Appendix A

Status Update on Assembly Bill 118 AQIP Projects

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A. Summary

In the previous 3 funding cycles (fiscal year's 2009-10, 2010-11, and 2011-12), the Air Resources Board (ARB) awarded about $28 million to Air Quality Improvement Program (AQIP) projects each year as shown in Table 1, which lists the project categories, funding levels, and project status. In fiscal year 2010-11, the Energy Commission supplemented ARB's awards by directing an additional $6 million to AQIP ($2 million for the Clean Vehicle Rebate Project and $4 million for the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project) projects to meet additional demand bringing the total project funding to $35 million for the year. Fiscal year's 2009-10 and 2010-11 project funding was scaled back in accordance with the contingency provisions identified in each year's Funding Plan.

ARB funded five project categories in the first year of AQIP – the largest two being vouchers for the purchase of hybrid trucks and buses through the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project , and rebates for zero-emission or plug-in hybrid passenger cars through the Clean Vehicle Rebate Project. Both hybrid truck and electric vehicle technologies are at a key point where public incentives can help them become mainstream choices. These AQIP investments are an important first step in the fundamental transformation of the California fleet to one with widespread use of hybrid trucks and ZEVs critical to meeting California's long-term air quality and climate change goals.

For the most part, ARB continued funding these same categories in the second year, with the addition of one new category, a pilot project to evaluate and deploy off-road hybrid equipment. ARB did not allocate additional funds to the agricultural utility terrain vehicle rebate project in fiscal year 2010-11 because existing funds were sufficient to meet the projected demand. This program closed in December 2011 due to lack of demand and funds were redistributed in accordance to the contingency provisions in the fiscal year 2011-12 Funding Plan to three projects: locomotive demonstrations, hybrid truck testing and the Clean Vehicle Rebate Project. No new project categories were added in fiscal year 2011-12. While at different points in expenditure and implementation, all projects with the exception of the agricultural utility terrain vehicle rebate project are being implemented as envisioned, and the streamlined nature of the projects has enabled funds to be spent in a timely manner.

The Fiscal Year 2008-09 State Budget included a one-time appropriation from AQIP fund to implement a heavy-duty vehicle air quality loan program to assist smaller truck fleets affected by ARB's In-Use Truck and Bus Regulation and the Heavy-Duty Vehicle Greenhouse Gas Emission Reduction Regulation. Under this appropriation, $35 million is available for a financial assistance program referred to as the Providing Loan Assistance for California Equipment program.

This Appendix provides detailed information on the status of each projects' implementation.

Table 1: Status of Fiscal Year 2009-10, 2010-11, and 2011-12 AQIP Projects

Project Category	FY09-10 Award	FY10-11 Award	FY11-12 Award	Project Status[1]
Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project	$20.4 M	$23 M[2]	$11 M	Launched Feb 2010. ~$31 M spent; over 1050 vouchers issued; implementation ongoing.
Clean Vehicle Rebate Project	$4.1 M	$7 M[3]	$15.5 M[4]	Launched March 2010. ~$20 M spent; over 6,400 rebates issued; implementation ongoing.
Lawn & Garden Equipment Replacement	$1.6 M	$1 M	--	Launched spring 2010 with 9 air districts. ~$2.4 M spent; 12,400 mowers replaced; implementation ongoing.
Zero Emission Agricultural Utility Terrain Vehicle Rebates	$1.1 M[5]	--	--	Launched April 2010; closed December 2011. ~$135,000 spent; 56 rebates issued.
Off-Road Hybrid Equipment Pilot	--	$2 M	--	Launched July 2011. ~$850,000 spent; 15 vouchers issued. Emissions testing late 2012.
Advanced Technology Demonstrations	$1.8 M	$1.8 M	$1.5 M	11 projects ongoing from 1st two years; additional 2 projects in 2012
Total Funding	$29 M	$35 M	$28 M	

[1] Status as of May 1, 2012. Funds spent reflect vouchers/rebates in process and redeemed.
[2] Includes $4 million in funding from the California Energy Commission for zero-emission trucks.
[3] Includes $2 million in funding from the California Energy Commission.
[4] Includes $500,000 in funds redirected from the fiscal year 2011-12 locomotive demonstration.
[5] Remaining funds were redirected based on the contingency provisions in the Fiscal Year 2011-12 Funding Plan: $199,800 to hybrid truck testing and $675,000 to the Clean Vehicle Rebate Project.

B. Clean Vehicle Rebate Project

Overview

The Clean Vehicle Rebate Project offers vehicle rebates on a first-come, first-served basis for light-duty zero-emission vehicles, zero-emission motorcycles, and neighborhood electric vehicles. In the first 3 AQIP funding cycles, the Air Resources Board (ARB) has allocated a total of $24.1 million for the Clean Vehicle Rebate Project. An additional $2 million in funding was provided by the Energy Commission's AB 118 funding in mid-2011. To date nearly $20 million of this has been spent. ARB has made several program refinements since project inception to clarify project requirements and improve project effectiveness. The Clean Vehicle Rebate Project launched with its first year of funding in Fiscal Year (FY) 2009-10. In year 2, changes were made to expand opportunities for consumers to have experience driving clean cars without having to make the purchase commitment by including special provisions for rental and car share fleets that allowed these entities to more easily participate in the Clean Vehicle Rebate Project. Additional changes addressed growing consumer demand by establishing a cap on the number of rebates any entity could receive in each calendar year and the establishment of a waiting list. In year 3, in response to continuing demand increases, ARB reduced the maximum rebate amount for all vehicle types and set aside 10 percent of funds for car share fleets. Current rebates range from $900 for zero-emission motorcycles and neighborhood electric vehicles to $2,500 for full functioning zero-emission vehicles. Currently, 19 manufacturers have rebate-eligible vehicles, some with multiple models, and more vehicle introductions are planned in the next 6 months. Plug-in hybrid electric vehicles are new to the California consumer market, with several models introduced early in 2012.

The non-profit California Center for Sustainable Energy (CCSE) has been selected via competitive solicitation to administer the Clean Vehicle Rebate Project statewide in each of the 3 fiscal years. The California Center for Sustainable Energy responsibilities include project website development and maintenance, processing rebate applications and issuing rebate checks, consumer outreach and education, data reporting, and other duties associated with day-to-day implementation. ARB's responsibilities include program development and oversight, evaluating and approving eligible vehicles, verifying consumer compliance with rebate terms, and contract management and administration. The Clean Vehicle Rebate Project webpage, at http://www.energycenter.org/cvrp provides a real-time accounting of rebate funds available to consumers, a downloadable rebate application and instructions, list of eligible vehicles, an online tutorial, and other project information.

Program Status as of May 1, 2012

Since the project's consumer launch in March 2010, rebates for over 6,445 vehicles totaling nearly $20 million have been issued.

Table 2 presents a summary of rebates by vehicle type and model. The majority of total rebates (86 percent) have gone to light-duty zero-emission vehicles, with 79 percent of those rebates going toward the Nissan LEAF. Plug-in hybrid electric vehicles were introduced in late February 2012, and already comprise 8 percent of the total rebates issued as of May 1, 2012. As expected the recent diversity of vehicle types is resulting in more consumer choice. The list of rebate-eligible vehicles continues to expand, and 20 vehicles are now rebate-eligible covering a spectrum of prices and mileage range.

Table 2. Rebates by Vehicle Types and Model

Vehicle Type By Model	Number of Rebates	Total Dollars Allocated	Percentage of Total Dollars Allocated
Light-Duty Zero-Emission Vehicle	**5166**	**$17,130,750**	**86%**
CODA Sedan 2012	4	$ 10,000	0.05%
Honda 2010/11 FCX-Clarity	9	$ 42,500	0.21%
Mitsubishi i-MiEV 2012	50	$ 100,000	0.50%
Nissan Leaf 2011-2012 SV/SL Model	4634	$15,711,250	79%
Smart USA Cabriolet and Coupe 2011	319	$ 625,000	3%
Tesla Roadster 2009-2011	146	$ 632,500	3%
Think City 2011	3	$ 7,500	0.04%
Wheego LiFe 2011	1	$ 2,000	0.01%
Plug-In Hybrid Electric Vehicle	**1063**	**$ 1,594,500**	**8%**
Chevy Volt Low Emission package	286	$ 429,000	2%
Toyota Prius Plug-In Hybrid	777	$ 1,165,500	6%
Neighborhood Electric Vehicles	**74**	**$ 85,450**	**0.4%**
GEM 2009/10/11 e2	24	$ 21,900	0.11%
GEM 2009/10/11 e4	5	$ 6,100	0.03%
GEM 2009/2010 eL	3	$ 4,050	0.02%
GEM 2009/2010 eL-XD	4	$ 5,400	0.03%
GEM 2009/2010 eS	3	$ 3,300	0.02%
Miles EV 2009/2010 ZX40S-AD	34	$ 43,200	0.22%
Vantage 2010 EVX1000	1	$ 1,500	0.01%
Zero-Emission Motocyles	**93**	**$ 109,900**	**0.6%**
Brammo 2010-2012 Enertia	12	$ 15,000	0.08%
Vectrix 2007-2010 VX-1	5	$ 6,900	0.03%
Zero DS 2009-2011	76	$ 88,000	0.44%
Commercial Zero-Emissions Vehicles	**49**	**$ 980,000**	**5%**
Navistar 2010 eStar 300 series	10	$ 200,000	1%
Smith 2009/2010 Newton1-9	39	$ 780,000	4%
Total	**6445**	**$19,900,600**	**100%**

Table 3 presents rebates issued by applicant type. Consistent with ARB expectations, nearly 90 percent of the rebates have been issued to individual consumers, with the remainder going to businesses, non-profit organizations, or government fleets.

Table 3. Rebates by Applicant Type

Type of Application	Rebates Issued	Total Rebate Amounts	Percentage of Total Distributed
Private individual or sole proprietor	5783	$17,750,950	89%
California Licensed Business	610	$ 2,036,850	10%
Non-profit organization	12	$ 24,550	0.1%
State government agency	27	$ 49,650	0.2%
Local government agency	13	$ 38,600	0.2%
Total	**6,445**	**$19,900,600**	**100%**

Figure 1a illustrates the trends in rebate activity under the Clean Vehicle Rebate Project to date. The project was launched in March 2010, but the number of rebate applications was low until the release of the Nissan LEAF in early 2011. About 80 percent of the rebate funding for fiscal years 2009-2011 was spent from April until mid-June 2011, at which time a waiting list began. Another rebate spike occurred in March 2012 after the commercial release of plug-in hybrid electric vehicles.

