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California Energy Commission

COMMISSION REPORT

2014-2015 Investment Plan Update for the Alternative and Renewable Fuel and Vehicle Technology Program

Edmund G. Brown Jr., Governor

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California Energy Commission

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ABSTRACT

The 2014-2015 Investment Plan Update for the Alternative and Renewable Fuel and Vehicle Technology Program guides the allocation of program funding for fiscal year 2014-2015. This 2014-2015 Investment Plan Update covers the sixth year of the program and reflects laws, executive orders, and policies to reduce greenhouse gas emissions, petroleum dependence, and criteria emissions.

It details how the California Energy Commission, with input from stakeholders and the program Advisory Committee, determines the program's goal-driven priorities, coupled with project opportunities for funding. These priorities are consistent with the program's overall goal "to develop and deploy innovative technologies that transform California's fuel and vehicle types to help attain the state's climate change policies."

This *2014-2015 Investment Plan Update* establishes funding allocations based on the identified needs and opportunities of a variety of alternative fuels and vehicle technologies. As an update, the *2014-2015 Investment Plan Update* relies on the narrative and analyses developed in previous investment plans, most recently the *2013-2014 Investment Plan Update.*

This commission report represents the final product in the development of the 2014-2015 Investment Plan Update. The Energy Commission held public Advisory Committee workshops at the Energy Commission on November 4, 2013, to collect feedback on the initial staff draft, and at the University of California, Irvine campus on February 10, 2014, to collect feedback on the revised staff draft. A lead commissioner report version was released on April 8, 2014, and the Energy Commission adopted this commission report at its Business Meeting on April 22, 2014.

Keywords: California Energy Commission, Alternative and Renewable Fuel and Vehicle Technology Program, AB 118, funding program, alternative transportation fuels, investment plan, electric vehicles, hydrogen, biofuels, biomethane, biodiesel, renewable diesel, diesel substitutes, renewable gasoline substitutes, ethanol, natural gas, propane, federal cost-sharing, workforce training, sustainability, fueling stations, fuel production

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EXECUTIVE SUMMARY

Since the middle of the last decade, California has established a series of aggressive goals for reducing its greenhouse gas emissions. Assembly Bill 32 (Núñez, Chapter 488, Statutes of 2006) established a goal of reducing greenhouse gas emissions to 1990 levels by 2020, and Executive Order S-3-05 established a goal of further reducing greenhouse gas emissions to 80 percent below 1990 levels by 2050. Nearly 40 percent of these emissions come from the transportation sector, and significant changes to the state's fuel and vehicle profiles will be needed. The Alternative and Renewable Fuel and Vehicle Technology Program, established by Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007) and administered by the California Energy Commission, is crucial in helping the state meet these and related policy goals.

Through this program, the Energy Commission provides up to $100 million per year toward the development and deployment of low-carbon alternative fuels, fueling infrastructure, and advanced vehicle technologies. While sizable, this $100 million in funding is less than what Californians spend on gasoline and diesel in a single day, and therefore, the Energy Commission must leverage public and private investments to maximize its positive impact. This program is one element in California's broad suite of policies, regulations, and investments intended to transform its transportation system to an alternative-fuel, low-carbon future. The Energy Commission invests in a portfolio of alternative fuels and vehicle technologies, recognizing that all fuels and technologies have unique risks and benefits and no single fuel or vehicle technology may be applicable for all purposes.

The Energy Commission prepares and adopts an annual investment plan update that identifies the funding needs and opportunities for the coming fiscal year. This investment plan update, covering fiscal year 2014-2015, is the sixth investment plan document. It builds on previous analyses and narratives from the preceding investment plans and provides updates based on recent developments. This commission report version of the investment plan update for fiscal year 2014-2015 establishes funding allocations for the upcoming fiscal year. The development of this document reflects input from two public Advisory Committee meetings and more than 40 docket comments.

To date, the Energy Commission has invested more than $415 million in program funding into more than 260 projects that support a variety of alternative and renewable fuels and vehicle technologies aimed at advancing innovation in this sector and sparking the needed transformation of the transportation fleet. The Energy Commission has also reviewed more than 600 proposals requesting nearly $1.6 billion in program funding in response to 23 solicitations. Demand for program funding has regularly exceeded available funding. For every $1 awarded through competitive solicitations, roughly $1.80 was requested by qualified projects. These experiences provide important feedback to the Energy Commission on the opportunities and challenges that face alternative fuels and vehicles, which help guide subsequent funding decisions.

Relevant policies and regulations also guide program funding decisions. In September 2013, the statutory extension of this program and related funding programs through January 1, 2024, demonstrated California's ongoing commitment to a low-carbon, clean air future.) A broad coalition of air districts, public health organizations, environmental organizations, alternative fuel and vehicle technology developers, vehicle manufacturers, conventional fuel associations, and other organizations supported Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013). The bill also reconfigured the state's approach to supporting hydrogen fueling stations by dedicating $20 million per year (not to exceed 20 percent) from this program until a network of at least 100 stations has been established, requiring the California Air Resources Board (ARB) and the Energy Commission to report jointly on progress toward achieving the necessary hydrogen fueling network, and requiring the ARB to assess the number of anticipated fuel cell electric vehicles each year. In addition to these statutory changes, the Governor's *Zero-Emission Vehicle Action Plan* identifies several critical strategies and actions needed to support the deployment of zero-emission vehicles. These commitments by the State of California will help provide automakers and hydrogen fuel suppliers with the confidence they need to move forward. The gradual ramp-up of carbon reductions required by the Low Carbon Fuel Standard also plays a significant role in supporting the funding decisions of this program.

Within this investment plan update, the Energy Commission provides funding for a portfolio of project types. Organized to reflect the supply chain of alternative fuels, the first category of funding in the investment plan is a $20 million allocation to support the in-state production of biofuels. These alternative fuels represent an immediate opportunity for reducing carbon emissions because they can already be used in more than 97 percent of California's existing vehicle stock. Furthermore, biofuels derived from waste-based feedstocks (which are emphasized by the program) offer some of the lowest carbon pathways currently available, with some potential pathways even resulting in net greenhouse gas elimination. The volume of biofuel production supported through this program can be immense, given previous projects expected to produce hundreds of thousands to millions of gallons of biofuel per year. This category has also been significantly oversubscribed with qualified projects in previous solicitations.

The next category of projects highlighted in the investment plan update focuses on the infrastructure needed to support the rollout of zero-emission and low-emission vehicles. Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) requires the Energy Commission to dedicate $20 million toward the installation of hydrogen fueling infrastructure to support the deployment of fuel cell electric vehicles. This funding, when combined with previous awards and remaining funding from previous years, may bring the total number of hydrogen stations funded by the program to more than 40 (depending on cost). This investment plan update also provides $15 million to support charging infrastructure for plug-in electric vehicles. This increase from previous years is warranted by the variety of charging types needed, the rapid increase in plug-in electric vehicles within the state, and the potential for emerging needs (including medium- and heavy-duty vehicle charging) arising in this category. Finally, the investment plan update reserves $1.5 million for natural gas fueling stations. While many

private fleets are able to incorporate natural gas fueling infrastructure into the overall costs of their transition to natural gas, some entities cannot. This $1.5 million allocation of funding is intended primarily for these entities, such as school districts and public transit districts. The Energy Commission may also consider ways to more selectively pair natural gas infrastructure funding with natural gas vehicle funding.

The third category of funding allocations in this investment plan update focuses on vehicles. The first allocation is $10 million to provide incentives for fleets to transition medium- and heavy-duty vehicles from diesel to natural gas. Natural gas trucks are gaining market attention because they have lower fuel costs, can reduce GHG emissions compared to diesel trucks by 15- 20 percent (or lower with the incorporation of renewable natural gas), and typically offer lower oxides of nitrogen oxide emissions compared to similar diesel alternatives. This allocation is somewhat reduced from previous years due to the Energy Commission's expectation that the per-vehicle incentive level can be reduced and more specifically targeted as the market matures. Additionally, when combined with funding from fiscal year 2013-2014, there will be roughly $22 million dedicated to accelerating the transition from higher polluting vehicles to cleaner- burning natural gas vehicles. Some fleet operators and truck purchasers can recoup the incremental cost difference in as little as two years, and private entities are in the midst of constructing a chain of natural gas fueling stations across the country. The investment plan update also includes a $15 million allocation for the demonstration of medium- and heavy-duty advanced technology vehicles, similar to previous years. Unlike most light-duty passenger vehicles, medium- and heavy-duty trucks serve a broad variety of purposes in the California economy and have a similarly broad variety of needs. Accordingly, this allocation provides opportunities for a wide variety of vehicle applications, fuel types, and vehicle technologies.

Deployment incentives for light-duty plug-in electric vehicles, as well as for medium- and heavy-duty hybrid and all-electric vehicles, are provided by the ARB through its Air Quality Improvement Program. As the number of these vehicles increases, so too does the demand for these incentives. The Legislature augmented funding for the Air Quality Improvement Program via a loan of $40 million from the Vehicle Inspection and Repair Fund. The Legislature also transferred a scheduled $24.55 million General Fund repayment to the Energy Commission's program to the Air Quality Improvement Program. In addition to this transfer, the Energy Commission has assisted in augmenting this shortfall by dedicating $19.5 million over the last four years through previous investment plans. At an October board meeting, the ARB allocated the majority of these additional funds toward light-duty electric vehicle incentives, with additional funds going to medium- and heavy-duty hybrid and electric vehicle incentives and a truck loan assistance program. In this investment plan, the Energy Commission reserves $5 million to support the continuation of some form of incentives for light-duty plug-in electric vehicles into fiscal year 2014-2015.

The Energy Commission also supports other project types that do not fall into the above fuel production, infrastructure, and vehicle categories. To hasten and smooth the transition to a lower-carbon future, the Energy Commission has traditionally reserved additional funding for

activities that provide more indirect support for these fuels and technologies. In this investment plan, the Energy Commission is dedicating $6 million to support an emerging opportunities category. This category originated with the intention to leave open the possibility of funding for valuable projects that do not fit into any funding allocation. In addition, this category may also be used to leverage federal cost-sharing by providing match costs for projects that are successful in federal solicitations. This investment plan will also reserve $5 million for manufacturing projects that can help translate the state's significant venture capital investments into more permanent economic growth. Finally, this category includes an allocation of $2.5 million to support workforce training and development grants with partner agencies. The training of vehicle manufacturing technicians, repair technicians, auto dealers, first responders, and others affected by the growth of alternative fuels and vehicles is intended to smooth the state's transition toward reducing GHG emissions from the transportation sector.

The final section of this investment plan update summarizes all of the funding allocations. This investment plan update for fiscal year 2014-2015 provides program funding allocations totaling $100 million, which were adopted by the full Energy Commission at its Business Meeting on April 22, 2014. However, program fee revenue deposited in the Alternative and Renewable Fuel and Vehicle Technology Fund continues to total less than $100 million annually. This ongoing revenue shortfall may necessitate a reduction of funding allocations in future investment plan updates. For example, current estimates suggest about $90 million may be available for fiscal year 2015-2016, which will be addressed in the next investment plan update.

CHAPTER 1: Introduction

Since the middle of the previous decade, California has set aggressive goals and policies for reducing the emission of greenhouse gases (GHGs) responsible for long-term climate change. The transportation sector is responsible for a significant portion of these emissions, totaling 38 percent of statewide GHG emissions as of 2011.[1] Assembly Bill 32 (Núñez, Chapter 488, Statutes of 2006), also known as the Global Warming Solutions Act of 2006, set a goal of reducing GHG emissions to 1990 levels by 2020. Executive Order S-6-06 also established a goal of reducing GHG emissions 80 percent below 1990 levels by 2020. To meet these targets, California will require a drastic transformation of its vehicle technologies and fuels.

California depends heavily on a single fuel type for its current transportation needs. Petroleum- based fuels represent more than 90 percent of California's transportation fuel use. This dependence comes with economic risks. In 2012, average gasoline prices in California reached a record high at $4.66 per gallon. Prices have declined since then but are still at long-term highs. Gasoline prices nearly doubled over the past 10 years (from roughly $2.00 per gallon in September 2003 to $3.80 in September 2013), due primarily to the price of crude oil tripling during that period.[2]

To support California's aggressive environmental goals and to help mitigate identified risks, the Legislature passed Assembly Bill 118 (Núñez, 750, Statutes of 2007). This statute created the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVT Program) and authorized the Energy Commission "to develop and deploy technology and alternative and renewable fuels in the marketplace, without adopting any one preferred fuel or technology."[3] The ARFVT Program has an annual program budget of about $100 million for projects that:

- Reduce California's use and dependence on petroleum transportation fuels and increase
- the use of alternative and renewable fuels and advanced vehicle technologies.
- Produce sustainable alternative and renewable low-carbon fuels in California.
- Expand alternative fueling infrastructure and fueling stations.

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[1] California Air Resources Board, *Climate Change Scoping Plan: First Update,* Discussion Draft, October 2013. Available at http://www.arb.ca.gov/cc/scopingplan/2013_update/discussion_draft.pdf.

