CALIFORNIA STATE VEHICLE FLEET FUEL EFFICIENCY REPORT: VOLUME II

CALIFORNIA ENERGY COMMISSION

CALIFORNIA AIR RESOURCE BOARD

CALIFORNIA DEPT. OF GENERAL SERVICES

CONSULTANT REPORT

April 2003
600-03-004

Gray Davis, *Governor*

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1. Executive Summary

1.1 SB 1170 and Report's Objective

Senate Bill 1170 requires that three state agencies (the Energy Commission, the Air Resources Board, and the Department of General Services) examine purchasing patterns for the state's fleet of motor vehicles, identifying costs and benefits associated with reducing energy consumption through the use of alternative fuels, high-efficiency vehicles, and other approaches (e.g., reducing vehicle miles traveled). SB 1170 also requires the development and adoption of a policy for purchasing light-duty fleet vehicles that are certified at or below California's Ultra Low Emission Vehicle standard.

This Volume II report was prepared by TIAX LLC, a consultant to these three agencies. It provides details about various strategies and measures that the state can potentially use to reduce petroleum consumption in its on-road fleet of nearly 73,000 vehicles. A companion report (Volume I) prepared by the three agencies noted above provides a summary of all conclusions and findings, complete with the three agencies formal recommendations to the Legislature.

1.2 Overview of California State Vehicle Fleet and Available Information

Using the best-available data and interpreting SB 1170's, this study establishes the following "baseline" petroleum fuel consumption for the state fleet, and the minimum targets for achieving reductions by January 2005:

Summary of Assumed Targets for Reducing Fleet's Petroleum Use

Fuel	Estimated Current Consumption (gallons)	Estimated January 2005 Baseline (gallons)	10% Minimum Targeted Reduction by January 2005 (gallons)
Gasoline	45.9 million	45.0 to 49.0 million	**4.5 to 4.9 million**
Diesel	8.9 million	8.0 to 9.4 million	**800,000 to 940,000**

A major limitation in preparing this study is that insufficient data and information currently exist about the state fleet, which serves approximately 230,000 employees working at 250 agencies. This makes it possible only to roughly estimate how vehicles are currently deployed and potentials for reducing fuel consumption. A significant "wild card" for the study involves how California's current fiscal situation will affect efforts to meet SB 1170's objectives, since budget cuts alone could potentially result in fleet downsizing, as well as significant reductions in resources needed to carry out recommended actions.

1.3 Strategies and Measures to Reduce Petroleum Consumption by January 2005

As shown in the table below, this study estimates that a combination of measures can be used to achieve the targeted 10 percent (or greater) reduction in state fleet fuel usage, roughly within the timeframe noted in SB 1170.

Summary of Measures for Potential Implementation by January 2005

Potential Measure to Reduce Petroleum Consumption in Fleet by January 2005	Estimated Annual Gasoline Displacement	Percent Reduction in Gasoline Use for state Fleet	Estimated Incremental Costs (2003 $)	Estimated Savings in Fuel Costs (2003 $)*	Actions Needed to Overcome Issues or Barriers
Operate state fleet's 1,610 bi-fuel LPG vehicles 100% on LPG	**2,023,770 gallons**	**4.4%**	**Vehicles:** no new costs **Infrastructure:** no new costs	~$425,000 per year for 7-yr. Life of vehicles	Executive Order requiring use of alternative fuels
Operate state fleet's 1,962 bi-fuel CNG vehicles 100% on CNG	**1,269,414 gallons**	**2.8%**	**Vehicles:** no new costs **Infrastructure:** $3.0 to $4.5 million for new fueling stations	~$90,000 per year for 7-yr. Life of vehicles	Executive Order requiring use of alternative fuels Expansion of CNG infrastructure at state garages
Purchase highest fuel economy cars and pickup trucks, as alternatives to currently procured vehicle types **(OR)**	**33,592 gallons** **(OR)**	**0.07% to 0.10%**	**Vehicles:** $367,890 over two years **Infrastructure:** no new costs	~$51,732 per year for 7-yr. life of vehicles	Possible changes in procurement policies Note: assumes 254 cars and 154 pickups will be phased in during 2003 and 2004. Subject to EPACT limits.
Purchase hybrid electric vehicles (hybrids), as alternatives to currently procured compact sedans	**47,625 gallons**		**Vehicles:** $1,389,380 over two years** **Infrastructure:** no new costs	~$73,500 per year for 7-yr. life of vehicles	Possible changes in procurement policies Note: assumes 254 hybrids will be phased in during 2003 and 2004. Subject to EPACT limits.

Various measures to reduce VMT, increase in-use vehicle efficiency, and allocate vehicles for more efficient use	**1.38 to 3.21 million gallons per year**	**3% to 7%**	(Insufficient information to quantify)	(Insufficient information to quantify)	Various changes in policy and procedures
TOTALS	**4.71 to 6.55 million gallons per year**	**10% to 14%*** **			

Notes:
*All estimates for fuel savings were based on late-2002 prices for transportation fuels. Actual fuel costs and relative savings will depend on prices that are subject to significant volatility.
**Federal incentives may apply to help offset capital costs
***The minimum target under SB 1170 is a 10% reduction (approximately 4.59 million gallons of gasoline per year). Estimated reductions in diesel fuel usage are not included here.

As this table shows, nearly 75 percent (approximately 3.3 million gallons of gasoline per year) of the targeted reductions (excluding heavy-duty vehicles) can be achieved by maximizing the use of compressed natural gas (CNG) and propane in the state's fleet of existing bi-fuel vehicles. These two measures will entail no significant new vehicle-related capital costs, but there will be costs associated with the construction and operation of new fueling stations, especially in the case of CNG. Savings in fuel costs (assuming late 2002 prices for gasoline, CNG and propane) will offset some of these infrastructure costs.

Purchasing and deploying high-efficiency gasoline cars (hybrid-electric vehicles and "best-in-class" cars for fuel economy) as alternatives to typically purchased fleet vehicles will also help reduce petroleum consumption in the state fleet. The near-term benefits will be moderate (a reduction of 33,000 to 49,000 gallons per year), largely because the federal Environmental Policy Act (EPACT) limits the number of gasoline-fueled vehicles that can currently be used in the fleet. As described below, maximizing the use of such vehicles (especially hybrid-electric vehicles, or hybrids) over the longer term will lead to significant additional benefits.

This report describes policy changes and enhancements that can save fuel by 1) reducing "vehicle miles traveled" (VMT) within the state fleet, 2) increasing the fuel economy of in-use vehicles, and 3) promoting vehicle *uses* that are fuel efficient. It is estimated that the remaining reductions (at least 1.3 million gallons per year) needed to meet the minimum SB 1170 target by January 2005 can be achieved by a combination of these measures.

1.4 Longer-Term Strategy Requiring Amendments to Federal EPACT

This report describes a wide range of benefits that hybrids can offer the state over the longer term. It recommends that the state aggressively seek amendments to EPACT that will allow state fleets to routinely purchase large volumes of hybrids and other high-efficiency vehicles. Assuming that enabling amendments can be made to EPACT, approximately 1,000 to 1,200 high-efficiency vehicles (especially hybrids) could be

purchased by the state each year, as an alternative to purchasing conventional sedans and certain types of alternative fuel vehicles (AFVs) that do little to displace petroleum fuel use. Using this approach, an estimated 187,500 gallons of gasoline would be "saved" annually for every 1,000 hybrids purchased. In 2003 dollars the estimated incremental capital costs for 1,000 hybrids would be about $5.4 million. Partially offsetting these costs, approximately $290,000 in fuel savings would be realized annually for the 7-year life of the vehicles.

1.5 Recommended Actions and Anticipated Costs

This report provides detailed recommendations on various actions that the state should take to implement these various measures, and realize the potential petroleum reduction targets. Nearly all the recommendations provided entail some type of cost to the state associated with agency actions or further study. Insufficient information exists to assess potential costs, beyond the estimates provided in the table above (Section 0). Immediate consideration must be given to further estimate costs and how these efforts will be funded, especially in light of the current budget situation and how the budgets of key agencies will be affected.

2. Introduction and Background

2.1 Senate Bill No. 1170

2.1.1 Objectives of Bill

California Senate Bill No. 1170 (Chapter 912, Statutes of 2001), signed into law in October 2001, requires the California Energy Commission (Energy Commission), the Department of General Services (DGS) and the California Air Resources Board (CARB) to develop and submit a strategy to the Legislature to reduce petroleum dependence in California's vehicle fleets. SB 1170 specifically requires these three agencies to "jointly conduct a study to examine state vehicle purchasing patterns and to analyze the costs and benefits of reducing the energy consumption of the state vehicle fleet by no less than 10 percent on or before January 1, 2005."[i]

SB 1170 requires that this study include analyses of the following topics:

1. Use of alternative fuels
2. Use of fuel-efficient vehicles
3. Costs and benefits of decreasing the size of the state vehicle fleet
4. Reduction in vehicle trips and increase in use of alternative means of transportation
5. Improved vehicle maintenance
6. Costs and benefits of using fuel-efficient tires relative to using retreaded tires, as described in the Retreaded Tire Program

7. Costs and benefits of purchasing high fuel efficiency gasoline vehicles, including hybrid electric vehicles, instead of flexible fuel vehicles.

   SB 1170 also requires that, on or before January 31, 2003, and annually thereafter, these agencies "develop and adopt air pollution emission specifications governing the purchase by the state of passenger cars and light-duty trucks that meet or exceed the state's Ultra-Low Emission Vehicle (ULEV) standards for exhaust emissions."

2.1.2 Commonality of Objectives with Assembly Bill 2076

The objectives and goals of Assembly Bill 2076 (Chapter 936, Statutes of 2000) are similar to those of SB 1170, except that AB 2076 involves a broader scope over longer time frame. AB 2076 requires the Energy Commission and the CARB to develop strategies that can help reduce petroleum dependence in California's entire transportation sector over the next several decades. Strategies identified in AB 2076 include 1) reducing the rate of growth in the demand for petroleum fuels; 2) increasing transportation energy efficiency; and 3) displacing petroleum fuel consumption using advanced transportation technologies such as alternative fueled vehicles, hybrid vehicles, and high fuel efficiency vehicles.

SB 1170 specifically focuses on the state fleet and addresses near-term methods to reduce fuel consumption. Although differing from AB 2076 in both time frame and scope, extensive overlap exists regarding the types of technologies and strategies assessed. Readers can refer to the AB 2076 report for additional background and technical information about petroleum-reduction strategies, as well as detailed discussion about the types of costs and benefits that can be expected through their implementation.

2.2 Interpretation of SB 1170's Specific Requirements

Although the underlying intent of SB 1170 is clear, key language in the bill is ambiguous and subject to interpretation. Most of the introductory part focuses on the need to reduce petroleum dependency and use of petroleum-based fuels, which means reducing consumption of gasoline and diesel since they collectively fuel nearly 100 percent of the state's transportation sector. Among the ways to accomplish this is to "displace" gasoline and diesel with alternative fuels such as natural gas and liquefied petroleum gas (propane).

On the other hand, SB 1170 specifically seeks ways to achieve a 10 percent or greater reduction in the state fleet's energy consumption. The implications of this terminology can be very significant to the objectives of this study. Substituting the use of alternative fuels for conventional fuels in state vehicles will not necessarily reduce the fleet's energy consumption – in fact, energy use could increase.[ii]

Given that SB 1170 acknowledges the need to effect greater use of alternative fuels in the state fleet, a more precise objective has been assumed for this study, as follows: "Examine state vehicle purchasing patterns and the costs and benefits of reducing gasoline and diesel consumption by the state vehicle fleet by no less than 10 percent on or before January 1, 2005."

It is also important to note that SB 1170 does not define the "baseline" fuel consumption to be used for achieving a 10 percent reduction by 2005. In a recent similar study performed for the federal government fleet, the fuel consumption baseline was assumed to be the last calendar year (1999) for which the most complete data were available. Based on this approach, the baseline for the California fleet would be the volume of gasoline and diesel used by all state vehicles in 2001. However, it can also be argued that the baseline should be the fleets estimated consumption by the end of 2004, taking into account normal fleet growth in the absence of any new actions to promote fuel efficiency or usage reductions. The complicating factor here is that currently, insufficient data exist about the rate of growth in the state fleet's demand for petroleum fuels. Additional information is needed to fully understand consumption trends and whether fuel use can be expected to increase or decrease over the next two years, assuming no new attempts to conserve or displace gasoline and diesel.

In the absence of any clear direction from SB 1170, the baseline consumption for this study has been estimated using the best available information on current use and growth trends, as of late 2002, and extrapolating to early 2005. Further discussion is provided in Section 4.1.

2.3 Study Caveats and Limitations

A variety of data and information sources were used in preparing this report. The major source of information was provided by the Office of Fleet Administration (OFA) within the DGS, which allocated extensive staff time to assist with the report, as did staff from the Energy Commission and the CARB. Numerous other state agencies also provided information, through the DGS.

Using the best information currently available, this report provides guidance towards methods and procedures to decrease consumption of petroleum-based fuels in the California state fleet over the next two years. In addition to those already noted, the following caveats and limitations exist for this report:

- California includes approximately 250 state agencies employing 230,000 people and operating nearly 73,000 on-road vehicles. It is one of the largest public fleets in the world. No single agency has access to detailed information about these vehicles, how they are used, and the volumes of petroleum fuel consumed. A major limitation of this study is that insufficient data and information currently exist about the state fleet to pinpoint potentials for reducing fuel consumption, or to fully assess the associated costs and benefits.

- At a minimum, detailed data and information are needed about the fleet operations for each California agency, such as the types and numbers of vehicles, how they are used, and the volume and type of fuels they currently consume. A recent questionnaire sent to state agencies – for which 27 responses were received – was merely a first step in that process. Additional, better-automated procedures may be needed to establish baseline fuel usage by each agency, and track fuel usage in the future.

- Although not clearly defined in SB 1170, the scope of this study has been focused on gasoline-fueled light- and medium-duty vehicles. This sector dominates the fleet in terms of gallons consumed, and appears to be better documented than the heavy-duty sector (e.g., vehicle types and fuel use). However, heavy-duty vehicles use very large volumes of petroleum fuel (diesel), and are attractive candidates for reducing consumption (e.g., fuel displacement through use of alternative-fuel engines). Additional information on the state's heavy-duty fleet is needed to accurately assess this potential.

- Funding for conducting this report under SB 1170 was not discussed in the legislation. The Energy Commission, the CARB and the DGS funded this study. Comprehensive assessments of potential costs and benefits noted in SB 1170 are not within the scope of the funding provided, especially given the lack of detailed information in key areas and the relatively short deadline stipulated.

- SB 1170's wording is unclear on the role that propane and certain other alternative fuels should play in meeting its objectives. This report makes the interpretation that expanded use of such fuels in the state fleet to displace gasoline and diesel fuel is fully consistent with SB 1170's intent. As further described (see Section 5.1.2), the implications are quite significant to meeting the petroleum-use reductions targeted by early 2005.

3. Regulatory Programs and Fiscal Influences

This section describes key regulatory programs and fiscal influences that play important roles in determining how the state fleet is operated, and therefore its current and future petroleum consumption.

3.1 The Federal Energy Policy Act (EPACT)

A very important influence regarding the mix of vehicles purchased and operated by the state comes from the federal government. The Energy Policy Act of 1992 (EPACT) was passed by Congress to reduce America's dependence on imported petroleum. Under the oversight of the U.S. Department of Energy, EPACT includes regulatory efforts as well voluntary initiatives, most of which are aimed specifically at reducing petroleum use by government agencies.

EPACT is directly relevant to California's efforts to reduce the state fleet's petroleum consumption, albeit not necessarily in the way intended. Under EPACT, California and local government are required to purchase 75 percent of their non-exempt light-duty vehicle as AFVs.[iii] Vehicle types that can satisfy EPACT's AFV definition include "pure" (100 percent battery power) electric vehicles; "flexible fuel vehicles" that can burn variable mixtures of gasoline and ethanol or methanol; natural gas vehicles that have dedicated bi-fuel CNG engines, and propane vehicles (either dedicated or bi-fuel). However, as further discussed in this report, the DGS has adopted internal policies that preclude the purchase of certain EPACT-approved AFVs.[iv]

EPACT's current version is severely limited as a significant driver towards actual displacement of petroleum fuels in the state fleet. First, it includes exemptions for vehicles heavier than 8,500-lb. Gross Vehicle Weight Rating. As a result, fleets that operate medium- and heavy-duty vehicles – which are among the largest users of petroleum fuels in America – currently, have no major energy-related regulatory drivers to reduce their petroleum consumption. Second, EPACT exempts a large population of specialized vehicle types and applications (see endnote iii), some of which could arguably be suitable for alternative fuel use. Finally, a major loophole of EPACT is that bi-fuel, and flexible-fuel vehicles, which can readily operate on 100 percent gasoline, are not actually required to use their respective type of alternative fuel.

The net effect is a dichotomy: EPACT plays a key role in determining vehicle purchase options and patterns for state agencies, but it does little to incentivize purchase of fuel-efficient vehicles or actual use of alternative fuels in EPACT-compliant AFVs. On page 18 provides a specific example of how EPACT has affected California's vehicle purchases over the last three years.

It is possible that EPACT will be amended in at least two key ways related to this study. First, the "fuel-use" loophole could be closed, making it a requirement that all newly purchased AFVs use an alternative fuel for most (or all) of the miles driven. This would ensure that the state's fleet of bi-fuel AFVs (assuming such vehicles are purchased in the future) would not operate on gasoline. However, it would do little to directly affect gasoline consumption within the existing fleet of bi-fuel vehicles. Second, EPACT could be amended for a broader interpretation of hybrid electric vehicles (hybrids), acknowledging their full value as high-efficiency "alternative technology vehicles" and putting them on equal footing with AFVs for meeting EPACT requirements. Many fleet administrators favor this because EPACT requirements would be easier to meet, and greater numbers of hybrids could be purchased. Section 5.3.1 further describes this important issue and the implications to SB 1170's targets for reduced petroleum use.

3.2 Key California Regulations and Programs

The California Air Resources Board has been a world leader in the development and adoption of stringent motor vehicle emissions standards for more than 30 years. In 1990, The CARB adopted the worlds first set of "low-emission vehicle" (LEV) standards, which run from 1994 through 2003. In 2004, the next generation of low-emission vehicle standards (LEV II) will take effect, requiring even cleaner on-road motor vehicles to be sold throughout California. LEV II includes a wide variety of measures and standards to regulate California's entire light- and medium-duty fleet, including sport utility vehicles and pickup trucks that are often used as passenger vehicles. The CARB has also adopted the world's most stringent emissions standards for heavy-duty vehicles. Detailed descriptions of these various programs are beyond the scope of this report, but extensive information can be found on the CARB website at: http://www.arb.ca.gov/msprog/. Section 8 entitled "8. Air Emission Standards Governing Fleet Purchases" further describes the relationship between the CARB's emissions standards and how vehicles are purchased for the state fleet.

Unlike emissions, California does not regulate vehicle fuel economy.[v] However, top priorities include maximizing vehicle fuel efficiency and reducing fuel consumption in the transportation sector. Over the years, many technologies developed and installed on vehicles in response to the CARB's emissions requirements have simultaneously helped increase fuel economy. Reducing per-vehicle fuel consumption is essential because California's annual use of gasoline and diesel fuel are by far the nation's largest, and the number of vehicles driven in the state continues to grow.

The Energy Commission is the state's primary energy policy and planning agency. One function of the Energy Commission is to oversee state efforts to reduce dependence on petroleum fuels and promote the use of fuel-efficient technologies. A particular focus for the Energy Commission over several decades has been to diversify the transportation fuels market by working with vehicle manufacturers and other stakeholders to commercialize AFVs. An essential element of this effort has been parallel development of the necessary fueling infrastructure to support various types of AFVs. Today the Energy Commission has developed and is implementing the California Clean Fuel Infrastructure Development Plan, which provides an integrated development for clean fuels infrastructure in California. Efforts by the Energy Commission to reduce petroleum dependency and consumption are further described in this report, in the context of their relation to SB 1170.

