



California Energy Commission Clean Transportation Program

# FINAL PROJECT REPORT

# NORCAL Alternative Fuels and Advanced Vehicle Technology Center

Prepared for: California Energy Commission Prepared by: CarbonBlu, LLC



Gavin Newsom, Governor January 2020 | CEC-600-2020-015

# **California Energy Commission**

### Sedale Turbovsky Primary Author(s)

CarbonBlu, LLC PO Box 2731 Rocklin, CA 95667 (916) 543-5230 <u>CarbonBlu Website</u> (http://www.carbonblu.com/)

### Agreement Number: ARV-14-005

Tomas Ortiz Project Manager

Elizabeth John Office Manager ADVANCED VEHICLE TECHNOLOGIES OFFICE

Kevin Barker Deputy Director FUELS AND TRANSPORTATION

Drew Bohan Executive Director

#### Disclaimer

Staff members of the California Energy Commission prepared this report. As such, it does not necessarily represent the views of the Energy Commission, its employees, or the State of California. The Energy Commission, the State of California, its employees, contractors and subcontractors make no warrant, express or implied, and assume no legal liability for the information in this report; nor does any party represent that the uses of this information will not infringe upon privately owned rights. This report has not been approved or disapproved by the Energy Commission nor has the Commission passed upon the accuracy or adequacy of the information in this report.

# PREFACE

Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007) created the Clean Transportation Program, formerly known as the Alternative and Renewable Fuel and Vehicle Technology Program. The statute authorizes the California Energy Commission (CEC) to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policies. Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) reauthorizes the Clean Transportation Program through January 1, 2024, and specifies that the CEC allocate up to \$20 million per year (or up to 20 percent of each fiscal year's funds) in funding for hydrogen station development until at least 100 stations are operational.

The Clean Transportation Program has an annual budget of about \$100 million and provides financial support 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.
- 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.

To be eligible for funding under the Clean Transportation Program, a project must be consistent with the CEC's annual Clean Transportation Program Investment Plan Update. The CEC issued PON-13-605 to unify activities that may provide future development and expansion of alternative fuels and advanced vehicle technologies through collaboration with existing and new centers throughout the state. In response to PON-13-605, the recipient submitted an application that was proposed for funding in the CEC's notice of proposed awards April 22, 2014, and the agreement was executed as ARV-14-005 on July 22, 2014.

# ABSTRACT

California's economy supports thousands of commercial and public fleets statewide. The stateowned fleet alone includes more than 39,000 vehicles and pieces of equipment. Outside the public sector, various California businesses and organizations own and operate major private fleets. Several California fleets are early adopters of compressed natural gas and other alternative fuels. However, the vast majority of existing fleet vehicles are still fueled by conventional fossil diesel or gasoline, leaving significant potential for converting existing fleets to alternative fuels and alternative vehicle technologies. The project sought to develop, launch, and operate the NORCAL Alternative Fuels and Advanced Vehicle Technology Center to help support greater fleet transition to alternative fuels and advanced vehicle technologies.

In all, the project was highly successful in developing and operating the center, which completed full-fleet analyses for 23 public and private fleets statewide, representing 41,749 pieces of equipment and vehicles analyzed. When completed, the conversion efforts emanating from this work will support average emissions reductions of about 62 percent for fully participating fleets. Efforts completed to date have supported a 37 percent average reduction in emissions for fleets that have begun implementing their fleet transformation plans. Through target outreach, event-based outreach, trainings, and online education, the project team completed education and outreach to 980 individuals while maintaining a Web presence that includes immediately useful research and educational material and tools. In spite of a reduced scope of work compared to the original proposal, a yearlong contracting-related delay during implementation, the carbonBLU team has completed a highly successful project that is set to continue operations independently for the near future. The project team also expanded its reach well beyond its initial intended target of Northern California, having reached into Southern California to support fleet analysis, grant program development, and collaboration with other relevant industry organizations.

**Keywords**: Alternative fuels, alternative vehicle technologies, Center for Alternative Fuels, fleet analysis, fleet optimization, Northern California

Please use the following citation for this report:

Turbovsky, Sedale. CarbonBLU, LLC. 2020. *NORCAL Alternative Fuels and Advanced Vehicle Technology Center.* California Energy Commission. Publication Number: CEC-600-2020-015.

# **TABLE OF CONTENTS**

	Page
Preface	i
Abstract	ii
Table of Contents	iii
List of Figures	iv
List of Tables	v
Executive Summary	1
Introduction	1
Project Purpose	1
Project Implementation	1
Project Results	2
Benefits, Outcomes, and Next Steps	5
CHAPTER 1: Why This Paper Is Important	7
Project Overview	7
Project Aims and Successes	7
Future Implications	7
Relevance to Key Parties	8
CHAPTER 2: Introduction	9
Recipient Background	9
California Fleets	9
Key Alternative Fuels Barriers in California	9
Cost and Efficiency of Alternative Fuels	10
Alternative Fuels Integration for Small to Midsized Fleets	10
Regulatory Challenges	10
Purpose and Need for the Project	10
Project Benefits	11
CHAPTER 3: Project Goals and Objectives	
Project Goals	12
Project Objectives	12
CHAPTER 4: Project Approach	13
Fleet Analysis and Optimization	13
BLUprint Brief	13
BLUprint Fleet Assessment	14
Solutions Made Available Through Project Network	14
Project Implementation	
Center Preparation	16

Center Operations1	6
Targeted Outreach, Education, and Training1	6
Fund Development Activities1	17
Data Collection and Analysis1	17
CHAPTER 5: Project Results1	.8
Fleet Analysis1	8
Funds Identified	21
Education, Training, and Outreach	23
Fleets Served2	25
Facilities Development	25
Virtual Center/Web Development	26
Brick and Mortar Center	28
Collaborations and Partnerships	28
Jobs Developed2	28
CHAPTER 6: Project Outcomes and Recommendations2	9
Project Benefits and Lessons Learned	29
Summary of Project Outcomes	29
Key Lessons Learned	30
Conclusions	31
Recommendations and Next Steps	31
Ongoing Barrier to Adoption: Aggregated Purchase to Improve Fleet Economics	31
Communication Gap	32
Glossary	3
APPENDIX A: Sample BLUprint Brief Report	1
Sustainable Fleet Report	.2
Current Fleet Overview	.3
On-Road and Off-Road Inventory, Use, and Emissions	.4
VEHICLE USE	.6
RECOMMENDATIONS	.6
APPENDIX B: New Intake Sheet	1

# **LIST OF FIGURES**

Page

Figure ES-1: Total Vehicles Analyzed Under the Project	3
Figure ES-2: Total Anticipated Future Project Emissions Reductions	4
Figure 1: Total Vehicles Analyzed Under the Project	18
Figure 2: Project Emissions Reductions Achieved to Date	19
Figure 3: Total Anticipated Future Project Emissions Reductions	21

Figure 4: Total Funds Identified	22
Figure 5: Number of People Trained	23
Figure 6: Google Classroom Training Platform	24
Figure 7: Center Website Splash Page	26
Figure 8: Center Website Services Selection Page	27
Figure 9: Center Website Improved Virtual Classroom	27

# LIST OF TABLES

Page

Table ES-1: Summary of Anticipated Benefits and Project Outcomes	5
Table 1: Summary of Anticipated Benefits and Project Outcomes	29

# **EXECUTIVE SUMMARY**

# Introduction

California's economy supports thousands of commercial and public fleets statewide. The stateowned fleet alone includes over 39,000 vehicles as well as pieces of transportation and construction equipment. Outside of the public sector, major private fleets are owned and operated by California utilities, manufacturers, transportation industry operators, port tenants, construction companies, sanitation companies, healthcare industry, pest control managers, agricultural suppliers, and various other organizations. Several California fleets are early adopters of compressed natural gas and other alternative fuels. However, the vast majority of existing fleet vehicles are still fueled by conventional fossil diesel or gasoline, leaving significant potential for the conversion of existing fleets to alternative fuels and alternative vehicle technologies.

In close partnership with CALSTART, the Sacramento Clean Cities Coalition, Alternative Fuels Advocates LLC, and Grant Farm, carbonBLU, LLC leveraged \$321,200 in funding from the CEC to develop, launch, and operate the NORCAL Alternative Fuels and Advanced Vehicle Technology Center. The center included the <u>Virtual Center for Alternative Fuels</u> (www.centerforalternativefuels.org) and a "brick-and-mortar" hub at 222 Judah St. in Rocklin (Placer County). The project team developed the project over four years and continues to operate the center, supporting ongoing efforts to help target fleets transition away from conventional fossil-based fuels and technologies.

