June 2020

Action Plan

Paths to Clean Vehicle Technologies and Alternative Fuels

in **San Bernardino County**

Prepared for the Southern California Association of Governments (SCAG)
and the San Bernardino County Transportation Authority (SBCTA)

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1 Introduction

San Bernardino County faces twin challenges of air pollution and climate change. Home to more than 2.2 million resident and 700,000 jobs, the County plays a vital role in the economy of Southern California and the nation. However, like much of Southern California, San Bernardino County suffers from poor air quality and faces long-term threats resulting from global climate change. The transportation sector is a major contributor to the emissions that cause both air pollution and climate change. Fortunately, a variety of advanced technology vehicles and alternative fuels provide opportunities to significantly curb these emissions. This Action Plan describes steps that local governments in San Bernardino County and their partners can take to increase the deployment and use of clean vehicles and fuels, and thereby help to improve air quality and mitigate the impacts of climate change.

Importance of Transportation

The transportation sector plays an outsized role in the economy of San Bernardino County and the challenges it faces in reducing emissions. Because of dispersed development patterns and limited options for alternative travel modes, passenger vehicle travel is relatively high. San Bernardino County had 26.1 daily vehicle miles traveled (VMT) per capita in 2016, higher than other Southern California counties except Imperial.[1]

The County also has a robust freight transportation and logistics sector, which generates substantial heavy truck travel. Jobs in transportation, warehousing, and wholesale trade account for 14 percent of all employment in the County, a larger share

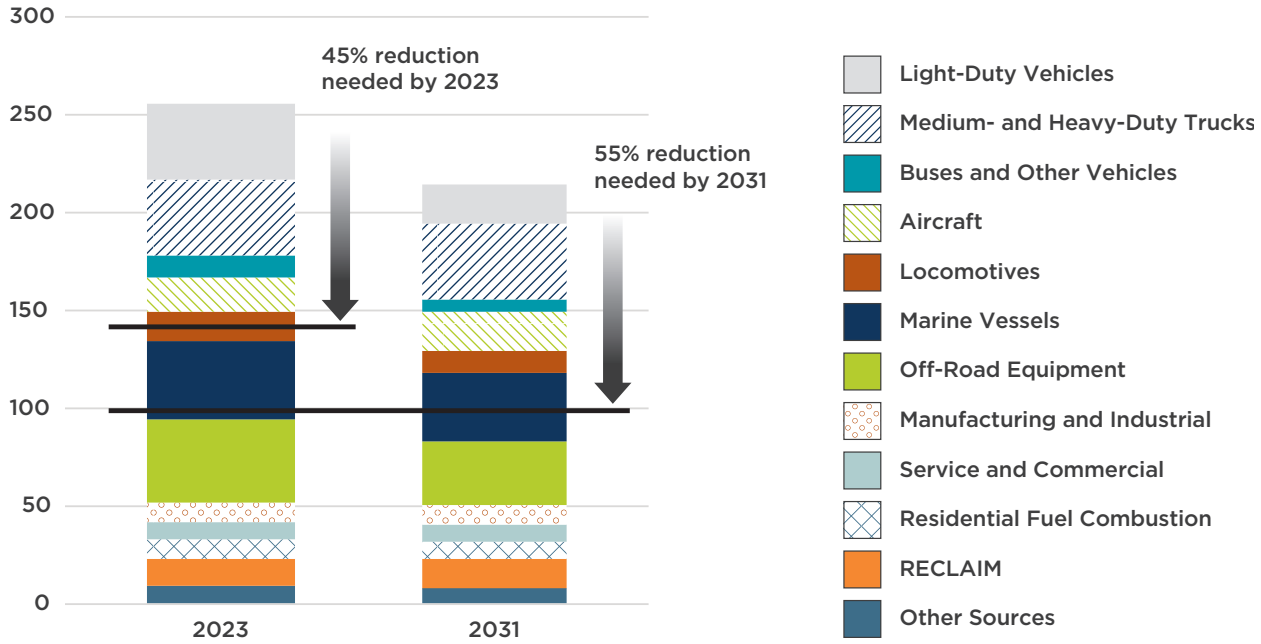
than the rest of the region. The County had approximately 300 million square feet of warehouse space in 2014, one quarter of the SCAG region total, and that value has likely increased significantly over the last six years.[2] But not all truck travel in the County is local. San Bernardino County is traversed by major freeways that connect the Ports of Los Angeles and Long Beach with the rest of the nation, so some of the heavy truck VMT in the County is pass-through trips. One-fifth of heavy-duty truck VMT in the County is caused by out-of-state trucks.[3]

The Air Pollution Challenge

San Bernardino County does not meet federal air quality standards designed to protect human health. The southwest portion of the County lies in the South Coast Air Basin, which is classified as an Extreme nonattainment area for the federal ozone standard. Ground-level ozone (commonly called smog) can trigger a variety of health problems including aggravated asthma, reduced lung capacity, and increased susceptibility to respiratory illnesses like pneumonia and bronchitis. The ozone pollution problem in the Basin results from a combination of emissions, meteorological conditions, and the mountains that surround the region.

Emissions of nitrogen oxides (NOx) are the greatest contributor to ozone formation in Southern California. NOx emissions are a product of fuel combustion, and most of these emissions come from diesel engines. The Clean Air Act requires that the South Coast Air Basin achieve attainment with federal standards; if not, the region will continue to experience air pollution-related health problems and also risks losing federal transportation funding. As shown in Figure 1, achieving the targets will require a 45 percent reduction in NOx emissions by 2023 and a 55 percent reduction by 2031, relative to the expected "business as usual" levels.[4]

Figure 1. South Coast Air Basin NOx Emissions (tons per day)



Source: South Coast Air Quality Management District, *Final 2016 Air Quality Management Plan,* March 2017

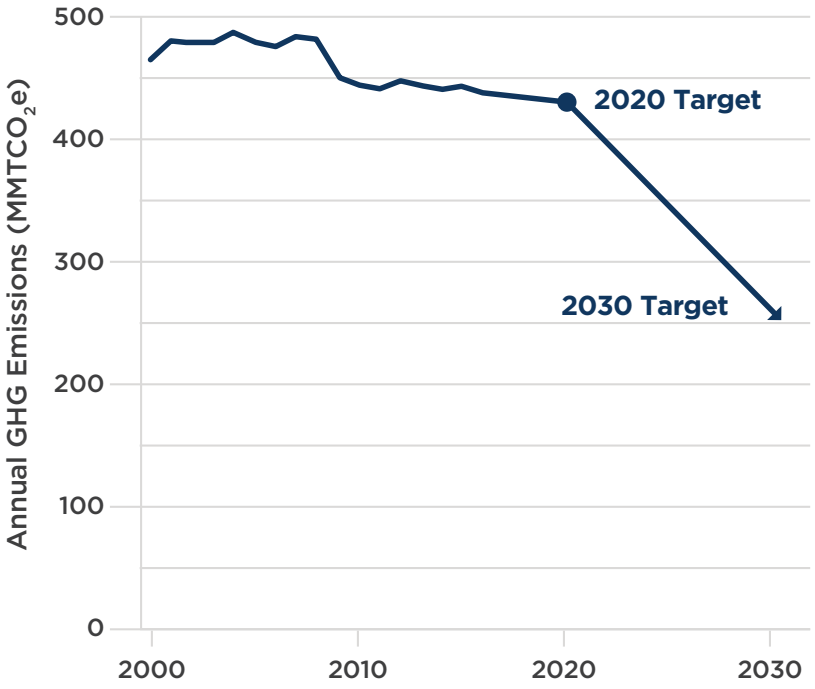
Air pollution from particulate matter is also a concern. Many scientific studies have linked breathing particulate matter to significant health problems, including aggravated asthma, chronic bronchitis, and heart attacks. New research suggests that an increase in PM2.5 levels is associated with higher a COVID-19 death rate.[5] The South Coast Air Basin is designated as nonattainment for the federal fine particulate matter (PM2.5) standard. Fine particulate matter is directly emitted from vehicle engines, and also forms in the atmosphere when NOx or sulfur oxides (SOx) react with other compounds to form particles. Diesel particulate matter is of particular concern because it is widely believed to be a human carcinogen when inhaled.

The Climate Change Challenge

Greenhouse gas (GHG) emissions are causing global climate change, with potentially catastrophic effects on California and the planet. San Bernardino County and the rest of the state are already feeling the effects of climate change. Evidence is mounting that climate change has contributed to a variety of recent problems plaguing California including drought, wildfires, pest invasions, heat waves, heavy rains, and mudslides. Projections show these effects will continue and worsen in the coming years, with major implications for our economy, environment, and quality of life.[6]

In response to the threat of climate change, the State of California and many local governments have adopted policies to reduce GHG emissions. The initial policies have largely succeeded—California achieved the 2020 GHG emissions target four years ahead of schedule. But more significant reductions will be needed going forward to avoid catastrophic impacts. Senate Bill 32, passed in 2016, requires the state to cut GHG emissions to 40 percent below 1990 levels by 2030, as shown in Figure 2.