3.3 The California Budget Situation

As of the writing of this report (January 2003), California is faced with a fiscal situation that may lead to significant spending cutbacks in state agencies. While not yet fully understood or quantifiable, this is likely to have important near-term implications on the size and fuel-efficiency characteristics of the state fleet. Examples of potential impacts that are relevant to this study include the following:

- Historical growth in the state fleet's size (two to three percent) may be slowed or reversed.

- Agencies could be constrained from purchasing conventional, hybrid-electric, or alternative fuel vehicles which offer the best potential to displace petroleum-based fuels but have significantly higher capital costs than conventional vehicles.

- Staffing at state agencies may be reduced (through attrition and/or layoffs), scaling back or eliminating a variety of services and activities that otherwise have potential to reduce petroleum usage.

This situation makes near-term reductions in the state fleet's petroleum use difficult to achieve. It's possible that this factor alone could result in fuel usage reductions that meet or exceed the targeted 10 percent by 2005.

4. Overview of State Fleet

4.1 Estimated "Baseline" Fleet Size and Fuel Consumption

There are about 250 state agencies in California, employing approximately 230,000 people. Over the period from 1998 to 2002, the state's work force increased by about 12 percent. However, there has been a slight downturn in the number of employees since late 2001 (see Figure 4-1).

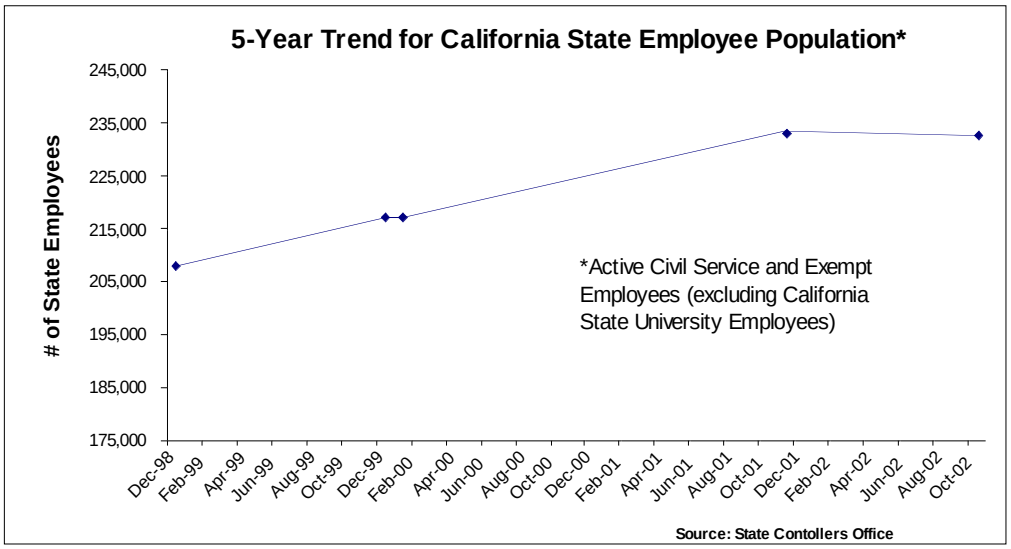
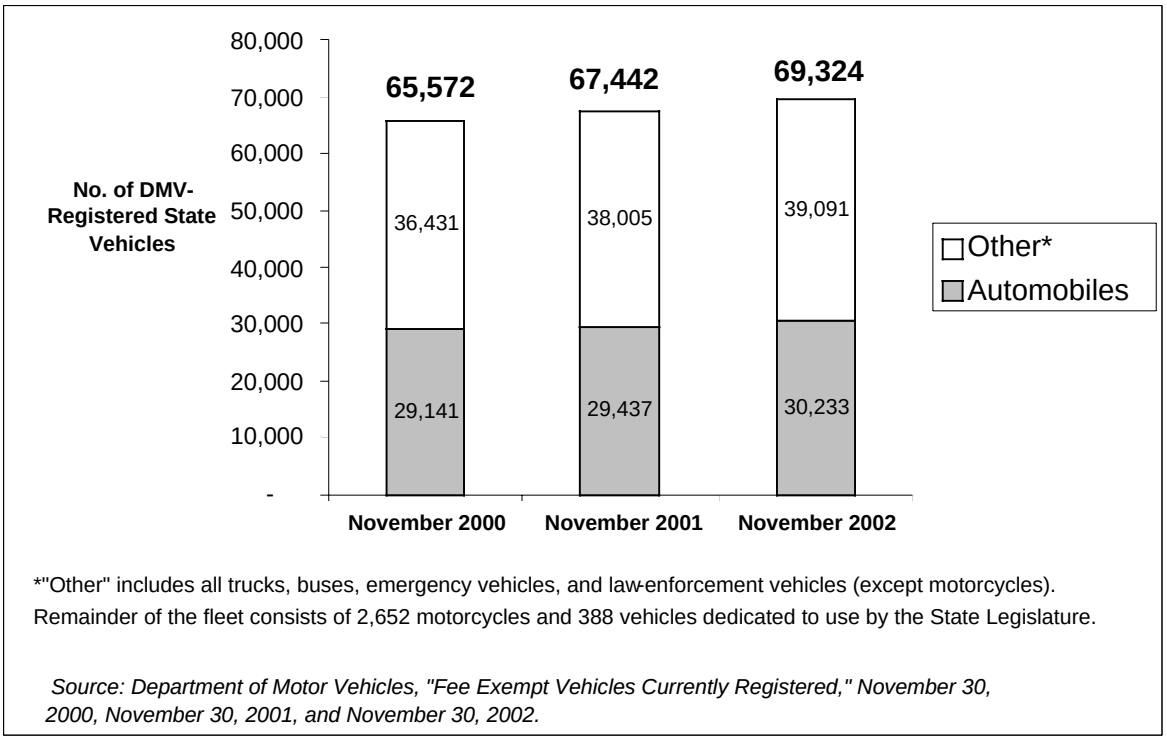


Figure 4-1 5-Year Trend for State Employee Population

According to DMV records for December 2002, a fleet of 72,364 on-road vehicles serves the official transportation needs of these state employees. As Figure 4-2 shows, 30,233 vehicles in the fleet (41.8 percent) are classified by the Department of Motor Vehicles as "automobiles," and 39,091 (54.0 percent) are a mix of vans, pickup trucks, trucks and buses (shown below as other).[vi] (Not included in these numbers are 388 automobiles and SUVs that are dedicated to the State Legislature and about 2,652 motorcycles used primarily for law enforcement.) As Figure 4-2 shows, the state's on-road fleet has grown over the last three calendar years; the rate of growth per year has been about 2.8 percent.

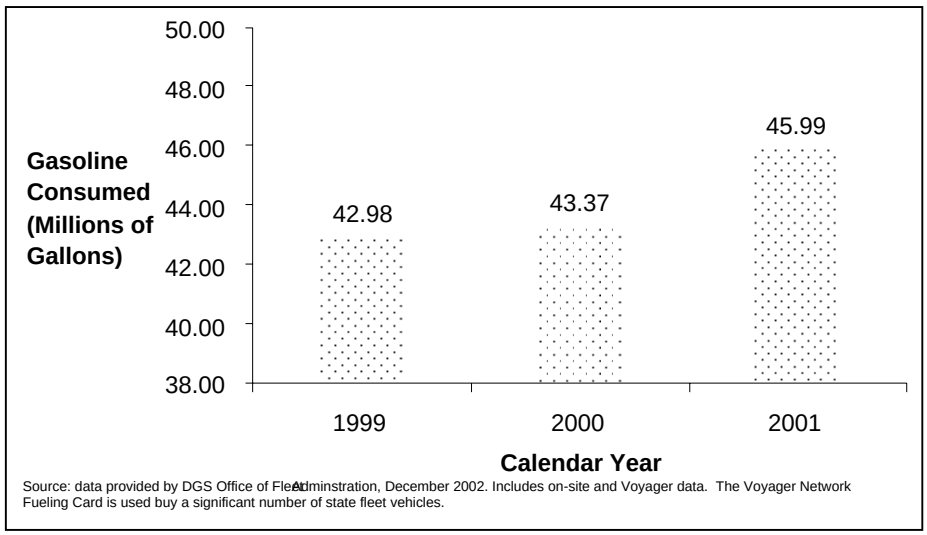


*"Other" includes all trucks, buses, emergency vehicles, and law-enforcement vehicles (except motorcycles). Remainder of the fleet consists of 2,652 motorcycles and 388 vehicles dedicated to use by the State Legislature.

Source: Department of Motor Vehicles, "Fee Exempt Vehicles Currently Registered," November 30, 2000, November 30, 2001, and November 30, 2002.

Figure 4-2 Size of California's State On-Road Motor Vehicle Fleet, 2000-2002

No additional breakdown is currently available for these 72,364 state-operated vehicles, although efforts are underway to develop more detailed fleet profiles. Therefore, for this report it was necessary to make assumptions about key fleet characteristics (e.g., the mix of gasoline- and diesel-fueled vehicles) using the best-available fuel use data and other information.



Source: data provided by DGS Office of Fleet Administration, December 2002. Includes on-site and Voyager data. The Voyager Network Fueling Card is used buy a significant number of state fleet vehicles.

Figure 4-3 Gasoline Consumption by Vehicles in the State Fleet, 1999-2001

In 2001, the state fleet collectively consumed about 46 million gallons of gasoline and 9 million gallons of diesel. As Figure 4-3 shows, gasoline consumption increased significantly in 2001 (6.5 percent) compared to the average from the two previous years. Data for 2002 are not yet available.

Based on these fuel-use data and other information provided by state agencies, a reasonable estimate can be derived for a breakdown of the state fleet by vehicle category (light, medium or heavy duty) and fuel type. This estimate is provided in Table 4-1.

Table 4-1

Estimated Breakdown of the State Fleet by Technology and Fuel Use

Vehicle Type	Primary Fuel Used (w/ Frequency)	Number of Vehicles	Percent of Total Fleet
Conventional Light- and Medium-Duty Vehicles, (Including Motorcycles)	100% Gasoline	62,091*	85.8%
Light-Duty AFVs with Bi-, or Flex-Fuel Capability	98.8% Gasoline[vii]	5,221	7.2%
Conventional Heavy-Duty Vehicles	100% Diesel	4,400*	6.1%
Light-Duty Dedicated AFVs	100% CNG	288	0.4%
Light-Duty Hybrid Electric Vehicles	100% Gasoline	220[viii]	0.3%
Light-Duty Battery EVs	100% Electricity	149	0.2%
Totals		72,369	100%

Source: Information provided by the Department of Motor Vehicles and the DGS Office of Fleet Administration
*Rough estimates: data were unavailable to accurately estimate breakout of gasoline- versus diesel-fueled vehicles

4.2 Targets for Reduction of Petroleum Fuel Use under SB 1170

For reasons previously described, this report assumes that the appropriate baseline for quantifying a 10 percent decrease in petroleum fuel usage would be the estimated January 2005 consumption in the absence of any new fuel efficiency measures. A key limitation is that data and information are currently lacking to derive a baseline estimate that is highly accurate or precise. For example, 2001 represented a significant increase in gasoline usage for the fleet compared to 2000 and 1999, but data for 2002 are not yet available to further corroborate this trend. Historical trends suggest that gasoline consumption will increase by two to three percent each year, which could equate to a January 2005 baseline (i.e., no further reduction efforts) that approaches 49 million gallons. However, other factors suggest that the state fleet's fuel consumption could increase more gradually, if at all. For example, modest declines have recently occurred in the number of state employees (Figure 4-1). Also, the state purchased 12.7 percent fewer fleet vehicles in FY 2001-2002 compared to FY 2000-2001 (see Section 4.3). Finally, the natural process of replacing older vehicles with new, more-efficient vehicles of the same class is likely to help reduce the fleet's overall fuel consumption.

Based on simple extrapolation of current trends and taking into account uncertainty about key factors (e.g., the state's fiscal picture), it appears that the minimum 10 percent

reduction targeted for January 2005 roughly equates to 4.5 to 4.9 million gallons of gasoline. The estimated January 2005 target for reduction of diesel fuel use is between 800,000 and 940,000 gallons. Table 4-2 provides these numbers and how they were derived.

Table 4-2

January 2005 Petroleum Fuel Baselines and Targets for Reductions

Fuel	Estimated Current Consumption (gallons)	Estimated January 2005 Baseline (gallons)	10% Minimum Targeted Reduction by January 2005 (gallons)[ix]
Gasoline	45.9 million*	45.0 to 49.0 million	**4.5 to 4.9 million**
Diesel	8.9 million**	8.0 to 9.4 million	**800,000 to 940,000**

* Based on 2001 fuel use at state's onsite stations plus Voyager card purchases
**Includes only state's onsite stations – no Voyager data provided

Given the current limitations on detailed input about the state fleet, this study focuses on methods to achieve per vehicle reductions in petroleum usage. Where sufficient data exist, estimates of potential reductions in gallons are also provided.

4.3 State Vehicle Procurement Process and Participating Agencies

One key objective of this report is to examine vehicle purchase patterns for the state fleet to determine how to focus future purchases on the most fuel-efficient vehicles available. As discussed in Section 3.1, compliance with EPACT is an important determinant of how the state purchases its vehicles. For purposes of meeting and tracking compliance with federal law as well as state guidelines and procedures, vehicles to be purchased are categorized as "non-exempt" or "exempt" from EPACT requirements. All light-duty cars and trucks rated at less than 8,500 Gross Vehicle Weight Rating (GVW) that do not meet certain special criteria are considered non-exempt, and are therefore subject to AFV target percentages (75 percent of non-exempt vehicles). Exempt vehicles are not subject to such requirements because they are rated at or above 8,500 lbs. GVW, and/or they are used in exempted applications such as law enforcement, military, and emergency services.

Table 4-3

Effect of EPACT on California State Fleet Purchase Patterns

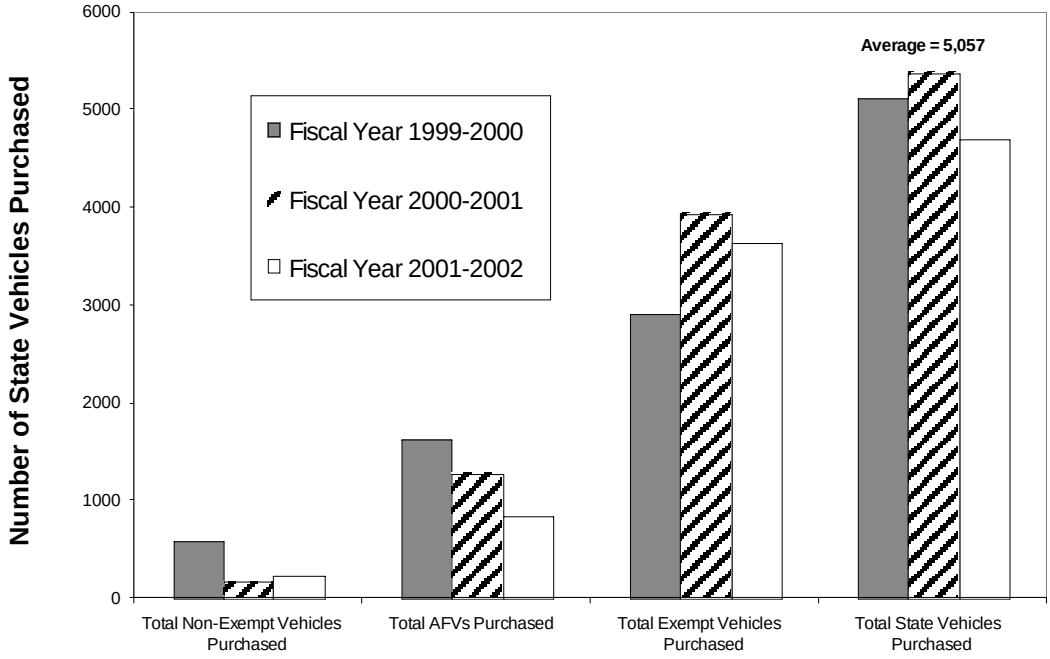
Avg. number of vehicles purchased per year over last three years	5,057
Avg. number of vehicles per year that were exempt from EPACT	- 3,489 (69%)
Avg. number of vehicles per year that were **not** exempt from EPACT	**= 1,568 (31%)**
Avg. number of non-exempt vehicles purchased per year that were AFVs, including bi-fuel and flex-fueled vehicles (must be at least 1,176 of 1,568)	1,243 (79%)
Avg. number of non-exempt vehicles purchased per year that were conventionally fueled, including hybrid electric vehicles (cannot exceed 392 of 1,568)	325 (21%)
	1,568 (100%)

All vehicle purchases for the state fleet are coordinated through the Department of General Services, which has a long-standing policy to competitively bid its vehicle contracts and make them available to a wide array of California governmental entities. These statewide vehicle procurement contracts leverage pricing based upon California government business volume enhanced by manufacturer and dealer incentive programs provided to government agencies. According to the DGS, a broad spectrum of vehicles are available using this system, at an 8 percent to 12 percent cost savings over volume commercial fleet pricing. For a given model year, contract ordering generally begins in October.[x]

The state's vehicle procurement contracts are available to any California governmental entity, including state agencies, county and city governments, K-12 education, special districts, colleges and universities. Agencies can order directly from the contract dealer, with a copy of the order going to the DGS's Procurement Division, which charges a minimal administrative fee.[xi] Through this system, the DGS has a history of helping a wide variety of government agencies in California to purchase environmentally benign vehicles such as AFVs, at the lowest-available prices. It is expected that in the future, the statewide vehicle procurement system in will continue to assist non-state agencies to purchase AFVs and high-efficiency vehicles such as hybrids.

4.4 Trends from Recent Vehicle Procurements

Over the last three fiscal years, the state has purchased an average of 5,057 new motor vehicles. As shown in Figure 4-4, there was a significant drop off in vehicle purchases (13 percent) in the most recent fiscal year (2001-2002) compared to the previous year. However, the longer-term trend is not clear, and the FY 2002-2003 purchase cycle is not yet complete.



Non-Exempt Vehicles: sedans, vans, and light trucks less than 8,500 lbs GVWR, and subject to federal EPACT requirements
AFVs: Non-Exempt Vehicles that meet Federal definition of alternative fueled (i.e., comply with EPACT 75% requirement)
Exempt Vehicles: various vehicles >8,500 GVWR and/or emergency vehicles (e.g., law enforcement), not subject to EPACT requirements.

Figure 4-4 Three Year Trend for State Fleet Vehicle Purchases

As the previous two figures show, more than two-thirds (69 percent on average) of the vehicles purchased by the state over the last three fiscal years were exempt from EPACT requirements. This is presumably because the state fleet requires many vehicles that fall within one or more of the exemption categories for EPACT. These categories are: 1) medium- and heavy-duty vehicles (exceeding 8,500 GVWR); 2) categorized as military tactical vehicles, law enforcement or emergency vehicles; and 3) geographically located outside a covered "metropolitan statistical area."

The scope of potential petroleum-reduction efforts outlined in SB 1170 appears to include the state's relatively large fleet of exempted vehicles.[xii] Therefore, this report describes some methods to potentially reduce fuel consumption in exempted vehicles, but the menu of options is currently smaller for these vehicles. More information is needed about the specific types of vehicles, how they are operated, and the individual needs of the agencies that operate them.

Part of that process to gain direct input from various state agencies has already been initiated, as described below.

4.5 Direct Input on Fleet Operations from State Agencies

Consistent with SB 1170, this study includes direct input from the agencies that will be most affected by efforts to reduce petroleum consumption in the state fleet. In the third quarter of 2002, a questionnaire was created by the three agencies (CARB, Energy Commission, and DGS) and sent to a wide variety of California's state agencies. This questionnaire requested information from each agency about programs and policies it utilizes to help reduce petroleum dependency in the state fleet. For those agencies that operate their own fleets, questions focused on existing and planned use of AFVs and high-efficiency vehicles (e.g., hybrids). An objective was to gain greater insight about the types of programs that have already worked in certain fleets, and if they can be successfully applied to other state fleets.

Table 4-4 lists the 26 state agencies that responded to the questionnaire.

