



BLACK & VEATCH
MANAGEMENT CONSULTING

San Diego Regional Electric Vehicle Gap Analysis

Accelerate to Zero Emissions Collaboration



July 2021

Acknowledgments

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Accelerate to Zero Emissions Collaboration Core Team Members

City of San Diego
County of San Diego
San Diego County Air Pollution Control District
San Diego Association of Governments (SANDAG)
San Diego Gas & Electric (SDG&E)

Accelerate to Zero Emissions Collaboration Steering Committee Members

City of Carlsbad
City of Chula Vista
City of San Diego
City of Escondido
City of Santee
Cleantech San Diego
County of San Diego
San Diego County Air Pollution Control District
GRID Alternatives
MAAC
San Diego Association of Governments
San Diego Gas & Electric
University of San Diego – Energy Policy Initiatives Center

Participants in Stakeholder Survey

American Lung Association
Baker Electric
Bayside Community Center
Beam Global
Building Industry Association
Cajon Valley Union School District
California Department of Transportation
California Fuel Cell Partnership
Caltrans
Casa Familiar
Center for Community Energy
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Qualcomm, Inc.
San Diego Association of Governments
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San Diego Gas & Electric
Tesla
UC San Diego
University of San Diego
University of San Diego – Energy Policy Initiatives Center

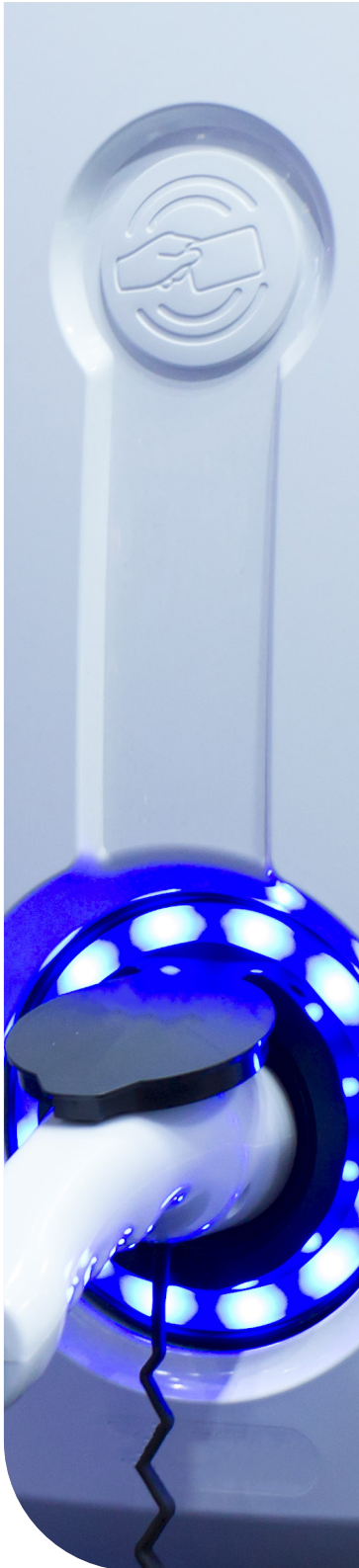
Black & Veatch Team

Alex Bettencourt, Senior Managing Director
Heather Donaldson, Project Director
Alok Patil, Project Manager
Felise Man, EV Industry Expert
C.J. Berg, EV Industry Expert
April Bolduc (S Curve Strategies), Stakeholder Engagement
Kritika Sachdeva, Policy and Incentive Research
Quentin Cole, EV Infrastructure Expert



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Contents



Executive Summary	4
Vehicle Targets	4
Infrastructure Targets	5
Barriers and Gaps	5
Vehicle Barriers and Gaps	6
Infrastructure Barriers and Gaps	6
End Users Barriers and Gaps	6
Workforce Barriers and Gaps	7
Next Steps	7
ZEV Gap Analysis	8
ZEV Gap Analysis Approach	8
Current Policies, Incentives and Regional Actions	9
Current Policies and Incentives	9
Current San Diego Region Actions and Policies	12
Stakeholder Engagement	14
Survey Overview and Approach	14
Survey Results	14
Vehicle and Infrastructure Analysis	17
Vehicle Adoption Analysis	17
ZEV Fueling Infrastructure Gap Analysis	18
Gaps and Barriers	21
Vehicles	21
ZEV Ownership Cost Premium and Vehicle Affordability	21
EV Models and Availability	22
ZEV Secondary Market and Incentives	22
Infrastructure	22
Policies Targeted to Meet Forecasted ZEV Fueling Needs	22
ZEV Fueling Infrastructure Access and Availability	23
Streamlined Permitting for ZEV Fueling Infrastructure	23
Land Availability	23
Technology Uncertainty	24
End Users	24
Coordinated Outreach and Education Initiatives	24
Overlapping Stakeholder Efforts	24
Customer Perception and Education	24
Property Owner Expertise and Awareness	25
Data to Support ZEV Program Growth	25
Funding for Local Pilots	25
Workforce	25
Skillset Gaps with Commercial Drivers	25
Trained Workforce Availability	25
Considerations for Regional Strategy	26
Appendix: A2Z EV Vehicle Adoption Model	28
Vehicle Adoption	28
Assumptions	28
Methodology	29
Results	30
Cost Parity Model	34
General Assumptions and Methodology	34
Results	34
EV Infrastructure Gap Analysis	35
Assumptions	35
Methodology	36
Results	36

Executive Summary

The A2Z Collaboration is comprised of organizations in the San Diego region that are invested in a clean transportation future. The A2Z Collaboration members recognize the importance of regional partnerships to advance transportation electrification to combat air pollution and climate change. The A2Z Collaboration brings together key stakeholders in the region to develop a framework to advance clean transportation equitably. As a precursor to developing a regional strategy, the A2Z Collaboration engaged Black & Veatch (BV) to perform a Regional Electric Vehicle Gap Analysis. BV assembled a team of experts, including S Curve Strategies, to perform this work for the A2Z Collaboration.

To establish a baseline for this gap analysis, the A2Z Collaboration examined the current counts for zero-emission vehicles (ZEVs) and their associated charging and fueling infrastructure. The scope of the gap analysis included ZEVs comprised of battery electric vehicles (EVs), plug-in hybrid electric vehicles (PHEVs) and hydrogen fuel cell vehicles (FCEVs), collectively referred to as ZEVs in this report. The number of ZEVs in the San Diego region stood just under 70,000 in 2020. These ZEVs were supported by about 6,500 level 2 and 250 direct current fast chargers (DCFCs). There was also one active hydrogen fueling station identified in the San Diego region as of 2020.

The A2Z Collaboration studied what infrastructure will be required to support statewide executive orders in the San Diego region, including EO N-79-20, which mandates that all passenger vehicles sold in California be zero-emissions by 2035. This gap analysis studied EV charging and hydrogen fueling infrastructure for the San Diego region. BV performed an extensive review of

existing programs, incentives and regional strategies and developed models to estimate ZEV growth in the region and estimate the need for ZEV fueling infrastructure by end-use both in public and private domains.

The A2Z Collaboration and its core members recognize the importance of ensuring that all residents in the region share the same benefits and burdens from climate solutions. This includes historically underserved, systemically marginalized groups impacted by actions and inactions at all levels of government and society.

As such, the ZEV Gap Analysis specifically evaluated ZEV infrastructure gaps and barriers for “Communities of Concern”¹. This additional layer of analysis will facilitate the prioritization of investment into these areas as the region decarbonizes its transportation sector.

Vehicle Targets

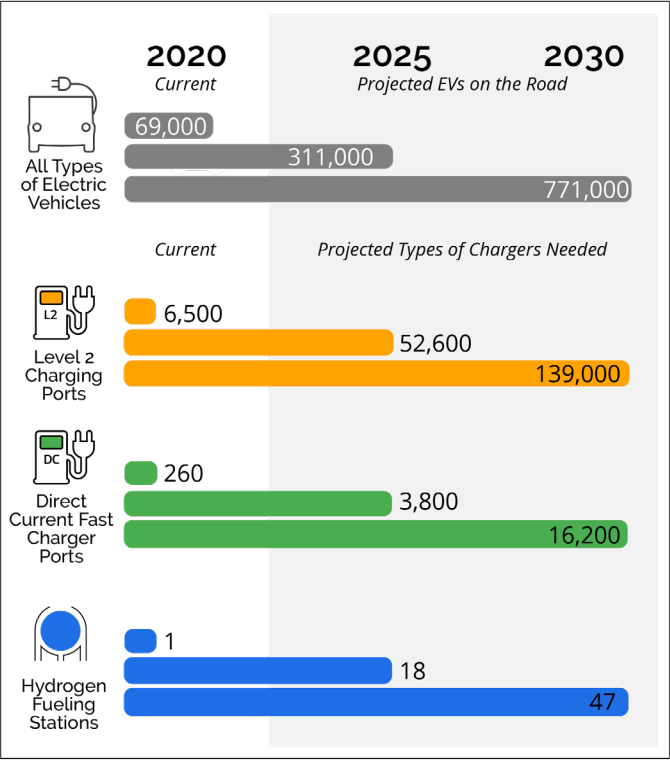
While there is a state-level goal for ZEVs, this is being implemented as a mandate on new car sales. It does not remove existing internal combustion vehicles from the road. The A2Z Collaboration studied the replacement rate of vehicles to determine if the new car mandate would result in the necessary number of ZEVs in the San Diego region to meet its share of California state goals. The team calculated the region’s share of the statewide goal of ZEVs based on population². As the adoption of ZEVs in the future is difficult to predict, the analysis was based on historical vehicle replacement rates and extrapolated out to 2030 for ZEV adoption. The team assessed new car sales, replacement rates and the overall business case for moving towards EVs. The results of this vehicle analysis showed that **the San Diego region could meet its share of the statewide goal of ZEVs by 2030**. As such, it will be important for the region to deploy supporting infrastructure.

¹Communities of concern are areas that are designated by the state as either a “disadvantaged communities” per Senate Bill (SB) 535 (De León, Chapter 830, Statutes of 2012), or a “low-income community” Assembly Bill (AB) 1550 (Gomez, Chapter 369, Statutes of 2016). Disadvantaged communities are identified by the California Environmental Protection Agency (CalEPA) as the top 25 percent most impacted census tracts in CalEnviroScreen 3.0 - a screening tool used to help identify communities disproportionately burdened by multiple sources of pollution and with population characteristics that make them more sensitive to pollution. Low-income communities and households are defined as the census tracts and households, respectively, that are either at or below 80 percent of the statewide median income, or at or below the threshold designated as low-income by the California Department of Housing and Community Development’s (HCD) 2016 State Income Limits.

