EXECUTIVE SUMMARY

"Now, more than ever, it is clear that clean transportation is the future, and California's policies and companies are leading the way…Our nation-leading green policies are not only creating jobs and inspiring entrepreneurs and innovators to create and grow businesses in California, they are charting the path to a future that doesn't depend on oil, will reduce costs for consumers and leave this world a better place for the next generation."

~ Governor Schwarzenegger June 15, 2010

Transportation fuels is one of the top three energy use sectors in the United States, accounting for two-thirds of the 20 million barrels of petroleum consumed daily. Of that, 65 percent is imported from foreign sources. In California, the transportation sector represents roughly half of all energy consumed and, like the United States, is 95 percent dependent on petroleum. In 2008, California's transportation sector consumed about 15 billion gallons of gasoline and more than 3 billion gallons of diesel fuel. This sector represents approximately 40 percent of the state's greenhouse gas emissions, the largest amount from any sector.

It has been nearly four decades since the 1973 Arab Oil Embargo and the ensuing economic disruption and geopolitical instability. The United States continues to be vulnerable to oil supply disruption and price shocks as a result of the nation's dependence on petroleum, sending almost a billion borrowed dollars a day out of the country for oil imports. This exacerbates the growing trade imbalance and severely dampens economic recovery. In addition to economic and geopolitical risks, the authors now see how domestic petroleum extraction presents increasing environmental risks as evidenced in the recent Gulf of Mexico oil spill disaster.

The unprecedented events of the past two years that have affected all Californians and the state's economy have challenged the development of non-petroleum transportation fuels and advanced vehicle technologies. The Great Recession of 2008-2009, gasoline price increases in 2008, bankruptcies in the auto industry, financial institution collapses, job losses, and severe capital constraints are among the many events. The destabilizing impacts of these events have resulted in creating this challenging environment, while underscoring the importance of the development of alternative and renewable fuel and vehicle technologies for the many public benefits they can provide.

California is positioned to dramatically affect the direction of the nation's transportation sector as it leads the way with landmark state regulations and incentives to decrease petroleum use and greenhouse gas emissions. The *State Alternative Fuels Plan of 2007* (Assembly Bill 1007, Pavley, Chapter 371, Statutes of 2005), jointly developed and adopted by the Energy Commission and Air Resources Board, presented strategies to increase the use of alternative and non-petroleum fuels for transportation. The *State Alternative Fuels Plan* set goals of reducing petroleum dependence by 15 percent and increasing alternative fuels use by 20 percent, by 2020. The alternative fuels proposed in the plan could achieve these goals and reduce greenhouse gases by 15 percent to 20 percent in the near term. Other important California regulations include the Global Warming Solutions Act of 2006 (Assembly Bill 32,

Núñez, Chapter 488, Statutes of 2006), "Zero Emission Vehicle" regulations, the Low Carbon Fuel Standard, the *Bioenergy Action Plan*, the Renewable Portfolio Standard and the *San Pedro Bay Ports Clean Air Action Plan*.

The Alternative and Renewable Fuel and Vehicle Technology Program, created by Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007), has a crucial role in attaining the state's climate change policies. Through 2014, the Energy Commission will provide incentives of up to $100 million annually through the program to leverage public and private investment in the development and deployment of clean, efficient, and low-carbon alternative fuels and technologies. Assembly Bill 118 also provides up to $50 million per year for the Air Quality Improvement Program, administered by the Air Resources Board, which complements the Energy Commission's investment plan in providing alternative fuel vehicle incentives.

The Energy Commission is required to prepare an annual investment plan to determine funding priorities and opportunities and describes how program funding will be used to support other public and private investments. The program also provides a foundation for the sustainable development and use of transportation energy and an economic stimulus to create California jobs and businesses by encouraging the invention and production of the technologies and services necessary for the future transportation system. The Energy Commission adopted its first investment plan combining funds from fiscal year 2008-2009 and fiscal year 2009-2010 in April 2009. This *2010-2011 Investment Plan for the Alternative and Renewable Fuel and Vehicle Technology Program* is the funding guide for fiscal year 2010-2011.

Although significant, the funding necessary to transform California's transportation system is greater than what the program provides and requires the Energy Commission to effectively leverage its funding with other agencies and private industry.

2010-2011 Investment Plan Funding Priorities

The Energy Commission will continue to provide funding to accelerate the development and deployment of clean, efficient low-carbon technologies that will achieve several key policy objectives: reducing greenhouse gas emissions and petroleum dependence and increasing alternative and renewable fuel use and in-state biofuels production. Achieving these objectives requires a portfolio of fuels and vehicle technologies including developing electric drive and fuel cell vehicles, producing low-carbon biofuels, increasing vehicle efficiency, and continuing deployment of natural gas and propane vehicles.