Figure 1a. Rebates Issued by Month

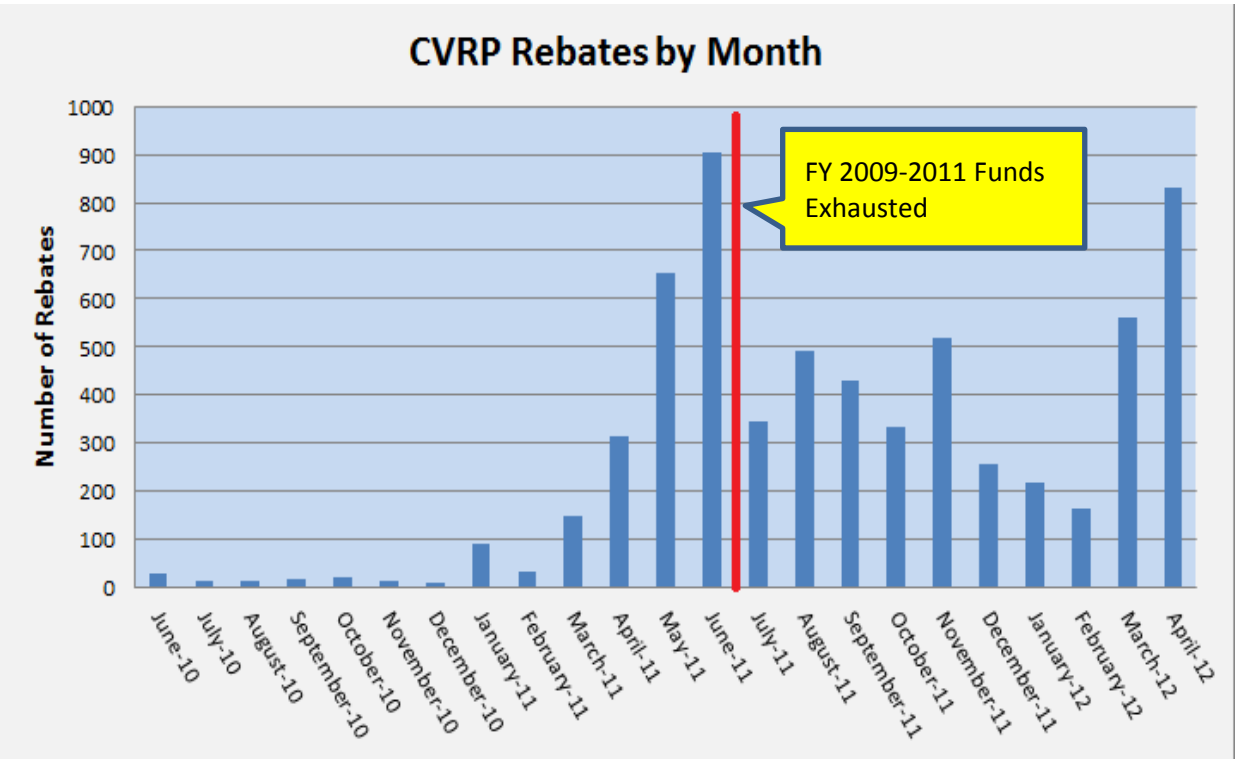
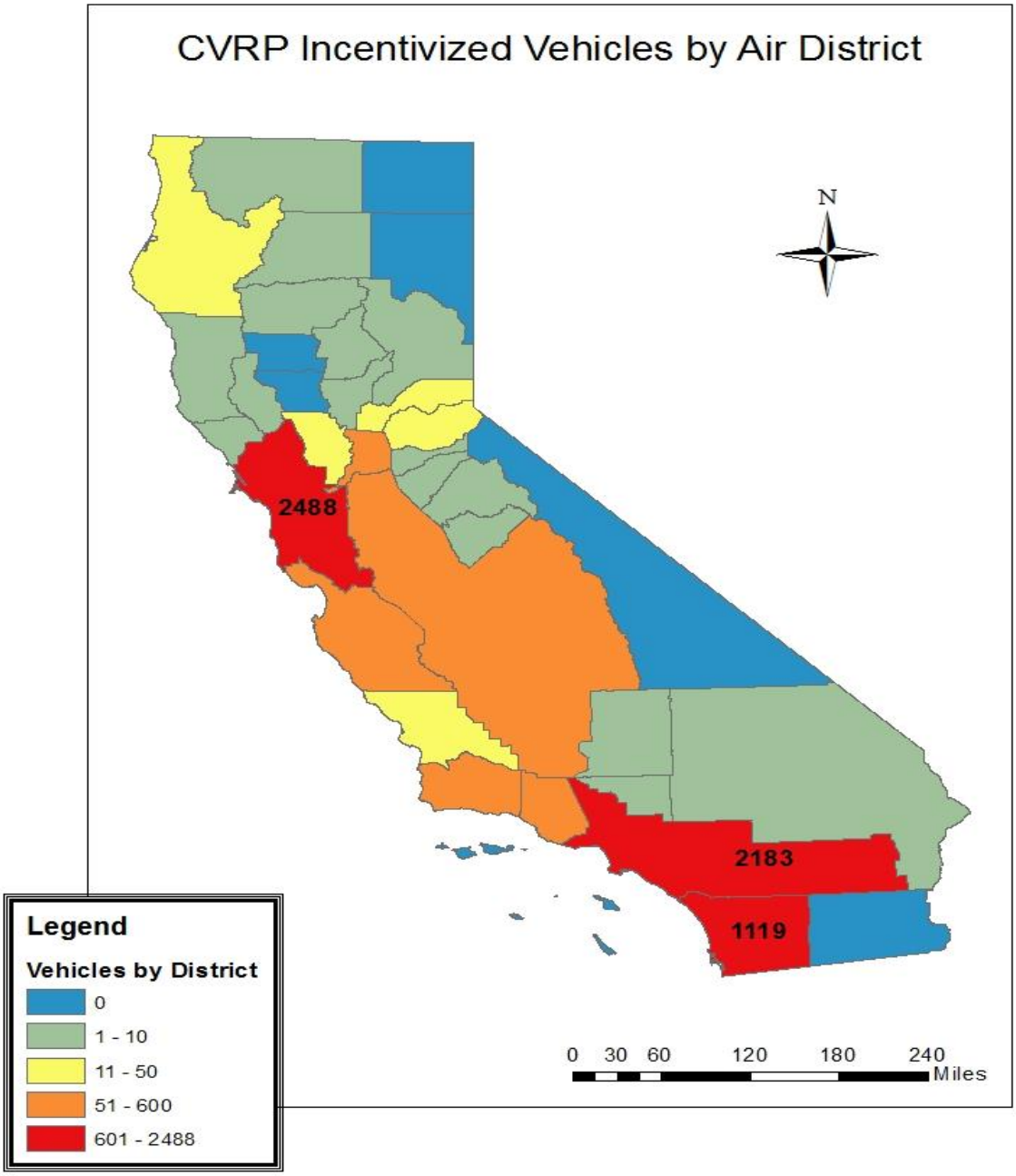


Figure 1b illustrates the statewide distribution of rebates by air district. The majority of rebates are in the Bay Area Air Quality Management District, South Coast Air Quality Management District, and San Diego County Air Pollution Control District. This distribution is due to manufacture marketing, population density, and additional incentives for charging infrastructure focused in these areas.

Figure 1b. Distribution of Rebates by Air District



C. Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project

Overview

The Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project offers vouchers on a first-come, first-served basis for new hybrid and zero-emission trucks. In the first 3 AQIP funding cycles, ARB has allocated a total of $50.4 million for the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project. An additional $4 million in funding was provided by the Energy Commission's AB 118 funding in mid-2011 for zero-emission trucks. ARB has made several program refinements since project inception in fiscal year 2009-10 to improve project effectiveness and transparency. In year 2, zero-emission trucks were shifted from the Clean Vehicle Rebate Project to the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project to better align with the commercial nature of truck purchases, voucher amounts were reduced for the heaviest vehicles to avoid purchasers from oversizing their vehicles, and $2 million was set aside for public fleets to address their challenges in procuring vouchers on a first-come, first-serve basis. In year 3, ARB established voucher funding tiers by purchase volume to encourage new fleets, especially small fleets, to invest in hybrid and zero-emission truck technology. In addition, to ensure continuing diversity in the marketplace, ARB limited any single manufacturer to no more than 50 percent of the fiscal year 2011-12 funds. Currently, over 50 hybrid and zero-emission truck and bus models from 11 different manufacturers are eligible for the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project.

The non-profit transportation consortium Calstart has been selected via competitive solicitation to administer the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project statewide in each of the 3 fiscal years. Calstart's responsibilities include project website development and maintenance, processing voucher applications and issuing checks, consumer and dealer outreach and education, data reporting, and other duties associated with day-to-day implementation. ARB's responsibilities include program development and oversight, evaluating and approving eligible vehicles, verifying fleet owner compliance with voucher terms, and contract management and administration. The Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project webpage, at http://www.californiahvip.org/, provides a real-time accounting of voucher funds remaining, on-line application, list of eligible vehicles, training, and other project information.

Program Status as of May 1, 2012

Since the project's launch in February 2012, vouchers for over 1,000 vehicles totaling over $31 million have been issued. In July 2011, the Board approved $11 million in funding for the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project for fiscal year 2011-12, bringing the cumulative project funding total $54.4 million.[1] Tables 4, 5 and 6 contain cumulative summaries of vouchers issued by eligible vehicle type,

[1] Includes $4 million from the Energy Commission in fiscal year 2011-12.

vehicle weight, and vehicle manufacturer, while Figure 1c illustrates voucher distribution by air district.

Table 4. Vouchers Issued By Vocation (Completed and In-Progress)

Vehicle Type	Vouchers Issued[1]	Total Voucher Funds	Average Voucher Amount	% of Total Vouchers	% of Total Voucher Funds
Beverage Delivery	384	$ 12,705,000	$ 33,086	36%	41%
Parcel Delivery	311	$ 8,821,000	$ 28,363	29%	28%
Uniform and Linen Delivery	108	$ 3,890,000	$ 36,019	10%	12%
Food Distribution	109	$ 2,615,000	$ 23,991	10%	8%
Other Truck	94	$ 1,785,000	$ 18,989	9%	6%
School, Shuttle or Urban Bus	28	$ 831,776	$ 29,706	3%	3%
Liquid Propane Pick-Up & Delivery	22	$ 570,000	$ 25,909	2%	2%
Total	1,056	$ 31,217,776	$ 29,562	100%	100%

1 Data includes $4 million in Energy Commission funding and vouchers completed and in-progress.
2 Commercial zero-emission vehicles incentivized through the Clean Vehicle Rebate Project in Year 1 are not included. See Table 1 for Year 1 commercial zero-emission vehicle information.

Table 5. Vouchers Issued By Gross Vehicle Weight Range (Completed and In-Progress)

Gross Vehicle Weight Range	Vouchers Issued[1]	Total Voucher Funds	% of Total Vouchers	% of Total Voucher Funds
5,001 – 6,000 lbs.	40	$ 516,000	4%	2%
6,001 – 10,000 lbs.	0	$ 0	0%	0%
10,001 – 14,000 lbs.	34	$ 715,000	3%	2%
14,001 – 19,500 lbs.	183	$ 4,200,000	17%	13%
19,501 – 26,000 lbs.	306	$ 9,985,000	29%	32%
26,001 – 33,000 lbs.	84	$ 2,151,776	8%	7%
>33,000 lbs.	409	$ 13,650,000	39%	44%
Total	**1,056**	**$ 31,217,776**	**100%**	**100%**

1 Data includes $4 million in Energy Commission funding and vouchers completed and in-progress.
2 Commercial zero-emission vehicles incentivized through the Clean Vehicle Rebate Project in Year 1 are not included.

Table 6. Rebates by Vehicle Types and Model[1]

Vehicle Types by Model	Number of Vouchers	Average Voucher Amount	Total HVIP Funding
Hybrid Vehicles			
Freightliner/FCCC	358	$27,011	$ 9,670,000
Kenworth	188	$33,963	$ 6,385,000
Ford/Azure	138	$24,565	$ 3,390,000
Navistar	90	$25,186	$ 2,266,776
Peterbilt	13	$26,923	$ 350,000
New Flyer	7	$40,714	$ 285,000
Thomas Built	5	$30,000	$ 150,000
Total	**799**	**$28,156**	**$22,496,776**
Zero-Emission Vehicles[1]			
Electric Vehicle International (Box Truck)	100	$46,000	$4,600,000
Smith Electric Vehicle (Newton)	83	$34,458	$2,860,000
Ford/Azure (Transit Connect)	40	$12,900	$ 516,000
Navistar (eStar 300)	34	$21,912	$ 745,000
Total	**257**	**$33,934**	**$8,721,000**

[1]Includes Energy Commission $4 million contribution.

