Center for Clean Air Policy

Analysis of Measures for Reducing Transportation Emissions in California

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Overview

This memo represents the results of technical analysis conducted in support of the California Energy Commission's Climate Advisory Committee. In undertaking this analysis, we have attempted to include a review of all pertinent data on CA transportation from CEC and CARB as well as information from nonprofits, the private sector and other U.S. states.[1] The policies evaluated were selected based on recommendations by members of the Advisory Committee. This assessment includes measures pertaining to motor vehicles, low-GHG fuels, freight and travel demand-reduction. Some of the more innovative measures analyzed include:

- CA feebates and vehicle efficiency,
- Alternative fuel LDVs, (HEVs, Hydrogen, CNG),
- Heavy Duty and Medium Duty Truck strategies,
- Port and Truck Electrification (anti-idling), and
- Freight and High Speed Rail

Finally, cost estimates are based upon fuel savings in 2020 (in some cases 2025) from the California Energy Commission's Addendum to ***Options to Reduce Petroleum Fuel Use In Support of the 2005 Integrated Energy Policy Report, May 2005*** and a forthcoming analysis of electrification from California Electric Transportation Coalition (CalETC) and TIAX.

[1] All assumptions are subject to refinement by the Transportation Advisory Committee.

I. Motor Vehicles

Strategy: Improved Fuel Economy in Light Duty Vehicles (LDVs)

POLICY/PROGRAM DESCRIPTION: Increase the light-duty gasoline vehicle fuel economy of the light duty vehicle fleet in California and nationwide

Data Sources, Methods, & Assumptions:
In the CEC report, ***Options to Reduce Petroleum Fuel Use In Support of the 2005 Integrated Energy Policy Report, May 2004***, the California Energy Commission staff used a consumer preference model called "CalCars" to forecast base gasoline (and diesel demand) from light-duty vehicles. Staff then used a spreadsheet model called FUTURES to extend the CalCars results to consider further enhanced fuel efficiency. This enables staff to study future vehicle configurations but does not allow use of consumer preference to determine which model of vehicles consumers would choose.

Sample Scenario (from CEC)

This scenario assumes an MPG of 39.9 mpg for new cars, starting in 2010 with 100% of new cars sold in 2017 achieving this MPG. This treatment assumes that hybrids will extend achieve 15 to 18 percent further fuel efficiency improvements and a set of Technology Packages for light-duty vehicles (LDVs). These packages include various technologies and are not limited to a particular device or implement. Rather, these technology options are assembled into systems that would collectively deliver improved fuel efficiency. Note: Here hybrid-electric light-duty vehicles are a small but growing segment of new vehicle sales. The CalCars Base Case forecast assumes that this segment will grow until it represents approximately 10 percent of new vehicle sales by 2020. Plug-in hybrids are discussed separately below.

We have chosen a CEC scenario that assumes full adoption of the CA GHG Vehicle standard. However, while this measure would 25.3 MMTCO2 in 2020 we have not added those tons to the total.
Ancillary Costs & Benefits:
According to the May 2005 IEPR analysis the consumer will pay an additional $1100 for $1800 for a hybrid that reduces emissions by the stated 15 to 18 percent noted above. There are more aggressive and expensive hybrid technologies but we selected the scenario just beyond BAU.

Implementation Approach: TBD (i.e., county, region, state or NW statewide)

Next Steps: Work with the federal government to increase CAFE standards nationwide. Consider implementing an alternative ZEV requirement. See table.

LEV II Options: (ii) Partial ZEV Allowances

In the eight years since the ZEV requirements were originally adopted, a variety of new, advanced technologies have been developed. Many of these technologies are capable of achieving extremely low levels of emissions on the order of the power plant emissions that occur from charging battery-powered electric vehicles, and some demonstrate other ZEV-like characteristics such as inherent durability and partial zero-emission range. As a result, staff proposed additional flexibility in the ZEV program from broadening the scope of vehicles that could qualify for meeting some portion of the ZEV requirement. Manufacturers would decide which mix of vehicles to use to meet the 10% ZEV requirement for the 2003 and subsequent model years, with the exception that large-volume manufacturers would have to meet at least 40% of the requirement using true ZEVs or vehicles receiving a full ZEV allowance. The process of calculating ZEV allowances for candidate vehicles would consist of assigning basic "allowances" consisting of a baseline allowance, a zero-emission vehicle miles traveled (VMT) allowance, and a low fuel-cycle emissions allowance.

