Policy to Induce Adoption of Alternative Fuel Vehicles

Overall Effect on California Petroleum Use		**Affects Petroleum Demand Through Intermediate Indicators:**	
Magnitude	High	**Primary**	Fuel Composition
Certainty	High	**Secondary**	
Applicable Level of Government	Federal, State, and Local		
Relevant Laws or Cases Affecting Factor	See description section for specific laws, codes, and regulations. The American Recovery and Reinvestment Act (Pub. L. 111-5, 123 Stat. 115) authorized or extended many of the federal incentives available today.		
Time horizon for implementation and maturity	In the short term, policy and financial incentives provide support for the early adopter market. This leads to real, but minimal, reductions in petroleum demand. Support for the early market is intended to develop a critical mass of fueling infrastructure and choice of vehicles to support wider adoption of alternative fuel vehicles in the future. The vehicle fleet replacement cycle limits the time frame over which policies to support alternative fuel vehicle acquisition will take effect. The California Air Resources Board estimates that a 50% of automobiles sold in California in 2011 will still be on the road in 13 years (California Air Resources Board, 2011). As alternative fuel vehicles currently make up a small percentage of new vehicle sales in California, achieving 50% or greater market share of alternative fuel vehicles is a long-term proposition.		
Relevant Topics	Electric vehicles, hydrogen vehicles, natural gas vehicles, incentives, tax expenditures		
Summary	Increasing the share of alternative fuel vehicles in the fleet will reduce consumption of petroleum, but increase consumption of energy from other sources. Switching to alternative fuel vehicles is unlikely to have a 1-to-1 effect on petroleum demand as petroleum is often used to process or distribute alternative fuels.		

Introduction

Most federal, state, and local policies to promote alternative fuel vehicles attempt to influence consumer and firms' vehicle purchase decision. These policies include financial subsidies for vehicle or equipment purchases, supply-side incentives for manufacturers of alternative fuel vehicles, and special privileges for users of alternative fuel vehicles.

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Other policies affect the supply of alternative fueling infrastructure. The availability of alternative fueling infrastructure affects both the vehicle purchase decision and subsequent decisions to utilize alternative fuels. Drivers of flex-fuel, plug-in hybrid electric, and biodiesel-capable vehicles can choose to refuel with petroleum or alternative fuels. The availability and price of alternative fuels will affect the proportion of petroleum these drivers use.

In the academic literature, scholars discuss the relative effectiveness of policy versus non-policy forces at inducing advanced technology and alternative fuel vehicle purchases. Kahn (2007) found that hybrid vehicle registrations in California correlate with Green Party registrations, inferring that green behavior influences vehicle choice. Diamond (2009) argues that gasoline prices have the strongest effect on hybrid vehicle adoption nationwide, with upfront purchase subsidies being the most effective policy incentive. A 2011 study of the Los Angeles electric vehicle market found that monetary subsidies that lower a vehicle's purchase price and total cost of ownership are more effective at inducing vehicle purchases than are special privileges for vehicle users (Dubin, et al., 2011).

Several incentives reduce the purchase price for alternative fuel vehicles in California. These include:

Alternative fuel vehicle purchase incentives

Incentive	Administration	Authorization
Up to $7,500 Federal Tax Credit for eligible plug-in electric drive vehicles	U.S. Internal Revenue Service	Enacted by Energy Improvement and Extension Act of 2008, Pub. L. 110-343, 122 Stat. 3765. Amended and extended by American Recovery and Reinvestment Act of 2009, Pub. L. 111-5, 123 Stat. 115). Codified in 26 USC § 30D. Requires IRS Form 8936.
Up to $4,000 in Federal Tax Credit for eligible hydrogen fuel cell vehicles	U.S. Internal Revenue Service	Codified at 26 USC § 30B. Requires IRS Form 8910. Expires in 2014
Up to $2,500 rebate per eligible vehicle from California Clean Vehicle Rebate Project	California Center for Sustainable Energy	Enacted in AB 118 (2008), vehicle license fee funding authorization codified in California Health and Safety Code Section 44060.5 and expenditure guidelines codified in California Health and Safety Code Section 44270-44274. Applies to Zero Emissions Vehicles, Plug-In Hybrid Electric Vehicles, Neighborhood Electric Vehicles, and Zero Emissions Motorcycles.

Additionally, incentives for the purchase and installation of alternative fueling infrastructure and charging equipment help increase the supply of this infrastructure:

Alternative fueling infrastructure purchase and installation incentives

Incentive	Administration	Authorization
Up to $2,000 for Compressed Natural Gas home refueling equipment	South Coast Air Quality Management District	Funded by Clean Fuels Program, collection authorized by California Vehicle Code Section 9250.11 and eligible expenditures defined under California Health and Safety Code Sections 40448.5 and 40512
Subsidies for installation publicly-accessible electric vehicle supply equipment	U.S. Department of Energy	ChargePoint America and EV Project (ARRA Funded)
Subsidies for home installation of chargers for Nissan Leaf and Chevy Volt owners in San Diego, and LADWP territory		EV Project (ARRA funded)
Up to $1,200 in installation credit for residential electric vehicle supply equipment for BEV owners	Bay Area Air Quality Management District and the EV Project	EV Project (ARRA funded) and BAAQMD funds
Tax credit for consumers and businesses who purchase and install qualified hydrogen fuel infrastructure	U.S. Internal Revenue Service	26 USC § 30B and 38. Requires IRS Form 8911.