²9 percent of the state’s total projection of 8 million ZEVs statewide by 2030

The vehicle analysis results in Figure 1 show that the San Diego Region can expect a sufficient amount of ZEVs will be available to meet its share of the most recent statewide EV projections. While there is a mandate on the seller to supply ZEVs, there still needs to be demand from the buyer for ZEVs. During the A2Z regional strategy work, it will be necessary to include actions that can be taken to help ensure all residents have an opportunity to buy a ZEV, including low and moderate income households. However, BV does not believe vehicle supply—which has been a barrier in the past and today—will be a factor in reaching 2030 targets.

Figure 1: San Diego Region ZEV Forecast



Infrastructure Targets

At the state-level, there have been various forecasts on the infrastructure needs to support ZEVs³. The California Energy Commissions’ [AB 2127 assessment report](https://www.ca.gov/archive/gov39/2018/01/26/governor-brown-takes-action-to-increase-zero-emission-vehicles-fund-new-climate-investments/index.html) completed in January 2021, and revised in

May 2021, provides the most recent forecast of ZEV infrastructure and identifies the infrastructure needs for the state to meet the 2035 ZEV goal. The A2Z Collaboration developed a similar assessment specific to the San Diego region to understand the infrastructure needed to support the different vehicle types and end-users. The team assessed ZEV fueling infrastructure for EV charging and hydrogen fueling across light, medium and heavy-duty vehicle types. Light-duty vehicle fueling infrastructure end-uses included multi-family residential, workplace, public and commercial fleet depots. An additional end-use analysis was conducted to determine the need for residential charging infrastructure in communities of concern, both in single-family and multi-family residences. For medium and heavy-duty charging end-uses, the analysis included depots and on-road chargers for goods movement, transit and school buses. The resulting gap analysis by vehicle types and end-users provides a detailed assessment of infrastructure needs in the region. The **San Diego region has significant gaps in its ZEV-supporting infrastructure** that will need to be closed in the coming years.

BV forecasts a significant amount of private and public ZEV fueling infrastructure is required to keep pace with the forecasted level of ZEV adoption in AB 2127. The infrastructure analysis results shown in Figure 1 illustrate the expected necessary growth. Level 2 charging infrastructure needs to grow more than eight-fold and DCFC infrastructure is projected to need an almost fifteen-fold increase by 2025. Only one hydrogen fueling station is operating in the region as of 2021. BV estimates that 18 hydrogen fueling points will be needed by 2025 and growing to 47 by 2030.

Barriers and Gaps

In parallel to the quantitative analyses outlined above, the A2Z Collaboration worked to qualitatively analyze and understand the barriers to meeting ZEV and infrastructure goals. The team interviewed and surveyed primarily EV ecosystem stakeholders in the

³<https://www.ca.gov/archive/gov39/2018/01/26/governor-brown-takes-action-to-increase-zero-emission-vehicles-fund-new-climate-investments/index.html>

region to inform the gap analysis and provide insight into the needs of different stakeholders. Stakeholders included a broad cross-section of local governments, industry, academic, non-governmental and community-based organizations. The BV team performed additional research and drew from market experience and lessons learned to identify the set of barriers and gaps. Through that work, barriers were identified across vehicles, infrastructure, end-users and workforce that need to be addressed in order for the San Diego region to meet its ZEV goals. These are organized to be consistent with the state's ZEV Market Development Strategy published in February 2021 by the California Governor's Office of Business and Economic Development (GO-Biz)⁴, as shown in Figure 2.

Figure 2: The 4 Pillars of Market Development Strategy as defined by CA GO-Biz in its ZEV Market Development Strategy



Vehicle Barriers and Gaps

One of the most significant barriers to ZEV ownership is the perceived and real cost premium of the vehicles. Additionally, many drivers have needs or preferences for particular vehicle classes and capabilities not available in a ZEV or only available at a significant premium as of 2021. The lack of availability is especially true for medium and heavy-duty vehicles that are not expected to be widely available in the marketplace until 2023. Finally, ZEVs are in limited supply in the marketplace today and therefore the secondary ZEV market is lacking.

Infrastructure Barriers and Gaps

As demonstrated by the infrastructure analysis, significant increases in ZEV fueling infrastructure are required to support the targeted ZEV population. Barriers to ZEV fueling infrastructure include the access and availability when and where it is needed, limited policies and mandates comparable to those focused on vehicle adoption, lack of streamlined permitting for installations, availability of suitable land and space for installation and general uncertainty in the technology.

End-Users Barriers and Gaps

Potential ZEV purchasers need readily available, easy-to-navigate information to help purchase the ZEVs available in the market. Property owners may not have the expertise or interest to plan and install ZEV fueling infrastructure. Many potential adopters, especially fleet owners, need confirmation of technology and advertised savings before adoption. Local government entities require granular vehicle data to support infrastructure planning. End-user confusion sometimes results from the multiple, overlapping stakeholder outreach efforts by different entities.

⁴<https://business.ca.gov/industries/zero-emission-vehicles/>

Workforce Barriers and Gaps

Vehicle dealers and frontline salespeople need additional education and tools to advance vehicle electrification at the point of sale. Vehicle maintenance and service workers may need to expand their skill sets to work on ZEVs, including understanding drive trains and technology interfaces with ZEV controlling software. Also, new qualified installers of ZEV infrastructure will need to be trained as charging needs grow.

Next Steps

The A2Z Collaboration undertook this gap analysis to inform the A2Z regional strategy. The goal is to use real-world data and the perspectives of stakeholders to inform the regional strategy. As a next step, this gap analysis will guide the A2Z regional strategy to establish a comprehensive strategic plan including actions, responsible stakeholders, timing, geographic distribution and metrics for success.



ZEV Gap Analysis

The A2Z Collaboration brings together key stakeholders in the region focused on developing a framework to advance transportation electrification and ensuring it is done in an equitable way. As a precursor to developing a regional strategy, the A2Z Collaboration engaged BV to perform a ZEV market gap analysis for the San Diego region. BV assembled a team of experts, including S Curve Strategies, to perform this work for the A2Z Collaboration.

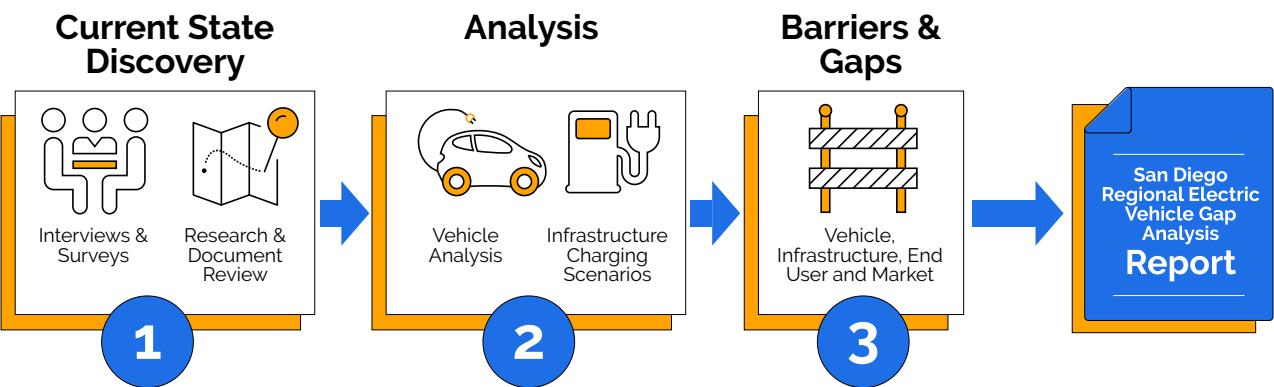
The A2Z Collaboration and its core members recognize the importance of ensuring that all residents in the region share the same benefits and burdens from climate solutions. This includes historically underserved, systemically marginalized groups impacted by actions and inactions at all levels of government and society. As such, the ZEV Gap Analysis specifically evaluated ZEV infrastructure gaps and barriers for “Communities of Concern”. This additional layer of analysis will facilitate the prioritization of investment into communities of concern as the region decarbonizes its transportation sector.

ZEV Gap Analysis Approach

This report outlines current policies, incentives, stakeholder perspectives and other actions related to the San Diego region’s journey toward its ZEV and associated infrastructure targets. It includes an analysis of the region’s anticipated needs and gaps and barriers to achieving them. The report concludes with the next steps providing some considerations to inform the A2Z Collaboration San Diego regional strategy.

The scope of the gap analysis included battery electric vehicles, plug-in hybrid electric vehicles and hydrogen fuel cell vehicles, collectively referred to as zero-emission vehicles or ZEVs in this report. ZEV fueling infrastructure includes both plug-in electric vehicle charging and hydrogen fueling for passenger and commercial vehicle applications. The analysis considered the end-uses of the infrastructure and examined the needs across multi-family residential buildings, workplaces and public ZEV fueling. It also specifically examined the needs for single-family residences in communities of concern. Commercial fleet depots were also examined. For medium and heavy-duty charging end-uses, the analysis included depots and on-road chargers for goods movement, transit and school buses.

Figure 3: A2Z Collaboration Regional EV Gap Analysis Methodology



The BV team consulted regional stakeholders during the **current state discovery phase**, including local governments, businesses, community-based organizations, non-government entities and academic sectors. The team also performed research to understand current policies and incentives relevant to ZEVs and fueling infrastructure. The stakeholder discovery effort involved personal interviews with most of the A2Z Collaboration Steering Committee and stakeholder surveys targeting regional ZEV stakeholders. This phase resulted in a list of current mandates, existing actions and stakeholder perspectives surrounding various aspects of transportation electrification.

The **analysis phase** focused on developing a new ZEV supply and infrastructure model for the San Diego region and leveraging existing BV models to estimate the regional ZEV supply and supporting ZEV infrastructure based on the current policies, incentives and stakeholders actions. The vehicle analysis examined the new sales data for light-duty passenger vehicles for personal, fleet and commercial use. It analyzes the impact of the California ZEV car sales mandate to forecast the number of light-duty ZEVs in the San Diego region. The analysis included medium and heavy-duty vehicle applications for fleet, goods movement, transit and school buses. As the state mandate is on sales, the analysis also confirmed the customer-side business case for purchasing a ZEV to validate uptake. Once the expected number of ZEV sales were established, the analysis evaluated ZEV fueling needs across end uses over time to forecast the amount of infrastructure required.