Figure 2. California GHG Emissions Target



Source: California Air Resources Board, *California's 2017 Climate Change Scoping Plan,* November 2017.

On-road vehicles are responsible for about one-third of GHG emissions in San Bernardino County. In addition to state-led efforts, programs and projects to reduce transportation GHG emissions are occurring at the regional and local level. The Regional Transportation Plan, developed by the Southern California Association of Governments, demonstrates how the region will reduce per-capita GHG emissions from passenger vehicles in accordance with the requirements of SB 375.[7] An effort led by the San Bernardino Council of Governments (SBCOG) has compiled an inventory of GHG emissions and an evaluation of reduction measures that could be adopted by 25 partnership cities in the County.[8]

Action Plan Overview

This Action Plan describes steps that local governments in San Bernardino County and their partners can take to increase the deployment and use of clean vehicles and fuels, and thereby help to improve air quality and mitigate the impacts of climate change. This document is a companion to the June 2020 Final Report entitled "Paths to Clean Vehicle Technology and Alternative Fuels Implementation in San Bernardino County".

2 Clean Vehicle and Fuel Options

Flex fuel logo, *John De La Rosa / NREL*

There are many options for advanced technology and alternative fuel vehicles that can reduce emissions as compared to conventional gasoline and diesel vehicles, as listed in Table 1. This section provides a brief description of the most promising of these options.

Table 1. List of Clean Vehicle and Fuel Options

Light-duty vehicle and fuel options	Medium- and heavy-duty vehicle and fuel options
Battery electric vehicle	Battery electric vehicle
Plug-in hybrid electric vehicle	Plug-in hybrid electric vehicle
Fuel cell vehicle	Fuel cell vehicle
Natural gas vehicle	Natural gas vehicle
E85 flexible fuel vehicle	Renewable natural gas
	Propane
	Biodiesel
	Renewable diesel

2.1 Electric Vehicles

Description and Availability. Plug-in electric vehicles (EVs) are rapidly growing in commercial availability and offer a promising alternative to gasoline and diesel-powered vehicles. EVs are typically broken out into two distinct architectures: plug-in hybrid electric vehicles (PHEVs) use a battery and internal combustion engine for propulsion while battery electric vehicles (BEVs) rely solely on a battery. Over 1.4 million EVs have been sold in the U.S., with nearly half of those sales occurring in California.[9]


Leaf EV, *Denver Metro Clean Cities*

There are approximately 60 EV passenger vehicle models available today in the U.S. and that number is expected to increase to over 100 by 2022, giving consumers more choice and flexibility in EV purchase decisions.[10]

Commercial offerings of EV are much more limited for medium- and heavy-duty vehicles. Transit buses are the most widely deployed heavy-duty EV. There are currently 27 zero-emission electric transit bus models eligible for state incentives, and California Air Resources Board (CARB) expects that 1,000 EV transit buses will be deployed in California by 2020.[11] In contrast, only a small number of medium- and heavy-duty EV trucks have been deployed. Long-haul tractor-trailer trucks currently face challenges to electrification due to limited electric range relative to their diesel counterparts. However, this market is evolving, and several major manufacturers and suppliers, including Tesla, BYD, TransPower, Daimler/Freightliner, Volvo, and Cummins, have either deployed or planning to deploy electric trucks or battery packs soon.

Foothill transit EV bus, *Robert Prohaska / NREL*

Most BEVs today do not have ranges comparable to their internal combustion engine counterparts. However, improvements in battery technology are increasing vehicle range: the Department of Energy found that the median range of new passenger vehicle BEVs increased from 73 to 125 miles from 2011 to 2018.[12] Moreover, many new BEVs have ranges exceeding 200 miles, including but not limited to: the Chevrolet Bolt (248 miles), Nissan LEAF PLUS (226 miles), Hyundai Kona (258 miles), and Tesla Model 3 (220+ miles). Given that motorists drive, on average, approximately 12,000 to 15,000 miles per year, EVs are well-suited to handling daily driving needs of most drivers between charges.

Emissions Impacts. EVs produce zero tailpipe emissions when running on electricity. PHEVs produce emissions when using their gasoline engines, but are generally more fuel-efficient than the average internal combustion engine vehicle. Well-to-wheels GHG emissions, which include emissions from fuel production and fuel use, are dependent on the regional electric generation mix. California's grid is one of the cleanest in the nation. On this generation mix, EVs produce 81 percent less GHG emissions than a comparable gasoline vehicle.[13] Moreover, under Senate Bill 100 (2018), the state's Renewable Portfolio Standard requirements ramp up to 60 percent by 2030 and 100 percent

by 2045. Therefore, as the state and regional electricity systems get cleaner, EV well-to-wheels emissions will continue to decline.

Costs. The purchase price for a light-duty EV is higher than a gasoline counterpart, largely due to the cost of the battery. An EV today costs $6,000 to $20,000 more than a comparable gasoline vehicle, although incentives can help offset this increment. However, battery costs are continuing to decline: average EV battery costs dropped from $373/kilowatt-hour (kWh) in 2015 to $176/kWh in 2018 and are expected to decline further over the next decade. Price forecasts vary, but many observers project that passenger vehicle EVs will achieve purchase price parity with comparable gasoline vehicles between 2024 and 2028, depending the size of the vehicle and the EV range.[14]

Fuel cost savings for EVs can be significant, particularly when drivers can take advantage of time-varying electricity rates that lower the cost of fuel during off-peak times. ICCT estimates that EV owners can expect to realize fuel savings of $3,500 for cars, $3,900 for crossovers, and $4,200 for SUVs over the first 5 years of ownership.

Infrastructure. San Bernardino County has more than 100 commercial EV charging stations, each providing two or more outlets. This does not include the large amount of residential EV charging infrastructure. EV charging is categorized by the level of power provided. Level 1 charging stations use a standard 120V outlet and provide about 1.1 kilowatts (kW) of power, refueling an EV at a rate of 2-5 miles per hour of charging. Level 1 stations are typically deployed at locations where vehicles are parked for long periods of time, such as homes, workplaces, and airports. Level 2 stations use a 208V/240V outlet and typically provide 3.3-6.6 kW of power, providing 10-20 miles of range per hour of charging. Level 2 stations are also deployed at locations where vehicles dwell for longer periods of time, including homes, workplaces, and other overnight locations. Direct Current Fast Charging (DCFC) stations require 240V or 480V service and current stations provide power at 25 kW up to 350 kW, although most installed DCFC stations provide 50 kW of power. These 50 kW plugs can add roughly 3 miles of range per minute, while 350 kW connectors can add up to 20 miles per minute. DCFC stations are installed in public locations where cars may only be parked a short time.

DC fast charger

More than 80 percent of EV charging takes place at home, typically overnight when the vehicle is parked.[15] However, lack of charging infrastructure is one of the key challenges associated with the widespread use of EVs; as the EV market continues to grow, more public and workplace charging infrastructure will be needed to support EV adoption for drivers without dedicated access to residential charging.

2.2 Natural Gas Vehicles

Description and Availability. Natural gas vehicles (NGVs) are a well-established alternative to diesel for certain types of heavy-duty vehicles. Natural gas is generally not used in the light-duty vehicle sector. Natural gas is consumed either as compressed natural gas (CNG) or liquefied natural gas (LNG). Southern California has a significant number of natural gas vehicles in service for port drayage, regional freight hauling, refuse fleets, and transit buses. For example, NGVs comprise 3 percent of the drayage fleet at the Ports of Los Angeles and Long Beach and are the most dominant alternative fuel vehicle drayage truck platform.[16]

CNG truck, *Lancer Automotive Group*

Unlike light- and medium-duty vehicles, the heavy-duty truck manufacturing industry is not vertically integrated, so the tractor, engine, powertrain, and trailer are typically manufactured separately. For heavy-duty vehicles (class 7 and 8), there is only one certified natural gas engine manufacturer (Cummins Westport's CWI line which includes a 6.7 liter engine, a 9 liter engine, and a 12 liter engine). These engines cover a wide array of performance requirements.

There is more modest NGV commercial availability in medium-duty vehicles. In Class 4-5 vocations, NGVs are well suited for shuttles and urban delivery trucks, and in Class 6 vocations they are used in regional haul applications. NGVs face some limitations in these segments because the compressed storage tanks of CNG require special consideration in the design of the chassis. NGV offerings for the light duty segment are very limited.

Emissions Impacts. Natural gas provides NOx and PM2.5 benefits over diesel. NGVs can reduce PM2.5 up to 70 percent and reduce NOx by 50 to 90 percent. NOx reductions vary based on

the NGV engine technology; new low-NOx engines meet a voluntary emissions standard that is 90 percent below the current NOx standard. The GHG emissions impacts of NGVs depends on the fuel source. Conventional (fossil) natural gas provides only modest GHG benefits—a 12 percent reduction on a lifecycle basis. Much larger GHG reductions are possible with renewable natural gas (RNG).

