could drive less. Those life-style choices need to be fully rewarded. The statements of Sections 2a and 2d of this Section apply.

## **5. Reasons to Adopt Road-Use Pricing Methods Tied to *Specific* VMT**

### **a. Need to Support Section II's Feature 6**

The current fuel tax is simple and, in theory it could be raised to cover the costs of driving, for those vehicles that use fuel. Alternatively, it is easy to imagine odometers that transmit their values at scheduled times to a billing computer. With vehicle-recognition schemes, implemented at the pump or within the billing computer containing odometer data, it would be possible to expand these simple methods to support Features 1 through 5, Feature 7, and Feature 8. However, these simple methods would not support congestion pricing, Feature 6, which is sufficiently important that it must be identified and supported.

### **b. Value Feature 6: Congestion Pricing**

Various names have been proposed for Feature 6, including "congestion pricing" or "convenience pricing". Regardless of the name, it is a powerful way to reduce our society's propensity for expanding highways. Proponents of freeway expansion frequently mention the fact that highway "gridlock" harms our public safety because it can significantly delay emergency vehicles. Individuals in society see this in personal terms. We can all imagine a need to get home to attend to a child, or to get to an emergency room. The consequences of congestion can go well beyond being just a frustrating inconvenience. Sometimes people feel that they would pay almost anything to be able to drive at higher speeds. How many people have missed a plane, or a train, or a critical business meeting, "stuck in traffic"? Besides this, lanes also often support transit. Transit success requires dependable and reasonably fast bus travel. In addition, stop and go traffic wastes fuel, increases GHG, and increases unhealthy emissions.

"Convenience Lanes" could provide an option for drivers when they feel it is worth the extra money to drive beyond congestion speeds. This pricing also provides a means to keep one or more lanes operating close to their theoretical capacity, instead of at the greatly reduced flow rate that comes when demand is large. The pricing can adjust automatically so as to keep demand below capacity, on one or more lanes. This means that congestion in parallel lanes will clear sooner than if all lanes were allowed to stay severely congested.

"Convenience Lanes" also offer the hope of significant revenue generation, if enough people are willing to, in effect, bid up the price. (This will probably happen if the price of driving is kept low enough in regular lanes that there are still times and places where congestion is significant.) Feature 6 would require that proceeds (collection minus collection costs) be used for transit systems that would tend to reduce the congestion. The lanes and roads that are parallel to the "convenience priced" lanes can be counted on to fail to carry their capacity when serious congestion strikes. Fortunately, there is no comparable effect for transit. Although it is conceivable that transit demand could exceed transit carrying capacity, when this happens, the transit can be counted on to continue to carry its full capacity.

### **c. Feature 6 and Road Price Variability**

Some roads are relatively expensive to build; others are relatively inexpensive. There is no reason we have to settle for charging the same per-mile price for all roads. Similarly, driving at different times should be priced differently. It is well understood that freeways are sized and

expanded to facilitate peak driving times. Since it is more costly to provide the added capacity needed at peak times, it is reasonable to charge peak-time drivers more. Charging more at the times that demand is high will tend to smooth out traffic demand over various times of the day.

#### **d. Feature 6 and Pollution**

Feature 6 can reduce congestion. This is important because stop-and-go traffic emits more pollution and GHG emissions than lanes operating at “optimum speed” as identified above.

#### **e. Feature 6 Supported by the CTC**

These powerful arguments have evidently been recognized by the CTC. In their *Addendum to the 2007 Regional Transportation Plan Guidelines, Addressing Climate Change and Greenhouse Gas Emissions During the RTP Process*, adopted on May 29, 2008, they provide strong support to lane pricing.

[http://www.catc.ca.gov/programs/rtp/Adopted\\_Addendum\\_2007\\_RTP\\_Guidelines.pdf](http://www.catc.ca.gov/programs/rtp/Adopted_Addendum_2007_RTP_Guidelines.pdf),

In the CTC’s Pricing Strategies Section (Page 3), the CTC instructs Metropolitan Planning Organizations to “model adding pricing **to existing lanes**, not just as a means for additional expansion. **Variable/congestion pricing should be considered.**”

Variable/congestion pricing cannot be done without Section II’s Feature 6 of its Condition 1.

#### **f. Arguments to Support Road-Pricing Guideline**

There is widespread confusion regarding who owns existing lanes and what promises were made. Converting existing, “free” lanes to be lanes that are priced can be justified by explaining that fuel taxes have always been road-use fees and that any stated or implied promise that paying fuel tax entitled drivers, for all time forward, to drive free on the roads that the fuel taxes may have been used to fund was specious. Specifically, the claim that drivers “already paid” for roads through the payment of fuel taxes is incorrect because (i) many drivers have just started driving; (ii) many drivers that paid fuel tax for many years have died; and (iii) paying a fee to use a public road is no different than paying rent to use property and paying rent does not lead to quasi ownership. These same arguments can be used against statements supporting the idea that drivers can forever drive free over a bridge because the tolls have paid off the loan for the bridge.

### **6. Reasons for Features 2 – 5**

These features charge vehicles for their environmental impacts.

### **7. Reasons for Feature 7**

The ability of low-income families to be able to drive to work and other essential family errands must be protected. However, given our challenge of global warming, this needs to be “constructive charity”. The features shown in Section II suggest that a billing computer will probably be involved. If so, that computer’s database can, perhaps at the individual’s discretion, be supported with information such as current housing details, current salary, job location, occupation and job skills to include a full resume, childcare, location of family and friends, hobbies, or recreational pursuits, and other items that could be related to the individual’s current need to drive. When the software determines that the person qualifies for a reduced multiplier of the full cost of driving (a subsidy), it could then also run various programs to offer, in creative, tailored, form letters, suggestions for changing circumstances to reduce driving. This could involve a search for jobs, a search for suitable housing, a search for daycare, and a search for better locations to pursue hobbies or recreational pursuits. The

availability of transit would be considered in the software and would be offered. Job training could be suggested or offered at a discount. If circumstances support it, the person could also be asked if they would be interested in a class on riding a bicycle in traffic. Taking such a class could earn the person a financial award, perhaps to include a new or used bicycle. The software would put a high priority on helping the person achieve a lifestyle that requires less driving. As a last resort the software would take into account the congestion level of various routes and offer a driving route that requires a reduced subsidy. If no billing computer is involved, the person receiving the subsidy might be required to send in data to support the running of these programs to reduce driving and the subsidy to driving.

## **8. Reasons for Feature 8**

Privacy must be protected, unless confidential disclosure to law enforcement agencies is ordered by a judge based on reasonable cause. We currently rely on laws and judges to protect our privacy regarding what we say on the telephone, our emails, our internet activities, and the information we provide on our tax forms. This information could be both politically revealing and highly embarrassing, to the point where it could seriously degrade our personal and professional lives. In terms of protecting our democracy, it is especially important that our political activities be protected. Where we drive and park a car is also somewhat sensitive in this regard. However, in most cases it is less sensitive than our emails and what we say on the phone. Cell phone companies already have information about our travel. Many locations, such as Dallas, have "toll-tags" that record every time someone goes through a toll plaza and charges them accordingly. The conclusion is that the argument that many people will never accept a computer, with built in privacy protections, from having information about where we drive is overblown and not supported by the facts.

## **9. Reasons for Condition 2**

Railroads pay property tax on the land under their tracks. Utility companies pay property taxes on the land under their transmission lines. There is no reason that large highways should not pay a property tax for the land they take off the tax rolls in each community. The favored status of roads should be eliminated.

## **10. California's Budget Problem**

California currently has a large budget gap. Children may lose their health care and education cuts will probably be severe. State parks may close. Most state funding for transit may be cut. This strategy might help to reduce some of these cuts.

## **11. Raising the Fuel Tax vs. Pricing a Road-Use Fee**

There are advantages in reframing the question from should we raise the fuel tax to: Should we replace the fuel tax with a road-use fee and, if so, how should we set the price of the road-use fee? Section III. 2 showed that a 2/3rds vote is needed in the state legislature to raise a tax; while, as shown in Section III. 8, only a simple majority is needed to set and then raise a user fee. Besides this, there are a lot of common misunderstandings about our fuel taxes. Many think they are a mechanism whereby drivers somehow buy new roads. This confusion was discussed in detail in this Section's Subsection 5f. If we can move the discussion to one of how to properly set the price of road use, we will have already made large gains in framing the question to the advantage of environmentalists and everyone that recognizes that it is time to stop favoring driving.

## **12. Technology**

It is not our responsibility to pick the technologies that will ultimately be used in the implementation of the road-use pricing described. Email and phone conversations with employees of “Skymeter”, <http://www.grushhour.blogspot.com/>, indicate that they were ready to respond to a Request For Proposal (RFP) to implement VMT pricing in the Netherlands, to include every road in the country. Their proposal would have been that each car will have a GPS unit, about as large as an eye-glasses case, sitting on the dash. It will contain a database of roads and a variable set of pricing coefficients. The GPS software will determine the car’s location with sufficient accuracy so as to support software computing a running tabulation of charges, as the car is driven. They state that the final challenge was to design the software so that the unit would function when the car was being driven in the presence of GPS reflections, such as in city “canyons” which is to say around multiple large buildings. They have solved this problem with additional algorithms and have demonstrated this in the most severe conditions they could find. However, they don’t want to have to distinguish between lanes, suggesting that congestion pricing on large multi-lane roads, where pricing varies between parallel lanes, may require a Radio Frequency Identification (RFID) overlay pricing scheme, such as is currently used for “toll tags.”

There are probably several, perhaps even many, ways to accomplish road-use pricing that has the features described in this Section.

### **3.7.2 Conclusions**

The best strategies to reduce VMT are shown here, with the estimated driving reductions for each one shown in square brackets:

- Comprehensive (equitable and environmentally sound) road use fee pricing system, as could be installed by *Skymeter*; [15%]
- Unbundling the cost of car parking; [15%] (This estimate is based on Table 1 of Reference 3.)
- Good bicycle projects and bicycle education; [5%,] (This estimate should be checked by the League of American Bicyclists.)
- Stopping all freeway expansions and reconfiguring TRANSNET to be 67% for transit and 33% for road maintenance [10%]

These strategies could be implemented by 2020, not 2035, and would decrease per capita driving by a sum of at least 45% (15+15+5+10). The strategies to do this are primarily those that increase fairness for all, especially families that drive less than average.