[2] California Energy Commission, "*California Average Weekly Retail Gasoline Prices*," http://energyalmanac.ca.gov/gasoline/retail_gasoline_prices.html.

[3] California Health and Safety Code Section 44272.

- Improve the efficiency, performance, and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- Retrofit medium- and heavy-duty on-road and nonroad vehicle fleets to alternative technologies or fuel use.
- Expand the alternative fueling infrastructure available to existing fleets, public transit, and transportation corridors.
- Establish workforce training programs and conduct public outreach on the benefits of alternative transportation fuels and vehicle technologies.

The same statutes require the Energy Commission to prepare an annual investment plan to guide funding decisions for the coming fiscal year. The Energy Commission adopted three investment plans for four fiscal years (2008-2009 through 2011-2012). Assembly Bill 1314 (Wieckowski, Chapter 487, Statutes of 2011) subsequently reduced the scope of the annual investment plan to an update. Two of these updates, covering fiscal years (FYs) 2012-2013 and 2013-2014, were adopted in May 2012 and May 2013, respectively. This *2014-2015 Investment Plan Update for the Alternative and Renewable Fuel and Vehicle Technology Program (2014-2015 Investment Plan Update)* builds on the framework and analyses of previous investment plans.[4]

Chapter 2 of this report provides an update on programs, policies, and regulations that affect the allocations of this investment plan. The remainder of the report is divided into sections that reflect the various stages in the supply chain for alternative fuel vehicles and provides justifications for the funding allocations of this report. Chapter 3 focuses on the in-state production and supply of lower-carbon alternative fuels. Chapter 4 addresses the local distribution and infrastructure needs of these emerging fuel types. Chapter 5 focuses on the demonstration and deployment of alternative fuel and advanced technology vehicles. Chapter 6 discusses related activities and investments that can expedite the development and deployment of the fuels and technologies described in the preceding chapters. Chapter 7 summarizes the funding allocations in this investment plan.

This investment plan update for fiscal year 2014-2015 provides program funding allocations of $100 million. However, program fee revenue deposited in the Alternative and Renewable Fuel and Vehicle Technology Fund continues to total less than $100 million annually. This ongoing revenue shortfall may necessitate a reduction of funding allocations in future Investment Plan Updates. For example, current estimates suggest about $90 million may be available for fiscal year 2015-2016, which will be addressed in the next investment plan update.

Table 1 below summarizes California's major policy goals that pertain to the activities funded under this *Investment Plan Update*. Each of the fuel and technology funding activities under this investment plan update includes reference to the relevant goals identified in Table 1.

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[4] The previously adopted investment plan, the *2013-2014 Investment Plan Update*, is available for review at http://www.energy.ca.gov/2012-ALT-2/documents/.

Table 1: Climate, Fuel, and Air Quality Goals and Milestones

Policy Origin	Objectives	Goals and Milestones
Assembly Bill 32	GHG Reduction	Reduce GHG emissions to 1990 levels by 2020 and 80% below 1990 levels by 2050
Low Carbon Fuel Standard	GHG Reduction	10% reduction in carbon intensity of transportation fuels in California by 2020
State Alternative Fuels Plan	Petroleum Reduction	Reduce petroleum fuel use to 15% below 2003 levels by 2020
Bioenergy Action Plan	In-State Biofuels Production	Produce in California 20% of biofuels used in state by 2010, 40% by 2020, and 75% by 2050
Energy Policy Act of 2005; Energy Independence and Security Act of 2007	Renewable Fuel Standard	36 billion gallons of renewable fuel by 2022
Clean Air Act	Air Quality	80% reduction in nitrogen oxide by 2023
Executive Order B-16-2012	ZEV Mandate	Accommodate 1 million electric vehicles by 2020 and 1.5 million by 2025

Source: California Energy Commission

This final commission report for the *2014-2015 Investment Plan Update* benefits from public and Advisory Committee feedback following the release of two previous staff drafts and a lead commissioner report. The Energy Commission also receives, reviews, and incorporates input from stakeholders via a public docket and ongoing outreach.[5] State law requires the Energy Commission to submit a draft of the investment plan update to the Legislature concurrent with the Governor's budget in January and a final investment plan update concurrent with the Governor's revised budget in May.

[5] The Energy Commission encourages all comments on *the 2014-2015 Investment Plan Update* to be submitted to the Energy Commission's docket. To submit comments via e-mail, please include your name (or the name of your organization) in the name of an attached file. Additionally, in the subject line of your comments, please include the docket number "13-ALT-02" and indicate "2014-2015 Investment Plan." Comments should be sent as either a Microsoft Word document or a Portable Document File (PDF) to docket@energy.ca.gov

CHAPTER 2:
Context of the 2014-2015 Investment Plan Update

Although the ARFVT Program receives nearly $100 million per year, this funding alone is not nearly enough to independently achieve the state's ambitious goals for the transportation sector. (For comparison, Californians currently spend more than $50 billion per year on gasoline and diesel *fuels*, plus tens of billions more on gasoline- and diesel-fueled *vehicles*.) Fortunately, the ARFVT Program is one program in a suite of incentive funds, policies, and regulations intended to help the state reach its greenhouse gas and criteria air pollution reduction goals.

This chapter focuses on identifying these related activities and how they affect the funding allocations included in the investment plan. Alternative fuel producers, distributors, and vehicle manufacturers also invest heavily into alternative fuels and vehicle technologies; these investments are summarized in subsequent chapters.

This chapter also summarizes the funding activities of the ARFVT Program to date. The statutes governing the ARFVT Program call on the Energy Commission to "develop and deploy technology and alternative and renewable fuels in the marketplace, without adopting any one preferred fuel or technology." In response, the Energy Commission has pursued a portfolio- based funding strategy that supports numerous fuel and vehicle technologies that can help attain the state's vision for long-term GHG emission reductions. Funding decisions reflect a mixture of near-term opportunities for immediate GHG emission reductions, long-term needs for deeper GHG emission reductions, and projects that can bridge this gap.

Summary of Program Funding

Since the first investment plan was adopted, the ARFVT Program has invested more than $415 million into more than 260 projects related to alternative fuel production, infrastructure, vehicles, and related projects. These projects are summarized by fuel type and activity in Table 2 below. The majority of these projects are in progress: production facilities are still being sited and constructed, infrastructure is still being installed, and vehicles are still being demonstrated or deployed. However, many projects are nearing completion, and the first round of funded projects from FY 2008-2009 will require completion by June 2014 to meet grant term and funding liquidation deadlines. The details associated with each project type are discussed further in respective sections of the investment plan. Table 3 outlines the funding allocations of the two most recent investment plans, in comparison to the funding allocations for FY 2014- 2015.

Major highlights of the ARFVT Program's funding portfolio to date include:

- 7,798 electric vehicle charging points, including 3,882 residential charging points, 3,096 public and commercial charging points, 743 workplace charging points, and 77 direct current fast chargers.
- 10 plug-in electric vehicle (PEV) readiness planning grants to help regions plan for PEV deployment, new charging infrastructure, and permit streamlining. Six other planning grants have also been issued for multiple alternative fuels, and one has been issued specifically for hydrogen in the early deployment area for fuel cell electric vehicles.
- Nearly $20 million to fund nearly 9,000 incentives for battery electric vehicles and plug-in hybrid electric vehicles via the Air Resources Board's Clean Vehicle Rebate Project. An additional $24.5 million transferred from the ARFVT Program fund to the Air Quality Improvement Program fund will likely cover an additional 12,400 vehicle incentives.
- 21 new or upgraded hydrogen fueling stations to serve fuel cell vehicles, plus the development of retail fueling standards, protocols, and regulations to enable hydrogen sales on a per-kilogram basis.
- 35 projects to expand the production of low-carbon biofuels within the state capable of displacing tens of millions of gallons of gasoline and diesel per year. More than 20 of these projects will use primarily waste-based feedstocks to achieve carbon intensities lower than most electric vehicles. Preliminary estimates from the recipients suggest more than 36 million gallons per year of biofuel production capacity could directly result from these projects by 2017.
- More than 1,000 incentives for natural gas vehicles now in operation or pending, primarily medium- and heavy-duty trucks.
- 62 fueling stations for compressed and/or liquefied natural gas. At least four of these stations will dispense a mixture of conventional and renewable natural gas, which will significantly reduce carbon intensity.
- 30 projects to demonstrate advanced technologies in medium- and heavy-duty trucks, including electric, hybrid electric, fuel cell, and advanced natural gas engines.
- 18 manufacturing projects, primarily for electric drive-related batteries, components, and vehicles
- 39 workforce training agreements to translate California's substantial clean technology investments into economic development.

Table 2: Previous Awards and FY 2014-2015 Funding (Dollars in Millions) as of 3-27-2014

Category	Funded Activity	Cumulative Awards to Date*	Projects	FY 2014-2015
Alternative Fuel Production	Biomethane Production	$38.9	12	$20
	Gasoline Substitutes Production	$18.4	8	
	Diesel Substitutes Production	$34.1	13	
Alternative Fuel Infrastructure	Electric Vehicle Charging Infrastructure	$26.8	28	$15
	Hydrogen Fueling Infrastructure	$36.8	8	$20
	E85 Fueling Infrastructure	$16.5	4	-
	Upstream Biodiesel Infrastructure	$4.0	4	-
	Natural Gas Fueling Infrastructure	$17.5	48	$1.5
Alternative Fuel and Advanced Technology Vehicles	Natural Gas Vehicle Deployment**	$33.5	3	$10
	Propane Vehicle Deployment**	$7.3	1	-
	Light-Duty Electric Vehicle Deployment	$20.1	3	$5
	Medium- and Heavy-Duty Electric Vehicle Deployment	$4.0	1	-
	Medium- and Heavy-Duty Advanced Vehicle Technology Demonstration	$56.1	30	$15
	Emerging Opportunities	†	†	$6
	Manufacturing	$48.1	18	$5
	Workforce Training and Development	$24.3	39	$2.5

Related Needs and Opportunities	Fuel Standards and Equipment Certification	$4.0	1	-
	Sustainability Studies	$2.1	2	-
	Regional Alternative Fuel Readiness and Planning	$4.0	17	-
	Centers for Alternative Fuels	$3.7	3	-
	Technical Assistance and Program Evaluation	$15.6	26	-
Total		$415.8	269	$100

Source: California Energy Commission. *Includes all projects and agreements that have been executed or approved at an Energy Commission business meeting or are expected for business meeting approval following a Notice of Proposed Award. Does not include cancelled projects that received no funding from ARFVT Program; as a result, amounts may be lower than in previous drafts. **Includes both completed and pending incentives. † Previous awards from this category have been reclassified by project type into other rows.

Table 3: Most Recent and Current Investment Plan Allocations (in Millions)

Category	**Funded Activity**	**2012-2013***	**2013-2014**	**2014-2015**
Alternative Fuel Production	Biofuel Production and Supply	$18.0	$23	$20
Alternative Fuel Infrastructure	Electric Charging Infrastructure	$6.75	$7	$15
	Hydrogen Fueling Infrastructure	$9.9	$20	$20
	E85 Fueling Infrastructure	$1.35	-	-
	Natural Gas Fueling Infrastructure	$1.35	$1.5	$1.5
Alternative Fuel and Advanced Technology Vehicles	Natural Gas Vehicle Incentives	$10.8	$12	$10
	Propane Vehicle Incentives	$0.8	-	-
	Light-Duty Electric Vehicle Deployment	$12.5	$5	$5

	Medium- and Heavy-Duty Advanced Vehicle Technology Demonstration	$5.4	$15	$15
Related Needs and Opportunities	Emerging Opportunities	$2.5	$4	$6
	Manufacturing	$14.66	$5	$5
	Workforce Training and Development Agreements	$1.19	$2	$2.5
	Regional Alternative Fuel Readiness and Planning	$2.1	$3.5	-
	Centers for Alternative Fuels and Advanced Vehicle Technology	$2.7	$2	-
Total		$90	$100	$100

Source: California Energy Commission. * All funding allocations in FY 2012-2013 were evenly reduced due to insufficient program funds. Certain funding allocations for FY 2012-2013 were modified at a subsequent business meeting to reflect the listed amounts.

The Energy Commission includes a benefits assessment of the ARFVT Program as part of its biennial *Integrated Energy Policy Report* (*IEPR*). Chapter 8 of the *2013 Integrated Energy Policy Report* includes additional information on the direct and indirect benefits from the ARFVT Program's investments.[6] Additionally, the Energy Commission continues to review how ARFVT Program investments, results, and benefits can be assessed and communicated to stakeholders and how to more clearly articulate the application of all scoring criteria in program solicitations. This assessment includes consideration of how to further address benefit-cost assessments in solicitations (as required by Assembly Bill 8). As part of this effort, the Energy Commission will host a workshop in 2014 to seek input on how to best create a robust benefit-cost assessment.

