April 28, 2014

Michael Tollstrup

California Air Resources Board 1001 “I” Street

Sacramento, CA 95814

Submitted via CARB comments webpage: <http://www.arb.ca.gov/cc/scopingplan/2013comments.htm>

# RE: Comments on the California Air Resources Board (CARB) 2014 Draft First Update to AB 32 Scoping Plan (“Draft”) and It’s Supporting

**Appendix B, Appendix C (Working Paper on Transportation), and Appendix F (Draft Environmental Analysis)**

Dear Mr. Tollstrup:

I appreciate the opportunity to offer these transportation-related comments on the 2014 Draft First Update to the AB 32 Scoping Plan (“Draft”) and its Appendices B, C, and especially F, the Environmental Analysis for the Draft. I am a retired satellite systems engineer. I worked for 36 years at Lockheed Martin in Sunnyvale. I have a BSEE and an MSE in engineering. I am now the Transportation Chair, speaking for a large and well-known environmental organization on regional issues, in my region, here in San Diego. Climate-transportation is a systems engineering problem. I have published and presented four times with the Air and Waste Management Association on subjects relating to how this problem can be solved.

Given the shortcomings of the Draft, if it were to be adopted as the CARB 2014 Update to AB 32 Scoping Plan (“Update”), it would itself, contribute to the ultimate human catastrophe of destabilizing our climate. It fails to do what if must do, which is to ensure that cars and light duty trucks (“LDVs”) in California will support climate stabilization.

Note that the four documents identified in the subject of this letter (the Draft and its 3 appendices) will be referred to as the “Subject Documents”.

1. **THE SUBJECT DOCUMENTS FAIL TO STATE THAT ANY CALIFORNIA AB 32 GOBAL-WARMING SCOPING PLAN THAT FAILS TO ENSURE THAT LDVs SUPPORT CLIMATE STABILIZATION COULD DO GREAT AND IRREPARABLE ENVIRONMENTAL HARM, THEREBY MAKING IT A *PROJECT*, UNDER CALIFORNIA ENVIRONMENTAL QUALITY ACT LAW.**

For example, AB 32 requires that all measures that

* + would reduce greenhouse gas (GHG) emissions and
  + are technologically feasible and cost effective

be adopted. This is reasonable, given the severity of our climate crisis. It will be shown in this response letter that measures that would greatly reduce emissions from the car and light-duty (Light-Duty Vehicle or “LDV”) sector that are both technologically feasible and cost effective have been perhaps overlooked but most certainly not described or considered in this Draft. If the final version of the *California Air Resources Board (CARB) 2014 First Update to AB 32 Scoping Plan* (“Update”) continues to ignore these measures, it will send a message to the world that California perhaps cares more about pleasing its oil industry and its road-building lobby than it cares about helping to solve the climate crisis. It is unreasonable to expect China and India, for example, to stop building coal-fired electrical generating plants, if we continue to widen our freeways, as we have done for the last six decades (helping to produce a “drive everywhere” life style, a high average commute length, and a high level of per-capita driving and CO2\_e emissions).

As another example, if this Draft adopts CO2\_e emission-reduction goals that are insufficient to support climate stabilization, this would put the state of California on a path to climate failure. The negative impact of this would be unacceptably large.

1. **THE SUBJECT DOCUMENTS FAIL TO DESCRIBE THE FUNDAMENTAL NATURE OF THE CLIMATE THREAT WE NOW FACE, WHICH IS NECESSAY, SO READERS CAN UNDERSTAND WHAT MEASURES AND LEVEL-OF-EFFORT ARE APPROPRIATE.**

Genocide requires an inner circle of dangerously misguided (some would say evil) leaders and a large number of complicit government enablers. Climate destabilization, which would result in a “devastating collapse of the human population” (quote taken from the June 2008 issue of *Scientific American*, on its Page 100, within its featured article, *The Ethics and Economics of Climate Change*) is far worse than genocide, for it will most likely kill off most life forms on our currently-magnificent, teaming-with-life, planet. Facilitating this unbelievably gruesome process requires many sets of misguided leaders and complicit government enablers. With this Draft, CARB is mistakenly playing the role of a complicit government enabler. This is unacceptable.

Please consider how this Draft talks around climate destabilization’s unbelievably-large potential for harm.

On Page 1, it says, “ global warming poses a serious threat to the economic wellbeing, public health, natural resources and environment of California”. Killing most life forms on the planet is the reality and the selected words are misleading. The words used are closer to the truth if they are applied to climate *success*, given our current prospects. climate *failure* (destabilization) will be an entirely different outcome. “Economic health” has no meaning if there are no people left.

On Page 2, it says, “ catastrophic climate change”. However, why climate change could be “catastrophic” is never explained in plain English. Who are the authors trying to protect? If they are concerned that children might read the Draft and they don’t want to traumatize them, they should consider that if children understood what was going on, they would rather have the facts fully explained, as disturbing and distasteful as they are.

On Page 6, it says “ climate goals” and “ climate objectives”. However, given our predicament, what is needed is a climate *requirement*, where that *requirement* is to achieve the greenhouse gas (GHG) reductions that, if achieved by the world, going forward from 2014, will guarantee climate stabilization at a livable level.

On Page 6, it says, “In addition to our climate objectives, California must also meet federal clean air standards.” While I don’t take sickness and life-ending cancer lightly, this is still similar to saying that in addition to not hitting an ice berg and sinking, the Titanic should prepare healthy meals for everyone. Statistically speaking, healthy meals will extend life and reduce the likelihood of life-ending sickness. Sinking in the frigid waters of the Atlantic Ocean was an outcome of a very different nature. Something to the effect of “In meeting our climate *requirements*, it so happens that we will also meet our federal clean air standards” would be appropriate.

On Page 9, it says, “ avoid the most severe impacts of climate change.” What are those “most severe impacts”? Again, who is the Draft trying to protect, the oil companies or the children?

On Page 11 it says, “ avoid the worst impacts of climate change .” However, the Draft never explains what those impacts might be. Will we only have to turn up our air conditioners or is it something more serious?

On Page 13 is says, “ the first Climate Change Adaptation Strategy for California .” However, nowhere is the key fact stated that without sufficient mitigation, no adaptation is possible. Without sufficient mitigation, any and all adaptation strategies will be overwhelmed. Any adaptation strategy must explain what climate outcome is being assumed.

On Page 14 is says, “ 2o C poses severe risks to natural systems and human health and well-being.” Nowhere in the Draft are these “severe risks” explained.

1. **THIS DRAFT FAILS TO EXPLAIN WHAT DESTABILIZATION IS**

Destabilization (sometimes called the tipping point) occurs when positive feedbacks take over and we lose all control, as the climate proceeds to warm so much that the planet is uninhabitable to most of its current life forms, including our own.

Positive feedback is any process where the warmer it gets, the more the process causes warming.

Two examples are

* the loss of ice mass that reflects a significant amount of the solar radiation it receives, because the warmer it gets, the less ice there is to reflect solar radiation and
* the melting of what was permafrost, giving off methane gas, a powerful greenhouse gas (GHG), because the warmer it gets, the more methane gas is put into the atmosphere.

These two positive feedbacks are underway and will be accelerated as more heat is trapped by our ever-increasing, elevated levels of atmospheric CO2. There is probably still hope that we can avoid destabilization. Destabilization must be avoided because it is such a bad outcome (loss of most life, including our own). This justifies doing hard work, making hard choices, and adopting significant changes.

1. **THE SUBJECT DOCUMENTS FAIL TO STATE THAT SUPPORTING CLIMATE STABILIZATION MUST BE, BY THE VERY NATURE OF DESTABILIZATION, A HARD AND FAST *REQUIREMENT*, NOT A GOAL AND NOT AN OBJECTIVE.**

Stating the obvious, destabilization must be avoided at all costs, because it is so dire. Therefore, climate stabilization must be supported. Achieving that support must be a requirement.

1. **THE SUBJECT DOCUMENTS FAIL TO TAKE ANY POSITION WHATSOEVER, ON WHAT CO2\_e REDUCTION RATES ARE NEEDED TO ACHIEVE SUPPORT FOR CLIMATE STABILIZATION**

The Draft presents the Governor’s Executive Order S-3-05 (“S-3-05”) and its three targets, on Page 1, where it also states that it was designed such that if the world’s developed nations had achieved those targets, the atmospheric levels of CO2\_e would be capped at 450 PPM, in the year of 2050. This fact is informative and historically important. However it is now 2014 and we know that in the nine years since the formulation of S-3-05, the industrialized world has failed to achieve the S-3-05 trajectory. The Draft makes it clear that achieving S-3-05 is not just hitting the targets, but is instead progressing from target to target with each year’s CO2\_e emission levels near or, better yet, below the straight-line that connects the target points, as shown in the Draft’s Figure 6. This is true because what matters the most is the area under the achieved sets of year-by-year emission levels, which correspond to the net CO2\_e emitted. For example, on the Draft’s Figure 6, the blue-dashed line is preferable to the red line, because the area under that line, the total CO2\_e emitted, is less.

However, at this point, it is clear to any climate realist that the S-3-05 target for 2050 is now too late, because, besides other reasons, the world’s emissions, from 2005 to 2014 have put amounts of CO2\_e into the atmosphere that far exceed what was allowed under S-3-05. The draft never makes a definitive statement about what must be done, given this situation. What targets are now needed? The Draft never states anything on that topic, but proceeds as if S-3-05 is still sufficient.