# The Development of California Light-Duty Vehicle (LDV) Requirements to Support Climate Stabilization: Fleet-Emission Rates & Per-Capita Driving

Paper #30793

**Mike R. Bullock**

Retired Satellite Engineer (36 years), 1800 Bayberry Drive, Oceanside, CA 92054

## ABSTRACT

An Introduction to the topic is provided, including the importance of cars and light duty trucks (Light Duty Vehicles, LDVs), and an identification of the top-level LDV requirements.

The fundamentals of our climate crisis are presented, including its cause, its potential for harm, and existing mandates: *California's Executive Order S-3-05*, *California's Global Warming Solutions Act of 2006* (AB 32), and *California's Sustainable Communities and Climate Protection Act* (SB 375). An earlier calculation of a driving reduction target is described.

Reference year 2005 is identified. The latest climate-stabilizing greenhouse-gas (GHG) reduction target value, for 2030, is calculated, using unambiguous statements by recognized climate experts and California's expected 2020 emissions. The formula for GHG emissions, as a function of per-capita driving, population, fleet CO<sub>2</sub> emissions per mile, and low-carbon fuel standards is given. From that expression, a mathematical relationship between defined factors associated with these variables is derived. These factors are the ratio of the value at the specified later year to the reference year. The factor of car-emission-per-mile driven, for year 2015, with respect to year 2005, is obtained.

Internal Combustion Engine (ICE) mileage values from 2000 to 2030 are identified, as either mandates or assumptions. A table is presented that estimates LDV fleet mileage, for year 2015.

Zero Emission Vehicle (ZEV) values to support a calculation of equivalent-fleet mileage with a significant fraction of ZEVs (ZEV LDVs) are given. A table is shown that uses assumptions about ZEVs, ICEs (ICE LDVs), and the fraction of electricity that comes from renewables, to compute the LDV fleet equivalent mileage, for year 2030. This set of assumptions is dubbed the "Heroic-Measures" (HM) case. It includes having the fraction of ZEVs quickly climb up to significant values, while the ICEs, for the years before significant fractions of ZEVs appear, are, to a significant degree, taken off the road or otherwise caused to be driven less, due to assumed strong governmental policies. The equivalent fleet mileage computed by this table is used, with population and the needed factor of emission reductions, to compute a needed per-capita driving reduction, for 2030, with respect to 2005. Policies to achieve this per-capita reduction are described, with reductions allocated to each policy.

The fleet-equivalent mileage for 2030 that would support a 2005 per-capita driving level is computed. A table is constructed to achieve that equivalent mileage. The assumptions in that table are said to define an "extra-heroic-measures" (EHM) case. They would probably be very difficult to achieve. The electricity required to power the HM case is estimated and compared to current usage.

## **INTRODUCTION**

Humanity's top-level requirement is to reduce greenhouse gas (GHG) emissions enough to support stabilizing our climate at a livable level. This top-level requirement must flow down to LDVs, due to the significance of their emissions. As an example, LDVs emit 41% of the GHG in San Diego County<sup>1</sup>.

From a systems engineering perspective, the needed requirements are an upper bound on greenhouse gas (GHG) emissions per mile driven (applicable to the entire fleet of LDVs on the road in the year of interest) and an upper bound on per-capita driving, given population growth. This paper will do a calculation of required driving levels, based on calculations of how clean our cars and fuels could be, predicted population growth, and the latest, science-based, climate-stabilizing target. All three categories of LDV emission-reduction strategies will be considered: cleaner cars, cleaner fuels, and less driving.

## **BACKGROUND: OUR CLIMATE PREDICAMENT**

### **Basic Cause**

Our climate crisis exists primarily because of these two facts<sup>2</sup>: First, our combustion of fossil fuels adds "great quantities" of CO<sub>2</sub> into our atmosphere. Second, atmospheric CO<sub>2</sub> traps heat.

### **California's First Two Climate Mandates**

California's Governor's Executive Order S-3-05<sup>3</sup> is similar to the Kyoto Agreement and is based on the greenhouse gas (GHG) reductions recommended by climate scientists for industrialized nations, back in 2005. In 2005, climate scientists believed that the reduction-targets of S-3-05 would be sufficient to support stabilizing Earth's climate at a livable level, with a reasonably high level of certainty. More specifically, this executive order aims for an average, over-the-year, atmospheric temperature rise of "only" 2 degree Celsius, above the preindustrial temperature. It attempts to do this by limiting atmospheric CO<sub>2\_e</sub> to 450 PPM by 2050 and then reducing emissions further, so that atmospheric levels would come down to more tolerable levels in subsequent years. The S-3-05 emission targets are as follows: 2000 emission levels by 2010, 1990 levels by 2020, and 80% below 1990 levels by 2050.

It was thought that if the world achieved S-3-05, there might be a 50% chance that the maximum temperature rise will be less than 2 degrees Celsius, thus leaving a 50% chance that it would be larger than 2 degrees Celsius. A 2 degree increase would put over a billion people on the planet into a position described as "water stress" and it would mean a loss of 97% of our coral reefs.

There would also be a 30% chance that the temperature increase would be greater than 3 degrees Celsius. A temperature change of 3 degree Celsius is described in Reference 3 as being "exponentially worse" than a 2 degree Celsius increase.

The second California climate mandate is AB 32, the so-called *Global Warming Solutions Act of 2006*. It includes provisions for a cap and trade program, to ensure meeting S-3-05's 2020 target

of the 1990 level of emissions. It continues after 2020. Over all years, AB 32 requires CARB to implement measures that achieve the maximum *technologically feasible and cost-effective* (words taken from AB 32) greenhouse-gas-emission reductions.

California is on track to achieve its second (2020) target. However, the world emission levels have, for most years, been increasing, contrary to the S-3-05 trajectory. Because the world has effectively failed to achieve S-3-05, California, if it still is interested in leading the way to human survival, must do far better than S-3-05, going forward, as will be shown.

## **Failing to Achieve these Climate Mandates**

What if we fail to achieve S-3-05 and AB 32 or we achieve them but they turn out to be too little too late and other states and countries follow our example?

It has been written<sup>R4</sup> that, “A recent string of reports from impeccable mainstream institutions—the International Energy Agency, the World Bank, the accounting firm of PricewaterhouseCoopers—have warned that the Earth is on a trajectory to warm by at least 4 Degrees Celsius and that this would be incompatible with continued human survival.”

It has also been written<sup>R5</sup> that, “Lags in the replacement of fossil-fuel use by clean energy use have put the world on a pace for 6 degree Celsius by the end of this century. Such a large temperature rise occurred 250 million years ago and extinguished 90 percent of the life on Earth. The current rise is of the same magnitude but is occurring faster.”

## **Pictures That Are Worth a Thousand Words**

Figure 1 shows (1) atmospheric CO<sub>2</sub> (in blue) and (2) averaged-over-a-year-then-averaged-over-the-surface-of-the-earth world atmospheric temperature (in red). This temperature is with respect to a recent preindustrial value. The data starts 800,000 years ago. It shows that the current value of atmospheric CO<sub>2</sub>, which is now over 400 PPM, far exceeds the values of the last 800,000 years. It also shows that we should expect the corresponding temperature to eventually be about 12 or 13 degrees above preindustrial temperatures. This would bring about a human disaster<sup>3,4,5</sup>.

Figure 2 shows the average yearly temperature with respect to the 1960-to-1990 baseline temperature (in blue). It also shows atmospheric levels of CO<sub>2</sub> (in red). The S-3-05 goal of 450 PPM is literally “off the chart”, in Figure 2. Figure 2 shows that, as expected, temperatures are starting to rise along with the increasing levels of CO<sub>2</sub>. The large variations in temperature are primarily due to the random nature of the amount of solar energy being received by the earth.

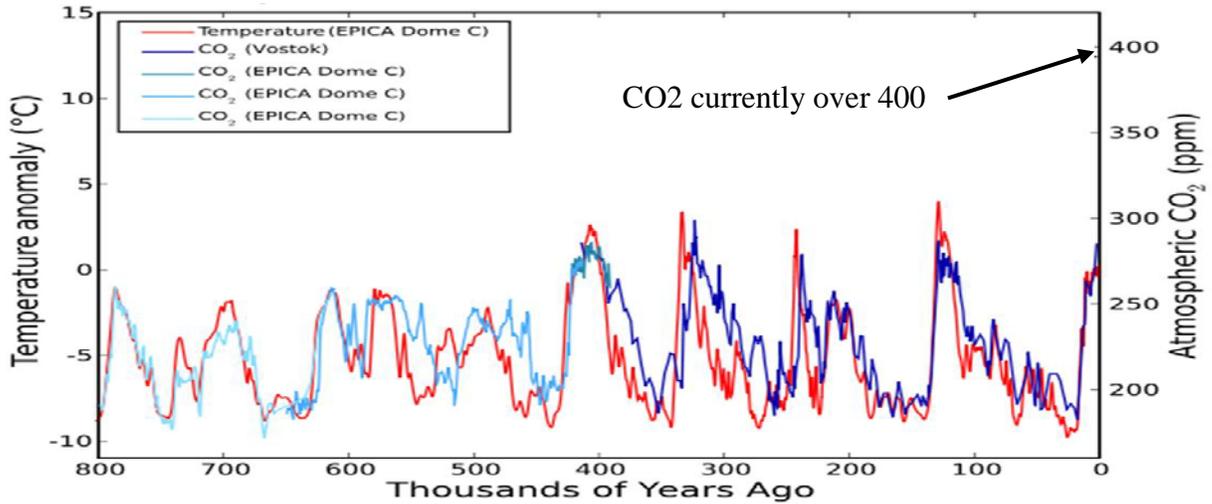
## **FURTHER BACKGROUND: CALIFORNIA’S SB 375 AND A PREVIOUS CALCULATION OF HOW MUCH WE CAN DRIVE**

As shown in the Introduction, LDVs emit significant amounts of CO<sub>2</sub>. The question arises: will driving need to be reduced or can cleaner cars and cleaner fuels arrive in time to avoid such behavioral change? Steve Winkelman, of the Center for Clean Air Policy (CCAP), has worked on this problem. Using CCAP data, an S-3-05-supporting driving reduction, for San Diego County, will be estimated.