RNG is derived from biomass or other renewable resources, and is a pipeline-quality gas that is fully interchangeable with conventional natural gas. RNG accounts for more than 60 percent of California's market for natural gas as a transportation fuel. Most RNG in California is made from landfill gas, which reduces GHG emissions by 56 percent compared to diesel. Production will likely shift over time to lower carbon intensity RNG made from feedstocks such as the anaerobic digestion of animal manure and digesters deployed at wastewater treatment plants; the GHG benefits of these forms of RNG can exceed 90 percent.

Costs. NGVs carry a higher purchase cost of between $25,000 to $60,000, as compared to medium- and heavy-duty diesel vehicles. Fueling costs for NGVs tends to be lower than diesel. So the total cost of ownership of the vehicle, which includes fuel costs, can be slightly less for certain vocations of NGVs, particularly as VMT increases. Vehicle costs can also be defrayed by incentives; the state's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP), for instance, provides vehicle incentives, and the renewable fuel standard (RFS) and low carbon fuel standard (LCFS) programs both provide incentives that are typically passed on to the fleet or end user in some way.

Infrastructure. There are about 30 public and private natural gas fueling stations in the Inland Empire, most of them CNG. The costs for natural gas fueling infrastructure varies by the size of the fueling station. Assuming vehicles return to a base, they can be fueled at a centralized location using a fast-fill or time-fill station. A small time-fill station will typically cost $250,000 to $500,000 to develop; a large fast-fill natural gas station can cost well over $1 million.

2.3 Liquid Biofuels

Biofuels can be produced from plants or from agricultural or commercial wastes. Common biofuels include ethanol, biodiesel, and renewable diesel. Biofuels are typically blended with conventional fuels, although can sometimes be used as a transportation fuel in pure form.

E85 pump, *Mark Bentley*

Ethanol. Ethanol is an alcohol made from corn or other plant materials. Ethanol has been used as a transportation fuel since the 1970s. In the U.S., nearly all gasoline is blended with 10 percent ethanol to increase octane and reduce emissions. E15 is a blend of 15 percent ethanol with gasoline and is approved for use in model year 2001 and newer vehicles. E85, sometimes known as flex fuel, is a blend containing up to 85 percent ethanol and is only for use in flex fuel vehicles. Flex fuel vehicles are available as a standard option for many light-duty vehicle models. But manufacturers have significantly reduced flex fuel vehicle production in recent years, as both consumer and regulator preferences have shifted to EVs.

Ethanol blends have only minimal impacts on NOx and PM2.5 emissions. On a life cycle basis, ethanol produced from corn reduces GHG emissions by about 30 percent, while ethanol produced with cellulosic feedstocks can reduce GHG emissions from 50 to 90 percent. Most ethanol is made from corn, but due in part to the state's Low Carbon Fuel Standard, ethanol producers selling into the California market have been reducing carbon intensity over time. There are approximately 20 stations that sell E85 in San Bernardino County.

Biodiesel. Biodiesel is manufactured from vegetable oils, animal fats, or recycled restaurant grease. It is commonly sold as a 20 percent blend with conventional diesel (B20). Some studies have found that biodiesel can cause a small increase in NOx emissions; for this reason, biodiesel use has been discouraged in Southern California due to ozone concerns. Depending on feedstock, B20 reduces GHG emissions by 10 to 18 percent. One public fueling stations currently sells B20 in the county.

Biodiesel fuel pump

Renewable Diesel. Renewable diesel is a liquid fuel produced from biomass. It meets the fuel specification requirements for petroleum diesel fuel, meaning that although it is produced from biomass, it has the properties of conventional diesel. Renewable diesel is a drop-in replacement and can be blended into the conventional diesel supply without limitations. Due in part to incentives that result from the Low Carbon Fuel Standard, use of renewable diesel has been increasingly rapidly in California. In 2019, renewable diesel accounted for approximately 16 percent of all diesel sold in the state, up from approximately 4 percent in 2015. Most of this renewable diesel is blended with conventional diesel and thus largely unknown to truck owners and operators.

The GHG emissions impacts of renewable diesel depend on the feedstock and blend percentage. A five percent blend (RD5) reduces GHG emissions by about 3 percent, while RD100 reduces GHG emissions by about 66 percent. Renewable diesel has no significant impact on NOx but can reduce PM2.5 emissions. Renewable diesel is priced competitively with conventional diesel, and does not have any additional operations and maintenance costs as compared to conventional diesel.

2.4 Fuel Cell Vehicles

Description and Availability. Similar to EVs, fuel cell vehicles (FCVs) use electricity to power an electric motor. However, rather than a battery, the electricity instead comes from stored hydrogen gas that passes through a fuel cell, which generates an electric current by splitting the hydrogen molecules. Light-duty FCVs are commercially available but have not been deployed to the same degree as EVs. About 8,000 FCVs have been sold or leased in the U.S. to date (versus 1.4 million EVs).[17] For heavier vehicles, transit buses are the most mature application of fuel cell technology; approximately 40 fuel cell buses currently operate in California. Beyond transit buses, medium- and heavy-duty FCV demonstration projects have been primarily focused at ports. Nikola Motors is currently in the demonstration phase of producing two fuel cell tractor models that are expected to reach mass production around 2025.

Toyota Mirai FCV, *Dennis Schroeder / NREL*

FCVs can have a range similar to their gasoline and diesel vehicle counterparts, an advantage over EVs.

Emissions Impacts. FCVs produce zero tailpipe emissions, and instead emit only water vapor and warm air. Similar to electricity for EVs, hydrogen for FCVs can be produced from a number of processes and sources which affects the FCV well-to-wheels GHG emissions. The most common process is natural gas reforming, which involves the use methane and thermal processes to create hydrogen gas. This process dilutes some of the emissions reductions benefits of FCVs: on a lifecycle basis, it may only reduce GHG emissions by 10 percent relative to diesel fuel in the U.S.[18] Hydrogen is increasingly being produced by electrolysis, which uses electricity to split water into hydrogen and oxygen; in California, that electricity is produced by increasingly cleaner generating resources. Currently, FCVs running on hydrogen produced by electrolysis in California have about 40 percent lower GHG emissions than similar gasoline vehicles. As hydrogen production becomes powered primarily be renewable energy resources, it is expected that the carbon intensity of the fuel will be cut roughly in half by 2030.[19]

Costs. FCVs are significantly more expensive than conventional vehicles on an upfront basis, due in part to low production volumes. The Toyota Mirai (comparable to a Toyota Prius) and Hyundai Nexo (comparable to the Hyundai Kona) both have a suggested retail price of approximately $58,000. For medium- and heavy-duty vehicles, reliable vehicle cost data is scarce. A 2018 assessment found that recent fuel cell bus orders cost $1.27 million, down from $2.5 million in 2010.[20]

Infrastructure. The challenge with widespread deployment of FCVs is related less to the vehicles and more to the infrastructure needed to fuel them. Currently, there are only 42 public hydrogen fueling stations available in the U.S., nearly all of them in California. The California Energy Commission (CEC) estimates a cost of about $2 million per station.[21]

FCV bus, *Leslie Eudy / NREL*

2.5 Summary

The vehicle technologies and alternative fuels summarized above offer promising opportunities to reduce both NOx and GHG emissions from vehicles operating in San Bernardino County. Some trends are particularly encouraging, such as the steady decline in EV battery costs, the growing use of RNG, and rapid increase in renewable diesel as a blend in California's diesel fuel supply. But the clean vehicle options still vary widely in terms of the level of technology readiness and commercial availability, as well as their emissions benefits and costs. At this point, no one can say for certain

which technologies and fuels will win out in the marketplace and prove to be the best option for vehicle owners in the long run. This uncertainty creates a dilemma for local governments, who may be eager to support the transition to clean vehicles and fuels but are wary about investing in vehicles and fueling infrastructure that may be obsolete in the future. While this uncertainty calls for careful planning and analysis before devoting municipal resources, it does not warrant inaction. Local governments can make well-informed decisions today that carry little risk of obsolete technologies and stranded assets.

For light-duty vehicles, it is abundantly clear that EVs (including battery electric and plug-in hybrid electric vehicles) should be the focus of government clean vehicle support efforts. The price of EVs is declining, the number of commercial offerings is expanding significantly, and the emissions benefits are clear. For medium- and heavy-duty vehicles, the outlook is less clear. In the long-run, electric powertrains are expected to dominate the marketplace, and state regulations are pushing manufacturers to sell more EVs across all vehicle types. But for the next 10-20 years, a number of different technologies and fuels can offer optimized solutions for medium- and heavy-duty vehicles while maximizing emissions benefits, depending on the vehicle duty cycle, range, payload, fueling location, and other factors. This situation has been described as the "messy middle", and it will require public agencies to stay informed about the various options and support those that are most feasible and beneficial to County residents and businesses.[22]

3 Implementation Strategies for Local Governments

Given the importance of regional air quality and climate goals, near-term actions must be taken to reduce transportation sector emissions while maintaining the economic competitiveness of San Bernardino County's businesses. Local governments have a number of tools at their disposal to accelerate the adoption of clean vehicles and fuels. State and regional partners including SCAG, SBCTA, CARB, CEC, the South Coast Air Quality Management District (AQMD), Southern California Edison (SCE), Southern California Gas Company (SoCalGas), and other stakeholders also have a valuable role to play in facilitating the transition to alternative fuels. The figure below summarizes high level principles that shape the approach to implementation strategies described in this Action Plan.