1. **THE SUBJECT DOCUMENTS ATTEMPT TO GET THE READER TO ACCEPT THE FALSE NOTION THAT S-3-05 IS A LEGITMATE REQUIREMENT TO SUPPORT CLIMATE STABILIZATION.**

That S-3-05 is somehow sufficient is an absurd conclusion, based on the statements that appear in the Draft and also when considering other facts surrounding S-3-05. As stated at the top of the Draft’s Page 2, S-3-05, if it had been achieved by the world, would have stabilized the atmospheric level of CO2\_e at 450 PPM[[1]](#footnote-1) by the year of 2050 and this would have *reduced the likelihood* (emphasis added to point out that there is no assurance, rather, it is simply stated that the likelihood is reduced and furthermore, how *muc*h the likelihood is reduced is not stated) of catastrophic climate change. It also aimed for “only” a 2°C increase in temperature, from preindustrial temperature. This “aiming” generally means that there would have been a 50% chance that the increase would be less than 2oC and there would have been a 50% chance that it would have been larger than 2°C. However, even this discussion of what might have been is overly optimistic. On Page 14, it is stated that 2oC poses a “severe risk to the natural systems and human health and wellbeing.” However all of this hope that S-3-05 would have been sufficient was probably misplaced all along. As shown on Page 14, a 2009 study which “synthesized many studies on climate” concluded that we would have needed to stabilize the atmospheric levels of CO2\_ at 400 PPM, and that even if we did that, there would have been a 20% chance of exceeding 2°C. This is a good indication of how much trouble we are in because the current atmospheric level of CO2\_e exceeded 400 PPM, several months ago. But it gets even worse. A recent paper by what may be the world’s best climate scientists, including our own pre-eminent climate scientist, Dr. James Hansen, states that the 2°C target has always been too high and may in fact cause “irreparable harm to nature and future generations”.

1. **A REASONABLE CALIFORNIA TARGET TO SUPPORT CLIMATE STABILIZATION AT A LIVABLE LEVEL IS 80% BELOW THE 1990 LEVEL BY 2030, NOT 2050, AS DEFINED IN S-3-05.**

Reference 1, using an Amicus Brief from James Hansen and other climate scientists, concludes that if California wants to set an example for the world, which is the only responsible action, given what we know, the correct target beyond 2020 is to reduce emission down to 80% below our 1990 levels by 2030. This is a full 20 years sooner than the third S-3-05 target. (Reference 1 also develops a set of requirements for California cars and light-duty trucks so that they can support this target.)

1. **THE SUBJECT DOCUMENTS LEAVE OUT THE CRITICAL INFORMATION THAT CARB’S SB-375 TARGETS TO THE METROPOLITAN PLANNING ORGANIZATIONS (MPOs) FAILED TO EVEN SUPPORT S-3-05**

As an example, this failure will be shown for the MPO named SANDAG, the San Diego Association of Governments. First, the target CARB gave to SANDAG is shown in this Wikipedia link, <http://en.wikipedia.org/wiki/SB_375>. As shown there, it was just 13%, which is exactly what SANDAG requested, so that they could continue to build all of their planned freeway expansions. However, using the car-efficiency data compiled by Steve Winkelman, Reference 1 derives the SB-375 target for 2035 that supports S-3-05. It is 35.1%. This derivation is shown, in painstaking detail, on Pages 3 through 9 of Reference 1, in its section titled, *The Required Driving Reduction for San Diego County, for 2035, Using Winkelman’s LDV and Fuel Efficiency Values and S-3-05*.

1. **THE SUBJECT DOCUMENTS NEED TO BE CHANGED SO THAT IT ESTABLISHES AND APPLIES NEW SB 375 TARGETS TO THE MPOS THAT WILL, ALONG WITH A SET OF REQUIREMENTS TO CLEAN UP OUR FLEET OF LDVS, SUPPORT CLIMATE STABILIZATION.**

Reference 1 does this very thing. Reference 1 has been peer reviewed and accepted by the Air and Waste Management Association (AWMA). It will be published as part of the proceedings of AWMA’s yearly conference, this June, in Long Beach. The paper will be presented there in a panel discussion.

1. **THE SUBJECT DOCUMENTS FAIL TO DISCLOSE THAT THE ACT OF PROVIDING SB 375 TARGETS HAS SIGNIFICANT ENVIRONMENTAL CONSEQUENCES AND SHOULD HAVE BEEN CONSIDERED A PROJECT UNDER CEQA AND IF IT HAD BEEN, THE FACT THAT THE TARGETS IGNORED S-3-05 COULD HAVE BEEN EXPOSED AND PERHAPS PREVENTED.**

The Draft needs to provide this information. That will make it clear that CARB is now going to provide the MPOs with SB 375 targets for 2035 that will support stabilization. As will be shown, CARB can also provide the MPOs with the help they need to ensure that the LDV sector will support climate stabilization.

1. **THE SUBJECT DOCUMENTS OMIT THE FACT THAT SANDAG, FOLLOWING CARB’S LEAD OF IGNORING S-3-05, WAS FOUND TO BE IN VIOLATION OF CEQA AND IN FACT THE FINAL RULING AGAINST SANDAG, IN SUPERIOR COURT, STATED THAT THE EIR FOR THEIR RTP WAS “IMPERMISSIBLY DISSMISSIVE OF S-3-05”.**

SANDAG, following the bad example set by CARB, of ignoring S-3-05 and its responsibility to support stabilization is unapologetic and is in fact appealing the case, using money that should instead be used to improve active transportation and transit. Keeping these important and relevant facts hidden from the reader is part of a criminal conspiracy to protect the parts of the status quo that have been a large contributor to our current climate crisis, as much as possible and as long as possible,.

1. **AFTER ESTABLISHING THE CO2\_E REDUCTIONS REQUIRED TO SUPPORT CLIMATE STABILIZATION, AS SHOWN IN VII ABOVE, THE SUBJECT DOCUMENTS MUST DEVELOP AND ADOPT A PLAN, FOR EACH EMITTING SECTOR OF THE ECONOMY, TO ACHIEVE THOSE REDUCTIONS.**

Climate stabilization is, among other things, a math problem. It is certainly a systems engineering problem. The task described in XII should be viewed as the primary purpose of the subject documents. The LDV sector is complicated by the fact that car efficiency (including the low-carbon fuel standard, LCFS) is controlled primarily by the state but driving reduction strategies are often under local control. However, CARB, thanks to SB 375, has the ability to apply the needed driving reductions to the MPOs. Therefore, the Subject Documents needs to have an overall plan to ensure that LDVs will support stabilization. Reference 1 shows such a plan. In fact, it develops two sets of requirements. One is called “Heroic Measures”, due to its required rapid adoption of Zero Emission Vehicles (ZEVs) into California’s fleet. It also has an “Extra Heroic Measures” set of requirements, created to satisfy those that want to continue to support the 2005 level of per-capita driving. Most would agree that the “Extra Heroic Measures” rate of ZEV adoption is not achievable. Reference 1 is only a start and only an example of the work that must be done.

1. **FOR LDVS, A SET OF MEASURES MUST BE DEVELOPED AND INCLUDED IN THE SUBJECT DOCUMENTS THAT WILL ACHIEVE THE NEEDED DRIVING REDUCTIONS TO SUPPORT CLIMATE STABILIZATION**

An example of such a list is given in Reference 1, on its Pages 17 to 20. All of the measures are technologically feasible and cost effective and therefore must be included in the Update and in the MPOs SCS (under SB 375, these are the Sustainable Communities Strategies, containing only measures that would be feasible for the MPO or for the MPO’s local governments) and APS (under SB 375, these are the Alternative Planning Strategies, containing only measures that would be infeasible for the MPO or for the MPO’s local governments), as part of their next Regional Transportation Plan (RTP).

1. **THE SET OF MEASURES IDENTIFIED IN XIII ABOVE MUST INCLUDE A COMPREHENSIVE ROAD-USE FEE PRICING AND PAYOUT SYSTEM**

This measure is identified on Page 18 of Reference 1.*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 to the greatest extent possible; 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 at least critical driving and perhaps all 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 (currently just gas taxes and tolls) are not enough to cover road costs as shown in an article *Gasoline Taxes and Tolls Pay for Only a Third of State & Local Road Spending*, viewable here, <http://taxfoundation.org/article/gasoline-taxes-and-tolls-pay-only-third-state-local-road-spending>. In fact, the article shows that in California, only 22.7% of state and local road spending is covered by user fees.

More than any other California agency, CARB should be aware of the fact that as our fleet of cars gets more efficient, there will be a continuously dwindling amount of gas tax revenue available. This means that our indefensibly bad situation will get worse. The large number of ZEVs needed mean that gas tax revenues will drop precipitously. What is the CARB recommendation to solve this obvious problem? The Draft indicates a desire to increase fairness, but what is fair about forcing those that drive less to subsidize those that drive more? Obviously, subsidizing driving increases the *amount* of driving and thus increasing the CO2\_e emissions.

It is impossible to believe that CARB has been unaware of these facts, which have been noted for decades. The first significant thing that Republican Congressman Ray LaHood said after he became President Obama’s first Secretary of Transportation is that the gas tax was inadequate and it was time for what he called a “VMT Fee”. (“Road-Use Fee” is a better description since the rate per mile would need to vary depending on a handful of variables, such as type of car.) There is nothing technologically infeasible or that is not cost effective about this measure.

This situation shows that CARB has been ignoring a technologically feasible and cost effective measure to reduce emissions, a clear violation of AB 32. The first Resolution shown in this letter’s Appendix A contains more details on this measure.

1. **THE SET OF MEASURES IDENTIFIED IN XIII ABOVE MUST INCLUDE A DESCRIPTION OF A PLAN TO UNBUNDLE THE COST OF MOST PARKING THAT IS NOW BUNDLED-COST PARKING, STARTING WITH GETTING DEMONSTRATION PROJECTS THAT DEVELOP AND INSTALL REDUCED-FEATURED SYSTEMS**

Reference 2 explains how a reduced-feature demonstration project could be developed and implemented. Reference 2 shows that the concept is feasible and cost effective. It would also increase fairness, transparency, and economic choice. Since its potential to reduce driving is large, it would be unacceptable for this measure to be left out of the Subject Documents. The second Resolution shown in Appendix A contains more details on this measure.