Related Programs and Policies

Assembly Bill 8

In September 2013, the Legislature passed and Governor Brown signed Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013). Supporters included a broad coalition of air districts, public health organizations, environmental organizations, alternative fuel and vehicle technology developers, vehicle manufacturers, conventional fuel associations, and other organizations. This bill made several major statutory changes that are relevant to the ARFVT Program, including:

- Extending funding for the ARFVT Program and Air Quality Improvement Program through January 1, 2024.
- Requiring the California Air Resources Board (ARB) to survey fuel cell vehicle automakers annually and determine the projected number of fuel cell vehicle sales for the next three years and assess the state's hydrogen fueling infrastructure.
- Dedicating $20 million annually from the ARFVT Program for hydrogen fueling stations until at least 100 stations are publicly available, or until additional funding is no longer necessary.
- Preempting the Clean Fuels Outlet regulation from requiring regulated parties to install hydrogen fueling stations through January 1, 2024.
- Requiring the Energy Commission and ARB to consider "benefit-cost score" as a factor when selecting projects for funding.
- Extending funding for the Carl Moyer Memorial Air Quality Standards Attainment Program through January 1, 2024.[7]

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[6] California Energy Commission. 2013. 2013 Integrated Energy Policy Report. Publication Number: CEC-100-2013-001-LCD.

[7] The Carl Moyer Memorial Air Quality Standards Attainment Program is administered by local air districts and provides funding for cleaner-than-required engines and equipment. More information is available online at http://www.arb.ca.gov/msprog/moyer/moyer.htm.

In continuing to implement the ARFVT Program, the Energy Commission is incorporating the new responsibilities and mandates established by Assembly Bill 8.

Zero-Emission Vehicle Action Plan

On March 23, 2012, Governor Brown issued Executive Order B-16-12, which set a target of 1.5 million zero-emission vehicles on the road by 2025 and tasked various state agencies with specific actions needed to support this goal. The *ZEV Action Plan*, issued in February 2013, includes actions that apply directly to the funding categories of the ARFVT Program.[8] For instance, the *ZEV Action Plan* calls for developing infrastructure networks and community readiness plans for both plug-in electric vehicles and fuel cell electric vehicles, which have been priorities in the ARFVT Program. The *ZEV Action Plan* also highlights the importance of economic development that can result from growth of the ZEV sector, specifically calling on the need for public investment into workforce training and advanced technology manufacturing. Both of these have been captured in the ARFVT Program's annual investment plans since the program's inception.

In October 2013, the Governor's Office of Planning and Research followed up with the release of the *Zero-Emission Vehicles in California: Community Readiness Guidebook*. This guidebook helps local planning and permitting agencies familiarize themselves with ZEVs and support these vehicles in their communities. The guidebook includes an overview of ZEV technologies, specific suggestions for how these agencies can better prepare for ZEVs, as well as a collection of tools that can help streamline ZEV infrastructure permitting, prepare for increased electricity demand, and develop ZEV-friendly building codes.

Air Quality Improvement Program

The Air Quality Improvement Program (AQIP) was also established by Assembly Bill 118 (Núñez, 2007) and is administered by the ARB. The primary goal of the AQIP is to reduce criteria air pollutants and improve air quality. As part of implementing the AQIP, the ARB develops an annual funding plan that summarizes projects anticipated for funding in the next fiscal year.[9] Funding for AQIP is up to $40 million per year, though this amount is typically closer to $25 million to $30 million, based on actual fund revenues.

Two vehicle incentive projects account for the majority of funding provided through the AQIP. The Clean Vehicle Rebate Project provides a consumer incentive for the purchase

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[8] Governor's Interagency Working Group on Zero-Emission Vehicles, *2013 ZEV Action Plan: A Roadmap Toward 1.5 Million Zero-Emission Vehicles on California Roadways by 2025*, February 2013. Available at http://opr.ca.gov/docs/Governor's_Office_ZEV_Action_Plan_(02-13).pdf.

[9] The most recent funding plan for the AQIP, covering FY 2013-2014, is available at http://www.arb.ca.gov/msprog/aqip/fundplan/fundplan.htm.

of light-duty passenger vehicles, such as fully battery electric vehicles, plug-in hybrid electric vehicles, and fuel cell vehicles. As of March 2014, more than 54,000 incentives totaling $114.5 million had been issued, with about $6 million to $7 million in incentives being provided per month.

The AQIP also provides incentive funding for advanced technology trucks and buses through the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project. The Hybrid and Zero-Emission Truck and Bus Voucher Incentive Program provides an incentive for fleets that purchase hybrid and zero- emission trucks and buses and has approved vouchers for roughly 1,286 hybrid-electric vehicles and 380 all-electric vehicles. Some air districts also provide additional incentives to entice fleets to take advantage of the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Prgram funding. AQIP funding also goes toward supporting a truck loan assistance program. This program is intended to assist small business truck owners in their financing of cleaner trucks ahead of regulatory compliance schedules.

The Energy Commission's ARFVT Program and ARB's AQIP provide opportunities for complementary strategies. For example, the Energy Commission has historically funded electric vehicle charging infrastructure and hydrogen fueling infrastructure, while the ARB provides incentives for the vehicles that will use this infrastructure. While both agencies can fund vehicle technology development and demonstration projects as well as commercial deployment projects, the Energy Commission has focused a greater share of its funding on the former, while the ARB has focused its funding on the latter. As with previous investment plans, the Energy Commission will develop the *2014-2015 Investment Plan Update* in collaboration with the ARB as it prepares its own funding plan for FY 2014-2015.

Low Carbon Fuel Standard

Executive Order S-01-07 established the Low Carbon Fuel Standard in 2007, with a goal of reducing the carbon intensity of California's transportation fuels by 10 percent by 2020. The ARB adopted the Low Carbon Fuel Standard (LCFS) regulation in April 2009, and regulated parties began filing quarterly reports in 2010. Since then, regulated parties have been required to slowly reduce the carbon intensity of their transportation fuel.

Through 2013, for example, transportation fuels must reduce their carbon intensity by 1 percent. Carbon intensity is measured in grams of carbon dioxide-equivalent per megajoule of energy and accounts for the energy economy ratio of alternative fuel vehicles. By requiring regulated parties to meet certain requirements, the LCFS provides an economic incentive for them to invest in the expanded deployment of low-carbon alternative fuels.

In spring 2013, the UC Davis Institute of Transportation Studies released a review on the implementation of the LCFS. Based on available data, the review indicated several signs of progress in reducing the carbon intensity of transportation fuels. From 2011

through 2012, regulated parties produced an excess of credits in each quarter. Conventional corn ethanol still accounted for the majority of carbon credits, but lower-carbon ethanol, biodiesel (9 percent of credits), and compressed natural gas (12 percent of credits) also represented significant shares of the carbon credits generated. Electricity grew from near-zero share of LCFS credits to 2 percent by the end of 2012. The average trading price of LCFS credits grew from $10-$15 per metric ton carbon dioxide-equivalent to more than $30 in early 2013.[10]

Assembly Bill 32 Scoping Plan Update

In 2006, the Legislature enacted Assembly Bill 32, which required the ARB to adopt a statewide GHG emission limit for 2020 equivalent to the statewide GHG emission levels in 1990. Executive Order S-3-05 also set an objective of reducing emissions to 80 percent below 1990 levels, which is consistent with an Intergovernmental Panel on Climate Change analysis of the emissions trajectory that would stabilize atmospheric GHG concentrations at 450 parts per million carbon dioxide-equivalent and reduce the likelihood of catastrophic climate change. In 2008, the ARB adopted an initial *Scoping Plan* aimed at achieving the maximum feasible and cost-effective GHG reductions from applicable sources.

The first proposed update to the *Scoping Plan* was recently developed by ARB in collaboration with the Climate Action Team and reflects the input and expertise of a range of state and local government agencies.[11] The update will incorporate new information, define priorities for the next five years, and continue to lay the groundwork for longer-term GHG emission reduction goals. Within the transportation sector, the update identifies four key strategies that must be employed to achieve the long-term GHG emission reduction goals, including (1) improving vehicle efficiency and developing zero emission technologies, (2) reducing the carbon content of fuels and providing market support to get these lower-carbon fuels into the marketplace, (3) planning and building communities to reduce vehicular GHG emissions and provide more transportation options, and (4) improving the efficiency and throughput of existing transportation systems.

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[10] Yeh, Sonia, Julie Witcover, Jeff Kessler. *Status Review of California's Low Carbon Fuel Standard-Spring 2013 (Revised Version).* Institute of Transportation Studies, University of California, Davis 2013. Available at http://www.its.ucdavis.edu/?page_is=10063&pub_id=1861.

[11] California Air Resources Board, *Proposed First Update to the Climate Change Scoping Plan: Building on the Framework*, February 2014. Available at http://www.arb.ca.gov/cc/scopingplan/2013_update/draft_proposed_first_update.pdf.

CHAPTER 3:
Alternative Fuel Production and Supply

Biofuel Production and Supply

Biofuels, defined here to include gasoline substitutes, diesel substitutes, and biomethane, represent the largest existing stock of alternative fuel in California's transportation sector. Of the nearly 28 million vehicles on California's roads, roughly 97 percent rely on gasoline or diesel for all of their fuel. Low-carbon biofuels that can directly displace the roughly 14 billion gallons of gasoline and 3.3 billion gallons of diesel used per year in California represent both an immediate and long-term opportunity to reduce GHG emissions and petroleum dependence. One goal of the ARFVT Program is to help build the capacity of California companies to produce economically competitive biofuels from waste-based and renewable feedstocks.

Blended into all California reformulated gasoline at 10 percent, ethanol is the largest volume alternative fuel used in California. Roughly 1 billion gasoline-equivalent gallons of ethanol per year were reported through the LCFS in 2012, representing nearly 80 percent of the LCFS credits generated.[12] Despite this large demand, in-state ethanol producers account for just fewer than 150 million gallons per year, with a present capacity to produce up to 240 million gallons per year. The U.S. Environmental Protection Agency (EPA) issued a waiver in 2011 to allow up to 15 percent blending of ethanol in gasoline; however, California's blend limit remains at 10 percent. Higher blends of ethanol, including E85 (85 percent ethanol and 15 percent gasoline), can also be used by flex-fuel vehicles. There are around 500,000 flex-fuel vehicles in California that can use these higher blends, though most continue to use gasoline. The Energy Commission previously provided $16.5 million to establish a network of up to 205 E85 fueling stations, most of which are still in development.

Biodiesel, the most common diesel substitute, can similarly be blended with diesel. While there is no mandate for blending biodiesel as there is ethanol, biodiesel can be blended with conventional diesel up to 5 percent without special modifications, akin to the 10 percent ethanol blend in gasoline.[13] Blends of 20 percent are also common, though this depends on distinct retail infrastructure and vehicle warranty provisions. In

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[12] Yeh, Sonia, Julie Witcover, Jeff Kessler. *Status Review of California's Low Carbon Fuel Standard-Spring 2013 (Revised Version).* 2013.

[13] California Air Resources Board, *Proposed Regulation on the Commercialization of New Alternative Diesel Fuels*, October 23, 2013. Available at http://www.arb.ca.gov/regact/2013/adf2013/adf2013isor.pdf.

contrast with biodiesel, renewable diesel is fully fungible with conventional diesel, but it is at an earlier stage of commercialization and is not as broadly available. Current in-state biodiesel producers have a production capacity of roughly 50 million gallons per year and are producing at about half this capacity. Due to its low carbon intensity, just 45 million gallons of biodiesel accounted for 9 percent of all LCFS credits through 2012.[14]

Since most diesel substitutes are not fungible with conventional diesel, terminal blending racks are typically used to store bulk volumes of unblended fuels and dispense blended fuels for trucks to deliver to retail, fleets, and farm customers. For the most part, California terminal racks are not modified to accept diesel substitute fuels. The Energy Commission previously provided roughly $4 million toward four upstream biodiesel infrastructure projects. However, the LCFS regulation has encouraged the regulated fuel distributors to integrate larger shares of biodiesel into their upstream infrastructure. Several major oil terminals throughout the state have begun converting existing infrastructure to accommodate biodiesel blending. Given the private investment beginning to support large-scale biodiesel blending, the Energy Commission is not currently proposing additional funding for diesel substitutes infrastructure.

Biomethane represents another major opportunity for low-carbon biofuel production within California as a substitute for natural gas. According to the life-cycle analysis prepared for the LCFS, biomethane from landfill gas can reduce GHG emissions to 88 percent below diesel, while biomethane derived from high solids anaerobic digestion possesses negative carbon intensity roughly 115 percent below diesel.[15] While the number of natural gas engines is currently much smaller than the number of gasoline or diesel engines, this number is expected to increase as the comparative price of natural gas remains lower than gasoline or diesel. While this development may open up a larger number of prospective consumers for biomethane, it may also be more difficult for biomethane producers to compete in the market against a lower-priced fuel. In addition to the funding the Energy Commission provides, it is anticipated that the California Department of Resources Recycling and Recovery (CalRecycle) will administer $30 million in funding from cap-and-trade revenue in the Governors' proposed budget for biogas-to-energy projects.