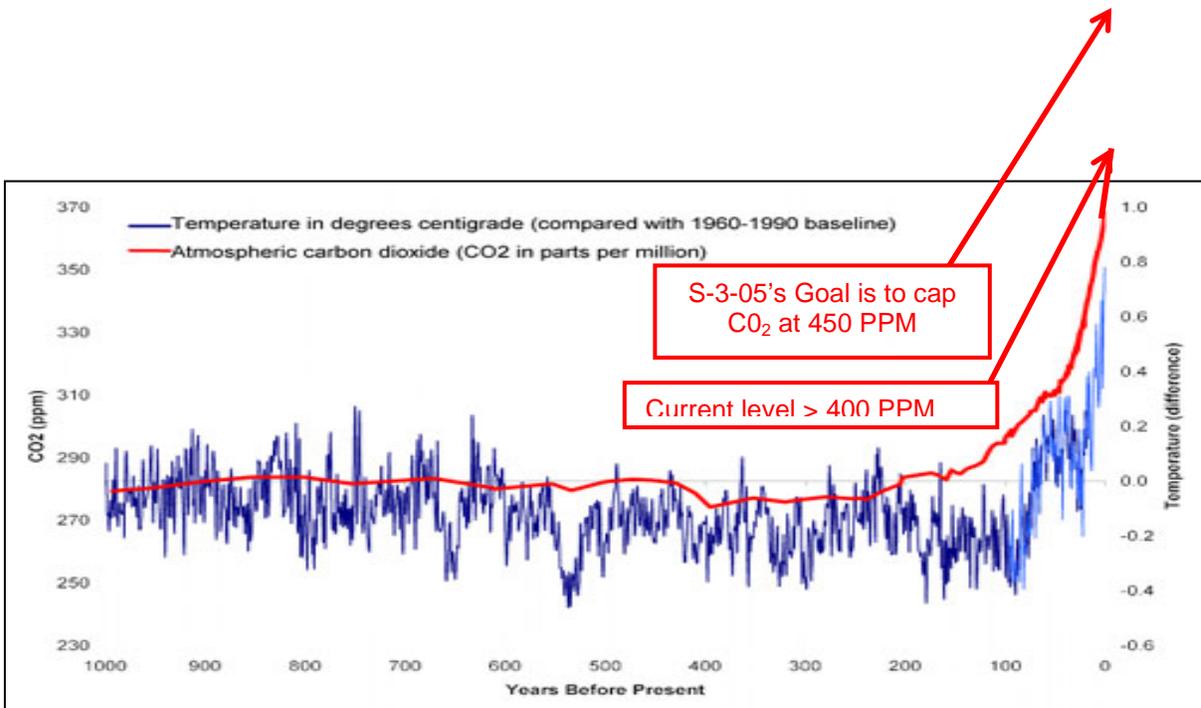
## SB 375, the Sustainable Communities and Climate Protection Act of 2008

Under SB 375, the California Air Resources Board (CARB) has given each Metropolitan Planning Organization (MPO) in California driving-reduction targets, for the years 2020 and

**Figure 1. Atmospheric CO<sub>2</sub> and Mean Temperature from 800,000 Years Ago**



**Figure 2. Atmospheric CO<sub>2</sub> and Mean Temperature, Over the Last 1,000 Years**



2035. "Driving" means yearly, per capita, vehicle miles travelled (VMT), by LDVs, with respect to 2005. The CARB-provided values are shown at this Wikipedia link, [http://en.wikipedia.org/wiki/SB\\_375](http://en.wikipedia.org/wiki/SB_375).

Under SB 375, every Regional Transportation Plan (RTP) must include a section called a Sustainable Communities Strategy (SCS). The SCS must include driving reduction predictions corresponding to the CARB targets. Each SCS must include only *feasible* transportation, land use, and transportation-related policy data. If the SCS driving-reduction predictions fail to meet the CARB-provided targets, the MPO must prepare an Alternative Planning Strategy (APS), which must also appear in the MPO’s RTP. An APS uses *infeasible* transportation, land use, and transportation-related policy assumptions. The total reductions, resulting from both the SCS and the APS, must at least meet the CARB-provided targets.

## Factors Used to Compute the Required Driving Reduction

The definitions in Tables 1 and the two conventions in Table 2 will be used to compute the needed driving reductions, with respect to year 2005, from known and estimated variables and the S-3-05 GHG reductions that were thought to support climate stabilization, back in 2005. By SB 375 convention, Year “*i*”, the reference year, is 2005.

The fractional reduction in per-capita personal driving, with respect to 2005 driving, needed to achieve any desired level of GHG emission, can be computed using predicted population growth and two of the variables shown in Figure 3<sup>6</sup>. The two needed values are the factor with respect to year 2005 of CO<sub>2</sub> emitted per mile driven (the green line, sometimes referred to as “Pavley”, since AB 1493 was authored by Senator Fran Pavley) and the factor with respect to year 2005 of the advantage from achieving the low carbon fuel standards (LCFS, the purple line).

The variables plotted in Figure 3 are the factors which can be used to multiply the 2005 values to get the values for the years shown. For example, in 2030, the CO<sub>2</sub> emitted from the cars and light-duty trucks in California (the dark blue line), can be computed to be 1.12 times as large as it was in 2005. It can also be said that the value will be 12% larger than it was in 2005. Likewise, the green line, which is the average CO<sub>2</sub> emitted per mile driven, for California’s fleet of LDVs, is predicted, in 2030, to be .73 times the 2005 value. This means the value is predicted to be reduced 27%, below its 2005 value. Figure 3 also shows that the 1990 value of emissions (on the light blue line) was about 13% less than it was in 2005.

The S-3-05 trajectory is shown as the gold (or dark yellow) line. It is the factors that can be used to convert 2005 values of emissions to values for the years shown. For example in 2030, emissions will need to be 37% lower than they were in 2005, to meet the S-3-05 mandate.

The SB 375 convention is for CARB to require and for the Metropolitan Planning Organizations (MPOs) to estimate and report their predicted per-capita driving reductions. To compute the per-capita driving reduction, the equation for computing the emissions is used. That equation is the product of the following four factors:

- the Low Carbon Fuel Standard, “*L*” (which reduces the CO<sub>2</sub> emitted from each gallon of fuel burned),
- the fleet-average CO<sub>2</sub> per mile driven (using the CO<sub>2</sub> per gallon burned without accounting for “*L*”),

## Table 1. Variable Definitions

| <b>Variable Definitions</b> |                                                                                                                                       |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| $e_k$                       | LDV Emitted CO2, in Year “ $k$ ”                                                                                                      |
| $L_k$                       | Low Carbon Fuel Standard (LCFS) Factor that reduces the Per-Gallon CO2 emissions, in Year “ $k$ ”                                     |
| $C_k$                       | LDV CO2 emitted per mile driven, average, in Year “ $k$ ”, not accounting for the Low Carbon Fuel Standard (LCFS) Factor              |
| $c_k$                       | LDV CO2 emitted per mile driven, average, in Year “ $k$ ”, accounting for the Low Carbon Fuel Standard (LCFS) Factor                  |
| $p_k$                       | Population, in Year “ $k$ ”                                                                                                           |
| $d_k$                       | Per-capita LDV driving, in Year “ $k$ ”                                                                                               |
| $D_k$                       | LDV Driving, in Year “ $k$ ”                                                                                                          |
| $M_k$                       | LDV Mileage, miles per gallon, in Year “ $k$ ”                                                                                        |
| $m_k$                       | LDV Equivalent Mileage, miles per gallon, in Year “ $k$ ” accounting for Low Carbon Fuel Standard (LCFS) Factor, so this is $M_k/L_k$ |
| $N$                         | Number of pounds of CO2 per gallon of fuel but not accounting for the Low Carbon Fuel Standard (LCFS) Factor                          |

**Table 2. Two Conventions**

| <b>Two Conventions: Variable in a Given Year and Factors to Compute a Variable’s Value in Year “<math>k</math>” from it’s Value in Year “<math>i</math>”</b> |                                                                                                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $X_i$                                                                                                                                                        | Variable “ $X$ ” in year “ $i$ ”                                                                                                                                                                                                                            |
| $f_{x_{k/i}}$                                                                                                                                                | Ratio of the value of “ $X$ ” in year “ $k$ ” to the value of “ $X$ ” in Year “ $i$ ”, which could also be expressed as $x_k/x_i$ . Note that this is the factor that could be used to multiply the value in Year “ $i$ ” to get the value in Year “ $k$ ”. |

- the per-capita driving, and
- the population. (The per-capita driving multiplied by population gives the miles driven.)

$$e = L * C * d * p \quad \text{(Eq. 1)}$$

For Year “ $k$ ”, this is the following:

$$e_k = L_k * C_k * d_k * p_k \quad \text{(Eq. 2)}$$

For Year “ $i$ ”, this is the following:

$$e_i = L_i * C_i * d_i * p_i \quad \text{(Eq. 3)}$$

Since the two sides of Equation 3 are equal, an equation can be formed by dividing the left side of Equation 2 by the left side of equation 3 and the right side of Equation 2 by the right side of Equation 3. Associating the terms on the right side of this new equation gives Equation 4

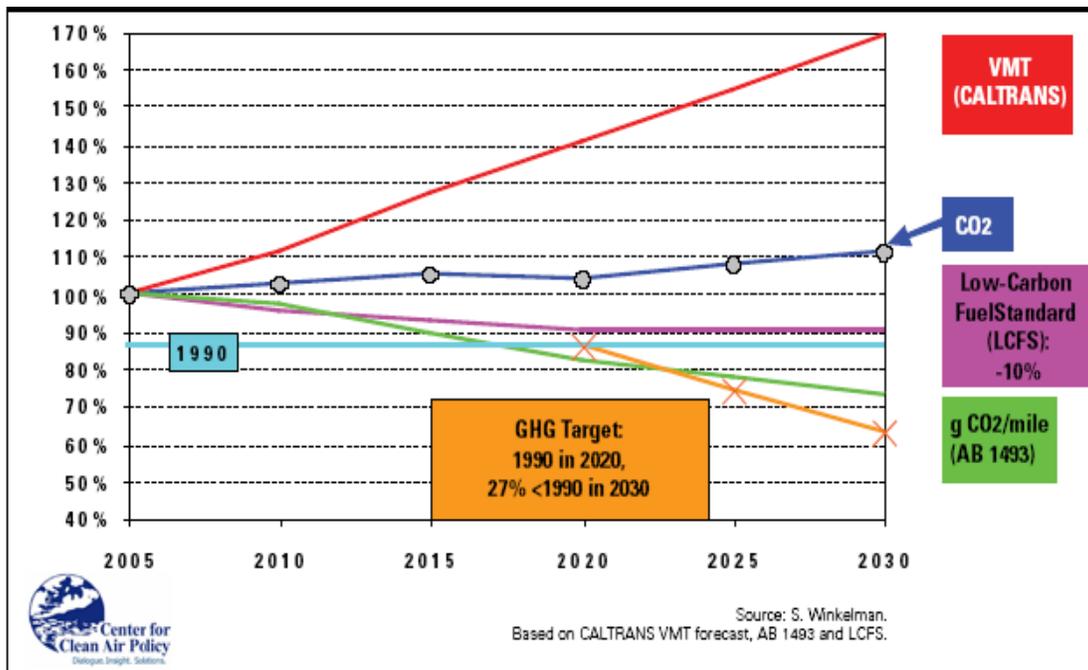
$$\frac{e_k}{e_i} = \frac{L_k}{L_i} * \frac{C_k}{C_i} * \frac{d_k}{d_i} * \frac{p_k}{p_i} \quad (\text{Eq. 4})$$