The ultimate and needed change would be the full implementation, as described here, <http://www.sandiego.gov/environmental-services/pdf/sustainable/parkingcosts.pdf>.

1. **APPENDIX D’S TABLE 2-2, ON PAGES 15 THROUGH 17 IS DEFICIENT IN THAT IT ASSUMES THERE IS NO CARB RESPONSIBILITY TO IDENTIFY BOTH A TARGET THAT WOULD RELIABLY SUPPORT CLIMATE STABILIZATION AND A SET OF MEASURES THAT WOULD ENSURE THAT THE LDV SECTOR ACHIEVES THAT CLIMATE STABILIZATION TARGET**

There is nothing in this table about how these measures might or might not support climate stabilization. It is clearly the work of an organization that does not realize that it has a responsibility to identify what target will support climate stabilization and what transportation measures will cause the LDV sector to achieve the target. Reference 1, which is also Appendix B in this letter does both of these things: it identifies the target and derives a set of actions to achieve the target.

CEQA requires that negative impacts be considered. At a minimum this would require that climate destabilization be accurately described in terms of how bad it will get with insufficient reductions in the burning of fossil fuels (extinction of most species) and what it would take to support the avoidance of such destabilization. Table 2-2 contains measures with no accounting for how much they might collectively reduce CO\_2 emissions. However, Reference 1 shows that is not even close to what is needed. Sadly, thanks to the impermissibly deficient nature of the Subject Documents, the reader has no way of knowing how far Table 2-2 is from achieving support for climate stabilization at a livable level.

1. **APPENDIX D’S TABLE 2-2 SHOWS CARB STILL DOES NOT KNOW THAT WHEN SANDAG WAS FOUND TO BE “IMPERMISSIBLY DISMISSIVE OF S-3-05”, EVEN THOUGH IT MET ITS SB-375 TARGETS, THAT WAS A CLEAR INDICATION THAT CARB SHOULD HAVE PROVIDED TARGETS THAT WOULD HAVE, AT THE VERY LEAST, SUPPORTED S-3-05.**

This in no way excuses SANDAG. Clearly CARB and SANDAG engaged in a conspiracy to betray the public trust by defeating the intent of SB 375, which is to support climate stabilization. They did this by pretending that ignoring the S-3-05 trajectory, which was thought by some to provide a path to climate stabilization, was responsible behavior. Behavior which leads to climate failure is irresponsible and unacceptable. Even now, Table 2-2’s first sentence, under the “Transportation, Land Use and Housing” heading, says they will do a “technical review” to “inform the need” for revisions” and the “appropriate timing” of the revisions. Of course the climate-killing targets need to be fixed. This was pointed out in 2010 in Reference 4. The first 30 pages of Reference 4 is shown as Appendix D. Since SB 375 does not allow strengthening the targets for 8 years, CARB needs to admit its crime against humanity, and ask the legislature to pass a law to allow them to impose climate-stabilization-supporting targets to replace the climate-killing targets they gave the MPOs back in 2010.

1. **TABLE 2-2 MEASURES INCLUDE NOTHING ABOUT IMPROVING THE WAY WE PAY FOR ROADS AND PARKING, AS IF MONEY MEANS NOTHING AND AS IF CARB STAFF IS INCAPABLE OF NOTICING THAT THE GAS TAX ACCOUNTS HAVE A POOR FUTURE, SINCE WE MUST HAVE SUBTANTIALLY CLEANER CARS AND AS IF CARB STAFF IS INCAPABLE OF NOTICING THAT BUNDLING THE COST OF PARKING, AT MOST LOCATIONS, IS INCREASING THE USE OF LDVS FOR TRANSPORTATION AND, FINALLY, AS IF CARB NEVER RECEIVED REFERENCE 4.**
2. **THE FOUR “COMPLIANCE RESPONSES” SHOWN IN APPENDIX E, JUST AFTER ITS TABLE 2-2, REPEAT THE UNACCEPTABLE OVERSIGHTS THAT ARE IDENTIFIED IN XVII ABOVE.**
3. **PAGE 10 OF ATTACHMENT 3 OF APPENDIX F HAS A DEFICIENT, COVER-UP DESCRIPTION OF THE DISASTEROUS ENVIRONMENTAL CONSEQUENCES OF GIVING THE MPOS THE EXACT TARGETS THEY REQUESTED, TARGETS THAT IN NO WAY CAME EVEN CLOSE TO SUPPORTING THE S-3-05 TRAJECTORY.**

**Sincerely,**

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Mike Bullock  
California Democratic Party Delegate, 76 AD (author of 2 adopted resolution and 5 Platform changes)

Elected Member of the San Diego County Democratic Party Central Committee (author of 5 adopted resolutions)

Satellite Systems Engineer, 36 years (Retired for 7 years)

Air and Waste Management Association published and presented (or to be presented; the first will be presented in June) papers:

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

Author, ***A Climate-Killing Regional Transportation Plan Winds Up in Court: Background and Remedi****es*

Co-author, ***A Plan to Efficiently and Conveniently Unbundle Car Parking Cost*** <http://www.sandiego.gov/environmental-services/pdf/sustainable/parkingcosts.pdf>

Memberships (not denoting support for this email):

Sierra Club San Diego's 2011 Volunteer of the Year

Oceanside Bicycle Committee

SVBC

CirculateSD

CNFF

Action4Oceanside

**References**

1. Bullock, M.; *The Development of California Light-Duty Vehicle (LDV) Requirements to Support Climate Stabilization: Fleet-Emission Rates & Per-Capita Driving*; Paper 2014-30793-AWMA, from the Air and Waste Management Association’s 2014 Annual Conference and Exhibition; Long Beach, California, June 24-27, 2014. (Also shown as Appendix B)
2. Bullock, M.; *Equitable and Environmentally-Sound Car Parking Policy at Schools*; July 20, 2011. Unpublished. Available from [mike\_bullock@earthling.net](mailto:mike_bullock@earthling.net), upon request. (Also shown as Appendix C)
3. 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 103rd Annual Conference and Exhibition; Calgary, Canada, June 21-24, 2010. <http://sierraclub.typepad.com/files/mike-bullock-parking-paper.pdf>
4. *Comments on the Draft GHG Reductions, Pursuant to Senate Bill 375*, July 21, 2010, Letter summited to CARB regarding their targets to MPOs, from M. Bullock (Also shown as Appendix D.)

**Appendix A, Two Resolutions Adopted by the Democratic Club of Carlsbad and Oceanside (DEMCCO) in 2014**

***A Privacy-Protecting, Road-Use-Fee Pricing & Payout System to Help Solve Climate, Congestion, Deferred Road Maintenance, and the Social Inequity of Using General Funds to Maintain Roads, Since that Money is Needed for Such Things as Transit, Food Stamps, and Education***

**WHEREAS**, greenhouse gas (GHG) emissions must be significantly reduced; about 35% of California’s GHG is caused by on-road vehicles; and, given prospects for fleet efficiency, to reach climate stabilization requirements, it will be necessary to reduce driving; and

**WHEREAS,** in California, user fees (gas tax and/or tolls) only total to 22.7% of the amount spent on roads; having the true cost of road use hidden increases driving, adding significantly to air pollution, congestion, sprawl, and GHG emissions; a 2011 assessment conducted by the California Transportation Commission found that 58 percent of the state’s roads require rehabilitation or pavement maintenance, 20 percent of bridges need major or preventive maintenance, and 6 percent of bridges require complete replacement; construction jobs are needed; and on July 11, 2009, Sierra Club California passed a resolution supporting a “comprehensive road-use fee pricing system”; and

**WHEREAS,** the “gas tax” is currently our most significant road-use fee; state-mandated increases in fleet mileage and battery-electric vehicles will result in declining “gas tax” revenue; and a “gas tax” cannot properly account for time, place, driver income, vehicle weight, vehicle pollution level, or roadway congestion level;

**THEREFORE, BE IT RESOLVED,** that DEMCCO supports a road-use fee pricing and payout system that (1) would cover all road-use costs, including the environmental and health costs caused by driving; (2) could still include a fuel tax or fee; (3) would mitigate impacts on low-income users; (4) would protect privacy; (5) would include congestion pricing when that technology becomes feasible; (6) would keep the per-mile price incentive to drive energy-efficient cars at least as large as it is with today’s fuel excise tax; and (7) would send its earnings to all citizens and institutions that are losing money under the current system, with the goal being to achieve a full and just compensation.

**BE IT FURTHER RESOLVED,** that this support be communicated to our San Diego County Democratic Party Central Committee.