Table 4-4

State Agencies That Responded to "Three Agency" Questionnaire

State Agency	
1. Department of Alcoholic Beverage Control	14. Department of Toxic Substances Control
2. California Conservation Corp	15. Department of Water Resources
3. Department of Food and Agriculture	16. Department of Housing and Community Development
4. California Department of Transportation	17. Department of Forestry and Fire Protection
5. California Energy Commission	18. Native American Heritage Commission
6. California Highway Patrol	19. Office of Environmental Health Hazard Assessment
7. California Housing Finance Agency	20. Office of the Patient Advocate
8. California Integrated Waste Management Board	21. Office of Traffic Safety
9. Department of Boating & Waterways	22. Rivers and Mountains Conservancy
10. Department of Fish & Game	23. Santa Monica Mountain Conservancy
11. Department of Managed Health Care	24. State Coastal Conservancy
12. Department of Motor Vehicles	25. State Water Resources Control Board
13. Department of Parks & Recreation	26. Stephen P. Teale Data Center

Source: Completed questionnaires provided by the DGS Office of Fleet Administration

The range of detail in the responses from these 26 agencies was quite varied. Some agencies extensively documented their vehicle-related issues relevant to SB 1170, while others did not. Throughout this report, input and recommendations from these agencies are provided, in sections that discuss specific fuel-efficiency measures and programs.

Important conclusions that can be inferred from the responses received include the following:

1. Many of the responding agencies operate EPACT-exempted vehicles that use special equipment, and/or are used in remote areas of the state.

2. To obtain a quantitative analysis of the potential costs and benefits, detailed new information will be required from certain agencies and departments that are the biggest fuel users. Examples of information that may be required include complete vehicle inventories, usage patterns, mileage and fueling habits, maintenance practices, and other parameters.

3. Similarly, information will need to be collected and provided regarding the costs associated with existing or potential fuel conservation measures.

4. Obtaining detailed data could be a very time-consuming process. Some agencies may not have the necessary staff, especially in the current budgetary environment.

For the next annual update of this report, it is recommended that a more structured and comprehensive questionnaire be designed and sent to all state agencies that operate vehicles. However, it may be necessary to determine in advance if sufficient manpower exists to respond adequately. Since the state has considerable influence in how other government agencies in California purchase vehicles, this questionnaire could be expanded to include and benefit cities, counties and municipalities.

5. Vehicle Procurement and Technology Strategies to Reduce Petroleum Consumption

This section focuses on procurement of new vehicles that 1) can be operated on alternative fuels as a means to "displace" gasoline, or 2) achieve the highest possible fuel efficiency in their class. While some of these strategies offer the greatest potential to reduce petroleum consumption, they also generally have the highest costs and/or involve the most difficult tradeoffs and compromises.

To better understand such costs and tradeoffs, as well as time constraints, it is useful to compare three Honda Civic models that the state could potentially procure in the near term. For the 2003 model year, three comparably equipped Honda Civic models are available in distinctly different powertrain technologies. These are 1) the conventional gasoline-fueled Civic, considered a "best-in-class" vehicle for fuel economy; 2) the gasoline-fueled Civic hybrid electric vehicle, which uses a hybrid drivetrain featuring a small gasoline engine and an electric motor; and 3) the Civic GX fueled by a dedicated compressed natural gas (CNG) engine. Each of these Civic sedans offers the state a potential strategy to reduce petroleum use. Table 5-1 provides a comparison of price, fuel economy, vehicle range, and petroleum displacement potential.

Table 5-1

Comparison of Conventional, Hybrid, and CNG Honda Civics

Comparably Equipped Honda Civics	MSRP	Price Premium Over ICE	Fuel Economy (MPGe)	Driving Range (miles)	Annual Fuel Cost*	Annual Gasoline Use (gal)
2003 MY **Gasoline ICE**	$16,010	--	37	488	$624	405
2003 MY **Gasoline Hybrid**	$20,550	$4,540	48	634	$481	313
2003 MY **Dedicated CNG**	$20,510	$4,500	32	256	$609	0**

ICE: Internal combustion engine (conventional vehicle) with automatic transmission
MSRP: Manufacturer's Suggested Retail Price (slightly higher than price paid by State)
MPGe: Miles per gallon equivalent (of gasoline)
*Assuming 15,000 miles per year and gasoline at $1.54 per gallon, or CNG at $1.30 per GGE
**CNG Civic will use approximately 469 gasoline gallon equivalents, but displacement of gasoline is 100%

Source: U.S. Environmental Protection Agency, "Find and Compare Cars," www.fueleconomy.gov.

A specific requirement of this report is to examine the costs and benefits of purchasing high-efficiency gasoline vehicles (including hybrids) and dedicated AFVs (e.g., the Honda Civic GX) as alternatives to purchasing EPACT-compliant vehicles that effectively use no alternative fuel. Table 5-2 summarizes the various advantages and disadvantages of each choice, and helps to clarify this point. If the state chooses to improve the fuel efficiency of its vehicles in this class at the lowest capital cost, it may choose the "best-in-class" conventionally fueled Honda Civic. If the state seeks to displace the most gasoline while complying with EPACT requirements and achieve the lowest emissions, it might choose the dedicated CNG version of the Civic. However, in doing so it must ensure that the relative disadvantages of this option (higher cost, reduced range, limited refueling infrastructure) are "affordable" for the agency. If it chooses to reduce the greatest amount of energy, it would choose the gasoline hybrid.

On the other hand, for state agencies that operate in remote areas where CNG is not available, the best choice may be the Civic hybrid, which offers the highest available fuel economy in the sedan class, as well as the longest driving range. A downside is that purchasing the Civic Hybrid (or a conventional Honda Civic) does not help the state fleet meet its 75 percent quota for purchasing AFVs, as required under EPACT.

Table 5-2

Summary of Advantages and Disadvantages [a]

Comparably Equipped Honda Civics	Capital Cost [b]	Life Cycle Cost [c]	EPACT AFV	Vehicle Range	Emissions Certification	Gasoline Displacement
2003 MY **Gasoline ICE**	~13% higher	Nearly Same	No	Better	+ (ULEV)	Moderate
2003 MY **Gasoline Hybrid**	~47% higher	Higher	No	Much Better	+ (ULEV)	Good
2003 MY **Dedicated CNG**	~47% higher	Higher	Yes	Worse	++ (SULEV)	Excellent (100%)

[a] The baseline vehicle for comparison is a typical 4-passenger ICE vehicle achieving about 30 mpg and costing about $14,000.
[b] Not including potential capital costs to obtain access to CNG fuel (for NGV option)
[c] Assuming a 7-year life over 105,000 miles and full use of federal, state or local incentives such as tax rebates

The above "apples to apples" comparison helps to shed light on the types of costs and benefits that can be expected. Actually deciding which type of vehicle to purchase is a more complicated exercise – it will depend largely on specific needs of the agency purchasing the vehicle, and the actual commercial offerings for that class of vehicle.

These types of costs, benefits and tradeoffs are further discussed below as they pertain to specific petroleum-displacement options for the state fleet.

5.1 Alternative Fuel Vehicles and Fueling Infrastructure

As previously described, EPACT and other regulatory drivers require the state fleet to purchase AFVs for at least 75 percent of its purchases in the "non-exempt" vehicle category. Essentially, this means that 75 percent of the non-emergency, non-law-enforcement automobiles, vans and light-duty pickups purchased by the state must be at least capable of operating on an alternative fuel. This requirement is a major influence on how California (or any other state) purchases its fleet vehicles.

Table 5-3 provides a breakdown of the 5,658 light- and medium-duty AFVs that are currently operated in the state fleet. As these data show, three types of vehicles dominate the state's AFV roster: bi-fuel NGVs (34.7 percent), bi-fuel LPGVs (28.5 percent), and flexible-fuel vehicles (29.1 percent). A common characteristic of these three vehicle types is that they can each be operated exclusively on gasoline. By contrast, the two types of AFVs in the fleet designed for exclusive operation on alternative fuels – the 288 "dedicated" NGVs and 149 battery electric vehicles – collectively constitute less than 8 percent of the fleet's AFV population.

Table 5-3

Breakdown of Light- and Medium-Duty AFVs in State Fleet (11/02)

Fleet	Dedicated NGVs	Dual-Fuel* NGVs	Bi-Fuel* LPGVs	E-85 and M-85 FFVs	Battery Electric Vehicles
The DGS Office of Fleet Administration	175	1050	75	247	119
All Other sate Agencies	113	912	1535	1402	30
Total for the California State Fleet	**288**	**1962**	**1610**	**1649**	**149**
Percent of Fleet's Total AFV Population	**5.1**	**34.7**	**28.5**	**29.1**	**2.6**

NGV: Natural Gas Vehicle
LPGV: Liquefied Petroleum Gas (Propane) Vehicle
FFV: Flexible Fuel Vehicle
E-85: A variable mixture of gasoline and up to 85% ethanol
M-85: A variable mixture of gasoline and up to 85% methanol

*"Dual-fuel vehicle" is frequently used in reference to NGVs, while "bi-fuel vehicle" can refer to either NGVs or LPGVs. These terms refer to AFVs capable of being operating on either gasoline or the alternative fuel, from separate fuel-induction systems and on-board storage tanks.

Figure 4-1Figure 5-1 provides a breakdown of the AFVs that were purchased over each of the last three fiscal years, by type.

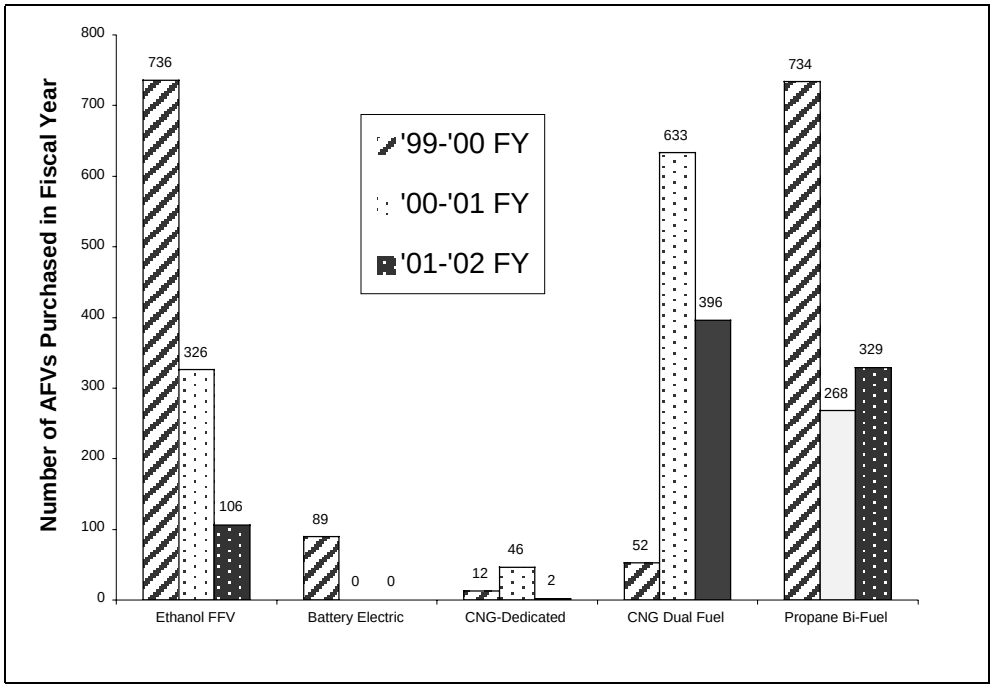


Figure 5-1. Types of AFVs Purchased for State Fleet, Last Three Fiscal Years

As with the existing AFV fleet as a whole, AFV purchases over the last three fiscal years were dominated by bi-and flex-fuel vehicles. Such vehicles cannot serve as a significant strategy to reduce petroleum consumption in the state fleet by 2005 unless they are regularly driven on the alternative fuel for which they were designed. The importance of past and future purchase trends for each AFV type is further discussed below.

5.1.1 Dedicated and Bi-Fuel Natural Gas Vehicles

One of the largest potential reductions of petroleum use in the state fleet involves the existing NGV fleet. Two key opportunities exist for greater displacement of gasoline. First, the fleet's 1962 bi-fuel CNG vehicles – currently being driven approximately 96 percent on unleaded gasoline – could be switched over to natural gas as the predominant fuel. As Table 5-4 shows, an estimated 1.269 million gallons of gasoline usage per year can be displaced if the state's 1,962 dual-fuel vehicles were to be operated on CNG for 100 percent of their miles driven. This measure would result in an estimated 2.8 percent reduction from the state fleet's petroleum fuel use baseline January 2005 gasoline usage – equivalent to more than one fourth of the minimum target under SB 1170. Using CNG for any fraction of the miles driven would yield proportionate reductions.

Table 5-4

Estimated Reduction in Gasoline Usage from Using CNG fuel in Bi-fuel Vehicles for 100 Percent of Miles Driven

Estimated annual miles driven per vehicle	15,000
Estimated percent of miles currently driven on gasoline	95.8%
Estimated annual miles driven on gasoline	14,370
EPA-rated combined fuel economy for MY 2001 dual-fuel Chevy Cavalier when operating on gasoline	26.2
Estimated real-world fuel economy (85% of EPA combined rating)	22.2
Estimated annual gasoline usage per vehicle (gallons) as operated today	647
Number of bi-fuel vehicles (Chevy Cavaliers, others) in state fleet	1,962
Estimated annual gasoline displacement (gallons) if all bi-fuel vehicles use CNG for 100% of miles driven	1,269,414
Estimated baseline gasoline usage (gallons) for state fleet in 2005	45,900,000
Estimated percent reduction from 2005 baseline	**2.8%**

Assumptions and Uncertainties:

- Assumes all bi-fuel vehicles in state fleet are 2001 MY Chevy Cavaliers, or similar
- The estimated percent driven on gasoline was derived by total CNG use in 2001 for the entire state fleet, which includes some dedicated CNG vehicles.
- The actual number of average annual miles driven by the state's bi-fuel vehicles is not known. Using 10,000 miles per vehicle will reduce the gasoline displacement and % reduction from baseline by 33%.

This analysis estimates that a major portion of the petroleum displacement goals set forth in SB 1170 will be met if CNG can be used as the exclusive fuel for the state's 1,962 bi-fuel NGVs. Although details are not yet available about use characteristics for the state's 288 dedicated NGVs, it is likely that these vehicles offer additional opportunity to displace petroleum fuel. Currently, the fleet's 288 dedicated NGVs are used predominantly as pool vehicles for "tripper" applications. This type of use generally entails sporadic short trips that do not accumulate significant miles. This limited use may largely be attributable to uncertainty and anxiety that users of dedicated AFVs typically exhibit concerning fuel access when station infrastructure is limited, as is the case with CNG (see discussion below). Even assuming no infrastructure improvements, it's possible that the state's 288 dedicated CNG vehicles could be used more frequently and for longer trips, resulting in significantly more gasoline displacement. However, additional information is needed about the numbers of dedicated CNG vehicles in the state fleet by type, their annual mileage, how they are currently being used, and their access to stations.

For both types of NGVs in the state fleet, the key to maximizing gasoline displacement will be to expand the CNG fueling infrastructure in strategic areas. Today, there a nearly 10,000 gasoline stations in California, dispersed throughout the state at convenient locations in even the most remote areas. By contrast, there are about 112 public CNG stations, most of which are concentrated in high-profile NGV corridors such as the greater Los Angeles region. Extensive improvement is needed in the CNG fueling infrastructure, especially in the greater Sacramento region of northern California, and the Central Valley. As long as CNG stations are less convenient to access and use, state employees driving bi-fuel NGVs are likely to continue to use gasoline, and miles driven for dedicated NGVs will be limited.

Progress on CNG infrastructure is being made, led by the Energy Commission's infrastructure development program and various other governmental efforts. Building a new CNG station is a major capital and time investment; within the timeframe noted in SB 1170, the potential is limited to significantly displace more gasoline through CNG infrastructure expansion. However, at least two key CNG infrastructure improvements are already underway that can positively impact the ability of the state fleet to increase NGV use in the near term. Many of the state fleet's 2,250 NGVs (most of which are dual-fuel versions) are operated out of seven state garages located throughout California. As Table 5-5 shows, none of these seven garages currently has on-site access to CNG fuel, and the nearest accessible CNG station is typically one to five miles away. Plans have been approved, however, to build new CNG stations at the Los Angeles and Sacramento state garages.

Table 5-5

NGVs and Infrastructure at California's Seven State Garages

State Garage	Onsite CNG Station?	Current Closest CNG Fueling Station*
Fresno	None	Public station about 2 miles.
Los Angeles	Planned for 2004 opening	ENRG station about 3 miles
Oakland	None	Several PG&E stations within 5 to 8 miles.
Sacramento	Planned for 2004 opening	PG&E station and other within 1 to 3 miles
San Diego	None	SDGE station within 1 mile
San Francisco	None	Two PGE stations within 1 mile.
Van Nuys	None	SoCal Gas station within 3 miles

The DGS's Office of Fleet Administration is working with several other state agencies and the private sector to build these two stations. The original decision to build was made several years ago, but the state budget and other factors delayed final approval until late 2002. These two state garages are the most strategically located in reference to the fleet's bi-fuel CNG vehicles. Current estimates indicate that fueling of NGVs could begin at the two stations by mid 2004. The estimated costs for these two CNG fueling stations are $953,240 for the Sacramento state garage and $795,480 for the Los Angeles state garage.

While this represents good progress, additional action is needed that will ensure maximum use of CNG in NGVs located at these two state garages, as well as elsewhere in the fleet. It may be necessary to re-deploy some vehicles to locate in closer proximity to CNG fueling locations. It is also recommended that the state adopt an executive order requiring employees to use AFVs and alternative fuel whenever practical. This may be essential to meet the challenging targets under SB 1170 for displacing petroleum fuels, especially in the case of the state's numerous bi-fuel vehicles, which are currently operated almost exclusively on gasoline.

Another improvement in NGV fueling logistics involves advancements with "open-access" user-friendly methods to purchase CNG at the pump. Since natural gas and other alternative fuels are not typically provided by petroleum companies at conventional fueling stations, and acceptance of cash is often not an option, payment methods have long been needed that are consistent with the way individual AFV operators are accustomed to purchasing automotive fuels. Generally, at least two types of card access are desired. First, new stations funded with government funds are generally required to offer public access, so a typical credit card such as Visa or MasterCard should be accepted. Second, for California's fleet vehicles that fuel at CNG stations, it will be necessary for the Department of General Services to obtain normal fleet management services through use of a fleet fueling card (i.e., Voyager).

Recently, the Energy Commission joined with the U.S. DOE, the National Renewable Energy Laboratory, and the South Coast Air Quality Management District to initiate new

efforts towards development of a "universal" card reader access program. The immediate focus of this effort is on CNG fueling stations in California. However, the ultimate objective is to apply the resulting advancements in open-architecture card reader systems across the United States, at stations dispensing other types of alternative transportation fuels. Significant progress has been made in retrofitting of existing CNG stations with open-architecture card reader systems, as well as building new stations with state-of-the-art systems. These developments will help ensure that the new CNG stations at the Los Angeles and Sacramento state garages are able to accommodate state employees using Voyager cards as well as the general public using a major credit card like Visa. These two new CNG stations will open in 2004, and can help the state's NGV fleet displace greater volumes of gasoline. However, it is difficult to quantify the volume of fuel that can be displaced by the SB 1170-targeted date of January 2005.

Over the longer term, it is recommended that a comprehensive plan be developed to address the shortage of CNG fueling infrastructure available to fuel the state's existing and planned NGV fleet. It is expected that the cost in 2003 dollars for each station would be from $600,000 to $900,000, depending on the station size and other factors. In addition to any requests that must be filed through Budget Change Proposals, various grant funding should be sought from state, local and federal programs. To best manage costs, it may be necessary for the state to provide land for some (or all) of the stations. One possible approach would be for state agencies to own and operate these stations. Another approach is to contract with a third-party "turnkey" CNG provider to build and operate each station as part of public/private partnerships. However, an essential element to attract private investment for such stations will be the presence of at least one "anchor fleet" that can use approximately 15,000 to 20,000 gasoline gallon equivalents per month. Because the state's local fleet of NGVs may not be able to generate this level of fuel throughput, it may be necessary to select station locations that can attract other large NGV fleets.