The convention of the 2<sup>nd</sup> row of Table 2 can be used to create Equation 5 from Equation 4.

$$f_{e_{k/i}} = f_{L_{k/i}} \times f_{C_{k/i}} \times f_{d_{k/i}} \times f_{p_{k/i}} \quad (\text{Eq. 5})$$

The first factor (from left to right) of the right side of Equation 5 is the purple line of Figure 3; the second factor of Equation 5 is the green line of Figure 3; and the product of the last two factors of

**Figure 3** The S-3-05 Trajectory (the Gold Line) AND the CO<sub>2</sub> Emitted from Personal Driving (the Blue Line), where that CO<sub>2</sub> is a Function (the Product) of the California-Fleet-Average CO<sub>2</sub> per Mile (the Green Line), The Predicted Driving (VMT, the Red Line), and the Low-Carbon Fuel Standard (the Purple Line)



the right side of Equation 5 is the red line of Figure 3. Figure 3's, dark-blue-line values are the product of the purple-line values, the green-line values, and the red -line values. For example, in 2030, the dark-blue value of 1.12 can be computed by multiplying the purple-line value of 0.9 times the green-line value of 0.73, times the red-line value of 1.7, times the red-line value of 1.7. As a check, (0.9)\*(0.73)\*(1.7) = 1.1169, which is reasonably close to the (eye-ball-estimate) value of the dark-blue line, for year 2030, 1.12.

### The Required Driving Reduction for San Diego County, for 2035, Using Winkelman's LDV and Fuel Efficiency Values and S-3-05

As described in Footnote 3 of this report, the CARB-supplied targets are per-capita driving reduction targets. Page 8, of [http://arb.ca.gov/cc/sb375/staffreport\\_sb375080910.pdf](http://arb.ca.gov/cc/sb375/staffreport_sb375080910.pdf), says, “The RTAC recommended that targets be expressed as a percent reduction in per-capita greenhouse gas emissions from a 2005 base year”. However, Footnote 3 applies.

***The Key Relationship and Derivation of the Needed Formula***

They key relationship is Equation 5. Solving for the fractional reduction in per-capita driving, with respect to 2005, results in Equation 6.

$$f_{d_{k/i}} = \frac{f_{e_{k/i}}}{f_{L_{k/i}} \times f_{C_{k/i}} \times f_{P_{k/i}}} \quad \text{(Eq. 6)}$$

This driving reduction is a per-capita value, matching the convention of the CARB-supplied target.

***Getting the Values to Use in the Equation***

Figure 3 will supply all of the needed values, except for the factor of population. Neither Figure 3’s red-line values nor its blue-line values are used.

***Getting the Net Factor of the Emissions of GHG, for Year 2035, With Respect to 2005***

To get the factor of the emissions of GHG, for year 2035, with respect to year 2005, it is necessary to extrapolate the Governor’s Executive Order target values (the gold line of Figure 3), out to year 2035. Figure 3’s gold line shows that this factor is 0.87 in 2020 and is 0.64 in 2030. Therefore, in year 2035, the factor will be

$$0.64 + [(0.64 - .87) / (2030-2020)] * (2035-2030) = 0.525$$

***Getting the (Pavley) Factor of the Average CO2 per Mile Driven, in 2035, with Respect to 2005***

To get the Pavley reduction factor, for Year 2035, it is necessary to extrapolate the average CO2 per mile driven, which is Figure 3’s green line, out to Year 2035. It is 0.82 in 2020 and it is 0.73 in 2030. Therefore, in Year 2035 the statewide mileage factor data will be

$$0.73 + [(0.73 - .82) / (2030-2020)] * (2035-2030) = 0.685$$

***Getting the Factor of the Reduction of GHG Due to Fuels that Burn less Carbon***

To get the factor of the reduction of GHG due to fuels that burn less carbon, it is only necessary to observe the purple line of Figure 3. It indicates that the factor will be 0.9 in 2035.

***Getting the Factor of the Increase in Population***

The factor for population in San Diego County is computed using the populations estimated in CARB’s <http://arb.ca.gov/cc/sb375/mpo.co2.reduction.calc.pdf>, namely 3,034,388 people in 2005 and 3,984,753 people in 2035. So the factor, from 2005 to 2035 is 3,984,753/3,034,388 = 1.313.

***Computing the Required Per-Capita Driving Reduction, for 2035***

These 4 values are used in Eq. 6, to compute the required factor of per-capita driving (VMT), for 2035, with respect to 2006.

$$f_{d_{k/i}} = .525 \div ( .685 \times 0.9 \times 1.313 )$$

Therefore,  $f_{d_{k/i}} = f_{Per\ Capita\ VMT} = .649.$

This corresponds to a 35.1% reduction in per-capita driving, in year 2035, compared to 2005.

### ***Computing the Net Amount of Driving, in 2035, Compared to 2005 and its Significance***

The net factor of driving in 2035, compared to 2005, is the product of the per-capita factor of driving (.649, as just computed) and the factor of population change (1.313, as computed above).

Factor of net driving in 2035 compared to 2005:

$$f_{VMT} = .649 \times 1.313 = 0.8515.$$

Based on this set of assumptions, even though San Diego County's population would grow by 31.3%, from 2005 to 2035, the people would have to drive 15% less than they did in 2005.

## **THE DEVELOPMENT OF CALIFORNIA'S TOP-LEVEL LDV REQUIREMENTS TO SUPPORT CLIMATE STABILIZATION**

The above work is obsolete due to our latest understanding of how fast emissions will need to be reduced. It is also clear that cleaner cars will be needed and can probably be achieved. As will be seen, much cleaner cars will be needed if driving reductions are going to remain within what many people would consider achievable. Mileage and equivalent mileage will need to be specified. Some of the above equations will need to be modified, since a significant fleet-fraction of Zero-Emission Vehicles (ZEVs, either Battery-Electric LDVs or Hydrogen Fuel Cell LDVs) will be needed and mileage and equivalent mileage will be used instead of CO2 per mile driven.

Since the SB-375 work used 2005 as the reference year, it will remain the reference year here.

### **GHG Target to Support Climate Stabilization**

The primary problem with S-3-05 is that California's resolve and actions have been largely ignored by other states, our federal government, and many countries. Therefore, rather than achieving 2000 levels by 2010 and being on a track to achieve 1990 levels by 2020, world emission have been increasing. Reference 7 states on Page 14 that the required rate of reduction, if commenced in 2020, would be 15%. That rate means that the factor of 0.85 must be achieved, year after year. If this were done for 10 years, the factor would be  $(0.85)^{10} = 0.2$ . We don't know where world emissions will be in 2020. However, it is fairly safe to assume that California will be emitting at its 1990 level in 2020, in accordance with S-3-05. This situation shows that the correct target for California is to achieve emissions that are reduced to 80% below California's 1990 value by 2030. Note that if the reductions start sooner, the rate of reduction of emissions can be less than 15% and the 2030 target could be relaxed somewhat. However, it is doubtful that the world will get the reduction rate anywhere near the needed 15% by 2020. Therefore, the target, of 80% below 1990 levels by 2030 is considered to be correct for California. Reference 7 also calls into question the advisability of aiming for a 2 degree Celsius increase, given the possibilities of positive feedbacks that would increase warming. This concern for positive feedbacks is another reason that this paper will work towards identifying LDV requirement sets that will support achieving 80% below 1990 values by 2030.

Using the top-row definition in Table 1, and this requirement, results in the following equation.

$$\frac{e_{2030}}{e_{1990}} = 0.2 \quad \text{(Eq. 7)}$$

From Figure 3,

$$\frac{e_{1990}}{e_{2005}} = 0.87 \quad \text{(Eq. 8)}$$

Multiplying the equations together give the following:

$$\frac{e_{2030}}{e_{2005}} = 0.87 \times 0.2 = .174 \quad (\text{Eq. 9})$$

Using the convention shown in Table 2 gives this equation:

$$f_{e_{2030/2005}} = .174 \quad (\text{Eq. 10})$$

## How Miles-Per-Gallon (MPG) Updates the LDV Efficiency Estimates

The number of pounds of CO<sub>2</sub> per mile driven, defined as “C” in Table 1, is equal to the number of pounds of CO<sub>2</sub>, per gallon of fuel, divided by the number of miles travelled on that gallon of fuel. However, in different years, this amount can change from the standard value of “N” as defined in the last line of Table 1, because of the Low Carbon Fuel Standard. Therefore, using the definitions in Table 1, the following equation can be written:

$$c_k = \frac{N \times L_k}{M_k} \quad (\text{Eq. 11})$$

For the baseline year “i”, this is the following:

$$c_i = \frac{N \times L_i}{M_i} \quad (\text{Eq. 12})$$

Using Table 1’s definition of mileage that accounts for the Low Carbon Fuel Standard gives these equations, since  $m = M/L$ :

$$c_k = \frac{N}{m_k} \quad (\text{Eq. 13})$$

$$c_i = \frac{N}{m_i} \quad (\text{Eq. 14})$$

Using Table 2’s second convention and dividing Equation 13 by Equation 14 gives:

$$f_{c_{k/i}} = \frac{c_k}{c_i} = \frac{m_i}{m_k} \quad (\text{Eq. 15})$$

This shows that to get the factor to convert CO<sub>2</sub>-emission-per-mile from the baseline value to a future-time value, the new value is divided by the baseline value. However, if the mileage values are used, the baseline value must be divided by the newer value.