Figure 3. Guiding Principles for Clean Vehicle and Fuel Implementation Strategies

Addressing both **air pollution and climate change** is essential.	**State policies, programs, and regulations** guide major funding opportunities for clean vehicles and fuels.	Electrification is a clear priority in the **light-duty sector**.	Diverse vehicle and technology options are available for the **medium and heavy-duty sector**.	Local jurisdictions can still pursue **"no-regrets" strategies** to accelerate clean vehicles and fuels.

This section provides more detail on strategies that local governments can pursue to drive clean vehicle adoption. Strategies are divided into three sections based on vehicle type: private vehicles, commercial fleets, and municipal fleets.

3.1 Strategies for Private Vehicles

Most residents that live, work in, or visit San Bernardino County drive light-duty passenger vehicles. Light-duty vehicles comprise the majority of on-road GHG emissions in the County and a significant portion of on-road NOx emissions that cause ozone pollution. The following strategies outline how local governments can encourage the adoption of EVs and associated charging infrastructure in the San Bernardino region. More information on San Bernardino County's light-duty EV landscape is also available in SBCTA's 2019 "Zero-Emission Vehicle Readiness and Implementation Plan".[23] The table below provides a summary of proposed private vehicle strategies and the category.

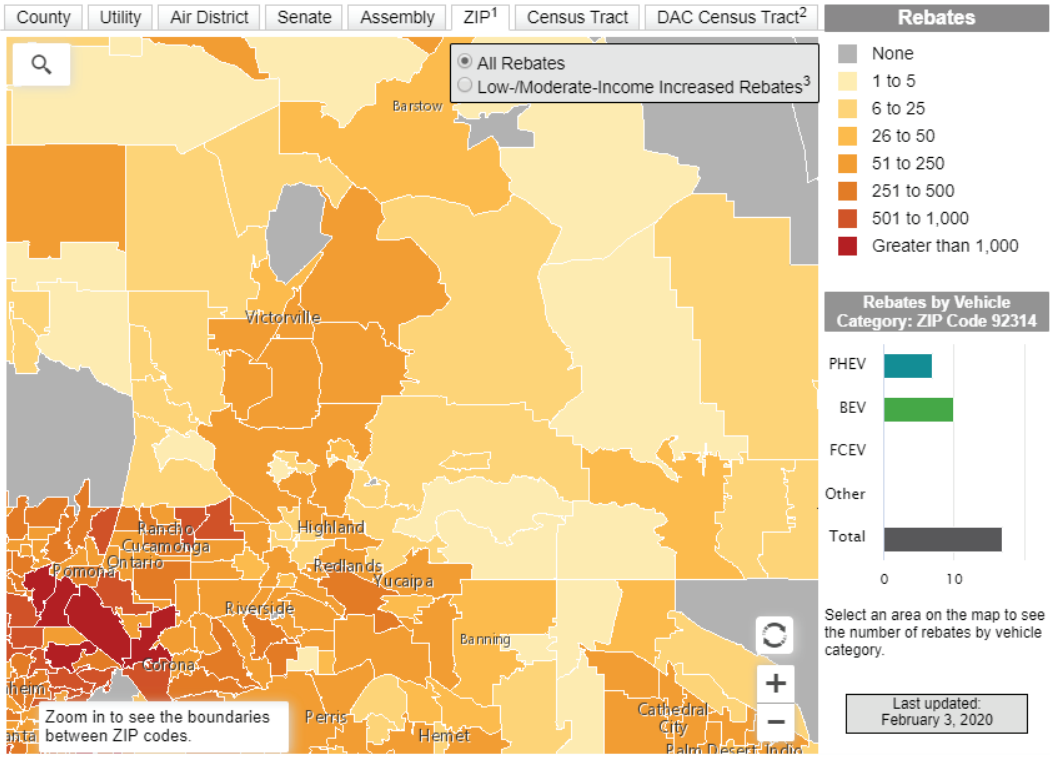
Table 2. Private Vehicle Implementation Strategies

Light-duty vehicle and fuel options	Strategy
Information Gathering	1. Assess EV registrations in local jurisdictions
	2. Identify EV charging infrastructure gaps
Enabling	3. Streamline EV charger permitting processes
	4. Strengthen EV-ready building codes
	5. Strengthen EV-ready zoning and parking codes
Investing	6. Deploy public EV charging infrastructure
Reinforcing	7. Explore EV shared mobility services
	8. Support State EV programs
	9. Develop or update a Climate Action Plan

Assess EV registrations in local jurisdictions

Cities can plan more effectively for the transition to alternative fuel vehicles by completing a detailed assessment of vehicle registrations in their jurisdiction. The California Department of Motor Vehicles compiles and reports data on vehicle registrations by fuel type, by county, city, or zip code.[24] This data source can be used to determine the number and percent of battery electric, plug-in hybrid, fuel cell, ethanol, and natural gas vehicles are registered at the city level. Officials can also develop more accurate estimates of EVs and FCEVs in their jurisdiction by using Clean Vehicle Rebate Project (CVRP) data. According to the Zero-Emission Vehicle Readiness and Implementation Plan, 52 percent of CVRP rebates were for PHEVs, 46 percent for BEVs, and 2 percent for FCEVs.[25] The CVRP also maintains a rebate map that provides zip code and census tract-level information that cities can use. The figure below shows CVRP participation by zip code across a portion of San Bernardino County.

Figure 4. CVRP Rebates by Geography: San Bernardino County



Source: Center for Sustainable Energy

Identify EV charging infrastructure gaps

Similar to assessing local EV registrations, cities can also identify gaps in local EV charging infrastructure networks by developing a greater understanding of current public charging investments. The U.S. Department of Energy's Alternative Fuels Data Center Station Locator tool provides detailed information on publicly available charging infrastructure, including: station address, contact number, charging station type, plug type, number of outlets, and hours of accessibility.[26] Station Locator maps can provide cities with a comprehensive view of where public charging infrastructure exists and where gaps remain. Maps may be particularly valuable for closing gaps in DCFC infrastructure needed to enable intercity highway corridor travel and reduce range anxiety among prospective EV drivers. SBCTA's Zero-Emission Vehicle Readiness and Implementation Plan recommends deploying DCFC stations at least every 50 miles to facilitate inter-county and intra-county travel; more stations are needed in higher density areas.

Streamline EV charger permitting processes

Streamlining EV charger permitting can improve the efficiency and cost-effectiveness of charging infrastructure deployment. Assembly Bill (AB) 1236 requires California cities to develop ordinances to streamline EV charging station permitting processes and provide clarity for EV charging service

providers, site hosts, and local governments on permit review requirements.[27] The figure below illustrates the key requirements of the law.

Figure 5. AB 1236 Requirements

AB 1236 Compliant	Not AB 1236 Compliant (Challenging to Deploy Charging)
Ordinance creating an expedited, streamlined permitting process for electric vehicle charging stations (EVCS) including level 2 and direct current fast chargers (DCFC) has been adopted	No permit streamlining ordinance; and/or ordinances that create unreasonable barriers to EVCS installation
Checklist of all requirements needed for expedited review posted on Authority Having Jurisdiction (usually a city or county) website	No checklist for EVCS permitting requirements
EVCS projects that meet expedited checklist are administratively approved through building or similar non-discretionary permit	Permitting process centered around getting a discretionary use permit first
EVCS projects reviewed with the focus on health and safety	EVCS projects reviewed for aesthetic considerations in addition to building and electrical review
AHJ accepts electronic signatures on permit applications	Wet signatures required on one or more application forms
EVCS permit approval not subject to approval of an association (as defined in Section 4080 of the Civil Code)	EVCS approval can be conditioned on the approval of a common interest association
AHJ commits to issuing one complete written correction notice detailing all deficiencies in an incomplete application and any additional information needed to be eligible for expedited permit issuance	New issue areas introduced by AHJ after initial comments are sent to the station developer

Source: California Governor's Office of Business and Economic Development (GO-Biz)

To help cities comply with the law, the California Governor's Office of Business and Economic Development (GO-Biz) has developed several key resources on charging infrastructure permitting and installation, including the Electric Vehicle Charging Station Permitting Guidebook, the Permitting Electric Vehicle Charging Station Scorecard and Map, and a compilation of permitting best practices.[28] California Building Officials has also developed toolkits and sample EV charging station permitting ordinances that can assist local jurisdictions in compliance with AB 1236.[29] Without streamlined, easy-to-follow permitting processes, cities risk losing opportunities for private EV charging infrastructure investment to jurisdictions with AB 1236-compliant procedures: Electrify America has identified complex permitting reviews as a significant challenge to the deployment of publicly accessible charging stations.[30] However, cities can take immediate action to simplify

permitting processes and accelerate the deployment of EV charging stations. For example, GO-Biz highlights the City of Redlands' permitting ordinance as an example of best practice compliance with AB 1236.