*Note: The information supporting the first sentence in the second “Whereas” statement comes from* [*http://taxfoundation.org/article/gasoline-taxes-and-tolls-pay-only-third-state-local-road-spending*](http://taxfoundation.org/article/gasoline-taxes-and-tolls-pay-only-third-state-local-road-spending)*.*

**Funding for a Demonstration Project of an Equitable and Environmentally-Sound Car-Parking Policy**

**WHEREAS,** (1) our greenhouse gas (GHG) emissions must be controlled, because stabilizing our climate is critical to our future; (2) about 35% of California’s GHG is caused by on-road transportation; (3) properly reducing parking subsidies and revealing the actual cost of parking to drivers would (a) reduce GHG emissions, air-pollution, and congestion, by reducing vehicle trips and (b) give employees more control over their potential earnings, and (c) give renters and consumers more control over their costs; and

**WHEREAS,** (1) government policy should not promote driving; (2) the general free-market principle, that people should not be forced to pay for something they don’t use, is violated, if non-drivers lose money due to parking facilities; (3) “free” employee parking is paid for by lower wages for all workers, including those who do not drive; “free” parking at an apartment complex can easily increase rents by $50 dollars per month, for all renters, even those not owning a car; and (4) eliminating parking subsidies improves social equity; and

**WHEREAS**, (1) methods to bill car owners based on when and where their car was parked, to include such factors as the income of the driver and their “need to drive”, could soon, if not now, be implemented, while having safeguards to fully protect privacy and (2) fair methods of earnings distribution could be devised, such as, for employee parking, earnings being given directly to employees in proportion to their time spent at the workplace;

**THEREFORE, BE IT RESOLVED,** that DEMCCO supports funding the development and prototype installation of car-parking systems with at least the last two features (numbered 7 and 8), so as to demonstrate useful feasibility, with the full set of features as follows: (1) have full-cost base pricing; (2) have congestion pricing; (3) have charge and payout policies that will minimize money lost by non-drivers, due to parking facilities; (4) will support sharing of parking facilities; (5) will provide retrievable knowledge of the use of each parking space; (6) have a data interface that will support on-demand predictions of parking-space price and availability; (7) have automatic car detection; and (8) will do efficient mailing of invoices, containing both parking charges and parking earnings.

**BE IT FURTHER RESOLVED,** that this support be communicated to our San Diego County Democratic Party Central Committee.

**Appendix B, Reference (1) of this letter**

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

**Paper #30793**

**Mike R. Bullock**

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**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 CO2 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**1**.

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**2**: First, our combustion of fossil fuels adds “great quantities” of CO2 into our atmosphere. Second, atmospheric CO2 traps heat.

**California’s First Two Climate Mandates**

California’s Governor’s Executive Order S-3-05**3** 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 CO2\_e 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**4** 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**5** 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 CO2 (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 CO2, 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**3,4,5**.

Figure 2 shows the average yearly temperature with respect to the 1960-to-1990 baseline temperature (in blue). It also shows atmospheric levels of CO2 (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 CO2. The large variations in temperature are primarily due to the random nature of the amount of solar energy being received by the earth.

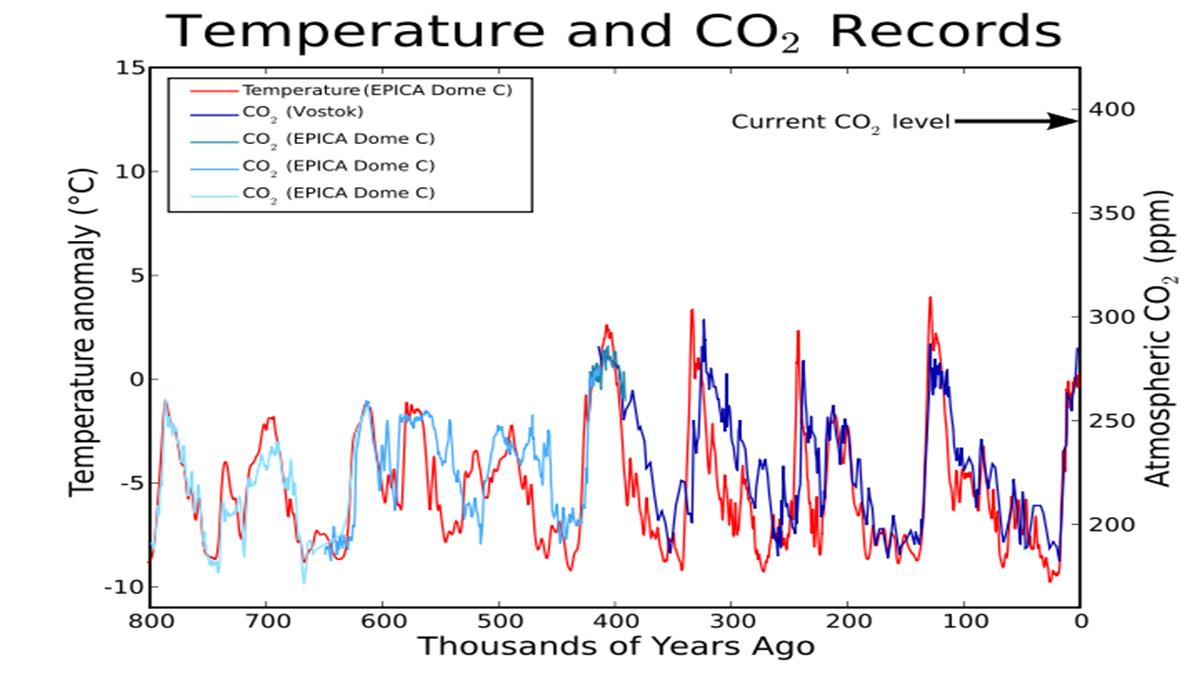
**Further Background: CALIFORNIA’S SB 375 AND A PREVIOUS CALCULATION OF how much we CAN drive**

As shown in the Introduction, LDVs emit significant amounts of CO2. 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***

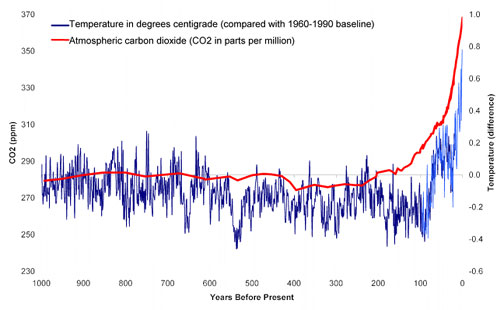
Under SB 375, the California Air Resources Board (CARB) has given each Metropolitan Planning Organization (MPO) in California driving-reduction targets, for the years 2020 and

**Figure 1. Atmospheric CO2 and Mean Temperature from 800,000 Years Ago**



CO2 currently over 400 PPM PPM

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



Current level > 400 PPM

S-3-05’s Goal is to cap C02 at 450 PPM

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>.

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**6**. The two needed values are the factor with respect to year 2005 of CO2 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 CO2 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 CO2 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 CO2 emitted from each gallon of fuel burned),
* the fleet-average CO2 per mile driven (using the CO2 per gallon burned without accounting for “L”),

**Table 1. Variable Definitions**

|  |  |
| --- | --- |
| **Variable Definitions** | |
|  | **LDV Emitted C02, in Year “*k*”** |
|  | **Low Carbon Fuel Standard (LCFS) Factor that reduces the**  **Per-Gallon CO2 emissions, in Year “*k*”** |
|  | **LDV CO2 emitted per mile driven, average, in Year “*k*”, not**  **accounting for the Low Carbon Fuel Standard (LCFS) Factor** |
|  | **LDV CO2 emitted per mile driven, average, in Year “*k*”, accounting**  **for the Low Carbon Fuel Standard (LCFS) Factor** |
|  | **Population, in Year “*k*”** |
|  | **Per-capita LDV driving, in Year “*k*”** |
|  | **LDV Driving, in Year “*k*”** |
|  | **LDV Mileage, miles per gallon, in Year “*k*”** |
|  | **LDV Equivalent Mileage, miles per gallon, in Year “*k*” accounting for the Low Carbon Fuel Standard (LCFS) Factor, so this is Mk/Lk** |
| **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**

|  |  |
| --- | --- |
| **Two Conventions: Variable in a Given Year and Factors to**  **Compute a Variable’s Value in Year “*k*” from it’s**  **Value in Year “*i*”** | |
|  | **Variable “*X*” in year “*i*”** |
|  | **Ratio of the value of “*X*” in year “*k*” to the value of “*X*” in Year “*i*”, which**  **could also be expressed as . 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.)

**= (Eq. 1)**

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

**= (Eq. 2)**

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

**= (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

**(Eq. 4)**

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

**(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 CO2 Emitted from Personal Driving (the Blue Line), where that CO2 is a Function (the**

**Product) of the California-Fleet-Average CO2 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>, 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.

**(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 + [(.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 + [(.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.

.525 **(** .685 0.9 1.313 **)**

Therefore, = .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:

.649 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.

**(Eq. 7)**

From Figure 3,

**(Eq. 8)**

Multiplying the equations together give the following:

**(Eq. 9)**

Using the convention shown in Table 2 gives this equation:

**(Eq. 10)**

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

The number of pounds of CO2 per mile driven, defined as “C” in Table 1, is equal to the number of pounds of CO2, 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:

**(Eq. 11)**

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

**(Eq. 12)**

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

**(Eq. 13)**

**(Eq. 14)**

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

**(Eq. 15)**

This shows that to get the factor to convert CO2-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.

**(Eq. 14)**

**(Eq. 15)**

Multiplying these equations together results in Equation 16.

**(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.

**(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:

**(Eq. 18)**

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

**= (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

**(Eq. 20)**

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

**(Eq. 21)**

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

**(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.

**(Eq. 23)**

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

**(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,

**(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.

**(Eq. 26)**

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

**(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>

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.c2es.org/federal/executive/vehicle-standards#ldv_2012_to_2025>. They are the LDV Corporate Average Fleet Efficiency (CAFÉ) values enacted into law in the first term of President Obama. From 2025 to 2030, it is assumed that the yearly ICE improvement in CAFÉ will be 2.5 MPG.

**Figure 6 Mileage Values From the PEW Environment Group**

**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 Lk that is shown in Table 1.

**(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**  **LYear** | **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** |
| **Sum of Gallons:** | | | | | | **54.29** |
| **Miles = 100\*Sum(f’s):** | | | | | | **1500** |
| **MPG = Miles/(Sum of Gallons):** | | | | | | **27.63** |

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-C02 sources. The variables defined in Table 4 are used.