The final **barriers and gaps stage** synthesized the data collected and created documented barriers and gaps to be addressed in the A2Z Collaboration's next step: setting the strategy for implementing this infrastructure in the San Diego region. While developing solutions was not the mandate of this work, the team captured ideas from stakeholders and the analysis in the form of considerations that can serve the strategy.

Current Policies, Incentives and Regional Actions

California actively promotes clean energy goals and transportation electrification through legislative, gubernatorial and regulatory actions. This section brings forward these key actions germane to advancing transportation electrification in the San Diego region.

Current Policies and Incentives

California has taken several policy actions to reduce greenhouse gas (GHG) emission and promote transportation electrification as an essential component to achieve state climate goals. The state policy actions most pertinent to this gap analysis are those related to vehicle and infrastructure targets, including:



- **Executive Order B-48-18⁵:** EV chargers shall be built to support 1.5 million ZEVs on California roads by 2025 and 5 million ZEVs on the road by 2030.
- **Executive Order N-79-20⁶:** All new passenger cars and trucks sold in California will be zero-emission by 2035; drayage and off-road vehicles and equipment will also be 100 percent zero-emission sales by 2035 where feasible; and all medium and heavy-duty vehicles to be zero-emission by 2045 where feasible.

On June 25, 2020, the California Air Resources Board passed the Advanced Clean Trucks rule⁷. This rule increases the share of electric trucks manufactured each year, advancing to all-new truck sales being zero-emission by 2045. Like the Advanced Clean Trucks rule, the Innovative Clean Transit regulation adopted in 2018 requires all public transit agencies to gradually transition to 100 percent zero-emission bus fleets by 2040 and meet 100 percent of new purchases zero-emission buses by 2030⁸.

On May 20, 2021, the California Air Resources Board (CARB) established the Clean Mile Standard which sets electrification and GHG emission targets for transportation network companies (TNCs) operating in California (e.g., Uber and Lyft). TNCs must begin electrification of their California fleets starting in 2023 with the goal to reduce GHG emissions, increase vehicle electrification, and reduce vehicle miles traveled. Specifically, TNCs are required to achieve a level of zero GHG emissions and to ensure 90 percent of their vehicle miles are fully electric by 2030.

Additionally, AB 2127 Staff Report projects 8 million ZEVs statewide by 2030. AB 2127 exceeds the targets put forth in the Governor's Executive Order B-48-18 issued in 2018 of 5 million.

Assembly Bill (AB) 2127 Electric Vehicle Charging Infrastructure Assessment

This inaugural AB 2127 Electric Vehicle Charging Infrastructure Assessment examines charging needs to support California's plug-in electric vehicles (PEVs) in 2030. Under AB 2127, the Energy Commission is required to publish a biennial report on the charging needs of five million ZEVs by 2030. In September 2020, Governor Newsom issued Executive Order N-79-20, which directed the Energy Commission to update this assessment to support expanded ZEV adoption targets. This EV Gap Analysis was based on the January 2021 edition of the report. There was a subsequent update in May 2021.

Executive Order B-48-18 set a goal of having 250,000 chargers (including 10,000 DCFCs) by 2025. California has nearly 70,000 public and shared chargers installed, including over 6,000 DCFCs, as of May 2021. This report finds that an additional 123,000 are planned, leaving a gap of 57,000 installations.

Several additional legislative, gubernatorial and regulatory actions taken in California, especially those targets to reduce GHG emissions, also include measures to electrify transportation. Many agencies across the state have also taken action to establish programs and incentives to promote transportation electrification. Figure 4 captures the current policies and incentives relevant in the San Diego region.

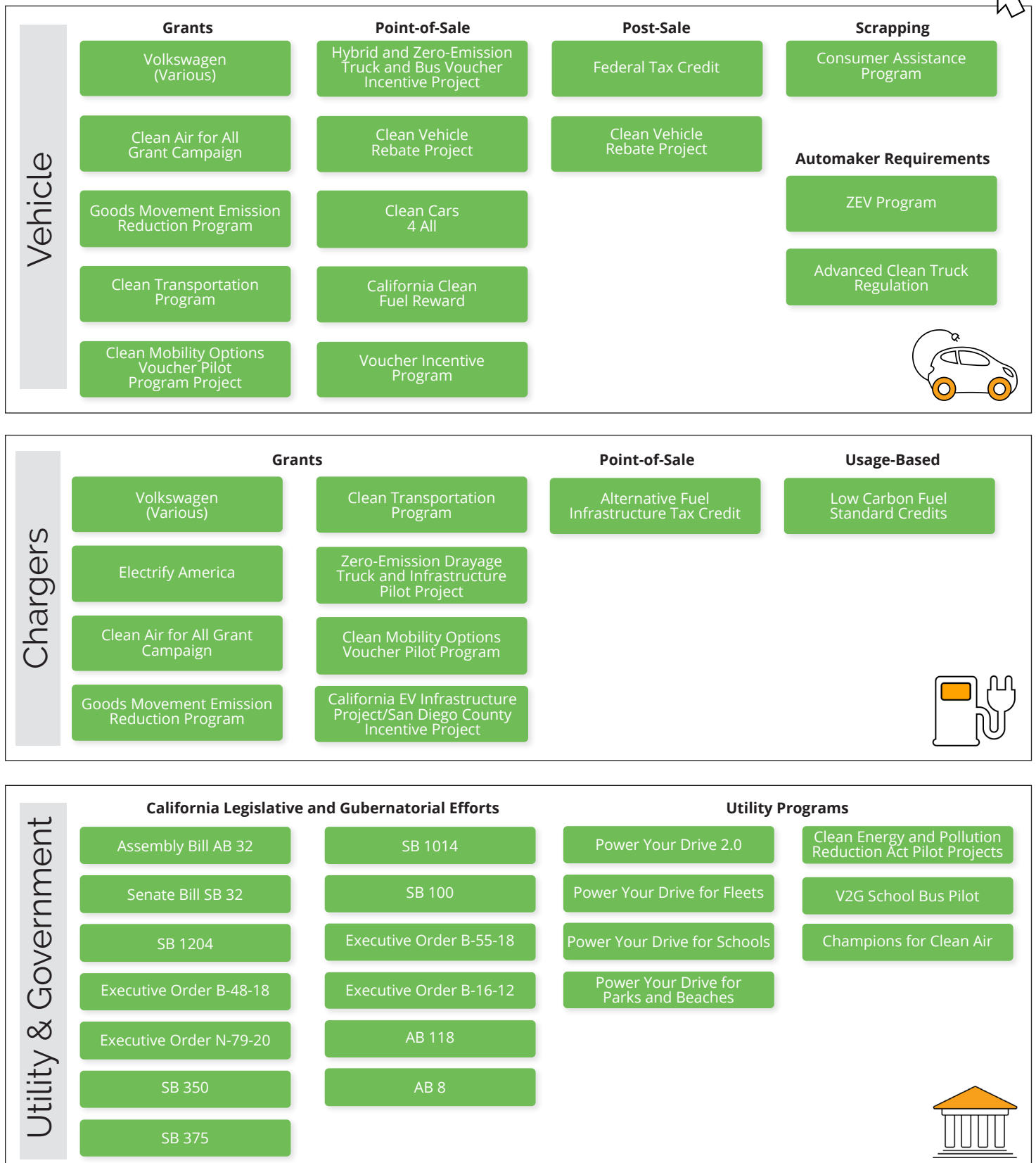
⁵ <https://www.ca.gov/archive/gov39/2018/01/26/governor-brown-takes-action-to-increase-zero-emission-vehicles-fund-new-climate-investments/index.html>

⁶ <https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf>

⁷ California Air Resources Board Resolution 20-19, June 25, 2020. Fount at: <https://ww3.arb.ca.gov/regact/2019/act2019/finalres20-19.pdf>

⁸ <https://ww2.arb.ca.gov/our-work/programs/innovative-clean-transit>












Figure 4: Vehicle and Infrastructure Policies and Incentives Relevant to the San Diego Region















Current San Diego Region Actions and Policies

There are several current actions directed at clean transportation and climate mitigation by entities across the state and within the governments of the San Diego region. The local governments have prepared climate action plans (CAP), EV roadmaps, sustainability plans and other policies supporting ZEVs. The examples of regional efforts highlighted in Figure 5 were gathered through interviews with A2Z Collaboration member interviews, stakeholder surveys and independent research.

Figure 5: Current Actions by Selected Governments in the San Diego Region
Black text reflects region goals while blue text reflects current actions