Figure 1c. Distribution of Vouchers by Air District

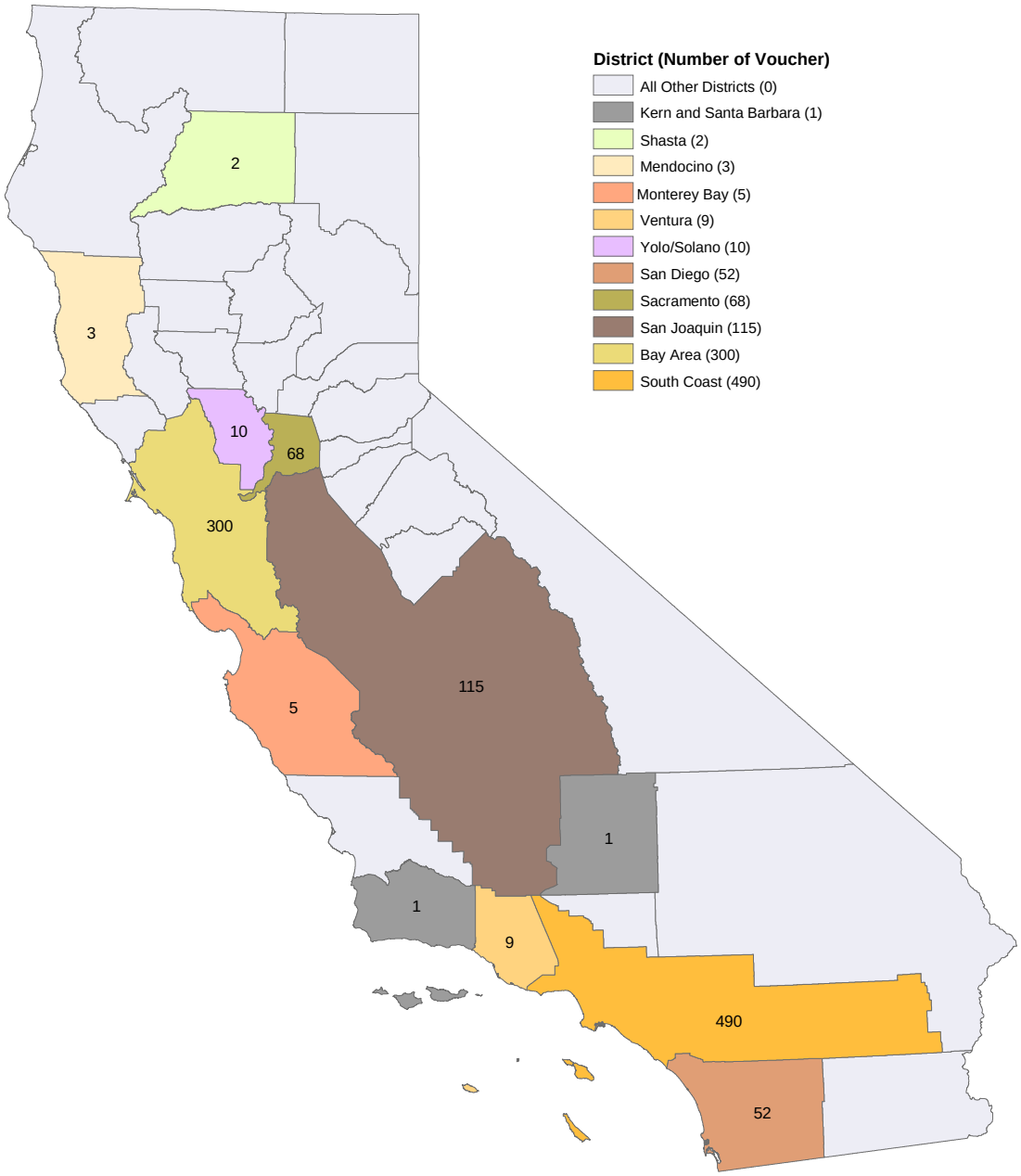
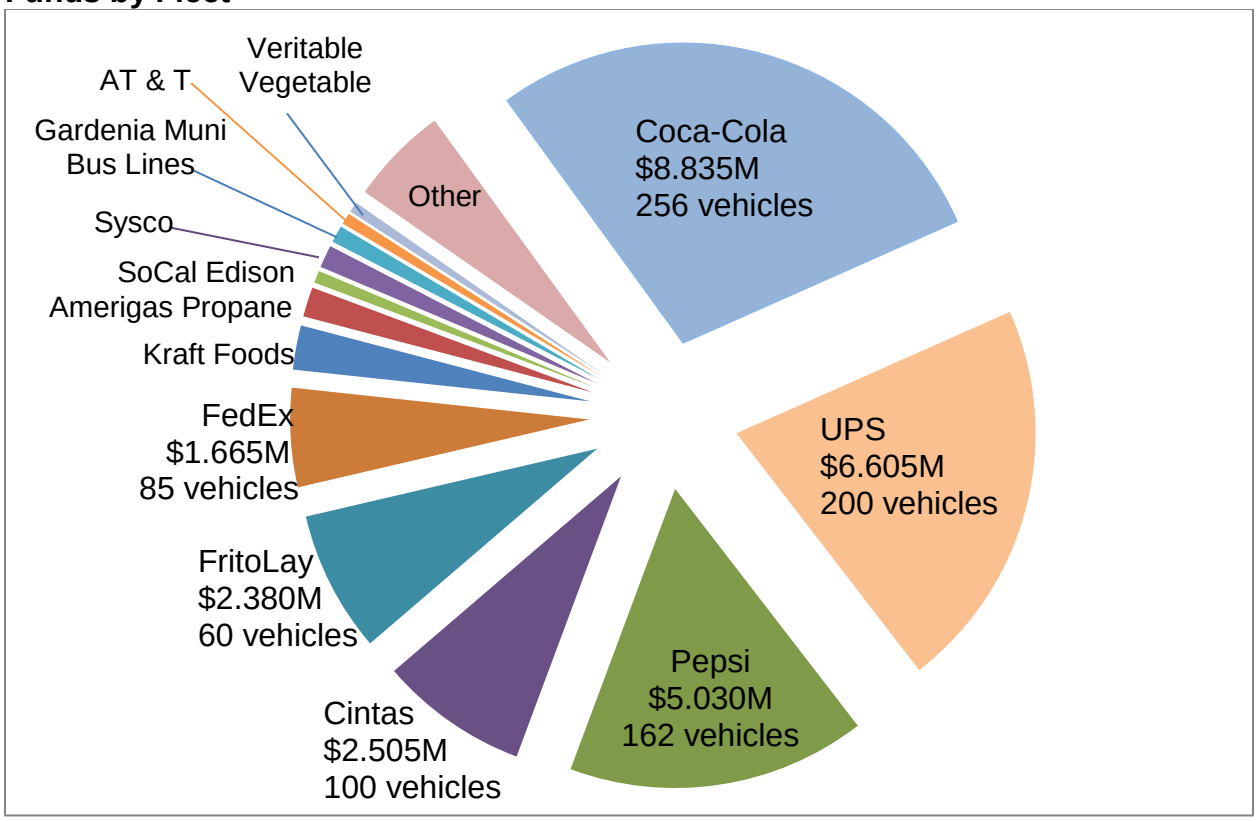


Figure 1d illustrates the number of Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project vouchers requested by each participating California fleet. These early adopter fleets have been critical in laying the foundation for hybrid and zero-emission trucks and buses to become a mainstream purchase option. The majority of Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project funds thus far have gone to large national fleets, with Coca-Cola Enterprises and United Parcel Service receiving about half of program funds and the top 6 participants receiving 85 percent of all funding. Larger fleets have more resources to make the up-front investment in hybrid and zero-emission vehicle purchases and absorb perceived financial risk associated with being the first to adopt a new technology. However, more small and medium sized fleets must make the jump to these technologies in the near term for California to meet its air quality and climate change goals.

Figure 1d. Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project Funds by Fleet



Hybrid Truck Testing

To complement the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project, ARB has directed approximately $700,000 for testing of hybrid heavy-duty trucks to the United States Department of Energy National Renewable Energy Laboratory. The testing will consist of data logging hybrid vehicles in order to improve duty cycle classifications and characterization, complementary chassis emissions

testing of both hybrid and conventional vehicles, and supplemental portable emissions measurements in real-world conditions. If possible, all the testing will be completed on Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project funded vehicles on a voluntary basis. This testing supports ARB's monetary investment in hybrid trucks and near-term updates to ARB's heavy-duty hybrid test procedures providing a better understanding of the utilization and emissions of medium- and heavy-duty hybrid vehicles in California. This effort will allow ARB and other California state agencies to strategically match advanced propulsion systems and duty cycles to optimize for fuel economy, emissions reductions, and return on grant funding or capital investment. The contracting phase is nearly complete with work to be completed within 18 months of contract execution.

D. Advanced Technology Demonstration Projects

The primary goal of Advanced Technology Demonstration Projects has been to accelerate advanced emission reducing technologies that are on the cusp of commercialization into the California marketplace. A public investment in these technologies helps to achieve significant emission reductions of criteria pollutants and toxic air contaminates sooner than would be possible otherwise. Funding advanced technology demonstration projects carries inherent risks such as the project may not meet its stated goals on schedule, or there may be a failure of the demonstration technology. ARB mitigates this risk by requiring a competitive selection process to award funding to the most promising technology, requiring a significant cost share from the technology demonstrator, and requires that the project applicant be a California-based public agency with expertise in the project category. Grants are awarded to public agencies to manage the day-to-day administration of the projects with ARB oversight. Typically public agencies are local air districts, port authorities, or public school districts, but other agencies are eligible. The team concept for demonstration projects, with technology demonstrators partnering with a local public agency and one or more end-users, has proven to be effective and is planned to continue for future projects.

Throughout the first 3 years of Advanced Technology Demonstration Projects, AQIP has funded 12 separate projects totaling $4.6 million (Table 7). AQIP investment has a corresponding $6.3 million in match funding from grantee's and technology demonstrators giving a total of $10.9 million of demonstration funding.

AQIP demonstration funds have predominately been focused toward large engine off-road mobile sources, such as marine vessels and locomotives. However, AQIP demonstration project funds have also been applied to the electrification of small horsepower engine applications such as lawn and garden equipment typically powered by gasoline engines. Additionally, AQIP demonstration project funds have supported on-road projects, with the battery-electric school bus demonstration.

The following discussion identifies all of the projects that have been pursued with Advanced Technology Demonstration Projects funding, by project category.