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[14] Ibid.

[15] Carbon intensity of high solids anaerobic digestion based on staff paper. California Air Resources Board, *Proposed Low Carbon Fuel Standard Pathway for the Production of Biomethane from High Solids Anaerobic Digestion of Organic Wastes*, Staff Report, June 28, 2012. Available at http://www.arb.ca.gov/fuels/lcfs/2a2b/internal/hsad-rng-rpt-062812.pdf.

Table 4 summarizes the number of awards made for each of these fuel types through the ARFVT Program so far. As used in the table, "qualifying proposals" include those receiving at least a passing score. In addition to these qualifying proposals, many more proposals were also received in each solicitation.

Table 4: Summary of Biofuel Production Awards to Date

Fuel Type	Qualifying Proposals Submitted	Funds Requested by Qualifying Projects	Awards Made	Funds Awarded
Gasoline Substitutes	70	$217 million	8	$18.4 million
Diesel Substitutes			13	$34.1 million
Biomethane			12	$38.9 million
Total	70	$217 million	33	$91.4 million

Source: California Energy Commission.

The carbon intensities of the above-mentioned biofuels can vary significantly, depending on the feedstocks and conversion processes used in their production. Biofuels derived from waste-based feedstocks typically represent the lowest carbon intensities among all biofuels and often among all alternative fuels. From 2011 through 2012, ethanol and biodiesel derived from waste-based feedstocks accounted for less than 1 percent of alternative fuels in the LCFS system but contributed more than 10 percent of net LCFS credits. Maximizing these lowest-carbon options is particularly important due to the blending limits for ethanol and biodiesel. Low GHG emissions, as well as other sustainability considerations, have been a primary factor in determining ARFVT Program funding for biofuel production projects.

Table 5 shows some of the more common carbon intensities and pathways presented to the ARFVT Program for biofuel production funding. These are not all the biofuel production projects funded by the ARFVT Program, but only a sample. The maximum annual production capacity for these projects (most fewer than 5 million gallons) reflects the fact that most ARFVT Program funding to date has been focused on precommercial projects. Preliminary estimates from all recipients suggest more than 36 million gallons per year of biofuel production capacity could directly result from all the ARFVT Program-funded biofuel production projects, though actual production rates will vary. Furthermore, several awardees have indicated that they may pursue additional similar projects within the state, depending on results from the initial project.

Table 5: GHG Emission Pathways for Select ARFVT Program Biofuel Production Projects

Fuel Type	Pathway Description	Estimated GHG Emission Reduction[16]	# of Projects	Range of Annual Capacity for Individual Projects (Diesel or Gasoline Gallon Equivalent)
Biomethane	Food, green, yard, and mixed municipal waste	115%	4	50,000 – 660,000
Diesel Substitutes	Waste oils (various)	60-88%*	7	300,000 – 7,000,000
Gasoline Substitutes	Sweet sorghum	50%	1	Feasibility study
Gasoline Substitutes	Woodchips and switchgrass	67%	1	Feasibility study
Gasoline Substitutes	Sugar beets	80%	1	TBD

Source: California Energy Commission. *Several diesel substitutes production projects will use a mixture of waste-based oils and conventional vegetable oils (for example, canola or soy).

In its most recent solicitation for biofuel production projects, the Energy Commission focused on commercial-scale projects with the ability to produce a minimum of 15 million diesel- or gasoline-equivalent gallons per year. In November, the Energy Commission awarded $9.9 million (FY 2012-2013 funds) to two projects that are anticipated to expand their in-state biodiesel production capacity by a combined 12 million gallons per year. Based on anticipated feedstocks, the awarded projects expect to produce fuels with carbon intensities that are respectively 40 percent and 88 percent lower than conventional diesel.

Following this solicitation, the Energy Commission still has its original FY 2013-2014 allocation of $23 million remaining in this category. For FY 2014-2015, the Energy Commission allocates an additional $20 million into this category. Recent allocations and funding solicitations have combined all biofuels into one production category to fund the highest scoring projects regardless of fuel type. For this investment plan, the Energy Commission will retain the single allocation but may target funding to specific

[16] Compared to California diesel (98.03g CO2e/MJ) for biomethane and diesel substitutes, and California gasoline (99.18g CO2e/MJ) for ethanol. All GHG emission reductions will vary depending on the specific feedstock and production process used by each project. Based on a mix of established LCFS values and applicants' LCFS-derived estimates.

fuel types in developing future solicitations. The new funding for this category will likely be used in combination with any remaining FY 2013-2014 funds to issue a new solicitation that may include pilot- and demonstration-scale production facilities. The most recent solicitation in this area, issued in 2011, received more than $113 million in funding requests from proposals that received a passing score, indicating significant ongoing interest and quality of concepts. These proposals also offered significant GHG emission reductions relative to gasoline or diesel, based on the introduction of new, more sustainable feedstocks. The Energy Commission may also consider alternative funding mechanisms more suitable to large projects, such as a revolving loan guarantee fund.

Table 6: FY 2014-2015 Funding for Alternative Fuel Production and Supply

Biofuel Production and Supply *Relevant Policy Goals:* GHG Reduction Petroleum Reduction In-State Biofuels Production Low Carbon Fuel Standard	$20 million
Total	$20 million

Source: California Energy Commission.

CHAPTER 4:
Alternative Fuel Infrastructure

Electric Charging Infrastructure

A key part of accelerating market growth and acceptance of PEVs among consumers will be access to a convenient and reliable network of charging infrastructure. Particularly while battery size and costs continue to restrict the electric range of both battery electric vehicles and plug-in hybrid electric vehicles, PEV owners need charging infrastructure to maximize their miles driven using electricity, and prospective owners will want to see charging infrastructure available before investing in PEVs. Current generation PEVs have grown rapidly within the state, increasing from roughly 16,500 in December 2012 to roughly 43,700 in December 2013 to more than 65,000 in March 2014.[17] However, there are roughly 27 million light-duty vehicles on California's roads, indicating continued room for growth. Charging infrastructure is needed to keep up with this expanding number of vehicles.

To further accelerate the rollout of PEVs, the Energy Commission has provided $26.8 million in ARFVT Program funding for charging infrastructure. The funded projects have supported multiple types of charging infrastructure, as described in Table 7. Due in part to these investments, California possesses the largest network of nonresidential charging stations in the nation, totaling 5,713 out of 21,827 nationwide as of April 2014.[18] Table 7 also highlights the in-progress nature of these projects.

Table 7: Charging Points Funded by ARFVT Program

	Residential	Commercial	Workplace	DC Fast	Total
Installed	2,410	2,313	187	5	4,915
Planned	1,472	783	556	72	2,883
Total	3,882	3,096	743	77	7,798

Source: California Energy Commission.

[17] California Plug-in Electric Vehicle Collaborative, March 2014. http://www.pevcollaborative.org/sites/all/themes/pev/files/2_Feb_2014_Dashboard_PEV_Sales_140205.pdf.

[18] U.S. Department of Energy Vehicle Technologies Office, "Alternative Fueling Station Counts by State," http://www.afdc.energy.gov/fuels/stations_counts.html.

As depicted in Table 7, a majority of charging points funded by previous awards have gone toward residential charging infrastructure. Within this category, detached single-family houses represent all but 78 of the 3,882 funded installations. However, only half of all California homes are single-family houses, indicating that single-family homes have therefore been historically overrepresented in the ARFVT Program's charging infrastructure investments. Part of this may stem from the comparative complexity of providing charging infrastructure to residents of multifamily residences. In this situation, the owners or managers of the property may not have the same interests in installing charging infrastructure as their occupants. While a resident may be interested in receiving charging infrastructure for an existing (or prospective) PEV, the property owner or manager may not be able to recoup such an investment in the property.

Beyond residential charging, additional types of charging exist that may further inspire prospective buyers to invest in PEVs and encourage existing PEV owners to travel farther on electricity. Commercial charging, as identified in Table 7, includes stores, parking garages, universities, municipal governments, and other common destinations. Particular emphasis may be appropriate for destinations where a vehicle spends many hours parked, such as airports, hotels, and public transportation hubs. The need for further investment in this area is partially reflected in a survey of Clean Vehicle Rebate Project recipients conducted by the California Center for Sustainable Energy. In the survey, the number of respondents expressing satisfaction with the level of nonresidential public charging infrastructure rose from 17 percent to 23 percent between March and October 2012.[19] While indicative of progress, this relatively low percentage still shows significant room for growth of nonresidential charging infrastructure. PEV owners are also reporting early signs of congestion at popular charging locations, highlighting the need for investments in this area that can keep up with the growth in PEV ownership.

Workplace charging represents another priority in the ARFVT Program's portfolio of charging infrastructure. Where residents of multifamily dwellings are unable to charge at home, having a dedicated site to charge at work can serve as an alternative. If located far from home, workplace charging can also help a plug-in hybrid electric vehicles owner travel farther on electricity. In the same survey of Clean Vehicle Rebate Project recipients, 37 percent of respondents had access to workplace charging, and 82 percent of those could charge at no cost.[20] Workplace chargers can also serve as showrooms for potential customers to observe PEVs charging.

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[19] California Center for Sustainable Energy, *California Plug-in Electric Vehicle Driver Survey Results*, May 2013. Available at http://energycenter.org/programs/clean-vehicle-rebate-project/vehicle-owner-survey/may-2013-survey.

[20] Ibid.

Fast chargers, which can fully recharge a battery electric vehicle in 15 to 30 minutes (compared to several hours), will also play a key role in establishing a complete charging infrastructure network for PEVs, particularly battery electric vehicles. When located along major interregional corridors, these chargers can enable long-distance travel by battery electric vehicles. Furthermore, these chargers can provide a quicker alternative to charging at destinations or at home, if needed. Fast chargers can also serve the needs of drivers without access to charging at home, such as those living in multifamily housing. The number of these fast chargers is still comparatively small; only 5 have been installed via the ARFVT Program to date. However, 72 additional fast charger stations are expected from previous ARFVT Program funding, and at least 200 more fast chargers are expected to result from a settlement with NRG Energy, Inc. Some air districts and local utilities are also supporting the deployment of additional fast chargers within their territories.

So far, fast chargers funded by the ARFVT Program have prioritized urban areas. As these urban areas are increasingly saturated, the Energy Commission is beginning to look toward interregional corridors that will allow PEV drivers to travel smoothly between urban areas, while also serving any local PEV drivers. For example, Washington and Oregon have planned and installed fast chargers along Interstate 5 (and other nearby corridors) as part of the West Coast Electric Highway, with a goal of establishing a network of fast chargers that can enable PEV travel all along the West Coast.[21]The *ZEV Action Plan* tasks the Governor's Office with identifying a path to complete the California portion of this highway in a manner that also aligns with California's own state and regional plans for charging infrastructure. Energy Commission staff has met with the Governor's Office of Planning and Research to discuss strategies for completing this project and will continue to coordinate with the Office of Planning and Research to determine how ARFVT Program funding can best support the continued adoption of ZEVs in California.

In November 2013, the Energy Commission released a new solicitation for charging infrastructure that includes up to $6 million in funding available from FY 2012-2013, plus an opportunity for additional funds. The solicitation offers funding for a mixture of the above-mentioned charging types, including $4 million for destination, corridor, and publicly accessible workplace charging; $1 million for other workplace charging; and $1 million for multifamily homes. The $4 million for destination, corridor, and publicly available workplace charging will be awarded only through public agencies working to implement regional readiness plans developed for their area. Additional funding from FY 2013-2014 may be used to support this solicitation, as well as other more targeted needs for charging infrastructure. The ARFVT Program has also provided funding for

[21] West Coast Green Highway, "West Coast Electric Highway," http://www.westcoastgreenhighway.com/electrichighway.htm.

local regions to prepare for PEVs, as described later in the "Regional Alternative Fuel Readiness and Planning" section.

In the longer term, the *ZEV Action Plan* sets a goal of ZEV infrastructure that is able to support up to 1 million vehicles by 2020. While there is no single ratio for the number of chargers needed per PEV, the National Renewable Energy Laboratory is developing a *Statewide PEV Infrastructure Assessment* that can provide guidance on the recommended numbers and types of chargers that will help achieve the *ZEV Action Plan* goal. The Energy Commission anticipates a finalized version of the infrastructure assessment to be released in spring 2014. More targeted efforts may also be needed to support the introduction of electric drive technology into the medium- and heavy-duty truck and bus sector. Moreover, there may be future opportunities for the state to demonstrate the value of vehicle-to-grid technologies in expanding the business case for PEVs (pending) an anticipated report for the California Independent System Operator). In the interim, there is a visible need for additional charging infrastructure that can support both recent PEV sales and the broader marketability of PEVs in the future. For FY 2014-2015, the Energy Commission reserves $15 million in ARFVT Program funding to support the expansion of charging infrastructure. While a larger allocation than previous fiscal years, this increase reflects the rapid increase of PEVs within the state by more than 200 percent in the past year alone.