<div><div>Caltrans District 11</div><div></div></div> <div><p>Caltrans District 11 is partnering with SDG&E to provide charging at park and ride facilities throughout the San Diego region</p><p>Caltrans is also working to install corridor charging at rest areas and remote locations to support intercity travel</p></div>	<div><div>Carlsbad</div><div></div></div> <div><p>The City of Carlsbad has a goal to increase the amount of ZEV miles traveled from a projected 4.5% to 25% by 2035 as adopted in the 2011 CAP</p><p>Residential and non-residential ordinances for EV parking</p></div>	<div><div>Chula Vista</div><div></div></div> <div><p>Chula Vista now has around 31% alternatively fueled vehicles in their fleet aiming to reach their CAP goal of 40% by 2020</p><p>Chula Vista participated in SDG&E's Power Your Drive 1.0 program and had around 123 chargers installed for their fleet vehicles</p></div>
<div><div>County of San Diego</div><div></div></div> <div><p>The County's Electric Vehicle Roadmap, adopted October 2019, leverages the County's land-use authority, permitting processes and outreach platforms to increase EV ownership and charging installations in the unincorporated area and at County facilities. This includes installing 2,040 public level 2 charging stations by 2028, conversion of 501 fleet vehicles to EVs by 2027 and other goals</p><p>The County was one of the first jurisdictions in the region recognized by the State as having a streamlined EV charger permitting process consistent with Assembly Bill 1236. In 2017, the County established streamlined permitting processes to encourage EV charging infrastructure development by reducing project costs to homeowners and developers</p></div>	<div><div>El Cajon</div><div></div></div> <div><p>The City of El Cajon has a goal to reduce GHG to 1990 levels by 2020, 40% below 1990 levels by 2030 and 80% below 1990 levels by 2050 as outlined in their 2019 CAP</p><p>Plans to install 128 new EV charging stations at commercial developments and 79 new EV charging stations at multi-family developments by 2030</p></div>	<div><div>Del Mar</div><div></div></div> <div><p>Goal to increase percentage of vehicle miles traveled (VMT) to alternatively fueled vehicles to 15% of total VMT by 2020 and 30% by 2035 in their CAP plan</p><p>Set aside 10% on-street parking spots on Camino del Mar and in city-owned lots for high-efficiency and clean vehicles by 2020</p></div>
<div><div>Imperial Beach</div><div></div></div> <div><p>Within Imperial Beach's CAP there is a Clean and Efficient Transportation Strategy where two measures are outlined that reduce emissions by 12% by 2030</p><p>Imperial Beach plans to work with developers to encourage them to install EV charging infrastructure for both new and retrofits and the City will also develop an assessment of their owned municipal fleet to identify when to replace vehicles with zero-emission equivalents</p></div>	<div><div>Coronado</div><div></div></div> <div><p>In 2012, Coronado conducted an Energy Roadmap and identified "greening" the city's 100 fleet vehicles as a way to reduce GHG from transportation</p><p>The City of Coronado has installed 14 EV charging stations around the island (City Hall, Public Services, Municipal Golf Course and Coronado Cays)</p></div>	<div><div>Encinitas</div><div></div></div> <div><p>In their 2020 revision of their 2018 CAP, city expanded goal to reduce emissions 44% below 2012 levels by 2030</p><p>Starting in 2018, city required new residential units to install electric vehicle charging station (EVCS) equipment. Single-family: Install complete 40-Amp electrical circuit (EV Ready). Multi-Family: Install EVCS equipment at 5% of the total number of parking spaces</p></div>
	<div><div>Escondido</div><div></div></div> <div><p>In 2020, Escondido released a draft of the next version of its CAP with more aggressive targets of 4% below 2012 levels by 2020, 42% below 2012 levels by 2030 and 52.5 percent below 2012 levels by 2035</p><p>Plans to install 281 EV charging stations in Park and Ride lots by 2035</p></div>	<div><div>La Mesa</div><div></div></div> <div><p>The City of La Mesa has goals to reduce GHG emissions by 15% from 2010 levels by 2020 and 53% by 2035 outlined in the 2018 CAP</p><p>Partnered with SANDAG, SDAPCD and local multi-family property managers to develop strategies to increase installations of EV charging infrastructure in existing multifamily complexes</p></div>

<p>Lemon Grove</p>  <p>The City of Lemon Grove has goals to reduce GHG emissions by 4% below 2012 levels by 2020 and 42% by 2030, as described in their 2020 CAP</p> <p>Lemon Grove will adopt a zoning ordinance requiring the installation of EV charging stations for five percent of total parking spaces provided at new multi-family and commercial developments. Five percent of total parking spaces provided at multi-family and commercial renovations or additions, with a permit value of \$100,000 or greater</p>	<p>National City</p>  <p>National City has a goal to reduce GHG 15% below 2005/2006 baseline emissions by 2020 according to their 2011 CAP</p> <p>National City has participated in SDG&E's Power Your Drive 1.0 program with charging stations installed at City Hall and there are other deployments across the city as the area is a priority for deployment due to the area's designation as a community of concern</p>	<p>North County Transit District</p>  <p>North County Transit District has developed a Zero-Emission Bus Rollout Plan which details plans to fully transition to a zero-emission bus fleet by 2042</p> <p>North County Transit District is planning to purchase six battery-powered and eight hydrogen fueled buses before 2023</p>
<p>Oceanside</p>  <p>The City of Oceanside plans to reduce GHG emissions to 1990 levels by 2020, 40% below 1990 emissions by 2030 and 80% below 1990 levels by 2050 according to their 2019 CAP</p> <p>Will require all new single-family residential developments to include prewiring of the site with a dedicated 240-volt branch circuit to allow for future installation of a level 2 charging circuit</p>	<p>San Diego</p>  <p>The City of San Diego adopted their most recent CAP in 2015 and committed to reduce emissions to 15% below 2010 levels by 2020, 40% below 2010 levels by 2030 and 50% below 2010 levels by 2035</p> <p>The 2015 CAP includes a goal to convert 90% of gasoline-powered municipal fleet vehicles to zero-emission by 2035. The City of San Diego has 57 public EV charging stations at City facilities (e.g., parks, libraries)</p>	<p>Poway</p>  <p>In 2015, Poway conducted an Energy Roadmap and identified "greening" the city's 127 fleet vehicles as a way to reduce GHG from transportation</p> <p>The City of Poway has installed 11 EV charging stations around the city</p>
<p>SANDAG</p>  <p>In 2015, SANDAG launched Plug-in San Diego (Plug-in SD) in partnership with Center for Sustainable Energy and funded by the California Energy Commission to increase ZEV adoption and deployment of charging infrastructure through best practices and recommendations identified in the 2014 San Diego Regional Plug-in Electric Vehicle Readiness Plan</p> <p>SANDAG committed \$30 million over 30 years to support the regional network of level 2 charging stations. The San Diego County Incentive Project opened in 2020 and is expected to install approximately 1,100 level 2 EV chargers and 250 DCFCS</p>	<p>Santee</p>  <p>The Sustainable Santee Plan has a goal to reduce GHG to 15% below 2005 levels by 2020, 40% below 2005 levels by 2030 and 49% below 2005 levels by 2035</p> <p>By December 2020, required all new residential and commercial development to install e-chargers. For new single-family residential install complete 40 Amp electrical service and one e-charger</p>	<p>San Diego Metropolitan Transit System</p>  <p>The San Diego Metropolitan Transit System developed a transition plan to convert all of the agency's 800 buses to zero-emissions by 2040</p> <p>The San Diego Metropolitan Transit System has acquired eight battery electric buses to operate in their fleet</p>
<p>San Marcos</p>  <p>The City of San Marcos CAP has a goal of reducing emissions to 4% below 2012 levels by 2020 and to 42% below 2012 levels by 2030</p> <p>Starting in 2021, the City will require that five percent of parking spaces provided in new multi-family and commercial developments are equipped with EV charging stations</p>	<p>Solana Beach</p>  <p>The City of Solana Beach CAP has a goal to reduce CHG to 15% below 2010 levels by 2020 and 50% below 2010 levels by 2035</p> <p>Collaborating with SANDAG to increase EVs in the region</p>	<p>Vista</p>  <p>In 2019, Vista released a draft of the next version of the CAP with more aggressive targets of 4% below 2012 levels by 2020, 42% below 2012 levels by 2030</p> <p>Require that 3% of total parking spaces required in new multi-family projects have EV charging stations and 6% of total parking spaces required in new commercial projects have EV charging stations, starting in 2021</p>

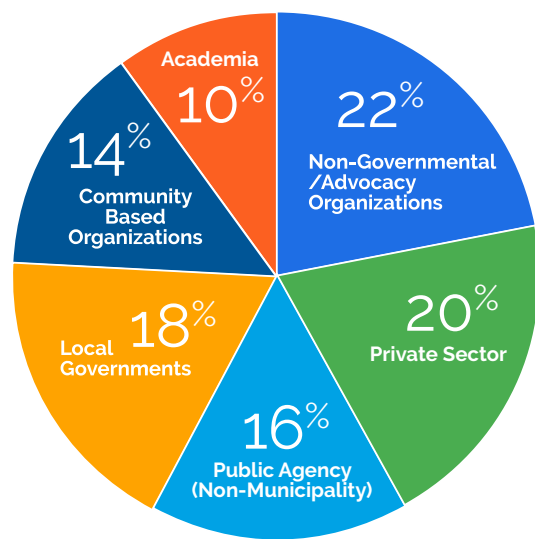
Stakeholder Engagement

Surveys and interviews with regional ZEV industry stakeholders provided a better understanding of current ZEV efforts and the perceived barriers to advancing regional transportation electrification on the scale envisioned by state goals. A broad community or resident-level engagement effort was beyond the scope of the gap analysis and is anticipated for future strategy development and implementation. In total, nearly 100 stakeholders participated across both surveys and stakeholder interviews.

A qualitative survey was administered in two phases to a broad group of stakeholders. The respondents prioritized barriers to ZEV adoption and recommended ways to overcome these barriers and exponentially increase adoption, based on their industry experience.

In addition to the qualitative surveys, structured interviews were conducted with 11 of the 13 A2Z Collaboration Steering Committee member organizations to deeper discuss the survey questions in greater detail. The results informed the gaps and barriers analysis which are outlined in the Gaps and Barriers Section.

Figure 6: ZEV Survey Respondents



Most stakeholders engaged were familiar with ZEVs in general and some of the ZEV programs taking place in the region. For example, 78 percent of respondents were aware of a ZEV incentive or charging and hydrogen fueling program, while 72 percent of respondents had participated in a local, regional, state, or federal ZEV program in the last 5 years.

Survey Overview and Approach

The survey was performed in two phases in November 2020 and January 2021. Figure 6 summarizes the participants in the stakeholder outreach survey. Some stakeholders responded to both surveys.

The objective of the phase 1 survey was to determine the perceived barriers to ZEV adoption throughout the region. It also sought to determine if stakeholder organizations had developed or participated in any EV programs to help the A2Z Collaboration understand if there were overlaps or gaps in these program efforts. Based on the phase 1 survey responses, the A2Z Collaboration identified six initiatives that could help the region meet its adoption and asked participating organizations to choose the most important initiative to increase EV adoption and the barriers to achieving that initiative in a phase 2 survey.

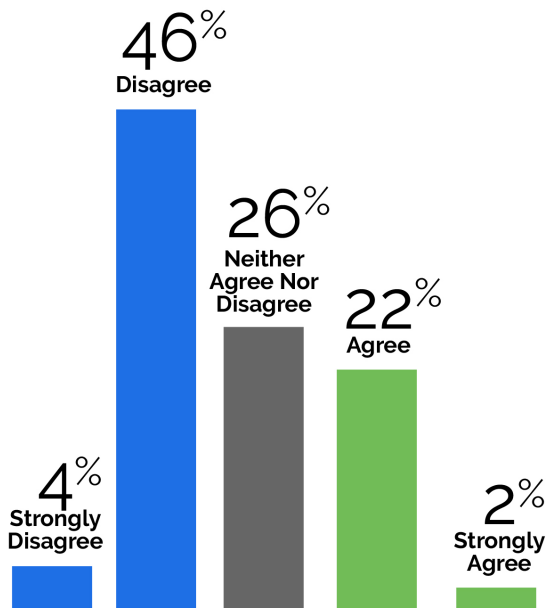
Survey Results

Participants were asked if they felt the region was on track to adopt the ZEV goal by 2030⁹. Half of the survey respondents (50 percent) disagree that the region is on track to meet its target. Stakeholders identified the most significant barriers to achieving this target as:

- Upfront costs of the vehicles
- Insufficient ZEV fueling at public, workplace and multi-family locations
- ZEV fueling is not affordable to most
- Lack of public education and outreach on ZEV benefits and programs
- Lack of available models that meet driver needs

⁹As the survey was administered prior to the publication of AB 2127, Executive Order B-48-18 target for 5 million ZEVs in California by 2030 was used. The San Diego County "share" was based on a population percentage (9%) of the total California population, equivalent to 450,000 ZEVs.