Strengthen EV-Ready building codes

Cities can help accelerate EV charger installation timelines and reduce costs by strengthening their local building codes. Several studies show that retrofitting electrical infrastructure to support EV charger installations can be 2-8 times more expensive than if the infrastructure is included during building construction.[31] [32] [33] The state's green building code (CALGreen) sets requirements for the construction of new buildings in California and has recently developed minimum requirements for the installation of electrical infrastructure (e.g. conduit, panels) that supports the deployment of EV charging stations.[34] As of January 2020, newly constructed buildings are required to meet the updated specifications outlined in the table below.

Table 3. CALGreen 2020 EV-Ready Requirements

Building Type	Requirement
Single Family Residences, Duplexes, and Townhomes (with garages)	Must install conduit and panel capacity to support future installation of Level 2 charging stations
Multi-unit Dwellings	Must install conduit and panel capacity to support future installation of Level 2 charging stations at a minimum of 10 percent of parking spaces
Non-Residential Buildings	Must install conduit and panel capacity to support future installation of Level 2 charging stations at 4-10 percent of parking spaces depending on number parking spaces available.

CALGreen has also developed "reach codes" that outline how local jurisdictions can exceed the requirements specified in the building code. These reach codes typically require higher percentages of parking spaces to equipped with conduit and panel capacity necessary for additional Level 2 charging station deployments. Cities can also demonstrate leadership by strengthening EV readiness requirements beyond the furnishing of conduits and panels to include the installation circuits and wiring to support EV charging stations—further reducing the cost and complexity of deploying EV charging stations at the building site. Cities can also extend building codes to include existing buildings—particularly in cases when existing buildings undergo major retrofits. The City of Oakland's EV-readiness ordinance requires new electric panel capacity to service 20 percent of parking spaces in new multi-unit dwellings and non-residential buildings as well as full circuits installed for 10 percent of parking spaces.[35]

Strengthen EV-Ready zoning and parking codes

City parking regulations and requirements can also encourage EV charging station deployment. Many cities and municipalities have minimum parking requirements that govern the number of spaces that real estate developers need to provide for certain building types. Developers and businesses may be hesitant to deploy charging in new and existing buildings if parking spaces equipped with charging infrastructure are not counted toward minimum parking requirements. Updated parking ordinances that recognize EV charging equipped spaces as parking spaces (and not traditional fueling stations) will create certainty for project developers looking to deploy charging stations at commercial properties. Cities can go further to incentivize EV charging stations in new buildings by allowing EV charging equipped spaces to count as two parking spaces for the purposes of meeting local minimum parking requirements—potentially reducing developer costs associated with satisfying zoning requirements. For example, the City of Stockton allows parking spaces equipped with EV charging stations to count as two parking spaces for up to 10 percent of total parking required by the local zoning ordinance.[36]

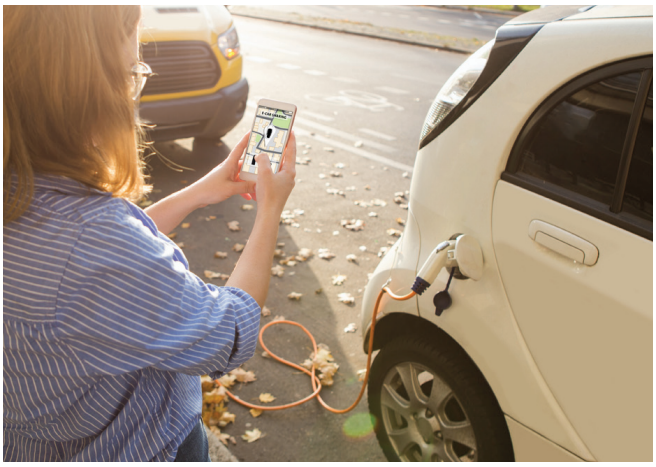
EV parking space, *P.J. Ray / PNM Resources*

Deploy public EV charging infrastructure

To expand access to electricity as a transportation fuel, local jurisdictions can make strategic investments to deploy EV charging stations in their communities. Cities own property that could be ideal to support community charging needs: municipally-owned parking lots at parks, libraries, other recreational areas, parking garages, and street parking may all provide valuable recharging opportunities for residents.[37] The state has resources on the basic types of EV chargers and strategies to make charger installations easy.[38] Equally as important, the CEC also provides incentive funding for EV chargers via the California Electric Vehicle Infrastructure Project (CALeVIP): approximately $2 million in incentives were allocated specifically to San Bernardino County for the installation of DCFC stations. Local electric utilities may also have additional incentives and resources available to deploy charging stations. SCE's Charge Ready Program has a goal of supporting 2,500 Level 2 charging stations across multi-unit dwellings, workplaces, and other public locations across SCE's service area. Although the program is fully subscribed, SCE's pending Charge

Ready 2 Program could support an additional 48,000 Level 1, Level 2, and DCFC chargers across the region.[39] Cities should also ensure that appropriate networking and maintenance contracts are in place to support the reliable and safe operation of EV charging stations in the long-term. In short, cities can stretch local resources further by seeking out additional funding to deploy charging stations that support their communities. For example, the City of Sacramento owns over 70 EV chargers that are available for use at City parking facilities.[40] Cities can also reduce electricity costs associated with EV charger use by participating in the state's Low Carbon Fuel Standard (LCFS).

Explore EV shared mobility services



Cities have begun promoting alternatives to vehicle ownership via EV carsharing and other shared mobility services; local jurisdictions can assess the potential for these services in partnership with state agencies, non-profit and community-based organizations, and EV industry stakeholders. Car sharing services could provide access to e-mobility for residents that may not drive personal vehicles and could serve as a complement to public transit. Charging infrastructure deployment at designated car sharing parking spaces may also be necessary to refuel EVs in a timely manner and maintain utilization. The CVRP may be able to provide incentives for the purchase of qualified shared mobility fleet vehicles.[41] CARB's Clean Mobility Options may also be able to provide additional voucher-based funding for zero-emission carsharing, vanpooling, and other transportation services in the region's underserved communities.[42] California Strategic Growth Council's Transformative Climate Communities Grants may also provide similar funding opportunities for projects that can provide environmental and economic benefits to individual neighborhoods.[43] Los Angeles' BlueLA is an all-electric carsharing service with 100 EVs and 200 charging stations at 35 Central Los Angeles locations; discounted rates are also available for income-qualified drivers.[44] GIG Car Share is an all-electric carsharing service operating in Sacramento with 260 Chevy Bolts available for use. The City of Sacramento has enabled carshare operators to apply for special parking privileges in the city's right-of-way; permit fees are designed to incentivize the use of zero-emission vehicles, including EVs.[45]

Support State EV programs

Local governments can engage the Assembly and relevant state agencies to encourage the expansion of programs that would accelerate EV adoption in San Bernardino County. Participation in public hearings and comment periods can help demonstrate San Bernardino County's leadership and commitment to advance transportation electrification. Examples of existing state level incentive programs for light-duty vehicles are included in the following table.

Table 4. List of California State Agency Light-Duty EV Programs

Program Name	Lead Agency	Program Description
Clean Vehicle Rebate Project (CVRP)	CARB	CVRP provides incentives toward the purchase of new, qualified battery electric and plug-in hybrid electric vehicles for qualified drivers. Funds are awarded on a first-come, first-served basis.
Clean Cars 4 All Program	CARB	Clean Cars 4 All promotes cleaner air by providing low-income residents in eligible air districts with incentives to scrap and replace their old vehicle with low-emission options such as EVs or transit passes. The program also supports incentives for residential EV chargers.
Clean Mobility Options	CARB	Clean Mobility Options is a grant-based program to address the transportation needs of low-income and disadvantaged community residents. The program supports initiatives such as zero-emission carsharing and vanpooling.
VW Beneficiary Mitigation Plan (BMP)	CARB	The BMP provides modest funding opportunities to support fueling infrastructure for zero-emission vehicles, including EVs.
Financing Assistance for Lower-Income Consumers	CARB	This initiative provides attractive financing options for qualified California residents on a grant basis for the purchase of low and zero-emission vehicles.
Zero-Emission Assurance Project (ZAP)	CARB	ZAP provides incentives toward the replacement of EV batteries and fuel cells in used EVs for qualified California drivers. The program will launch in 2020.
CALeVIP	CEC	CALeVIP provides rebates for the purchase and installation of publicly accessible and shared use charging infrastructure on a first-come, first-served basis. The program has funded both L2 and DCFC charging infrastructure to date.