Table 8: FY 2014-2015 Funding for Electric Charging Infrastructure

Electric Charging Infrastructure	
Relevant Policy Goals:	
GHG Reduction	$15 million
Petroleum Reduction	
Low Carbon Fuel Standard	
Air Quality	
ZEV Mandate	

Source: California Energy Commission.

Hydrogen Fueling Infrastructure

Fuel cell electric vehicles (FCEVs) are expected to play a major role in reducing GHG and air pollution emissions from the state's transportation sector. In addition to having no tailpipe emissions, FCEVs will reduce lifecycle GHG emissions per mile by roughly 50-70 percent compared to gasoline, which is comparable to PEVs.[22] FCEVs also offer a driving range (200 to 300 miles) and refueling time similar to consumers' experiences of conventional internal combustion engine vehicles. Based on initial automaker surveys and the California Road Map document developed by the California Fuel Cell Partnership, automakers anticipate an initial network of 68 stations could support the deployment of 20,000 FCEVs through 2017.[23]Establishing a network of accessible, reliable hydrogen fueling stations will be critical to the successful introduction of fuel cell vehicles. However, given the high upfront cost of hydrogen fueling infrastructure and the comparatively small station throughput while the number of FCEVs is still growing, public funding for these stations is needed until the number of FCEVs can sustain station growth and operations.

The Energy Commission has already taken aggressive steps toward establishing this early network of stations. A total of $36.8 million from previous investment plans will fund the development of 21 new or upgraded hydrogen fueling stations in Southern and Northern California. Most of these stations are located at retail gasoline stations in Southern and Northern California to maintain a more traditional fueling experience for customers. The Energy Commission is partnering with the South Coast Air Quality Management District by transferring $6.7 million to fund 3 station upgrades in the South Coast Air Basin. These upgrades will convert 3 older hydrogen fueling stations in high-value locations to modern engineering and performance standards. The Energy Commission is also providing funding to AC Transit in the San Francisco Bay Area to construct a new hydrogen fueling station that will serve transit vehicles. Finally, the Energy Commission is providing $4 million to the California Department of

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[22] Based on a range of potential fuel pathways for electricity and hydrogen established by the LCFS, as well as a requirement that one-third of hydrogen for FCEVs comes from renewable resources. This includes energy economy ratios of 3.4 and 2.5 for PEVs and FCEVs respectively, as well as ranges of carbon intensities including 104.7-124.1 gram of carbon dioxide equivalents per megajoule of energy for electricity and 76.1-110.2 grams of carbon dioxide equivalents per megajoule of energy for hydrogen with one-third renewable content. Sources: ARB's LCFS carbon intensity look-up tables (available at http://www.arb.ca.gov/fuels/lcfs/lu_table_11282012.pdf) and LCFS Final Regulation Order (available at http://www.arb.ca.gov/fuels/lcfs/CleanFinalRegOrder112612.pdf).

[23] California Fuel Cell Partnership, *A California Road Map: The Commercialization of Hydrogen Fuel Cell Vehicles*, June 2012. Available at http://cafcp.org/sites/files/A%20California%20Road%Map%20June%202012%20(CaFCP%20technical%20version)_1.pdf. The ARB is also surveying automakers on their production and rollout plans for FCEVs.

Measurement Standards to develop retail fueling standards, protocols, and regulations that will allow hydrogen to be sold on a retail per-kilogram basis.

In addition to the above funding, the Energy Commission released a $29.9 million solicitation for hydrogen fueling stations in November 2013 with funds from FYs 2012-2013 and 2013-2014. This solicitation increased capital funding to up to 85 percent of total project cost, or $2.1 million, if rapid construction goals are met by station developers. It also includes funding for a broader range of project types, including station operations and maintenance support, mobile hydrogen refuelers, 100 percent renewable hydrogen stations, and new station locations. To help early hydrogen station providers cover their costs during the initial deployment of FCEVs, the solicitation offers up to $300,000 to cover the operations and maintenance costs for existing, planned, and newly proposed hydrogen fueling stations. To encourage early station completion, applicants are eligible for a higher cost share depending on the operational date of their station. The number of new stations expected from this solicitation will depend on the number of applications received; however, the Energy Commission estimates 12-15 additional fueling stations. Table 9 summarizes ARFVT Program investments in hydrogen fueling stations to date, as well as anticipated investments through FY 2014-2015.

Table 9: ARFVT Program Investments in Hydrogen Fueling Stations

Solicitation/Agreement	Amount	# of Stations	Cumulative Stations	Expected Operation
PON-09-608	$15.1 million	8 new, 2 upgraded	10	Sept 2014
Agreement with AC Transit	$3 million	1 (transit only)	11	May 2014
PON-12-606	$12 million	7	18	Oct 2014
Agreement with South Coast	$6.7 million	3 upgraded	21	Dec 2015
PON-13-607	$29.9 million	12-15 (estimate) plus operations and management costs	33-36	Oct 2015
Future	$20 million (FY 2014-2015)	10 (estimate)	43-46	TBD

Source: California Energy Commission.

In September, the Legislature passed and Governor Brown signed Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013), which makes several modifications to the state's support for hydrogen fueling infrastructure. First, the legislation directs the Energy Commission to provide $20 million (or up to 20 percent of appropriated funding) per fiscal year through the ARFVT Program to fund hydrogen fueling stations

until 100 public stations are in operation, or until the Energy Commission and ARB determine that this annual amount is not needed. This dedicated funding for hydrogen fueling infrastructure is intended to demonstrate the state's resolve in supporting the deployment of FCEVs and thereby inspire further confidence in automakers and early adopters that stations will be available to meet the needs of their FCEVs.

The statute also directs the ARB to aggregate and publish the number of FCEVs expected over the next three years through a confidential survey to automakers planning to sell fuel cell electric vehicles in California. Based on this number, the ARB evaluates and communicates the need for additional public hydrogen fueling stations to the Energy Commission. Beginning in 2015, the ARB and Energy Commission will prepare a joint assessment report to ensure that the pace of station development is commensurate with the deployment and sales of fuel cell electric vehicles.

In accordance with Assembly Bill 8, the Energy Commission reserves $20 million for expanding California's network of hydrogen fueling stations in FY 2014-2015. Based on previous experience and the draft concepts document, this amount is anticipated to support around 10 additional fueling stations.

Table 10: FY 2014-2015 Funding for Hydrogen Fueling Infrastructure

Hydrogen Fueling Infrastructure	
Relevant Policy Goals:	
GHG Reduction	$20 million
Petroleum Reduction	
Low Carbon Fuel Standard	
Air Quality	
ZEV Mandate	

Source: California Energy Commission.

Natural Gas Fueling Infrastructure

The vast majority of natural gas vehicles depend on an expanding network of natural gas fueling stations, including a mixture of public and private stations capable of dispensing compressed natural gas and, in some cases, liquefied natural gas. The technology for these stations is fully commercialized and relies on the existing network of natural gas pipelines throughout the state. According to the U.S. DOE's Alternative Fuel Data Center, there are about 145 public compressed natural gas stations, 2 public liquefied natural gas stations, and 8 liquefied natural gas/compressed natural gas

stations in California.[24] Fleets with natural gas vehicles may opt for their own private access-only stations, and these are more difficult to quantify.

Particularly in the case of private stations for individual fleets, the costs of installing a natural gas fueling station can be built into the long-term savings associated with switching to natural gas vehicles. As a result, several organizations have encouraged the Energy Commission to focus its ARFVT Program funding on natural gas vehicle incentives, rather than natural gas fueling infrastructure. In recent investment plans, this focus has been the case, with funding allocations for natural gas vehicles significantly higher than funding allocations for fueling infrastructure.

However, certain entities (especially public agencies and school districts) may not have access to the necessary capital to afford such long-term investments on their own. Since the beginning of the ARFVT Program, the Energy Commission has provided a total of $17.5 million in ARFVT Program funding for 62 natural gas fueling stations. In the most recent solicitation for proposals, applicants were permitted to request up to $300,000 for stations dispensing compressed natural gas and $600,000 for stations dispensing liquefied natural gas (due to the higher costs of such stations). Of the 18 successful applicants, 6 were school districts, 5 were municipalities, and 4 were municipal solid waste entities, two were fuel vendors, and one was a local utility. Roughly half of these applicants received funding to upgrade or expand their existing natural gas stations, indicating a need for funds to refurbish natural gas stations that may have been installed many years earlier. However, this interest will need to be balanced against the state's interest in expanding the number of new stations as well.

For FY 2014-2015, the Energy Commission allocates $1.5 million in ARFVT Program funding to support continued expansion of natural gas fueling infrastructure. This funding may be prioritized toward school districts and other public entities; however, the Energy Commission is also open to considering other needs, as identified. In developing funding mechanisms for natural gas vehicle deployment, the Energy Commission may also consider integrating this infrastructure funding with vehicle funding as part of a larger solicitation in the future.

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[24] California Natural Gas Vehicle Coalition, *2013 Natural Gas Fueling Station Directory*, 2013. Available at http://www.cngvc.org/pdf/CNGVC_fuel_station_directory_2013.pdf.

Table 11: FY 2014-2015 Funding for Natural Gas Fueling Infrastructure

Natural Gas Fueling Infrastructure *Relevant Policy Goals:* Petroleum Reduction Air Quality Low Carbon Fuel Standard GHG Reduction (with incorporation of biomethane)	$1.5 million

Source: California Energy Commission.

Table 12: Summary of FY 2014-2015 Funding for Alternative Fuel Infrastructure

Electric Charging Infrastructure	$15 million
Hydrogen Fueling Infrastructure	$20 million
Natural Gas Fueling Infrastructure	$1.5 million
Total	**$36.5 million**

Source: California Energy Commission.

CHAPTER 5:
Alternative Fuel and Advanced Technology Vehicles

Natural Gas Vehicles

As a result of increasing domestic supplies of natural gas, the low cost of natural gas as a transportation fuel attracted the attention of many vehicle suppliers and consumers. Current retail prices for compressed natural gas generally range from $2-$2.50 per gasoline gallon equivalent within California and may be lower for private fleets, which represent up to a 50 percent savings over diesel fuel. The incremental upfront costs for natural gas engines vary significantly by engine size and supplier but typically are in the tens of thousands of dollars. As a result, natural gas engines are most economical in vehicle applications where fuel costs constitute a higher share of overall vehicle costs, such as heavy-duty trucks that travel tens of thousands of miles per year. In such cases, the payback period for investing in a natural gas engine can be two years or less. Once the incremental cost difference is paid off, the truck owner can benefit from significant savings in fuel costs over the useful life of the truck and engine.

The GHG emissions from compressed natural gas and liquefied natural gas trucks are roughly 15-25 percent and 10-20 percent below diesel trucks, respectively. However, these emissions can be significantly reduced with the introduction of biomethane, which possesses the lowest carbon intensity values established by the LCFS. Compressed natural gas from landfill gas and dairy digester biogas offers lifecycle GHG emission reductions of 85-90 percent compared to diesel, while biomethane derived from high solids anaerobic digestion can reduce lifecycle GHG emissions by upwards of 115 percent. As a result, natural gas trucks can reach GHG emissions equivalent to an electric truck by using 40 to 60 percent biogas content, or a fuel cell truck by using 25 to 40 percent biogas content.[25] Biomethane and natural gas were responsible for roughly 12 percent of LCFS credits from 2011 to 2012.[26]

In addition to these cost savings, some fleets may consider natural gas trucks as a means of compliance with air quality requirements. The ARB is investigating an optional reduced nitrogen oxide emission standard for heavy-duty vehicles, which could

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[25] Assuming 39 grams of carbon dioxide equivalents per megajoule of energy for electric trucks and 52 grams of carbon dioxide equivalents per megajoule of energy for fuel cell trucks, after accounting for their higher energy economy ratios.

[26] Yeh, Sonia, Julie Witcover, Jeff Kessler. *Status Review of California's Low Carbon Fuel Standard-Spring 2013 (Revised Version).* 2013.

encourage engine manufacturers to demonstrate their emission reductions. Such standards might include nitrogen oxide levels that are 50, 75, and 90 percent lower than the current 0.20 grams per brake horsepower-hour emission standard.[27] According to the Initial Statement of Reasons for the voluntary standard, there are 23 Model Year 2012 engine families that meet the 50 percent reduction (as of October 2013). Of these, 11 utilize natural gas, and only 3 utilize diesel fuel. Within the Statement, ARB staff anticipates that heavy-duty natural gas engines may also be the primary initial technology for meeting the more aggressive 75 and 90 percent nitrogen oxide reduction targets.[28] Depending on the ability of natural gas engine manufacturers to demonstrate such reductions, this could further support the market deployment of heavy-duty natural gas trucks.