Table 7. AQIP Advanced Technology Demonstration Projects

Fiscal Year	Project	Grantee	Grant Amount
2009-10	Marine	Port of Los Angeles: Hybrid Tugboat Retrofit	$1,000,000
	Locomotive	Port of Long Beach: Diesel Particulate Filter Retrofit of Switcher	$ 346,178
		Sacramento Metropolitan Air Quality Management District: Electro-Motive Diesel Incorporated Line-Haul Diesel Particulate Filter Retrofit	$ 502,865
2010-11	Marine	South Coast Air Quality Management District: Tugboat Diesel Particulate Filter /Selective Catalytic Reduction Retrofit	$ 439,000
		Bay Area Air Quality Management District: Sail Ferry Demo	$ 165,000
	Locomotive	Bay Area Air Quality Management District: Tier-4 Genset Switcher	$ 529,810
		Bay Area Air Quality Management District: Diesel Particulate Filter Retrofit on Genset Switcher	$ 270,190
	Lawn and Garden	Mojave Desert Air Quality Management District	$ 15,000
		South Coast Air Quality Management District	$ 100,000
		San Joaquin Valley Air Pollution Control District	$ 250,000
2011-12	School Bus	Kings Canyon Unified School District: Battery Bus	$ 496,696
		San Diego County Air Pollution Control District: Battery Bus	$ 502,304
	Locomotive	Tier-4 in High Horsepower Locomotives	No applications submitted
		Total	**$4,617,043**

Locomotive Category

AQIP has devoted almost half of all demonstration funds to the locomotive category demonstrating the importance of advanced technologies that have the potential to significantly reduce emissions from locomotives in California. Over the last 3 years, AQIP has funded projects that have continued a path toward lowering emission levels from locomotives. The first year focus was on retrofitting switcher and line-haul locomotives with diesel particulate filters. Second year funding was directed at further advances in retrofitting switcher locomotives with a diesel particulate filter and the development and manufacture of the world's cleanest diesel-fueled switch locomotive, projected to reach U.S. EPA Tier-4 emission levels for both oxides of nitrogen and particulate matter, using existing off-road engines. The third year was focused on technologies in high horsepower locomotives that can approach, meet, or exceed U.S. EPA Tier-4 emission levels for both oxides of nitrogen and particulate matter. However, no applications were submitted for this $1 million grant opportunity, staff believes that the $1 million was insufficient funding for locomotive engine manufacturers to accelerate introduction of their U.S. EPA Tier-4 emission engine technology.

<u>Fiscal Year 2009-10 — Retrofit of a Line-Haul Locomotive with a Diesel Particulate Filter</u>
Sacramento Metropolitan Air Quality Management District, Electro-Motive Diesel, and Union Pacific Railroad

The retrofit of Electro Motive Diesel's model 710, 3,200 horsepower line-hail engine with a diesel particulate filter is a major engineering accomplishment. The retrofit can be seen in the photo as the winged area in the middle of the locomotive which houses the diesel particulate filter. This project marks the first time a large, two-stroke locomotive diesel engine has been successfully retrofitted with a diesel particulate filter, reducing particulate matter emission below U.S. EPA Tier-4 levels. This technology could be used on nine other existing in-use locomotives, and has potential for transfer into new locomotive engines. The project's main highlights are:

- Diesel particulate filter retrofit for line-haul locomotives
- Reduce particulate matter emissions beyond U.S. EPA Tier-4
- AQIP demonstration project grant: $502,865
- Will begin durability testing July 2012 for multiyear deployment

AQIP provided funding to accelerate its development and push forward the project timeline to facilitate an accelerated verification of the diesel particulate filter. This locomotive will be delivered to Union Pacific Railroad in Roseville, California, by the end of June 2012, for use between the Port of Oakland and the Roseville railyard. The

locomotive may see service as far afield as Reno or the South Coast Air Basin during its multiyear field demonstration being supervised by Sacramento Metropolitan Air Quality Management District.

Fiscal Year 2009-10 — U.S. EPA Tier-4 Particulate Matter Retrofit System for a Three Engine Genset Switch Locomotive
Port of Los Angeles, Johnson Matthey and Union Pacific Railroad

This project retrofitted all three Cummins engines in a National Railway Equipment Companies Genset switch locomotive with diesel particulate filters. In the photo of the UP2755, the retrofit devices can be seen protruding above the car body. This locomotive is currently undergoing its field demonstration at Union Pacific Railroad at the Intermodal Container Transfer Facility serving the Port of Los Angeles and Port of Long Beach. The project's main highlights are:

- Diesel particulate filter retrofit for in-use switch locomotives
- Reduce particulate matter emissions to U.S. EPA Tier-4
- AQIP demonstration grant: $346,178
- Project completion Date: June 1, 2013

The goal of this project is to receive ARB-verification of the retrofit to reduce particulate matter emissions by at least 85 percent, providing assurances that the device will perform in the demanding rail environment, and providing a pathway for public funding to incentivize the use of this retrofit on other locomotives thru programs such as the Carl Moyer Memorial Air Quality Standards Attainment Program (Carl Moyer Program). There is the potential for technology transfer to over 100 in-use genset switchers. This locomotive is currently in operation at the Intermodal Container Transfer Facility accumulating hours of operation toward its official ARB verification. Emission testing has been performed at zero hour and at 1,500 hours of operation and the devices are performing better than expected. A cumulative 3,000 hours of operation is expected to be completed and the final emission testing performed by June 2013.

Fiscal Year 2010-11 — Demonstrate U.S. EPA Tier-4 Particulate Matter Emission Control of a National Railway Equipment Company Genset Switcher Using a Catalytic Diesel Particulate Filter

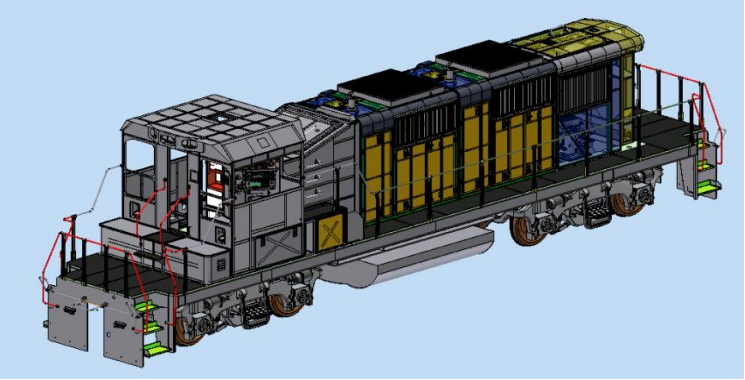
Bay Area Air Quality Management District, GT Exhaust, and BNSF Railway Company

This demonstration project retrofitted all three engines on a National Railway Equipment Company genset switch locomotive with diesel particulate filters on BNSF Railway Company's locomotive number 1284. The goal of the projects was to reduce emissions of diesel particulate matter beyond 85 percent to below U.S. EPA Tier-4 for particulate matter on switch locomotives. During the baseline emission tests for this locomotive, after retrofit, particulate matter emission goal was surpassed. The retrofit devices take the place of the engine's silencer so there is no protrusion out of the locomotive car body. As a result, diesel particulate filters are almost a bolt on replacement for the engine's muffler, reducing the time and cost to retrofit additional genset switchers. There is the potential for technology transfer to over 100 in-use genset switchers. The project's main highlights are:

- Diesel particulate filter retrofit for in-use switch locomotives
- Reduce diesel particulate matter by 85 percent or more
- AQIP demonstration grant: $270,190
- Project completion date: June 30, 2013

BNSF locomotive 1284 is currently in revenue service at BNSF Railway Company's railyard in Richmond, California, accumulating durability hours before it's next emission test after 1,500 hours of use. ARB expects that this locomotive retrofit device will complete its required 3,000 hours of durability testing to apply for official ARB verification of the device before the end of fiscal year 2013.

Fiscal Year 2010-11 — Build and Deploy a Genset Switch Locomotive that Achieves U.S. EPA Tier-4 Emission Levels for Oxides of Nitrogen and Particulate Matter
Bay Area Air Quality Management District, National Railway Equipment Company, and Richmond Pacific Railroad



This project represents a major advance in the current state-of-the-art for switch locomotives. The objective of this project is to design, build, and deploy the world's cleanest diesel-fueled locomotive. The technology demonstrator, National Railway Equipment Company, is combining two Cummins QSX 15 Tier-4 off-road engines, into National Railway Equipment Company's switch locomotive car body. The locomotive, once completed, will be brought into the Bay Area Air Quality Management District for durability testing. That durability testing will be performed while in revenue service by Richmond Pacific Railroad, a family owned California company, at its facilities in Richmond, California. The project's main highlights are:

- Design, build and deploy a U.S. EPA Tier-4 switch locomotive
- Meet Tier-4 emission levels for oxides of nitrogen and particulate matter
- AQIP demonstration grant: $529,810
- Project completion date: June 15, 2013

The Cummins QSX-15 Tier-4 off-road engine employs cooled exhaust gas recirculation and a diesel particulate filter to meet Tier-4 emission levels. The U.S. EPA Tier-4 switch locomotive that is developed under this project will see service beyond the end date of the demonstration project. ARB and the Bay Area Air Quality Management District have secured a commitment by National Railway Equipment Company and Richmond Pacific Railroad to operate this locomotive in the Bay Area until at least July 2016.

Marine Category

AQIP marine demonstration projects have been focused on enhancing options available to vessel owners by advancing emission-reducing technologies beyond what is required by regulation. Selected projects in the marine category have the opportunity to realize significant reductions in operational costs for vessel operators and reductions in criteria pollutants, with greenhouse gas reductions as a co-benefit. Technologies can be applied in a variety of different vessel types from tugboats to ferries.

Fiscal Year 2009-10 — Hybrid Tugboat Retrofit
Port of Los Angeles and Foss Maritime Company

The goal of this project was to seize the momentum that Foss Maritime had generated with building the world's first hybrid tugboat, the *Carolyn Dorothy* (a Dolphin Class tugboat built by Foss Maritime) by retrofitting an existing tugboat with the hybrid system that was originally developed for the *Carolyn Dorothy*. To date, the retrofit of the *Campbell Foss*, has been completed and durability testing is currently underway. The *Campbell Foss* is currently in-use at the Port of Long Beach along with her sister vessel the *Carolyn Dorothy*. The project's main highlights are:

- Retrofit an existing tugboat with hybrid system
- Substantially reduce emissions of criteria pollutants and reduce fuel usage
- AQIP demonstration grant: $1 million
- Project will be complete by June 30, 2013

The hybrid technology employed in this project is different than what is typically found in on-road vehicles; there is not regenerative braking, but there is plug-in charging. This project takes advantage of inherent efficiencies of operating diesel engines at their most efficient load and engine speed. The *Campbell Foss* employs 2 3,000 horsepower main engines, 2 smaller auxiliary diesel generators, and a series of battery packs, to safely propel the vessel as the situation dictates. In certain circumstances, it is not efficient to use 2 3,000 horsepower engines to operate the vessel, in these situations the *Campbell Foss* can be operated with batteries alone, thereby reducing main engine idling. Transiting the *Campbell Foss* around the harbor can be accomplished with the use of one auxiliary generator, rather than using the main engines under slight load. This project has demonstrated the feasibility of the hybrid system in tugboats and the next objective is ARB's validation of the technology to facilitate additional tugboat hybrid retrofits. In operation within California, there are four other Dolphin Class tugboats, nearly identical to the *Campbell Foss*, which would be good candidates for retrofit after the completion of this project. In addition, there are more than 150 other tugboats operating in California that this technology could transfer to in the future.

Fiscal Year 2010-11 — Retrofit of a Tugboat with a Diesel Particulate Filter and Selective Catalytic Reduction Device
South Coast Air Quality Management District, Hug Filtersystems, and Sause Brothers

The goal of this project is to demonstrate the feasibility of retrofitting an in-use tugboat's main engines with a diesel particulate filter and a selective catalytic reduction system to reduce emissions of particulate matter and oxides of nitrogen to levels beyond what is

required by regulation. There are more than 150 other tugboats operating in California that this technology could transfer to. The project's main highlights are:

- Retrofit an existing tugboat with diesel particulate filter/selective catalytic reduction system
- Substantially reduce criteria pollutant emissions from the retrofitted vessel
- AQIP demonstration grant: $439,000
- Project will be complete by June 30, 2013.

Pursuing official ARB verification of the device at emission levels beyond what is required by regulation allows for public funding to incentivize the use of this retrofit on other similar vessels through programs such as the Carl Moyer Program.