Figure 7: Survey Results Related to Stakeholder's Perspective on Whether the Region is on Track to Meet the ZEV Targets



Based on the key barriers identified in phase 1 survey results, the A2Z Collaboration identified six broad initiatives to advance regional ZEV adoption. From those initiatives, phase 2 survey respondents identified the top initiative they perceived would have the most significant impact toward meeting the region's ZEV adoption goals. Results are shown in Figure 8. The two initiatives related to infrastructure together amounted to 36 percent of the total survey results.

Steering Committee Interviews

Interviews were conducted with A2Z Collaboration Steering Committee member organizations for a deeper discussion of the survey questions. During these interviews, Steering Committee members identified key barriers that they believe will prevent success of the region from accomplishing its EV goals.

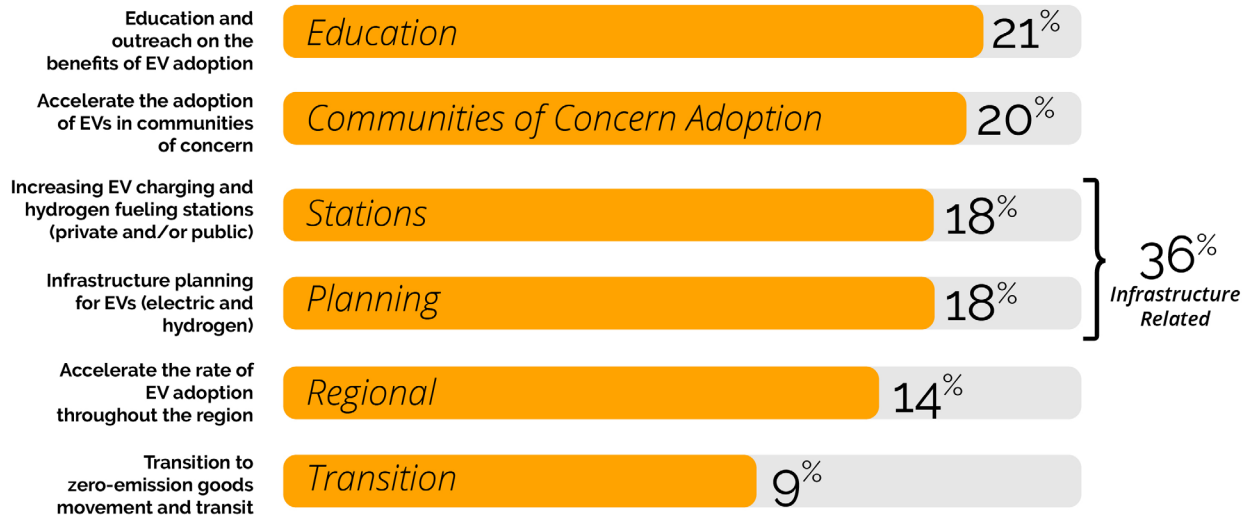
The barriers included:

- Lack of available funding to support adoption
- Lack of ZEV education and outreach efforts
- Lack of access to a regional database of ZEVs
- EV charging stations and hydrogen fueling stations

The interviews identified that funding is needed for local government fleet vehicle and infrastructure pilot programs. Successful public sector pilot programs could act as testimonials to local private fleets.



Figure 8: Stakeholder's Perspective on Which initiatives They Felt Would Have the Most impact Towards Light-Duty EV Goals by 2030



Top Initiative by Organization Type

The survey asked different organizations which initiative they felt would make the biggest impact towards light-duty EV goals by 2030. The leading initiative by organization type were:

- **Local governments and public agencies:** Increasing EV charging and hydrogen fueling stations
- **Private sector:** Increasing EV charging and hydrogen fueling stations
- **Academia:** Accelerate the rate of EV adoption throughout the region
- **NGO / Advocacy:** Education and outreach on the benefits of EV adoption and Increasing EV charging and hydrogen fueling stations
- **Community-Based Organization:** Education and outreach on the benefits of EV adoption

Vehicle and Infrastructure Analysis

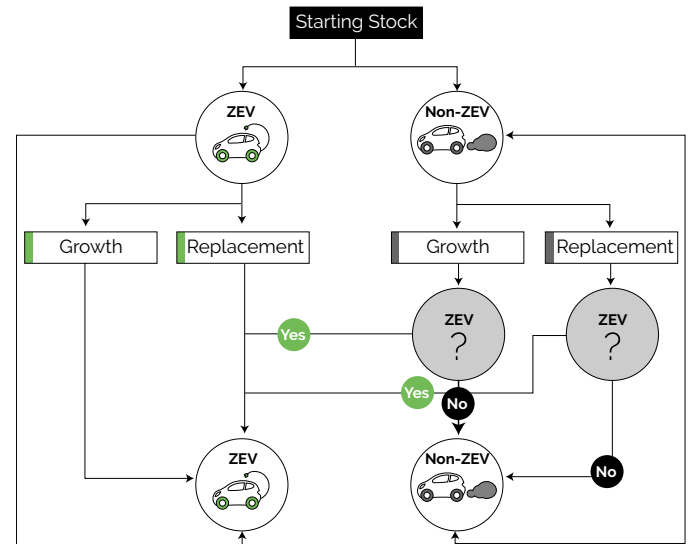
A cornerstone of this gap analysis is a forecast of the expected ZEVs in the San Diego region and a corresponding analysis of the infrastructure required to support them. BV leveraged existing infrastructure forecasting models and developed new models specific to the San Diego region for this gap analysis. The analysis first focused on projecting the ZEV supply expected in the San Diego region and whether it would meet the AB 2127 targets through 2030 based on new car sales. As current statewide mandates are on the supply side, BV conducted a further analysis of the business case on the demand side. The team confirmed the total cost of ownership (TCO) for ZEV relative to an internal combustion engine (ICE) car.

With this number of expected ZEVs confidently forecasted, an additional analysis was conducted to understand the need for EV charging and hydrogen fueling infrastructure to support this adoption in the San Diego region.

Vehicle Adoption Analysis

The vehicle adoption analysis examined growth for light-duty passenger ZEVs for personal, fleet and commercial use from 2020 to 2030, including vehicles used by TNCs like Uber and Lyft. It also included medium and heavy-duty vehicle applications for fleet, goods movement, transit and school buses. BV built a model, shown in Figure 9 to account for growth in vehicles, replacements and retirements. As a simplifying assumption, BV assumed that an individual would continue to purchase ZEVs for their future vehicle after their first purchase of a ZEV. Details about BV's assumptions, modeling and analysis performed are provided in the appendix.

Figure 9: BV Vehicle Adoption Model Representation



Assuming current California policies such as ZEV, Advanced Clean Truck and Innovative Clean Transit Mandates are in place and successfully implemented, the model projects there to be enough vehicles available in the San Diego region to meet the 2030 targets. Figure 10 represents the San Diego region's share of the AB 2127 Staff Report, which projects 8 million ZEVs statewide by 2030. AB 2127 exceeds the targets put forth in the Governor's Executive Order B-48-18 issued in 2018¹⁰. This order established targets of 1.5 million ZEVs on the road in California by 2025 and 5 million ZEVs by 2030. While we have confirmed that the ZEV supply will be available, it is essential to note that people and businesses still need to purchase the vehicles based on their preferences and needs.

¹⁰This analysis relied on the AB 2127 analysis released in January 2021 and acknowledge that a revised report was published in May 2021. <https://www.ca.gov/archive/gov39/2018/01/26/governor-brown-takes-action-to-increase-zero-emission-vehicles-fund-new-climate-investments/index.html>

Figure 10: San Diego Region ZEV Forecast

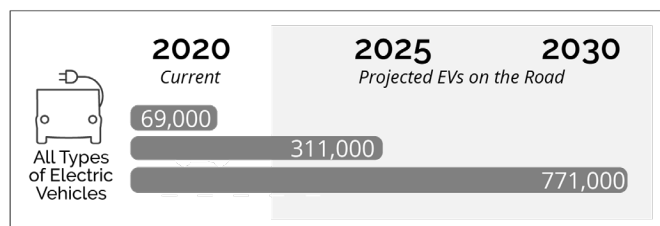
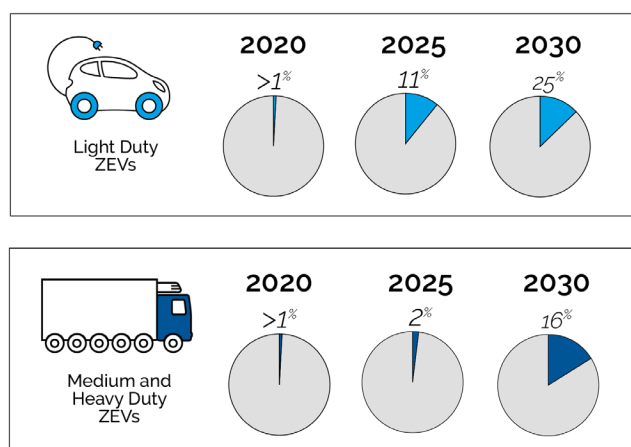