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

|  |  |
| --- | --- |
| **Variable** | **Definition** |
|  | **ZEV Equivalent mileage** |
|  | **ZEV Equivalent mileage if the electricity is from renewables** |
|  | **ZEV Equivalent mileage if the electricity is from fossil fuels** |
|  | **fraction of electricity generated from sources not emitting CO2** |
| ***G*** | **Gallons of equivalent fuel used** |
| ***D*** | **Arbitrary distance travelled** |
| ***Num*** |  |
| ***Den*** |  |

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.

**(Eq. 29)**

**(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.

**(Eq. 31)**

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

**(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**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | **r** | **1-r** | **Num** | **Den** |  |
| **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** |
|  | **Distance travelled by ICE vehicles** |
|  | **Distance travelled by ZEVs** |
|  | **Gallons of Equivalent fuel used by ICE vehicles** |
|  | **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:

**(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.

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | **ICE Parameters and Calculations** | | | | | | **ZEVs** | | | **Yearly Totals** | | |
| **CAFÉ MPG** | **LCFS** | **Eq.**  **MPG** | **f** |  |  | **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: l:** | | | | | | | | | | ***111.12*** | | |
| Sum of ZEV Miles = **860**. Fraction of Miles Driven by ZEVs = **68.9%** | | | | | | | | | | | | |

**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 is equal to 1.0.

**MPG (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>, 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.

**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** |  |  | **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: l:** | | | | | | | | | | ***162.27*** | | |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Cases** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **20292** | **2030** |
| **HM** | .00 | **.00** | **.00** | **.05** | **.10** | **.25** | **.40** | **.55** | **.70** | **.85** | .95 | .95 | .95 | .95 | .95 | .95 |
| **EHM** | .00 | **.10** | **.30** | **.50** | **.70** | **.90** | **.95** | **.95** | **.95** | **.95** | .95 | .95 | .95 | .95 | .95 | .95 |

User fees (gas taxes and tolls) are not enough to cover road costs**10** 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.

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**11** 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**12**. Most car-bike accidents are caused by wrong-way riding and errors in intersections; the clear-cut-hit-from-behind accident is rare**12**.

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**12**) 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> 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>, 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**](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.

**ABREVIATIONs AND aCRONYMS**

**AB 1493** California’s Assembly Bill 1493 **ICE** Internal Combustion Engine LDV

**AB 32** California’s Assembly Bill 32 **kW-h** Kilo Watt-hour

**APS** Alternative Planning Strategy **LCFS** Low Carbon Fuel Standard

**CAFE** Corporate Average Fleet Efficiency **LDV** Light-Duty Vehicle

**CARB** California Air Resources Board **MPO** Metropolitan Planning Organization

**CBD** Center for Biological Diversity **Pavley** Senator Pavley’s AB 1493

**CEQA** California Environmental Quality Act **PPM** Parts per Million

**CCAP** Center for Clean Air Policy **RPS** Renewable Portfolio Standard

**CNFF** Cleveland National Forest Foundation **rtp** Regional Transportation Plan

**SB 375** California’s Senate Bill 375 **S-3-05** Governor’s Executive Order S-3-05

**CO2**Carbon Dioxide **SANDAG** San Diego Association of

**CO2\_e** Carbon Dioxide Equivalent GHG Governments

**EHM** “Extra Heroic Measures” LDV Case **SCS** Sustainable Community Strategy

**GEO** Governor’s Executive Order **TransNe**t San Diego County sales tax

**GHG** Greenhouse gas **URL** Universal Resource Locator

**GW-h** Giga Watt-Hours **VMT** Vehicle Miles Travelled

**HM** “Heroic Measures” LDV Case **ZEV** Zero Emission Vehicle LDV

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**Keywords**

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

**Appendix C, Reference (2) of this letter**

**Equitable and Environmentally-Sound**

**Car Parking Policy at Schools**

By Mike Bullock [mike\_bullock@earthlink.net](mailto:mike_bullock@earthlink.net)

July 20, 2011

**Introduction**

This paper describes a parking policy that distributes the benefit of parking to all students of driving age, regardless of how often they choose to drive. It does this by

* charging a fair price for the parking, per unit of time parked,

and by

* giving the earnings to all students of driving age, in proportion to the time they spend at the school.

This same method is applied to the school’s employees.

Reference 1 describes a more comprehensive policy that will efficiently and conveniently unbundle the cost of parking in all circumstances. It is available at the following URL: <http://www.sandiego.gov/environmental-services/pdf/sustainable/parkingcosts.pdf>.

The system described herein is less complex because it does not include congestion pricing, price predictions, or policies that are unique to on-street parking. These features can be eliminated, because it is assumed that there will be an adequate supply of parking, so no congestion pricing is needed; that the price can be relatively stable, so no price predictions are needed; and finally, that students and employees can be successfully required to park only at the school, so there is no need for new, on-street parking policies, designed to protect adjoining neighborhoods from the intrusion of additional parked cars.

**Rationale**

This system of “unbundled parking cost” will allow all stakeholders to see the actual value of the parking. It will reduce driving to the school. Less driving will reduce traffic congestion, air pollution and greenhouse gas (GHG) emissions.

Parking is expensive to provide. Therefore, if no parking had been provided, the saved money could have been invested to increase employee salaries. The method described in this paper allows employees to gain some of that lost salary back, by driving less.

Providing free or underpriced parking only benefits employees that would drive every day, even if they had a method to recover some of their lost salary.

**Methods**

The parking is operated on the behalf of the students and employees, as if it were their own business. Those that drive are therefore their own customers.

*Charge* for parking is proportional to time parked and is charged to the student or employee associated with the car. (A charge rate that is acceptable to all must be established.) For example, if sixty cents per hour is selected, the charging software could round off the parking duration time to the nearest minute and apply a one-cent-per-minute charge. The data-collection method could be implemented with RFID’s on cars being detected at parking-lot entrances and exits. (Unauthorized cars coming onto the campus would be identified with license-plate detection and, if a car belonging to a felon is driven onto the campus, a warning notice could be sent to authorities, if this is desired by the school board.)

*Earnings* (net revenue, minus the cost of collection and distribution) are given to students of driving age and to employees, in proportion to the time they spend at the school (except for the days they were “dropped off”, meaning chauffeured; this feature is described in the next paragraph). This could be based on a student’s or employee’s schedule or, for more accuracy, could be based on “time-at-the-school” data, collected using personal radio frequency identification units (RFIDs) and detectors that are tied to a central, implementing computer. The variables used to compute the amount of money to be paid to a student are shown in Table 1. The corresponding formula is shown in Figure 1. The same approach would be used to compute the earnings of the employees.

**Table 1 Variables Used to Compute a Student’s Monthly Earnings**



**Figure 1 Formula Used to Compute a Student’s Monthly Earnings**



*“Drop off” (chauffeured) policy* is as follows. Students may only be dropped off in designated areas. Cars used for this purpose must be authorized and associated with either a student or an employee. For the day that a car is used for drop off or pickup, the student or employee associated with the car accumulates no time at the school, used for the purpose of computing earnings.

*Parking statements* are automatically sent out monthly, showing the individual’s charges and earnings. For students, the net earnings, for those that drive less than the average, could be distributed in the form of a check, or could be deposited to a school-board-created 401K or other type of savings account. This savings account money could then be used for college tuition or awarded to the student when they turn 21 years of age, if that is desired by the school board. Studies have shown that students that have a savings account for college are more likely to attend college.

**Implementation**

Since this is a new system, it would be prudent for the school board to have the vendor take the full responsibility for operating the system, for the first 10 years. This arrangement would ensure that the vendor would debug the system and continue to look for operational efficiencies, over the 10 year period. A sliding scale of vendor-compensation could be specified in the contract, as follows: The vendor could operate the system for 10% of the revenue, for the first 5 years; 5% of the revenue, for the next 3 years; and 2% of the revenue, for the final 2 years. For example, if it is assumed that, on average, 600 cars are parked for 8 hours, for 200 days per year, at a rate of 50 cents per hour, then the yearly revenue would be $480,000 per year. The vendor would therefore collect $240,000 over the first 5 years, $72,000 over the next 3 years, and $28,800 over the last two years. Figure 2 shows contact information and excerpts of received emails, from a San Diego vendor. This particular vendor has stated that both the design and the installation of a fully-automated system would be easy to perform.

**Experience of Other Schools/Organizations**

Table 2 shows nine public schools and two private schools that charge for parking. (It should be noted that the method described here is much more than just “charging for parking”, because the earnings are given back to the students and employees.) Table 3 shows that introducing a price differential into the choice of how often to drive will decrease the amount of driving.

**Other Benefits**

Depending on the school’s location and the size of its access roads, there could be a substantial decrease in local congestion, improving the health of all students. This parking policy will show neighbors that the administration is working to be a good citizen. This program will encourage active transportation, meaning modes that provide exercise for the students. It will also teach the students the value of parking. It is recommended that the method of determining the selected rate of charge be shared with both the students and the community at large. This program can be thought of as a demonstration project of a new approach to parking.

**Figure 2 One Set of Identified-Vendor Information**



**Green House Gas Impacts**

S-3-05 is a California Governor’s Executive Order to drop Year 2020 levels of greenhouse gas (GHG) emissions to the level of 1990 emissions and to drop our Year 2050 level of GHG emissions to 80% *below* 1990 levels. If the world achieves similar reductions, the earth’s level of atmospheric C02 will be capped at 450 parts per million (PPM). Figures 3, 4, and 5 show how large 450 PPM is, compared to values over the last 800 thousand years. Reference 3 shows that the goal of S-3-05 is to limit atmospheric C02 to 450 PPM and it also shows that even if this cap is achieved, the risk of a human catastrophe caused by global warming is significant. Reference 4’s Figure 1 shows that a significant reduction in driving is critically needed.