# **Project Purpose**

With the project, carbonBLU sought to alleviate key barriers to alternative fuels and advanced vehicle technologies among California's fleets:

- Need for developing cost and benefit scenarios, especially for small and moderate-sized fleets
- Need to identify workable and cost-effective strategies for integrating alternative fuels into small and midsized fleets
- Demand for support to manage regulatory challenges relevant to target fleets

To these ends, the center was intended to serve as a much-needed hub for education and adoption of alternative fuels and advanced vehicle technologies. Ultimately, the activities of the center sought to help target fleets develop workable, economically beneficial strategies to use alternative fuel and advanced vehicle fleets to support emissions reduction, fleet optimization, cost savings, and regulatory compliance.

# **Project Implementation**

The project used a variety of fleet-oriented services and infrastructure development (brick and mortar as well as virtual), including:

- **BLUprint Brief** initial fleet assessment, providing an easy-to-read initial feasibility study that provides a snapshot of the emissions footprint of a fleet and current compliance with regulatory requirements. It also offers a customized, high-level strategy for fleet enhancement and ballpark costs for deployment.
- BLUprint Fleet Assessment, wherein fleet managers select one or more potential solutions to explore in a full fleet analysis and optimization evaluation. This process results in the production of a comprehensive report, the BLUprint, which draws on detailed data collection efforts and provides highly tailored, fleet-specific implementation procedures and recommendations.
- **Project Network Solutions**, which leverage the project team's network of alternative fuel and advanced vehicle technology providers that provide various solutions, including alternative fuel conversion, retrofitting, telematics, driver training, fueling infrastructure, and grant identification and development.
- **Virtual Center Preparation**, involving the development of online infrastructure including a website targeted at fleet analytics that enables users to review the various information provided by the center under the project.
- **Brick-and-Mortar Center**, located in Roseville (Placer County), which was intended to serve as a physical hub and meeting place to support the development and use of project services.
- **Center Operations**, including implementation and deployment of various education, outreach, and technical services, all targeted at transitioning fleets to alternative fuels and advanced vehicle technologies.
- **Targeted Outreach, Education, and Training**, wherein the project team sought to perform valuable outreach activities, including hosting and participating in relevant conferences, conducting education events, and providing various training and educational materials.
- **Fund Development** identification intended to help align fleets with potential grant or other funding sources or both to support their transition.

### **Project Results**

The project team completed its first fleet BLUprint in February 2015 and subsequently completed full fleet analyses for 23 fleet operators. These fleets ranged in size from three to 10,088 vehicles/pieces of equipment. In total, the team analyzed 41,749 pieces of equipment. As shown in Figure ES-1, fleets analyzed included a combination of public and private fleets, although the public fleets were considerably larger, overall, than the nonconfidential private fleets.



#### Figure ES-1: Total Vehicles Analyzed Under the Project

Fleet

Source: carbonBLU

Ultimately, as target fleets complete the respective ongoing transitions, the project will support significant emissions reduction. Fleets that have already initiated the transition have already realized, on average, a 37 percent emissions reduction amounting to 44,596 megatonnes of emissions reductions. Figure ES-2 summarizes anticipated future emissions reductions based on commitments made by project participants. As shown, nine out of 12 (or 75 percent) of disclosed project participants will achieve an average emissions reduction of 62 percent compared to baseline (that is, preproject conditions).



#### Figure ES-2: Total Anticipated Future Project Emissions Reductions



Source: carbonBLU

The project also successfully:

- Identified more than \$10 million in funds available to support fleet transition to • alternative fuels and advanced vehicle technologies.
- Trained 980 people through direct training sessions, as well as webinars and online ٠ content.
- Launched a virtual classroom to support remote, on-demand learning. ٠
- Participated in conferences and training sessions with local, statewide, and national • stakeholders.
- Provided detailed analyses to 23 public and private fleets, with sizes from three to more ٠ than 10,000 vehicles/pieces of equipment.
- Developed, launched, and operated the virtual center. •
- Updated, opened, and operated the brick-and-mortar center. ٠

- Leveraged partnerships with regional Clean Cities, Municipal Equipment Maintenance Associaiton (MEMA) NorCal, local community colleges, and other statewide centers and accelerators.
- Directly created four new jobs.

# Benefits, Outcomes, and Next Steps

The project supported multiple successful outcomes, as summarized in Table ES-1, below.

 Table ES-1: Summary of Anticipated Benefits and Project Outcomes

Category/Target	Outcome
Help fleets accurately assess existing carbon emissions and regulatory compliance	Completed full fleet analysis, including identification of baseline emissions, for 23 public and private fleets statewide for 41,749 pieces of equipment analyzed.
Help fleets understand economics of conversion to alternative fuels or advanced vehicle technologies	See previous. Also completed training for 980 persons, including direct training of 80 fleet personnel.
Help fleets measurably reduce emissions, ensure compliance, and save money	Identified likely/anticipated future average emissions reductions of 62% for participating fleets, along with a 37% average reduction in emissions currently, for fleets that have already begun deploying.
Provide tools to fleets to allow them to quantify benefits of conversion, including emissions improvements, petroleum displacement, and return on investment	Tools available through center and virtual center/website. Full fleet analysis, as described previously, was completed for 23 fleets.
Improvements in overall ambient air quality, resulting in improved public health	Fleet conversions completed to date are already reducing air quality emissions and supporting improved public health. These effects are expected to increase as target fleets fully implement fleet plans that were developed under the project.
Increased public awareness of alternative fuels and vehicles	Completed education and outreach to 980 individuals. Maintained a Web presence and completed direct outreach to various fleets and key decision makers.
Increase demonstration and launch of alternative technology fuels and vehicles	Three fleets have already begun implementing the programs suggested by the center, with at least 17 other fleets expected to initiate deployment within the next five years.

Source: carbonBLU

In all, the project was highly successful in demonstrating the effective initiation and use of the center, which completed full fleet analyses for 23 public and private fleets statewide, representing 41,749 pieces of equipment and vehicles analyzed. When fully implemented, the conversion toward alternative fuels and advanced vehicle technologies will support average

emissions reductions of roughly 62 percent for fully participating fleets, or reductions of 139,280 megatonnes. Already, deployment efforts completed to date have supported a 37 percent average reduction in emissions for fleets that have begun implementing their fleet transformation plans. Through target outreach, event-based outreach, trainings, and online education, the project team completed education and outreach to 980 individuals while maintaining a Web presence that includes immediately useful research and educational material and tools. In spite of a reduced scope of work compared to the original proposal, and a yearlong contracting-related delay during implementation, the carbonBLU team has completed a highly successful project that is set to continue operations independently for the near future. The project team also expanded its reach well beyond its initial intended target of Northern California, having reached into Southern California to support fleet analysis, grant program development, and collaboration with other relevant industry organizations.

Recommendations and next steps include:

- 1. Actions to help improve fleet economics by aggregating the purchasing power of multiple fleets to negotiate lower per-vehicle costs.
- 2. Translation of outreach and educational materials into alternate languages to reach additional end users and fleet operators/managers.
- 3. Address existing communication gaps by communicating basic economic information regarding alternative fuel and vehicle systems, to help address administrative and research burdens on fleet managers as when they are attempting to determine which fuels or technologies are most appropriate for their specific requirements and needs.

# CHAPTER 1: Why This Paper Is Important

# **Project Overview**

In close partnership with CALSTART, the Sacramento Clean Cities Coalition, Alternative Fuels Advocates LLC, and Grant Farm, carbonBLU, LLC leveraged \$321,200 in funding from the CEC to develop, launch, and operate the NORCAL Alternative Fuels and Advanced Vehicle Technology Center. The center included the <u>Virtual Center for Alternative Fuels</u> (www.centerforalternativefuels.org) and a "brick-and-mortar" hub at 222 Judah St. in Rocklin (Placer County). The project team developed the project over four years and continues to operate the center, supporting ongoing efforts to help target fleets transition away from conventional fossil-based fuels and technologies.

# **Project Aims and Successes**

The center has served as a virtual and physical hub supporting innovation, education, and adoption of alternative fuels and advanced vehicle technologies throughout California. By providing a variety of valuable technical services—including a powerful fleet analysis and optimization process developed by carbonBLU—the center is helping regional and statewide municipal and private fleet managers:

- 1. Accurately assess their existing carbon emissions and regulatory compliance.
- 2. Fully understand the economics of conversion to alternative fuels or advanced vehicle technologies.
- 3. Take concrete steps that help them measurably reduce emissions, ensure compliance, and save money.

Equally important, the center provides these fleet managers with tools that enable them to quantify and validate accurately many of the benefits of fleet conversion, including improvements in ambient air quality, reductions in carbon dioxide (CO2) and carbon monoxide (CO) emissions, petroleum displacement, and return on investment (ROI).

To date, the center has successfully analyzed and evaluated 41,479 fleet vehicles across 20 fleets ranging in size from three to 10,088 pieces of equipment. Ultimately, when fully implemented, the alternative fuel and alternative vehicle transitions identified by the center will result in about 57 percent average future reduction in emissions. The project also directly created four new jobs and trained and educated 980 people representing cities, state agencies, universities, clean cities coalitions, industry organizations, and private companies.