Figure 11: BV San Diego Vehicle Adoption - Percentage of ZEVs on the Road

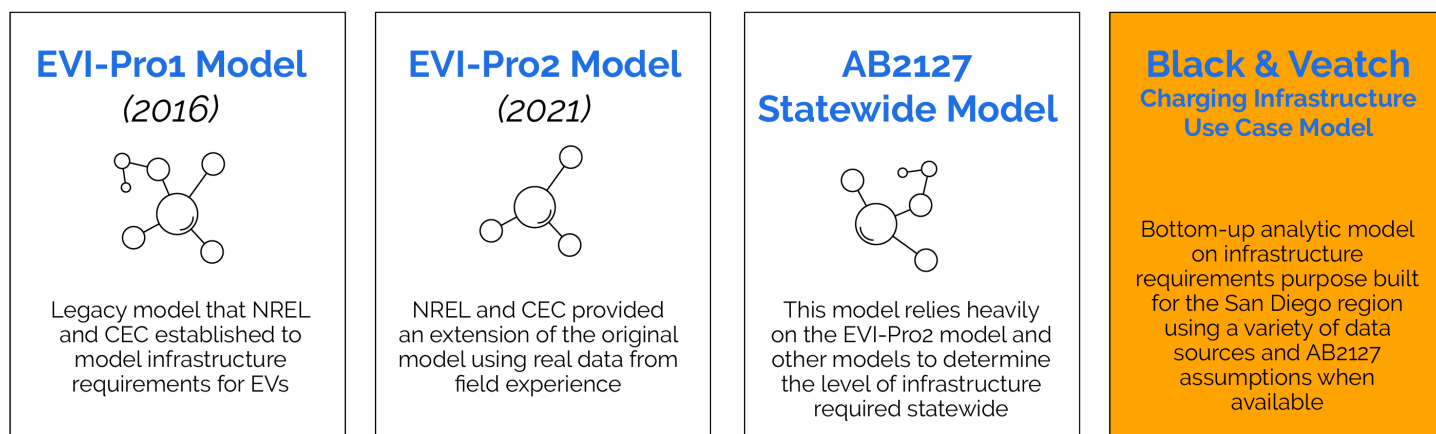


ZEV Fueling Infrastructure Gap Analysis

With the target number of ZEVs confirmed, the analysis moved on to forecast the required infrastructure. This analysis included evaluated public, workplace and multi-

unit dwelling locations to support most ZEV needs for fueling infrastructure. Fueling includes both EV chargers and hydrogen fueling stations. Public hydrogen fueling stations will likely mimic the experience and structure of existing gas stations. Drivers will bring their vehicle to a fueling location to top up with hydrogen as the fuel. The infrastructure analysis included ZEV fueling infrastructure for multi-family residential, single-family residential in communities of concern, workplace, public and commercial fleet depots for light-duty ZEV fueling. It did not include non-communities of concern single-family residential charging infrastructure estimates as this is not a focus of the A2Z regional strategy. It also included medium and heavy-duty ZEV fueling at depots and on-road stations for goods movement, transit and school buses.

BV performed its analysis using the initial version of the EVI-Pro Model¹¹ and a proprietary model BV built to understand the ZEV fueling infrastructure needed to support the projected vehicles. In January 2021, the California Energy Commission published a staff report for AB 2127¹² to project infrastructure required to meet the state's EV goals set out by Executive Order N-79-20. BV reviewed the approach and assumptions then compared it again to our model. The objective was to compare results for the BV analysis with those from other sources to provide confidence in the model results.

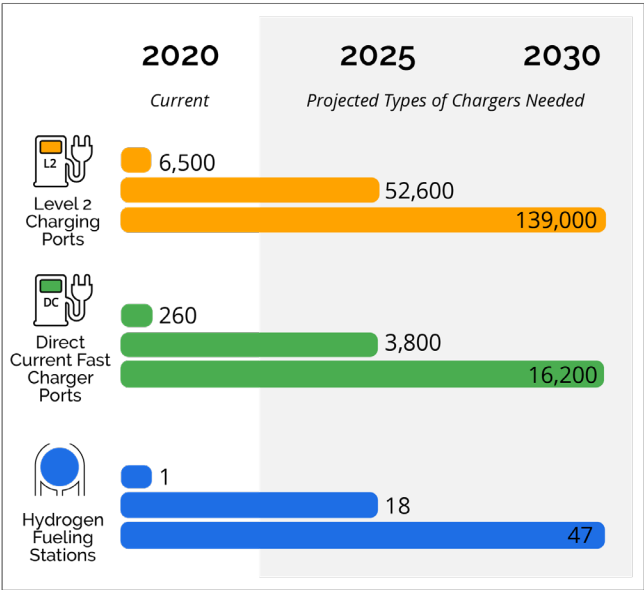


¹¹<https://afdc.energy.gov/evi-pro-lite>

¹²<https://efiling.energy.ca.gov/getdocument.aspx?tn=236237>

The BV model and the AB 2127 staff model both produced similar results. It is important to note that the BV model shows higher ZEV fueling infrastructure needs than the EV-Pro1 model for the workplace and public end-uses as BV used updated assumptions from the more current AB 2127 assessment. Figure 12 shows the high-level projected ZEV fueling infrastructure needed compared to currently available infrastructure.

Figure 12: San Diego Region ZEV Forecast



The model relied on several assumptions, as provided in the appendix and shown in Table 1.

Table 1: General ZEV Fueling Infrastructure Assumptions

	A2Z Collaboration Regional Gap Analysis	AB 2127 Assessment
ZEV Population	771,000 by 2030 (SD County)	7.9 million in 2030 (statewide)
Electric / Hydrogen Fuel Cell Electric Split	95/5% in 2030	95/5% in 2030
Within electric, Hybrid / Battery Split	30/70% in 2030	30/70% in 2030
Charging Behavior Objective	Maximize electric vehicle miles traveled	Mirror observed behavior
Electric w/ Home Charging	67%	67%
Time-of-Use Rate Participation	Not included	67% in 2030
Infrastructure Utilization	Assumed	Observed

Table 2 presents the results of the infrastructure analysis for the model run by BV against the statewide AB 2127 assessment. The BV model shows that level 2 charging infrastructure needs to grow more than eight-fold and DC fast charging infrastructure needs to grow by nearly 14x by 2025. Only one hydrogen fueling station is operating in the region as of 2021. BV estimates that 47 hydrogen fueling points will be needed by 2030.

Table 2: ZEV Fueling Infrastructure Modeling Results for 2030

End-Use	A2Z Collaboration Regional Gap Analysis Model			AB 2127 Assessment	
	Level 2 Chargers	DCFCs	Hydrogen	Level 2 Chargers	DCFCs
Multi-family (Not Including Communities of Concern)	16,300	--	--	--	25,800
Multi-family (Communities of Concern)	12,400	--	--	--	--
Workplace	47,300	--	--	51,300	--
Public	52,800	6,000	41	55,600	4,900
Light-Duty Fleet	8,100	--	--	Not Included	--
TNC Vehicles	400	1,200	3	200	600
Distribution of Goods (Freight)	--	8,400	1	--	12,700 50kW 1,400 350kW
Total	129,200	15,700	47	132,900	19,600

Additional End-Uses in Regional Gap Analysis Model Not in AB 2127 Assessment	A2Z Collaboration Regional Gap Analysis Model			AB 2127 Assessment	
	Level 2 Chargers	DCFCs	Hydrogen	Level 2 Chargers	DCFCs
Single-Family (Communities of Concern)	160,200	--	--	Not Included	
Commercial Transit	--	600	1		
School Buses	1,700	--	1		

Overall, the infrastructure needs between the two models are semi-aligned in results. This gives confidence to the A2Z Gap Analysis infrastructure need forecast.

Gaps and Barriers

Through the interviews, surveys and A2Z Steering Committee meetings, regional stakeholders contributed their understanding of the barriers and gaps to broad transportation electrification. The BV team performed additional research and drew on professional experiences to identify the following sets of barriers and gaps. These are organized according to the pillars identified in the California ZEV Market Development Strategy published in 2021 by GO-Biz shown in Figure 12¹³. The four pillars are vehicles, infrastructure, end-users and workforce.

Figure 12: The 4 Pillars of Market Development Strategy as Defined by CA GO-Biz in its ZEV Market Development Strategy



Vehicles

ZEV Ownership Cost Premium and Vehicle Affordability

If current incentives remain in place, the BV TCO model, developed specifically for the San Diego region, shows cost parity between new light-duty ZEVs and comparable ICE vehicles by 2022. Without incentives, cost parity is delayed two years, to 2024.

Cost parity for medium-duty vehicles is projected to be much longer, with projections of cost parity to occur in 2032. This timing can be attributed to the later availability of larger battery sizes and the lack of at-scale manufacturing of medium-duty vehicles. Heavy-duty vehicles cost parity does not occur in our analysis timeframe.

For all vehicle classes, this cost premium is seemingly more difficult to overcome as most purchasers consider only the purchase price rather than the TCO metric. The BV TCO model goes beyond the vehicle purchase price and includes fuel, vehicle efficiency, vehicle miles traveled, maintenance, fueling infrastructure costs and fueling infrastructure maintenance costs.

While ZEVs will eventually meet parity on a TCO basis, the upfront costs typically drive buying decisions. Current levels of incentives and funding are insufficient to address the ZEV cost premium upfront. This is true for low and medium-income sectors of the population. Financing options are limited for all. More needs to be done to make vehicles more affordable for all sectors of the market and raise awareness around TCO.

This TCO calculation highlights the need for continued incentives. For organizations that identified increasing ZEV adoption as their key contribution to accelerating zero-emission transportation, they highlighted the cost parity of ZEVs with traditional vehicles as the most significant barrier to adoption.

¹³<https://business.ca.gov/industries/zero-emission-vehicles/>

EV Models and Availability

Many drivers need or prefer vehicle classes currently unavailable or only available at a significant premium in ZEV form. Automakers have been slow to make ZEVs aligned with market preferences (i.e. sport utility vehicles (SUVs) and pickup trucks). Many automakers have been working to produce these popular vehicle classes in electric form but have been met with delays. For example, Ford is expected to deliver their all-electric F-150 (the bestselling vehicle in the U.S.) in 2022. Costs for these larger ZEV SUVs and pickup trucks are expensive for the near-term, with pricing well above comparable ICE vehicles.

Medium and heavy-duty vehicles are experiencing a similar issue with delays and high costs. In general, medium and heavy-duty vehicles are not expected to be widely available until 2023 or 2024. For example, Tesla committed to delivering two versions of an all-electric semi-truck by 2019, but have yet to become commercially available. Daimler committed to delivering all-electric semi-trucks to pilot customers but recently pushed out their volume production timeline from 2023 to 2024. Pricing for most of these vehicles is not yet known. Pricing is anticipated to be significantly higher in the early years and follows a similar cost decline as with light-duty vehicles.

ZEV Secondary Market and Incentives

ZEVs are in limited supply in the marketplace today and therefore the secondary ZEV market is currently small. A recent search on a leading used car website for used electric cars in the San Diego region showed only 200 ZEVs compared to an entire market of 16,000 ICE vehicles. As more ZEVs enter the market, a healthy secondary market with robust supply, demand and incentives could provide a low-cost pathway to ZEV adoption. A healthy secondary market can also instill confidence for existing ZEV owners to sell and upgrade their vehicles (preferably to another ZEV). California Energy Commission (CEC) data shows that about half the ZEVs registered in California are the model year

2017 and prior¹⁴. Many of these vehicles are due for their end of lease or change in ownership in the coming years.