It is also recommended that the state utilize the Department of Motor Vehicle's database to better assess optimized locations for new CNG stations. For example, this would help pinpoint locations for the 1,025 NGVs currently in the state fleet that are not operated by the DGS. In addition, this analysis would provide a better understanding about current geographic spacing of non-state NGV fleets using CNG fuel. This information can be used to select new CNG station locations that will maximize return on investments. Similar information could be provided involving other AFV types and fueling stations (e.g., propane vehicles as discussed below).

5.1.2 Bi-Fuel (Propane / Gasoline) Vehicles

The state fleet currently includes 1,610 bi-fuel[xiii] vehicles, or 28.5 percent of the entire AFV fleet (refer back to Table 5-3). During the 2001 calendar year, the total use of propane in these 1,610 bi-fuel vehicles was 8,100 gallons (or about 5,952 gasoline gallon equivalents). Assuming that all 1,610 vehicles were in operation by the end of 2001, on average each bi-fuel vehicle in the fleet used only five gallons of propane for the entire year. Table 5-6 provides an analysis of the estimated annual reduction in gasoline usage

that could theoretically occur by early 2005 if all 1,610 bi-fuel vehicles in the state fleet were to be driven 100 percent on propane.

As Table 5-6 shows, substituting propane for gasoline as the "dedicated" fuel for the state's 1,610 bi-fuel vehicles can reduce the entire fleet's baseline gasoline consumption by an estimated 4.4 percent. This is nearly half of the minimum target for early 2005 as identified in SB 1170. However, as with the dual-fuel NGVs, a key barrier to using more propane in bi-fuel vehicles is the lack of a well-developed fueling infrastructure. Additional propane stations will be needed that are located on site with the state's bi-fuel vehicles, if these vehicles are to be operated predominantly on propane.

Table 5-6

Estimated Reduction in Gasoline Usage from Using Propane in State's Bi-fuel Vehicles for 100 Percent of Miles Driven

Estimated annual miles driven per vehicle	15,000
Estimated percent of miles driven on gasoline	99.8%
Estimated annual miles driven on gasoline	14,970
EPA-rated combined fuel economy for MY 2001 bi-fuel Ford F-150 pickup when operating on gasoline	14
Estimated real-world fuel economy (85% of EPA combined rating)	11.9
Estimated annual gasoline usage per vehicle (gallons) as operated today	1,257
Number of bi-fuel vehicles (Ford F-150 Pickups, others) in state fleet	1,610
Estimated annual gasoline displacement (gallons) if all bi-fuel vehicles use propane for 100% of miles driven	2,023,770
Estimated baseline gasoline usage (gallons) for state fleet in 2005	45,900,000
Estimated percent reduction from 2005 baseline	**4.4%**

Assumptions and Uncertainties:

- Assumes all bi-fuel vehicles in state fleet are Ford F-150 pickups, or similar
- The actual number of average annual miles driven by the state's bi-fuel vehicles is not known. Using 10,000 miles per vehicle will reduce the gasoline displacement and % reduction from baseline by 33%.

Fortunately, that process has already begun for the state's largest user of bi-fuel vehicles. The California Department of Transportation (Caltrans) operates approximately 700 of the state's 1,610 bi-fuel Ford F-150 pickup trucks; until recently these have been operated almost exclusively on gasoline.[xiv] However, funding from the Energy Commission's infrastructure program is now being used to add 15 new propane stations in California.[xv] One specific objective is to select locations for those stations that help incentivize Caltrans to use propane in its bi-fuel vehicles, instead of gasoline. The potential benefits from Caltrans alone making a commitment to use propane could be very significant, as shown in Table 5-7. However, this analysis is theoretical and does not take into account the specific needs and requirements of Caltrans involving use of these 700 bi-fuel vehicles.

While progress on propane fueling stations is being made to help achieve these reductions in gasoline usage, there is a problem that may need clarification in future SB 1170 assessments. The use of propane in the state fleet instead of gasoline may not meet SB 1170's definitions regarding displacement of petroleum-based fuels. On the one hand, propane is widely acknowledged as being an alternative transportation fuel that provides extremely low emissions in optimized engines. However, the language of SB 1170 is unclear if use of propane in the state fleet will technically qualify towards reducing petroleum use by January 2005. It is the interpretation of this report that displacement of gasoline and diesel in the state fleet by using propane is wholly consistent with the objectives and intent of SB 1170, and therefore this should be included as a viable strategy. This is because each mile driven would displace a mile on gasoline (or diesel) with a fuel that is essentially not being used today, regardless of the course of the propane.

Table 5-7

Estimated Gasoline Usage Reduction from Operating Caltrans' Bi-fuel Vehicles 100 Percent on Propane

Number of bi-fuel vehicles in Caltrans' fleet	700
Estimated annual gasoline usage per vehicle (gallons) as operated today	1,261
Estimated annual gasoline displacement (gallons) if all bi-fuel vehicles in the Caltrans fleet use propane for 100% of miles driven	882,700
Estimated baseline gasoline usage (gallons) for state fleet in 2005	45,900,000
Estimated percent reduction from 2005 baseline	**1.9%**

Assumptions and Uncertainties:
- Assumes all bi-fuel vehicles in the Caltrans fleet are Ford F-150 pickups, or similar
- The actual average number of annual miles driven by Caltrans' bi-fuel vehicles is not known

5.1.3 Flexible-Fuel Vehicles

Table 5-3 (refer back to page 245) indicates that there are currently 1,649 flexible-fuel vehicles (FFVs) in the state's light-duty vehicle fleet, or about 29 percent of the entire AFV fleet. FFVs are capable of operating on any mixture of unleaded gasoline and fuel ethanol (E-85) or fuel methanol (M-85).[xvi] Of the 1,649 FFVs in the state fleet, 72 percent were originally sold for use with E-85 / gasoline mixtures, and 28 percent were sold for use with M-85 / gasoline mixtures.

FFV technology was originally developed and commercialized (at least in part) to address the infamous "chicken or egg" dilemma that has historically hindered broad-scale market acceptance of AFVs.[xvii] However, neither E-85 nor M-85 are currently available in California as commercial motor vehicle fuels. Effectively, FFVs have become widely available commercial offerings because they help automobile manufacturers meet Corporate Average Fuel Economy requirements and fleets meet quotas for AFV purchases under EPACT. As a result, the many FFVs on the road in California --

including 1,649 in the state fleet -- are now driven exclusively on unleaded gasoline, and therefore make no contribution to the state's efforts to displace petroleum-based fuels.[xviii]

Due to market conditions as well as the complexities and costs involved, it does not appear practicable for the state to increase use of alternative fuels by providing access to E-85 or M-85 fuel. However, the DGS has recognized this problem and taken corrective action, as evidenced by a steep decline in the number of FFVs purchased by the state over the last three years. Under a recent amendment to the DGS policy, state agencies and departments will only be able to purchase AFV technologies designed for an alternative fuel that is currently available in California. This means that FFVs designed to operate on E-85 or M-85 can no longer be purchased for the state fleet. The policy will apply to all state vehicle purchases, effective with the 2003 model-year.[xix]

With FFVs no longer on a purchase option, SB 1170 notes the need to determine if high-efficiency hybrid electric vehicles (hybrids) should be purchased as the preferred alternative, beginning with the 2003 model year. Such a strategy can help reduce gasoline consumption in the fleet, and is consistent with SB 1170's objectives. However, hybrids do not meet the definition of AFVs under major regulatory programs, including EPACT. This means that the state cannot currently obtain credits for its EPACT obligations (i.e., 75 percent of new non-exempt vehicles must be AFVs) by purchasing hybrids. This significantly limits the numbers of hybrids that can be purchased, unless changes in EPACT's requirements can be made (see Section 5.2.2). In addition, purchasing large numbers of hybrids would entail significantly higher capital costs, although reduced operating costs and other factors could make up some of this difference.

5.1.4 Expanded Use of Alternative Fuels in Heavy-Duty Sector

It is well documented that medium- and heavy-duty vehicles (greater than 8,500 pounds Gross Vehicle Weight Rating) can make excellent platforms for successful use of alternative fuels (e.g., natural gas or propane). The potential to displace large volumes of petroleum fuel (diesel) can be very significant because these vehicles consume much more fuel per mile traveled than light-duty vehicles. In addition, they are often centrally fueled and garaged, making fueling logistics easier for alternative fuels. Medium- and heavy-duty vehicles can also use non-traditional alternative fuels such as Fischer-Tropsch fuels, or bio-diesel blends that can help generate AFV acquisition credits for fleets under EPACT.

State agencies are currently in the process of obtaining more information about the medium- and heavy-duty vehicles operated in their fleets. It is currently not known how many of these vehicles are operated on alternative fuels, if any. Additional information is needed before a meaningful assessment can be made about the potential to help meet the objectives of SB 1170 by addressing alternative fuel use in this important sector.

5.2 Purchase and Use of Most Fuel-Efficient Vehicles

Another potential approach to reducing petroleum consumption in the state fleet is to purchase only the most fuel-efficient vehicles of a given class. Vehicle classes are

defined by such parameters as size, carrying capacity (people or cargo), special uses and operations, etc. Each class offers a range of fuel economy performance. In theory, at least, state agencies can purchase the highest-mileage vehicle offered in a desired class, without sacrificing vehicle carrying capacity, safety or other desired attributes.

The U.S. Environmental Protection Agency prepares lists for consumers regarding the most- and least-efficient vehicles by classification. Until the 2000 model year, EPA's list of vehicles with the highest fuel economy was dominated by front-wheel-drive subcompact cars that use small three- or four-cylinder gasoline engines and traditional powertrains. The commercial introduction of a hybrid-electric model for the 2000 model year pushed automobile fuel economy to new levels, however. For the 2002 model year, two hybrid models (the Honda Insight and the Toyota Prius) were dubbed the "greenest" gasoline-fueled cars in America, based on their high fuel efficiency and low emissions. Following these hybrids on the list were several small conventional cars (see Table 5-8).

Table 5-8

"Greenest" Conventional Vehicles of 2002

Make & Model	Specifications	Emission Standard	MPG City / Hwy	Green Score
Honda Insight	1.0 L 3, auto CVT[a]	SULEV	57 / 56	57
Toyota Prius	1.5L 4, auto CVT	SULEV*	52 / 45	51
Honda Civic HX	1.7L 4, manual[b]	ULEV*	36 / 44	42
Toyota Echo	1.5L 4, manual[b]	LEV*	34 / 41	41
Nissan Sentra CA	1.8L 4, auto	SULEV	27 / 33	40
Honda Civic	1.7L 4, manual[b]	ULEV*	33 / 39	40
Mitsubishi Mirage	1.5L 4, manual	LEV*	32 / 39	39
Toyota Corolla	1.8L 4, manual	LEV*	32 / 41	39
Chevrolet Prizm	1.8L 4, manual[b]	LEV*	32 / 41	39
Saturn SL	1.9L 4, manual	LEV*	29 / 40	38

[a]The manual transmission version of this model scores nearly as well.
[b]Automatic transmission versions of these models score nearly as well.
*California-certified vehicle available nationwide.

From: American Council for Energy-Efficient Economy website (http://www.greenercars.com/12green.html)

This section addresses potentials to reduce the state fleet's petroleum fuel usage by greater deployment of vehicles deemed "best-in-class" for fuel efficiency.[xx] (The issue of vehicle emissions as a driver for state fleet vehicle purchases is discussed separately in Section 8.)

5.2.1 "Best-in-Class" Conventional Vehicles

Within the constraints previously described (e.g., EPACT), the state can potentially purchase a number of non-exempt, non-alternative fuel vehicles over the next two years that are considered "best in class" for fuel economy. Essentially, the state purchases

three types of conventional gasoline vehicles that fall into this category: sedans, pick-up trucks, and vans. Table 5-9 provides best-in-class examples for two of these three vehicle types (sedans and pickup trucks). It shows the costs associated with the choices made, and the estimated effects on gasoline usage in the overall state fleet.

Table 5-9

Example Costs and Benefits from Purchasing "Best-in-Class" Vehicles

Parameter	Cars (Sedan)	Pickup Trucks
Current conventional vehicle in class	Ford Focus SE, 4 cyl 2.0 L, 4-sp. Automatic FWD	Chevy S10, 4cyl, 2.2 L, 2WD
Current combined fuel economy of vehicle in class (MPG)	30	21
Current "best in class" vehicle for fuel economy	Honda Civic, 4 cylinder, 1.7 L, fully variable automatic FWD, lean-burn engine	Toyota Tacoma, 4 cylinder, 2.4 L 2WD
Best in class vehicle's combined fuel economy (MPG)	37	23
Fuel economy improvement	23.3%	9.5%
Incremental capital cost for best-in-class vehicle	$930*	$855
Average number of vehicles in class that state purchased over last three fiscal years	127	77
Assumed number of best-in-class conventional vehicles that state will purchase in FY 2002-2003 procurement	127	77
Assumed number of best-in-class conventional vehicles that will be purchased in FY 2003-2004 procurement	127	77
Number of vehicle-months of operation (July '03 to December '04) for procurement completed by June '03	127 X 18 = 2,286	77 X 18 = 1,386
Number of vehicle-months of operation (July '04 to December '04) for procurement completed by June '04	127 X 6 = 762	77 X 6 = 462
Total vehicle-months of operation for all vehicles in category	3,048	1,848
Gasoline reduction per vehicle per month (gallons)**	7.9	5.2
Estimated gasoline reduction for all vehicles in category if phased in (2 procurements) from July '03 to December '04	24,079	9,610
Total gasoline reduction from both Best in Class choices	**33,689 gallons**	
Incremental capital cost for Best in Class vs. baseline (2003 $)	$367,890	
Fuel cost savings (June '03 to December '04)	($51,732)	
Total incremental cost (2003 $)	$316,158	

* The DGS specifications include a lower-cost Ford Focus that isn't comparable to Honda Civic base vehicle.
**Car: [(15,000 miles per year / 30 mpg)-(15,000 miles year / 37 mpg)] * 1 year / 12 months = 7.9 gallons / month
Fuel economies are from EPA website www.fueleconomy.gov.
Prices are 2003 MY MSRPs from Carsdirect.com. The DGS prices will be lower, but differentials should be comparable
Gasoline price of $1.54 is assumed

On average over the last three fiscal years, the state purchased 127 sedans and 77 pickup trucks. The analysis shown assumes that by the end of 2004, two procurements of roughly the same number of vehicles in each class will occur. These new best-in-class vehicles will be phased into the fleet as they are purchased, replacing vehicles ready for retirement. This simplified assumption yields a total estimated number of "vehicle-months" of potential operation for the new vehicles that can be achieved by early 2005.

As Table 5-9 indicates, an estimated 33,689 gallons of gasoline can be "saved" by January 2005 if the state purchases best-in-class cars and pickup trucks (instead of the noted "normal" fleet vehicle for the class) during the FY 2002-2003 and FY 2003-2004 procurements. On a per vehicle basis, this represents an annual reduction in gasoline usage of about 19 percent for the sedans and 9 percent for the pickup trucks.[xxi] However, the overall magnitude of the benefit is small, due to the relatively small purchase involved. Compared to the minimum targeted reduction in gasoline usage by 2005 for the entire state fleet (about 4.6 million gallons), it is only 0.7 percent. The incremental capital cost to purchase these best-in-class vehicles is estimated to be $367,890 (in 2003 dollars). The estimated fuel cost savings during the assumed months of vehicle operation until January 2005 would amount to about $51,732, effectively buying down the near-term incremental cost to $316,158.

It is important to note that the above analysis does not incorporate life-cycle cost estimates, due to the short-term timeframe identified in SB 1170. Over the full life of the vehicles (about 7 years), a notable portion of the incremental capital costs would be paid back through lower fuel costs. Other factors (such as maintenance costs, insurance) could vary for the compared vehicles, and would therefore influence life-cycle costs. Likewise, much more fuel would be saved.

5.2.2 Hybrid Electric Vehicles

In addition to best-in-class conventional vehicles, SB 1170 calls for an assessment of purchasing high-efficiency hybrid electric vehicles (hybrids) as alternatives to today's normally procured vehicles. Hybrids are a key emerging trend in automotive markets. Current technology utilizes a hybrid drivetrain consisting of a small engine, an electric motor and controller with "regenerative braking" capability, and a relatively small pack of advanced technology batteries. Collectively, these systems provide the most efficient driving mode possible under changing road conditions, resulting in major advancements in fuel economy. All primary energy for propulsion is derived from gasoline fuel, i.e., current-model hybrids don't need (and are not equipped for) "plugging in" to recharge their battery packs. The net result is a high-efficiency vehicle that performs at least as well as a comparable conventional vehicle, and does not require special refueling infrastructure.

The first commercial hybrid in America was Honda's two-door Insight, introduced for the 2000 model year. Rated that year at 61 mpg (city) and 70 mpg (highway), this Insight model became the most fuel-efficient vehicle ever commercially offered by a major auto manufacturer; subsequent model years have slipped slightly in fuel efficiency, but the Insight remains number one in America for fuel economy. For the 2001 model year,

Toyota introduced its four-door Prius hybrid; a more main-stream passenger vehicle that achieved EPA fuel economy ratings of 52 and 48 mpg for the city and highway, respectively. For the 2003 model year, Honda commercialized its Civic Hybrid model (compared to other Civics on page 21). The result is that for the 2003 model year, three different hybrid models are available for purchase, each of which has a combined EPA fuel economy rating of at least 48 mpg (see Figure 5-2).

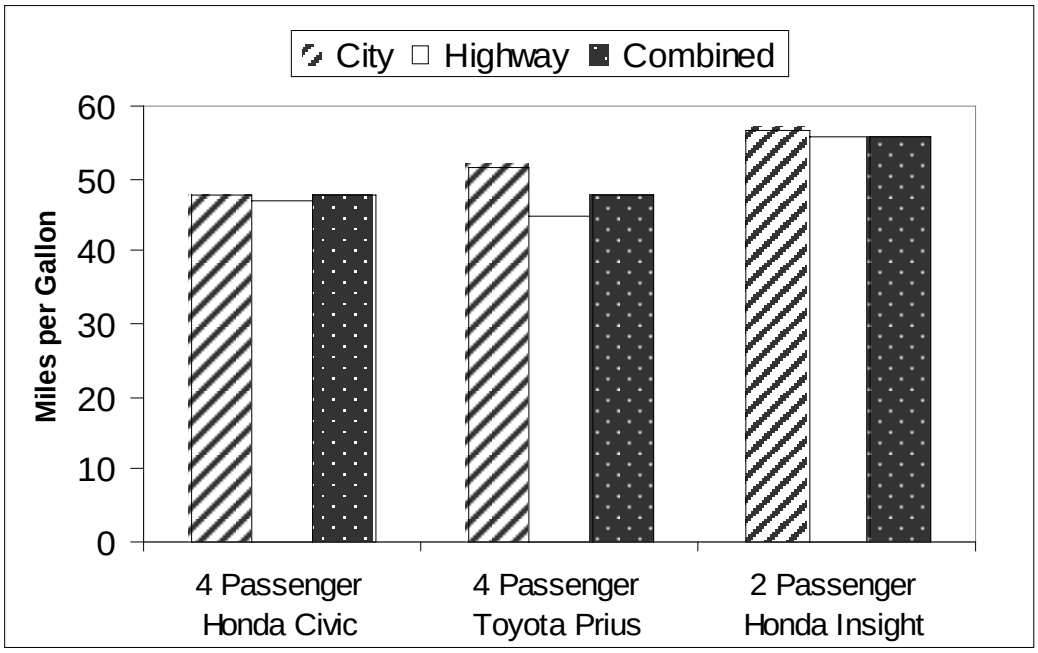


Figure 5-2 EPA Fuel Economy Ratings for 2003 Model Hybrids

Hybrids are sometimes loosely considered to be AFVs, perhaps because they use electric drive and battery power, which makes them significantly different from conventional vehicles. However, current models don't use alternative fuels, and are not classified as AFVs under federal or state regulatory and incentive programs. A more precise term for today's hybrids might be alternative technology vehicles. This is a significant distinction, because only vehicle types defined by the federal government as AFVs can meet the state fleet's obligations under EPACT. Thus, any hybrids purchased by the fleet must come under the allotment for non-exempt, non-AFVs procurements, which cannot total more than 25 percent of the fleet's non-exempt vehicle purchases. On average over the last three model years, only 324 vehicles in this category have been purchased per year, compared to an average of 5,057 vehicles purchased per year for the total fleet.