It is also useful to use an intermediate year to get the factor from the baseline year to the year of interest. This can be done by using Equation 13 for different years to result in Equation 14 and Equation 15, where “j” denotes the intermediate year.

$$f_{c_{j/i}} = \frac{m_i}{m_j} \quad (\text{Eq. 14})$$

$$f_{c_{k/j}} = \frac{m_j}{m_k} \quad (\text{Eq. 15})$$

Multiplying these equations together results in Equation 16.

$$f_{c_{j/i}} \times f_{c_{k/j}} = \frac{m_i}{m_j} \times \frac{m_j}{m_k} = \frac{m_i}{m_k} \quad (\text{Eq. 16})$$

Recognizing the right side of Equation 16 shows that these factors can be strung together, as shown by Equation 17, which is a direct result of Equation 16.

$$f_{c_{k/i}} = f_{c_{j/i}} \times f_{c_{k/j}} \quad (\text{Eq. 17})$$

Since the low carbon fuel standard has been incorporated into the carbon emission per mile parameter, “c”, the following equations result, using the definitions of Table 1.

For Year “k”, this is the following:

$$e_k = c_k * d_k * p_k \quad (\text{Eq. 18})$$

For Year “i”, this is the following:

$$e_i = c_i * d_i * p_i \quad (\text{Eq. 19})$$

Since the two sides of Equation 19 are equal, an equation can be formed by dividing the left side of Equation 18 by the left side of equation 19 and the right side of Equation 18 by the right side of Equation 19. Associating the terms on the right side of this new equation gives Equation 4

$$\frac{e_k}{e_i} = \frac{c_k}{c_i} * \frac{d_k}{d_i} * \frac{p_k}{p_i} \quad (\text{Eq. 20})$$

The convention of the 2<sup>nd</sup> row of Table 2 can be used to create Equation 5 from Equation 4.

$$f_{e_{k/i}} = f_{c_{k/i}} \times f_{d_{k/i}} \times f_{p_{k/i}} \quad (\text{Eq. 21})$$

This can be expanded by using Equation 17 to give the following.

$$f_{e_{k/i}} = f_{c_{j/i}} \times f_{c_{k/j}} \times f_{d_{k/i}} \times f_{p_{k/i}} \quad (\text{Eq. 22})$$

For the purposes here, the intermediate year “j” is 2015 and, recalling that “c” takes into account the Low Carbon Fuel Standard, Figure 3 shows that the following is true, where 0.9 is taken (eyeballed) from the green line at 2015 and the .93 is taken (eyeballed) from the purple line.

$$f_{c_{j/i}} = 0.9 \times 0.93 = 0.837 \quad (\text{Eq. 23})$$

Using Equation 22, to solve for the per-capita driving-reduction factor, results in Equation 24.

$$f_{d_{k/i}} = \frac{f_{e_{k/i}}}{f_{c_{j/i}} \times f_{c_{k/j}} \times f_{p_{k/i}}} \quad (\text{Eq. 24})$$

Reference 8 shows that California’s population in 2005 was 35,985,582. Reference 9 shows that California’s population in 2030 is predicted to be 44,279,354. Therefore,

$$f_{p_{k/i}} = 44279354 \div 35985582 = 1.2305 \quad (\text{Eq. 25})$$

Using the values in Equation 10, 23, and 25 gives Equation 26, where “j” is the intermediate year of 2015 and Equation 15 is also used.

$$f_{d_{k/i}} = \frac{0.174}{0.837 \times \frac{m_j}{m_k} \times 1.2305} \quad (\text{Eq. 26})$$

Evaluating the values shown and with j = 2015 and k = 2030 gives Equation 27.

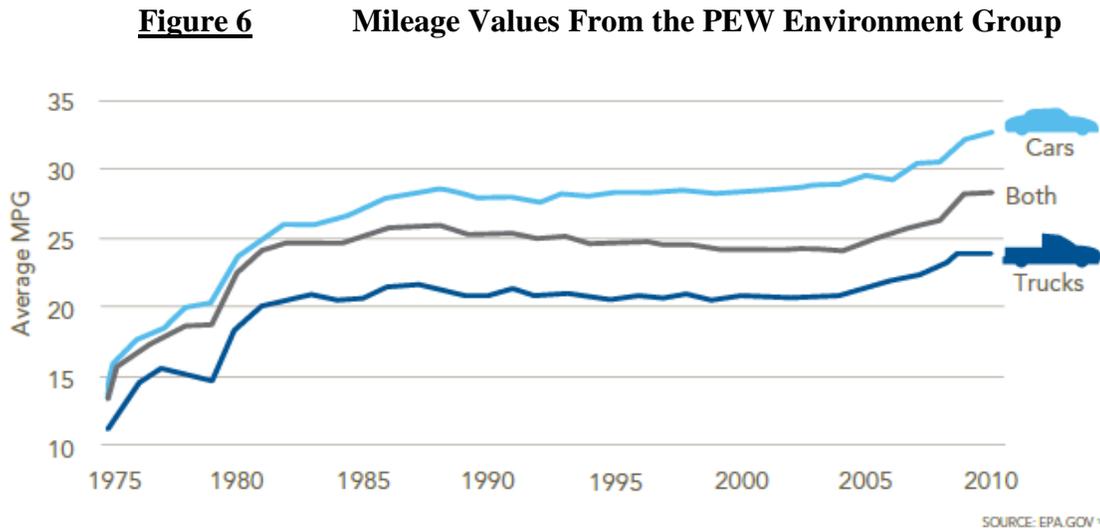
$$f_{d_{k/i}} = 0.1689 \times \frac{m_{2030}}{m_{2015}} \quad (\text{Eq. 27})$$

If the per-capita driving factor was 1 (no per-capita driving reduction needed from 2005 to 2030), the 2030 fleet (all LDVs on the road) mileage would need to exceed the 2015 fleet mileage by a factor of 1 divided by 0.1689, which is 5.92. For example, if the mileage for the 2015 fleet is 25 MPG, then the 2030 value would need to be 148 MPG. Clearly, most LDVs in 2030 will need to be ZEVs.

### Internal Combustion Engine (ICE) Mileage, from Year 2000 to Year 2030

The years from 2000 to 2011 are taken from a plot produced by the PEW Environment Group, [http://www.pewenvironment.org/uploadedFiles/PEG/Publications/Fact\\_Sheet/History%20of%20Fuel%20Economy%20Clean%20Energy%20Factsheet.pdf](http://www.pewenvironment.org/uploadedFiles/PEG/Publications/Fact_Sheet/History%20of%20Fuel%20Economy%20Clean%20Energy%20Factsheet.pdf)

The plot is shown here as Figure 6. The “Both” values are used.



The values from 2012 to 2025 are taken from the US Energy Information Agency (EIA) as shown on their website, [http://www.eia.org/federal/executive/vehicle-standards#ldv\\_2012\\_to\\_2025](http://www.eia.org/federal/executive/vehicle-standards#ldv_2012_to_2025). They are the LDV Corporate Average Fleet Efficiency (CAFE) values enacted into law in the first term of President Obama. From 2025 to 2030, it is assumed that the yearly ICE improvement in CAFE will be 2.5 MPG.

### Mileage of California’s LDV Fleet in 2015

Table 3 uses these values of ICE mileage to compute the mileage of the LDV fleet in 2015. It assumes that the fraction of ZEVs being used over these years is small enough to be ignored. The 100 miles driven, nominally, by each set of cars, is an arbitrary value and inconsequential in the final calculation, because it will divide out. It is never-the-less used, so that it is possible to compare the gallons of fuel used for the different years. The “f” factor could be used to account for a set of cars being driven less. It was decided to not use this option by setting all of the values to 1. The Low Carbon Fuel Standard (LCFS) values are taken from Figure 3. The gallons of fuel are computed as shown in Equation 28, using the definition for  $L_k$  that is shown in Table 1.

$$\text{Gallons Used per } f * 100 \text{ miles} = \frac{f \times 100}{(\text{CAFE MPG}) / L_k} \quad (\text{Eq. 28})$$

## How ICE Mileage Values Will Be Used with ZEV Equivalent Mileage Values

As will be seen, after 2015, the net (computed using both ICEs and ZEVs) mileage values for each year are assumed to greatly improve by having a significant fraction of ZEVs. The ICE CAFÉ standards are used in this report as just the ICE contribution to fleet MPG. The ICE MPG values are inadequate by themselves and will therefore need to become less important because ZEVs will need to quickly take over the highways.

Federal requirements will need to change dramatically. Currently, federally-mandated corporate average fuel efficiency (CAFÉ) standards have been implemented, from 2000 to 2025. These standards require that each corporation produce and sell their fleet of cars and light-duty trucks in the needed proportions, so that the combined mileage of the cars they sell, at least meet the specified mileage.

**Table 3. Calculation of the Fleet MPG for 2015**

| LDV Set                              | Years Old | Model Year | CAFE MPG | LCFS Factor $L_{Year}$ | Factor Driven $f$ | Gallons Used Per $f*100$ Miles |
|--------------------------------------|-----------|------------|----------|------------------------|-------------------|--------------------------------|
| 1                                    | 14-15     | 2001       | 24.0     | 1.0                    | 1.0               | 4.17                           |
| 2                                    | 13-14     | 2002       | 24.0     | 1.0                    | 1.0               | 4.17                           |
| 3                                    | 12-13     | 2003       | 24.0     | 1.0                    | 1.0               | 4.17                           |
| 4                                    | 11-12     | 2004       | 24.0     | 1.0                    | 1.0               | 4.17                           |
| 5                                    | 10-11     | 2005       | 25.0     | 1.0                    | 1.0               | 4.00                           |
| 6                                    | 9-10      | 2006       | 25.7     | .9933                  | 1.0               | 3.87                           |
| 7                                    | 8-9       | 2007       | 26.3     | .9867                  | 1.0               | 3.75                           |
| 8                                    | 7-8       | 2008       | 27.0     | .9800                  | 1.0               | 3.63                           |
| 9                                    | 6-7       | 2009       | 28.0     | .9733                  | 1.0               | 3.48                           |
| 10                                   | 5-6       | 2010       | 28.0     | .9667                  | 1.0               | 3.45                           |
| 11                                   | 4-5       | 2011       | 29.1     | .9600                  | 1.0               | 3.30                           |
| 12                                   | 3-4       | 2012       | 29.8     | .9533                  | 1.0               | 3.20                           |
| 13                                   | 2-3       | 2013       | 30.6     | .9467                  | 1.0               | 3.09                           |
| 14                                   | 1-2       | 2014       | 31.4     | .9400                  | 1.0               | 2.99                           |
| 15                                   | 0-1       | 2015       | 32.6     | .9333                  | 1.0               | 2.86                           |
| <b>Sum of Gallons:</b>               |           |            |          |                        |                   | <b>54.29</b>                   |
| <b>Miles = 100*Sum(f's):</b>         |           |            |          |                        |                   | <b>1500</b>                    |
| <b>MPG = Miles/(Sum of Gallons):</b> |           |            |          |                        |                   | <b>27.63</b>                   |

The car companies want to maximize their profits while achieving the required CAFÉ standard. In California, the car companies will already be required to sell a specified number of electric vehicles, which have a particularly-high, equivalent-value of miles-per-gallon. If the laws are not changed,

this will allow these companies to sell more low-mileage, high profit cars and light-duty trucks, and still achieve the federal CAFÉ standard.