Although many used ZEVs are priced much lower than their new counterparts, there are limited incentives that contribute to the upfront affordability of used ZEVs. As of 2020, BV found that many incentives do not extend to used ZEVs. One program, the Clean Vehicle Assistance Program, promotes the purchase of used ZEV vehicles. Program eligibility is dependent on applicants' income and requires applicants to submit tax returns up to three months before the incentive is to be used. These seemingly arduous application requirements and delays can be discouraging to individuals interested in purchasing an EV at reduced costs at the time of purchase.

In addition to hindering adoption at lower cost points, the lack of a secondary market can lead to a flow of used ZEVs out of California to other states, especially if those with states offer incentives for used ZEVs. For example, Oregon offers an incentive for low and medium-income individuals to purchase a used ZEV¹⁵. Washington state has a similar program¹⁶. When ZEVs were primarily compliance vehicles from the automaker, they were only sold in California and challenging to purchase in other states. Once the vehicles were listed on the secondary market, buyers in other states could purchase and ship these out of state. Keeping vehicles in California contributes to achieving both local ZEV and GHG goals.

Infrastructure

Policies Targeted to Meet Forecasted ZEV Fueling Needs

This gap analysis and future regional EV strategy can be used to develop near-term infrastructure policies and targets to support the transition to zero-emission before the vehicles arrive in large numbers and potentially overwhelm existing charging/hydrogen infrastructure. California has clearly defined statewide

¹⁴Vehicle Population in California

¹⁵<https://goelectric.oregon.gov/incentives-rebates>

¹⁶https://dor.wa.gov/sites/default/files/legacy/Docs/Pubs/SpecialNotices/2019/sn_19_CleanAltHybridExmpt.pdf

ZEV targets and regulatory mandates on vehicle manufacturers, transit agencies, TNCs and others to support vehicle targets. However, there is no similar mandate to deploy charging infrastructure and hydrogen fueling stations in support of the vehicles. No organization is accountable for meeting the infrastructure goals identified in Executive Order B-48-18, which calls for 200 hydrogen fueling stations and 250,000 EV charging stations, including 10,000 DCFCs, statewide by 2025.

The BV infrastructure model shows a need for 56,400 EV chargers in the region by 2025, which is more than double the region's proportional amount of the earlier B-48-18 goal. The lack of infrastructure could lead to poor ZEV ownership experiences and reduced confidence in the technology. BV believes that policies could be developed to support infrastructure needs with responsibility and clear targets for each jurisdiction to meet in the near-term.

ZEV Fueling Infrastructure Access and Availability

Today, the private sector deploys EV chargers to follow existing and future ZEV adoption patterns, traffic flows, among many other criteria. BV found limited public ZEV fueling opportunities in communities of concern, which can deter individuals in those communities who also do not have access to home charging. Policies are needed to target areas with less access to ZEV fueling infrastructure.

The BV model estimates that the region will need 47 hydrogen fueling stations by 2030 as fuel cell EVs become more commercially available. There are transportation use-cases where hydrogen fueling may be more appropriate, such as long-haul trucking and transit. Currently, there are three hydrogen fuel cell EV models on the road and limited hydrogen fueling stations. As of 2020, there is one in operation, one in permitting, and four in the planning phase to support light-duty vehicles.

Streamlined Permitting for ZEV Fueling Infrastructure

In 2015, California passed AB 1236, which mandated that Authorities Having Jurisdiction (AHJs) streamline the permitting process for residential and commercial EV charging stations by the end of September 2016 for AHJs over 200,000 residents and by the end of September 2017 for AHJs under 200,000. Permit streamlining requirements as outlined in AB 1236 have not yet been implemented across all San Diego region jurisdictions. At the time of the gap analysis research in late 2020, four local governments in the San Diego region had fully completed the streamlining, seven were partially streamlined and eight had not started yet.

Inconsistent permitting processes across jurisdictions slows down the work of developers. This time delay increases the costs of installation. Also, a streamlined permitting process, through the use of technology and online tools, can help attract private investment for charging.

Land Availability

Freight and transit facilities were designed around a fossil-fueled drivetrain powering all vehicles within the fleet. EV charging infrastructure requires space for placement of the pedestals and dispensers. DC fast charging requires separate power equipment, which is challenging for existing properties and new construction with limited space. EV charging infrastructure targeted in dense urban areas to support ZEVs at multi-family housing is challenged to find space to install infrastructure. Many installations may require additional space and may eliminate more parking, putting the property into non-compliance with local government ordinances. The additional space requirement increases the ZEV transition barriers for these fleet and property owners.

Technology Uncertainty

The ZEV fueling technology is advancing at a rapid pace. With technology transitions, there is a potential risk of installing ZEV fueling infrastructure that could become obsolete in the future. On the EV side, technology innovations in faster charging solutions, wireless charging, or larger battery capacities that reduce the need for chargers create risk for investments. On the hydrogen side, the advancement of the technology, adoption by fleets and cost of hydrogen all create risks for building hydrogen fueling infrastructure. There is also an existing investment in other legacy low-carbon fuels such as compressed natural gas. These investments will need to be paid off before fleets consider switching to a zero-emission option.

Careful forethought must be given to deploying charging infrastructure with the future in mind to have assets with longer useful life and reduced stranded asset risk. Uncertainty should not halt progress and risks can be hedged with regular industry assessments to understand the market.

End Users

Coordinated Outreach and Education Initiatives

There are multiple, potentially overlapping education and outreach campaigns on the benefits of ZEV adoption. Some are program-specific campaigns and others are national and statewide led by organizations like Plug-in America and Veloz. Where possible, coordinating and collaborating on local, regional and broader education campaigns can improve overall effectiveness for local populations. Coordination with community-based organizations is essential as they are vital local resources and can assist with ZEV outreach messaging.

The survey and A2Z Collaboration Steering Committee interview results show many stakeholders feel there is a lack of residential and business customer education and outreach pertaining to ZEVs. Many indicated that a regional effort could increase ZEV adoption for passenger vehicles and fleets – with messaging tailored to each segment.

- Local government staff, especially planners, were identified as a target for education in the region. This training would help city planners provide better guidance during the development of ZEV programs.
- Community-based organizations would benefit by better understanding the available incentives and programs to increase EV utilization by the communities they serve.
- Fleet managers would benefit by understanding the operational considerations associated with ZEVs and the fundamentals behind the TCO calculations.

Overlapping Stakeholder Efforts

One of the key drivers to establish the A2Z Collaboration was to coordinate ZEV activities across organizations to increase ZEV adoption region-wide. Many agencies and organizations are active in the ZEV arena and a lack of regional coordination can lead to consumer confusion and lesser impact than the sum of efforts.

A collaborative approach promotes an environment of learning and accountability amongst stakeholders. It helps ensure that potential risks are adequately identified, improving a decision-making process to save time and money. BV found overlapping efforts and assessments performed by local bodies, community-based organizations and regional bodies during stakeholder interviews. There are several events carried out by SDG&E, different interest groups, community-based organizations and government bodies. However, there is not a formal and periodic forum for stakeholders to get together and discuss their plans.

Customer Perception and Education

Consumers may be unaware of easy-to-navigate information on vehicle and charger availability, available incentives, the TCO and other factors necessary for vehicle purchase decisions that go above and beyond what many would typically account for when purchasing an ICE vehicle. Additionally, much of this information may be disaggregated across many different sources and require extra effort for consumers to access. Many consumers also lack information or misunderstand

vehicle performance capabilities, safety records and fueling considerations due to ZEV technologies' nascency. This inability to easily access information on ZEVs can all be barriers to adoption for consumers.

Car dealerships and frontline sales individuals lack knowledge of ZEV technology, charging costs and available incentives, leading to customers not receiving accurate comparisons to conventional vehicles. The knowledge gap will also become more apparent with medium or heavy-duty vehicles as they become more available in the marketplace. Similar challenges will emerge as with light-duty vehicle dealerships.

Property Owner Expertise and Awareness

Based on BV's experience in the industry, many property owners lack the expertise to plan and install charging stations, including evaluating the business case for public and private charging opportunities. Similarly, survey respondents stated that the most significant barrier to broader adoption of workplace charging relate to equipment and installation costs and a lack of associated incentives. Some Steering Committee interviews determined many employers lease space and need the approval of the property owner to install charging. Distances between electrical service and desired charging station locations can be a challenge for property owners and increase costs and parking lot disruption for long service runs. Multi-family dwellings that are not owned by a single developer, such as condominiums, are challenged to distribute infrastructure costs across residents. There are also the engineering challenges of solving distances between electrical rooms and resident parking spots to be equipped with EV charging and the reduction in parking stalls which can be a zoning mandate.

Data to Support ZEV Program Growth

Local government entities lack granular data to understand where vehicles would dwell when charging within their jurisdictions. Access to vehicle registration data by jurisdiction and accurate charger counts can enable local governments to plan efficient infrastructure deployment, make a case for infrastructure investments to support growing vehicle

populations and help inform regional approaches to infrastructure deployment.

Funding for Local Pilots

Through the interviews, a need for local government pilot programs was voiced. These pilots would accelerate the adoption of ZEVs in each jurisdiction and successfully demonstrate to their business communities that ZEV technology can perform for their needs. All Steering Committee members agree that businesses within each community need to see successful programs adopted by neighboring businesses.

Workforce

Skillset Gaps with Commercial Drivers

Zero-emission medium and heavy-duty trucks, buses and fleet vehicles are still relatively new, and drivers of these vehicles will need to gain experience operating these vehicles. From BV's experience with transit agencies, the additional torque associated with EVs can create faster-than-needed acceleration, which can deplete the battery more quickly than necessary. Training will be needed to become accustomed to the driving differences and to avoid increased maintenance costs. For instance, torque management of EVs with proper training can reduce tire wear and increase the tires' useful life. Proper stopping to use regenerative braking can maximize the range. Automakers that do not provide training with smaller orders may leave those businesses without robust training for drivers unfamiliar with ZEVs.

Trained Workforce Availability

Existing automotive maintenance workers will need specialized training to diagnose and fix issues with zero-emission drivetrains. Although maintenance is needed less often than conventional fossil-fueled vehicles, the workforce must be ready to respond and repair the vehicles when they require a fix. Moving from internal combustion-driven drive trains to those powered by batteries, electric motors and computers will require additional training of maintenance staff.