In order to receive any ZEV allowance, a vehicle would have to qualify for the "baseline ZEV allowance" of 0.2. To receive this allowance, the vehicle would have to meet the SULEV standard at 150,000 miles, satisfy applicable second generation on-board diagnostics requirements (OBD II), and have "zero" evaporative emissions — evaporative emissions below the background level established for non-fuel evaporative emissions resulting from off-gassing of paint, upholstery, tires and other vehicle sources. The manufacturer would also need to provide an emission warranty under which all malfunctions identified by the OBD II system would be repaired under warranty for a period of 15 years or 150,000 miles, whichever occurs first. An additional allowance would be provided based on the potential for realizing zero emission VMT (e.g. capable of some all-electric operation traceable to energy from off-vehicle charging), up to a maximum of 0.6. If a vehicle does not have any zero-emission VMT potential but is equipped with advanced ZEV componentry, it could qualify to earn an additional 0.1 ZEV allowance. Under the final allowance, a vehicle that uses fuels(s) with very low fuel-cycle emissions can receive a ZEV allowance of up to 0.2. In order to qualify for a full ZEV allowance of 1.0, a car would have to qualify for the maximum amount under each allowance.

Staff also proposed that, where a ZEV (or full ZEV allowance vehicle) has a long all electric range, it will qualify for declining numbers of multiple ZEV credits in the 1999-2007 model years.
Source: CA LEV Regulations with amendments, effective 23/26/04.

Strategy: Feebate or GHG-based rebate system (g/CO_2 per mile)

POLICY/PROGRAM DESCRIPTION: Use incentives and/or fees to influence consumer purchases of motor vehicles; charge a fee on purchases of high-emitting vehicles and provide rebate for purchases of low-emitting vehicles. A feebate program uses incentives and disincentives to incorporate the environmental costs of CO_2 emissions into the prices that the consumer faces. By incorporating some of the cost of the CO_2 emissions, this practice incentivizes choices that are in society's best interest. In this case, cars that emit relatively less CO_2 will be less expensive than those emitting relatively more CO_2 will be more expensive.

Specific Analysis
Design parameters, such as how the incentives are calculated, collected and defined have not been specified yet. There are different methodologies available for the feebate program.
For example, a series of fees and rebates could be designed taking into account the classes of vehicles covered. Within every class of vehicles (e.g., compact car, sedan, station wagon, pickup, SUV, van) there is at least a 25 percent difference in the GHG emission rate between the most and least polluting vehicle in a class.

Regardless of design, inefficiencies can occur if the program is implemented on a limited geographic basis. Without regulation to prevent it, buyers of relatively high CO_2 emitting vehicles will have the incentive to cross state borders to purchase their vehicles. In the northeast a regional feebate initiative is currently being considered. This regional approach would help prevent out of state vehicle purchases (leakage).

The latest analysis on feebates have concluded that a feebate rate of $500 per 0.01 gallon per mile (GPM) produces a 16 percent increase in fuel economy, while a $1000 per 0.01GPM results in a 29 percent increase, even if consumers count only the first 3 years off fuel savings. Unit sales decline by about 0.5 percent but sales revenues increase because the added value off fuel economy technologies outweighs the decrease in sales. In all cases, the vast majority of fuel economy increase is due to adoption of fuel economy technologies rather than shifts in sales.

Data Sources, Methods, & Assumptions:
- Do we want to focus on a California only or regional program (e.g., in conjunction with the West Coast Governor's Initiative?) which might prevent or minimize potential leakage?
- Source: Feebates, Rebates And Gas-Guzzler Taxes: A Study Of Incentives For Increased Fuel Economy. David L. Greene,*, Philip D. Patterson, Margaret Singh, Jia Lia. Oak Ridge National Laboratory, National Transportation Research Center.

Ancillary Costs & Benefits: A feebate program can be revenue neutral, so that the fees collected cover rebates, administration and education costs; or alternatively, it could be designed to generate revenues for investment in other programs or in GHG reduction measures.

Implementation Approach: TBD (i.e., county, region, state or NW statewide)

Next Steps: There is interest in designing a GHG-based feebate program for CA but the Transportation Subcommittee has yet to make any decisions or assign responsibilities.