<u>Fiscal Year 2010-11 — Wind Assist Marine Demonstration Project</u>
Bay Area Air Quality Management District, Wind + Wing Technologies, and Harbor Wing Technologies

The objective of this project is to evaluate the viability of using a wing-sail to provide motive power, either in whole or in part, to a vessel plying ferry routes on the San Francisco and San Pablo Bays. The number of ferries operating in the Bay Area is expected to expand beyond its current extensive service considerably in the next several years. This project evaluates the wing-sail not the vessel, to determine the potential to reduce criteria pollutant and fuel usage and influence future ferry design. If the project is successful, it can provide confidence to the Bay Area ferry districts that a purpose built ferry with the wing-sail design would perform as expected. The project's main highlights are:

- Mimic existing ferry routes and measure winds to determine potential of wing-sail to operate in the Bay Area ferry environment
- Potential to influence future ferry designs
- AQIP demonstration grant: $165,000
- In-Use testing to be completed by October 2012

The vessel is owned by the United States Navy Office of Naval Research. Once the field demonstration is complete, scientists at the University of California, Berkeley will evaluate the data and prepare a report on the feasibility of this technology for ferry service.

School Bus Category

Through the Lower-Emission School Bus Program, ARB has provided approximately $250 million toward school bus replacement and retrofit. The objective for AQIP school bus projects is to build upon the success of the Lower-Emission School Bus Program and advance the cleanest technologies for use in school buses beyond regulatory requirements and toward zero-emission. There are several benefits to demonstrating advanced technologies in schools buses:

- School transportation officials have the opportunity to try out advanced technology school buses without a major financial commitment.
- Battery-electric and hybrid-electric school buses reduce student's exposure to diesel particulate matter.
- Provides school districts experience with the financial saving that can be realized by operating advanced technology buses.
- Opportunities exist for school districts to purchase these advanced technology buses with little to no out-of-pocket expense by using local Assembly Bill 923 funds or state Lower-Emission School Bus Program funds if available, in combination with an AQIP Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project voucher.

<u>Fiscal Year 2011-12 — Deploy and Share Two Battery-Electric School Buses Among School Districts within the San Joaquin Valley</u>
Kings Canyon Unified School District and Trans Tech Bus

The objective of this project is to take the currently commercially available Trans Tech eTrans battery-electric school bus and allow public school districts to gain experience operating this advanced technology school bus without the financial commitment. This project gets advanced technology buses into the fleets of participating school districts within the San Joaquin Valley by allowing them to operate the buses transporting students from home to school over a several week demonstration at no cost to the participating school district. This project funds 2 eTrans buses that will be shared between 20 or more public school districts over a two year period. In addition, Kings Canyon Unified School District, the project grantee, is including a hybrid-diesel school bus in the pool of buses for school districts to select from. During each school district's demonstration, data will be collected on charge time, battery status, bus usage and other parameters to help better understand the applicability of battery electric and hybrid-electric school buses to school district fleet managers. The project's main highlights are:

- Fund two eTrans battery electric buses for sharing among many school districts
- Zero-emission operation reducing children's exposure to pollutants
- AQIP demonstration grant: $496,696
- Project will run thru June 30, 2014

Fiscal Year 2011-12 — Build and Deploy an Economical Electric School Bus for Use Among Participating San Diego School Districts
San Diego County Air Pollution Control District and TransPower

The goal of this demonstration project is to build and deploy a battery-electric school bus for use transporting students from home to school. The bus being developed is a Type-C bus, large enough to carry over 40 students, for use in daily operation by a school district and will be the largest electric school bus in operation. This bus, once approved by the California Highway Patrol, will be shared among several participating school districts over a period of several months to allow for a thorough evaluation by district school transportation officials. The objective of this project is to develop an electric school bus that can compete with diesel or alternative fueled buses of similar size and function on an economic basis. The technology demonstrator for this project, TransPower, is a California based company with manufacturing operations in San Diego County. The project's main highlights are:

- Build and deploy a battery-electric school bus
- Reducing children's exposure to criteria pollutants
- Reducing school district operational costs
- AQIP demonstration grant: $502,304
- Project will be completed by June 30, 2014

Zero-Emission Commercial Lawn and Garden Category

AQIP Advanced Technology Demonstration Projects provide funding for commercial cordless zero-emission lawn and garden equipment at a strategic time in product development with several manufacturers just beginning to bring equipment to market. A large segment of existing in-use commercial-grade lawn and garden equipment remains long-lived two-stroke engines. Significant emission reductions can be achieved by replacing this equipment with cleaner technology. It is the goal of these demonstration projects to foster market acceptance by reducing barriers of acceptance by commercial landscape firms. Those barriers include, but are not limited to, incremental cost for battery-electric equipment, confidence in the advanced technology and an existing sense of familiarity with gasoline powered equipment. Providing the end user an opportunity to operate the zero-emission equipment without a large financial outlay allows the operator to see the benefits first-hand, such as, lower maintenance and operational costs, less noise during operation, zero pollution at job site and the presentation of an environmental company image.

Fiscal Year 2010-11 — Demonstrate Zero-Emission Lawn and Garden Equipment in a Commercial Setting

In June 2011, ARB awarded $365,000 in grant funding to 3 local air districts to the following projects:

- $100,000 to South Coast Air Quality Management District to demonstrate Stanley Black & Decker Incorporated commercial grade cordless zero-emission lawn mowers, string trimmers, and hedge trimmers in a non-residential application. South Coast Air Quality Management District has partnered with Stanley Black & Decker Incorporated, Valley Crest Landscape Maintenance, and the Center for Environmental Research and Technology at University of California Riverside (CE-CERT) to test, collect, and evaluate data on Stanley Black & Decker Incorporated equipment.

- $15,000 to the Mojave Desert Air Quality Management District to demonstrate a variety of cordless zero-emission lawn and garden equipment (riding lawn mowers, blowers, chainsaws, trimmers, etc.) in the Mojave Desert's extreme climate. Mojave Desert Air Quality Management District has partnered with the City of Hesperia, City of Victorville, Stanley Black & Decker Incorporated, and STIHL® to evaluate the impact Mojave Desert's extreme climate may have on equipment performance.

- $250,000 to San Joaquin Valley Air Pollution Control District to demonstrate cordless zero-emission lawn and garden equipment in non-residential applications. San Joaquin Valley Air Pollution Control District is currently selecting one or more cordless zero-emission commercial lawn and garden equipment manufacturers and professional landscapers and is scheduled begin testing and data collection July 2012.

E. Lawn and Garden Equipment Replacement Project

Overview

The Lawn and Garden Equipment Replacement Project replaces gasoline powered residential lawn and garden equipment with cordless, zero-emission lawn and garden equipment, encouraging further development and deployment of this technology. AQIP's Lawn and Garden Equipment Replacement Project augmented local air districts program's which had proved successful in reducing criteria pollutant emissions cost-effectively, but were limited in scope partially due to deficient funding. In fiscal year 2009-10, AQIP awarded $1.6 million in funding to Lawn and Garden Equipment Replacement Project, with an additional $1 million in fiscal year 2010-11. In fiscal year 2011-12, ARB shifted zero-emission lawn mower replacement projects to the Carl Moyer Program in part based on the success of AQIP Lawn and Garden Equipment Replacement Project.

Program Status as of May 1, 2012

To date, a total of 12,403 mowers have been replaced (Table 8). AQIP funds expanded local air district programs by requiring districts to provide match funding, which resulted in the replacement of an additional 8,645 lawn mowers.

Table 8. Lawn and Garden Equipment Replacement Project Summary

District	Fiscal Year	Grant Award	Mowers Replaced[1]	Project Status
Antelope Valley Air Quality Management District	2009-10	$ 10,000	50	Complete
	2010-11	$ 10,000	39	Ongoing
Bay Area Air Quality Management District	2010-11	$ 182,025	0	June 2012 Exchange event
Mojave Desert Air Quality Management District	2009-10	$ 10,000	50	Complete
	2010-11	$ 50,000	242	Ongoing
South Coast Air Quality Management District	2009-10	$ 816,000	4,690	Complete
	2010-11	$ 494,314	2,493	Complete
San Diego Air Pollution Control District	2009-10	$ 150,000	648	Complete
San Joaquin Valley Air Pollution Control District	2009-10	$ 464,000	1,671	Complete
	2010-11	$ 183,661	735	Complete
Sacramento Metropolitan Air Quality Management District	2009-10	$ 75,000	682	Complete
	2010-11	$ 65,000	538	Complete
Ventura County Air Pollution Control District	2009-10	$ 50,000	225	Complete
Yolo-Solano Air Quality Management District	2009-10	$ 25,000	235	Complete
	2010-11	$ 15,000	105	Ongoing
Total		**$2,600,000**	**12,403**	

F. Hybrid Off-Road Equipment Pilot Project

Overview

The goal of the Hybrid Off-Road Equipment Pilot Project is to accelerate deployment of commercialized hybrid construction equipment while evaluating the emissions benefits of the equipment in real world applications. The project deployment element provides funding for up to half the incremental cost of fully commercialized hybrid off-road equipment. This project will help provide the foundation for growth in the hybrid off-road equipment fleet by spurring initial deployment of commercialized (but more expensive) hybrid equipment and providing fleets with experience using and maintaining this new technology.

ARB assembled the Hybrid Off-Road Equipment Work Group, including equipment manufacturers, fleets, and other stakeholders to identify commercially available hybrid equipment eligible for participation in the Hybrid Off-Road Equipment Pilot Project. Only 2 equipment makes/models were determined to be commercially available for California purchase in early 2011 – the Caterpillar D7E dozer and the Komatsu HB215-LC-1 excavator. Hybrid equipment in the demonstration phase of commercialization is not eligible for this project. The dozer's and excavator's respective $75,000 and $28,500 voucher amounts reflect approximately one-half of the hybrid equipment's incremental cost.

The CE-CERT was competitively selected in June 2011, to administer both the voucher distribution and emission testing elements of the Hybrid Off-Road Equipment Pilot Project. The goals of the project testing element are to determine oxides of nitrogen, particulate matter, total hydrocarbon, carbon monoxide, and carbon dioxide emission benefits of funded equipment relative to its non-hybrid counterpart. Equipment characterization and emissions testing are to be conducted on 3 hybrid Komatsu HB215-LC-1 excavators and 3 hybrid Caterpillar D7E dozers in a variety of typical vocations. In April 2012, CE-CERT began collecting activity data on funded equipment to develop appropriate in-use equipment duty cycles. CE-CERT is scheduled to complete emissions testing by late 2012 or early 2013. Table 9 details Hybrid Off-Road Equipment Pilot Project funding available for the equipment deployment and testing elements.

Table 9. Off-Road Hybrid Pilot Project Funding Distribution

	Project Implementation	Project Administration	Total
Hybrid Equipment Deployment	$ 901,578	$ 98,842	$1,000,420
Hybrid Equipment Testing 1. *Activity Characterization* 2. *Sequence of Operations/ Test Cycle Development* 3. *In-Use Emissions Testing* 4. *Data Analysis and Final Report*	$ 905,308	$ 94,272	$ 999,580
Total	**$1,806,886**	**$193,114**	**$2,000,000**

Program Status as of May 1, 2012

Since the project's launch in August 2011, vouchers for 15 pieces of equipment totaling $846,000 have been issued. Tables 10 and 11 provide cumulative summary of vouchers issued by eligible equipment type and voucher distribution by air district.