### **Future Implications**

The project has taken meaningful steps forward, substantiating to key fleet managers and leaders that alternative fuels and alternative vehicle technologies provide cost and emissions

benefits to specific fleets and operating models. The project is intended to serve as a starting point, supporting the ongoing transition of fleets away from fossil fuels and toward alternative fuels and alternative vehicle technologies. Through collaborations instituted during the project, the center will continue to leverage the training materials, fleet-oriented services, and outreach materials developed during the grant period to support regional Clean Cities Coalition member organizations, other alternative fuels centers, and public and private fleets across the state. Ultimately, these efforts will contribute to a cleaner, lower-emission, and lower-cost fleet and fueling infrastructure in California.

### **Relevance to Key Parties**

The project and the associated key outcomes are relevant to public and private fleets statewide, including the managers of those fleets and public and corporate decision makers involved in fleet development and oversight. The programs, education, and services offered by the center are directly relevant to Clean Cities programs, other alternative fuel/vehicle centers, clean energy incubators/accelerators, and industry organizations that support clean fuels development. Finally, the center serves as a model for future deployments by the state or other organizations seeking to fast-track alternative fuel and alternative vehicle deployment.

# CHAPTER 2: Introduction

# **Recipient Background**

The company carbonBLU seeks to help California municipalities and commercial clients that use motorized fleets to:

- 1. Better understand their existing engine-based and industrial carbon inventory.
- 2. Formulate steps they can take to offset their overall carbon footprint by implementing realistic and economically and environmentally sound mitigation solutions.
- 3. Operate at maximum efficiency.

Drawing on grant support from the CEC, carbonBLU has expanded its services from a local to statewide scope and outlook. The company specializes in fleet analytics, fleet optimization, and the development of alternative fuels and advanced vehicle technologies. The company carbonBlu works with fleets of all sizes, especially targets small to medium-sized (<500) vehicle and equipment fleets.

# **California Fleets**

California's economy supports thousands of commercial and public fleets statewide. The stateowned fleet alone includes more than 39,000 vehicles and pieces of equipment, including light-, medium-, and heavy-duty trucks and buses; light-duty autos, vans, and pickups; construction equipment; and farm equipment. Some of these items are more than 30 years old. Outside the public sector, major private fleets are owned and operated by California utilities, manufacturers, transportation industry operators, port tenants, construction companies, sanitation companies, healthcare industry, pest control managers, agricultural suppliers, and various other organizations. Several California fleets have been early adopters of compressed natural gas (CNG) and other alternative fuels. However, the vast majority of existing fleet vehicles are still fueled by conventional fossil diesel or gasoline, leaving significant potential for the conversion of existing fleets to alternative fuels and alternative vehicle technologies.

# **Key Alternative Fuels Barriers in California**

Many organizations are attempting to develop and expand the use of alternative fuels and advanced vehicle technologies across California. They have, however, historically faced several key barriers, unresolved issues, and knowledge gaps that have hindered the development and widespread use of these fuels and technologies in California.

Based on carbonBLU's assessment, neither the marketplace nor other institutions have been able to adequately address these barriers, primarily because of misconceptions regarding the cost and efficiency of alternative fuels and advanced vehicle technologies, as well as a lack of education about the integration and application of alternative fuels and advanced vehicles. These misconceptions have been historically difficult to dispel among fleet managers because most of them lack the resources or time to research and develop a program to integrate alternative fuels and advanced vehicles into their operations. The project sought to directly target and alleviate these key barriers, which are detailed below.

### **Cost and Efficiency of Alternative Fuels**

Historically, operators of many fleets—particularly small and moderate-sized fleets—have struggled to understand the costs and benefits of using alternative fuel and alternative fuel vehicles. Smaller fleets may not have access to the resources or in-house expertise needed to develop cost models or the economic analysis needed to substantiate the monetary benefits of using alternative fuels and alternative fuel vehicles. Especially at beginning of the project, many fleet managers viewed alternative fuels and advanced vehicles as a high-risk technical and cost liability, rather than as an opportunity to improve efficiency, reduce emissions, and potentially provide meaningful economic benefits.

#### **Alternative Fuels Integration for Small to Midsized Fleets**

Integrating alternative fuels into fleet operations, a process that can reduce fuel costs and emissions, has been historically employed only by large fleets (>500 vehicles) such as those managed by UPS or FedEx. Managers for these large fleets have the capital, technical understanding, and time to research alternative fuels and advanced vehicle technology options for fleet optimization. Many small to medium-sized fleets, however, lack the resources to devote to exploring these solutions and, therefore, are far less likely to take advantage of the savings and emissions reductions that they could enjoy.

#### **Regulatory Challenges**

In addition, regulatory requirements have created prohibitive costs and technical barriers to the expanded proliferation of conversion kits and other alternative fuel vehicles in California. Specifically, the project sought to address California Air Resources Board (ARB) regulations requiring alternative fuel vehicle manufacturers to comply with emission validation and diagnostic requirements equivalent to those required of original equipment manufacturer (OEM) vehicles. The large OEM manufacturers (Ford, General Motors, Chrysler, and others) are able to amortize the cost of emissions and on-board diagnostics compliance across more than 500,000 vehicles per year. Conversion systems manufacturers, on the other hand, must amortize the same costs across production volumes of 1,000—2,000 vehicles per year. Onboard diagnostics II requirements in California were also identified as a factor limiting expansion of alternative fuel vehicle technology in the state.

### **Purpose and Need for the Project**

By implementing the project, carbonBLU sought to alleviate the key alternative fuels barriers identified above: development of cost and benefit scenarios especially for small and moderate sized fleets, identification of workable and cost-effective strategies for integration of alternative fuels into small and midsized fleets, and support for managing regulatory

challenges relevant to these fleets. To these ends, the center was intended to serve as a much-needed hub for stakeholder education and the adoption of alternative fuels and advanced vehicle technologies. Ultimately, the activities of the center were intended to help target fleet managers develop workable, economically beneficial strategies to launch alternative fuel and advanced vehicle fleets to support emissions reduction, fleet optimization, cost savings, and regulatory compliance.

# **Project Benefits**

The project was designed to:

- Help regional fleet managers accurately assess their existing carbon emissions and regulatory compliance.
- Help fleets managers understand the economics of conversion to alternative fuels or advanced vehicle technologies.
- Help fleets measurably reduce emissions, ensure compliance, and save money.
- Provide tools to fleets that enable fleet managers to quantify the benefits of conversion, including improvements in air quality emissions, reductions in CO and CO2 emissions, petroleum displacement, and ROI.
- Improve overall ambient air quality resulting in improved public health.
- Increase public awareness of alternative fuels and vehicles.
- Increase demonstration and use of alternative technology fuels and vehicles.

# CHAPTER 3: Project Goals and Objectives

# **Project Goals**

This project sought to create and operate a Northern California center for alternative fuels and advanced vehicle technology. The center was designed to help promote existing and new education, outreach, and collaboration and fund development focused on the future development and expansion of alternative fuels and advanced vehicle technologies in Northern California. The center also sought to provide local municipal and private fleets with valuable technical and training services needed to help fleet managers understand the economics of fleet conversion, accurately assess their current carbon emissions and regulatory compliance, select a customized fleet optimization plan, and implement solutions that measurably reduce emissions while ensuring regulatory compliance.

# **Project Objectives**

The project objectives were to:

- Host or cohost six events, including workshops, conferences, and advanced vehicle technology demonstrations.
- Conduct grant proposal preparation workshops.
- Increase demonstration and use of alternative technology fuels and vehicles.
- Reduce petroleum use in the proposed region by reducing the petroleum consumption of the fleets it helped implement alternative fuels and advanced vehicle technology solutions.
- Apply for more grant funding for the center and partner organizations.

# CHAPTER 4: Project Approach

# **Fleet Analysis and Optimization**

Fleet analysis and optimization are the process of first carefully evaluating existing/available fleet resources and then assessing the potential to increase efficiency, reduce operating costs, and achieve regulatory compliance. The company carbonBLU specializes in helping fleets achieve these goals through the use of proprietary analytics tools that help them identify specific solutions—such as purchasing alternative fuels vehicles, converting existing vehicles, driver training, and/or installing alternative fueling infrastructure—and preparing a realistic, economically viable pathway to fleet enhancement.

Historically, before grant implementation, carbonBLU's target customers were primarily organizations that operated small- to medium-sized (<500 units) vehicle or equipment fleets. Under the project, carbonBLU sought to implement the following elements:

### **BLUprint Brief**

A key operational task the center performed was the complimentary BLUprint Brief assessment. The brief provided users with a customized, easy-to-read initial feasibility study that provides a snapshot of the unique emissions footprint and current compliance with regulatory requirements for a fleet. It also offered a customized, high-level strategy for fleet optimization and the ballpark costs associated with the potential solutions.