Funding priorities were analyzed based on the *2050 Vision* goals stated in the *State Alternative Fuels Plan,* which specifies scenarios for categories of fuels and light-duty vehicles that could be used over the next 40 years to achieve the 2050 greenhouse gas emission reduction target. These funding priorities are shaped by the program opportunities to achieve the 2020 greenhouse gas emission target and the necessary "trajectory" of continued greenhouse gas emission reductions through 2050. A similar approach was used for medium- and heavy-duty vehicles.

The plan also evaluates existing public funding that is already developing and deploying alternative and renewable fuel and vehicle technology and assesses where gaps exist,

and funding is required. Funding required for workforce training, sustainability studies, standards and certification, public education and outreach, and analytical support was also considered. This investment plan recognizes the necessity to leverage existing federal, state, and local funding as well as stakeholder investments. Auto manufacturers, utilities, other stakeholders, and federal and local governments are investing in alternative fuel and advanced vehicle technologies. The Energy Commission intends to leverage these investments to accelerate the introduction and use of these fuels and technologies.

To help develop the *2010-2011 Investment Plan* five stakeholder workshops were held in September and October 2009. The workshops focused on the technologies and markets for electric drive, biofuels, natural gas and propane, hydrogen, and electric drive infrastructure. The *2010-2011 Investment Plan* also considers:

- Program funds that have been awarded to date.
- American Recovery and Reinvestment Act funds awarded to successful California project applicants.
- The effects of the Zero Emission Vehicle regulation modifications, the Low-Carbon Fuel Standard, the Bioenergy Action Plan, the Clean Fuels Outlets regulations, the Renewable Fuel Standard, the National Greenhouse Gas and Corporate Average Fuel Economy Standards for Vehicles, the Renewable Portfolio Standard, and the Clean Air Action Plan.

Program Status

The second investment plan has benefited from several public workshops, stakeholder comments and proposed project concepts, and funded projects. Using this information, the competitive solicitations have resulted in the best projects for alternative and renewable fuels and advanced vehicle technologies. The program funding is heavily oversubscribed, receiving project proposals totaling more than four times the available funding. Greenhouse gas and petroleum use reductions are substantial, and the amount of leveraged public, stakeholder, and venture capital is unprecedented.

One of the major developments since the adoption of the first investment plan has been the American Recovery and Reinvestment Act and the billions of dollars that are being distributed nationally for a broad range of economic stimulus activities. To help California entities successfully compete for available American Recovery and Reinvestment Act funds, the Energy Commission issued a solicitation in April 2009 offering $175 million in cost share funds from the first investment plan government response to a transportation-related American Recovery and Reinvestment Act funding opportunity announcement. The Energy Commission reviewed 108 proposals requesting more than $624 million of program funds and $1.815 billion of American Recovery and Reinvestment Act funds. To date, the Energy Commission has committed $36.5 million to California projects that have been awarded approximately $105.3 million in additional American Recovery and Reinvestment Act funds and that also include $113.3 million in private funds. These funds have gone to:

- Install 3,891 new electric vehicle charging sites.
- Demonstrate over 800 medium- and heavy-duty natural gas and hybrid-electric trucks.
- Develop high energy density lithium-ion batteries.
- Provide public outreach and education to promote the deployment of heavy-duty natural gas vehicles.

With a significant amount of funding still available, the Energy Commission issued a number of additional solicitations and agreements (totaling $124.4 million) for the following purposes:

- Biomethane production facilities: $21.5 million
- Alternative and renewable fuel infrastructure: $9.5 million
- Demonstration of medium- and heavy-duty advanced vehicle technology: $13.8 million
- Manufacturing facilities for electric vehicles, alternative fuel vehicles, vehicle components and batteries: $19 million
- Biofuel production plants: $15 million
- Hydrogen fueling infrastructure: $19 million
- Ethanol production incentive program: $6 million
- Certification of hydrogen dispensing equipment for retail hydrogen fueling stations and establishment of specifications for hydrogen and biodiesel fuels: $4 million
- Establish statewide workforce training and development programs: $15 million.
- Convert state-owned hybrid-electric vehicles to plug-in hybrid-electric vehicles: $600,000
- Technical assistance in administering the Alternative and Renewable Fuel and Vehicle Technology Program: $1 million

As of July 2010, all of the above solicitations are closed. The Energy Commission is preparing to release the following solicitations and agreements, which will account for all remaining funding (totaling $14.65 million) from fiscal year 2008-2009 and fiscal year 2009-2010:

- Medium- and heavy-duty vehicle Center of Excellence: $7 million
- Medium-duty propane school buses and other vehicles: $2 million
- Hydrogen fueling infrastructure for transit: $3 million
- Sustainability studies and certification programs: $2 million
- Technical analysis with the National Renewable Energy Laboratory: $1.2 million
- Spatial analysis for fuel/charging infrastructure establishment with the University of California, Irvine, Spatially and Temporally Resolved Energy and Environmental Tool model: $.25 million

Investment Plan Allocations

The allocations in the investment plan are based on possible alternative and renewable fuel increases and advanced vehicle technology deployment, petroleum displacement, potential greenhouse gas reductions, the level of current public and private funding, and feedback from stakeholders. These allocations provide funding for commercial demonstration and deployment in the short-, mid- and long-term to meet program goals. For example, funding is being provided for immediate establishment of electric drive infrastructure for electric vehicles ready to be deployed in 2010 to 2012—the near term. Funding for biofuel feedstock development and improved production methods will provide alternative vehicle fuels for the mid-term, and funding for hydrogen infrastructure will help to meet petroleum and greenhouse gas reduction goals for the long term as commercial volumes fuel cell vehicles are introduced in 2015. The funding allocations for fiscal year 2010-2011 are shown in Table ES-1 and are described below.

Battery Electric Drive

Estimates of cumulative sales of in-state plug-in electric vehicles expected by 2015 range from 125,000 to 450,000, with the most likely estimate between 250,000 and 275,000. To support the accelerated deployment of these vehicles, the Energy Commission is providing $3 million for charging infrastructure and related activities. These funds will be used to both expand and coordinate the state's growing network of public and private charging stations.

The Energy Commission will also provide $14 million in grants and loans for ongoing demonstrations of medium- and heavy-duty electric drive vehicles, including on-road and non-road applications. The Air Resources Board will provide incentives for commercialized medium- and heavy-duty vehicles. Similarly, the Air Resources Board has already announced its intent to provide incentives for commercialized light-duty electric drive vehicles.

Additionally, the Energy Commission is allocating $7.5 million for in-state electric drive manufacturing facilities. California is the home of numerous start-up electric vehicle manufacturers. This funding, properly leveraged with private capital, will allow them to address high initial capital costs, and expand into the broader commercial market.

Hydrogen Electric Drive

Hydrogen vehicles, including fuel cell vehicles, are expected to rapidly expand within the state over the next decade. Based on a recent Energy Commission and Air Resources Board survey of major automakers planning to produce fuel cell vehicles, the Energy Commission is planning for fuel cell vehicle deployments in the hundreds by 2012, in the thousands by mid-decade, and in the tens of thousands by the end of the decade. To support these vehicle deployments, the California Energy Commission will offer up to $13 million for hydrogen fueling infrastructure, following the results of its June 2010 hydrogen infrastructure solicitation. This funding will be tailored to automakers' anticipated vehicle rollout schedules, regional needs, and fueling capacity needs prior to the accelerated deployment of fuel cell vehicles in 2015.

As with electric drive vehicles, incentives for light-duty hydrogen vehicles will be available from the Air Resources Board. However, significant deployment of these vehicles is not anticipated before 2015, and they are likely to comprise a small percentage of the Air Resources Board's incentives before then.

Gasoline Substitutes

Gasoline substitutes offer a significant opportunity for reducing both greenhouse gas emissions and petroleum use. The state's Low Carbon Fuel Standard and *Bioenergy Action Plan*, as well as the federal Renewable Fuel Standard, will rely heavily on biofuels (including ethanol) in meeting their targets. Toward this end, the Energy Commission is providing $10 million to expand in-state production for gasoline substitutes. An additional $6.5 million will be provided to expand E-85 dispensers and retail outlets. Given the relatively modest marginal cost for the purchase of flex-fuel vehicles, the Energy Commission is not proposing vehicle funding for this fuel category.

Diesel Substitutes

Much like gasoline substitutes, diesel substitutes offer an immediate opportunity to significantly reduce California's greenhouse gas emissions and petroleum dependence. The same policy drivers that will accelerate gasoline substitutes will also accelerate diesel substitutes. To accelerate the in-state production of diesel substitutes, the Energy Commission will provide $5 million to expand and support California's diesel substitute production plants. The Energy Commission additionally allocates $4 million to support needed fuel terminal and distribution infrastructure for diesel substitutes. This funding will include modifications to existing rack-terminals, enabling them to dispense biomass-based diesel, and expansion of bulk terminal and storage facility capacity.

Natural Gas

In response to greenhouse gas emission reduction targets, volatile petroleum prices, and air quality standards, the Energy Commission expects natural gas to play a significant role in the state's transportation sector. A number of automakers, as part of their loans and grants from the American Recovery and Reinvestment Act, are expected to begin promoting light-duty natural gas vehicles. Additional opportunities remain for expanding the use of medium- and heavy-duty natural gas vehicles in ports and other applications. To capitalize on these opportunities, the Energy Commission is allocating $13 million for natural gas vehicle incentives for light-, medium- and heavy-duty vehicles.