The state has recognized that hybrids offer two key benefits: high fuel efficiency and low emissions (two models are certified as SULEVs). Studies have been commissioned to assess the longer-term potential for hybrids to reduce petroleum consumption in California.[xxii] For the more immediate issue – improving the fuel efficiency of the state fleet – hybrids have been purchased by state agencies in progressively larger numbers since they were first introduced in the 2000 model year. Currently, the state fleet includes at least 220 hybrids; of these, 206 are four-door Toyota Priuses and 14 are two-

door Honda Insights. The 2002-2003 vehicle procurement is not yet complete, but so far the state has purchased several 2003 model year Honda Civic Hybrids (the only 2003 model year hybrid currently listed under the state master contract list).

Similar to the analysis done for high-fuel-economy conventional vehicles, Table 5-10 provides the estimated gasoline gallons that could be "saved" if the state fleet maximizes the percentage of hybrids that it purchases, as an alternative to purchasing comparable conventional vehicles. Again, it must be noted that under current EPACT requirements and given today's commercial offerings, effectively the state's only current option is to purchase sedan-type hybrids as part of its limited allotment of non-exempt non AFVs. But, it is possible that the state could buy greater numbers of sedan hybrids than shown in Table 5-10, as an alternative to purchasing light-duty pickup trucks and vans in the non-exempt, non-AFV category.[xxiii]

Table 5-10

Example Costs and Benefits from Purchasing Hybrids

Current conventional vehicle in class	Ford Focus SE, 4 cylinder 2.0 L, 4-sp. automatic FWD
Current combined fuel economy of vehicle in class (MPG)	30
Current comparable Hybrid in class	Honda Civic Hybrid, 4 cylinder 1.3 L / electric motor, variable automatic FWD
Hybrid's combined fuel economy (MPG)	48
Fuel economy improvement	60%
Incremental capital cost for best-in-class vehicle	$5,470*
Average number of non-hybrid vehicles in non-exempt non AFV class that state purchased over last three fiscal years	127
Number of hybrids that state could purchase in FY 2002-2003 procurement	127
Number of hybrids that state could purchase in FY 2003-2004 procurement	127
Number of vehicle-months of operation (July '03 to December '04) for procurement completed by June '03	127 X 18 = 2,286
Number of vehicle-months of operation (July '04 to December '04) for procurement completed by June '04	127 X 6 = 762
Total vehicle-months of operation for all vehicles in category	3,048
Gasoline reduction per vehicle per month (gallons)**	15.62
Estimated total gasoline reduction for all hybrids if phased in (2 procurements) from July '03 to December '04	**47,625**
Incremental capital cost for Honda Civic Hybrid vs. baseline (2003 $)	$1,389,380
Estimated fuel cost savings (July '03 to December '04)	($73,342)
Total incremental cost (2003 $)	$1,316,038

* The DGS vehicle procurement specifications include a lower-cost Ford Focus that isn't comparable to Honda Civic hybrid.
**[(15,000 miles per year / 30 mpg)-(15,000 miles year / 48 mpg)] * 1 year / 12 months = 15.6 gallons / month
Fuel economies are from EPA website www.fueleconomy.gov.
Prices are 2003 MY MSRPs from Carsdirect.com. The DGS prices will be lower, but differentials should be comparable.
Gasoline price of $1.54 is assumed

This analysis estimates that 47,625 gallons of gasoline can be "saved" by January 2005 if the state purchases 254 Honda Civic Hybrids over the next 24 months, instead of purchasing the same number of the noted conventional sedan. On a per vehicle basis, this represents about a 38 percent reduction in annual gasoline usage, although it is only 1 percent of the total reductions needed to meet the minimum under SB 1170. The incremental capital cost to purchase these hybrids is estimated to be $1,389,380 (in 2003 dollars). The estimated fuel cost savings during the assumed months of vehicle operation until January 2005 would amount to about $73,342, effectively buying down the near-term incremental cost to $1,316,038. I should be noted, that additional years continue to reduce incremental cost and bring about more parity.

Assessing the cost of hybrids relative to comparable conventional vehicles needs to be done on a full life-cycle basis, and real-world data are just beginning to become available. Still, accruing fuel economy benefits over full life and also taking advantage of available monetary incentives, today's hybrids will not achieve full payback to cover their higher incremental costs. This has been confirmed by the OFA, which has performed a capital vs. fuel cost comparison on its past and potential hybrid purchases.

Even though SB 1170 is focused on near-term petroleum reduction, a broader and longer-term perspective should be taken in the case of hybrids. In addition to Honda and Toyota, several major manufacturers have announced intention to sell hybrids for the 2004 model year and beyond. Chosen platforms include small and large SUVs as well as pickup trucks.[xxiv] Some experts predict that the costs to manufacture hybrids will be reduced by as much as 50 percent over the next four years,[xxv] in part due to volume manufacturing and economies of scale on the most costly components (e.g., electric motors, controllers and battery packs). For this to come to fruition, large government fleets may need to lead the way in purchasing significant numbers of hybrids over the next few years. When the state places a premium on high fuel economy and purchases vehicles accordingly, an important message is sent to automobile manufacturers as well as the general public. Additional vehicle cost reductions could take place in future years.

It can be argued that maximizing the state's purchase of hybrids will pay significant dividends from a longer-term perspective while also providing immediate fuel efficiency gains. A similar argument can be made for purchasing conventional gasoline vehicles that provide best-in-class fuel economy, although the associated benefits are on a smaller scale. These barriers are discussed below.

5.3 Current Barriers to Purchasing Most-Fuel-Efficient Vehicles

There are at least two significant constraints that deter state fleet administrators from purchasing the most fuel-efficient vehicles available as a routine practice. These include 1) EPACT's exclusion of hybrids from being eligible to meet fleet quotas for AFVs, and 2) the current policy to purchase vehicles on the basis of low bid (i.e., lowest capitol cost) rather than fuel efficiency or a life-cycle basis. These barriers and possible solutions are discussed further below.

5.3.1 The Need for EPACT Amendments Favoring Hybrid Purchases

Despite EPACT's stated purpose to reduce America's dependence on foreign oil in the transportation sector, it does little to encourage fleets to purchase the most fuel-efficient vehicles available. As previously described, the primary problem is that hybrids cannot be purchased to meet fleet quotas under EPACT. The result is actually counterproductive to EPACT's intent: fleets end up purchasing dual- or flex-fuel "AFVs" that provide marginal fuel economy and are rarely operated on alternative fuels. Clearly, the better choice for reducing petroleum dependence would be to purchase commercially available hybrids. In the case described in Section 5.2.2, the 2003 Honda Civic Hybrid travels 60 percent further on a gallon of gasoline than a comparably equipped 2003 conventional vehicle and consumes 37.5 percent less fuel.[xxvi] As a bonus, the

Hybrid is certified to a lower emissions level. Compared to a bi-fuel AFV that uses only gasoline, these benefits would be even greater.

It can be argued that EPACT needs to take a broader interpretation of hybrids that goes beyond the distinction of alternative fuel and takes into account their full importance as emerging vehicle technologies. It is true that today's hybrids use only gasoline to supply all primary energy for propulsion, and they cannot operate on battery power alone. However, these hybrids utilize similar components to "pure" electric vehicles, such as advanced battery technology and efficient electric drive systems. They effectively supplement the gasoline energy stored onboard by generating "alternative" energy (electricity) during deceleration. Conventional vehicles cannot provide this regenerative braking because they lack electric motors and other equipment to convert kinetic energy into electricity, and battery packs to store it until needed by the vehicle. Also, today's commercialized hybrids essentially serve as test beds for fuel cell vehicles. These vehicles will likely use alternative fuels and have potential to provide even greater efficiency enhancements than hybrids, while achieving near-zero emissions. In other words, hybrids are high-efficiency alternative technology vehicles that offer strong "big-picture" benefits, and on this basis they should be accepted as EPACT-compliant vehicles.

The OFA is among the many state fleet administrators nationwide that supports amendments to EPACT that will allow credits for hybrids. Reportedly, there is an on-going national effort to convince Congress that EPACT should be changed. While amendments have been proposed, none have yet survived hearings by congressional committees.[xxvii] Thus, it appears unlikely that EPACT will be amended in time to help the state purchase greater percentages of hybrids by January 2005.[xxviii] To the extent feasible, it is recommended that the state continue to use its influence on DOE and Congress to get EPACT amended as described above.

5.3.2 The Need to Revise Current Low-Bid Purchase Process

High-efficiency vehicles have higher capital costs compared to less-fuel-efficient vehicles that are otherwise comparable. Although the DGS has been able to purchase significant numbers of high-efficiency vehicles over the last three years (including more than 200 hybrids), the low-bid procurement process currently used by the state restricts the ability to routinely purchase such vehicles. Thus, a significant change in the state's purchase policy (in addition to changes in EPACT, as discussed above) is needed before future procurements can target large percentages of these vehicles.

A compounding problem is that the state's low-bid procurement process generally restricts purchases to just one vehicle on the state bid list within each class. As previously described in Section 5.2.2, there are now three hybrid models available in California; two of these (Honda Civic Hybrid and Toyota Prius) fall into the same vehicle class. By the 2004 model year a variety of new hybrid platforms are expected to be offered. Other types of high-efficiency vehicles may also emerge as commercial offerings over the next few years. Under existing purchase procedures, it may be difficult to purchase the most fuel-efficient vehicle types, as they become available. This process

could send mixed signals to the automobile industry, which is being asked (and in some cases required) to produce vehicles with high fuel efficiency while also achieving very low emissions.

Therefore, this report recommends that the state change its vehicle purchase policy to better allow a wider range of vehicles to be purchased within the same class. This "multiple-awards process" would allow the state to develop vehicle specifications around a combination of important attributes (efficiency, emissions, life-cycle costs, cargo or passenger capacity, etc.). Special "green vehicle" points could be awarded to vehicle purchase options that offer the state most potential to meet both short- and long-term energy efficiency objectives, as identified in SB 1170 and AB 2076, respectively.

The costs to implement this recommended change would entail mostly staff time and effort. Certain specific codes and regulations would require review and updating to accommodate this new purchase procedure. Additional data would need to be collected and analyzed regarding life-cycle factors such as maintenance, tires, and fuel use, especially on hybrids, which are relatively new to the fleet. Section 5 includes discussions on the estimated per-vehicle costs and benefits associated with substituting high-efficiency vehicles for the types of vehicles currently purchased in large numbers.

Like many government agencies, approximately 10 percent of the state's vehicle fleet is replaced annually.[xxix] There are just two procurement cycles before early 2005; this allows enough time at best to initiate an effective strategy for phasing in high efficiency vehicles into the state fleet. The following summarizes key changes that are needed as soon as possible to begin that process:

- EPACT fleet requirements will need to be modified to enable greater numbers of non-AFV non-exempt vehicles to be purchased.

- Changes in the DGS procurement procedures will be needed to 1) enable more than one type of vehicle per class to be offered under the state master agreements, and 2) evaluate vehicle bids according to full life-cycle costs, possibly with some type of system to award special points for environmentally benign attributes.

- All state agencies will need to purchase the most-efficient vehicles available in class, whenever practicable.

6. Improved Vehicle Components and Maintenance Procedures to Reduce Petroleum Consumption

The fuel efficiency of motor vehicles can be significantly compromised due to excessive frictional losses associated with (among other things) tires and moving drivetrain parts. This section assesses the potential to reduce such frictional losses by minimizing the "rolling resistance" of tires on state vehicles and applying optimized maintenance procedures.

6.1 Fuel Efficient Tires and Improved Tire Maintenance

SB 1170 specifically requires an assessment of the role that vehicle tires play in determining fuel efficiency of the state fleet. Tires affect fuel efficiency because they are a major determinant of vehicle rolling resistance. For a typical set of on-road vehicle tires, rolling resistance can be minimized in part by keeping them properly inflated. However, tires specially designed for reduced rolling resistance can also be purchased. Thus, tire-related strategies to improve fuel efficiency of the state fleet focus on 1) the use of low rolling resistance tires, and 2) methods to ensure that tires are operated at their proper inflation pressure as often as possible.

To meet the requirements of SB 1170, a draft report was recently prepared by an independent consultant for the Energy Commission and other state agencies. This draft California State Fuel-Efficient Tire Program Report (Energy Commission Tire Report)[xxx] found that "the opportunity for cost-effective energy savings in California from low rolling resistance (LRR) tires is substantial, resulting in a 3 percent average improvement in the fuel efficiency of light duty vehicles currently operating on replacement tires."[xxxi] The draft report also indicates that proper tire inflation will provide fuel savings. Table 6-1 shows the potential fuel savings for an incremental change in tire rolling resistance or tire inflation pressure. According to the report, these fuel savings can be achieved at an incremental cost far less than the value of fuel saved over the life of the vehicle.[xxxii]

Table 6-1

Incremental Fuel Savings from Selected Tire-Related Practices

Fuel-Efficiency Measure	Estimated Fuel Savings[a]
Increase Tire Pressure by 1 psi to proper level[b]	1.1%
Lower Rolling Resistance by 10%	1 to 2%

[a] Fuel savings depend on several factors such as vehicle type, vehicle load, road conditions, and environmental conditions
[b] Indicated fuel savings are for tires that are under inflated by 1 psi.

Source: Energy Commission Tire Report (see Endnote No. xxx)

These incremental benefits could be multiplied to achieve greater fuel reduction. The Energy Commission Tire report provides a comparison of vehicle fuel economy over a range of tire inflation pressure and rolling resistance. The comparison results indicate an average 3 percent fuel reduction is reasonable for LRR use, and indicates that in some cases, up to 6 percent fuel savings can be achieved.[xxxiii] Improved tire inflation adds to these fuel savings. Table 6-2 provides example phase-in strategies that reflect the range of fuel reduction that could be achieved through LRR tires and increased tire inflation, by the time frame specified in SB 1170 (2005). However, state fleet vehicles may be more likely to have proper tire inflation than average consumer vehicles.

Table 6-2

Range of Potential Fuel Savings in State Fleet from Tire Measures

Assumed Implementation within State Fleet by 2005[a]	Range of Fuel Savings from LRR Tires and Tire Inflation	Potential Reduction in Gasoline Consumption[b]
25%	1.0%	0.12 million gallons
50%	3.0%	0.69 million gallons
100%	6.0%	2.8 million gallons

[a] This assumes sufficient a supply of LRR tires could be located and installed on the % of state vehicles indicated
[b] Reductions are based on current state fleet gasoline consumption of approximately 46 million gallons annually

One issue discussed in the report is that no standard definitions and certification procedures current exist regarding LRR tires. Although the tire industry has significantly reduced the rolling resistance of tires equipped as original equipment on new vehicles, consumers currently have little information available to help select replacement tires for optimal fuel economy. Determined customers can obtain information, but nothing is routinely available from tire dealerships regarding relative rolling resistance or the likely impacts individual tires would have on vehicle fuel economy. A few tire models bear names or advertising messages implying "green" performance or greater fuel efficiency, but such claims are not based on independently validated or consistently comparable measurement protocols. This effectively eliminates rolling resistance as a purchase criterion in the replacement tire market today, without action by government and industry to provide such information.[xxxiv] To rectify this problem, the tire study recommends that the Legislature require tire manufacturers to disclose the rolling resistance of all light duty vehicle tires offered for sale in the state.

As noted in the report, the state can and should move quickly to modify its procurement process for replacement tires to include consideration of rolling resistance, once consistently measured data on tire rolling resistance become available and requires more real-world data to estimate long term benefit. One option the state should consider is to purchase OEM tires as replacements; evidence shows that they offer superior rolling resistance qualities when compared to Non-OEM tires.

The Energy Commission Tire report does not state definitively that all LRR tires are as safe as standard tires. However, it does indicate that "the evidence to date does not suggest that improving rolling resistance comes with any automatic or significant safety penalty." The report also indicates that "the evidence suggests no strong correlation between tire rolling resistance and longevity…." However, the report does not specifically assess the present availability of LRR tires that provide the indicated fuel savings while avoiding a trade-off in safety and longevity.[xxxv]

The merits of encouraging LRR tires are similar to the merits of encouraging proper tire inflation. Both policies are worth pursuing for their own sake, and both offer a means of reducing fuel consumption. However, according to the Energy Commission Tire report, "fleets that purchase LRR tires will enjoy the fuel-saving benefits of that technology for another 30,000 to 50,000 miles of driving, with no other action or behavioral

modification required." Such a measure will take time to phase in, as not all vehicles have their tires replaced at the same time. In contrast, fuel savings from proper tire inflation – although smaller – could be applied to all vehicles with little are no phase-in period, but would require regular attention by the fleet operator to maintain its effect.[xxxvi]

Independent of this study, there has been at least one documented case where the longevity and safety of LRR tires have been an issue. In early 2002, Toyota sent a notice to owners of the 2001 Prius hybrid, acknowledging that its standard-equipped LRR tires could exhibit "uneven tire wear between the outer edges and the center portions of the tire during normal use."[xxxvii] To address this problem at no charge to the customer, Toyota extended the tire warranty and offered to replace all original equipment tires of this type showing improper wear. Toyota reported that "changes to the production process" were incorporated to make the next generation of LRR tires for the Prius "more resistant" to this type of uneven wear. While this early experience with LRR tires has provided useful information, it must be noted that conventional tires have also exhibited similar problems. Also, the use of LRR tires on hybrids under U.S. driving conditions is still a relatively new phenomenon.

The OFA has also investigated the potential to use retreaded tires on heavy-duty vehicles as a means to lower cost and possibly improve fuel efficiency. No data are currently available on this program, which has been geared for vehicles using tire sizes of 19 inches and higher.

6.2 Optimized Vehicle Maintenance

6.2.1 Frequency of Preventative Maintenance

Fuel economy for light-duty vehicles is partially a function of the frequency and quality of scheduled maintenance performed. Proper maintenance ensures that the engine is operating as designed and certain frictional losses are minimized. This relationship was recently further evaluated in the Staff Draft Report for AB 2076 entitled Task 3: Petroleum Reduction Options.[xxxviii] Option 1D of this report provides an analysis on the costs and benefits of improved vehicle maintenance practices to reduce future demand for gasoline consumption. The focus of the analysis was on periodic changing of engine oil, the oil filter, and the air filter.[xxxix] A conclusion was that optimal maintenance practices involving these activities can potentially improve a light-duty vehicle's fuel economy by 1 percent to 10 percent. Other government agencies have evaluated the relationship of vehicle maintenance and fuel efficiency, with similar findings. This type of analysis focuses on maintenance of personal vehicles by the general motoring population. Table 6- summarizes the potential per-vehicle benefits in fuel economy that can be expected from improved state fleet vehicle maintenance under these general assumptions.

Table 6-3

Summary of Findings: Fuel Economy and Vehicle Maintenance

Maintenance Issue / Procedure	Fuel Economy Benefit	Impact on Fuel Consumption of State Fleet Vehicles
Properly Tuned Engine	4-40%	**Negligible:** existing state fleet maintenance procedures and other checks and balances (e.g., California Smog Check, On-Board Diagnostics) generally prevent occurrence of mal-tuned vehicles.
Regular Change of Air Filter	1-10%	**Moderate:** existing state fleet maintenance procedures are adequate; efficacy should be re-evaluated.
Regular Change of Oil and Oil Filter	1-2%	**Moderate:** existing state fleet maintenance procedures are adequate; efficacy should be re-evaluated.
Use of Proper Oil Grade	1-2%	**Moderate:** existing state fleet maintenance procedures are adequate; efficacy should be re-evaluated.
Proper Tire Inflation	1-3%	See Section 6.1 for detailed discussion

Sources: U.S. Environmental Protection Agency website, Tips to Improve Your Gas Mileage, http://www.fuelconomy.gov; Energy Commission and California Air Resources Board, Task 3: Petroleum Reduction Options (Staff Draft Report for AB 2076), March 2002.

Generally, it is the responsibility of each individual California state agency and department to insure compliance with minimum preventive maintenance standards for state-owned mobile equipment.[xl] The OFA helps coordinate these procedures and plays a key role to ensure that the state's nearly 73,000 on-road vehicles are properly maintained, even though many state vehicles are under the direct control of other agencies. For the DGS-controlled vehicles and possibly others, preventive maintenance service is provided in six of the eight state garages (all but San Francisco and Van Nuys).