**Conclusion**

Adopting this program will benefit the school in numerous ways. Students will gain an understanding of economics and technology. All members of the school community can take pride in being part of this pioneering effort to reduce driving and the associated green house gases. It is a demonstration of the fundamental features of Reference 1. It will set an example for other schools and employers.

**Table 2 American High Schools that Charge for Parking**



**Table 3 Eleven Cases of Pricing Impact on the Amount of Driving**

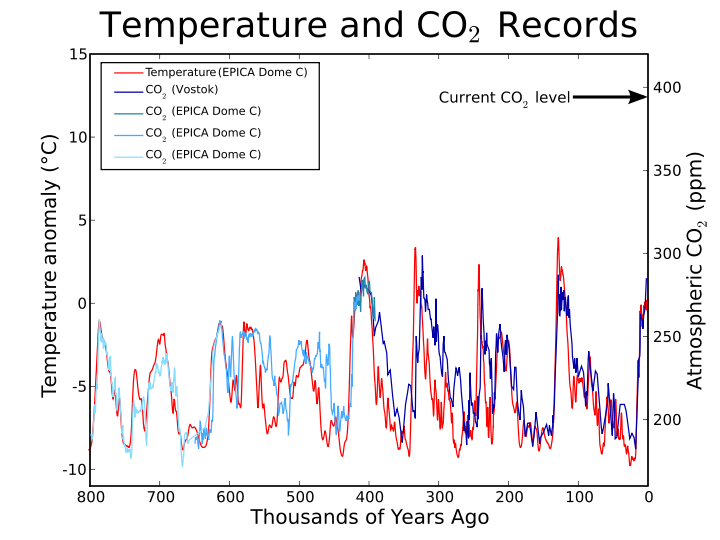


**Figure 3 Atmospheric CO2, Increasing Over Recent Decades**



**Figure 4 Atmospheric CO2 and Mean Temperature,**

**800,000 Years Ago, with 450 PPM C02 Shown**



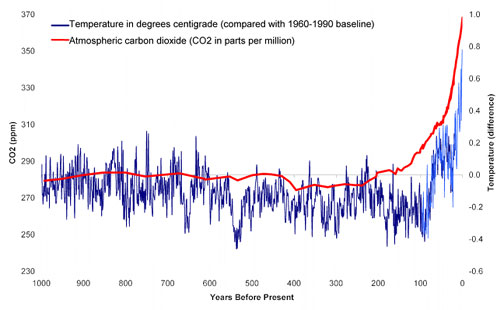
**Current Level of C02 is 390 PPM**

\*

**S-3-05’s goal is to cap C02 at 450 PPM**

**Figure 5 Atmospheric CO2 and Mean Temperature,**

**Over the Last 1,000 Years**



Current level = 390 PPM

S-3-05’s Goal is to cap C02 at 450 PPM, which is off this chart.

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**Appendix D, Reference (4) of this letter**

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July 21, 2010

Air Resources Board

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SUBJECT: Comments on the Draft GHG Reductions, Pursuant to Senate Bill 375

**Dear Air Resources Board Chair Mary Nichols and Members of the Board:**

**1.0 Introductory Comments**

The time for debate has long since passed. The climate science is clear; we need to achieve significant GHG reductions today if we are to avert climate disaster in the future.

**1.1 AB 32, SB 375, What Science Has Determined, and Current GHG Levels**

AB 32 requires California emissions, from all sources, to be at 1990 levels by 2020. The years after 2020 are covered by a Governor’s executive order. It calls for emissions to be 80% below 1990 levels, by 2050. These reductions, world wide, would limit GHG levels to 450 PPM.

When AB 32 and the executive order were formulated, it was thought that limiting GHG levels to 450 PPM would provide humanity adequate safety from catastrophic climate destabilization. However, climate science now tells us that any level above 350 PPM is dangerous. Unfortunately, the current level is 390 PPM, higher than it has been in over a million years.

SB 375 was written to give CARB authority over cars and light-duty trucks, sometimes referred to as personal driving. This personal driving is quantified as vehicle miles traveled, or VMTs. Personal driving is responsible 32% of GHG in California. In San Diego County, it is responsible for 41%. SB375 calls for CARB to give each regional government in the state (Metropolitan Planning Organization, or MPO) GHG reduction targets, for personal driving, for the years 2020 and 2035. SB375 requires that CARB give each MPO their targets by September 30th of this year.

SB375 also calls for an interim “bottoms up” process to produce CARB draft targets, at this time. That is the primary subject of this public review process. CARB is to consider what the MPOs modeled and submitted to CARB as “ambitious but achievable” targets and then submit draft targets to the MPOs.

**1.2 Scoping Plan Observations**

AB 32 gives CARB the responsibility of allocating reductions to the various sectors. In the “Scoping Plan”, adopted in December 2008, on page 17, CARB specified only 5 million tons per year as the reduction from “Regional Transportation-Related GHG Targets” by 2020.

The Plan added in a footnote, “This number represents an estimate of what may be achieved from local land use changes. It is not the SB 375 regional target. ARB will establish regional targets for each MPO region following the input of the Regional Targets Advisory Committee and a public consultation process with MPOs and other stakeholders per SB 375.

We note that the 5 million tons identified in Table 2 is in addition to the 31.7 million tons for Light-Duty Vehicle Greenhouse Gas Standards, including the implement of Pavley I standards and developing Pavley II standards, plus 15 million tons for the Low Carbon Fuel Standard.

**1.3 Danger in “Bottom Up” Process of Identifying Draft Targets**

In modeling “achievable” reductions, MPOs are free to ignore both the AB 32 legal requirements for reductions and the additional reductions needed for public health and safety, in light of our need to get GHG levels down to 350 PPM as soon as possible. Local politicians on MPO Boards may push for “path-of-least-resistance” strategies, hoping to sell these strategies to CARB as “aggressive but achievable”. Since government’s primary responsibility, at all levels, is public health and safety and since this responsibility extends from the three branches of state government down to all boards and agencies (most of which are extensions of the executive branch), it follows that the final GHG reductions must be based on what the climate scientists have determined is safe. Such reductions will significantly exceed those required by AB 32. It is certainly CARB’s responsibility to address this issue, even if it is in some other proceeding. Ignoring this issue is demonstrably criminally negligent, since it will lead to catastrophic climate destabilization, resulting in a significant die off of the human population.

**1.3 Reducing GHG from Cars and Light-Duty Trucks**

There are three things that will reduce GHG from driving. They are “clean cars”, “clean fuels” and less driving. “Clean cars” includes the benefits of more efficient gasoline and diesel powered cars, hybrids, and battery electric vehicles (BEVs). Since some of our cars will be BEVs, when CARB computes the overall average GHG per mile of our state’s fleet of cars, it must account for how much of our electricity is generated from fossil fuels. Most of our electricity will come from fossil fuels for many years, perhaps several decades. “Clean fuel” refers to fossil fuel formulated to have more hydrogen and less carbon, to result in less GHG emissions. “Clean fuel”, referred to as Low Carbon Fuel Standards (LCFS), is expected to provide a 10% emission reduction by 2020, but no more after that. This paper uses the LCFS factor of nine-tenths for both 2020 and 2035, even though this may be overestimating reductions in 2035 because the factor is inappropriate for BEVs and the number of BEVs could become significant by 2035.

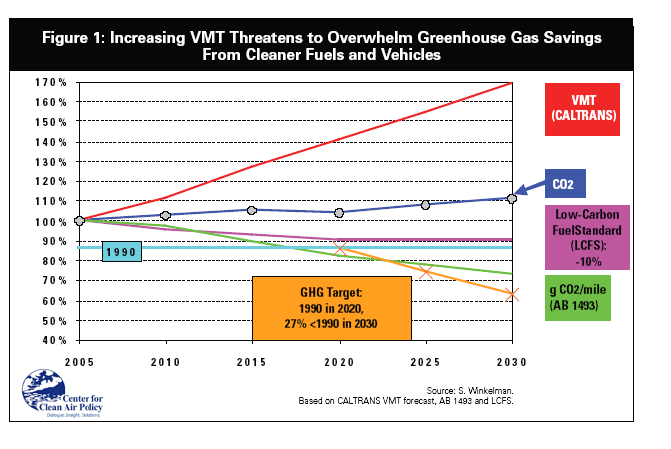
For at least the next decade and perhaps much longer, less driving will be needed to provide the largest reduction in GHG, relative to current 2010 levels. However, relative to the SB 375 reference year of 2005, the “clean car” reduction will provide the largest decrease in GHG, for the target year of 2020.

These factors can be observed in Figure 1 of an analysis by S. Winkleman, [[2]](#footnote-2) based on CalTrans VMT forecast (red line), AB 1493 (“Pavley”, green line), and the Low Carbon Fuel Standard (LCFS, purple line), compared with the AB 32 target of 1990 levels (light blue line). This Figure has been placed into this document for convenience. Note that the dark blue line, which combines all three factors, shows how the projected increase in VMT overwhelms GHG savings from cleaner fuels and vehicles. Decreasing VMT is the objective of SB 375.

**2.0 Evaluation of CARB Draft Targets for 2020**

The VMT reductions proposed by CARB for the MPOs, at this time, are shown in the Table 1.

It is important to note the implications of the Table 1 asterisked footnote and the fact that this target is per capita. It means that the calculation of GHG reduction estimates from this number requires the use of factors to account for population growth, the Pavley reductions (“Pavley”), and LCFS reductions, as shown below.