It will be better to apply the CAFÉ standards to only the ICEs and then require that the fleet of LDVs sold achieve some mandated fraction of ZEVs. The ZEVs will get better and better equivalent mileage, as our electrical grid is powered by more renewables. Therefore, their equivalent mileage is not fixed, but will improve over the years. Requirements developed here are for 2030. Therefore a high percentage of all the electricity generated in the state, including both the “in front of the meter” (known as the “Renewable Portfolio Standard” or “RPS”) portion and the “behind the meter” portion is assumed to come from sources that do not emit CO2. The value of 80% is assumed.

### ZEV Equivalent Mileage Values

To calculate the mileage of the 2030 fleet of LDVs, it is necessary to derive a formula to compute the equivalent mileage of ZEVs, as a function of the percent of electricity generated without emitting CO2, the equivalent ZEV mileage if the electricity is from 100% fossil fuel, and the equivalent ZEV mileage if the electricity is from 100% non-CO2 sources. The variables defined in Table 4 are used.

**Table 4. Variables Used in the Calculation of ZEV Equivalent Mileage**

| <b>Variable</b> | <b>Definition</b>                                                      |
|-----------------|------------------------------------------------------------------------|
| $m_z$           | <b>ZEV Equivalent mileage</b>                                          |
| $m_{zr}$        | <b>ZEV Equivalent mileage if the electricity is from renewables</b>    |
| $m_{zf}$        | <b>ZEV Equivalent mileage if the electricity is from fossil fuels</b>  |
| $r$             | <b>fraction of electricity generated from sources not emitting CO2</b> |
| $G$             | <b>Gallons of equivalent fuel used</b>                                 |
| $D$             | <b>Arbitrary distance travelled</b>                                    |
| $Num$           | $m_{zr} \times m_{zf}$                                                 |
| $Den$           | $r \times m_{zf} + (1 - r) \times m_{zr}$                              |

The derivation of the equation for equivalent ZEV mileage is based on the notion that the ZEV can be imagined to travel “r” fraction of the time on electricity generated from renewables and “(1-r)” fraction of the time on fossil fuel. If the vehicle travels “D” miles, then, using the definitions shown in Table 4, the following equation can be written.

$$G = \frac{r \times D}{m_{zr}} + \frac{(1-r) \times D}{m_{zf}} \quad (\text{Eq. 29})$$

$$m_z = D/G = D / \left( \frac{r \times D}{m_{zr}} + \frac{(1-r) \times D}{m_{zf}} \right) \quad (\text{Eq. 30})$$

Dividing the numerator and the denominator by D and multiplying them both by the product of the two equivalent mileage values results in Equations 31.

$$m_z = m_{zr} \times m_{zf} / (r \times m_{zf} + (1 - r) \times m_{zr}) \quad (\text{Eq. 31})$$

Again, using the definitions in Table 4 results in the following.

$$m_z = \text{Num}/(\text{Den}) \quad (\text{Eq. 32})$$

Table 5 shows an assignment of assumed values and the result of a calculation, using Equations 31 and 32, to produce a ZEV equivalent mileage.

**Table 5. Variable Assignment and the Resulting ZEV Mileage**

| $m_{zr}$ | $m_{zf}$ | r   | 1-r | Num       | Den     | $m_z$  |
|----------|----------|-----|-----|-----------|---------|--------|
| 5000     | 70       | 0.8 | 0.2 | 350000.00 | 1056.00 | 331.44 |

### Computing an LDV Fleet Mileage Assuming Heroic Measures (HM)

Table 6 shows the additional definitions that will be used in this calculation. Table 7 computes the 2030 LDV mileage, assuming “Heroic Measures” to reduce the miles driven in poor-mileage ICE’s, in building and selling a significant fraction of ZEVs, and in getting the Low Carbon Fuel Standards to continue to improve beyond the Table 3 minimum of 0.90.

**Table 6. Additional Variables Used in the Calculation of 2030 LDV Mileage**

| Variable | Definition                                      |
|----------|-------------------------------------------------|
| $D_i$    | Distance travelled by ICE vehicles              |
| $D_z$    | Distance travelled by ZEVs                      |
| $G_i$    | Gallons of Equivalent fuel used by ICE vehicles |
| $G_z$    | Gallons of Equivalent fuel used by ZEVs         |

As shown by the values for “f”, government policies must be adopted to reduce the miles driven by the ICE’s, from 2016 to 2023. The 2016 model ICE’s are driven only 30% as much as the nominal amount. The 2017 year ICE’s can be driving 10% more. This rate of change continues up to 2023, when the ICE’s are doing less damage, due to the large fraction of ZEVs on the road.

As shown, the ZEV fraction of the fleet assumes the value of 5%, just 4 years from now. It then proceeds upward, to 10% in 2019, 25% in 2020, 40% in 2021, and so on, until it reaches 95%.

Achieving these fractions of ZEVs might be compared to what was done during World War II, when automobile productions lines were rapidly converted to produce tanks. This reduced the new cars that could be purchased. Besides this, rationing gasoline made it difficult to drive at times and, due to shortages of leather, which was being used to produce boots for soldiers, some citizens found it hard to even buy shoes. These rapid and inconvenient changes were tolerated, because most people agreed that the war needed to be won. The heroic measures assumed here may not be possible unless citizens and the political leaders they elect understand the dire consequences of climate destabilization and therefore accept, and even demand, the measures that are needed to support climate stabilization.

The equivalent miles per gallon of the LDV fleet in 2030, specifically 111.12 miles per gallon, will be considered as a potential 2030 LDV requirement.

### Computing the Heroic-Measures (HM) Case Per-Capita and Net Driving Factor Requirements, Based on the Result Shown in Table 7

Plugging the

- equivalent MPG of the LDV fleet in Year 2030, taken from the bottom of Table 7, which is 111.12 MPG, and
- the MPG of the LDV fleet in Year 2015, taken from the bottom of Table 3, which is 27.63 MPG,

into Equation 27, gives the following result:

$$f_{d_{k/i}} = 0.1689 \times \frac{m_{2030}}{m_{2015}} = .1689 \times \frac{111.12}{27.63} = .6795 \quad (\text{Eq. 31})$$

This means that the per-capita driving will need to be about 32% less than in year 2005. The net driving can be computed by multiplying the per-capita driving, 0.6795, by the population factor of 1.2305, computed in Equation 25, resulting in 0.8361. This means that, even with the 23% increase in California's population, the net driving will have to drop by about 16%. If this LDV requirement set is selected, all of California's transportation money can be used to improve transit, improve active transportation (mainly walking and biking), and maintain, but not expand, roads.

### Computing LDV Requirements that Support 2005 Per-Capita Driving

The first step is to use Equation 27 and the value of the mileage in 2015 to compute the needed LDV equivalent fleet mileage for 2030 so that  $f_{d_{k/i}}$  is equal to 1.0.

**Table 7. Calculation of 2030 LDV Mileage Assuming Heroic Measures**

| Year                                              | ICE Parameters and Calculations |       |         |     |       |        | ZEVs |       |       | Yearly Totals |               |          |
|---------------------------------------------------|---------------------------------|-------|---------|-----|-------|--------|------|-------|-------|---------------|---------------|----------|
|                                                   | CAFÉ MPG                        | LCFS  | Eq. MPG | f   | $D_i$ | $G_i$  | z    | $D_z$ | $G_z$ | Total Miles   | Total Gallons | 2030 MPG |
| 2016                                              | 34.3                            | .9267 | 37.01   | .3  | 30.0  | .8105  | 0    | 0     | .000  | 30.0          | .8105         | 37.01    |
| 2017                                              | 35.1                            | .9200 | 38.15   | .4  | 40.0  | 1.0484 | 0    | 0     | .000  | 40.0          | 1.0484        | 38.15    |
| 2018                                              | 36.1                            | .9133 | 39.53   | .5  | 47.5  | 1.2018 | .05  | 5     | .015  | 52.5          | 1.2168        | 43.14    |
| 2019                                              | 37.1                            | .9000 | 40.92   | .6  | 54.0  | 1.3197 | .10  | 10    | .030  | 64.0          | 1.3498        | 47.41    |
| 2020                                              | 38.3                            | .8500 | 42.56   | .7  | 52.5  | 1.2337 | .25  | 25    | .075  | 77.5          | 1.3091        | 59.20    |
| 2021                                              | 40.3                            | .8000 | 47.41   | .8  | 48.0  | 1.0124 | .40  | 40    | .121  | 88.0          | 1.1331        | 77.66    |
| 2022                                              | 42.3                            | .8000 | 52.88   | .9  | 40.5  | .7660  | .55  | 55    | .166  | 95.5          | .9319         | 102.48   |
| 2023                                              | 44.3                            | .8000 | 55.38   | 1.0 | 30.0  | .5418  | .70  | 70    | .211  | 100.0         | .7530         | 132.81   |
| 2024                                              | 46.5                            | .8000 | 58.13   | 1.0 | 15.0  | .2581  | .85  | 85    | .257  | 100.0         | .5145         | 194.36   |
| 2025                                              | 48.7                            | .8000 | 60.88   | 1.0 | 5.0   | .0821  | .95  | 95    | .287  | 100.0         | .3688         | 271.18   |
| 2026                                              | 51.2                            | .8000 | 64.00   | 1.0 | 5.0   | .0781  | .95  | 95    | .287  | 100.0         | .3648         | 274.16   |
| 2027                                              | 53.7                            | .8000 | 67.13   | 1.0 | 5.0   | .0745  | .95  | 95    | .287  | 100.0         | .3611         | 276.92   |
| 2028                                              | 56.2                            | .8000 | 70.25   | 1.0 | 5.0   | .0712  | .95  | 95    | .287  | 100.0         | .3578         | 279.48   |
| 2029                                              | 58.7                            | .8000 | 73.38   | 1.0 | 5.0   | .0681  | .95  | 95    | .287  | 100.0         | .3548         | 281.87   |
| 2030                                              | 61.2                            | .8000 | 76.50   | 1.0 | 5.0   | .0654  | .95  | 95    | .287  | 100.0         | .3520         | 284.10   |
| Sum of Miles and then Gallons of Equivalent Fuel: |                                 |       |         |     |       |        |      |       |       | 1247.5        | 11.23         |          |
| Equivalent MPG of LDV Fleet in 2030:              |                                 |       |         |     |       |        |      |       |       | <b>111.12</b> |               |          |

**Sum of ZEV Miles = 860. Fraction of Miles Driven by ZEVs = 68.9%**

$$m_{2030} = f_{d_{k/j}} \times \frac{m_{2015}}{0.1689} = 1.0 \times \frac{27.63}{0.1689} = 163.54 \text{ MPG} \quad (\text{Eq. 32})$$

Table 8 is constructed, with the fraction of ZEVs selected to achieve the needed equivalent fleet mileage of about 163.54 MPG. Since its ZEV fractions are larger and sooner than in the “Heroic Measures table, Table 8 is the “Extra-Heroic Measures” (EHM) case. The ICE “f” values are unchanged; as are the LCFS values. The EHM ZEV differences from the HM case are the highlighted “z” values.