First, the center provided an intake questionnaire that helps it assess the fleet operations by gathering critical information about the existing blend of vehicles (make, model, and year), fuel types, freight, routes, replacement intervals, and distances traveled. The intake questionnaire also helped the center identify the sources of carbon and other emissions for each fleet. Next, the center conducted a preliminary audit that consisted of:

- Gathering data about the emissions and practices of the fleet to determine current operational emission output.
- Analyzing data to determine the emissions output and costs of each source.
- Selectively matching the carbon sources of each fleet to the most viable and costeffective market solutions to help the fleet reduce fuel costs, cut emissions, and futureproof itself against ever-more stringent environmental regulations.
- Comparing findings from the report to United States Environmental Protection Agency (U.S. EPA) and ARB regulations to determine regulatory compliance status of the fleet.
- Assembling the findings in in a short (four to five pages) BLUprint Brief.

### **BLUprint Fleet Assessment**

After reviewing the BLUprint Brief, fleet managers were able to select one or more of the potential solutions to explore in the full fleet analysis and optimization process, which resulted in the production of a comprehensive report known as the BLUprint. This document was a customized report that outlines a specific, economically viable path to fleet optimization. The development of a BLUprint represented almost 80 hours of work by center staff. It involved site visits, face-to-face meetings, a detailed questionnaire, phone interviews, and more. The objectives of this step were to perform an in-depth analysis of the fleet data, routes and driving times, and physical site/infrastructure by using proprietary databases and analytics tools of the center.

Using the information from the preliminary BLUprint Brief audit and this subsequent in-depth audit, the center worked directly with the customer to develop a complete systematic strategic plan for achieving the customer's efficiency goals based on the most viable options available. After gathering the required information, carbonBLU used its proprietary analytical tools to prepare and present a full BLUprint for the fleet. This report detailed each carbon output source and related costs and provided a detailed "BLUprint" of the steps that the center recommended that the client implement. The full BLUprint included:

- An overview of the proposed solution(s) and a projected scope of work, project schedule, and overall cost.
- A list of project subcontractors.
- Estimated time to ROI that factors in payments schedules, tax incentives, grants, and other potential state and federal funding.
- Comprehensive list of proposed modifications and solutions.
- Manufacturers' quotes for fleet conversion costs to potential solutions.
- Expected post-modification emissions profile.
- Regulatory a compliance strategic plan that factors in identification of gaps between compliance requirements and the estimated emissions of the fleet.
- Detailed line item breakdown of project cost, calculated savings, incentives, and ROI.
- Detailed vehicle turnover and replacement report.
- Systematic strategic plan for achieving efficiency goals.
- Emissions credit identification.

### Solutions Made Available Through Project Network

The center sought to provide accurate analysis relevant to each of the fleets that it serves. However, an important component of the success of the center in implementing the solutions it recommended in its BLUprints is the network of alternative fuel and advanced vehicle technology providers that carbonBLU staff have developed over its many years of work. Center staff members have experience working with all major alternative fuel system conversion manufacturers—including Westport, Roush, Clean Fuel, ICOM, and BAF—and have expertise in developing test plans, interpreting emissions test data, and submitting data to the U.S. EPA and ARB. As carbonBLU developed its proprietary tools, it forged close relationships with various telematics solution providers, including Teletrac and KORE. In addition, Center staff members also have established dialogues with fuel and infrastructure companies, including Amerigas, Ferrell Gas, Kamps Propane, Raymundo Engineering, and Alliance Auto Gas. These companies will help fleets implement a variety of solutions, including:

- Alternative Fuel Conversion: Getting vehicles converted from high-greenhouse gas (GHG)-emitting fuels, such as diesel, to use alternative fuels such as liquefied petroleum gas and CNG is part of the solution. The center will identify which vehicles in the customer's fleet can be converted to a desired fuel type and match those vehicles with the best service provider for that type of vehicle conversion.
- **Retrofitting:** Coordinating the purchase and installation of any aftermarket treatments, building upgrades, and alternative technologies available for the customers, fleets, buildings, or equipment.
- **Telematics:** Coordinating the purchase and installation of telematics systems on the customer's fleet of vehicles or equipment. Telematics systems are onboard diagnostics devices that monitor and track a range of variables that affect a company's environmental impact. Telematics provide information about driver behavior, vehicle usage, fuel consumption, and more. Telematics can provide greater insight into the daily operation and carbon output of a company's vehicles.
- **Driver Training:** Providing educational training to drivers about the effects of different driving behaviors on the fuel consumption and emissions output of their vehicles. Training includes in-person and online training courses that describe wasteful driving habits, as well as best practices for improving the environmental impact of the company as a whole. These trainings can help lower fuel consumption and vehicle emissions by helping improve driving behaviors.
- **Fueling Infrastructure:** Providing support to clients interested in installing fueling infrastructure to provide a source to refuel company vehicles. This service can help fleets create a convenient fuel source and, in some cases, a new revenue stream.
- **Grant Development Program:** Assisting our commercial customers in acquiring government funding to subsidize the costs of implementing initiatives offered by carbonBLU. The company carbonBLU will verify eligibility for various grants and government programs and monitor each step of the funding process. This process can help fleet managers reduce the total out-of-pocket costs to fleets implementing emission-reducing initiatives.

### **Project Implementation**

Project implementation included the following elements.

### **Center Preparation**

The project sought to use an online virtual center accessible through the Internet, as well as a physical center. Development of the virtual center, using a local Web developer, was to include development and initiation of online infrastructure. The online infrastructure would include a website targeted at fleet analytics that enables users to review the information provided by the center under the project. The physical center, originally planned for a site at the former McClellan Air Force Base north of Sacramento, was meant to serve as a meeting place to support the development and use of carbonBLU's proposed services under the project. Grant funds originally included money targeted at completing various physical preparations to the site to ensure usability.

### **Center Operations**

Project operations included two key components:

- 1. Ongoing maintenance of and updates to the center website
- 2. Performance of the BLUprint Brief assessments—the most important marketing tool for the center

Under the direction of the operations manager of the center, the center sought to operate and regularly update its website, engaging the Web developer to use search engine optimization to improve the ranking of the site in prominent search engines and maintain security and functionality. This work was to be ongoing throughout the operational and reporting period of the project and beyond.

The operations manager sought to conduct marketing efforts on behalf of the center, including updating the website, social media, operating booths at trade shows, client referrals, media outreach, participation in industry associations, and, most importantly, completing the customized *BLUprint Brief* assessment for at least 48 regional fleets identified by the Sacramento Clean Cities Coalition and the marketing efforts of the center. The briefs were designed to convince fleet managers that it would be worth their time and money to have center staff perform a full *BLUprint* assessment. These efforts will generally raise awareness of the fleet analysis and optimization services available at the center and generate new clients to help ensure the ongoing five-year viability of the center.

### Targeted Outreach, Education, and Training

In addition, the center sought to perform a range of other valuable outreach activities, including participating in at least 10 regional conferences on alternative fuels and advanced vehicle technologies, hosting an additional six at the center site, and conducting 12 tours or educational events about alternative fuels and advanced vehicle technologies for elementary and middle school students. Finally, the center will offer, in conjunction with Alternative Fuels Advocates and Grant Farm, a variety of fund development services, including six grant writing workshops, a one-on-one public funding strategy session with the showcase fleet managers, and six Renewable Energy Credit generation and utilization workshops.

### **Fund Development Activities**

The fund development activities of the project sought to educate fleet managers about the economic viability of fleet conversion and provide resources that help them apply for public and private funding. Center staff members regularly updated a wide range of resources on the center website, including a list of California and federal grant opportunities. Furthermore, Grant Farm hosted grant writing workshops for regional fleets, conducted a one-on-one public funding strategy session with the showcase fleet, and developed and submitted grant proposal applications to raise funds for the center over the 24-month operations period. Finally, in conjunction with Alternative Fuels Advocates, Grant Farm conducted credit generation and utilization workshops for fleets and fuel providers.

### **Data Collection and Analysis**

The project team compiled service information for each of the fleets analyzed under the project. Many fleets required carbonBLU to keep detailed fleet information—and, in some cases, specifics regarding fleet names and clients—private. As a result, project data collection and analysis focused on a high-level evaluation of benefits of the project, including the number of fleets and fleet vehicles served, as well as likely emissions reductions and other benefits associated with ultimate implementation of the fleet and fuels conversions proposed by the center.

# CHAPTER 5: Project Results

### **Fleet Analysis**

The project team completed its first fleet BLUprint in February 2015 and subsequently completed full fleet analyses for 23 fleet operators. These fleets ranged from three to 10,088 vehicles/pieces of equipment. In total, the team analyzed 41,749 pieces of equipment. As shown in Figure 1, fleets analyzed included a combination of public and private fleets, although the public fleets were considerably larger, overall, than the nonconfidential private fleets. The project was initially conceived to support fleet analysis for small to moderate-sized fleets—that is, fleets having about 500 or fewer vehicles. Of the nonconfidential fleets shown below, about eight of 12, or 67 percent of fleets analyzed, fit into the small to midsized fleet category. Notably, six of the 12 fleets—or 50 percent—are considered small fleets, having fewer than 100 vehicles or pieces of equipment. Thus, the project analyzed and identified alternative fuels and advanced vehicle technology options even for very small fleets—a population that is otherwise underserved for advanced fuels/technology evaluation.