Strategy: Expanded Use of HDV Trucks: CNG/LPG, Efficiency and Hybrids

POLICY/PROGRAM DESCRIPTION: Improving engine efficiency and using alternative fuel systems are effective measures for reducing greenhouse gas emissions from vehicles. A variety of incentives and initiatives can encourage public and private owners of vehicle fleets to purchase low-GHG vehicles. This approach presents an opportunity for government to lead by and help manufacturers to diversify product offerings.

Data Sources, Methods, & Assumptions:
The savings for each category are based upon the CEC's May 2005 revised IEPR analysis on Petroleum Reduction. For the HDV and MDV efficiency category, the report states we assumed four fuel economies for the classes of vehicles examined. For Class 3-6 vehicles we used a nominal fuel economy of 17.5 mpg in the year 2020 for the lower bound case. We used 25.4 mpg by 2020 to represent an upper bound based on the aggressive targets of the 21st Century Truck Program. We used a nominal fuel economy of 8.5 mpg by 2020 for Class 8 trucks for our lower bound case. We used 13 mpg by 2020 to represent an upper bound based on the aggressive targets of the 21st Century Truck Program.

Use of Alternative Fuels & Vehicle Technologies in Heavy and Medium Duty Trucks:
Below we have identified a set of technologies and alternative fuels that can help reduce the GHG emissions from freight and delivery trucks.[2] These HDV and MDV strategies are based on CEC and CCAP analyses developed based on the requests from the TAC. Collectively these HDV technologies and fuels reduce 21.35 MMTCO_2 in 2020. **When adding in Medium Duty Gasoline HEVs the Total Savings is 24.85 MMTCO2.**

Note: While this is the largest source of reductions it is based upon significant, on-going research on truck efficiency at US DOE and several national labs and research centers. This estimate is based on diesel fuel savings of 100M gals in 2010 and 2.0B gals in 2020. The fuel savings are based on the aggressive goal scenario in CEC Petroleum Reduction Addendum and assume U.S. DOE 21st Century Truck Program from a range of savings technologies (1-14%). They also account for the AEO baseline efficiency increases which show truck MPG going from 5.52 in 2002 to 6.16 in 2025.

[2] www.calstart.org/info/publications/Californias_ clean_vehicle_industry/Californias_Clean_Vehicle_Industry.pdf

Summary MDV & HDV Trucks (MMTCO2 Savings)		
Range	**2010**	**2020**
Alternative Fuels Penetration (CNG, LPG)	1%	15%
Gallons of Diesel Saved (M)	44	660
AFV HDVs	3,520	52,800
MMTCO2	**0.02**	**1.01**
Truck Efficiency Penetration (retrofit & new)	14%	57%
Gallons of Gas and Diesel Saved (M)	100	2,000
MDVs and HDVs (Class 3-6)	78,575	280,626
HDVs (Class 7-8)	3,965	14,162
MMTCO2	**1.02**	**20.34**
Gasoline HEV Technology Penetration (for delivery trucks)	50%	75%
Gallons of Gasoline Saved (M)	195	293
HEV MDV Gasoline Vehicles	123,401	185,101
MMTCO2	**1.59**	**3.50**
% CA diesel displaced	3%	60%
% CA gasoline displaced	1.0%	1.5%
TOTAL MMTCO2 Reduction	**2.63**	**24.85**

Source: Savings based on information from Lifecycle GHG savings from the GREET Model and Michael Wang at Argonne National Laboratory as well as the Transportation Advisory Committee members, the Alternative Fuels Working Group and CCAP estimates.

*** Gasoline HEV Technology Penetration is included separately on the summary table.**

Ancillary Costs & Benefits: TBD

Implementation Approaches

Below we offer examples of approaches that might be used to help foster HDV technologies an fuels. Specific details, including a design framework, will need to be provided by the TAC.

- Establish a CA state procurement policy to reduce GHG emission rates for HDVs, supported by expanded tax credits
- Partner with nearby states (or looks at lessons learned)
- Establish an outreach and education program (i.e., public awareness campaign)
- Simultaneously work with the automobile industry and federal government to advance policies that will improve the market for low-GHG vehicles

II. Low GHG Fuels

Strategy: Expanded Use of Alternative Fuels:
1) Biofuels (Biodiesel & Ethanol)
2) Alternative Fuels (CNG, Hybrids and Hydrogen Fuel Cells)

POLICY/PROGRAM DESCRIPTION: BIOFUELS
Encourage new initiatives to develop markets for alternative and renewable fuels and support and supplement existing efforts. Bolster public and private sector support for alternative fuel infrastructure.