Table 10. Vouchers Issued By Equipment Make/Model (Completed and In-Progress)

Vehicle Type	Vouchers Issued	Total Voucher Funds	Average Voucher Amount	Average Equipment Purchase Price
Caterpillar Hybrid D7E Dozer	9	$675,000	$75,000	$614,380
Komatsu Hybrid HB215-LC-1 Excavator	6	$171,000	$28,500	$288,389
Total	**15**	**$846,000**	**$56,400**	**$483,984**

Table 11. Voucher Distribution by Air District

Location of Participating Fleet	Number of Vouchers	Total Funding
South Coast Air Quality Management District	5	$375,000
San Diego County Air Pollution Control District	4	$207,000
Bay Area Air Quality Management District	2	$150,000
Sacramento Metropolitan Air Quality Management District	2	$ 57,000
San Joaquin Valley Air Pollution Control District	1	$ 28,500
Shasta County Air Quality Management District	1	$ 28,500
Total	**15**	**$846,000**

Table 12 describes the California early adopter fleets that are participating in the Hybrid Off-Road Equipment Pilot Project. These fleets' early investment in hybrid construction equipment is helping lay the foundation for development of additional hybrid equipment models, greater consumer acceptance of this technology, and the eventual widespread commercialization of zero- and near-zero- equipment needed to meet California's air quality and climate change goals.

Table 12. Voucher Distribution by Fleet

Purchasing Fleet	Number of Vouchers	Total Funding
Hybrid Caterpillar D7E Dozer		
Waste Management	1	$ 75,000
Orange County Water District	2	$150,000
Republic Services, Incorporated	5	$375,000
Riverside County	1	$ 75,000
Hybrid Komatsu Excavator		
Road Machinery, Limited Liability Corporation	4	$114,000
Clairemont Equipment	2	$ 57,000
Total	**15**	**$846,000**

G. Agricultural Utility Terrain Vehicle Rebate Project

In fiscal year 2009-2010, AQIP allocated $1.1 million to the Zero-Emission Agricultural Utility Terrain Vehicle Rebate Project with the purpose of accelerating the deployment of zero-emission work vehicles for use in California agricultural operations. Eligible vehicles included zero-emission all-terrain and utility vehicles that satisfied specified horsepower, vehicle weight, payload limit, and tow capacity criteria. Over the course of the project, 41 vehicle models were approved for rebates, ranging from $1,374 to $5,250 per vehicle. Initially, the project provided rebates for 15 percent of the manufacturer's suggested retail price, up to $2,500 per vehicle (which corresponded to about half the vehicle incremental cost) to qualified individuals and entities. The rebate amount was increased from 15 percent to 25 percent of manufacturer's suggested retail price in September 2010 to further spur demand. However, even with the increased rebate amount the project did not provide enough money to encourage more agricultural operators to consider purchase a zero-emission utility terrain vehicle rather than a gasoline or diesel powered engine. As a result of insufficient consumer interest and expenditure deadlines, the project closed on December 31, 2011, and remaining funds were returned to AQIP.

The San Joaquin Valley Air Pollution Control District was selected through competitive solicitation to administer the rebate project statewide on a first-come, first-serve basis. The San Joaquin Valley Air Pollution Control District's responsibilities included evaluating and processing rebates, consumer outreach and education, project website development and maintenance, data reporting, and other duties associated with the day-to-day implementation. ARB's responsibilities included program development and oversight, updating the Implementation Manual, evaluating and approving eligible vehicles, verifying consumer compliance with rebate terms, and contract management and administration.

The San Joaquin Valley Air Pollution Control District issued a valley-wide and statewide press release with the help of ARB to launch the program. To promote the rebate project and to inform interested stakeholders, an advertisement for the Zero-Emission Agricultural Utility Terrain Vehicle Rebate Project was featured in the February and March issues of the Ag Source magazine (the premiere magazine of the World Ag Expo) to coincide with the World Ag Expo in Tulare, California. In addition, the San Joaquin Valley Air Pollution Control District contacted vehicle dealers on a routine basis to get feedback on the program. District staff also communicated with purchasers about their vehicles and experience. Two owners of Polaris Ranger Electric Vehicles spoke favorably about their all electric vehicles — enjoying reduced maintenance and battery life that lasted an entire work day. The San Joaquin Valley Air Pollution Control District suggests that the biggest hurdle was the amount of the incentive since the rebate was insufficient to cover the incremental cost.

Between February 1, 2010 and December 31, 2011, 56 rebates totaling $134,509 were issued. Table 13 presents the regional distribution of the rebates issued. As shown in

Table 14, the majority of the rebates were issued to individuals and about a third of the total rebates were provided to businesses.

Table 13. Rebates by Air District

Local Air Districts	Number of Rebates	Total Rebates	Total Dollars Spent	Total Dollars Spent	Project Dollars Spent
San Joaquin Valley Air Pollution Control District	18	32%	$ 43,407	32%	4.4%
Northern Sonoma County Air Pollution Control District	10	18%	$ 24,526	18%	2.5%
Bay Area Air Quality Management District	7	13%	$ 15,702	12%	1.6%
Feather River Air Quality Management District	5	9%	$ 2,180	9%	1.2%
San Luis Obispo Air Pollution Control District	3	5%	$ 7,105	5%	0.7%
Siskiyou Air Pollution Control District	2	4%	$ 5,975	4%	0.6%
San Diego Air Pollution Control District	2	4%	$ 5,150	4%	0.5%
Shasta Air Quality Management District	2	4%	$ 4,284	3%	0.4%
Ventura Air Pollution Control District	2	4%	$ 4,152	3%	0.4%
Colusa Air Pollution Control District	1	2%	$ 2,750	2%	0.3%
Santa Barbara Air Pollution Control District	1	2%	$ 2750	2%	0.3%
Yolo-Solano Air Quality Management District	1	2%	$ 2,499	2%	0.3%
Northern Sierra Air Quality Management District	1	2%	$ 2,499	2%	0.3%
South Coast Air Quality Management District	1	2%	$ 1,605	1%	0.2%
Total	**56**	**100%**	**$134,509**	**100%**	**13.4%**

Table 14. Rebates by Applicant Type

Type of Applicants	Rebates Issued	Percentage of Total Distributed
Private individual or sole proprietor	38	68%
California Licensed Business	18	32%
Total	**56**	**100%**

H. Air Quality Loan Program for Trucks

Background

The California Legislature directed an appropriation of first year AQIP funds for use in establishing a loan assistance program to aid small business fleet owners affected by ARB's In-Use Truck and Bus Regulation and the Tractor-Trailer Greenhouse Gas Regulation. Formally known as the Providing Loan Assistance for California Equipment program, about $35 million is available to assist truckers. To date, ARB has implemented two Providing Loan Assistance for California Equipment program components:

- $21.3 million for a Truck Loan Assistance Program implemented in partnership with the California Pollution Control Financing Authority; and
- $714,000 for a Pilot Revolving Loan/Lease-to-Own Program implemented by Cascade Sierra Solutions.

Providing Loan Assistance for California Equipment program expands ARB's portfolio of air quality grant programs, providing additional opportunities to fund heavy-duty vehicle projects and to maximize a finite amount of State funding available for air quality incentives. On its own or coupled with ARB's traditional grant programs, the program is designed to specifically assist small business owners that face difficulty obtaining affordable financing, particularly during California's economic downturn and tight credit market. This innovative financial assistance program is an integral tool in bridging the financing gap for fleet owners that receive other ARB grant funding but still require some level of additional financing; for fleet owners that do not receive grant funding due to program oversubscription; or for projects that do not meet grant program requirements.

Program Performance

The first program component is a Truck Loan Assistance Program developed in partnership with the California Pollution Control Financing Authority within the State Treasurer's Office. Launched in April 2009, this component builds on California Pollution Control Financing Authority's highly successful California Capital Access Program, which provides a stable financing structure enabling lenders to provide competitive-rate loans to small businesses that fall just outside of conventional underwriting standards. Eligible borrowers seeking a lease-to-own option can now also finance truck purchases through Terminal Rental Adjustment Clause leases as a result of recent legislation (Senate Bill 225; Chapter 492, Statutes of 2011). In the second program component, ARB successfully demonstrated a Pilot Revolving Loan/Lease-to-Own Program administered by Cascade Sierra Solutions, a non-profit organization dedicated to saving fuel and reducing emissions from heavy-duty diesel vehicles. The pilot launched in 2009, and all funds were spent within a year. As of May 1, 2012, approximately $13 million in Providing Loan Assistance for California Equipment

program funds has been leveraged to provide $85 million in financing for the purchase of nearly 1350 cleaner trucks and about 350 exhaust retrofits.

Future Expectations

Last year ARB staff redirected approximately $12 million from the first year AQIP funds to pursue the development of a Direct Loan Program that would target the same credit-challenged borrowers as the other Providing Loan Assistance for California Equipment program components but provide ARB more direct control over interest rates and other loan terms. Due to constraints in internal resources necessary to support the program's fiscal infrastructure, this program component has been suspended. These funds are being redirected as follows: $9 million to the Providing Loan Assistance for California Equipment program and $3 million to the Clean Vehicle Rebate Project. At the current expenditure rate, ARB staff estimates remaining funds along with the additional $9 million will last through June 2013 and therefore does not propose additional funding for the Providing Loan Assistance for California Equipment program in the proposed Fiscal Year 2012-2013 Funding Plan. Staff will reevaluate the need for additional funding in next year's Funding Plan.

Appendix B

AQIP Program Benefits and Coordination with Other Agencies

A. Program Benefits

California's air quality challenges require the development and widespread deployment of zero- and near-zero-emission technologies. Preliminary evaluations predict that to meet these goals California will need to see a fundamental transformation of the transportation sector. Sales of conventional technology light-duty vehicles will need to end by 2040 with new sales consisting primarily of fuel cell, battery electric and plug-in hybrid electric vehicles. The overall light-duty fleet fuel economy will need to double by 2050. A similar transformation will need to occur in the heavy-duty sector with sales of conventional vehicles for in-state fleets ending by 2040 and reduced by 75 percent by 2050 for the interstate fleet. The heavy-duty fleet will need to recognize a minimum of a 175 percent increase in fuel economy by 2050. To achieve this, battery electric and hybrid trucks must penetrate the market early to pave the way for wide scale adoption of these technologies and provide a base for even more advanced technologies, such as fuel cell vehicles.

AQIP provides a modest down payment on the technologies needed to meet these needs with a focus on stimulating the widespread use of these technologies. AQIP projects provide both immediate emission reductions from the vehicles directly funded and, more importantly, set the stage for greater, indirect reductions in the future by accelerating large-scale market penetration. These longer-term program benefits accrue primarily from overcoming deployment barriers and accelerating technology transfer.

<u>Overcoming Deployment Barriers</u>

Significant barriers are involved when transitioning advanced technologies to widespread use in the marketplace. These barriers include, among others, the higher purchase price of the advanced technology, consumer acceptance and technology confidence, technology limitations (such as range for electric vehicles), and new infrastructure needs. AQIP funding is critical in providing assistance to overcome some of these barriers. AQIP's two main deployment projects, the Clean Vehicle Rebate Project and the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project, provide funds to partially offset the higher costs of cleaner vehicles. These benefits are provided directly to the consumer, encouraging a purchase decision that may not have occurred without the incentive. This allows the vehicle to become more cost-competitive since most consumers are reluctant to make purchasing decisions with a payback period of longer than three years. The direct incentive provides ancillary benefits to the manufacturers of these clean vehicles by increasing sales with the prospect of reducing production costs through economies of scale.