#### Figure 1: Total Vehicles Analyzed Under the Project

Source: carbonBLU

To illustrate the impact that the project is having and will have on future emissions reductions for target fleets, identifying and tracking emissions reductions are a key facet of the project. To provide a holistic picture of emissions reductions achieved through the project, this report reviews emissions reductions that have been achieved to date, as well as anticipated future emissions reductions, based on commitments made for use of alternative fuel and advanced vehicles by each target fleet, as relevant. To that end, Figure 2 summarizes project emissions reductions that have already been achieved as of the publication of this document. As shown, to date, three fleets have successfully initiated use of alternative fuels or advanced vehicle technologies or both because of work completed under the project. On average, these fleets have achieved a 37 percent reduction in net emissions.



#### Figure 2: Project Emissions Reductions Achieved to Date

Fleet

Source: carbonBLU

Overall, most fleets analyzed still operate a large portfolio of gasoline vehicles. The initial 37 percent reduction (44,596 megatonnes of carbon annually) reflects replacement strategies that focus on transitioning light-duty sedans from gasoline to electric vehicles (EVs). Moreover, most fleets have a robust diesel portfolio in the heavy-duty weight range. Some of the initial emissions reductions and planned future emissions reductions are from fleets expanding the CNG fleet in the Classes 7 and 8 weight ranges.

A potential 62 percent overall emissions reduction would occur with replacement of all vehicles over time. This replacement would generate an annual reduction of almost 139,280 megatonnes of carbon. With current technology, there will still be a significant number of vehicles that simply cannot be replaced with current commercially available fuels. Several carbonBLU reports ended up modeling complete replacement of the vehicle fleet, with the highest emissions reduction found available in specific fleets resting at just 90 percent.

The company carbonBLU recognizes that using alternative fuels and advanced vehicle technologies and systems can take time: for drop-in replacement fuels such as biodiesel, suppliers must be identified and minor equipment or facility modifications may be required. Updating to other types of renewable fuel—for example, from diesel or gasoline to natural gas—can require a more substantial equipment upgrade, potentially including new or upgraded vehicles as well as new refueling or storage infrastructure or both. These types of updates take time to complete and typically require upfront capital investment. Identifying a source of capital—possibly including identifying new funding—as well as procuring or installing new or upgraded vehicles or equipment or both are often completed incrementally, in line with typical fleet upgrading and vehicle replacement efforts. As a result, most fleets will experience a delay between making the commitment to transition to alternative fuels and alternative vehicle technologies and the actual implementation of those systems—therefore, the realization of emissions reduction benefits.

Figure 3 summarizes anticipated future emissions reductions, based on commitments made by project participants. As shown, nine out of 12 disclosed project participants, or 75 percent, are expected to realize significant emissions reduction benefits following project participation. Fleets that have chosen to move forward will realize emissions reduction benefits ranging from 30—90 percent, for an average emissions reduction of 62 percent in comparison to baseline (that is, preproject conditions).



**Figure 3: Total Anticipated Future Project Emissions Reductions** 

Source: carbonBLU

### **Funds Identified**

As noted, implementing an alternative fuel or advanced vehicle technology upgrade or both can require considerable capital investment. A common solution to identifying funds to implement these upgrades focuses on replacing only a portion of fleets annually, in line with standard vehicle replacement schedules. Nonetheless, identifying funding for the additional, incremental costs of upgrading to a new system or technology can still present a challenge. Identifying other sources of supplemental funding can help expedite alternative fuel and advanced vehicle technology implementation. A growing number of grant-based funding opportunities has become available to support fleet transition to renewables. Under the project, carbonBLU, in collaboration with Grant Farm, has helped identify a series of grant and other related funding opportunities that may be applicable to project participants. Under the project, potential funding sources were identified based on each participant's fleet characteristics, goals, and proposed upgrade portfolio. Results from this analysis are shown in Figure 4. Among the nine participants that elected to move forward with fleet upgrades, the project team identified an average of \$625,000 in applicable funds. Total funding amounts identified ranged from \$75,000 to \$5 million.



Figure 4: Total Funds Identified

#### Source: carbonBLU

The project team also completed other specific fund development activities to support regional collaboration and help develop long-term services provided by the center. These efforts included development of grant proposals for the Central Valley Center for Alternative Fuels, in collaboration with CALSTART, Grant Farm, Alternative Fuel Advocates, and Central Valley Clean Cities. In October 2015, the team worked with Grant Farm on a clusters proposal to help ensure that innovation clusters have access to the resources provided by the alternative fuels industry. The team also worked with Grant Farm and the Port of Long Beach to apply for

funding vouchers for the advanced infrastructure related to rubber tire gantries at the port. This effort meaningfully expanded the reach of the center into Southern California. The team also focused on targeting federal innovation clusters grants and pursuing relationships with potential partners, including NextGen American and the DiCaprio Foundation. To support the related programs, the center, in collaboration with Grant Farm, also maintained an actively updated list of ongoing grant opportunities added to the center website. Finally, the center completed a series of webinars with Sacramento Metropolitan Air Quality Management District (SAQMD), Grant Farm, and Alternative Fuel Advocates to highlight vehicles eligible for funding through the ARB's Advanced Technology Freight Demonstration Zero Emission Drayage Truck Project and Multi-Source Facility Demonstration Project grant programs.

### Education, Training, and Outreach

During the project, carbonBLU, with support from its team members, was able to successfully provide education and training to 980 people. Trainings were completed primarily through outreach surrounding hosted sustainability training efforts at regional Clean Cities events, as well as events completed in association with MEMA, the National Association of Fleet Administrators (NAFA), and GoBiz. Incremental additional trainings were also completed in conjunction with fleet analysis for each fleet participants for the project. Total training results are summarized in Figure 5.





Source: carbonBLU

Training was completed through a series of webinars and group, small-group, or individual training sessions. To improve access to training materials and help ensure that training materials were readily available to a wider audience, carbonBLU also made training materials available through the center website via a Google Classroom platform. As shown in Figure 6, below, the platform included specific training targeting alternative fuel infrastructure, fleet sustainability, bookkeeping relevant to alternative fuels and advanced vehicle deployment, an overview of the center, and other relevant materials. The center overview session, for example, was included to help empower students to understand and effectively use the tools of the center to enhance their own educational programs. This element supports project target fleets, as well as others in the industry including educators, activists, and entrepreneurs.

≡ Google Classroom	5	5	5	
Alternative Fuel Infrast : Sustainability O students	Social Media Marketing : Entropreneurship 0 students	Fleet Sustainability 101 : Sustainability O students	Bootstrapping 101 : Entrepreneurship O students	The Center for Alternat
				-

#### Figure 6: Google Classroom Training Platform

#### Source: carbonBLU

The following list summarizes major training activities completed in support of the project. Webinars were completed primarily in April through June 2015 in collaboration with the SMAQMD, Grant Farm, and Alternative Fuel Advocates, and during 2016 for the West Coast Collaborative, the Green Transportation Summit and Expo, webinar on renewable diesel and the Diesel Emissions Reduction Act program, and a series of webinars for organizations including regional Centers for Alternative Fuels, Clean Cities, and Grant Farm.

Outreach completed under the project included the specific training webinars and events identified above as well as several other conferences and outreach activities. These included:

- Funding support and participation in the CALSTART Low Carbon Fuel Summit in February 2015.
- Educational track and sponsorship for the California Green Summit in April 2015.
- Hosting of the natural gas vehicle Bridge event along with select clean transportation industry forums in April 2015.
- Participation in the annual NAFA Institute & Expo event in May 2015.
- Partnership and sponsoring of the Northern California Clean Cities Coalition Infrastructure and Clean Fleet Funding Event in July 2015, with more than 185 fleet managers and policy makers attending.

- Organization of educational panels and development of webinar materials for AltCar in Oakland in May 2016.
- Presentations at a regional fleet event with MEMA in May 2016.
- Northern California Regional Clean Cities regional fleet events in the spring of 2018

## **Fleets Served**

Through the project, the center sought to provide support to fleets across Northern California. However, as the project progressed, demand for Center services continued to grow and by September 2018 included requests from fleets in Southern California as well as Northern California. The center supported initial or full analyses and fleet evaluation or both for the following fleets:

- California Department of Fish and Wildlife
- California Department of Transportation
- California State University
- City of Arvin
- City of Bakersfield
- City of Beverly Hills
- City of Long Beach
- City of Roseville
- City of Sacramento
- City of Wasco
- County of Sacramento
- Devine Intermodal
- Grimmway Farms
- IKEA
- Local beverage distributor
- Private contractors serving FedEx
- Saccani Distributing
- University of California
- Eleven additional fleets (confidential)

Statistics regarding outcomes of the analysis and other services provided to these fleets are summarized above.