Roughly 13,500 Class 3-8 trucks registered with the California Department of Motor Vehicles use compressed natural gas or liquefied natural gas, along with nearly 19,700 light-duty vehicles. With funding from previous fiscal years, the Energy Commission has provided funding for two large natural gas truck deployment projects, plus a buydown incentive that provided incentives for natural gas and propane vehicles. Within the buydown incentive, the level of incentive has depended on the expected fuel displacement, GHG benefits, and estimated incremental cost associated with the weight class of the vehicle. The number of vehicles and funding amounts associated with these projects are summarized in Table 13.

On January 27, 2014, the ARFVT Program released the latest solicitation to provide incentives to fleets and other consumers for new on-road natural gas vehicles that will directly benefit California's economy by expanding the use of domestically produced nonpetroleum fuels that are lower-cost alternatives to gasoline and diesel and have lower carbon emission characteristics. The level of incentive depends on the expected fuel displacement and GHG benefits mostly estimated by the weight class for each vehicle. The level of incentive is also intended to reflect the incentive needed to induce the purchase of an alternative fuel vehicle, as well as the upfront capital cost in comparison to a desired "payback period," which represents the length of time until the fuel and maintenance savings are sufficient to overcome the higher upfront cost.

The Energy Commission has also provided measured support for propane vehicles as a means of reducing petroleum dependence and improving air quality in regions that may have limited access to alternative fuels. However, some stakeholders have raised concerns that the propane incentive process has even inhibited the deployment of the vehicles. The lack of an approved GHG emission reduction number for propane vehicles

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[27] For more information on these potential voluntary standards, please visit http://www.arb.ca.gov/msprog/onroad/optionnox/optionnox.htm.

[28] Air Resources Board, "Staff Report: Initial Statement of Reasons for Proposed Rulemaking," October 23, 2013. Available at http://www.arb.ca.gov/regact/2013/hdghg2013/hdghg2013isor.pdf.

in the LCFS, in combination with varying estimates from other sources, has also raised uncertainty about the actual GHG emissions of these vehicles. A limited supply of certified engines and aftermarket conversions has also slowed progress of propane vehicles in California (though this may change following recent amendments to the ARB's alternative fuel conversion certification procedures). For these reasons, the Energy Commission discontinued funding for propane vehicle incentives in the *2013-2014 Investment Plan Update*.

Table 13: Natural Gas and Propane Vehicle Deployment Funding

Recipient (Agreement #)	**Number of Vehicles**	**Funding**
San Bernardino Associated Governments (ARV-09-001)	202 Heavy-Duty Natural Gas Trucks	$9.31 million
South Coast Air Quality Management District (ARV-09-002)	120 Heavy-Duty Natural Gas Drayage Trucks	$5.14 million
Various (Natural Gas Vehicle Buydown Incentive)	1,053 Natural Gas Vehicles (claimed and/or pending)	$19.01 million
Various (Propane Vehicle Buydown Incentive)	599 Propane Vehicles (claimed and/or pending)	$7.32 million
Total	1,974 Vehicles	$40.78 million

Source: California Energy Commission.

The Energy Commission is identifying the desired funding mechanisms for previous funding allocations for natural gas vehicles, including $12 million from FY 2013-2014. These funding mechanisms may include revisiting vehicle-type eligibilities, per-vehicle incentive levels, an end-user voucher incentive, and/or a proposal-based solicitation (rather than a reservation-based incentive) for natural gas vehicle incentives. Over time, the Energy Commission expects to reduce the incentive level for natural gas trucks as prospective owners become more familiar with the overall cost savings of the vehicles and suppliers are able to reduce their prices in response to higher volume. Moreover, there may be some vehicle types and applications where an incentive is no longer needed to encourage the purchase of a natural gas alternative. For the coming fiscal year, the Energy Commission is allocating $10 million toward natural gas vehicle incentives.

Table 14: FY 2014-2015 Funding for Natural Gas Vehicles

Natural Gas Vehicle Deployment *Relevant Policy Goals:* Petroleum Reduction Air Quality Low Carbon Fuel Standard GHG Reduction (with incorporation of biomethane)	$10 million

Source: California Energy Commission.

Medium- and Heavy-Duty Advanced Technology Vehicles

Demonstration

To ensure long-term emission reductions from the transportation sector, a special emphasis must be placed on the medium- and heavy-duty sector. These vehicles represent a disproportionate share of GHG emissions within the transportation sector. Furthermore, new standards for lowering nitrogen oxide emissions to reduce ozone formation in severe nonattainment air basins in California will require the rapid transition of medium- and heavy-duty vehicles to advanced technologies. Mandatory regional criteria pollutant reduction targets will be established under State Implementation Plans by 2016 and will target reductions to 90 percent below 2010 levels.

Making this more challenging, the qualities of the alternative fuel and technology must be matched to the needs of the particular vehicle application. Providing funding for a variety of fuel type and vehicle application combinations is, therefore, a key part of the Energy Commission's strategy for this sector.

With funding from previous fiscal years, the Energy Commission has provided more than $56 million toward 30 medium- and heavy-duty truck demonstration projects. These projects have spanned multiple fuel types, including electric, hydrogen, natural gas, and E85, as well as multiple vehicle types, including bucket trucks, long-haul trucks, drayage trucks, transit buses, and shuttles.

From a block grant solicitation in 2011, four block grant administrators were selected to administer a total of 14 demonstration projects. This set of awards, totaling $22.6 million, used funding from FYs 2010-2011, 2011-2012, and 2012-2013. More recently, the Energy Commission released a Notice of Proposed Awards focused on retrofitting used medium-duty trucks (between 10,001- and 26,000-pounds gross vehicle weight rating) with all-electric drive technology. This funding would demonstrate the feasibility

of retrofitting trucks for electricity as a cost-effective way to increase market penetration of ZEV truck technologies. Three awardees were selected from among five applicants to receive a total of $4.8 million in ARFVT Program funding. Two projects will demonstrate the repowering of Class 5 walk-in delivery vans; the third project will demonstrate the repowering and potential vehicle-to-grid integration of an all-electric Class 6 school bus.

The Energy Commission has also funded medium- and heavy-duty demonstration projects through direct agreements with other public agencies. For example, through the Emerging Opportunities investment plan category, the Energy Commission is providing $3 million toward the South Coast Air Quality Management District's demonstration of a catenary lines system. This system is intended to allow cargo trucks along the busy Interstate 710 corridor to use overhead lines to travel the corridor on electricity and then transition to conventional fuel once the overhead lines end. This busy corridor, though just 24 miles long, sees more than 40,000 truck trips per day. The Energy Commission, through both the ARFVT Program and Public Interest Energy Research Natural Gas program, is also partnering with South Coast Air Quality Management District to support development and demonstration of natural gas engines with nitrogen oxide emission levels that are 90 percent lower than 2010 engine emission certification standards.

Table 15: Medium- and Heavy-Duty Advanced Technology Vehicle Demonstration Projects

Fuel or Technology Type	Number of Projects	ARFVT Program Funding
Battery Electric Buses	3	$5.07 million
Fuel Cell Buses	1	$2.54 million
Battery Electric Trucks	11	$20.14 million
Plug-in Hybrid Electric Trucks	4	$8.92 million
Fuel Cell and Battery Trucks*	2	$1.60 million
Hybrid Trucks	4	$6.74 million
Advanced Natural Gas Trucks	4	$8.34 million
E85 Hybrid Trucks	1	$2.71 million
Total	30	$56.06 million

Source: California Energy Commission. *These projects were proposed for awards in February 2014 as a result of a federal cost-sharing solicitation.

Table 15 summarizes the vehicle types and technologies being demonstrated through the ARFVT Program. While many previously funded demonstration projects are still in progress, several have already begun to prove their commercial viability. Electric Vehicles International, for example, has successfully demonstrated four Class 5 extended-range electric bucket trucks with PG&E. In addition to offering 45 miles of all-electric driving range, the vehicles can provide electricity to outage areas during repairs. PG&E operates a fleet of nearly 1,000 Class 5 vehicles and is looking into replacing all of them with similar electric hybrid models. The Energy Commission has also funded a series of Class 8 drayage trucks that can move shipping containers from the Ports of Los Angeles and Long Beach to warehouses and distribution centers in the north and east parts of the Los Angeles region. Transpower has produced a battery electric truck, while Volvo and Artisan are developing plug-in hybrid drayage tractors. The South Coast AQMD has identified alternative technology, low- and zero-emission drayage vehicles, as a priority investment area.

In previous years, the ARB's *AQIP Funding Plan* has also set aside funding for demonstration projects in coordination with the Energy Commission. However, recent demand for deployment project funding and the Truck Loan Assistance Program has prompted the ARB to redirect funding away from this area. At a September 2013 board meeting, the ARB decided to redirect $3 million in FY 2013-2014 funding from demonstration projects toward other categories. As a result, the need for the Energy Commission's own investments into demonstration projects is likely to continue.

To date, most awards from the ARFVT Program in this category have focused on vehicle propulsion technologies. While this is still likely to represent the majority of future awards, the Energy Commission may also consider funding supporting technologies, such as vehicle-to-grid demonstration projects, en-route charging demonstration projects, and vehicle application technologies. In each of these cases, the primary goal will remain the acceleration of medium- and heavy-duty vehicle technologies, whether by improving the technical capabilities of the technology or by improving the business case of the technology.

For FY 2014-2015, the Energy Commission includes $15 million to continue support for this category. This funding will likely go toward a future funding solicitation, in combination with remaining funds from FY 2013-2014 (roughly $9.9 million). The previous solicitation for projects included $22.6 million in requested funding from passing applications. Given an increasing level of interest from both suppliers and consumers of these technologies, a similar solicitation in the future is likely to include a similar or higher request for funding from worthy proposals.

Table 16: FY 2014-2015 Funding for Medium- and Heavy-Duty Advanced Technology Vehicle Demonstration

Medium- and Heavy-Duty Advanced Vehicle Technology Demonstration *Relevant Policy Goals:* GHG Reduction Petroleum Reduction Low Carbon Fuel Standard Air Quality	$15 million

Source: California Energy Commission.

Deployment

Several models of advanced technology trucks have moved beyond the precommercial demonstration phase and are now being sold to early fleet adopters. For example, medium–duty, electric-drive package delivery trucks developed by Electric Vehicles International and Boulder Electric Vehicles through initial ARFVT Program grants are now available for commercial orders. These vehicles have a higher incremental upfront cost compared to conventional vehicles, typically several tens of thousands of dollars. However, they also offer lower fuel and maintenance costs over time. To further reduce upfront cost barriers, the ARB's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project provides funding to reduce the higher incremental costs associated with these advanced technologies. Several local air districts also provide an additional incentive for vouchers within their territory.

To date, the ARB has approved more than $47 million in vouchers for more than 1,600 trucks through the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project. Roughly two-thirds of these vehicles have been hybrid trucks, with the remainder being battery electric vehicles. As mentioned, advanced technologies will need to be matched with truck applications that reflect their advantages. Beverage delivery, parcel delivery, and food distribution trucks make up the primary applications. Class 4-6 trucks make up roughly 65 percent of all vouchers, while Class 8 trucks represent roughly one-third. The Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project is expected to play an important role in transitioning both large and small fleets toward advanced technologies, including a planned 100 electric truck deployment project with Electric Vehicles International and UPS. The Energy Commission anticipates the ARB's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project to continue these or similar incentives in the future and, therefore, does not propose funding for deployment projects via the ARFVT Program. Additional funding for Hybrid and Zero-Emission Truck

and Bus Voucher Incentive Project may also come from cap-and-trade revenue identified in the Governor's initial FY 2014-2015 draft budget.

Light-Duty Electric Vehicles

From 2003 to 2010, no major automakers were offering PEVs. Over the past four years, however, the models and sales of PEVs have grown dramatically. There are at least 14 current generation PEVs for sale by major automakers, and national sales surpassed 160,000 toward the end of 2013. The number of PEV sales in any given quarter has been more than twice that of the same quarter in the previous year. (For example, sales in the second quarter of 2013 were 23,634, while sales in the second quarter of 2012 were 10,291.)[29]

This growth is also apparent within California, where the ARB provides a rebate to encourage the deployment of PEVs. The California Center for Sustainable Energy, which administers the Clean Vehicle Rebate Project, reports that more than 54,000 rebates totaling roughly $114 million have been issued for PEVs from April 2010 through March 2014.[30] So, while California accounts for just 12 percent of the U.S. population, it also accounts for nearly 33 percent of all PEVs. In 2012 and 2013, PEVs represented roughly 2 percent of all in- state car sales.[31] FCEV sales are also expected to grow in 2014 and 2015 as several automakers have announced their anticipated market launches.

However, there is still much more room for growth in electric vehicle sales. There are roughly 27 million light-duty vehicles on California's roads, and recent annual sales range from 1 million to 1.5 million. In recognizing this volume, the ARB's long-term goal for the Clean Vehicle Rebate Project is to prime the market for the much larger number of PEVs and FCEVs needed to meet the goals of the California's ZEV mandate. Furthermore, Governor Brown's Executive Order B-16-2012 calls for 1.5 million ZEVs on California's roads by 2025 to help meet air quality standards and climate change goals. In October 2013, a coalition of eight states (including California) jointly announced their support for PEVs, as well as their shared intent to adopt measures that encourage PEV ownership.