This means that with the 23% increase in California’s population, computed in Equation 25, the net driving would also increase by 23%. If this LDV requirement set were to be implemented, a lot of California’s transportation money will be needed to expand the highway system, leaving less to improve transit, improve active transportation (mainly walking and biking), and maintain roads.

### **Comparing the ZEV Fraction Values of the “Heroic-Measures” (HM) Case to the “Extra-Heroic Measures” (EHM) Case**

Table 9 shows the direct comparison of the ZEV fractions that are ZEV requirements for the HM Case and the EHM Case. The differences are highlighted.

### **ACHIEVING THE REQUIRED DRIVING REDUCTION OF THE HEROIC-MEASURES (HM) CASE**

As shown in Equation 31, in 2030, the per-capita driving will need to at least 32% below the 2005 value. As shown in this link, [http://en.wikipedia.org/wiki/SB\\_375](http://en.wikipedia.org/wiki/SB_375), California’s Metropolitan Planning Organizations (MPOs) are adopting Region Transportation Plans (RTPs) that will achieve reductions in year 2020 and 2035. As also shown there, the targets, for year 2035, range from 0% for Shasta to 16% for Sacramento Area Council of Governments Since this is for 2030 instead of 2035, and to be reasonably conservative, it is assumed here that the state will achieve a 10% reduction in per-capita driving, in 2030, compared to 2005. This leaves 22% to be achieved by new programs.

The title of each of the following subsections contains the estimated per-capita driving reduction each strategy will achieve, by 2030.

### **Reallocate Funds Earmarked for Highway Expansion to Transit and Consider Transit-Design Upgrades (3%)**

San Diego County has a sales tax measure called “TransNet”, which allocates one-third for highway expansion, one-third for transit, and one-third for road maintenance. It has a provision that allows for a reallocation of funds, if supported by at least two-thirds of SANDAG Board members, including a so-called weighted vote, where governments are given a portion of 100 votes, proportional to their population. It is hereby proposed to reallocate the TransNet amount, earmarked for highway expansion, to transit and to do similar reallocations throughout California.

This money could be used to fund additional transit systems; improve transit operations; and/or the redesign and implementation of the redesign of existing transit systems. The redesign could include electrification and automation or even upgrading to a different technology.

### A Comprehensive Road-Use Fee Pricing and Payout System to Unbundle the Cost of Operating Roads (7.5%)

*Comprehensive* means that pricing would be set to cover all costs (including road maintenance and externalities such as harm to the environment and health); that privacy and the interests of low-income drivers doing necessary driving would be protected; that the incentive to drive fuel-efficient cars would be at least as large as it is under the current fuels excise tax; and, as good technology becomes available, that congestion pricing is used to protect critical driving from congestion.

The words *payout* and *unbundle* mean that some of the money collected would go to people that are losing money under the current system.

User fees (gas taxes and tolls) are not enough to cover road costs<sup>10</sup> and California is not properly maintaining its roads. Reference 10 shows that in California user fees amount to only 24.1% of what is spent on roads. Besides this, the improved mileage of the ICEs and the large number of ZEVs needed mean that gas tax revenues will drop precipitously.

**Table 8. Calculation of 2030 LDV Mileage Assuming Extra-Heroic Measures**

| Year                                              | ICE Parameters and Calculations |       |         |     |       |       | ZEVs |       |       | Yearly Totals |               |          |
|---------------------------------------------------|---------------------------------|-------|---------|-----|-------|-------|------|-------|-------|---------------|---------------|----------|
|                                                   | CAFÉ MPG                        | LCFS  | Eq. MPG | f   | $D_i$ | $G_i$ | z    | $D_z$ | $G_z$ | Total Miles   | Total Gallons | 2030 MPG |
| 2016                                              | 34.3                            | .9267 | 37.01   | .3  | 30.0  | .8105 | .00  | 0     | .000  | 30.0          | .8105         | 37.01    |
| 2017                                              | 35.1                            | .9200 | 38.15   | .4  | 36.0  | .9436 | .10  | 10    | .030  | 46.0          | .9738         | 47.24    |
| 2018                                              | 36.1                            | .9133 | 39.53   | .5  | 35.0  | .8855 | .30  | 30    | .091  | 65.0          | .9760         | 66.60    |
| 2019                                              | 37.1                            | .9000 | 40.92   | .6  | 30.0  | .7332 | .50  | 50    | .151  | 80.0          | .8840         | 90.50    |
| 2020                                              | 38.3                            | .8500 | 42.56   | .7  | 21.0  | .4935 | .70  | 70    | .211  | 91.0          | .7047         | 129.14   |
| 2021                                              | 40.3                            | .8000 | 47.41   | .8  | 8.0   | .1687 | .90  | 90    | .272  | 98.0          | .4403         | 222.59   |
| 2022                                              | 42.3                            | .8000 | 52.88   | .9  | 4.5   | .0851 | .95  | 95    | .287  | 95.5          | .3717         | 267.66   |
| 2023                                              | 44.3                            | .8000 | 55.38   | 1.0 | 5.0   | .0903 | .95  | 95    | .287  | 100.0         | .3769         | 265.31   |
| 2024                                              | 46.5                            | .8000 | 58.13   | 1.0 | 5.0   | .0860 | .95  | 95    | .287  | 100.0         | .3727         | 268.35   |
| 2025                                              | 48.7                            | .8000 | 60.88   | 1.0 | 5.0   | .0821 | .95  | 95    | .287  | 100.0         | .3688         | 271.18   |
| 2026                                              | 51.2                            | .8000 | 64.00   | 1.0 | 5.0   | .0781 | .95  | 95    | .287  | 100.0         | .3648         | 274.16   |
| 2027                                              | 53.7                            | .8000 | 67.13   | 1.0 | 5.0   | .0745 | .95  | 95    | .287  | 100.0         | .3611         | 276.92   |
| 2028                                              | 56.2                            | .8000 | 70.25   | 1.0 | 5.0   | .0712 | .95  | 95    | .287  | 100.0         | .3578         | 279.48   |
| 2029                                              | 58.7                            | .8000 | 73.38   | 1.0 | 5.0   | .0681 | .95  | 95    | .287  | 100.0         | .3548         | 281.87   |
| 2030                                              | 61.2                            | .8000 | 76.50   | 1.0 | 5.0   | .0654 | .95  | 95    | .287  | 100.0         | .3520         | 284.10   |
| Sum of Miles and then Gallons of Equivalent Fuel: |                                 |       |         |     |       |       |      |       |       | 1309.5        | 8.07          |          |
| Equivalent MPG of LDV Fleet in 2030:              |                                 |       |         |     |       |       |      |       |       | <b>162.27</b> |               |          |

**Table 9. HM Case and the EHM Case Which Supports 2005 Per-Capita Driving**

| <u>Cases</u> | 2015 | 2016       | 2017       | 2018       | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|--------------|------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------|------|------|------|------|------|
| <b>HM</b>    | .00  | <b>.00</b> | <b>.00</b> | <b>.05</b> | <b>.10</b> | <b>.25</b> | <b>.40</b> | <b>.55</b> | <b>.70</b> | <b>.85</b> | .95  | .95  | .95  | .95  | .95  | .95  |
| <b>EHM</b>   | .00  | <b>.10</b> | <b>.30</b> | <b>.50</b> | <b>.70</b> | <b>.90</b> | <b>.95</b> | <b>.95</b> | <b>.95</b> | <b>.95</b> | .95  | .95  | .95  | .95  | .95  | .95  |

This system could be used to help reduce the ICE LDV miles driven in 2016 to 2022, as shown in the “f” column of Tables 7 and 8. This system could probably be implemented in less than 5 years.

### **Unbundling the Cost of Car Parking (7.5%)**

Unbundling the cost of car parking<sup>R11</sup> throughout California is conservatively estimated to decrease driving by 7.5%, based on Table 1 of Reference 11. That table shows driving reductions due to introducing a price, for 10 cases. Its average reduction in driving is 25% and its smallest reduction is 15%.

### **Good Bicycle Projects and Bicycle Traffic Skills Education (3%)**

The best criterion for spending money for bicycle transportation is the estimated reduction in driving per the amount spent. The following strategies may come close to maximizing this parameter.

#### ***Projects to Improve Bicycle Access***

All of the smart-growth neighborhoods, central business districts, and other high trip destinations or origins, both existing and planned, should be checked to see if bicycle access could be substantially improved with either a traffic calming project, a “complete streets” project, more shoulder width, or a project to overcome some natural or made-made obstacle.

#### ***League of American Bicyclist Certified Instruction of “Traffic Skills 101”***

Most serious injuries to bike riders occur in accidents that do not involve a motor vehicle<sup>12</sup>. Most car-bike accidents are caused by wrong-way riding and errors in intersections; the clear-cut-hit-from-behind accident is rare<sup>12</sup>.

After attending *Traffic Skills 101*, students that pass a rigorous written test and demonstrate proficiency in riding in traffic and other challenging conditions could be paid for their time and effort.