# **Facilities Development**

The project included development of virtual as well as physical facilities that collectively support outreach and fleet analysis provided under the project. Facilities development activities included:

### Virtual Center/Web Development

The company carbonBLU, in collaboration with a software and website developer, assembled and released to the public a <u>virtual center Web page</u> (www.centerforalternativefuels.org), as shown in Figure 7, below. The project team initially developed and beta tested the virtual center in April 2015 and completed an initial rollout of key tools (that is, small launch) during August of that year. Ultimately, the team decided on a more robust data collection and collaboration platform than initially planned for the project. Key elements included software that allows the team to collect more information from fleets, process it using an in-house analytics platform, and provide baseline data on environmental and impacts for the user's current operations. In this manner, the platform allowed the center to automate the analytics platform.



#### Figure 7: Center Website Splash Page

Source: Center for Alternative Fuels

Once a straightforward, free, signup process is completed, fleet operators, city planners, policy makers, and the public are given access to various tools that they can use to jumpstart their sustainability research (Figure 8). Data collected through the site are funneled into a database and are used by the center to better understand market needs. The updated platform also included an improved virtual classroom experience (Figure 9) designed to create a more intuitive and interactive system than originally planned. A revised soft launch of the final website and online center was completed December 20, 2018.

### Figure 8: Center Website Services Selection Page

### **Inspired By Excellence & Innovation**



Source: Center for Alternative Fuels

### Figure 9: Center Website Improved Virtual Classroom



Source: Center for Alternative Fuels

## **Brick and Mortar Center**

Under the original proposal, carbonBLU had proposed renting a large space at the former McClellan Air Force Base to operate as its brick and mortar center. However, during the initial phases of the project, and in coordination with the CEC, carbonBLU identified a lesser need for a large collaboration space, allowing the project team to use a larger fraction of grant funds to rent spaces for events meant to serve as public platforms for education. The strategy of carbonBLU herein was to better attract the attention of fleet managers and the public and reach a more diverse group of decision makers in Northern California.

To this end, in December 2015, the team secured a permanent office space at 222 Judah St., in Rocklin (Placer County). The team initiated renovations in March 2016 and initiated a presence in Sacramento with the Grant Farm. Incremental physical developments and improvements at the center continued into 2018, as the team developed and used the space concurrently. In September 2018, the team unveiled the brick-and-mortar Center for Alternative Fuels to the CEC. Online classes went live, and the center became fully open to use.

### **Collaborations and Partnerships**

To support its outreach and operations, the project team also established various collaborations and partnerships with other organizations. Key partnerships included those with regional Clean Cities, MEMA NorCal, local community colleges (Sierra College and American River College), and other statewide centers and accelerators to support the advancement of alternative fuels and advanced vehicle technologies, and connect with fleets and decision makers. The team specifically sought to unify with other clean fuels centers to develop a more optimized approach to programming. Collaborations therein included a joint presentation with the Southern California Center at the NAFA chapter, various meetings with other centers, work to improve the visibility of centers statewide, and development and outreach with the Redwood Coast Energy Authority to produce education materials and complete additional outreach in its area of Northern California. The team also initiated partnerships with select Clean Cities to provide administrative assistance.

### **Jobs Developed**

In total, the project directly created four new full-time equivalent (FTE) jobs, including the hiring of Kevin Nesbitt as the project operations manager in March 2015, two interns, an administrative team, and Kevan Hendrickson to support program development for local entrepreneurs and help secure the financial future of the center.

# **Project Benefits and Lessons Learned**

### **Summary of Project Outcomes**

The project supported multiple successful outcomes, as summarized in Table 1.

Category / Target	Outcome
Help fleets accurately assess existing carbon emissions and regulatory compliance	Completed full fleet analysis, including identification of baseline emissions, for 23 public and private fleets statewide for 41,749 pieces of equipment analyzed.
Help fleets understand economics of conversion to alternative fuels or advanced vehicle technologies	See previous. Also completed training for 980 persons, including direct training of 80 fleet personnel.
Help fleets measurably reduce emissions, ensure compliance, and save money	Identified likely/anticipated future average emissions reductions of 62% for participating fleets, along with a 37% average reduction in emissions currently, for fleets that have already begun deploying.
Provide tools to fleets to allow them to quantify benefits of conversion, including emissions improvements, petroleum displacement, and ROI	Tools available through center and virtual center/website. Full fleet analysis, as described previously, was completed for 23 fleets.
Improvements in overall ambient air quality, resulting in improved public health	Fleet conversions completed to date are already reducing air quality emissions and supporting improved public health. These effects are expected to increase as target fleets fully implement fleet plans that were developed under the project.
Increased public awareness of alternative fuels and vehicles	Completed education and outreach to 980 individuals. Maintained a Web presence, and completed direct outreach to various fleets and key decision makers.
Increase demonstration and deployment of alternative technology fuels and vehicles	Three fleets have already begun implementing the programs suggested by the center, with at least 17 other fleets expected to initiate deployment within the next five years.

### **Table 1: Summary of Anticipated Benefits and Project Outcomes**

Source: carbonBLU

### **Key Lessons Learned**

Having spent the last several years engaged in various fleet outreach programs in the Central Valley and Northern California, and more recently in Southern California, while collaborating with CALSTART and the CEC, the project team has learned the following lessons:

- Efficacy of Outreach. Clean Cities does an excellent job of reaching out to its members and engaging their assistance. Clean Cities' programs, including its ride and drives, technology expos, and information sessions, are well prepared, pertinent, and useful to attendees. Unfortunately, these events tend to attract the same people event after event. There are several reasons for this trend. However, one key cause is that materials, promotion, presentations, and engagement activities are all completed in a single language—English. Another key reason that engagement does not consistently reach new target audiences is that it is often viewed as a government program. Work needs to be done to recast the outreach rhetoric to emphasize economic development, ROI, regulatory compliance, and cost reduction. To effectively reach private fleets in particular, outreach must have a greater focus on the economic and operational benefits and bottom lines.
- **Coalition growth.** The current coalition of willing fleets provides a helpful starting point, but that coalition is not growing. The current population of all fleets and fleet operators consists of a very diverse group of individuals, many of Spanish or Middle Eastern descent. Funding needs to be allocated to translate the outreach materials produced under this project and under other similar programs into Spanish, Arabic, and Hindi at the very least. Fleets can set policy all they want, but that policy must be adopted by field managers, operators, and drivers, and targeted changes cannot be fully and effectively implemented if they cannot be understood by targeted fleet participants.
- Local Promotion. Programs should be developed to identify and equip local leaders with the tools they need to educate and promote alternative fueling and advanced vehicles. As a rule of thumb, fleet communities are fiercely independent, and often competitive. Especially in the private sector, while fleets may not compete directly, many tend to hold close their operations because effective fleet management can be considered a significant business advantage and even trade secret. Many fleet operators and managers are also wary of government intervention. The message of the benefits of fleet transition toward renewables and alternative technologies could be substantially promoted if it were to come, at least in part, from community members rather than from a government agency or its representatives.
- Vehicle Class Barriers. The biggest barrier to emission reduction remains the medium-duty trucks. These are fleet favorites because they tend to be incredibly versatile and useful. However, these trucks lack a good, commercially available and proven replacement option.

### Conclusions

In all, the project was highly successful in demonstrating the effective initiation and use of the center, which completed full fleet analyses for 23 public and private fleets statewide, representing 41,749 pieces of equipment and vehicles. When fully implemented, the conversion toward alternative fuels and advanced vehicle technologies will support average emissions reductions of roughly 62 percent for fully participating fleets. Already, implementation efforts completed to date have supported a 37 percent average reduction in emissions for fleets that have begun implementing their fleet transformation plans.

Most viable emissions reduction strategies pursued under the project involved transitioning from gasoline to electric vehicles for light- and medium-duty vehicles. Furthermore, many fleet managers are leveraging CNG as an emissions reduction strategy for their heavy-duty vehicles, with a few operators also using electric in that weight class. To achieve the projected 62 percent emissions reduction, fleet operators will eventually turn over their entire inventory.

Through targeted outreach, event-based outreach, trainings, and online education, the project team completed education and outreach to 980 individuals while maintaining a Web presence that includes immediately useful research and educational material and tools. In spite of a reduced scope of work compared to the original proposal and a yearlong contracting-related delay during implementation, the carbonBLU team has completed a highly successful project that is set to continue operations independently for the near future. The project team also expanded its reach well beyond its initial intended target of Northern California, having reached into Southern California to support fleet analysis, grant program development, and collaboration with other relevant industry organizations.