**Table 1 Four Largest MPOs**

**Draft Greenhouse Gas Reduction Targets for 2020**

**(Percent Reduction in Per Capita Emissions Relative to 2005)\***

|  |  |
| --- | --- |
| **MPO Regions 2020** | **Draft Targets** |
| Metropolitan Transportation Commission (MTC)  Sacramento Area Council of Governments (SACOG)  San Diego Association of Governments (SANDAG)  Southern California Association of Governments (SCAG) | 5 - 10% |

\* Percent reduction numbers do not include emission reductions expected from Pavley Greenhouse Gas Vehicle Standards and Low Carbon Fuel Standard measures.

**2.1 Adequacy, Compared to AB 32 Reductions**

In order to estimate the 2020 outcome of the Table 1 reductions, the calculation must compare the net effect of above per capita reduction target, the increase in population, the Pavley reduction, and the Low Carbon Fuel Standard; with the 2005 levels. For the calculation, the following factors apply:

1. 0.95, for the per capita reduction in driving (using the lower, 5% value, from Table 1);
2. 1.196, for the 19.6% projected increase in population (based on California Dept. of Finance official projections)[[3]](#footnote-3);
3. 0.825, for the 82.5%, shown for 2020, on the green “Pavley” line of Figure 1;
4. 0.90, for the reduction in low-carbon fuel standard (LCFS), as shown on the purple line of Figure 1.

Multiplying these four factors together results in a factor of (.95)\*(1.196)\*(.825)\*(.90) = 0.85.

This is a 15% reduction and so it barely passes the reduction that would be in line with AB 32, which is around 13%, as shown in the 1990 light-blue line on Figure 1, which is also the first yellow “X” on Figure 1.

Similarly, the 10% value results in factors of (.9)\*(.825)\*(.90)\*(1.196) = .81. This is a 19% reduction and so it passes the reduction that would be in line with AB 32, which 13%, again, as shown in the 1990 light-blue line on Figure 1, which is also the first yellow “X” on Figure 1.

**2.2 Need for “Pavley” and LCFS to Meet AB 32 Reductions**

What is needed is a complete picture of what the various factors are providing and whether or not both “Pavley” and the LCFS are needed to get the reductions within the AB 32 level. Therefore Tables 2 through 7 have been computed and appear here.

**Table 2 Factors Used to Estimate 2020 GHG Reduction from 2005,**

**With a 5% Driving Reduction, from 2005**



**Table 3 Results of Combining Factors to Estimate 2020 GHG**

**Reductions, With a 5% Driving Reduction from 2005**



**Table 4 Percent Reductions from Combining Factors to Estimate 2020**

**GHG Reductions, With a 5% Driving Reduction from 2005**



**Table 5 Factors Used to Estimate 2020 GHG Reduction from 2005,**

**With a 10% Driving Reduction, from 2005**



**Table 6 Results of Combining Factors to Estimate 2020 GHG**

**Reductions, With a 10% Driving Reduction from 2005**



**Table 7 Percent Reductions from Combining Factors to Estimate 2020**

**GHG Reductions, With a 10% Driving Reduction from 2005**



It is therefore shown that both “Pavley” and the LCFS are needed to meet the AB 32 standards by 2020. This is true for both the -5% and the -10% reductions in VMT.

**2.3 Conclusions Regarding 2020 Reductions, AB 32, & Reductions for Safety**

For the 5% reduction, the following conclusions can be drawn. Both “Pavley” and the LCFS are needed to meet the AB 32 reduction. Assuming that both “Pavley” and the LCFS stay on track out to the year of 2020; there is still only a 2.6% margin, with respect to the AB 32 reductions. Since AB 32 is inadequate for the industrialized countries, when compared to the world-wide reductions needed to protect humanity from a catastrophic climate destabilization, the proposed reduction of 5% should probably be viewed as morally indefensible.

For the 10% reduction, the following conclusions can be drawn. Both “Pavley” and the LCFS are still needed to meet the AB 32 reduction. Assuming that both “Pavley” and the LCFS stay on track out to the year of 2020; there is a 7.1% margin, with respect to the AB 32 reduction. Since AB 32 is inadequate for the industrialized countries, when compared to the world-wide reductions needed to protect humanity from a catastrophic climate destabilization, the proposed reduction of 10% might still be morally indefensible.

**3.0 Evaluation of CARB Draft Targets for 2035**

Only the largest value shown, -19%, will be considered, for reasons that will become obvious, if it is not already obvious to the reader. Table 14 shows the proposed targets for the four largest MPOs in California.

**Table 14 Four Largest MPOs**

**Placeholder Greenhouse Gas Reduction Targets for 2035**

**(Percent Reduction in Per Capita Emissions Relative to 2005)\***

|  |  |
| --- | --- |
| **MPO Regions** | **2035**  **Placeholder**  **Targets** |
| Metropolitan Transportation Commission (MTC) | 3-12% |
| Sacramento Area Council of Governments (SACOG) | 13-17% |
| San Diego Association of Governments (SANDAG) | 5-19% |
| Southern California Association of Governments (SCAG) | 3-12% |

\* Percent reduction numbers do not include emission reductions expected from Pavley Greenhouse Gas Vehicle Standards and Low Carbon Fuel Standard measures.

For 2035 it is necessary to extrapolate the Governor’s Executive Order target, which is Figure 1’s yellow line, out to year 2035. It is 0.87 in 2020 and it is 0.64 in 2030. Therefore, in year 2035, it will be

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

Likewise, for 2035 it is necessary to extrapolate “Pavley”, the green line, out to year 2035. It is 0.82 in 2020 and it is 0.73 in 2030. Therefore, in year 2035 it will be

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

For the calculation, the following factors apply:

1. 0.81, for the per capita reduction in driving, using the 19% reduction from Table 14;
2. 1.402, for the 40.2% projected increase in population (based on California Dept. of Finance official projections)[[4]](#footnote-4);
3. 0.685, from the above-computed extrapolation of the green “Pavley” line of Figure 1;
4. 0.90, for the reduction in low-carbon fuel standard (LCFS), as shown on the purple line of Figure 1.

Multiplying these four factors together results in a factor of (.81)\*(1.402)\*(.685)\*(.90) = 0.700.

This is a 30.0% reduction, which is not even close to the required AB 32 reduction value of 47.5%, from the above-computed extrapolation of the Governor’s Executive Order target fraction of .525.

This is a significant failure and indicates that neither the MPOs nor CARB are taking their climate crisis responsibilities seriously. It should be noted that although there is a chance that the Pavley reduction slope could be increased by a “Pavley 2” slope, it is also true that a poor economy and/or pure political “push back” could result in the current Pavley reduction slope becoming unobtainable sometime before 2035, such that the projected Pavley reduction factor of .685 would not be obtained. The forecasted “Pavley” reduction target depends on a certain level of fleet turnover, which has recently slowed down because of the recession. Thus we may not be able to depend on “Pavley”.

Tables 15, 16, and 17 provide a complete picture of what the various factors are and how they fail to achieve the AB 32 reductions.

**Table 15 Factors Used to Estimate 2035 GHG Reduction from 2005,**

**With a 19% Driving Reduction, from 2005**



**Table 16 Results of Combining Factors to Estimate 2035 GHG**

**Reductions, With a 19% Driving Reduction from 2005**



**Table 17 Percent Reductions from Combining Factors to Estimate 2035**

**GHG Reductions, With a 19% Driving Reduction from 2005**



**4.0 What 2035 Reduction Will Meet “AB 32” (Governor’s Executive Order) Reductions**

The EXCEL spreadsheets that produced Tables 15, 16, and 17 were copied onto another sheet and then the VMT Per Capita Reduction value was increased by an integer amount until the net 2035 result was within the AB 32 target value. The result was -40 percent. The effect of the various factors is shown in Tables 18, 19, and 20.

**Table 18 Factors Used to Estimate 2035 GHG Reduction from 2005,**

**With a 40% Driving Reduction, from 2005**



**5.0 A Correct and Reasonable, Science-Driven “AB 32” Reduction**

The Section 4 result of a 40% per-capita VMT reduction, required to meet the AB 32 target for year 2035, is a reasonable starting point. Given the uncertainty of the Pavley reduction by 2035 and the fact that climate scientists have shown that we need large reductions soon and need to be essentially off fossil fuels by 2050, a more reasonable reduction value for 2035 is a 50% reduction.

Results from this assertion are shown in Tables 21, 22, and 23.

**Table 19 Results of Combining Factors to Estimate 2035 GHG**

**Reductions, With a 40% Driving Reduction from 2005**



**Table 20 Percent Reductions from Combining Factors to Estimate 2035**

**GHG Reductions, With a 40% Driving Reduction from 2005**



**Table 21 Factors Used to Estimate 2035 GHG Reduction from 2005,**

**With a 50% Driving Reduction, from 2005**



**Table 22 Results of Combining Factors to Estimate 2035 GHG**

**Reductions, With a 50% Driving Reduction from 2005**



**Table 23 Percent Reductions from Combining Factors to Estimate 2035**

**GHG Reductions, With a 50% Driving Reduction from 2005**



The percent margin below the AB 32 target is 9.3% (56.8-47.5). This corresponds to being nearly off carbon fuels by 2050, which is needed.

**6.0 SCS Strategies that Can Do the Job**

The MPO calculations and their implied requests, for no more than a 10% reduction in per capita driving by 2020 and no more than 19% by 2035, indicates that the MPOs are not seriously considering the root causes of the car-oriented California lifestyle that are caused by widespread government policies. SANDAG has never allowed such an in-depth process, let alone authorized it.

The exception is zoning to reduce sprawl. Incremental improvements in zoning, referred to as support for “smart growth”, are taking place. Over time and to the extent the economy supports growth, this will yield driving reductions. However, fundamental changes in parking policy and road-use pricing, which are both related to the issue of congestion and freeway expansion, are never discussed in any depth. This oversight is reducing our chances of getting the strategies that will bring down rates of driving on the scale that is needed, for California to fully live up to its global warming responsibility and in a way that is equitable to all.