Providing a positive user experience is important to promote consumer acceptance of advanced technologies and the transition from early adopters to mainstream consumers. Mainstream purchasers are cautious about investing in new technologies that they do not fully understand. Initial consumer experience with advanced technology vehicles can play a significant role in changing perspectives for the

conventional market. By providing incentives early, more consumers are able to experience the technology at a critical time in bringing the technologies to market. These experiences can be marketed by consumer groups, manufacturers, and advocates bringing awareness to the public and fleet purchasers. Recognizing this benefit, refinements were made to the Clean Vehicle Rebate Project last year to include special provisions for car share and rental fleets since these vehicles have the opportunity to reach more consumers. Outreach continues to be a critical element of all AQIP projects and staff is investigating opportunities to better incorporate user feedback to help address consumer confidence.

Infrastructure Coordination

ARB and the Energy Commission have made a coordinated effort to ensure that both agencies' Assembly Bill 118 programs complement each other, with the authority to fund infrastructure residing in the Energy Commission's Alternative and Renewable Fuel and Vehicle Technology Program. According to the 2011 Integrated Energy Policy Report (California Energy Commission, 2011), projects funded through 2011 increased the number of electric vehicle charging stations in California by 244 percent and hydrogen fueling stations by 100 percent. In the first 4 Investment Plans, the Energy Commission has made significant investments in both electric charging infrastructure ($24.4 million) and public hydrogen fueling stations ($37.4 million). Additional commitments in the Fiscal Year 2012-13 Investment Plan include $7.5 million for electric charging infrastructure and $11 million for hydrogen fueling infrastructure. These investments help establish the infrastructure foundations for these vehicle types. The early establishment of these fueling networks as well as the consumer incentives for vehicles signals California's ongoing commitment to these advanced technology vehicles.

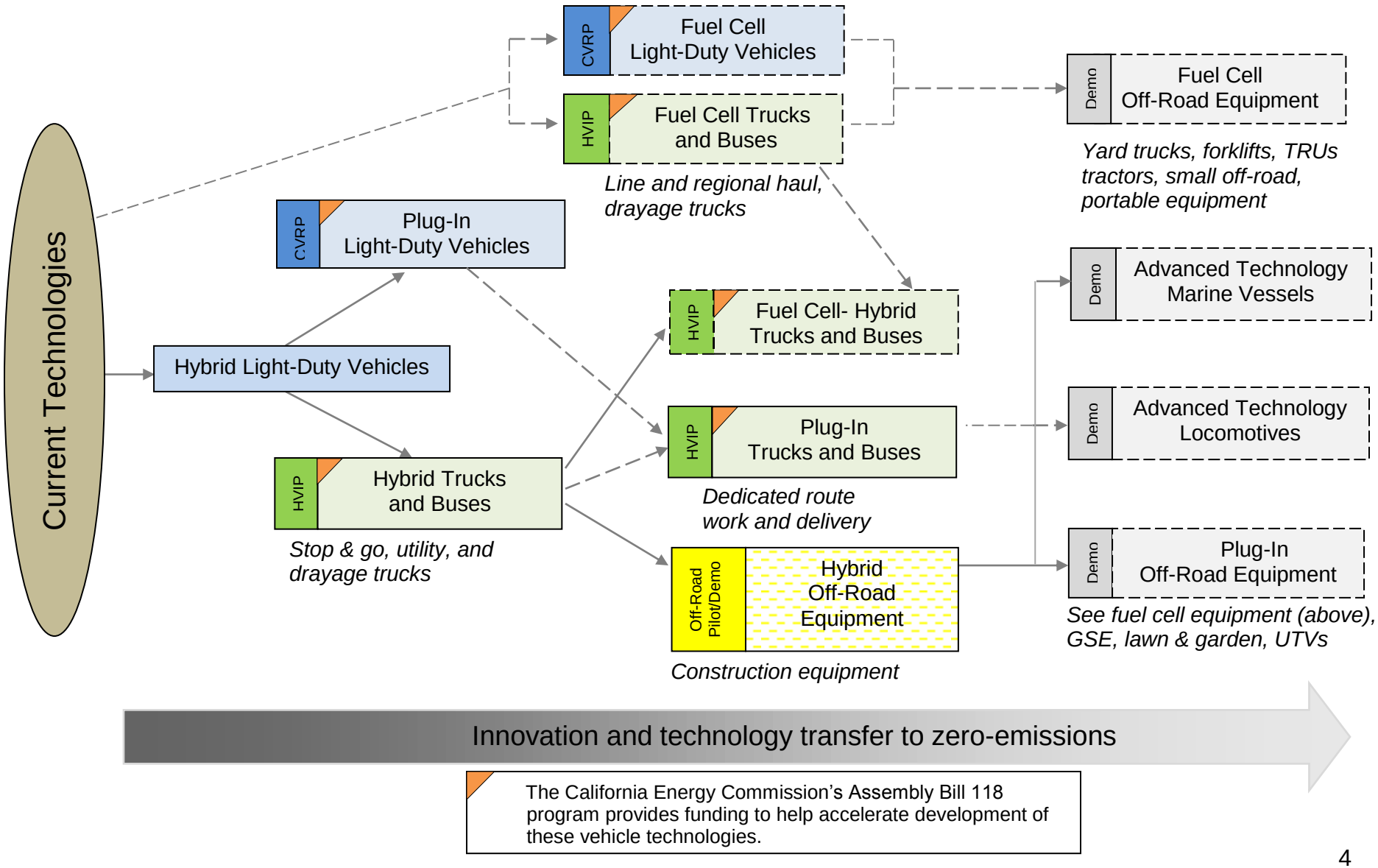
Accelerating Technology Transfer

AQIP helps to accelerate technology transfer to other sectors, such as promoting the transfer of on-road zero-emission and hybrid technologies to off-road equipment and marine vessels. While advances are still needed in the on-road transportation sector, these current technologies will need to make the leap into the other sectors to achieve long-term air quality goals. Figure 1 displays AQIP's role in advancing clean vehicle and equipment technologies. For example, light-duty hybrid electric vehicle technology was the starting point for advancing hybrid technology to the heavy-duty on-road and off-road sectors. Simultaneously, a demonstration of hybrid technology in marine vessels as occurred. AQIP invested in all levels of this technology transfer with the on-road heavy-duty deployment project through the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project, the off-road hybrid pilot project, and a marine demonstration project.

AQIP investments help to bring the cleanest advanced technologies to California and also help position the State for green job growth. Some of the vehicles or vehicle

components funded under AQIP are manufactured in California, and these vehicles and equipment are distributed through extensive local dealership networks.

Figure 2a: The AQIP's Role in Advancing Clean Vehicle and Equipment Technologies



The California Energy Commission's Assembly Bill 118 program provides funding to help accelerate development of these vehicle technologies.

B. Program Coordination

California Energy Commission

The Energy Commission receives about $100 million annually under Assembly Bill 118 to fund alternative and renewable fuel and vehicle technology projects to reduce greenhouse gas emissions. There is overlap between the vehicle projects that can be funded in each program because many advanced technologies achieve both greenhouse gas and criteria pollutant reductions. For example, Assembly Bill 118 statute lists hybrid and zero-emission technologies as eligible categories in both programs. ARB and the Energy Commission staff closely coordinate implementation of Assembly Bill 118 programs to ensure their respective investments complement one another.

Assembly Bill 118 statute does not authorize ARB to fund vehicle fueling infrastructure through AQIP. That authority resides with the Energy Commission in its Assembly Bill 118 program. The Energy Commission's investments in vehicle charging and fueling infrastructure complement ARB's incentives for clean vehicle deployment. These investments are important to ensure a successful California ZEV rollout. Staff from both agencies coordinate to match fueling infrastructure needs with advanced vehicle deployment projections.

The Energy Commission has also taken a lead in funding workforce training. It has already directed $22.3 million to workforce training projects and allocated an additional $2.5 million investment in the fiscal year 2012-13 funding cycle. ARB is working closely with the Energy Commission to ensure that these training investments support the technologies ARB is funding through AQIP.

ARB and the Energy Commission have jointly funded categories where demand exceeded each agency's available funds. Such pooling of resources is much more efficient than each agency independently providing funding for the same types of projects. In February 2011, the Energy Commission directed $2 million of its Assembly Bill 118 funding to ARB's Clean Vehicle Rebate Project to help meet the expected demand for ZEV rebates. In May 2011, the Energy Commission also directed $4 million to ARB's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project to provide increased incentives for zero-emission truck purchases. The Energy Commission allocated $5 million in the Fiscal Year 2012-13 Investment Plan for possible use by ARB to help meet consumer demand for the Clean Vehicle Rebate Project in fiscal year 2012-13. ARB staff plans to write its AQIP grant solicitations and grant awards with the flexibility to receive Energy Commission funding.

Other Local, State, and Federal Incentive Programs

ARB is implementing AQIP in a coordinated manner with other local, state, and federal air quality programs. Staff designed AQIP projects with as much flexibility as possible

to allow AQIP funds to be combined with other incentives that may become available. For example, the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project vouchers for the purchase of a new hybrid school bus can be combined with Lower Emission School Bus Program funding. In addition, ARB encourages local air districts to coordinate their funding with AQIP. To date, three local air districts – the South Coast Air Quality Management District, Sacramento Metropolitan Air Quality Management District, and the San Joaquin Valley Air Pollution Control District– have made investments in voucher programs following the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project model established in AQIP. In March 2012, the San Joaquin Valley Air Pollution Control District re-launched their zero-emission vehicle incentive program which coordinates more closely with the Clean Vehicle Rebate Project and includes funding for electric vehicle charging infrastructure. These local investments further leverage the State's investment and will bring additional clean vehicles to California.

As new opportunities unfold, staff will evaluate ways to leverage AQIP funds – either as a match to obtain federal funds to augment California's air quality programs or through opportunities to fold other local, state, or federal funding into AQIP.

Appendix C

Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project- Early Role in Long-Term Emission Reduction Strategies and Deployment Challenges

Deployment Challenges

Dozens of hybrid and zero-emission truck and bus makes and models from multiple vehicle manufacturers are now commercially available, in vocations including delivery vehicles, utility vehicles, refuse haulers, tractors, and transit, shuttle and school buses. However, the recent decline in Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project demand illustrates that significant barriers to these vehicles' widespread commercialization remain. The staff proposal in this Funding Plan is geared towards further incentivizing development and deployment of the cleanest possible truck and bus technologies. This Appendix identifies some of the key hybrid and zero-emission truck and bus deployment challenges and steps being taken to address them.

Incremental cost. Calstart's e-Truck Task Force, created to identify and address barriers to electric truck deployment, found technology cost to be fleets' greatest concern.[1] The e-Truck Task Force recommendation that incentives provide roughly half the incremental cost of zero-emission trucks is proposed as part of this Funding Plan.

As with battery-electric vehicles, incremental cost is a significant barrier for hybrid vehicles as well. The proposed Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project voucher structure provides additional funding only for those vehicle manufacturers that ensure their vehicles achieve and maintain the expected emission benefits. Staff is proposing hybrid truck and bus manufacturers receive significantly higher voucher amounts if they: 1) quantify their vehicle's emission benefits by voluntarily Air Resources Board (ARB)-certifying their vehicles, and/or 2) comply early with ARB's Heavy-Duty Vehicle On-Board Diagnostics requirement to ensure vehicle emission controls continue to function over time.

Infrastructure and electricity costs. The cost to install electric truck charging infrastructure can range from $1,500 to $10,000 per charging station, depending upon infrastructure location, amount of conduit needed, and other factors.[2] While AQIP is not authorized to fund charging infrastructure, the Energy Commission Assembly Bill 118 program provides charging infrastructure funds to complement ARB vehicle technology incentives. ARB staff will continue working with the Energy Commission to balance the need to promote public charging infrastructure (which benefits primarily light-duty vehicles) and commercial charging infrastructure needs.