State fleet vehicle procedures include performing prescribed lubrication services for all vehicles on a mileage or time basis, as well as inspecting and changing oil and air filters. State employees or contractors who perform these functions are professionally trained in vehicle maintenance. Thus, while not quantifiable within the scope of this study, a reasonable assumption is that preventative maintenance on state fleet vehicles is performed with greater frequency and effectiveness than in the general vehicle population.

Thus, it is difficult to quantify the fuel efficiency benefits that could potentially be realized in the state fleet through improved or enhanced maintenance procedures. A key unknown is the efficacy of current vehicle maintenance procedures. It is recommended that all state agencies operating vehicles review procedures and frequency of maintenance.

6.2.2 Use of Aftermarket Maintenance Products

A wide variety of aftermarket devices, fuel additives and the use of more energy efficient lubricating oil are currently sold in California, many of which relate to vehicle maintenance procedures. Generally, these claim to provide one or more of the

following benefits: 1) increased vehicle fuel efficiency, 2) reduced tailpipe emissions, and 3) reduced maintenance costs, by extending the time needed between common procedures. Many of these products have been tested within state vehicles and been shown at best to decrease the frequency of common maintenance procedures. In some cases, products have been independently tested under U.S EPA or the CARB procedures and shown to significantly correlate with fuel economy improvements.

Potentially, such products can be used to improve the fuel efficiency of California's state fleet vehicles. However, several issues and caveats exist, including the following:

- Further testing may be necessary to determine the effect on fuel economy (and other parameters) for the specific mix of light-duty vehicles (make, model, age, fuel type, duty cycle, etc.) operated in the state fleet.

- Improvements in fuel efficiency (if any) attributable to such products must be weighed against product capital costs, as well as potential costs related to changes in labor time (increased or decreased).

7. Policy and Procedure Based Strategies to Reduce Petroleum Consumption

The previous two sections focused on how to meet SB 1170's objectives by 1) procuring and deploying more-efficient vehicles and components in the state fleet, and 2) improving the in-use fleet's fuel-efficiency. This section focuses on the application of policy and procedure modifications that have potential to conserve fuel by reducing the state fleet's vehicle-miles-traveled (VMT).

As with vehicle acquisition issues, much of the activities described in this section primarily come under the jurisdiction of the OFA. All transportation and commute-related services for California's employees are provided by OFA, including oversight of vehicle pools, repair facilities, vehicle inspection, employee parking, discount air fares, commercial car rentals, vehicle disposition, and consultation regarding automotive management problems.[xli]

Various programs are described below that can help reduce petroleum-based fuel consumption in the fleet through VMT reduction. Some programs and incentives are already offered to state employees, while others are in the planning stages. These efforts help promote VMT reduction and conservation ethics to the general public, as well as to state employees.

7.1 Reduction of Fleet Size

One way that fuel consumption can be reduced in any fleet is to decrease its number of operational vehicles, thereby reducing total VMT. Such a reduction can be purposeful, but it can also occur unintentionally due to a variety of factors. Given the state's current budgetary crisis, it's possible that involuntary downsizing of the fleet may occur over the next few years; this was identified as a "wildcard" factor that may play an important role

in determining the state fleet's size and fuel consumption by January 2005. Per requirements of SB 1170, this section discusses the potential costs, benefits and petroleum reduction that might result from an intentional downsizing of the state fleet.

It is a state policy that vehicles in the fleet "may be disposed of or replaced when it is determined that it would be cost effective to do so, regardless of age or mileage"[xlii] (emphasis added). This implies that state fleet administrators can accelerate the retirement of selected vehicles if no longer needed (more efficient use of vehicle fleet), or if costs exceed benefits. Arguably, high fuel use is a cost that increases the state's petroleum dependency. SB 1170 recognizes the need to assess this cost (as well as others), versus the benefits that vehicles in the fleet provide.

As previously shown in Figure 4-2 on page 16, nearly 73,000 on-road vehicles are currently registered by the Department of Motor Vehicles for operation in the state fleet. Few details are immediately available about the relative numbers of light-, medium- and heavy-duty vehicles in the fleet, or which specific types of vehicles are operated by various state agencies. However, the process to gather detailed information is now underway, and it is expected that future annual updates to this report will have access to such information.

A decision to reduce the size of the state fleet must address complex issues about costs and benefits, which is made more difficult in the absence of detailed, agency-specific information. All else being equal, reducing the number of operational vehicles in the state fleet may reduce VMT and fuel consumption, and save fuel costs. However, a dichotomy exists: vehicle uses for which the most miles are accumulated (i.e., that consume significant volumes of fuel) are likely to be the least viable candidates for elimination, assuming all vehicle use is proper and mission critical for the agency. The key question is therefore: which state agencies and departments can downsize their fleet while still achieving their critical missions and objectives? What are the specific vehicle uses that can be eliminated?

Additionally, the current Governor's executive order to freeze new vehicle purchases will cause older vehicles to remain in use longer. This will delay any efficient vehicle purchases and delay fuel savings. Also to the degree that older vehicles degrade, further fuel consumption increases will occur.

According to input received from a number of state agencies (refer back to Table 4-4 on page 20), reductions in the size of their fleets can have an adverse impact on the services they provide to employees and/or the general public. This is clearly reflected in the summary of comments provided in Table 7-1; the complete questions and responses are provided in Table B-10-2 of Appendix B.

Table 7-1

Summary of Agency Comments Regarding Fleet Size Reduction

Agency	Summary of Comments on Impacts, Costs and Benefits
Conservation Corp	Fleet reduction can impact mission critical activities.
Dept. of Fish & Game	Would mean change in style of operations. May require establishment of satellite offices and vehicle-pools. Fleet reduction will impact mission critical activities.
Forestry and Fire Protection	May affect mission of the department and endanger public safety and increase property loss.
Dept. of Parks & Recreation	Reduction in fleet size would have a drastic impact on Parks' operations statewide.
Dept. of Toxic Substances Control	Workgroup is developing a fleet policy. Reducing HQ fleet would have minimal impact on staff. Field vehicle reduction will impact department's mission critical activities adversely.
Dept. of Food and Agriculture	Reduction in fleet services would severely impact field services. Would have to use rental cars. Californians would face health risks from fewer inspections.
Dept. of Water Resources	Department organizations have already begun reducing their fleet inventory due to current budget restraints.
California Highway Patrol	Mission critical. Adverse impact on public safety.
DMV	Mission critical. Will increase personal vehicle use.
Stephen P. Teale Data Center	Mission critical. Operating a fleet is less expensive than alternatives, such as personal vehicle use or public transportation.
Alcoholic Beverage Control	Mission critical.
Dept. of Managed Health Care	Mission critical. Employee to vehicle ratio is already high (~50:1)
Integrated Waste Management Board	No room to downsize. Mission critical. Increased costs if personal vehicles are used.
Dept. of Transportation	Mission critical. Impact would be statewide.
Office of Environmental Health Hazard Assessment	Employees will use personal vehicles. Potential for higher cost.
Dept. of Boating & Waterways	Could severely impact mandated programs.
Water Resources Control Board	Mission critical. Significant adverse impact on field work.

The general message from these various agencies is that downsizing the state fleet will entail costs that exceed the associated benefits.[xliii] The costs they cite generally involve two types: 1) loss of ability to fully accomplish critical missions, and 2) increased operating costs associated with employees using alternative modes of transportation for state business (e.g., personal vehicles, rental cars or public transportation). One agency indicated that the impact (cost) of downsizing its access to state fleet vehicles would be

negligible – but only in reference to its headquarters, noting that field operations would be adversely affected.

A reasonable conclusion is that purposeful downsizing of the state fleet is likely to be a controversial policy decision that would be better deferred, until additional information can be obtained. It is recommended that further study be initiated to assess the following:

- The implications of the state's budget situation on fleet operations, including petroleum consumption trends that can be expected if major cutbacks are made to capital and operational budgets for fleets.

- Detailed information from each agency that operates at least 15 state vehicles, including rosters of all vehicles, their ages and specifications, frequency of use, and types of applications, real-world fuel economy and volumes of fuel used per year, and other factors.

Until such information is available, it is not possible to fully define the costs and benefits of a purposeful reduction in the size of the state fleet. For example, accurate estimates cannot be made about the gallons of gasoline or diesel that can be conserved. The costs to perform these assessments will mostly entail time and effort of state employees at all affected agencies. Availability of staff may be an issue in a time of significant budget cuts.

Some fleet downsizing may be possible without further study or assessment. If there are any state fleet vehicles that are obvious candidates for early retirement and no longer serve a mission-critical purpose, they should be removed from the fleet without being replaced as a means to reduce petroleum consumption.

7.2 Ridesharing and Public Transportation

Fuel consumption in the state fleet can be reduced by maximizing the number of people transported (or amount of cargo, discussed later). For example, enhanced use of ridesharing and public transportation by state employees will reduce fleet VMT, provided that avoided trips involve state vehicles. Currently, some employees participate in state-sponsored rideshare programs and commute to work in state-operated vans, some of which are fueled by CNG. In this case, it is the personal vehicles of these employees that accrue less mileage and therefore save fuel; the state fleet's VMT and fuel use actually increase. Of course, these state employees help conserve fuel in the general vehicle population, as do people who commute to work in personal-vehicle carpools or by using mass transit.

In addition to the vanpool program, state agencies have initiated a number of programs that promote ridesharing and use of public transportation for VMT reduction, targeting the state fleet as well as the general vehicle population. These programs are promoted to state employees by coordinators, resulting in popular use that is generally run at full capacity.[xliv] Table 7-2 provides examples of programs that the DGS-OFA or other state agencies use to help promote fuel conservation and "green" commuting.

Table 7-2

Examples of State Ridesharing and "Green Commuting" Programs

Type of Program	Objectives	Features
Vanpool Program	-Assists state employees in carpooling to and from work -Promotes carpooling and ridesharing in general	-15 vans capable of transporting 7 to 15 passengers -Most vans are fueled by CNG -Monetary and other incentives (priority for parking) are provided
Membership in Sacramento Transportation Management Association (TMA)	-Provides ~83,000 commuters (including state employees) with information about alternative transportation modes	-Web site (www.sacramento-tma.org) that lists options and weblinks
Mass Transit Incentive Program	-Assists state employees in using mass transit to and from work -Promotes mass transit in general	-Vouchers from various state agencies and departments incentive employees to use mass transit

In the normal context of ridesharing, it is difficult to quantify the potential to help meet the objectives of SB 1170. This is because facilitation of employee commuting is not a major function of the state fleet.[xlv] The following section discusses potential measures to increase the efficiency of transporting employees (number of people per fleet VMT) during official state business.

7.3 Most-Efficient Transportation Choices for State Business

7.3.1 State Pool Vehicles

With some 230,000 employees, large numbers of trips involving official business are routinely generated by state agencies. These range from countless short trips, to long excursions across the state. At 158,693 square miles, California is America's third largest state in land area. Many state agencies must routinely transport people throughout this large area of jurisdiction, and beyond.

Whenever possible, state employees are required to use travel modes that are least costly to taxpayers. As noted in the State Fleet Handbook, employees are required to first utilize the services offered by OFA, which allows state "pool" vehicles to be leased on a daily or longer-term basis. OFA makes a variety of light-duty vehicles available for lease at each of the seven state garages (Fresno, Los Angeles, Oakland, Sacramento, San Diego, San Francisco, and Van Nuys). A vehicle reservation system (including Internet links) is provided that allows state employees to reserve vehicles from any of these garages for official business. Vehicles can be reserved on a daily basis for up to two weeks at a time. Routinely, the system allows sedans to be reserved, although other

types can be requested such as station wagons, pickup trucks, and SUVs. Included among these various types of vehicles that can be reserved are AFVs (e.g., dedicated Honda Civic NGVs and dual-fueled Chevy Cavaliers) and hybrids (e.g., Toyota Priuses and Honda Civic Hybrids).

The OFA is aware that significant opportunities exist to reduce petroleum consumption in this pool fleet through better matching of vehicle types with employees' travel needs. For example, greater fuel efficiency for the fleet can be gained by assigning front-wheel drive sedans or 2WD pick-up trucks instead of 4WD vehicles, except when driving conditions warrant otherwise. Similarly, fuel is wasted when a large SUV is assigned to a single user carrying no significant cargo. In addition, it's possible that improved information technology will soon allow OFA and other state agencies to use pool vehicles in "shared-vehicle" programs with links to mass transit (station car concepts). This applies to management of AFVs at the state garages also; an enhanced vehicle allocation system could help ensure that the state's 288 dedicated NGVs are used to their full petroleum displacement potential (refer back to Section 5.1). Localized use of the state's limited numbers of battery-electric vehicles can also be maximized through such a system.[xlvi]

The OFA has started the initial process to assess ways to more selectively allocate vehicles in the DGS fleet. The fuel savings that could result from new or improved efforts in this area could be significant, possibly within the short time frame targeted under SB 1170. However, quantifying this will require a more focused study on pool vehicles and how they are currently used. It is recommended that such a study be conducted, including an assessment of what new procedures and mechanisms are likely to be needed to better select the right vehicles for the uses requested. These efforts will have costs, most likely in the form of new resources that will be required from OFA, during a time that the outlook for the state budget and available staff resources are clouded.

7.3.2 Rental Cars and Other Modes of Transportation

In situations where fleet vehicles are not available or practical for travel, state employees are required to use the "most economical means" of transportation.[xlvii] Employees are offered assistance arranging such travel by OFA and contracted travel services. While fuel efficiency is currently not a major criterion for selection, the state has initiated conservation-minded programs such as the new "Plane & Simple" rail link from Burbank Airport to downtown Los Angeles. Programs like this encourage avoidance of rental car use, but when they are needed, rentals from several commercial companies are available at the DGS-negotiated rates across the state.[xlviii] Many of the rental companies offer AFVs and hybrids in their rental fleets, and state employees are "strongly encouraged" to rent such vehicles when available."[xlix] Thus, opportunities exist to displace petroleum during official travel, even when not using state fleet vehicles.

In Section 5.1 of this report, it was recommended that the state consider an executive order requiring employees to use AFVs whenever practical -- assuming reasonable access exists to the alternative fuel. This executive order could also apply to rental car use.

Reducing petroleum consumption in rental cars does not technically meet the directives outlined in SB 1170, but it is within the intent and spirit of the legislation, and will benefit society as a whole.

7.3.3 State Legislature Vehicles

According to the Department of Motor Vehicles, the state operates 388 on-road vehicles that are allocated to the State Legislature. As of late 2002, most vehicles (370) in this fleet are listed as "sedans," and the other eight are categorized as "commercial" vehicles (e.g., various types of trucks, vans, pickup trucks, etc.). No information is available regarding the specific types of vehicles, how they are used, or the fuels on which they are operated. Also unknown is how the vehicles are allocated, and if improvements can be made in fleet efficiency by better matching those allocations to actual driving needs. For example, it's possible that this fleet includes high-efficiency hybrids that are not accruing significant miles, while larger and less-efficient vehicles are receiving extensive use.

It is recommended that a review be conducted on the makeup of this relatively small fleet and how its vehicles are specifically used. This will enhance the ability for vehicles to be dispatched or allocated in the most fuel-efficient manner, without compromising the mission of the individuals who use them. In addition, if there are any AFVs in this group of vehicles (either dedicated or bi-fuel), it will help to ensure that their users can be offered improved access to the appropriate alternative fuel. The costs to perform this review will mostly entail staff time and effort.

7.3.4 Cargo and Service Vehicles

Previously it was noted that the state fleet includes approximately 4,400 vehicles that are classified as "commercial" by the DMV. Most of these are believed to be powered by diesel engines, which are inherently more fuel efficient than gasoline engines per power produced. Section 5.1.4 briefly discussed the potential to displace diesel fuel use in these vehicles through the use of alternative fuels. For the immediate term, it is possible that this fleet of vehicles can be utilized more efficiently by improved matching of vehicle load factors. For example, heavy-duty trucks should not be used routinely when light-duty pickups can perform the work adequately. However, more information about this fleet and how they are used would be needed to quantify the potential fuel savings. By way of future legislative authority and resource allocation, this information can be obtained as part of the assessment needed for the entire state fleet regarding vehicle types, fuel, and use factors.

7.4 Fuel-Efficient Driving Techniques

State employees can make a significant contribution to reducing fuel usage in the fleet simply by using certain driving techniques. For example, aggressive driving (speeding, rapid acceleration with hard braking) can decrease fuel economy by an estimated 5 percent in city driving, to as much as 33 percent in freeway driving. Not exceeding the speed limit can increase fuel economy by as much as 23 percent, because fuel consumption increases rapidly at higher speeds (above 60 mph). Other driving

techniques, such as using cruise control at freeway speeds and avoiding excessive idling, can also significantly improve fuel economy.[l]

It may be unrealistic to expect major improvements in fuel efficiency for the state fleet through use of better driving techniques. However, some benefits might be obtainable by "re-educating" employees about methods to drive more efficiently. It is recommended that such training be offered, preferably by assimilating this curriculum into existing driver training programs. The costs for providing this service would likely be minimal.

7.5 Telecommuting and Other Electronic Communications

The Energy Commission and other state agencies has already, further recognized for many years that increased use of electronic communications can reduce California's dependence on petroleum-based fuels.[li] In particular, the rapid ramp-up over the last decade of various "e-communication" technologies offers potential to reduce VMT (and therefore petroleum consumption) in the transportation sector. Enhancing this potential is the fact that advancements in e-communication technologies (e.g., broadband connections) are improving efficiency and expanding applications to greater numbers of people and businesses.

E-communications replace the need to physically move people and/or products by substituting the transport of electronic information. Examples include 1) telecommuting (or "teleworking"), where work-related commuting and travel are reduced; 2) tele-shopping or e-commerce, where traditional "brick and mortar" shopping is replaced with online purchasing and 3) "de-materialization," which allows written information to be transformed into bytes and electrons, instead of being transported as hard copies by truck, rail or air. E-communications also have the potential to indirectly reduce the energy intensity of the transportation system, by increasing its capacity utilization and improving the efficiency of the supply chain.[lii]

Of these types of e-communications, teleworking is perhaps the most studied for VMT reduction potential. Theoretically, teleworking reduces solo-driver VMT by obviating the need to commute. A recent study for the Energy Commission found that teleworking probably reduces VMT in the general population, but "the amount of that reduction is most likely small," falling somewhere between 0 and 2 percent. However, the study noted that "where costs and benefits can be quantified, the business case for telecommuting can be compelling." It recommended that public agencies obtain better data to gain "a more precise determination of the true impact of telecommuting on VMT."[liii]

As with ridesharing, VMT reduction from teleworking would normally decrease the fuel consumption of personal vehicles, not those of the state fleet. A different type of teleworking involves the use of videoconferencing to conduct business meetings, avoiding the need for one or more parties to travel. When state employees reduce VMT through videoconferencing, this most likely does directly result in decreased petroleum consumption for the state fleet. The use of the Internet by state employees to procure supplies or services may not significantly reduce state fleet VMT, because such business

has traditionally been done by telephone, mail and fax. The use of email and other types of "de-materialization" probably already significantly reduce energy consumption in state-owned vehicles, although no data are available to quantify this.

These are just a few examples of how the state can potentially take further advantage of emerging e-communication technologies to reduce its transportation-related energy use. State administrators have recognized this potential and are taking steps to help realize the benefits. For example, in late 2002 about 500 state employees attended workshops on such topics as electronic travel solutions; on-line state vehicle reservations; and an AFV "interactive workshop."[liv] Like many other government agencies nationwide, California's state agencies are increasingly conducting competitive business procurements through the Internet. This de-materialization of the state procurement system has significant potential to reduce energy use in the general transportation sector, although the implications specific to government fleets are less obvious.