### **Recommendations and Next Steps**

### **Ongoing Barrier to Adoption: Aggregated Purchase to Improve Fleet Economics**

The project has supported incremental statewide reductions in the key barriers to alternative fuels and advanced vehicle technology adoption identified previously. Nonetheless, it is clear that the largest remaining barrier to these technologies among California's fleets rests in the economics of purchasing and using alternative fuels and advanced vehicle technologies. Virtually all the fleets that the center engaged lack sufficient capital to purchase and implement many of these new fuels at a large scale. At carbonBLU, the team believes that aggregated purchasing can help solve these issues. As an ongoing effort, carbonBLU is providing the software platform implemented under this project to various universities around the state to help them aggregate purchases. It is the project team's opinion that this same approach, applied to all the fleets in the Central Valley, for example, would significantly drive down vehicle costs and help give signals to OEMs about production priorities. Outreach and education are key building blocks to such a strategy and would help fleet managers understand the need for cooperative purchasing and how that will drive down costs. Outreach and education are especially pertinent, given the independence of many private fleets (as discussed previously) as a status quo condition.

### **Communication Gap**

Future efforts should seek to address remaining communication gaps that continue to create barriers to alternative fleet development. Based on the experience of the project team, what is often perceived as an information gap is more accurately described as a communication gap. In general, fleet operators, managers, and other stakeholders have some degree of awareness of the current push for transition to alternative fuels and alternative vehicle technologies. Specifically, they understand that there is money available for new fleet technology. They also typically understand that poor air quality is bad for them and for communities, and they know where they could go to collect additional information. The communication gap, however, comes into play wherein fleet managers and other decision makers do not necessarily have the impetus to spend the effort needed to institute a fleet transition. Such a transition is risky in that it has the potential to incur considerable additional capital cost. Even if that capital cost is largely offset through grant funding or other incentives, the administrative and research burden to figure out which fuels or technologies are most appropriate for a given fleet is more than many fleets can handle. Communicating basic economic information regarding alternative fuel and vehicle systems, then, has great potential to lower this initial hurdle to additional deployments.

# GLOSSARY

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.

CARBON DIOXIDE (CO2) – A colorless, odorless, nonpoisonous gas that is a normal part of the air. Carbon dioxide is exhaled by humans and animals and is absorbed by green growing things and by the sea. CO2 is the greenhouse gas whose concentration is being most affected directly by human activities. CO2 also serves as the reference to compare all other greenhouse gases (see carbon dioxide equivalent).

CARBON DIOXIDE EQUIVALENT (CO2e) – A metric used to compare emissions of various greenhouse gases. It is the mass of carbon dioxide that would produce the same estimated radiative forcing as a given mass of another greenhouse gas. Carbon dioxide equivalents are computed by multiplying the mass of the gas emitted by its global warming potential.

CARBON MONOXIDE (CO) – A colorless, odorless, highly poisonous gas made up of carbon and oxygen molecules formed by the incomplete combustion of carbon or carbonaceous material, including gasoline. It is a major air pollutant on the basis of weight.

COMPRESSED NATURAL GAS (CNG) – Natural gas that has been compressed under high pressure, typically between 2,000 and 3,600 pounds per square inch, held in a container. The gas expands when released for use as a fuel.

ELECTRIC VEHICLES (EVs) – A broad category that includes all vehicles that are fully powered by electricity or an electric motor.

FLEX-FUEL VEHICLE (FFV) – FFVs are designed to run on gasoline or gasoline-ethanol blends of up to 85 percent ethanol (E85). Except for a few engine and fuel system modifications, they are identical to gasoline-only models. FFVs experience no loss in performance when operating on E85, and some generate more torque and horsepower than when operating on gasoline. However, since ethanol contains less energy per volume than gasoline, FFVs typically get about 15—27 percent fewer miles per gallon when fueled with E85.<sup>1</sup>

FULL-TIME EQUIVALENT (FTE) – A unit that indicates the workload of an employed person in a way that makes workloads (or class loads) comparable across various contexts. FTE is often

<sup>1</sup> U.S. Department of Energy (https://www.fueleconomy.gov/feg/flextech.shtml)

used to measure a worker's (or student's) involvement in a project, or to track cost reductions in an organization. An FTE of 1.0 is equivalent to a full-time worker or student.<sup>2</sup>

GREENHOUSE GASES (GHG) – Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include water vapor, carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), halogenated fluorocarbons (HCFCs), ozone (O3), perfluorinated carbons (PFCs), and hydrofluorocarbons (HFCs).

MUNICIPAL EQUIPMENT MAINTENANCE ASSOCIATION (MEMA) – MEMA's mission is to improve the quality of service in the public sector by providing a forum for the free exchange of experience, technical knowledge, ideas, and opinions that enhance the delivery of public services and promote the personal and professional growth of our members. MEMA serves the public safety by helping to ensure that environmentally responsible, safe, and efficient stationary and mobile systems are at work. MEMA NorCal is one of three local chapters; the other two are MEMA SoCal and MEMA Ohio.<sup>3</sup>

NATIONAL ASSOCIATION OF FLEET ADMINISTRATORS (NAFA) – A not-for-profit membership association for individuals who manage vehicular fleet and mobility responsibilities for their employers. NAFA has more than 2,000 individual fleet manager members who are employed by corporations, universities, government agencies, utilities, and any other entity that uses vehicles in its normal conduct of business or needs to move people or goods from one place to another.<sup>4</sup>

ORIGINAL EQUIPMENT MANUFACTURER (OEM) – Makes equipment or components that are then marketed by its client, another manufacturer, or a reseller, usually under that reseller's own name.

PLUG-IN HYBRID ELECTRIC VEHICLE (PHEV) – PHEVs are powered by an internal combustion engine and an electric motor that uses energy stored in a battery. The vehicle can be plugged in to an electric power source to charge the battery. Some can travel nearly 100 miles on electricity alone, and all can operate solely on gasoline (similar to a conventional hybrid).

RETURN ON INVESTMENT (ROI) – The interest rate at which the net present value of a project is zero. Multiple values are possible.<sup>5</sup>

<sup>2 &</sup>lt;u>Wikipedia</u> (https://en.wikipedia.org/wiki/Full-time\_equivalent)

<sup>3 &</sup>lt;u>Municipal Equipment Maintenance Association</u> (http://www.memafleet.org/)

<sup>4</sup> National Association of Fleet Administrators (https://www.nafa.org/)

<sup>5 &</sup>lt;u>Office of Energy Efficiency and Renewable Energy</u> (https://www.energy.gov/eere/bioenergy/full-text-glossary#R)

SACRAMENTO AIR QUALITY MANAGEMENT DISTRICT (SMAQMD) – Created in 1996 under Health and Safety Code Sections 40960 et. seq. to monitor, promote, and improve air quality in the County of Sacramento. It is one of 35 regional air quality districts in California.<sup>6</sup>

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (U.S. EPA) – A federal agency created in 1970 to permit coordinated governmental action for protection of the environment by systemic abatement and control of pollution through integration or research, monitoring, standards setting, and enforcement activities.

<sup>6</sup> Sacramento Metropolitan Air Quality Management District (http://www.airquality.org/)

# **APPENDIX A:** Sample BLUprint Brief Report



# carbon **BLU**



This sustainable fleet report:

- Is a 30,000-foot view of the City of Beverly Hills's fleet sustainability.
- Includes a simple inventory of the city's fleet-generated CO2 emissions.
- Compares emissions, acquisition and fuel cost, offsets, and payback time for three replacement scenarios.
- Provides an outline for a Sustainable Fleet Plan.
- Consolidates data needed for NAFA's Sustainable Fleet Accreditation.
- Is intended to give decision makers a better understanding of the choices and benefits that can be realized from adopting alternative fuels, advanced vehicle technologies, and best management practices.
- Is not a detailed or comprehensive analysis.

### **Sustainable Fleet Report**

This sustainable fleet report is a high-level overview of the City of Beverly Hills's fleet sustainability. It provides an inventory of the fleet-generated CO2 emissions and uses assumptions where detailed data are not available. The sustainable fleet report includes specific guidance and information to assist the fleet in setting and reaching sustainability goals. This report describes current fleet applications and use and contains comparisons for replacing vehicles, tools to help create a Sustainable Fleet Plan, consolidated data for NAFA's Sustainable Fleet Accreditation application, and general information on alternative fuels and advanced technologies that can help reduce petroleum use.

The sustainable fleet report is a starting point that establishes the current on-road vehicle inventory, fuel cost, and CO2 emissions to be used as a benchmark that is compared to three vehicle replacement scenarios and future progress. Standard replacement scenarios are presented in this sustainable fleet report as examples of what can be done.

The intent is to promote informed decisions by helping identify the choices and providing a path of action. Benefits that can be realized from adopting alternative fuels and advanced technology vehicles are illustrated and discussed. The sustainable fleet report also identifies areas that may benefit from further analysis.

This sustainable fleet report identifies available vehicle replacements based on default selections. Vehicle usage, individual tasks, vehicle assignments, and fleet practices should also guide the final acquisition decisions. These scenarios and vehicle replacement selections can be modified any number of ways using fleet-specific priorities and criteria.

There are other costs and emission sources associated with a fleet operation; however, the largest source of GHG emissions in a fleet operation is typically carbon from fuel used in vehicles. Vehicle purchase decisions today will affect costs and emissions for many years.