Data Sources, Methods, & Assumptions:

Market Potential of Ethanol & Biodiesel in CA
California currently has two plants in operation that produce a total of 30 million gallons of ethanol per year (MGY) with an additional 20 MGY plant close to completion. A 2003 study by the California Energy Commission, *Ethanol Supply Outlook for California* estimated the state would need between 760 – 990 MGY of ethanol to replace MTBE in 2004. This same study compared two scenarios, one with 200 million gallons per year of ethanol produced in California plus 100 million gallons per year of imported ethanol and a second scenario where no ethanol is produced in California and the entire 300 million gallons per year is imported.[3] The study found that CA will have to import all of its ethanol by US producer for the coming years, although it noted up to 10% of CA ethanol could currently be provided by foreign imports (e.g., Brazil) and this could increase in the future due to expanded international production.

The California Energy Commission and the California Air Resources Board (CARB) staff project that an adequate supply of ethanol could be made available from California, Midwest states, and foreign sources providing 4.6 billion gallons of ethanol in 2030.18
This supply would support about four million FFVs using an E-40 fuel (or half time use of E-85), while the rest of the fleet operated on E-10.

Biodiesel Use in CA: By 2004 there were more than 30 million gallons of biodiesel in the US with the number expected to grow to 1 billion gallons in 2010 and 6 billion in 2020.[4] Here we assume 2% biodiesel used in all of California's diesel fuel in 2010 and half of all diesel fuel in CA is blended with 20% biodiesel or B20.

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[3] In the US there are currently 83 ethanol fuel plants with the capacity to produce more than 3.7 billion gallons of ethanol each year. In addition, 15 ethanol fuel plants now under construction and two major expansions will eventually add nearly 700 million gallons in new ethanol production capacity.
[4] US DOE.

Expanded Ethanol Use in California (2010, 2020)				
Year	**CA FFVs using E-85**	**GGE saved (M)**	**MMTCO2e**	
	5% of CA FFVs (21K vehicles)		corn	cellulosic
2010	39,843,750	33	0.33	0.77
	25% of CA FFVs (75K vehicles)			
2020	1,406,250,000	1,172	**11.51**	37.66

Source: Oct 21, 2004 CEC Alternative Fuels Working Group (presentations and discussions) as well as from Lifecycle GHG savings from the GREET Model and Michael Wang at Argonne National Laboratory.
Note: GGE is gasoline gallon equivalent of ethanol and the actual gallons of ethanol are higher, due to its lower energy content. Please note these assumptions are similar order of magnitude, but slightly higher, than a Joint CEC/ARB estimate provided to CCAP. Assumptions are subject to refinement by the TAC as needed.

Bio-diesel (BD) Use in California, 2010, 2020					
Year	CA Diesel	Gallons of Diesel	CA Diesel	HDVs using BD	MMTCO2
		75% B2		75% B2	
2010	3,300,000,000	49,500,000	2%	617,401	0.55
		50% B20		50% B20	
2020	4,400,000,000	880,000,000	20%	492,310	**9.85**

Biodiesel Supply/Delivery Questions (from CEC's May 2005 Addendum)

- Will limitations in shipping biodiesel through pipelines due to possible contamination of jet fuel result in additional infrastructure at the Terminal? (e.g., pumps, tanks, meters, etc.)
- How do the CARB regulations fit with the federal regulations -- e.g., 1992 EPACT and 1998 ECRA acts --as they relate to the vehicle and fuel requirements?
- Any OEM/engine warranty issues when using biodiesel fuel?
- Discussion of "Tax Credit" for both vehicle and fuel tax credits, as well as both California and federal tax credits?

Ancillary Costs & Benefits: Recent reports have shown the potential for job creation from technology-sector.

Cost differentials for alternative fuels vary. For example, biodiesel producers receive $1.00/gallon subsidy from the federal government only for additional volumes produced over the previous year, leaving a typical price premium of $0.50 - $1.00/gallon. For this reason, most biodiesel is sold as B2 or B20 at the prices listed above. B2 (2% blended with 98% diesel) has a price premium of about $.01-.02/gallon. B20 (20% blended with 80% diesel) range from between $0.10 - $0.20/gallon.[5]

POLICY/PROGRAM DESCRIPTION: ALTERNATIVE FUELS

[5] This cost differential is consistent with US DOE values of $0.13 - $0.22/gal, as cited in the California Petroleum Reduction study, *op cit.*

Encourage new initiatives to develop markets for alternative fuels and technologies support and supplement existing efforts. Bolster public and private sector support for alternative fuel infrastructure.