Develop or update a Climate Action Plan (CAP)

Cities and county governments can develop and regularly update CAPs in accordance with local and state climate goals. CAPs leverage existing information from GHG inventories to establish GHG mitigation targets, identify cost-effective strategies to achieve these targets, and develop monitoring mechanisms to evaluate progress.[46] The California Strategic Growth Council Sustainable

Communities Planning Grants, along with city funding, can provide resources needed to draft and support implementation of CAPs. For example, the City of Brawley received a grant from the Strategic Growth Council to develop a CAP, which included measures to increase EV adoption and streamline city regulations to encourage EV charging station deployment.[47] SBCOG has developed a Regional Greenhouse Gas Reduction Plan that includes an inventory of GHG emissions and an evaluation of reduction measures that could be adopted by 25 partnership cities in the County.[48]

3.2 Strategies for Commercial Fleets

Most of the commercial vehicles in San Bernardino County are medium and heavy-duty trucks used for goods movement. The San Bernardino region's economy is heavily concentrated in logistics and freight sectors, which contribute to the County's air quality challenges. Although San Bernardino County may have little control over vehicle fleets based outside the region, local governments can implement measures to encourage the adoption of cleaner vehicles in commercial fleets. The table below provides a summary of the implementation strategies for commercial fleets.

Table 5. Commercial Fleet Implementation Strategies

Strategy Type	Strategy
Information Gathering	1. Support knowledge maintenance on emerging technologies
Enabling	2. Streamline hydrogen fueling station permitting processes
	3. Streamline natural gas fueling station permitting processes
	4. Streamline EV charger permitting processes
	5. Strengthen EV-ready building codes
Reinforcing	6. Support State clean vehicle programs

Support knowledge maintenance on emerging technologies

The medium and heavy-duty transportation sector is undergoing rapid change with the emergence of zero-emission alternatives to traditional diesel vehicles across an array of vehicle platforms: many new models are expected to be commercially available in 2021 or shortly thereafter.[49] However, vehicle demonstration projects are underway now to assess the performance of these emerging technologies; some of these pilots are taking place in or adjacent to San Bernardino County as part of a continued effort to reduce local emissions.[50] Local governments can reach out to CARB and other state or regional agencies to gather more information on pilot parameters and gain preliminary insights into the viability of various zero-emission vehicle options that may influence local clean transportation policy in the near-term. For example, Volvo LIGHTS (Low Impact Green Heavy Transport Solutions) is a collection of demonstration projects leveraging funding from

California Climate Investments and AQMD to assess battery electric truck performance across Southern California.[51] Several of the projects are located in San Bernardino County:

- Dependable Supply Chain Solutions in Ontario is installing two 150 kW DCFC chargers and deploying three Volvo heavy-duty battery electric trucks;
- TEC Equipment in Fontana and La Mirada will deploy 15 Volvo heavy-duty batter electric trucks, two 150 kW DCFC chargers, and two 50 kW DCFC chargers; and
- San Bernardino Valley College Heavy/Medium Duty Truck Technology Department is designing Certificate and Associate's degree-level training programs specific to heavy-duty battery electric truck maintenance to promote the region's workforce development.

Streamline hydrogen fueling station permitting processes

Although it may be premature for local governments to make investments in hydrogen fueling infrastructure, FCVs may become commercially viable options for select heavy-duty applications and cities can enable private sector infrastructure investment by streamlining hydrogen fueling station permitting processes. Currently, permitting and deployment of hydrogen fueling stations is a time-intensive process: for hydrogen fueling stations completed via a 2015 CEC grant funding opportunity (primarily for light duty vehicles), it took 386 days on average to advance from an initial permit application to approval to begin construction.[52] Cities can pursue a menu of options to streamline permitting processes and ultimately increase the availability of hydrogen fueling infrastructure:

- Where appropriate, clarify use of hydrogen fuels in commercial and industrial zones: local governments can assert that hydrogen fuel is zoned for commercial and industrial zones, reducing the need for developers to apply for conditional use permits or variances; some cities classify hydrogen as an automotive fuel that can be used at gas stations and other areas within commercial zones[53];
- Minimize architectural or other aesthetically-driven review processes where feasible: permit review for health and safety considerations should be priority for local governments; and
- Establish reasonable permitting fees: fees should be commensurate with the costs associated with application review and not unduly discourage the development of hydrogen fueling stations.

PHEV truck, *Dennis Schroeder/NREL*

Streamline natural gas fueling station permitting processes

NGVs powered by RNG will likely remain part of a comprehensive strategy to reduce emissions from medium and heavy-duty vehicles in San Bernardino County, and expanding natural gas fueling infrastructure will be critical for supporting the adoption of new NGVs. Inefficient permit review processes can cause infrastructure project delays that hinder the adoption of alternatives to diesel fuel. Similar to hydrogen fueling infrastructure, cities can facilitate private investment in CNG infrastructure by ensuring that permitting of natural gas fueling stations is streamlined and efficient. Zoning ordinances can clarify natural gas' use as a transportation fuel, and permitting officials could review applications solely based on health and safety criteria—reducing the risk of delays from aesthetic or other discretionary reviews. Permitting requirements can be made accessible via online checklist for station developers and fleet managers seeking to deploy CNG fueling stations.

Streamline EV charger permitting processes

Similar to private vehicles, commercial fleets may also benefit from streamlined EV charger permitting processes. Fleet owners may install EV charging equipment to coincide with the procurement of medium and heavy-duty EVs, elevating the importance of a straightforward, consistent permitting process. For more information on this topic, read "Streamline EV charger permitting processes" in Section 3.1.

Strengthen EV-Ready building codes

Strengthening EV-Ready building codes for commercial and industrial facilities can also reduce the costs of deploying EV charging infrastructure for commercial fleets. For more information on this topic, read "Strengthen EV-Ready building codes" in Section 3.1.

Support State clean vehicle programs

Similar to light-duty vehicles, California has implemented a variety of programs aimed to accelerate the adoption of cleaner medium and heavy-duty vehicles. San Bernardino County can demonstrate its commitment to air quality and climate change goals by leveraging public hearings, solicitations for comment, and other forums to expand or improve programs for alternative fuel medium and heavy-duty vehicles. Examples of existing state level incentive programs for light-duty vehicles are included in the following table.

Table 6. List of California State Agency Clean Medium and Heavy-Duty Programs

Program Name	Lead Agency	Program Description
Hybrid and Zero-Emission Truck and Bus Voucher Incentive Program (HVIP)	CARB	HVIP provides incentives for purchasers and lessees of zero-emission and low NOx MD/HD vehicles on a first-come, first-served basis. Unlike other incentive programs, HVIP does not require scrappage of replaced vehicles and can be combined with other funding sources. Vehicles operating in disadvantaged communities are eligible for increased incentives.
Carl Moyer Program	CARB	The Carl Moyer Program is a voluntary grant program that provides funding toward the incremental cost of clean MD/HD and off-road vehicles and engines that contribute to compliance with national ambient air quality standards—operating in partnership with local air districts. The program requires scrappage of baseline vehicles.
VW Beneficiary Mitigation Plan (BMP)	CARB	The BMP provides funding for zero-emission and low-NOx vehicles and related infrastructure that reduce the impact of NOx emissions attributable to VW's non-compliant diesel vehicles. The BMP is primarily a scrap-and-replace program for a wide variety of MD/HD vehicle types and platforms.
Goods Movement Emission Reduction Program	CARB	This program provides funding to local agencies to reduce air pollution attributable to freight movement in the State's busiest transit corridors. Funding may go towards new vehicle purchases or retrofits that reduce particulate matter emissions. This program has been fully awarded.
Advanced Technologies Demonstration Projects	CARB	This initiative is intended to accelerate the adoption of near-commercial vehicle technologies that reduce emissions. Per-vehicle incentives are relatively high for these early-stage demonstrations and intended to facilitate the commercialization of promising MD/HD vehicles across a variety of use cases.
Clean Off-Road Equipment Voucher Incentive Project (CORE)	CEC	CORE seeks to scale the deployment of commercially available off-road equipment and on-road freight vehicles by reducing upfront cost barriers. Similar to HVIP, it will be offered on a first-come, first-served basis and offer a streamlined purchasing experience for fleets.
Zero and Near-Zero Emission Freight Facilities Project	CARB	This project seeks to assess transformative strategies to accelerate zero and near-zero emission on-road vehicles in a manner that reduces GHGs, air pollutants, and other contaminants. SCAQMD received $45 million for a series of zero-emission projects in and adjacent to San Bernardino County.
Community Air Protection Incentives	CARB	The Community Air Protection Incentives program establishes a community-driven process to assess and deploy vehicles and infrastructure that improve public health in disadvantaged communities.
Low Carbon Fuel Standard (LCFS)	CARB	The LCFS is a market based program intended to reduce the carbon intensity of transportation fuels in California. MD/HD fleets can be eligible to receive revenue from LCFS credits generated by the use of low carbon fuels.
Low Carbon Transit Operations Program (LCTOP)	Caltrans	LCTOP provides funding to transit agencies to expand transit service while reducing greenhouse gas emissions, including zero-emissions buses and fueling infrastructure.. A majority of funding must benefit disadvantaged communities.
Intercity Rail Capital Program (TIRCP)	Caltrans	TIRCP provides grant funding to modernize and decarbonize transit operations, which includes the purchase of zero-emission buses.
Advanced Freight and Fleet Vehicle Projects	CEC	This project is funded by CEC's Clean Transportation Program and provides funding for a range of alternative fuel MD/HD demonstration projects. A majority of projects funded to date are focused on medium or heavy-duty EVs.
Rural School Bus Pilot Project	North Coast Unified Air Quality Management District	The Rural School Bus Pilot Project is intended to accelerate the adoption of low-carbon school buses, including battery electric and fuel cell buses. Scrappage is required for vehicles replaced by the pilot.