Further complicating the issue is the fact that enhanced e-communications also have potential to increase energy use in the transportation sector. First, complex region-specific dynamics are involved. Second, e-communications can cause "modal shifts" towards the use of relatively inefficient shipping means, such as overnight delivery by air and/or truck. Third, under certain circumstances e-communications can stimulate an increase in VMT involving both people and products, although this would be less of issue for state business as opposed to the general population. For example, the Internet fosters improved person-to-person communication, greater knowledge of potential far-away destinations, and the ease of purchasing travel-related services online – all of which can lead to increased human travel and/or greater distances traveled. In the case of products and materials, "globalization fostered by the Internet makes it easier to purchase objects from very far away," which can result in greater miles traveled, and higher energy consumption.[lv]

In sum, teleworking and other types of e-communications are likely to have a significant effect on existing and future petroleum consumption in the state fleet. Enhanced programs in certain areas (e.g., wider use of videoconferencing) could potentially provide benefits at relatively low cost. More information is needed to quantify the effect on energy consumption in the state fleet. However, expending staff resources specifically to assess the effects of e-communications on the state fleet's VMT is probably not a priority.

8. Air Emission Standards Governing Fleet Purchases

SB 1170 requires that appropriate state agencies "develop and adopt air pollution emission specifications governing the purchase by the state of passenger cars and light-duty trucks that meet or exceed the state's Ultra-Low Emission Vehicle (ULEV) standards for exhaust emissions." As this section describes, policies currently exist that effectively meet this criterion. However, improvements can be made to this effort to ensure wider coverage of vehicles that have previously fallen into categories that have

been exempt, primarily due to a real or perceived lack of available low-emission vehicle models for special applications.

The State of California has been a world leader in the development and adoption of stringent motor vehicle emissions standards for more than 30 years. In 1990, the CARB adopted the world's first set of "low-emission vehicle" (LEV) standards, which run from 1994 through 2003. In 2004, the next generation of low-emission vehicle standards (LEV II) will take effect, requiring even cleaner on-road motor vehicles to be sold throughout California. LEV II includes a wide variety of measures and standards to regulate California's entire light- and medium-duty fleet, including sport utility vehicles and pickup trucks that are often used as passenger vehicles. A complete description of California's LEV programs can be found on the CARB's website (http://www.arb.ca.gov/).

It is noteworthy that generally, the goals of achieving low emissions and using less petroleum fuel in motor vehicles have been compatible, and the two objectives have been simultaneously advanced. In conventional vehicles, a wide variety of advanced engines, fuel-induction and control technologies that were "technology-forced" through the CARB emissions regulations have also resulted in greater fuel efficiency. These include improved combustion chamber design, variable valve timing, multi-port electronic fuel injection, on-board diagnostics, and advanced evaporative emissions control.

As of December 2002, nine different 2003 model vehicles representing six different manufacturers are commercially available that meet the extremely stringent PZEV[lvi] standard. Like so-called SULEVs, PZEVs are 90 percent cleaner than the average 2003 model – except that they also provide near-zero evaporative emissions and come with a 150,000 mile warranty for their emissions control systems.

The result of this progress has been that California's in-use fleet of light- and medium-duty vehicles is progressively becoming more populated by vehicles that meet the most stringent emissions standards. It is estimated that the general light-duty vehicle population in California today roughly consists of 15 percent ULEVs, 84+ percent LEVs, and less than one percent collectively being SULEVs, PZEVs, and ZEVs.

State fleet administrators have taken significant measures to help ensure that the state fleet is populated with the cleanest available vehicles on an even faster rate than the general vehicle population. Table 8-1-1 lists some of the state's existing vehicle purchase policies that have been adopted to phase in the lowest-emission vehicle types available for a given vehicle class. It also summarizes possible improvements that could be made to enhance the policy, which could then be formally adopted by the appropriate agencies per requirements of SB 1170.

Table 8-1

Existing Vehicle Purchase Requirements by Emissions Certification

Affected Vehicle Type	State Fleet Purchase Requirement	Possible Policy Improvements
Vehicles < 8,5000 GVW and unsuitable for either AFV or hybrid purchase	Must be ULEV certified at a minimum. Preference is for SULEV.	Require SULEV as more models become available
Vehicles > 8,500 GVW	Lowest certified emission level available that meets agency specifications	Review needed for vehicles in this class, and options for lowest emissions.
Authorized law enforcement or emergency vehicles equipped with emergency lighting	Lowest certified emission level available that meets agency specifications	Review needed for vehicles in this class, and options for lowest emissions.

As this table indicates, the state has implemented important policies that help ensure purchase of vehicles meeting the lowest available emission certifications. For non-exempt vehicle purchases involving gasoline vehicles, this existing policy is very effective. However, the state operates large numbers of exempt vehicles, many of which are light- or medium-duty vehicles used in specialized applications such as law enforcement and emergency response. Under current policy, authorized emergency or law enforcement vehicles equipped with emergency lighting (as defined in California Vehicle Code Section 25252) are exempted from the requirement that replacement vehicle at least meet the ULEV standard.[lvii]

The process where vehicles are certified to ULEV or SULEV is dynamic; each new model year brings greater numbers of vehicles meeting both categories, covering a wide variety of on-road applications. As the agency responsible for working with other state agencies and departments on vehicle purchases and policy implementation, it is recommended that OFA review the criteria for granting exemptions to the policies highlighted in Table 8-1. This process can help identify vehicle applications previously exempted from purchasing only ULEVs or cleaner that can now be assimilated into the policy.

The costs associated with this recommended action will be minimal, involving mostly staff time and effort. Based on the findings of this further study, a revised policy meeting the language of SB 1170 should be adopted and enforced that expands the types of light-duty vehicle applications where ULEV or cleaner vehicles must be purchased.

The actual implementation of this revised purchase policy will require further study to determine costs and benefits. It is likely that additional cost to the state will be marginal, but details will be needed about the capital costs of ULEV or SULEV vehicles compared to vehicles certified at less stringent emission levels. Determining the benefits in terms of reduced emissions for the state fleet will depend on the specific types and numbers of additional vehicles affected by the new requirement. The effects on fuel efficiency for

the fleet will also vary accordingly. It is likely though not certain that the act of purchasing light-duty vehicles certified to lower emissions standards will also provide fuel economy benefits. Quantifying the magnitude would require further study.

9. Conclusions

SB 1170 targets a 10 percent or greater reduction in the petroleum consumption of California's vehicle fleet by January 2005. Due to a lack of detailed existing information about the state fleet (vehicle types, use characteristics, etc.), it is only possible to roughly estimate its "baseline" consumption of gasoline and diesel fuel. Such estimates indicate that approximately 73,000 on-road motor vehicles are operated in the state fleet, annually consuming about 46 million gallons of gasoline and nine million gallons of diesel. Although there are significant unknowns and inherent uncertainties (e.g., the implications of California's current budget crisis), this study concludes that the minimum 10 percent reduction in fuel usage can be achieved by January 2005. In addition, further actions can be taken over the longer term that will significantly reduce petroleum fuel consumption in the state fleet.

9.1 Measures to Reduce Petroleum Consumption by January 2005

Table 9-1 summarizes the most-effective measures that can be implemented by January 2005 to achieve the targeted 10 percent (or greater) reduction.

Table 9-1
Summary of Measures for Implementation by January 2005

Potential Measure to Reduce Petroleum Consumption in Fleet by January 2005	Estimated Annual Gasoline Displacement	Percent Reduction in Gasoline Use for state Fleet	Estimated Additional Capital Costs (2003 $)	Estimated Savings in Fuel Costs (2003 $)*	Actions Needed to Overcome Issues or Barriers
Operate state fleet's 1,610 bi-fuel LPG vehicles 100% on LPG	**2,023,770 gallons**	**4.4%**	**Vehicles:** no new costs **Infrastructure:** no new costs	~$425,000 per year for 7-yr. Life of vehicles	Executive Order requiring use of alternative fuels
Operate state fleet's 1,962 bi-fuel CNG vehicles 100% on CNG	**1,269,414 gallons**	**2.8%**	**Vehicles:** no new costs **Infrastructure:** $3.0 to $4.5 million for new fueling stations	~$90,000 per year for 7-yr. Life of vehicles	Executive Order requiring use of alternative fuels Expansion of CNG infrastructure at state garages
Purchase highest fuel economy cars and pickup trucks, as alternatives to currently procured vehicle types **(OR)**	**33,592 gallons** **(OR)**	**0.07% to 0.10%**	**Vehicles:** $367,890 over two years **Infrastructure:** no new costs	~$51,732 per year for 7-yr. life of vehicles	Possible changes in procurement policies Note: assumes 254 cars and 154 pickups will be phased in during 2003 and 2004. Subject to EPACT limits.
Purchase hybrid electric vehicles (hybrids), as alternatives to currently procured compact sedans	**47,625 gallons**		**Vehicles:** $1,389,380 over two years** **Infrastructure:** no new costs	~$73,500 per year for 7-yr. life of vehicles	Possible changes in procurement policies Note: assumes 254 hybrids will be phased in during 2003 and 2004. Subject to EPACT limits.
Various measures to reduce VMT, increase in-use vehicle efficiency, and allocate vehicles for more efficient use	**1.38 to 3.21 million gallons per year**	**3% to 7%**	(Insufficient information to quantify)	(Insufficient information to quantify)	Various changes in policy and procedures
TOTALS	**4.71 to 6.55 million gallons per year**	**10% to 14%*** **			

Notes:
*All estimates for fuel savings were based on late-2002 prices for transportation fuels. Actual fuel costs and relative savings will depend on prices that are subject to significant volatility.
**Federal incentives may apply to help offset capital costs
***The minimum target under SB 1170 is a 10% reduction (approximately 4.59 million gallons of gasoline per year). Estimated reductions in diesel fuel usage are not included here.

As this table shows, nearly 75 percent (approximately 3.3 million gallons of gasoline per year) of the targeted reductions (excluding heavy-duty vehicles) can be achieved by maximizing the use of compressed natural gas (CNG) and propane in the state's fleet of existing bi-fuel vehicles. These two measures will entail no significant new vehicle-related capital costs, but there will be costs associated with the construction and operation of new fueling stations, especially in the case of CNG. Savings in fuel costs (assuming ate 2002 prices for gasoline, CNG and propane) may offset some of these infrastructure costs.

Purchasing and deploying high-efficiency gasoline cars (hybrid electric vehicles and "best-in-class" cars for fuel economy) instead of more "conventional" fleet vehicles will also help reduce petroleum consumption in the state fleet. As the above table shows, the near-term benefits will be moderate (a reduction of 33,000 to 49,000 gallons per year). This is largely because the federal Environmental Policy Act (EPACT) limits the number of gasoline-fueled vehicles that can currently be used in the fleet. However, maximizing the use of such vehicles (especially hybrids) over the longer term will pay much larger dividends.

Table 9-1 also refers to a variety of other measures that the state will need to implement or expand to meet SB 1170's objectives. These measures can save fuel by reducing the fleet's VMT, increasing the fuel economy of in-use vehicles, or promoting uses of vehicles that are fuel-efficient. It is estimated that the remaining reductions (at least 1.3 million gallons per year) needed to meet the minimum SB 1170 target by January 2005 can be achieved by a combination of these measures.

9.2 Longer-Term Measures to Help Meet the Objectives of SB 1170

It is not currently possible to reduce fuel consumption in the state fleet by purchasing large numbers of hybrids and other high-efficiency gasoline vehicles. As currently enacted, EPACT requires that at least 75 percent of the light-duty vehicles purchased by the state must be alternative fueled, regardless of how this affects fleet fuel efficiency. However, if EPACT can be amended as described in this report, as many as 1,000 to 1,200 additional hybrids could be purchased by the state each year, as an alternative to purchasing conventional sedans and certain types of AFVs that are currently procured.

As summarized in Table 9-2, an estimated annual reduction in gasoline usage of 187,500 gallons would be realized for every 1,000 hybrids purchased. In 2003 dollars the estimated incremental capital costs would be about $5.4 million, although approximately $290,000 in fuel savings would be realized each year for the 7-year life of the vehicles.

Table 9-2
Longer-Term Measure to Deploy Hybrid Electric Vehicles

Measure to Displace Petroleum Fuel Over Next Several Years	Estimated Annual Gasoline Displacement	Percent Reduction in Gasoline Use for state Fleet	Estimated Capital Costs (2003 $)	Estimated Savings in Fuel Costs (2003 $)*	Actions Needed to Overcome Issues or Barriers
Purchase ~ 1,000 hybrids each year, as alternative to currently procured compact conventional sedans and/or AFVs	**187,500 gallons**	**0.4%**	**Vehicles:** $5,470,000 per year **Infrastructure:** no new costs	~$290,000 per year for 7-yr. life of vehicles	Obtain amendments to federal EPACT that allow AFV credits for hybrids **Note:** state purchases about 1,500 conventional sedans and AFVs combined, each year

*All estimates for fuel savings were based on late-2002 prices for transportation fuels. Actual fuel costs and relative savings will depend on prices that are subject to significant volatility.

10. Recommended Actions and Measures to Achieve SB 1170 Objectives

The Energy Commission, the CARB, and the DGS must take numerous specific actions if potential reductions in petroleum consumption are to be realized. This section provides recommendations on those specific actions – most of which appear to fall within the jurisdiction of OFA within the DGS. The costs in terms of staff time and resources to implement some of these actions are likely to be significant, but they cannot be quantified without additional information.

10.1 Maximized Use of Alternative Fuels

The state should issue a high-level policy calling for employees who drive bi-fuel AFVs to use CNG or propane whenever practical. This measure will be the single most-important step towards meeting the challenging targets under SB 1170 for displacing petroleum fuels. It is recommended that the Energy Commission continue and possibly accelerate its efforts to expand the existing fueling infrastructure for CNG and propane – with a focus on areas such as state garages where the largest numbers of vehicles are located. Public-private partnerships should be pursued to manage the state's costs. Because propane is a certified low emission alternative fuel that is accepted nearly universally in AFV programs, and one-half of California's propane supply is derived from non-petroleum sources, its use should be embraced by the state as a legitimate means to achieve the objectives of SB 1170.

10.2 Increased Purchases of Fuel-efficient Vehicles

The state should provide leadership and send an appropriate message by maximizing the purchase of hybrid-electric vehicles and high-mileage ("best-in-class") conventional

vehicles. Currently, this is constrained by EPACT requirements and other factors, but significant benefits can be realized immediately.

10.3 More Fuel-efficient Use of Vehicles and Employee Education

The DGS should expand its existing efforts to ensure that pool vehicles are used in the most fuel-efficient mode possible. New procedures and mechanisms may be needed to better select the right vehicles for the uses most often requested. The DGS should step-up efforts to educate state employees about the importance of reducing fuel consumption in the state fleet, and methods to achieve this such as techniques to drive vehicles more efficiently, and encourage increased use of alternative fuels.

10.4 State Vehicle Fleet Reduction

It is recommended that the state examine the best-available methods of funding the needed capital and operational budgets of fleets, and how the state budget will affect vehicle operations and petroleum consumption. Renewed efforts should be conducted to obtain detailed information from each agency that operates at least 15 state vehicles, including rosters of all vehicles, their ages and specifications, frequency of use and types of applications, real-world fuel economy and volumes of fuel used per year. Any vehicles that are obvious candidates for early retirement and no longer serve a "mission-critical" purpose should be removed from the fleet without being replaced.

10.5 Reduction of Vehicle Trips and Increasing Alternative Means of Transportation

The state should review and possibly expand programs such as flexible work options, telecommuting, teleconferencing and video conferencing as potentially cost-effective means to reduce fuel consumption in the fleet. However, more information may be needed to assess the costs and potential benefits associated with these programs.

It is also recommended that the state review how transportation alternatives such as ridesharing and public transportation can be used to offset trips in state vehicles.

10.6 Vehicle Components and Maintenance

It is recommended that the DGS work with other appropriate agencies and organizations to review and implement potential opportunities to reduce fuel consumption in state vehicles through improved maintenance-related activities. Examples include maintaining proper tire pressure, balancing and rotating tires, changing of air filters and oil filters, and front-end alignment. As outlined in the "California State Fuel Efficient Tire Report," [lviii] the state should consider use of low rolling resistance tires to optimize fuel economy of its existing fleet. The state should also consider the possible efficiency benefits associated with using synthetic lube oils in the vehicle fleet.

10.7 Data Collection

The DGS should take the lead to expand the existing database on state fleet operations and vehicle fuel consumption. New methods should be explored to optimize and streamline the data collection system. The new information system should be structured to allow future reports (e.g., EPACT and the SB 1170 annual report) to be more automated and ultimately more cost effective. Successful implementation of the new system will likely depend on receiving strong support from management of all agencies and commitments to respond with accurate fleet statistical data on a timely basis.

10.8 Federal Energy Policy Act Amendment

It is recommended that the state seek amendments to EPACT that will allow a broader interpretation of eligible vehicles, including the use of hybrids. This would allow the state to purchase as many as 1,000 to 1,200 additional hybrids per year as alternatives to non-dedicated AFVs. Per-vehicle reductions in gasoline usage of approximately 50 percent can be realized, delivering significant net "savings" in fuel economy within the state fleet. This will help expedite vehicle markets that are dominated by high-MPG hybrids, including alternative-fuel versions and those powered by fuel cells.

10.9 Internal Policies for State Vehicle Procurement

The DGS and the CARB should review the current criteria for granting exemptions to the policy that requires purchased vehicles to meet the Ultra Low Emission Vehicle Standard, or better. A more stringent policy (Super Ultra Low Emission Vehicles, or better) should be considered for vehicle classes that offer abundant commercial offerings.

It is recommended that the DGS explore changes to vehicle purchase policies that can allow a wider range of clean and alternative fueled vehicles to be purchased within the same class. A "multiple-awards process" should be considered involving vehicle specifications that incorporate a combination of important attributes (efficiency, emissions, life-cycle costs, cargo or passenger capacity, etc.). Special "green vehicle" points should be considered for those vehicle purchase options that offer the state most potential to meet both short- and long-term energy efficiency objectives, as identified in SB 1170 and AB 2076, respectively.

Appendix A: State Fleet "Driving Green" Questionnaire

The following State Fleet Questionnaire was sent to various state agencies. Responses to this questionnaire are the basis for some of the results presented throughout this report.