CNG Light Duty Vehicles
CNG vehicles are commercially available in limited quantities and vehicle models. While over 400 models of gasoline vehicles are offered for sale in model year 2005, only 5 models of CNG vehicles are available. Consistent with other options, CNG light-duty vehicles displace gasoline light-duty vehicles that get 22 mpg. According to the CEC, fuller adoption of CNG vehicles would likely require expanded home fueling kits and possibly incremental incentives to offset the greater marginal costs of CNG LDVs.

- Savings: Analysis by the CEC shows that today's natural gas vehicles could achieve between 0.3 and up to 0.8 MMTCO2 in 2020.

- Costs: The technology costs in this work are based on estimates derived by the ACEEE and CARB. Each of these estimates represents careful, thoughtful analysis. However, the long-term nature of these forecasts results in a significant degree of uncertainty in the technology costs used in this examination. The economic impacts calculated in this effort are, not surprisingly, highly dependent upon the assumed cost of improved fuel efficiency.

****Information provided from draft TIAX study sponsored by CalETC (do not cite or quote)****

Hydrogen fuel cell vehicles. Vehicle implementation for FCVs assumed to 100% of the ARB ZEV mandate "Gold Standard" category. Assumed the hydrogen produced by steam reformation of natural gas; hydrogen vehicles driving 13,322 miles per year, displacing a SULEV with LEV II DR total emissions.[6] CCAP analysis shows a potential for 0.052 MMTCO2 in 2020, due primarily to a small penetration of functional hydrogen vehicles.

Plug-in hybrid EVs. Population calculations are based on the assumption that the plug-in hybrid market will follow the same market trend as the Toyota Prius (w/ a commercial market start date of 2009), reaching 36,000 units after three years.[7] Market share is assumed to be 100% since there are currently no commercially available plug-in hybrid vehicles. It was assumed that a PHEV drives 13,322 miles and displaces a SULEV with LEV II DR total emissions.[8]

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[6] Reference: CARB for the last full ZEV program biennial review, August 7,2000) and a fuel efficiency of 21.2 miles/gallon. Achievable population assumes that all gold standard vehicles are FCVs and an additional 25% FCVs. Upstream emissions for natural gas are from the petroleum dependency study (AB2076 Appendix A, Table 2-4). The electricity required to produce hydrogen is an industry estimate of 7.99 kWh / kg hydrogen for 2010 and 4.0 kWh / kg hydrogen for 2015 and later.

[7] "Toyota Prius Hybrid Production Increased By 31 Percent For U.S. Market," *Automotive Intelligence News.* December 8, 2003

[8] Reference: CARB for the last full ZEV program biennial review, August 7,2000) and a fuel efficiency of 21.2 miles/gallon. A PHEV20 operating 5276 miles on electricity and 8046 miles on gasoline per year is used to calculate the upper or lower bound of connected load, electricity, emission, and petroleum reduction calculations. A PHEV60 operating 10,120 miles on electricity and 3,202 miles on gasoline is used to calculate the other upper or lower bound. Emissions factors came from the petroleum dependency study (AB2076).

According to the CCAP analysis plug in HEVs have the potential to reduce CO2 by 1.12 million metric tons in 2020. Costs from the ACEEE Mild HEV Scenarios show an incremental cost of between $3429 -$4982 depending on make and model.

NOTE: This measure is different that the Hybrid Scenario above which assumes fuller integration of HEV technology into the LDV fleet.

Implementation Approach: Below we suggest some considerations for implementation.

- Expand AF Pilot Program – fund pilot programs AF use in high-mileage, local government and private sector fleets such as school buses, garbage trucks, delivery vehicles.

- Work with other states to encourage the federal government to modify the 1992 Energy Policy Act (EPACT) to allow biodiesel vehicles full credit. Currently, agencies affected by EPACT receive full credit for purchasing vehicles with bi-fuel capability (generally gasoline and compressed natural gas), without showing any evidence of how much of the alternative fuel is ever used in the vehicle. Full credit for the use of biodiesel would lower the costs of complying with EPACT, while ensuring the use of a cleaner burning fuel, which is in keeping with the intent of EPACT.