3.3 Strategies for Municipal Fleets

If local governments in San Bernardino County seek to maximize the use of clean fuels and technologies for vehicles operating in the region, it is important that they lead by example. Local governments can play an important role in maximizing the deployment of cleaner transportation alternatives; although government fleets contain a small fraction of the total vehicle population operating in the County, these fleets have historically been leaders in the use of low-emission vehicles and fuels. With direct control over the municipal fleets, cities can help reduce emissions, increase adoption of cleaner technologies, and demonstrate their environmental stewardship to the private sector and the communities they serve. The table below provides a summary of the implementation strategies for municipal fleets.

Table 7. Municipal Fleet Implementation Strategies

Strategy Type	Strategy
Information Gathering	1. Conduct a fleet assessment
Gathering	2. Establish light-duty EV procurement goals
	3. Establish clean medium and heavy-duty procurement goals
Investing	4. Expand light-duty charging infrastructure investment
	5. Leverage vehicle master purchase contracts
	6. Establish RNG procurement goals for NGVs
	7. Establish renewable diesel procurement goals for remaining diesel vehicles
Reinforcing	8. Participate in the Low Carbon Fuel Standard

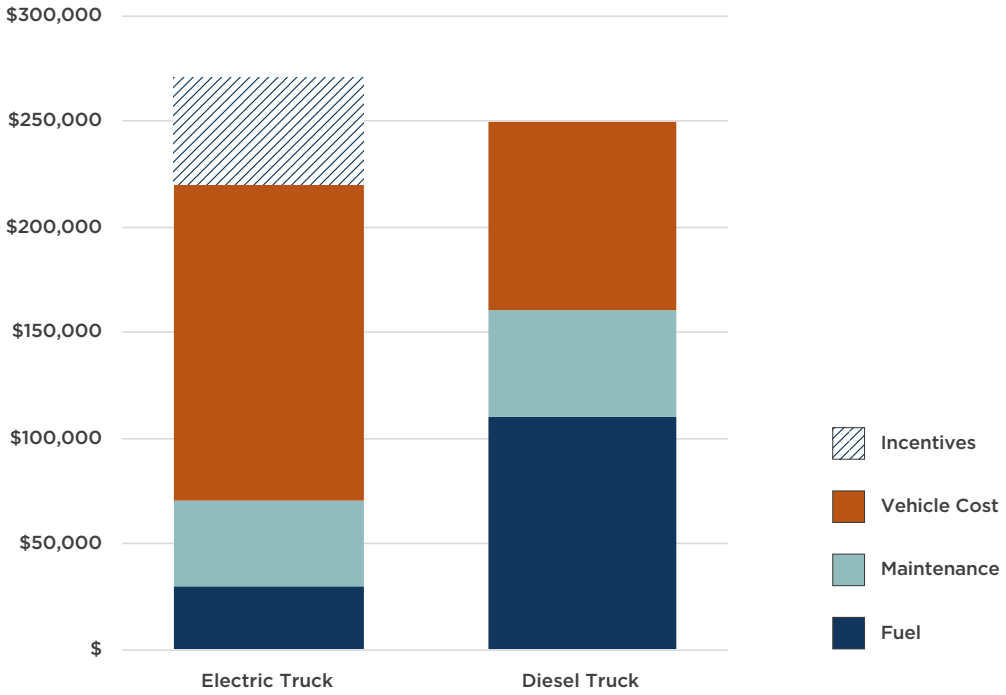
Conduct a fleet assessment

A first step in greening local government fleets is conducting a fleet assessment to identify the best opportunities to replace gasoline and diesel vehicles that are being retired with alternative fuel vehicles. Cities can start by documenting the current municipal fleet, including the number of vehicles, fuel type, annual mileage, fuel consumption, and fueling locations. Establishing a baseline for fuel use and fuel expenditures will help a city identify opportunities for improvement and allow the city to track progress over time. If municipal vehicles do not re-fuel at a centralized location, the city might need to implement to record-keeping procedures to track fuel purchasing.

In addition to assessing current fleet performance metrics, understanding new vehicle costs is critical for local governments. Many alternative fuel vehicles carry a higher up-front purchase price but have lower operating costs. A city should conduct a total cost of ownership (TCO) analysis, taking into account purchase price, available incentives, resale value, fueling infrastructure costs,

fuel costs, and maintenance costs over the useful life of the vehicle. Vehicle performance and duty cycles must also be considered. The figure below shows an example of TCO analysis results for hypothetical electric and diesel medium-duty trucks.

Figure 6. Example of TCO Analysis for Medium-Duty Trucks



Information on vehicle purchase and fueling infrastructure prices can be obtained from truck dealers, trade groups, infrastructure developers, and research reports. The U.S. Department of Energy's quarterly *Alternative Fuel Price Report* also provides current information on the price of alternative fuels in relation to gasoline and diesel prices.[54] Alternatives to gasoline and diesel differ in their energy content, which also needs to be considered when evaluating fuels. For example, E85 may cost less than gasoline on a per-gallon basis, but because ethanol has a lower heating value than gasoline and runs less efficiently in vehicle engines, the effective price of E85 may be higher than gasoline. In sum, local governments can develop a more comprehensive view of their fleets to determine which vehicles may be prime candidates to transition to alternative fuels.

Establish light-duty EV procurement goals

EVs have demonstrated significant potential to reduce emissions from the light-duty transportation sector, and local governments can accelerate the adoption of EVs through procurement of EVs for their own fleets. Establishment of formal procurement targets is directly within local governments' control, provides municipal fleets with firsthand experience owning and operating EVs, and potentially allows for significant fuel and maintenance cost savings over the life of the vehicles.

Given the availability and performance of light-duty EVs today, local government can establish near-term EV goals that extend through 2030 and beyond. To bolster the transition to cleaner vehicles and fuels, cities can update procurement guidance to require additional review and justification for the purchase of gasoline vehicles—particularly if the vehicle is intended to operate primarily in disadvantaged communities.

Source: Caltrans

CARB's CVRP for Fleets offers incentives for the purchase or lease of up to 30 eligible EVs annually for local, State, and tribal government entities.[55] Moreover, many cities have already made commitments to accelerate the electrification of their light-duty fleets. For example, the City of Sacramento has established a comprehensive Fleet Sustainability Policy that required a minimum of 50 percent of light-duty vehicles purchased in 2018 to be zero-emission vehicles and a minimum of 75 percent by 2020.[56] Cities can also use state fleet procurement goals as a baseline: Executive Order B-16-2012 directed state agencies to make 10 percent of new vehicle sales electric by 2015 and 25 percent by 2020.[57] More recently, the Governor's Office of Business and Economic Development established a new goal of 100 percent new EV purchases by 2030—with the exception of certain vehicle types.[58]

Establish clean medium and heavy-duty procurement goals

Several options for alternative fuel medium and heavy-duty vehicles exist today across virtually all vehicle types. Local governments should explore these options, identify appropriate choices, and integrate these vehicles into fleet purchasing decisions via flexible procurement goals. Similar to targets for light-duty vehicles, targets can focus on near-term procurement while extending to 2030. However, given the diversity of medium and heavy-duty vehicle vocations and evolving commercialization status of different alternative fuel vehicle options, targets can be made flexible to account for uncertainty in future clean vehicle options. For example, targets may vary across vocations and may be inclusive of all viable alternative fuel vehicle options without specifying a particular technology.

To learn more about medium and heavy-duty alternative fuel vehicles, the Department of Energy's Alternative Fuels Data Center provides an overview of vehicle technologies, fueling infrastructure, and related reports.[59] Other reports developed by the National Academy of Sciences[60], North

American Council for Freight Efficiency[61], California Electric Transportation Coalition[62], Edison Electric Institute[63], and Gladstein, Neandross & Associates[64] may also provide greater insights into vehicle costs, infrastructure needs, and emissions profiles.