Clean Vehicle Rebate Project rebates currently average about 3,000 per month, or 36,000 per year. The current rebate amount for battery electric vehicles and FCEVs is $2,500, while the rebate for plug-in hybrid electric vehicles is $1,500. With a roughly equal split between battery electric vehicle and plug-in hybrid electric vehicle rebates

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[29] U.S. DOE, Vehicle Technologies Office, "Electric Vehicle and Plug-in Hybrid Electric Vehicle Sales History," http://www1.eere.energy.gov/vehiclesandfuels/facts/2013_fotw796.html.

[30] California Center for Sustainable Energy, "Clean Vehicle Rebate Project Statistics," http://energycenter.org/programs/clean-vehicle-rebate-project/cvrp-project-statistics.

[31] Tom Turrentine, Presentation at UC Davis NextSTEPS Fall 2013 Symposium. December 10, 2013.

each month, the Clean Vehicle Rebate Project provides roughly $6 million of incentives per month. If extended over a full fiscal year, this amount would significantly exceed the ARB's annual available funds through the AQIP. This amount could also increase as market interest for battery electric vehicles and plug-in hybrid electric vehicles expands, and as FCEVs begin commercialization. For these reasons, the ARB has begun investigating modifications to the Clean Vehicle Rebate Project, whether through additional funding or by modifying the AQIP rebate programs. Additional funding is potentially available from cap-and-trade revenue identified in the Governor's initial FY 2014-2015 draft budget.

The Energy Commission strongly supports the Clean Vehicle Rebate Project's goal of getting more PEVs deployed within California and has provided a combined $19.5 million in previous investment plans to sustain the availability of the Clean Vehicle Rebate Project rebate. These transfers represent a mix of initial investment plan allocations and subsequent reallocations and are summarized in Table 17.

Table 17: ARFVT Program Funding for Clean Vehicle Rebate Project

Fiscal Year	Amount	Cumulative Total
2009-2010 (Reallocations)	$2 million	$2 million
2012-2013	$4.5 million	$6.5 million
2012-2013 (Reallocations)	$8 million	$14.5 million
2013-2014	$5 million	$19.5 million
General Fund Repayment Transfer	$24.55 million	$44.05 million

Source: California Energy Commission.

In September 2013, the Legislature also approved the transfer of $24.55 million from the ARFVT Program fund to the AQIP fund, as well as a total of $20 million (as a loan) from the Vehicle Inspection and Repair Fund specifically to the Clean Vehicle Rebate Project.[32] Based on these transfers, as well as previous allocations in the ARB's *2013-2014 Funding Plan*, there has been about $59.5 million available in Clean Vehicle Rebate Project incentives for FY 2013-2014. In this investment plan, the Energy Commission reserves an additional $5 million to help sustain the Clean Vehicle Rebate Project in FY 2014-2015.

[32] Assembly Bill 101 (Committee on Budget, Chapter 354, Statutes of 2013). Senate Bill 359 (Corbett, Chapter 415, Statutes of 2013).

Table 18: FY 2014-2015 Funding for Light-Duty Electric Vehicle Deployment

Light-Duty Electric Vehicle Deployment *Relevant Policy Goals:* GHG Reduction Petroleum Reduction Low Carbon Fuel Standard Air Quality ZEV Mandate	$5 million

Source: California Energy Commission.

Table 19: Summary of FY 2014-2015 Funding for Alternative Fuel and Advanced Technology Vehicles

Natural Gas Vehicle Deployment	$10 million
Medium- and Heavy-Duty Advanced Vehicle Technology Demonstration	$15 million
Light-Duty Electric Vehicle Deployment	$5 million
Total	**$30 million**

Source: California Energy Commission.

CHAPTER 6:
Related Needs and Opportunities

The preceding chapters have focused specifically on the fuel production, infrastructure, and vehicle changes that will be needed to transition California toward cleaner transportation. However, this transition cannot be complete without investment in related needs, such as workforce training and development and regional planning. Without an adequate workforce to service alternative fuel vehicles and related equipment, the transition costs will be higher. If local permitting and planning entities are not prepared for the introduction of new vehicle types, the transition will be slower and more disorderly.

Similarly, by narrowly focusing on increasing the quantity of fuel production, infrastructure, and vehicles, California may miss the economic development opportunities associated with these changes. In particular, the ARFVT Program can help support the in-state manufacturing of vehicles and components to support PEVs and other alternative fuel technologies. Program funding can also help local entities access federal funding, which can provide significant match funding for in-state projects.

Using ARFVT Program funds from previous years, funding was also provided for other support activities, such as fuel standards development, sustainability studies, program evaluation, and other technical analyses. Several of these projects are still underway. Until additional needs are identified, the Energy Commission does not propose further funding from investment plans into these areas.

Emerging Opportunities

Previous allocations in this investment plan targeted known areas of need for alternative fuels and advanced vehicle technologies. However, not all innovative projects will necessarily fit into these allocations. The Emerging Opportunities funding allocation was established in previous investment plans to allow for greater flexibility regarding project types and funding timelines by establishing a reserve fund that could be used by the Commission to cofund the "state match" portion of projects receiving federal awards, or to fund projects using technologies that do not readily fit current investment plan categories.

To date, the Energy Commission has approved program funding for three projects totaling $9 million through this funding category. In May 2012, the Energy Commission approved $5 million in cost-share funding for the Joint Center for Artificial Photosynthesis, an energy innovation hub sponsored by the U.S. DOE. This project will receive up to $122 million in federal funds (subject to Congressional appropriations) to identify and develop a method to produce alternative fuels directly from sunlight using a process similar to natural photosynthesis.

The Energy Commission also approved a $1 million agreement with Lawrence Berkeley National Laboratory to demonstrate an all-electric fleet of vehicles at the Los Angeles Air Force Base. These vehicles will also serve to evaluate the potential for similar vehicles to generate revenue by participating in the California Independent System Operator's ancillary services markets. This is an early step by the U.S. Air Force toward implementing a larger Department of Defense plan that would support large-scale integration of PEVs. As a result, similar opportunities to demonstrate vehicle-to-grid benefits may arise with the Department of Defense in the future.

This category has also been open to project types that do not necessarily fit into any other established funding category. For example, the ARFVT Program is working with South Coast Air Quality Management District to retrofit existing heavy-duty electric trucks with overhead wiring that will allow them to operate via electric rail. If successful, this project could lead to a broader demonstration of electric trucks using overhead lines along major transportation corridors.

Table 20: Executed and Planned Agreements for Emerging Opportunities

Primary Partners	**Description**	**ARFVT Program Funding**	**Outside Funding**
California Institute of Technology; U.S. DOE	Develop methods to generate fuels directly from sunlight. (Part of U.S. DOE's Energy Innovation Hub program.)	$5 million	Up to $122 million
Lawrence Berkeley National Laboratory; U.S. Department of Defense	Demonstrate the viability of an all-electric, nontactical vehicle fleet. Explore the possibility of the vehicles participating in the California Independent System Operator's ancillary services markets.	$1 million	$2.75 million
South Coast Air Quality Management District	Demonstrate the use of hybrid electric trucks with the ability to use an overhead electric line for charging and as a range extender.	$3 million	TBD

Source: California Energy Commission.

Using $2.2 million in this category from preceding investment plans, the Energy Commission released a new solicitation to support California-based projects seeking federal cost sharing. Federal solicitations are offered throughout each year and in a variety of subjects related to the goals of the ARFVT Program.

In March 2014, the Energy Commission released a Notice of Proposed Award for the grant solicitation PON-13-604, relating to federal cost-sharing for emerging technologies. Table 21 identifies the three projects selected for funding. As anticipated, this solicitation produced awards with an extremely high ratio of outside match funding

to ARFVT Program funding. The Center for Transportation and the Environment will receive $1.1 million to demonstrate 17 fuel cell battery electric delivery vans for the United Parcel Service. The vans will use electric drivetrains from Electric Vehicles International and fuel cell stacks from Hydrogenics to test and demonstrate the viability of such vehicles in delivery applications. CALSTART will administer a $495,000 award to demonstrate a battery dominant fuel cell bus at the Sunline Transit District. Finally, the University of California, Davis, will receive $605,000 to support its National Center for Sustainable Transportation, which will assess the critical barriers faced by alternative fuels and technologies, develop market surveys to support alternative fuel vehicle commercialization, evaluate and recommend intelligent transportation technologies that can reduce emissions, and disseminate the results of this work to all applicable stakeholders.

Table 21: Proposed Awards for Federal Cost-Share for Emerging Technologies Solicitation

Recipient	**Description of Project**	**ARFVT Program Funding**	**Outside Match Funding**
Center for Transportation and the Environment	Fuel Cell Hybrid Electric Walk-In Van Deployment Project	$1.1 Million	$3.4 Million
CALSTART, Inc.	Battery Dominant Fuel Cell Hybrid Bus	$0.5 Million	$7.6 Million
The Regents of the University of California, Davis Campus	National Center for Sustainable Transportation-Emerging Technologies Project	$0.6 Million	$5.6 Million
	Total	$2.2 Million	$16.7 Million

Source: California Energy Commission.

Based on the level of interest already expressed for this category, and in anticipation of further interest identified from the current solicitation, the Energy Commission reserves $6 million in funding for this category in FY 2014-2015. The receipt and review of applications for the recent solicitation will further help guide the proper funding allocation for this category for future fiscal years.

Table 22: FY 2014-2015 Funding for Emerging Opportunities

Emerging Opportunities *Relevant Policy Goals:* - GHG Reduction	$6 million

Source: California Energy Commission.

Manufacturing

California's advanced technology manufacturing companies have had tremendous success in raising capital for precommercial and early commercialization activities. In 2012 alone, venture capital invested just under $1 billion into clean transportation technology projects. More than $500 million was additionally invested into energy storage technology, which is of particular significance for PEVs and FCEVs. California entities filed more than 230 patents for battery technologies between 2010 and 2011, more than three times the next state. California trailed second only to Michigan in the number of patents for hybrid systems and electric vehicle technologies during these years. While the number of jobs in the general California economy fell by about 1 percent from 2001 to 2011, the number of "clean economy" jobs grew by 8 percent.

Within this clean economy total, the segment of jobs classified as "clean transportation" has grown faster than all other segments (more than 200 percent over the past 10 years). The plurality of these clean transportation jobs is in manufacturing, with supplying, services, and R&D jobs making up most of the remainder.[33]

To help further translate private investment into job growth, the Energy Commission has invested nearly $50 million to date into 18 in-state manufacturing projects that support the goals of the ARFVT Program. These projects have focused primarily on the manufacturing and assembly of new electric vehicles, electric retrofit kits, electric drive systems, and battery modules. While all awardees to date have focused on electric drive technologies, the most recent solicitations in this category have been fuel- and technology-neutral. Funded projects in this category typically require a minimum of 50 percent in nonstate match funding; however, some awardees have provided more than 80 percent match. Table 23 below summarizes the projects by hardware type, including their match funding.

[33] Next10, *2013 California Green Innovation Index*, March 2013. Available at http://www.greeninnovationindex.org/.

Table 23: Summary of Manufacturing Projects

Hardware Type	Number of Projects	ARFVT Program Funding	Match Funding
Battery systems	4	$13.1 million	$16.6 million
Charging equipment*	2	$1.9 million	$2.3 million
Electric cars*	2	$10.2 million	$50.2 million
Electric motorcycles	2	$2.7 million	$2.2 million
Electric powertrains and platforms	2	$3.0 million	$0.6 million**
Electric trucks	6	$17.2 million	$38.3 million
Total	18	$48.1 million	$110.2 million

Source: California Energy Commission. * Includes one canceled project; funding amount is limited to invoices that were paid before the project was canceled. ** Includes one project where match has yet to be finalized.

In August 2013, the U.S. Department of Energy announced that it would resume its Advanced Technology Vehicle Manufacturing loan program, which had been dormant since 2011. The AVTM is able to provide significantly more funding than the ARFVT Program, often hundreds of millions of dollars per applicant. The more modest levels of funding available from the ARFVT Program are typically better suited for projects that are in early stages of production. For this reason, the Energy Commission may also consider opportunities for precommercial product and working capital needs. Alternatively, the Energy Commission may consider tying this funding category to funding from the Medium- and Heavy-Duty Advanced Vehicle Technology category in future solicitations.

The *2013-2014 Investment Plan Update* included $5 million for this category, which has not yet been assigned to a solicitation. This amount was a reduction from previous years, due to a recent solicitation that included $28 million for the highest scoring proposals. This reduced amount was intended to allow for new potential projects to emerge before the Energy Commission's next solicitation in this area. For FY 2014-2015, the Energy Commission maintains this allocation of $5 million for similar reasons.