As an example of what could be done in San Diego County, if the average class size was 3 riders per instructor and each rider passes both tests and earns \$100 and if the instructor, with overhead, costs \$500 dollars, for a total of \$800 for each 3 students, that would mean that \$160M could teach  $\$160M/\$800 = 200,000$  classes of 3 students, for a total of 600,000 students. The population of San Diego County is around 3 million.

## **Eliminate or Greatly Increase the Maximum Height and Density Limits Close to Transit Stops that Meet Appropriate Service Standards (2%)**

As sprawl is reduced, more compact, transit-oriented development (TOD) will need to be built. This strategy will incentivize a consideration of what level of transit service will be needed, how it can be achieved, and what levels of maximum height and density are appropriate. Having no limits at all is reasonable if models show that the development can function without harming the existing adjacent neighborhoods, given the level of transit service and other supporting transportation policies (such as car parking that unbundles the cost and supports the full sharing of parking<sup>12</sup>) that can be assumed.

## **Net Driving Reduction from All Identified Strategies**

By 2030, the sum of these strategies should be realized. They total 23%, resulting in a 1% margin over the needed 22% (which is added to the existing 10% to get the needed 32%).

## **ADDITIONAL ELECTRICITY REQUIRED**

The URL [http://www.energy.ca.gov/2013\\_energypolicy/documents/2013-06-26\\_workshop/presentations/09\\_VMT-Bob\\_RAS\\_21Jun2013.pdf](http://www.energy.ca.gov/2013_energypolicy/documents/2013-06-26_workshop/presentations/09_VMT-Bob_RAS_21Jun2013.pdf) shows that Californians drove about 325 Billion miles per year, from 2002 to 2011. This value can be multiplied by the 0.8361 factor reduction of driving, computed right after the calculation shown in Equation 31, and the fraction of miles driven by ZEVs, shown at the bottom of Table 7, of 0.689 (from 68.9%), to give the 2030 miles driven by ZEVs = 325 Billion x 0.831 x 0.689 = 187 Billion miles per year.

Using the Tesla information here [http://en.wikipedia.org/wiki/Tesla\\_Roadster](http://en.wikipedia.org/wiki/Tesla_Roadster), it is assumed that 21.7 kW-h is used per 100 miles, or 0.217 kW-h per mile. The total energy used per year is therefore 187 Billion miles x 0.217 kW-h = 40,648 GW-h.

<http://www.cpuc.ca.gov/cfaqs/howhighiscaliforniaselectricitydemandandwheredoesthepowercomefrom.htm>, shows that California is using about 265,000 GW-h per year. Therefore the electricity needed to power California's HM ZEV LDF fleet in 2030 is 100% x 40,648/265,000 = 15.34% of the amount of electricity California is currently using.

## **CONCLUSION**

A requirement set named "Heroic Measures" (HM) is quantified. Table 9 shows that the HM LDV efficiency requirements are much easier to achieve than those needed to allow per-capita driving to remain close to its 2005 level. Strategies to achieve the required HM driving reductions are also allocated and described. They are perhaps about as difficult as achieving the HM LDV fleet efficiency. It is computed that the 2030 fleet of LDV HM ZEVs would require an amount of electricity which is equal to about 15% of what California is using today.

## **ABBREVIATIONS AND ACRONYMS**

|                |                                 |             |                                |
|----------------|---------------------------------|-------------|--------------------------------|
| <b>AB 1493</b> | California's Assembly Bill 1493 | <b>ICE</b>  | Internal Combustion Engine LDV |
| <b>AB 32</b>   | California's Assembly Bill 32   | <b>kW-h</b> | Kilo Watt-hour                 |
| <b>APS</b>     | Alternative Planning Strategy   | <b>LCFS</b> | Low Carbon Fuel Standard       |

|                         |                                      |                 |                                      |
|-------------------------|--------------------------------------|-----------------|--------------------------------------|
| <b>CAFE</b>             | Corporate Average Fleet Efficiency   | <b>LDV</b>      | Light-Duty Vehicle                   |
| <b>CARB</b>             | California Air Resources Board       | <b>MPO</b>      | Metropolitan Planning Organization   |
| <b>CBD</b>              | Center for Biological Diversity      | <b>Pavley</b>   | Senator Pavley's AB 1493             |
| <b>CEQA</b>             | California Environmental Quality Act | <b>PPM</b>      | Parts per Million                    |
| <b>CCAP</b>             | Center for Clean Air Policy          | <b>RPS</b>      | Renewable Portfolio Standard         |
| <b>CNFF</b>             | Cleveland National Forest Foundation | <b>RTP</b>      | Regional Transportation Plan         |
| <b>SB 375</b>           | California's Senate Bill 375         | <b>S-3-05</b>   | Governor's Executive Order S-3-05    |
| <b>CO<sub>2</sub></b>   | Carbon Dioxide                       | <b>SANDAG</b>   | San Diego Association of Governments |
| <b>CO<sub>2</sub>_e</b> | Carbon Dioxide Equivalent GHG        | <b>SCS</b>      | Sustainable Community Strategy       |
| <b>EHM</b>              | "Extra Heroic Measures" LDV Case     | <b>TransNet</b> | San Diego County sales tax           |
| <b>GEO</b>              | Governor's Executive Order           | <b>URL</b>      | Universal Resource Locator           |
| <b>GHG</b>              | Greenhouse gas                       | <b>VMT</b>      | Vehicle Miles Travelled              |
| <b>GW-h</b>             | Giga Watt-Hours                      | <b>ZEV</b>      | Zero Emission Vehicle LDV            |
| <b>HM</b>               | "Heroic Measures" LDV Case           |                 |                                      |

## ACKNOWLEDGEMENTS

Darrell Clarke, Lead Volunteer for the Sierra Club's "Beyond Oil Campaign"; Dr. Dennis Martinek, Oceanside Planning Commissioner; Sandra Goldberg, formerly California Deputy Attorney General; Dr. Nilmini Silva-Send, Senior Policy Analyst of the Energy Policy Initiative Center; Diane Nygaard, Director of Preserve Calavera and founder of *Nelson Nygaard Consulting Associates*; Jack Shu, CNFF President; Joan Bullock; San Diego Sierra Club Executive Committee Chairs: Caroline Chase, John Stump, and (former Assembly Member) Lori Saldaña; Malinda Dickenson, *Law Offices of Malinda R. Dickenson*; Conservation Committee Chair Mollie Biggers; Ed Mainland and Jim Stewart, Co-Chairs, Energy-Climate Committee, Sierra Club California; Bern Grush, Chief Scientist, *Skymeter Corporation*; and SANDAG Staff: Susan Baldwin, Senior Regional Planner; Charles Stoll, Director of Land Use and Transportation Planning; and Stephan Vance, Senior Regional Planner.

## REFERENCES

- 1 Anders, S. J.; De Haan, D. O.; Silva-Send, N.; Tanaka, S.T.; Tyner, L.; *San Diego County Greenhouse Gas Inventory*, September 2008, <http://www.sandiego.edu/epic/ghginventory/>
- 2 Tarbuck, E.; Lutgens, F.; *Earth Science*; Tenth Edition, published by Prentice Hall, 2003, page 539
- 3 Vespa, M.; *Comments on Survey of CEQA Documents on Greenhouse Gas Emissions Draft Work Plan and Development of GHG Threshold of Significance for Residential and Commercial Projects*, Letter from Center for Biological Diversity to Elaine Chang, Deputy Executive Officer of Planning, Rule Development, and Area Sources of the South Coast Air Quality Management District; dated April 15, 2009. [http://www.aqmd.gov/docs/default-source/ceqa/handbook/greenhouse-gases-\(ghg\)-ceqa-significance-thresholds/year-2008-2009/ghg-meeting-10/ghg-meeting-10-cbd-comment-letter.pdf?sfvrsn=2](http://www.aqmd.gov/docs/default-source/ceqa/handbook/greenhouse-gases-(ghg)-ceqa-significance-thresholds/year-2008-2009/ghg-meeting-10/ghg-meeting-10-cbd-comment-letter.pdf?sfvrsn=2)
- 4 Hertsgaard, M; *Latino Climate Solution, the Nation*, Dec. 24/31, 2012.
- 5 Whitney E.; *How to Meet the Climate Crisis, UU World*, Volume XXVI No. 4, Winter 2012.
- 6 Adams, T.; Eaken, A.; Notthoff, A.; *Communities Tackle Global Warming, A Guide to California's SB 375*, June 2009, NRDC; <http://www.nrdc.org/globalWarming/sb375/files/sb375.pdf>

- 7 Hansen, James, Brief of Amicus Curiae, Exhibit A, Case3:11-cv-o22o3-EMC Document108 Filed 11/14/11. from <http://ourchildrenstrust.org/sites/default/files/Hansen%20Amicus%20.pdf>
- 8 State of California, Department of Finance, California County Population Estimates and Components of Change by Year, July 1, 2000-2010. Sacramento, California, December 2011, from <http://www.dof.ca.gov/research/demographic/reports/estimates/e-2/2000-10/>, the “[E-2. California County Population Estimates and Components of Change by Year — July 1, 2000–2010](#)”
- 9 Schwarm, Walter, Demographic Research Unit, California Department of Finance, *Total Population Projections for California and Counties: July 1, 2015 to 2060 in 5-year Increments*, from <http://www.dof.ca.gov/research/demographic/reports/projections/P-1/>, then “[Report P-1 \(County\): State and County Total Population Projections, 2010-2060 \(5-year increments\)](#)” link, to open or download the EXCEL spreadsheet file.
- 10 Henschman, Joseph; *Gasoline Taxes and Tolls Pay for Only a Third of State & Local Road Spending*; January 17, 2013; <http://taxfoundation.org/article/gasoline-taxes-and-tolls-pay-only-third-state-local-road-spending>
- 11 Bullock, M.; Stewart, J.; *A Plan to Efficiently and Conveniently Unbundle Car Parking Costs*; Paper 2010-A-554-AWMA, from the Air and Waste Management Association’s 103<sup>rd</sup> Annual Conference and Exhibition; Calgary, Canada, June 21-24, 2010. <http://sierraclub.typepad.com/files/mike-bullock-parking-paper.pdf>
- 12 Forester, J. *Effective Cycling*, MIT Press, 6<sup>th</sup> Edition, 1993.

## **KEYWORDS**

Driving, climate, mandates, S-3-05, SB 375, RTP, CEQA, Unbundled, GHG, CAFÉ, ZEVs