STATE FLEET QUESTIONAIRE

1. Describe any programs, practices or policies used by your department regarding the use of alternative fuels in your fleet:

2. Describe any programs, practices, or policies used by your department regarding the use of fuel-efficient vehicles in your fleet:

3. Describe any programs, practices, or policies used by your department regarding the reduction of in vehicle trips and increased use of alternative means of transportation:

4. Describe your department's experience (costs and benefits) using high fuel efficiency gasoline vehicles, including hybrid electric, instead of flexible fuel vehicles:

5. Describe the potential impact, costs and benefits if your department was asked to reduce the size of its fleet:

Appendix B: Summary of Responses from State Agencies to Questionnaire

Table B-10-1

State Fleet Questionnaire Response: Inventory of Alternative and Fuel-Efficient Vehicles

State Agency	Alternative Fuel Vehicles	Fuel-Efficient Vehicles
California Conservation Corps	30 CNG + 2 bi-fuel	12 gas/electric hybrids and 2 electric vehicles
Forestry and Fire Protection	22 flexible fuel sedans (M85), 39 bi-fuel pickups (LPG), 2 dedicated CNG vans, and 1 bi-fuel CNG van	2 hybrids assigned to administrators. CDF has leased another hybrid for the business services office.
Department of Parks & Recreation	Operates large CNG fueling facility. Includes 14 CNG tour buses, 6 passenger vans. Received grant from the National Parks Foundation for 100 Ford Th!nk vehicles.	22 Toyota Prius'. 100 Ford Th!nk vehicles. 50 electric John Deere Gators.
California Department of Food and Agriculture (CDFA)*	1 Flex fuel Taurus	2 Toyota Priuses
Department of Water Resources	17% (196) of fleet (1,127) is AFVs. 6 Electric (4 vehicles, 2 pickups), 93 bi-fuel propane pickups, 9 dedicated CNG (2 vehicles, 2 vans, 5 pickups, bi-fuel CNG (14 vehicles, 2 vans, 2 pickups, bi-fuel ethanol (49 vehicles, 21 pickups). Vehicles = SUV/Car/station wagon	No hybrids
DMV	Not described	Possesses a few hybrid vehicles.
California Energy Commission	None	Three electric vehicles : Ford Ranger, Toyota RAV4, Honda EV Plus
Stephen P. Teale Data Center	1 flexible fuel vehicle	
Department of Managed Health Care	None	1 Toyota Prius
State Water Resources Control Board	None	2 EVs
California Integrated Waste Management Board	5 FFVs (Methanol)	3 Toyota Prius hybrids leased from the DGS
Office of Environmental Health Hazard Assessment	None	1 EV

Table B-10-2

State Fleet Questionnaire Response: Reduction in Fleet Size

	Impacts to Agency	Costs and Benefits
California Conservation Corps	Fleet reduction can impact mission critical activities.	(Not Provided)
Department of Fish & Game	Would mean change in style of operations. May require establishment of satellite offices and vehicle-pools. Fleet reduction will impact mission critical activities.	(Not Provided)
Forestry and Fire Protection	Affect mission of the department and endanger public safety and increase property loss.	(Not Provided)
Department of Parks & Recreation	Reduction in DPR's fleet size would have a drastic impact on Parks' operations statewide.	(Not Provided)
Department of Toxic Substances Control	Workgroup is developing a fleet policy. Reducing HQ fleet would have minimal impact on staff. Field vehicle reduction will impact the department's mission critical activities adversely.	(Not Provided)
California Department of Food and Agriculture (CDFA)*	Reduction in fleet services would severely impact field services.	Would have to use rental cars. Californians would face health risks from fewer inspections.
Department of Water Resources	Department organizations have already begun reducing their fleet inventory due to current budget restraints	(Not Provided)
California Highway Patrol	Mission critical	Adverse impact on public safety
DMV	Mission critical	Will increase personal vehicle use
California Energy Commission	Not applicable	Not applicable
Stephen P. Teale Data Center	Mission critical	Operating a fleet is less expensive than alternatives, such as personal vehicle use or public transportation
Alcoholic Beverage Control	Mission critical	(Not Provided)
Department of Managed Health Care	Mission critical	Employee to vehicle ratio ~50:1

California Integrated Waste Management Board	No room to downsize. Mission critical	Increased costs if personal vehicles are used.
California Department of Transportation (Caltrans)	Mission critical and statewide impact	(Not Provided)
Office of Environmental Health Hazard Assessment	Employees will use personal vehicles	Potential for higher cost
Rivers and Mountains Conservancy	Has a single vehicle. Major impact.	(Not Provided)
Department of Boating & Waterways	Severely impact mandated programs	(Not Provided)
State Water Resources Control Board	Mission critical. Significant adverse impact on field work	(Not Provided)

Table B-1-3

Agencies with Existing AFV and Fuel-Efficiency Programs, Practices, and Policies

	Alternate Fuels	Fuel-Efficient Vehicles	Vehicle Trip Reduction (alternate means increase)	Other practices to achieve 10% reduction
California Conservation Corps			Encourages the use of public transportation such as light-rail whenever possible. Also encourages trip planning and car pooling to reduce VMT	Question not asked
State Coastal Conservancy		No fleets of its own	BART and bus tickets to staff. Considering a telecommuting policy.	Question not asked
Department of Fish & Game	Followed guidelines in the purchase of AFVs	To the extent possible try to pick fuel efficient vehicles. Office staff uses smaller sedans that are relatively fuel efficient.	Employees are encouraged to telecommute and carpool for official business.	Question not asked
Forestry and Fire Protection	The department's policy is to purchase vans whenever practical.	Fleet is mainly used for emergency response and hybrids and other such are not suitable for such activities.	Alternative transportation is not consistent with department mission	Question not asked
Department of Parks & Recreation	Have made all attempts to reach 75% AFV purchases annually.	Have made all attempts to reach 75% AFV purchases annually.	DPR has been aggressively promoting the use of Van Pools and Light Rail.	Question not asked

Department of Toxic Substances Control	Policy is to follow the DGS guidelines	Hybrid and electric vehicles are leased from the state garage	Assigned "transportation Coordinator" educates staff on alternate transportation availability. Agency's website provides alternate transportation information to staff.	Question not asked
California Department of Food and Agriculture (CDFA)*	AFVs are used by field biologists and are encouraged to use AF whenever available	Department is required by the DGS to purchase FE vehicles as a percentage of the overall fleet	Whenever possible, carpooling for field trips is procedure. Teleconferencing. Only vital trips policy.	Trip consolidation, car pooling, teleconferencing, AFVs, hybrids, 4day/10hr
Department of Boating & Waterways	None	Keep existing conventional vehicles in optimal condition. Most of departments vehicles are HD pick-up trucks	No specified policy, however consolidate trips and teleconference	Question not asked
Department of Water Resources	Complying with EPACT requirements. 75% of LDVs purchased each year are AFVs. New CNG refueling station in Oroville. Propane RFUs in Sutter and Delta. Goal in 2003 is to implement 8 propane RFUs. Maintenance programs to positively affect fuel efficiency	Maintenance programs to positively affect fuel efficiency	Vanpool program since 1989. MEO manages the program. Vanpool commute program estimated to have prevented 34.5 million miles of travel since implementation.	Provide each state Fleet Manager with the delegated authority to ensure programs within their own departments to achieve 10% reduction.
California Highway Patrol	No AFVs are available that meet law enforcement specs. Purchase bi-fuel vehicles whenever possible, for use as undercover vehicles, but has to pass CHP requirements	None	None	
DMV	Purchases dual fuel vehicles and dedicated fueled vehicles in line with the DGS policy.	No programs in place. Planning on purchasing more hybrid vehicles	Vanpools for official business. Rapid transit passes are sold on site, provides shuttle service, guaranteed ride home program, preferential parking to car pool	Eliminate or reduce the requirements related to minimum usage
Office of the Patient Advocate			Transit bus pass program, carpool, shuttle service	
California Energy Commission	None	These are loaned to staff on a weekly basis under the consumer acceptance program	Promotes ride sharing	Not applicable

Stephen P. Teale Data Center		Investigating conversion of entire fleet to hybrids	Better coordination of meetings to decrease staff trips, teleconferencing, host meetings, carpool,	
California Housing Finance Agency			Carpool. light rail	
Alcoholic Beverage Control			Encourages carpool, public transportation	
Department of Managed Health Care			Encourages alternative commuting. Member of the Sacramento TMA. Video, teleconferencing	
State Water Resources Control Board	None	No policy. Encourages staff to use EVs for local trips	Consolidate courier trips and coordinates with others within the Cal/EPA building	
Santa Monica Mountain Conservancy			Working with National Parks to introduce a bus service that will reduce mountain traffic by visitors. Carpooling to off-site meetings is encouraged	
California Integrated Waste Management Board	Implementing AFV purchasing requirements outlined in EPACT. Considering replacing all non-AFV sedans with bi-fuel vehicles or hybrids		Telecommuting, car pooling and alternative means of commuting	
California Department of Transportation (Caltrans)	Caltrans purchases 75% of fleet under 8,000 GVWR having AF capabilities, including propane bi-fuel pickups. Diesel fuel burners are being replaced by propane burners. Has a website to show where to purchase AF	Has received funding to replace 231 gasoline sedans with hybrids. Pursuing the purchase of hybrid trucks. Willing to participate with the DGS on using "Best Value" bidding concept	Teleconferencing and video conferencing, free light rail passes, vanpools/carpools, alternate work schedules, telecommuting	
Department of Housing and Community Development - Office of Migrant Services	None of the contractors have any programs, practices or policies in place	None of the contractors have any programs, practices or policies in place		
Office of Environmental Health Hazard Assessment	None	None	Considering teleconferencing for the bi-weekly meeting. Video-conferencing done by various workgroups	

Table B-1-4

Other Comments from State Fleets Regarding AFVs and Hybrids

	Alternate Fuels	Fuel-Efficient Vehicles	Vehicle Trip Reduction (alternate means increase)	HFE gasoline vehicles vs FFVsc	Fleet Size Reduction
California Conservation Corps	Corp-members travel long distances - CNG not practicable because of lack of CNG refueling facilities in the back country	Mainly used to support administrative services		Currently data is not collected to quantify	Not conducted
Department of Fish & Game	Much of the fleet is located in rural areas where AF is unavailable. Therefore use of AF is lagging the 50 % target	Many vehicles are used in law enforcement and have limited opportunity	Rural nature of work does not lend itself to public transit easily.	No hybrids in the department at this time. No quantitative analysis performed. Anecdotal evidence of better mileage when using hybrids	
Forestry and Fire Protection	Fleet is mainly used during emergency response and AF is not practical. Many of these vehicles operate in remote areas where AF is not available			Not analyzed.	
Department of Parks & Recreation				Substantial reduction in fuel costs from the operation of the Toyota Prius'. They are being driven 14,000 miles annually.	
Department of Toxic Substances Control				Cannot accurately address cost/benefit issue.	
California Department of Food and Agriculture (CDFA)*				AF is not readily available at all locations. Cost of AF is higher.	Would have to use rental cars. Californians would face health risks from fewer inspections.

Department of Water Resources			DWR employees make monthly payments along with subsidy adjustments	Will use a fuel management system (EJ Ward) to identify areas for reduction in fuel usage by 10%	
California Highway Patrol					Adverse impact on public safety
DMV	AF rarely used due to lack of fueling stations			Not evaluated	Will increase personal vehicle use
California Energy Commission		The three EVs make up the entire Energy Commission fleet.		Not evaluated	Not applicable
Stephen P. Teale Data Center	6 vehicles in the departments fleet	Currently 4 charging stations on site. Can expand to have more		Not evaluated	Operating a fleet is less expensive than alternatives, such as personal vehicle use or public transportation
Alcoholic Beverage Control	No fleet. All vehicles used are assigned monthly by the DGS who owns the vehicles and manages the composition of the fleet	No fleet		Department is charged a standard mileage rate from the DGS. No difference between leasing an hybrid and a conventional	
Department of Managed Health Care	Total 6 vehicles in fleet			Not evaluated	Employee to vehicle ratio ~50:1
Santa Monica Mountain Conservancy	Fleet consists of a single old-model Crown-Victoria	No fleet			
California Integrated Waste Management Board	Total 33 vehicles in fleet	Considered EVs but field activities may be out of range		Impressed with fuel efficiency of hybrids. Not evaluated C&B quantitatively	Increased costs if personal vehicles are used.
California Department of Transportation (Caltrans)				Good experience with Hybrids. AF fueling infrastructure is poor	

Department of Housing and Community Development – Office of Migrant Services	OMS centers operate under contract with the department. Contractors are generally required to purchase vehicles adequate for task. Typically require light to heavy pickup trucks	OMS centers operate under contract with the department. Contractors are generally required to purchase vehicles adequate for task. Typically require light to heavy pickup trucks			
Office of Environmental Health Hazard Assessment		Total of 3 cars including above constitute OEHHA's fleet. Electric vehicle is used for "in-town" purposes			Potential for higher cost

Endnotes

[i] California State Legislature, Senate Bill No. 1170, Chapter 912, from http://info.sen.ca.gov/

[ii] For example, when diesel engines are converted to operate as dedicated alternative fuel engines, a loss of thermal efficiency usually results, due to the switch from compression ignition to spark ignition.

[iii] Exempt vehicles under EPACT include military tactical vehicles, law enforcement and emergency vehicles, medium- and heavy-duty vehicles (>8,500 GVWR), and vehicles geographically located outside a covered "metropolitan statistical area."

[iv] For example, flexible fuel vehicles can no longer be purchased, effective with the 2003 model year vehicle purchases. ***See Section***. A complete listing of all AFVs on the state's vehicle procurement contract can be viewed at http://www.pd.dgs.ca.gov/contracts/vehicles.htm.

[v] In 2002 AB 1493 authorized the CARB to develop statewide standards for tailpipe emissions of CO_2 beginning in model year 2009. Meeting such a regulation will require measures to reduce CO_2 emissions.

[vi] Source: Department of Motor Vehicles, "Fee Exempt Vehicles Currently Registered," November 30, 2000, November 30, 2001, and November 30, 2002.

[vii] The State's fleet of vehicles in this category collectively used about 70,000 gasoline gallon equivalents of alternative fuel (mostly CNG) in 2001, or about 1.2% of the total gasoline usage for those vehicles. See 5.1 for details.

[viii] This number may be low, as the State has recently purchased Honda Civic Hybrids that is not included here.

[ix] SB 1170 does not differentiate between reducing consumption of gasoline or diesel fuel. In reality, most of the reductions that can be achieved through measures discussed in this report will accrue to the light- and medium-duty vehicles (gasoline fueled).

[x] California Department of General Services website (http://www.pd.dgs.ca.gov/contracts/aboutvehicles.asp).

[xi] Department of General Services website.

[xii] It is noteworthy that federal Executive Order 13149, which calls for a 20% reduction in petroleum usage by the federal fleet, did NOT include certain exempted vehicles in its baseline fuel use.

[xiii] The term "bi-fuel vehicle" in this report refers to AFVs capable of operating on either gasoline or propane, from separate fuel-induction systems and on-board storage tanks.

[xiv] According to the 2001 EIA Alternative Fuel Report, Caltrans used a total of 2700 gallons of propane in these vehicles in 2001, or about 4 gallons per bi-fuel vehicle.

[xv] An advantage of propane fueling stations is that they entail relatively low capital costs. The cost to build 15 propane stations is approximately an order of magnitude lower than the cost to build 15 CNG stations.

[xvi] E-85 and M-85 consist of 85% ethanol or methanol, respectively, mixed with 15% unleaded gasoline (by volume). The gasoline portion of the mix improves cold-starting capabilities and other combustion characteristics.

[xvii] Since FFVs can use either gasoline or an alcohol fuel (E-85 or M-85) mixed in the same tank, they theoretically help effect simultaneous commercial development of fueling stations and AFVs.

[xviii] Records provided by the DGS and other State agencies show zero consumption of either E-85 or M-85 in recent years.
[xix] Department of General Services Office of Fleet Administration, Management Memo #02-21, November 27, 2002 (http://www.documents.dgs.ca.gov/osp/sam/mmemos/mm02_21.pdf).

[xx] Certain dedicated AFVs are considered both "green" and the most efficient AFV in their class (e.g. Honda Civic GX). This section does not discuss AFVs because the State's purchase of AFVs is guaranteed under EPACT, as discussed in Section 5.1.1. Dedicated AFVs offer 100% gasoline displacement, and commercial offerings are too limited to focus on best in class for fuel efficiency.

[xxi] Fuel economy and fuel consumption are related but different entities. Note for example, that a fuel economy improvement from 10 to 12 mpg is an increase of 20% that will decrease fuel use by 16.6%. The same 2 mpg increase from 20 to 22 mpg yields 10% more mpg and 9% less fuel consumed.

[xxii] For example: California Energy Commission, Consultant Report P600 02-01CR, Analysis and Forecast of the Performance and Cost of Conventional and Electric-Hybrid Vehicles, Prepared by Energy and Environmental Analysis, Inc., March 2002. (http://www.energy.ca.gov/fuels/petroleum_dependence/documents/2002-04-09_HYBRID.PDF)

[xxiii] However, hybrid versions of pickup trucks and SUVs will likely be available in the 2004 model year, as further discussed below.

[xxiv] Expected hybrid-electric offerings for the 2004 MY include a Ford Escape SUV, a Chevy Silverado / GMC Sierra pickup, a newer version of the Honda Insight, and possibly a GM SUV with the ParadiGM drive configuration.

[xxv] For example, a panel of vehicle and component manufacturers addressed this topic at the Electric Vehicle Association of the Americas meeting from December 10-13, 2002.

[xxvi] Recall that vehicle fuel economy is related to, but different from fuel consumption. Refer to endnote xxi.

[xxvii] For example, Congressman Henry Waxman of California sponsored legislation calling for partial credit for hybrids.

[xxviii] EPACT amendments would have to become law in 2003 to have much affect on fleet VMT by early 2005.

[xxix] Personal communication from staff of the Office of Fleet Administration, September 2002.

[xxx] California Energy Commission report, "California State Fuel-efficient Tire Program," 600-03-001D, November 2002. Prepared by TIAX LLC with subcontractor Ecos Consulting.

[xxxi] Tire rolling resistance is defined in the report as the energy a tire consumes per unit distance of travel. As a tire rolls under load, it deforms. A fraction of that energy is stored elastically, but the remainder is dissipated as heat.

[xxxii] Assumes vehicle lifetime of 120,000 miles, 21.2 mpg, and average fuel price of $1.53; a fuel savings of 1.0% translates to $87, much greater than the National Academy of Science estimates for incremental improved tire cost.

[xxxiii] Fuel savings depend on several factors such as vehicle type, vehicle load, road conditions, environmental conditions, driving cycle, and tire combinations.

[xxxiv] California Energy Commission Tire Report (draft), November 2002.

[xxxv] The California Energy Commission Tire Report does not specifically report the cost, volume available, vehicle models served, or other manufacturer-specific information that pertains to LRRs.

[xxxvi] The California Energy Commission Tire Report (draft), November 2002.

[xxxvii] Toyota Motor Sales USA, "2001 Model Year Toyota Prius Customer Support Program, Supplemental Tire Warranty Coverage," undated, posted on the DGS website at http://www.documents.dgs.ca.gov/ofa/Prius2001TireWarranty.pdf.

[xxxviii] California Energy Commission and California Air Resources Board, Task 3: Petroleum Reduction Options, Staff Draft Report P600-02-011D, March 2002 (http://www.energy.ca.gov/fuels/petroleum_dependence/documents/index.html)

[xxxix] The analysis notes that other maintenance-related activities such as engine tune ups are addressed through the existing Smog Check program. See Section 6-1 for tire-related improvements in fuel efficiency.

[xl] California State Administrative Manual (http://sam.dgs.ca.gov/sam.htm).

[xli] From: http://www.ofa.dgs.ca.gov/About+OFA/default.htm

[xlii] Department of General Services, Office of Fleet Administration Management Memo, January 11, 2002 (http://www.documents.dgs.ca.gov/ofa/memos/mm02_02.pdf).

[xliii] This section addresses the comments of State agencies other than the DGS, involving State vehicles not garaged and controlled by the DGS. The DGS controls the State's pool vehicles, and is assessing the potential to downsize this fleet separately.

[xliv] California Driving Green Task Force Meeting, "Notes for Dec. 3, 2002," provided by the DGS Office of Fleet Administration.

[xlv] As described, the State does operate vanpool vehicles for employees to commute, some of which run on CNG. To any extent that these vehicles are not already operating at or near maximum capacity, it would be beneficial to promote greater use by State employees. However, any avoided gasoline use would most likely involve the employee's personal vehicle.

[xlvi] It is unclear how long battery EVs will continue to be used in the fleet.

[xlvii] California State Administrative Manual http://sam.dgs.ca.gov/sam.htm)

[xlviii] From http://www.ofa.dgs.ca.gov/Services/Travel.htm.

[xlix] Department of General Services Office of Fleet Administration, Management Memo #02-17, July 15, 2002 (http://www.documents.dgs.ca.gov/osp/sam/mmemos/mm02_17.pdf).

[l] U.S. Environmental Protection Agency website, Driving More Efficiently, http://www.fueleconomy.gov.

[li] Much of this section has been repeated from a white paper written for the Commission in August 2000 by Jon Leonard of TIAX LLC, entitled The Effects of E-Communications on Energy Use in Transportation.

[lii] Joseph Romm. "The Internet Economy and Global Warming: A Scenario of the Impact of E-commerce on Energy and the Environment," Center for Energy and Climate Solutions, from http://www.cool-companies.org.

[liii] California Energy Commission, Consultant Report P600 01-020, Impacts of Telecommuting on Vehicle-Miles Traveled: A Nationwide Time Series Analysis, Prepared by the University of California, Davis Institute of Transportation Studies, December 2001. (http://www.energy.ca.gov/reports/2002-01-30_600-01-20.PDF)

[liv] The DGS newsletter, December 2002 (http://www.documents.dgs.ca.gov/ofa/newsletters/Newsletter_Dec2002.pdf).

[lv] Joseph Romm.

[lvi] PZEVs (Partial Zero Emission Vehicles) are so clean that they provide manufacturers “partial” credit as being zero emission vehicles.

[lvii] Department of General Services Office of Fleet Administration, Management Memo #02-21, November 27, 2002 (http://www.documents.dgs.ca.gov/osp/sam/mmemos/mm02_21.pdf).

[lviii] California State Fuel Efficient Tire Report, Volume I and II, Publication 600-03-001D