Expand light-duty charging infrastructure investment

Cities must accommodate additional EVs with corresponding investments in fleet charging infrastructure. Fleet managers should seek to deploy charging stations that meet the performance requirements and duty cycles of the EV fleet while minimizing costs.[65] For vehicles used regularly during daytime hours, L2 charging stations will likely allow for these vehicles to be fully charged overnight at centralized depots. For vehicles that are used infrequently or travel short distances daily, L1 charging stations may be appropriate for recharging vehicles overnight. Installation of DCFC stations can be significantly more expensive than L1 or L2 charging options and may be considered as a backup option. Alternatively, city fleets could leverage the existing public DCFC stations in San Bernardino County in cases where refueling is necessary. As fleets deploy charging infrastructure to meet their near-term needs, fleet managers may consider "futureproofing" their parking sites by making electrical upgrades necessary to support future charging station deployments. This approach to fleet planning could generate long-term savings when higher penetrations of EVs are incorporated into city fleets. Southern California Edison's (SCE) Charge Ready EV charging station incentive program is no longer accepting applications, but opportunities for additional incentives may become available in the near future with SCE's proposed Charge Ready 2 program.[66]

L2 charger, *Dennis Schroeder / NREL*

Leverage vehicle master purchase contracts

Local governments can often buy alternative fuel vehicles at lower prices by using a state or county master contract. By leveraging these procurement programs, a city can take advantage of the larger state or county purchase contracts to gain more favorable vehicle pricing. Cities have used the state Department of General Services (DGS) contracts to purchase cars, SUVs, and trucks.[67] DGS awards master vehicle contracts to individual dealerships for specific models of vehicles within a general class of vehicles. Local agencies can order vehicles directly from the selected dealerships under the DGS master contracts. Some vehicles may also be eligible for CVRP or HVIP incentives. Cities such

as Los Angeles, Long Beach, and San Diego have joined and purchased EVs through the Climate Mayors EV Purchasing Collaborative: an initiative to leverage the buying power of cities to lower EV and charging infrastructure procurement for city fleets.[68]

Establish RNG goals for NGVs

If is a city is operating natural gas vehicles, the GHG emissions from these vehicles can be significantly reduced by using renewable natural gas (RNG). Some state incentive programs, such as HVIP, already require vehicles purchased through the program to secure RNG contracts to cover all of the planned vehicle fuel use. However, local governments can build on this requirement by procuring RNG to cover the fuel use of all NGV fleet vehicles—reducing the emissions associated with fleet vehicle operations. For example, the City of Ontario signed a five-year, 3 million gallon-equivalent RNG contract with Clean Energy in 2019 to support city fleet operations.[69]

Establish renewable diesel procurement goals for remaining diesel vehicles

For diesel vehicles in municipal fleets that cannot readily transition to alternative fuels, local governments can establish renewable diesel procurement goals to lower GHG and criteria pollutant emissions associated with their operation—including vehicles typically exempted from SCAQMD source specific standards such as heavy-duty on-road vehicles.[70] Renewable diesel is a drop-in replacement for fossil diesel at all blend levels, and cities can contract with fuel suppliers to supply renewable diesel to support their fleet operations at prices comparable to fossil diesel.[71] The City of Oakland procures renewable diesel to fuel all 366 diesel vehicles in its fleet.[72]

Participate in the Low Carbon Fuel Standard

The Low Carbon Fuel Standard (LCFS) is a market-based regulation designed to reduce the carbon intensity of transportation fuel in California and can provide municipal fleets with a revenue stream to offset costs associated with alternative fuels and infrastructure.[73] Administered by CARB, the LCFS is the most significant GHG emissions reduction program to address transportation sector emissions in the state and is a critical policy for achieving the California's broader climate goals.

Qualified fleets can generate credits based on the tons of GHGs reduced from the use of alternative fuels, including electricity, RNG, and renewable diesel. These credits must be reported quarterly to CARB and can be sold to obligated parties to generate a new revenue stream to offset fueling costs.[74] The lower the carbon intensity of the fuel, the more credits a fleet can generate per equivalent unit of fuel.[75] As the LCFS regulation continues to get more stringent on an annual basis and as credit prices remain near $200 per ton, the potential for fuel cost savings is significant. The Orange County Transit Authority's fleet reported that the revenue generated from its LCFS credits generated a $3 million surplus for the authority over three years while covering the cost of fuel.[76]

4 Role of Partner Agencies and Organizations

Partner agencies and organizations are integral to the achievement of San Bernardino County's air quality and climate goals, providing complementary support to reinforce local implementation strategies. These partners possess a combination of strategic vision, technical expertise, regional coordination, program funding, and regulatory oversight needed to accelerate the adoption of clean vehicles and fuels.

4.1 State Agencies

State agencies play a significant role in regional clean transportation dynamics. The California Air Resources Board, California Energy Commission, and California Public Utilities Commission have a particularly influential effect on clean transportation policy. The figure below provides a summary of the key roles and responsibilities of these agencies.[77]

Figure 7. Roles and Responsibilities of Select State Agencies

CARB

- **Develops** and enforces Zero Emission Vehicle regulations
- **Administers** incentive programs for alternative fuel vehicle purchases
- **Administers** the Low Carbon Fuel Standard

CEC

- **Funds** CALeVIP incentive program
- **Assesses** fueling infrastructure needs of on-road and off-road vehicles
- **Provides** incentives for alternative fuel vehicle workforce development

CPUC

- **Regulates** investor-owned electric and gas utilities
- **Oversees** the approval of utility transportation electrification programs
- **Regulates** retail electric and gas rates that influence vehicle fuel costs

Many other state agencies are directly involved in funding or regulating clean transportation efforts that can support San Bernardino County's goals, including the Governor's Office of Business and Economic Development, Caltrans, California Building Standards Commission, and California Strategic Growth Council. Local governments can coordinate with these agencies and take advantage of grant programs to accelerate the transition to alternative vehicles and fuels in their jurisdictions.

4.2 Regional Agencies

Regional agencies also have important responsibilities in supporting the clean transportation efforts in the County. In particular, San Bernardino County Transportation Authority, Southern California Association of Governments, and South Coast Air Quality Management District will remain key resources for local governments to rely on. The figure below provides a summary of the key roles and responsibilities of these organizations.

Figure 8. Roles and Responsibilities of Select Regional Agencies

SBCTA

- **Allocates** funds for regional transportation projects in the County
- **Supports** congestion management efforts
- **Engages** in long-term transportation planning efforts

SCAG

- **Develops** long-range regional transportation plans
- **Administers** several local government grant programs
- **Provides** a forum to convene stakeholders on transportation issues

SCAQMD

- **Develops** regional Air Quality Management Plan to support compliance with clean air standards
- **Administers** incentive programs for alternative fuel vehicles and equipment

4.3 Utilities

Southern California Edison and Southern California Gas Company are the two largest utilities serving San Bernardino County; both these utilities and other local utilities have key roles to play in supporting the acceleration of alternative vehicles and fuels. At a fundamental level, utilities are responsible for the safe and reliable operation of electrical and gas infrastructure necessary to distribute energy to customers. This responsibility becomes more important as San Bernardino County transitions to alternative vehicles and fuels. SCE has additional legislative requirements

to support EV adoption through the implementation of transportation electrification programs and incentives that support the deployment of EV charging infrastructure.[78] Additionally, utilities provide information on electricity and gas rates that impact the economics of transitioning to EVs and NGVs. They may be able to advise customers on which rates are best suited to their unique conditions—potentially increasing fuel cost savings relative to gasoline or diesel fuel. Other municipal and cooperative utilities can explore establishing incentives and other internal resources to support customers transitioning to clean vehicles and fuels.

4.4 Additional Stakeholders

There are many other actors involved in San Bernardino County's clean transportation goals. Community-based organizations, environmental justice organizations, and other environmental groups can influence the trajectory of alternative fuel vehicles and fuels through advocacy and facilitation of demonstration projects. Trucking companies and associations can provide feedback and experience from the real-word application of medium and heavy-duty vehicles. Vehicle manufacturers will guide the availability, price, and performance of cleaner vehicles and fuels while taking state and regional policy into account. Fueling infrastructure providers and developers will develop fueling solutions necessary to support vehicle operations while working closely with utilities and customers. Academic institutions will continue to produce alternative fuel vehicle research and establish workforce development opportunities surrounding these technologies. A successful transition to clean vehicles and fuels in San Bernardino County depends on the coordination between these stakeholders and local governments.

5 Conclusion

It is highly unlikely that public agencies can achieve goals for air quality improvement and GHG emission reduction in San Bernardino County without significant increases in the use of clean vehicles and alternative transportation fuels. No single agency can make this happen in isolation; rather, achieving these goals requires cooperation among government agencies at different levels, working in partnership with the private sector. The twin challenges of air pollution and climate change also require a focus on all vehicle types—including light, medium, and heavy-duty vehicles—and participation by the owners of private vehicles, commercial fleets, and municipal fleets.

The barriers to adoption of clean vehicle technologies and fuels include vehicle purchase prices, fueling infrastructure availability, technology readiness and commercial availability, vehicle performance, and consumer awareness and acceptance. Local governments can play an important role in overcoming these barriers to accelerate the transition to clean vehicles and fuels. Municipal actions can include:

- Information gathering to better understand needs and gaps related to clean vehicle deployment and alternative fueling infrastructure installation
- Enabling residents and businesses to align with public goals by, for example, streamlining procedures for EV charging infrastructure and strengthening building codes and zoning ordinances
- Investing in public charging infrastructure as well as clean vehicles and low carbon fuels for municipal fleets
- Reinforcing clean vehicle momentum by participating in state programs, advocating for program improvements, and adopting supportive local plans.

Local governments should also remain coordinated with state agencies, regional organizations, utilities, and other key stakeholders as the transition to clean transportation evolves. In partnership with these actors, the public and private sector in San Bernardino County can take meaningful steps to reduce emissions while maintaining the economic vitality of the region.

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