A modest network of fueling infrastructure already exists for natural gas vehicles. However, many of these stations are in need of upgrade, and the funding for these upgrades is not available for certain operators (such as schools and local governments). The Energy Commission is therefore allocating $2 million to upgrade, refurbish or expand natural gas fueling stations for school districts and other public sector facilities.

The production and use of in-state biomethane will further advance state policy in the transportation sector. Biomethane, when produced from waste-based resources or byproducts, possesses one of the lowest carbon intensities of any existing fuel. For these reasons, the Energy Commission is allocating $7 million to promote in-state biomethane production for use in the transportation sector

Propane

Propane, like natural gas, offers the potential for immediately reducing greenhouse gas emissions, petroleum reductions, and fuel costs for light- and medium-duty vehicles. The prospect of renewably produced propane will further reduce greenhouse gas emissions from propane-fueled vehicles. Propane has been the preferred alternative fuel for rural communities and school districts that would not otherwise have access to an alternative fuel, as propane fueling infrastructure is readily available and affordable. The Energy Commission is allocating $3 million toward light- and medium-duty propane vehicle deployment.

Innovative Technologies and Advanced Fuels

In addition to the previous categories, the Energy Commission is interested in providing funding for other types of projects that can assist the state in meeting its greenhouse gas emission reduction and alternative fuel use goals. This could include, among other things, projects to improve engine efficiencies, develop high-productivity biomass feedstocks (such as algae), and lightweight vehicle materials for multiple vehicle platforms. To ensure adequate funding for these opportunities, the Energy Commission is reserving $3 million for this category. Additionally, the Energy Commission is reserving $5 million for cost-sharing opportunities for highly-leveraged federal solicitations.

Market and Program Development

To ensure the success of this program, the Energy Commission is also allocating funding for non-fuel categories. In support of workforce development and training, the Energy Commission is providing $1 million to expand workers' skills in clean fuels and vehicle technologies. In promoting the commercialization of alternative fuels, the Energy Commission is seeking to minimize any negative environmental impacts. To support this goal, the Energy Commission is providing $2.5 million for sustainability studies. An additional $2.5 million is allocated for marketing and program outreach, aimed at promoting awareness of the program and alternative fuels. Finally, the Energy Commission will provide $6 million for technical assistance and environmental, market, and technology analysis. Much of this funding will assist the program in focusing on funding priorities and identifying preferred opportunities for future funding. This category may also provide funding for full fuel cycle analysis, to assist small companies in developing and demonstrating the carbon intensity of their alternative and renewable fuels and technologies.

Table ES-1: Funding Allocation Summary for FY 2010-2011[2]

	Project/Activity	Funding Allocation for FY (2010–2011)
Battery Electric Drive	Develop and demonstrate advanced on-road and non-road medium and heavy-duty vehicles	$14 Million
	Infrastructure and related activities	$3 Million
	Manufacturing facilities and equipment	$7.5 Million
	Subtotal	**$24.5 Million**
Hydrogen Electric Drive	Fueling Infrastructure	$13 Million
	Subtotal	**$13 Million**
Gasoline Substitutes	Expansion of E-85 dispensers and retail outlets	$6.5 Million
	Gasoline substitutes production in existing, new and retrofit facilities	$10 Million
	Subtotal	**$16.5 Million**
Diesel Substitutes	Diesel substitutes production	$5 Million
	Bulk terminal storage and blending facilities	$4 Million
	Subtotal	**$9 Million**
Natural Gas	Light, medium, and heavy duty vehicles	$13 Million
	Upgrades to natural gas fueling stations	$2 Million
	Biomethane production plants and quality testing	$7 Million
	Subtotal	**$22 Million**
Propane	Light- and medium-duty vehicles	$3 Million
	Subtotal	**$3 Million**
Innovative Technologies and Advanced Fuels	Innovative technologies and advanced fuels	$3 Million
	Federal cost sharing	$5 Million
	Subtotal	**$8 Million**
Market and Program Development	Workforce Development and Training	$1 Million
	Sustainability studies	$2.5 Million
	Program marketing and public education and outreach	$2.5 Million
	Technical assistance and environmental/ market/ technology analyses	$6 Million
	Subtotal	**$12 Million**
	Grand Total	**$108 Million**

The Energy Commission will also fund up to 2 percent (or $2.16 million) of the total allocation for measurement, verification, and evaluation. This amount will be taken from each category on a prorated basis.

Source: California Energy Commission