Next Steps: The TAC will need to define capital, production and shipping costs (as well as emissions) to further develop $$/ton estimate. Further work is needed to develop an understanding of alternative fuel production and market potential and to develop a more detailed set of cost information (capital, infrastructure, operating, shipping) for all alternative fuels. CCAP will prepare a memo for California ethanol and biodiesel production prior to the April 6th full stakeholder meeting.

III. Freight

Strategy: Freight & Marine In-Use Elements
1) Idling Reduction, 2) Electrification and 3) Freight Rail

POLICY/PROGRAM DESCRIPTION:
Freight-In-Use Elements: Improve truck freight and port operation efficiencies.

Data Sources, Methods, & Assumptions:
Truck travel is the fastest growing mode of ground transportation and is expected to increase by 76% from 2001 to 2025, exacerbating roadway congestion and contributing to GHG emissions.[9] Trucks are responsible for more than 70% of freight GHG emissions.[10] Here we focus on improving efficiency of truck and port operations, shifting trucks to rail and mitigation of truck idling.

****Information provided from draft TIAX study sponsored by CalETC (do not cite or quote)****

Truck Anti-Idling (Also referred to as truck-stop electrification or TSE)
CalETC and TIAX, LLC are close to finalizing a report which quantifies the existing and projected impacts of truck anti-idling in California.[11] Market penetration values were provided by the Federal Highway Administrations report on "Study of Adequacy of Commercial Truck Stop Facilities - Technical Report", with CA Truck Stops/ Travel Plazas population being defined in 1999 w/ a 6.5% annual market growth, and Rest Stops in 2000 w/ a 1% annual market growth, with a 20 year forecast of ~2.7% annual increase in truck parking demand. Savings of 3.55 MMTCO2 in 2020 are based upon fuel savings minus electricity emissions. Costs have included infrastructure costs for equipment but more detail is necessary. TSE is typically considered cost effective on a $/MMTCO2 basis when the fuel savings are factored into the full cost of an installation, coupled with federal and state incentive programs.

<u>Electrification of Port Equipment</u>
CalETC and TIAX, LLC are close to finalizing a report which quantifies the existing and projected impacts of non-road and on-road electric freight technologies in California.[12] Below, we have included potential annual gallons of petroleum fuel displaced from electrification technologies as provided to CCAP by CalETC. **These measures could save up to 4.61 MMTCO2 in 2020.**

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[9] U.S. Department of Energy, Energy Information Administration's *Annual Energy Outlook, 2004*.
[10] U.S. EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2001*. April 2003.
[11] Report on the Electric Vehicle Markets, Education, RD&D and the California Utilities' Low Emission Vehicle Programs, Final Report, March 22, 2002, Arthur D. Little, Inc.
[12] Report on the Electric Vehicle Markets, Education, RD&D and the California Utilities' Low Emission Vehicle Programs, Final Report, March 22, 2002, Arthur D. Little, Inc.

Low GHG Freight: Anti-Idling, Trucks, Ports (2020 MMTCO2)				
Truck Programs	**Gallons of Diesel Saved**	**Low**	**Gallons of Diesel Saved**	**High**
Truck Electrification (anti-idling)*	60,000,000	0.61	350,000,000	3.55
Electric Refrigerated Trailers	12,000,000	0.12	60,000,000	0.61
Electric Forklifs	22,300,000	0.26	44,600,000	0.45
Diesel displaced (M gallons)	**94,300,000**		**454,600,000**	
Total (% CA diesel reductions & MMTCO2 savings)	**2%**	**0.99**	**10%**	**4.61**

Sources: 2003 CEC Petroleum Reduction Study; Jeffrey Ang-Olson and Will Schroeer, ICF Consulting. "Energy Efficiency Strategies for Freight Trucking: Potential Impact on Fuel Use and GHG Emissions." 2001 Annual Transportation Research Board Meeting; Oak Ridge National Laboratory, Technology Roadmap for the21st Century Truck Program, December 2000.

*** Truck Electrification is included separately on the summary table.**

The Potential GHG Benefits in CA from Freight Rail.