Inasmuch as these incentives increase the availability of alternative fueling infrastructure and reduce the costs of alternative fuels, they serve to reduce the proportion of petroleum used by dual-mode and flex-fuel vehicles.

Special privileges for advanced technology and alternative fuel vehicles may also increase demand. The California Department of Motor Vehicles issues decals to qualifying vehicles, which makes them eligible for special privileges:

California vehicle decals and special privileges

Decal	Qualified Vehicle Types	Privileges
Yellow	Hybrid-electric vehicles	Most privileges have expired
Green	Plug-in hybrid electric vehicles	HOV lane access for vehicles displaying decal
White	Hydrogen fuel cell, battery electric, and natural gas powered vehicles	HOV lane access for vehicles displaying decal Free parking in Santa Monica, Hermosa Beach, and San Jose

Many California electric utilities offer a special rate structures for sub-metered electric vehicle service equipment and time-of-use rates to discount charging during off-peak hours. These unique rate structures reduce the cost of refueling electric vehicles.

In addition to demand-side incentives that affect the vehicle purchase decision, federal production incentives serve to support the U.S. manufacture of electric vehicles. The U.S. Department of Energy has issued grants and loans to manufacturers through its Advanced Technology Vehicle Manufacturing Loan Program (10 CFR Part 611), authorized by Energy Independence and Security Act of 2007 (Pub L. 110-140), and extended by the American Recovery and Reinvestment Act (Pub L. 111-5, H.R. 1-24, 26). This program has awarded $8.4B in loans to vehicle manufacturers including Ford, Fisker, Nissan, and Tesla (U.S. Department of Energy, 2012). These loans are used to re-configure manufacturing plants to produce battery electric vehicles and plug-in hybrid electric vehicles. As of 2012, U.S. Department of Energy has provided $2.375B in grants for battery manufacturing and related activities through its Electric Drive Vehicle Battery and Component Manufacturing Initiative (U.S. Department of Energy, 2011).

Effect on Fuel Use

It is likely that the California market for alternative fuel vehicles would develop without policy incentives as petroleum becomes more scarce. However, policy serves to expedite and ease this transition, leading to reductions in California petroleum use before and beyond what would occur in absence of policy.

The California Energy Commission analyzed the effect of various policies to reduce petroleum demand in the state, including the proliferation of flex fuel, plug-in hybrid, natural gas, and zero emissions vehicles. Overall, the Commission estimates total annual gasoline consumption in California will fall to 11.7 billion gallons in 2030, a 21% reduction from 14.8 billion gallons in 2009 (California Energy Commission, 2011). Only a portion of these gains are due to a projected switch to alternative fuel vehicles.

Anticipated increases in ethanol demand are due to both the expected proliferation of flex-fuel vehicles and the low-carbon fuel and renewable fuel standards. Specifically, the Energy Commission (2011) forecasts that an increase in new or retrofitted flex-fuel capable vehicles will lead E85[1] demand to increase from 13.2 million gallons in 2010 to between 2.17 billion and 3.19 billion gallons in 2030. E85 will make large contributions toward the state's low carbon fuel standard. The Energy Commission (2011) also projects an increase in B20[2]

[1] 85% ethanol blended with gasoline
[2] 20% biodiesel blended with diesel

demand to 765 million gallons in 2020, in part to meet the low carbon fuel and renewable fuel standards.

The California Energy Commission (2010) expects the state will be home to 1,563,632 plug-in capable vehicles in 2020 and 2,847,580 in 2030. Electric vehicles demanded 120 million kWh of electricity in 2009, but the Commission (2011) expects 2030 demand to increase to 1.07 billion kWh, a 10.9% compound annual growth rate.

The Energy Commission (2010) expects the number of compressed natural gas vehicles in California to grow from 17,569 in 2007 to 206,071 in 2030. The Commission (2011) also expects demand for natural gas as a transportation fuel expected to increase from 130.6 million therms in 2009 to between 243.7 and 256.1 therms in 2030.

The Energy Commission did not predict future demand for hydrogen and hydrogen-powered vehicles.

Use of alternative fuels for transportation propulsion directly displaces petroleum, though alternative fuels often require petroleum for extraction, processing, and transportation. Thus, the ratio of alternative fuel consumption to petroleum displacement is not energy-equivalent, and can differ fuel-by-fuel. California uses the CA-GREET lifecycle analysis model in implementing its Low Carbon Fuel Standard to assess these differences. Nevertheless, the shift to alternative fuel vehicles will directly offset a tremendous portion of the state's demand for petroleum-based motor vehicle fuels.

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