The results shown are based on fuel savings only and do not take into account direct or indirect operational savings associated with operational efficiencies, maintenance, regulatory

compliance, safety and health, public relations, and so forth. Some of these potential cost savings are discussed in this report. Any savings identified can be included in the replacement scenario calculations, if costs are provided.

A complete and accurate total cost of ownership analysis and life-cycle needs assessment are expensive and time-consuming, and many times policy or operational practices will override recommendations identified in the analysis. The high-level view of this report provides many opportunities for improvement and identifies areas needing further analysis.

### **Current Fleet Overview**

The City of Beverly Hills operates 419 vehicles and equipment of which 379 are powered or use fuel or both. There are 284 powered on-road vehicles, of which 86 are due for replacement, based on replacement criteria provided. In Fiscal Year 2015, the city purchased 296,252 gallons of fuel at a cost of \$610,455 while generating 2,565 metric tons of CO2 emissions.

The city's fleet includes 115 alternative fuel and advanced technology vehicles, which constitute 40.5 percent of the on-road vehicles. Eighty-one of these vehicles are flex-fuel vehicles (FFVs) capable of operating on up to 85 percent renewable ethanol (E85) fuel, but they are using petroleum gasoline. The remaining 34 alternative fuel and advanced technology vehicles, which are operating on alternative fuels, are 12 percent of the on-road vehicles.

In addition to gasoline and diesel, the city fleet operates on CNG, plug-in hybrid vehicles (PHEVs), and battery electric vehicles. Twenty-four percent of the fuels consumed are alternative fuels.

Fuel purchases for FY 2015 were 57,662 gallons of diesel, 167,528 gallons of unleaded and 71,062 diesel gallon-equivalents of CNG. Electricity for EVs is not tracked. There is a 158,225-gallon difference between the reported on-road purchases and the expected fuel use based on assumptions used in this report. This difference indicates the need for better fuel and use record keeping and an opportunity to reduce fuel use through driver training and idle reduction.

City staff maintains the equipment in city facilities. Additional tech training is recommended, particularly for EVs.

There is an equipment replacement plan in place with an ongoing funding model. Policy and management and fleet services are responsible for the acquisition, specifications, and funding of equipment replacements.

There is a comprehensive fleet management software system in place to capture maintenance and cost data and a fuel management system capable of accurately tracking fuel use by vehicle.

The city has the necessary infrastructure for the alternative fuels and advanced technology vehicles already in the fleet. Additional fueling infrastructure will be necessary to implement some of the strategies outlined in this sustainable fleet report.

# **On-Road and Off-Road Inventory, Use, and Emissions**

Total fuel use and carbon emissions include the on-road vehicles discussed in this report and any of the 135 off-road vehicles and equipment that use fuel. Only 22 off-road vehicles and equipment were charged for fuel, per the data provided, which totaled 2,484 gallons at a cost of \$7,453. The fuel data for these vehicles are not accurate. It is recommended that fuel and use data are recorded at the equipment level to accurately identify off-road equipment fuel use. Also, a shared equipment program, such as <u>Munirent</u> (www.munirent.co), could reduce the number of off-road vehicles and equipment in the city fleet and provide capital savings.

On-road vehicle use is broken down by department and user group below. In general, the mileage and hour usage of the equipment and vehicles in the city are very low. Part of the reason is that the geographic area of the city is small, about 5.7 square miles. Even considering the geographic area, there are several vehicles and equipment that appear to be underused. Odometers should be audited to verify the use is based on accurate information. Excess equipment does not produce more emissions or use more fuel but does tie up capital. Other potentially unnecessary costs associated with excessive vehicles can include insurance, vehicle maintenance, and facilities.

While it is common for urban municipalities to need vehicles that may not travel many miles, these low mileage numbers indicate that some controls should be put in place to ensure an effective use of capital and other resources. During the interviews with user groups for this report, most user groups insisted they needed all the equipment they had, even though it may not be used to a high degree. Some vehicles are critical to providing municipal services, even if they do not travel many miles. Some examples include police and fire emergency vehicles and specially outfitted service vehicles for water, solid waste, and others.

Telematics can help identify not only how many miles the vehicle travels, but the frequency it is used. The use of telematics will identify how often and at what time of day the vehicle is used, which will help determine how many vehicles are necessary. Public works has recently installed a telematics system, Lytx DriveCam, on 136 vehicles. It is recommended that the use of DriveCam or a similar system be expanded to all on-road vehicles. It is also necessary that sufficient staff time be appropriated to provide the ongoing monitoring, reporting, and follow up necessary to use these tools to the fullest potential.

By reviewing the entire fleet's use with accurate data, it is expected that many opportunities will be apparent for consolidating or sharing equipment and identifying equipment that is truly not needed.

The vehicles highlighted in red on the list below indicate "very low" use. "Low" use vehicles would be highlighted in yellow. These vehicles may not be needed in the operation and potentially could be removed from the city inventory or placed in a pool for shared use within a department or throughout the city.

### 010 041 - Emergency Management

VEHICLE USE -

- Emergency Management has one vehicle and two FTE positions. The vehicle is used an average of 20 miles per week.

#### **RECOMMENDATIONS -**

- For this minimal use, a shared use or pool vehicle should be able to provide adequate vehicle coverage for operational needs. A priority could be given in the pool so that Emergency Management has first choice or could bump other pool customers for emergency use.

Eqp. #	U.S. EPA Class	Weekly Miles	Dept.	User Group	Vehicle Description
43	Class 3 Vehicle	20	010 - Policy and Management	041 - Emergency Management	2001 DODGE RAM 3500

-

# 200 – Police Department

User Group	Average Weekly Miles
021 - Police Administration	152
022 - Community Relations	63
023 - Patrol Bureau	115
024 - Police Support Services	81
025 - Investigations	134
026 - Traffic Bureau	74
027 - Emergency Services Bureau	58
029 - Police Personnel and Training	114
Grand Average	105

### VEHICLE USE

The police department has 109 vehicles and is budgeted for 199 FTE positions, with about 130 of those being sworn officer positions. The overall average use is 96 miles per vehicle per week.

Emergency use vehicles, operated by emergency personnel, are exempt from California vehicle emissions laws. These are vehicles that respond to emergencies with red lights. Applications that are not exempt include vehicles that use amber lights or are driven by nonsworn personnel.

Vehicles highlighted in red have minimal use reported of fewer than 50 miles per week. If the reported use is accurate, a shared use or pool vehicle may be able to provide adequate vehicle coverage for operational needs. Vehicles highlighted in yellow have low use reported of fewer than 100 miles per week. These vehicles should also be considered as candidates for pool use.

### RECOMMENDATIONS

- Consider creating an intradepartmental pool or use a city-wide pool to reduce the overall number of vehicles or do both.

- Use E85 ethanol in the existing FFVs.

- All patrol vehicles and other exempt vehicles, where capable, should be purchased as FFVs. FFVs are able to operate on gasoline or ethanol and any combination of the two without any loss in power. Sometimes FFVs are not ARB-certified but are U.S. EPA-certified. Because emergency vehicles are exempt from ARB, the U.S. EPA-certified FFV vehicle can be purchased for use in California and run on E85 in an exempt application.

- Purchase only alternative fuel and advanced technology vehicles for nonpursuit applications.

- EVs and PHEVs are well-suited for nonexempt replacement cars. Some of the potentially suitable EVs include the Chevy Bolt, Ford Focus EV, Nissan Leaf EV, Kia Soul EV, and Volkswagen Golf EV. Some potentially suitable PHEVs include the Ford Fusion Energi, Ford C-Max Energi, and Chevy Volt.

PHEVs operate on the battery with zero tailpipe emissions and very little noise for the first 20 to 40 miles of use. After that, they operate like any other hybrid, able to fuel at any gas station. This is a proven technology available from most automobile manufacturers. Truck systems are available, but not all are proven.

Emergency lighting can be used without idling the engine. If the battery on the PHEV gets low, the engine will start and charge the batteries. PHEVs can also provide 110 volts of electric power for lights, small tools, battery chargers, and so forth.

- Replace pickups and Class 2 vehicles with CNG vehicles or with a proven aftermarket PHEV system.

- Consider a Tesla patrol vehicle. It is a zero-emission, high-performance vehicle that has proven to be reliable. It could also be used in community outreach.

# **APPENDIX B:** New Intake Sheet

	Required								
	Critical Customer Supplied Information								
Equipment #	VIN	Fuel Type	In Service Date	Life Cycle Years &/or Miles	In-service ODO or Hourmeter	Last Odometer or Hourmeter	Last Odometer Date		

	Optional									
Vehicle Description			Important/	Not Critical	Route Info		Manager	nent Info		
Year	Make	Model	Equipment Code	Annual Fuel Use	Annual Miles Used	Max. Distance per Day	Vehicle Description	Department or User Group	On- Road/Off- Road	Fund

Cost Info	
Fuel Cost	Maintenance Costs