Assumptions herein and information from national freight rail infrastructure were reviewed in order to provide an order of magnitude potential for shifting some of the anticipated truck growth to rail. These included: the American Association of State Highway and Transportation Officials (AASHTO) Bottom Line Report, US GAO's National Corridor Strategy and ARB's Phase I Goods Movement Study. The latter identified rail priorities in CA and provided potential costs from rail and other freight infrastructure investments.

Based on these, CCAP felt the potential shift would be up to 10% by 2020. While this may seem high, it does not fully account for the growth in truck VMT. **This would reduce 3.77 MMTCO2 in 2020.** The AASHTO Bottom Line report indicated a short term need for up to $4 billion to just keep the system operating. The ARB report indicated a cost of between $500 million and $1B to help CA handle growth in the coming decade. These numbers were used to develop a order of magnitude cost per tonne of CO2 avoided. However, more information on California-specific truck and port emissions will be necessary as will further discussions with the freight and port experts on the true costs and priorities for freight rail infrastructure.

IV. Travel Demand Reduction

VMT Reduction Measures

POLICY/PROGRAM DESCRIPTION:

Data Sources, Methods, & Assumptions:
Estimate GHG Reductions/benefits. CCAP reviewed 5 of CA's regional planning documents: San Diego, Los Angeles, San Francisco, Monterrey and Sacramento, with an eye toward potential VMT reductions. We held discussions with those responsible for developing and/or modeling the results (e.g., VMT reductions, growth patterns, travel distances, etc.) This is in part an follow up to a Parsons-Brinkerhoff study[13] but based on new data from regional models done by MPOs since that 2001 study.

Initial Analysis Overview: Reducing VMT for California

According to the CEC's estimate, VMT in California is growing at just over 1.8% per year.[14] This is significantly lower than the U.S. Energy Information Administration's Annual Energy Outlook (AEO), which estimates national VMT growth of 2.3% per year over a twenty-year period. This reflects the fact that overall VMT reduction slowed nationwide, since the economic downturn in early 2001.

Our initial analysis found reductions in VMT from Regional Programs and Plans resulting in 0.1-10% VMT reduction vs. BAU by 2020.[15] This added up to a total of 34,014,676 from the five large CA MPOs (San Diego, Los Angeles, San Francisco, Sacramento, Monterey Bay Area) and over 41M VMT saved from the remaining MPOs. **Based on these VMT savings (76 M VMT in 2020) CCAP estimated that implementation of the 5 major regional plans would reduce GHGs by 5.49 MMTCO$_2$ in 2020.**

Ancillary Costs & Benefits: Cost estimates will include the fuel savings and potential infrastructure savings.

Implementation Approach: Any discussion of VMT in California must include consideration of state policies which reinforce the implementation of such VMT-reduction strategies. This includes both **pilot programs** such as Pay as You Drive Insurance and broader '**power of the purse'** efforts to target state transportation and infrastructure spending towards population and employment centers, and to withhold infrastructure funding from greenfield development. This

[13] Parsons Brinckerhoff, for the California Energy Commission. California MPO Smart Growth Energy Savings MPO Survey Findings. September, 2001.
[14] CEC, Base Case Forecast of California Transportation Energy Demand Staff Draft Report, Dec. 2001.
[15] To use a regional example, Portland, Oregon, a national leader in utilizing land use measures and transit to reduce VMT, recently announced they are on track to achieve a 10% VMT reduction by 2020. For more information, see the City of Portland, Transportation Planning Office, http://www.trans.ci.portland.or.us/planning/RegionalModeSplit.htm#Findings

will also include **evaluating state funding priorities from California Transportation Commission**.

Next Steps:
Refine GHG reductions. Review funding plans and develop a refined estimate of "what you get" in terms of GHG reductions from the combination of low-VMT policies contained in the regional plans. CCAP will further review and talk with MPOs and CA state officials to define what is funded and what is not likely to receive new investment. Depending on funded measures that might very well reduce our estimated VMT savings (i.e., less new transit investments, parking pricing, etc. = lower reductions)

Establish a proposed framework to help MPOs with tracking and reporting VMT/GHG reductions from transportation projects and plans. This framework can be used to help California develop more consistent methodologies for 1) reporting, monitoring and verification of GHG reductions from smart growth and 2) to ensure regional planning priorities and goals are being met. It should focus on how to incorporate climate change considerations into regional transportation and land use planning. Existing transportation and land use planning forums represent important opportunities to consider the impact of various future actions on climate change.