Table 24: FY 2014-2015 Funding for Manufacturing

Manufacturing *Relevant Policy Goals:* GHG Reduction ZEV Mandate	$5 million

Source: California Energy Commission.

Workforce Training and Development

Workforce training and development are vital to the Energy Commission's efforts to advance California's clean transportation market. Skilled workers are needed to address the alternative fuels and advanced vehicle technology market in California. The Energy Commission's workforce efforts also align with the Governor's *ZEV Action Plan* that recognizes the need for state agencies to continue providing workforce training funds for employer-driven needs, as well as job training programs through community colleges and local workforce investment boards.

The Energy Commission has three interagency agreements with California's workforce training agencies, including the Employment Development Department at $7.25 million, the California Community Colleges Chancellor's Office at $5.5 million, and the Employment Training Panel at $11.5 million. These interagency agreements are structured to fund alternative fuel and low-emission vehicle-specific training as a portion of the partner agency's broader workforce projects. The Employment Training Panel agreement delivers contract incumbent workforce training, while the Employment Development Department and California Community Colleges Chancellor's Office agreements provide workforce training development and support activities, including regional industry cluster support, planning grants, needs assessments for related industries and community college alternative fuel programs, curriculum development, and train-the-trainer support (including equipment purchases).

To date, these agreements have provided $24.25 million in training funds for more than 12,470 individuals and more than 135 businesses and municipalities, as shown in Table 25.

Table 25: Workforce Training Funding

Partner Agency	Funded Training (in Millions) *	Match Contributions (in Millions)	Trainees	Businesses Assisted	Municipalities Assisted
Employment Training Panel	$11.50	$10.3	11,473	88+	14+
Employment Development Department	$7.25	$7.5	999	36+	-
Total	$18.75	$17.8	12,472	124+	14+

Source: California Energy Commission. An additional $5.5 million agreement with California Community Colleges Chancellor's Office is expected to provide training to an unspecified number of trainees in the future. *Fund totals indicate completed training along with current and future contracts with estimated trainee participants.

Examples of workforce funding include the following:

- American River Community College, Long Beach Community College, and Solano Community College were each awarded $700,000 from a workforce solicitation with California Community Colleges Chancellor's Office and Employment Development Department for "train-the-trainer" programs, curriculum development, and equipment purchases. These programs serve multiple communities and private businesses.
- Kern Community College, El Camino Community College, and Riverside Community College have approved funding of $2,095,000 to train more than 4,700 first responders in safety training for alternative fuels and vehicle technologies.
- United Parcel Service has been approved to receive $23,000 to train more than 160 technicians and support staff for compressed natural gas, liquefied natural gas, hybrid, and other electric vehicles.
- John L. Sullivan Chevrolet of Roseville has received $138,000 in technical and educational training for staff to understand and explain alternative fuels and vehicle technology through the life-cycle process from purchase through service. The training is under review for use as a model for other California vehicle dealers.
- The California Manufacturers and Technology Association has been approved to receive $558,000 for upgrading the skills of more than 300 workers at alternative and renewable fuel companies. In particular, these jobs focus on workers involved in ethanol production, clean technology products, electric vehicles production, and battery development.
- The California Labor Federation was approved for $999,460 to develop a training program for three regional public transit agencies, which will train nearly 1,300 workers in green vehicles and equipment.
- Tesla Motors is approved to receive $756,000 for training 350 employees in a curriculum that spans the spectrum of PEV production. Training per worker ranges from 24 to 200 hours, based on topic and degree of technicality.

The Energy Commission will continue to expand workforce training opportunities for alternative fuels and advanced vehicle technologies with input from its partners in workforce delivery and private sector professionals in future workshops. In particular, the Energy Commission seeks information on avenues for providing applicable workforce training to military veterans and career pathways for high school students.

The Energy Commission will continue to work with partner agencies to determine how ARFVT Program funding can be implemented to maximize workforce and training needs. Additional opportunities may also arise with community colleges that are particularly interested in developing their own workforce training programs. The Energy Commission will reserve $2.5 million for workforce training and development projects for FY 2014-2015.

Table 26: FY 2014-2015 Funding for Workforce Training and Development

Workforce Training and Development *Relevant Policy Goals:* GHG Reduction ZEV Mandate	$2.5 million

Source: California Energy Commission.

Regional Alternative Fuel Readiness and Planning

Building on their early planning experience with large-scale charging infrastructure projects that were funded under the American Recovery and Reinvestment Act (with match funding from the ARFVT Program), several local regions within California expressed their interest in consolidating and expanding on this planning effort.

Following a solicitation in 2011, the ARFVT Program has developed 10 agreements totaling $2 million with local regions that will support PEV readiness and planning. These agreements, for roughly $200,000 each, include a mix of local planning entities, air districts, government associations, and nongovernmental organizations. These 10 regions cover nearly 40 of California's counties, including all major metropolitan areas. Goals for these readiness and planning regions include helping develop strategic plans for local charging infrastructure, establishing "best practices" for PEV-ready building and public work guidelines, and streamlining the processes of charging infrastructure permitting, installation, and inspection. Moreover, the California PEV Collaborative received a $1 million award from the U.S. Department of Energy to develop a statewide, multiregional approach for planning and implementation of charging infrastructure. The Energy Commission continues to coordinate the 10 local plans, as well as participate in the development of the broader statewide plan. Finalized versions

of the statewide plan as well as regional plans for the largest four metro areas, are expected to be completed in spring 2014.

The *2012-2013 Investment Plan Update* provided $2.7 million, later reduced to $2.1 million, for regional readiness and planning for multiple alternative transportation fuels. The Energy Commission released a solicitation in August 2013, with proposals continuously accepted through April 30, 2014, or until funds in the solicitation are exhausted. Awards up to $300,000 will be made on a first-come, first-served basis, provided that an applicant meets all the solicitation requirements and screening criteria. As of March 12, 2014, seven projects totaling roughly $2 million have been proposed for award from this solicitation. Of these seven, five focus on multiple fuel types, one focuses on PEVs, and one focuses on early adopter communities for FCEVs.

In the *2013-2014 Investment Plan Update*, the Energy Commission allocated $3.5 million to expand and build on the initial set of PEV regional readiness agreements. Local regions seek this funding to support the implementation of regional plans, coordination of dozens of permitting offices within each region to streamline charging infrastructure installations, local education on PEV issues and opportunities, development of informational resources, and other logical next steps. The FY 2013-2014 funding for this category should be sufficient to cover PEV regional readiness and planning needs through FY 2014-2015. Thus, the Energy Commission is not proposing additional funding at this time but will continue to review needs in this area in the development of future investment plans.

Centers for Alternative Fuels and Advanced Vehicle Technologies

The two previous investment plans established a funding allocation to support new and existing centers focused on alternative fuels and advanced vehicle technologies. Centers can provide several unique benefits, such as:

- Providing a neutral site for companies' collaboration.
- Hosting advanced technology demonstrations for potential investors or customers.
- Centralizing the attention of fleet managers that may be interested in alternative fuels.
- Serving as an independent clearinghouse for fuel and technology information.
- Providing a training site for potential customers.
- Integrating workforce training with technology development.

Using a combined $4.7 million from the two previous investment plans, the Energy Commission released a solicitation for proposals in August 2013 and released proposed awards in February 2014. The solicitation offered up to $1.56 million for each center and required proposals to include a plan for recruiting relevant partners, including manufacturers of alternative fuel vehicles or fueling systems, transit districts, school districts, colleges, and any other entities. Proposals also needed to document expected regional benefits through 2020, including demonstrating and deploying alternative fuels

and vehicles, increasing public awareness of alternative fuels and vehicles, and increasing training opportunities.

The two proposed awardees are identified in Table 27. A project at University of California, Berkeley, will provide education, training, demonstration, and full-scale deployment of alternative fuels and advanced technology vehicles, with both physical and online presence. A project with the Economic Development Corporation of Los Angeles County will create an alternative fuel and advanced technology vehicle center that will conduct public outreach activities, facilitate regional coordination on workforce development and planning, and promote collaboration among private companies, researchers, and public agencies interested in alternative fuels.

Table 27: Proposed Awards for Centers for Alternative Fuels and Advanced Vehicle Technology Solicitation

Recipient	**Title of Project**	**ARFVT Program Funding**	**Outside Match Funding**
The Regents of the University of California, Berkeley Campus	Northern California Center for Alternative Transportation Fuels and Advanced Vehicle Technologies	$1.56 Million	$1.56 Million
Economic Development Corporation of Los Angeles County	California Alternative Fuel and Advanced Vehicle Technology Center	$1.56 Million	$1.59 Million
	Total	$3.12 Million	$3.15 Million

Source: California Energy Commission.

This was the first solicitation to support centers that the ARFVT Program has funded. Until more details and results emerge from the projects funded under this solicitation, the Energy Commission does not plan on providing additional funding for this category in the investment plan.

Table 28: Summary of FY 2014-2015 Funding for Related Needs and Opportunities

Emerging Opportunities *Relevant Policy Goals:* - GHG Reduction	$6 million
Manufacturing *Relevant Policy Goals:* GHG Reduction ZEV Mandate	$5 million
Workforce Training and Development *Relevant Policy Goals:* - GHG Reduction	$2.5 million
Total	$13.5 million

Source: California Energy Commission.

CHAPTER 7:
Funding Allocations

Funding allocations for FY 2014-2015 are summarized in Table 29. As part of this commission report, these allocations were adopted by the Energy Commission at a Business Meeting on April 22, 2014. For specific details on each allocation, please see the relevant section of the preceding chapters.

Table 29: Summary of Funding Allocations for FY 2014-2015

Category	Funded Activity	Funding Allocation
Alternative Fuel Production	Biofuel Production and Supply	$20 million
Alternative Fuel Infrastructure	Electric Charging Infrastructure	$15 million
	Hydrogen Fueling Infrastructure	$20 million
	Natural Gas Fueling Infrastructure	$1.5 million
Alternative Fuel and Advanced Technology Vehicles	Natural Gas Vehicle Incentives	$10 million
	Light-Duty Electric Vehicle Deployment	$5 million
	Medium- and Heavy-Duty Advanced Vehicle Technology Demonstration	$15 million
Related Needs and Opportunities	Emerging Opportunities	$6 million
	Manufacturing	$5 million
	Workforce Training and Development	$2.5 million
	Total Available	$100 million

Source: California Energy Commission.

GLOSSARY

AIR QUALITY IMPROVEMENT PROGRAM (AQIP)—The Air Quality Improvement Program provides mobile source incentives to reduce greenhouse gas, criteria pollutant, and toxic air contaminant emissions though the deployment of advanced technology and clean transportation in the light-duty and heavy-duty sectors. The AQIP was established by the California Alternative and Renewable Fuel, Vehicle Technology, Clean Air, and Carbon Reduction Act of 2007 (Assembly 118, Statutes of 2007, Chapter 750).[34]

CALIFORNIA AIR RESOURCES BOARD (ARB)—The "clean air agency" in the government of California whose main goals include attaining and maintaining healthy air quality, protecting the public from exposure to toxic air contaminants, and providing innovative approaches for complying with air pollution rules and regulations.

ALTERNATIVE AND RENEWABLE FUEL AND VEHICLE TECHNOOGY PROGRAM (ARFVT)—Now known as the Clean Transportation Program, created by Assembly Bill 118 (Nunez, Chapter 750, Statutes of 2007), with an annual budget of about $100 million. Supports projects that develop and improve alternative and renewable low-carbon fuels, improve alternative and renewable fuels for existing and developing engine technologies, and expand transit and transportation infrastructures. Also establishes workforce training programs, conducts public education and promotion, and creates technology centers, among other tasks.

FUEL CELL ELECTRIC VEHICLE (FCEV)—A zero-emission vehicle that runs on compressed hydrogen fed into a fuel cell "stack" that produces electricity to power the vehicle.

GREENHOUSE GAS (GHG)— Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include water vapor, carbon dioxide (CO2), methane (CH4), nitrous oxide (NOx), halogenated fluorocarbons (HCFCs), ozone (O3), perfluorinated carbons (PFCs), and hydrofluorocarbons (HFCs).

LOW CARBON FUEL STANDARD (LCFS)—A set of standards designed to encourage the use of cleaner low-carbon fuels in California, encourage the production of those fuels, and therefore reduce greenhouse gas emissions. The LCFS standards are expressed in terms of the carbon intensity of gasoline and diesel fuel and their respective substitutes. The LCFS is a key part of a comprehensive set of programs in California that aim cut greenhouse gas emissions and other smog-forming and toxic air pollutants by improving vehicle technology, reducing fuel consumption, and increasing transportation mobility options.

PLUG-IN ELECTRIC VEHICLE (PEV)— A general term for any car that runs at least partially on battery power and is recharged from the electricity grid. There are two different types of PEVs to choose from—pure battery electric and plug-in hybrid vehicles.

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[34] California Air Resources Board, *Low Carbon Transportation Investments and Air Quality Improvement Program*. Available at https://ww2.arb.ca.gov/node/2878/about.