**6.1 Road Use Fee Pricing Systems**

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) wrote that the gas 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>.

A Canadian company, *Skymeter*, is designing and installing a variable and comprehensive road-use fee pricing system, in the Netherlands by 2014 and in Denmark by 2016. The charge per mile will vary by such things as model of car, road, time of day, and congestion level. In 2005, the gas tax in the Netherlands was equivalent to $3.50 per gallon. However, with the advent of the new system, the Netherlands will eliminate the gas tax. Nevertheless, the Netherlands estimates that the GHG from driving will drop by 10%. Note that such a system could easily charge a price of zero cents per mile for a low-income driver. Our current system of a gas tax has no such capability. *Skymeter* will program the navigational-unit-like box so that no travel information is stored, to protect driver privacy.

On July 11th 2009, the California Nevada Regional Conservation Committee (CNRCC) of the Sierra Club California passed a resolution supporting a “Comprehensive Road Use Fee Pricing System”. This paper can be provided upon request.

The CNRCC resolution is supported by a 10-Page “Reference Document” that outlines the principles and conditions of a road-use fee pricing system that would conform to Sierra Club values. It has an example of a road-use fee structure that supports the listed principles. Useful background information is also provided.

On November 14th, the Environmental Caucus of the California Democratic Party (CDP) passed a 1-page resolution in support of a “Comprehensive Road-Use Fee Pricing System”. This one-page resolution contains the following words.

**THEREFORE, BE IT RESOLVED,** that the California Democratic Party**\*** supports a state-funded study of a design of a road-use fee pricing system that (1) would pay for all road-use costs including the environmental and health costs caused by driving, (2) could still include a fuel tax or fee, (3) would mitigate impacts on low-income users and protect privacy, (4) would include congestion pricing when that technology becomes feasible, (5) would keep the per-mile price incentive to drive energy-efficient cars at least as large as it is with today’s fuel excise tax, and (6) could be accompanied by tax reductions sized to achieve either net-revenue neutrality or near-net-revenue neutrality.

**\*Not true because the resolution failed in the CDP Resolution Committee**

The Nevada Department of Transportation is taking comments on a proposal for a VMT fee to replace their gas tax, as shown at <http://www.vmtfeenv.com/>.

The 2010 Platform of the California Democratic Party (at <http://www.cadem.org/atf/cf/%7BBF9D7366-E5A7-41C3-8E3F-E06FB835FCCE%7D/Platform2010CDP_FINAL_June.pdf>), inspired in part by the 1-page resolution identified above, contains that following bullet:

* Work for equitable and environmentally sound road and parking use

Using sales taxes, property taxes, income taxes, and other general taxes pay for services that make it artificially cheap to drive is unjust to citizens that drive less than average. There is no reason why government should adopt policies that increase driving and economically discriminate against those that telecommute, walk, bike, car pool, or use transit; the unconstitutionality of the current system is plain to see.

Considering all of this information, CARB has a responsibility to notify the Governor and our legislative leaders that our state has good reasons to implement a comprehensive and variable road-use fee pricing system. There is probably no reason to reinvent the wheel. The *Skymeter* system would work fine here in California. The Sierra Club California analysis can be considered to ensure an implementation that is both equitable to all and environmentally sound.

**6.2 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 many 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, this agency (CARB) has not taken an active role in pushing vmt and parking pricing.

On June 22nd (2010), I 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 101st Conference and Exhibit of the Air and Waste Management Association, in Calgary, Canada. The session, *Sustainable Land Use and Transportation*, included my paper, *A Plan to Efficiently and Conveniently Unbundle Car Parking Costs*, which was well received.

My paper is therefore both peer reviewed and published. I would be pleased to present this paper to the staff of CARB, in the hopes that CARB could bring about equitable and environmentally-sound parking policies to California.

The following points, taken from the paper, apply.

* Vehicle miles traveled (VMT) are a major cause of global warming and pollution.
* California’s Metropolitan Planning Organizations (MPOs) will need to adopt strategies that reduce vehicle miles traveled (VMT), in order to meet SB375 GHG reduction targets, to be issued by the California Air Resources Board in late 2010, 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 cities to require significantly less parking.
* Typical systems of timed parking and metered parking are far from ideal. Parking has no automated record keeping, so it is difficult to know where there is too much or too little.
* Good policies will eventually let cities 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 MPO’s stated desire to foster “smart” growth, where “smart” should be defined as “less VMT”.

Here is a copy of the abstract of the paper.

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 I submit a manuscript, which was ultimately selected to become part of the written Conference Proceedings and for presentation. I hope that it will similarly arouse the interest in the CARB Board and staff. CARB needs to consider working to execute the implementation strategy described in *A Plan to Efficiently and Conveniently Unbundle Car Parking Costs*. I would be honored to help in any way possible.

**6.3 SANDAG Board’s Failures Regarding Climate Change**

SANDAG’s 2007 RTP, “RTP2030”, called for increasing the number of freeway lanes by 38%. This would be in a region that already had one of the highest VMT-per-capita metrics in the state. SANDAG also supported a sales tax measure, “TRANSNET”, that was advertised as one that would spend two-thirds of its money on roads and one-third on transit. However, after it was passed, SANDAG defined all HOV lanes to be “transit”, thereby significantly reducing the fraction of money spent on true transit.

Out of a $57 billion dollar budget for RTP2030, SANDAG budgeted about 1% for mitigation. This mitigation is split evenly between “smart growth” incentive money and a *Regional Bicycle Plan*. They have published a *Smart Growth* *Incentive Plan*, a *Smart Growth Design Guideline*, as well as the *Regional Bicycle Plan*. SANDAG has an excellent staff. However, the Board does not provide helpful direction. One obvious direction needed was to adopt a metric of reducing VMT to decide what “smart growth” should get funding, what “smart growth” design guidelines should be adopted, and what bicycle programs should be funded. They were asked repeatedly to put citizen comments, directed toward the early drafts of these documents, on line, to be viewed by all. Not doing this made it easy for the staff to ignore significant public comment and to instead follow the direction provided by the Board, which seemed to think that bike money should go mostly for trails and smart-growth money should go toward beautification projects in areas deemed suitable for smart growth. If less driving were used as a criteria for spending money, then funding the League of American Bicyclist’s class on how to ride a bike in traffic and the development of equitable and environmentally sound parking policy (good enough to be politically acceptable), would have been a large part of the spending. Instead, bicycle education and car-parking policies were marginalized to the point of being essentially unfunded.

**6.4 Putting a Stop to Freeway Expansion**

One of the most powerful strategies to reduce GHG would be to stop expanding freeways. Instead of costing money, it would generate money. It is well understood that the metric of freeway-lane miles per square mile of developed land increases an area’s average car-trip length and thereby increases VMTs. SANDAG is ignoring this fact and this is probably one of the primary reasons that its 2035 GHG Reduction Target is unacceptably small. When the SANDAG TRANSNET tax was passed, few voters understood that we were threatened with a climate catastrophe and that our responsibility was to drive significantly less. Given our current understanding, SANDAG has a responsibility to go back to voters with a ballot measure that reconfigures TRANSNET to be 100% for transit, bicycles, and pedestrians.

The current freeway-widening project being considered is to widen I-5 from 8 to either 12 or 14 lanes, from La Jolla to Camp Pendleton, at a cost of over $4 billion dollars. The DEIR was released in early July. Caltrans is holding public meetings, where no member of the public is allowed to speak publicly. It sent postcard notifications to those living along the route. However, instead of honestly notifying the recipients of the radical, land-consuming nature of the proposal, these postcards only refer to a “managed lane project”. Who would be worried about some plan to manage lanes? Nowhere on the postcard is there any information suggesting a wider freeway, a taking of land, a reducing of property-tax rolls, an increase in noise, an increase in driving, an increase in air pollution, an increase in GHG or even that there is any kind of construction project being proposed.

**7.0 Conclusions**

Targets will have to be more stringent than AB 32 targets if we are going to fulfill our world leadership responsibility, as required, to give the world a chance at avoiding climate destabilization. The 2020 Target of -10% (per-capita from VMT) can only result in an SB-375 AB 32 reduction if both “Pavley” and the LCFS factors are used. The 2035 reduction target of -19% would have to instead be 40% to just meet the AB 32 reductions, and this is assuming the Pavley reductions continue on the “Pavley 1” trajectory all the way to 2035. This assumption about “Pavley” may be overly optimistic. The science-supported 2035 reduction is 50%.

The best, largely overlooked strategies to reduce VMT are a comprehensive and variable road use fee pricing system, as is being installed by *Skymeter*; unbundling the cost of car parking; and putting a stop to all freeway expansions. I would like to discuss further a state-wide strategy to unbundle the cost of car parking.

Sincerely yours,



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1. This stabilization of atmospheric CO2\_e should not be confused with stabilizing the climate. [↑](#footnote-ref-1)
2. <http://www.nrdc.org/globalWarming/sb375/files/sb375.pdf> [↑](#footnote-ref-2)
3. State of California, Department of Finance, *P-2 Short-term Statewide Population Projections 1995-2015*, Sacramento, California, May 2010 and State of California, Department of Finance, Population Projections for California and Its Counties 2000-2050, by Age, Gender and Race/Ethnicity, Sacramento, California, July 2007 ( http://www.dof.ca.gov/research/demographic/reports/view.php). [↑](#footnote-ref-3)
4. State of California, Department of Finance, *P-2 Short-term Statewide Population Projections 1995-2015*, Sacramento, California, May 2010 and State of California, Department of Finance, Population Projections for California and Its Counties 2000-2050, by Age, Gender and Race/Ethnicity, Sacramento, California, July 2007 ( http://www.dof.ca.gov/research/demographic/reports/view.php). [↑](#footnote-ref-4)