Electricity demand charges, which charge a higher electricity rate once a usage threshold has been exceeded, can also provide a disincentive for fleets' shift to electric vehicle usage. Some fleets have indicated they have limited the number of electric vehicles they will purchase due to their electricity rate structure. Some have been able to address this issue by negotiating new rate structures with their utility. To fully address this issue, ARB will work with stakeholders to simultaneously encourage

[1] Best Fleet Uses, Key Challenges, and the Business Case for e-Trucks, Findings and recommendations of the e-Truck Task Force; Calstart; 2012; http://www.calstart.org/projects/E-Truck-Project/E-Truck-Task-Force-White-Paper.aspx .

[2] Idem.

energy efficiency and California's shift from liquid transportation fuels to clean, electric vehicle technologies.

Fuel economy uncertainties. Some fleets have stated their hybrid truck fuel economy benefits have been lower than expected. However, fuel economy benefits of hybrid trucks are driver and route dependent. Fleets are beginning to recognize the value of identifying optimal vehicle routes and driver training to maximize fuel economy. Hybrid vehicles have employed the same general driveline technology since the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project's inception in 2010. Next generation hybrid-electric drivelines will need to provide higher fuel economy at reduced costs to significantly increase this technology's market share.

ARB is in the final stages of entering into a $700,000 AQIP contract with the United States Department of Energy National Renewable Energy Laboratory, approved by the Board in Fiscal Year 2011-12 Funding Plan, to evaluate emission benefits of the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project funded hybrid truck technologies. Hybrid vehicle greenhouse gas, criteria pollutant, and fuel economy benefits will be part of this United States Department of Energy National Renewable Energy Laboratory evaluation. This information will feed into United States Department of Energy National Renewable Energy Laboratory's Fleet DNA Project, designed to capture and characterize data from various vocations to further vehicle design and strategic deployment. This data will help manufacturers improve vehicle performance and fleets identify how and where vehicles should be employed to minimize their payback period. ARB is evaluating development of an on-line calculator to help fleets identify which technology provides the greatest payback for their specific vehicle vocations and/or routes.

Performance data needs. Some fleet managers have expressed concern about purchasing their first hybrid or zero-emission truck or bus without credible, unbiased information about a vehicle's performance and benefits. Fleets need better performance data on hybrid and zero-emission trucks to validate the reliability and business case of the vehicles, including guidance on best use profiles for their operation. ARB is evaluating the potential for existing Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project participants to provide feedback on their hybrid or electric truck via the project webpage or database to potential new vehicle purchasers, much like users rate and comment on their purchases from on-line retailers. ARB is also participating in Calstart's Hybrid, Efficient and Advanced Truck Technology Roadmap and other forums to identify and address barriers to advanced technology vehicle deployment.

Manufacturers must also better educate vehicle purchasers regarding how and where hybrid and zero-emission vehicles provide the most benefits, and where these vehicles may not be the best choice. For example, while hybrids generally work best in urban environments, large hydraulic hybrid door-to-door refuse haulers may work better in suburban environments where longer distances maximize opportunity for hydraulic system generation between stops.

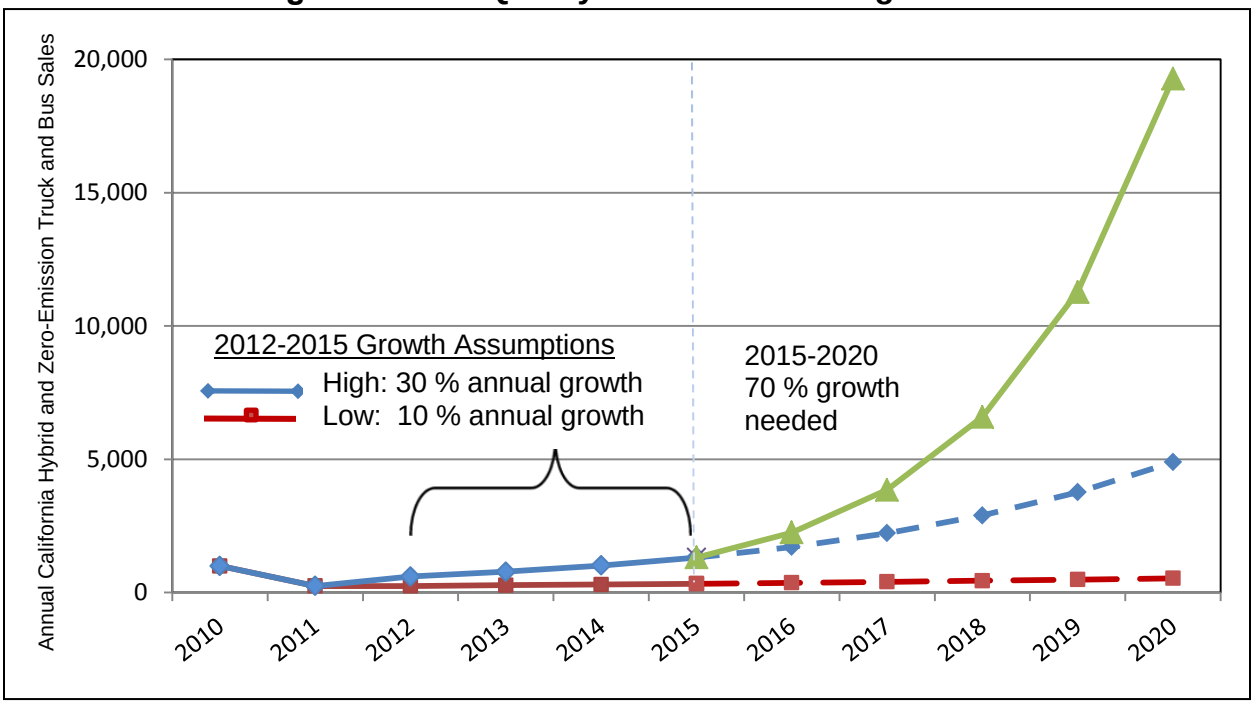
Market saturation among early adopters. Six early adopter national fleets have driven Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project demand thus far, receiving 80 percent of the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project funding as of May 1, 2012. Most of these fleets responded to the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project launch by replacing their older California urban vehicle fleet with new hybrids in early 2010. Some early participants indicate that they have 'saturated' their California fleet with hybrids out of concern that first year the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project funds would be depleted quickly, and indicate they are now more cautiously evaluating which advanced technologies work best for them and where to invest their vehicle funding. Other similar incentive programs in Texas, New York, and other states, now also provide competing regions in which these companies can now invest their limited advanced technology truck funding. In the long term, these other programs will help increase hybrid technology volumes and reduce technology costs. However, California's continued investment in advanced technology truck and bus incentives is critical to ensuring our state remains a primary destination for these vehicles. In the near term, staff's proposal for a fleet's first 3 Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project vouchers to receive up to an additional $10,000 helps make the business case for additional fleets that could benefit from hybrid and zero-emission technology to participate in the program.

Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project Role in Meeting Air Quality and Climate Change Goals

ARB is developing a vision document, along with the South Coast Air Quality Management District the San Joaquin Valley Air Pollution Control District, and other stakeholders, describing possible technology scenarios for meeting California's new federal 8-hour ozone standard in the 2030 timeframe and achieving 80 percent greenhouse gas emission reductions by 2050 pursuant to Governor's Executive Order S-03-05. Because truck and bus natural turn-over rates are so slow, a significant increase in hybrid and zero-emission truck and bus deployment is needed over the next several years to meet these longer term goals.

Preliminary analyses indicate close to 20,000 new hybrid and zero-emission vehicles will need to be purchased annually statewide by 2020 (Figure 3a) to achieve the market penetration needed in 2030 and 2050. These figures represent 5 to 10 percent of 2020 model year heavy- and medium-duty vehicle sales. Figure 3b identifies possible scenarios for achieving these sales volumes. The low growth scenario assumes a 10 percent annual growth in hybrid and zero-emission sales volumes and a $10 million to $15 million Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project investment through 2015. The high growth scenario assumes 30 percent annual sales growth driven largely by about $30 million per year in the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project, air district, and other complementary incentives, and aided by gradually declining vehicle technology costs.

Figure 3a. Advanced Technology Truck and Bus Penetration Needed to Achieve California's Longer-Term Air Quality and Climate Change Goals



Production capacity has substantial growth potential for both hybrid and electric trucks and buses, but current low production volumes contribute to a $25,000 to $80,000 vehicle cost premium for hybrid trucks and up to $120,000 cost premium for zero emission trucks. ARB expects production costs to decline as hybrid driveline and battery production volumes increase. When this occurs, the fuel economy payback period should shorten to the point where a hybrid or zero-emission truck purchase is economical without incentives (Figure 3b). Even when this tipping point is reached, however, additional incentives or regulatory approaches may be needed for sales volumes to reach levels needed to meet California's long-term air quality and climate change goals.

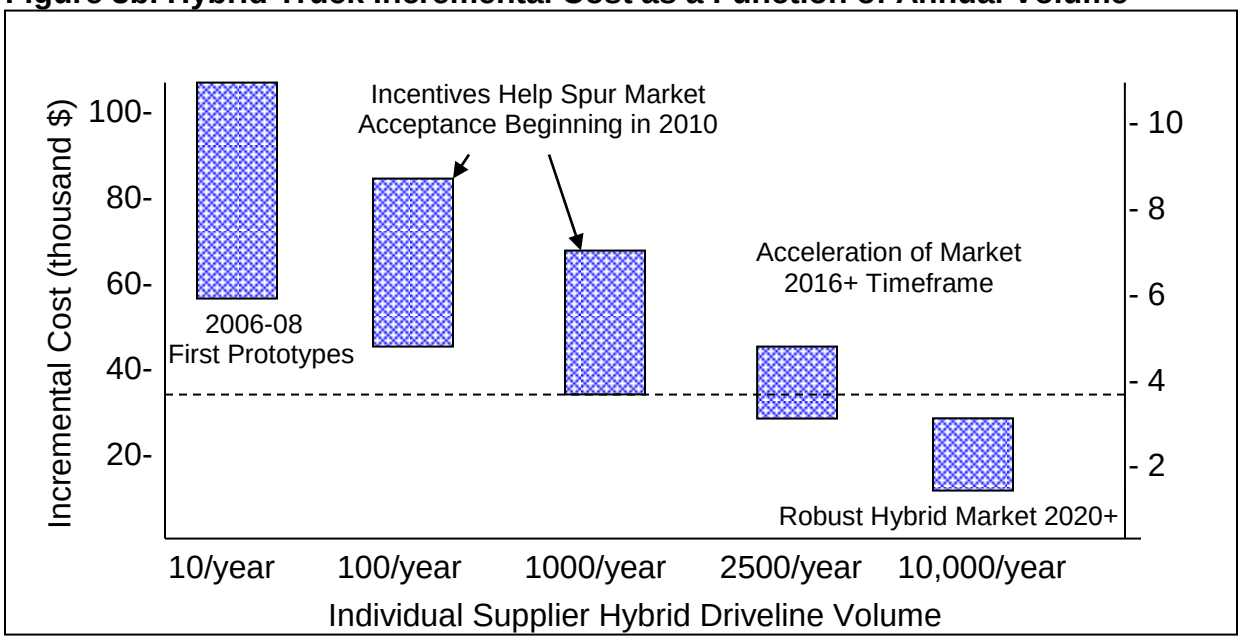



Figure 3b. Hybrid Truck Incremental Cost as a Function of Annual Volume