The automakers may provide limited training for fleet owners transitioning to ZEVs when the new ZEVs have a much greater technology focus than their diesel-fueled predecessors.

The power demand for ZEV infrastructure is greater than for typical properties. It requires workforces that understand the higher power level requirements larger service transformers, upsized switchgear and three-phase power. Designers and engineers need to understand what commercial ZEV fueling infrastructure means for complying with California disability requirements.

BV identified one formal workforce training program, the Electric Vehicle Infrastructure Training Program (EVITP¹⁷). EVITP provides training and certification programs for electrical contractors looking to boost their skillsets to install EV chargers. State-funded incentive programs for EV chargers will require EVITP trained electricians to perform the installations in the near future. SANDAG is currently facilitating two EVITP training sessions each year for the San Diego region. SDG&E also requires EVITP certified installers for all of their charging infrastructure programs.

Considerations for Regional Strategy

The A2Z Collaboration undertook this San Diego Regional EV Gap Analysis to identify needs that can inform its long-term strategy. The A2Z Collaboration plans to share this report with stakeholders and use it as a foundation to develop an EV strategy to help accelerate the transition to EVs in the region over the next ten years.

While the focus of this effort was to identify gaps and barriers, there was a natural tendency to create and capture solutions as the team conducted its work. The team captured the key considerations that can inform the strategy. These considerations were produced through stakeholder feedback, quantitative analysis and BV's research and experience.

Considerations for A2Z Collaboration Regional Strategy include the following.

- Lowering the upfront cost barriers to owning a ZEV is anticipated to be one of the most significant impacts on adoption. Future vehicle incentives should consider targeting both new and secondary markets.
- In the mid-2020s, medium and heavy-duty EV powered vehicles will become commercially available in volume. Regional entities will be able to provide or expand administrative support for fleets and organize cooperative buying in order to lower costs for smaller fleet operators.
- Hydrogen is a consideration for future vehicles in the region, especially for medium or heavy-duty vehicles that require longer ranges and higher payloads.
- Alternative policies to incentive adoption should be considered. Examples could include low-emission zones, EV mandates or ordinances. Registration controls could also be designed to require and enforce emission standards for vehicles.
- All local governments should implement the streamlined permitting requirements included in AB 1236.
- State-level or federal administrative support for agencies that do not have ordinances to mandate ZEV fueling infrastructure in new commercial and multi-family buildings.
- Efforts to update and expand the existing SANDAG PEV Infrastructure mapping tool could give agencies the data they need to show the specific gaps in charging and where to best locate infrastructure¹⁸.
- Infrastructure should be prioritized in communities of concern to enable wider ZEV adoption.
- Education is vital to provide end-users with helpful information and manage any prior misconceptions about ZEV technologies.
- Education campaigns should be coordinated across the region to maximize the impact. Consistent messaging strategies should be tailored to align with targeted audiences.

¹⁷<https://evitp.org/>

¹⁸<https://evcs.sandag.org>

- Existing programs such as EVITP should be continually promoted to get installers the baseline training they will need to install ZEV fueling infrastructure.
- Partnerships with the local community and technical schools, original equipment manufacturers (OEMs) and local maintenance shops could be considered to promote additional training and program development.



Appendix: A2Z EV Vehicle Adoption Model

Vehicle Adoption

For the A2Z Gap Analysis, BV developed a model to forecast vehicle adoption. The BV vehicle adoption model projects the number of vehicles by type through 2030. Like the model used in the A2Z Gap Analysis, the AB 2127 assessment vehicle adoption assumptions are driven by Executive Order N-79-20. AB 2127 did not provide specific assumptions for vehicle adoption that readily lends themselves to a direct comparison.

Assumptions

Assumptions used in the quantitative models were documented, reviewed and agreed to with the A2Z core team members. Assumptions are included below for the three models developed and used in the for vehicle adoption and to determine ZEV fueling infrastructure. BV also compared A2Z analysis assumptions against those used in the AB 2127 statewide assessment. Note that the AB 2127 assumptions have not been adjusted for the San Diego region.

The BV vehicle adoption model inputs by type are captured in Table 3. Also, the model assumed:

- For growth, 1.67 percent compounding growth year over year to 2030 based on the year over year change in registered vehicles in the US going back over the past nine years for light-duty vehicles and transportation network company vehicles.
- The growth rate for transit buses was taken from the MTS Adopted the Fiscal Year 2020 Budget. The medium and heavy-duty rate came from the American Trucking Associations (ATA) Freight Transportation Forecast 2019 – 2030.
- For vehicle replacement, ZEVs would be replaced by other ZEVs rather than ICE vehicles.
- Net inflows and outflows of ZEVs were assumed to stay constant, so if a ZEV registered in the San Diego region leaves the county, ZEV would be replaced with another ZEV coming into the county.

Table 3: Vehicle Adoption Model Assumptions

Model Inputs	Light-Duty Vehicles	Transportation Network Company Vehicles	Transit Buses	Medium and Heavy-Duty Class 3-8 Vehicles	Basis
2020 Vehicle Count	2,497,425	45,000	1,701	45,041	CEC Data, EMFAC (CARB's emission inventory)
Current Share of ZEVs	44,954	810	8	16	CEC data for light-duty, TNCs, EMFAC
Vehicle Growth Rate	1.67%	1.67%	1.00%	2.10%	Light-duty 9 year average for vehicles across the US, ATA forecast
Vehicle Replacement Rate	4.43%	20%	8.30%	8.30%	Car and Driver, Hedges and Company, MTS
Percent of New Vehicles that are ZEV by 2030	70%	100%	100%	40%	ZEV extrapolation, Uber/Lyft, ICT, ACT

Methodology

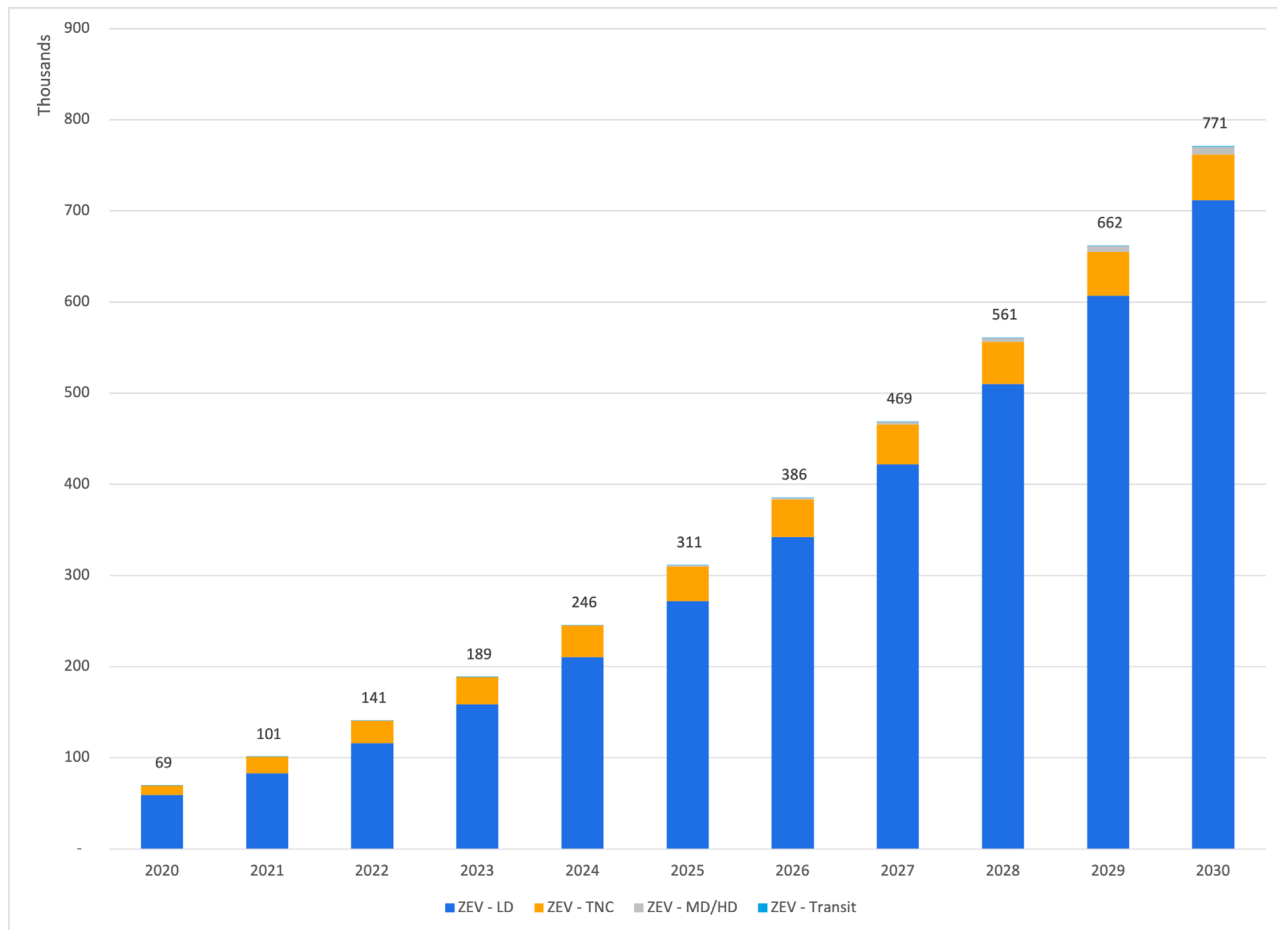
BV modeled ZEV adoption based on existing vehicle numbers, growth rates and replacement rates. The team obtained existing vehicle numbers from CEC data and determined vehicle growth rates based on the state goals established by legislation and gubernatorial order. This was informed by several industry resources for replacement rates as listed in the above table under column basis.

BV then projected vehicle growth based on 20 years of historical trends. Note that the team gathered data for several vehicle classes; however, data was not available across all vehicle classes. It is still valuable to break out the segments where data was available rather than generalize for light, medium and heavy-duty vehicles. The light-duty category above is for all light-duty vehicles, excluding TNC vehicles where were modeled separately. For light, medium and heavy-duty vehicles, the numbers include all class 3-8 vehicles excluding transit which was available separately.

Results

Based on our modeling, our region's share (based on population) of the statewide goal results in a little over 771,000 ZEVs by 2030 shown in Figure 13.

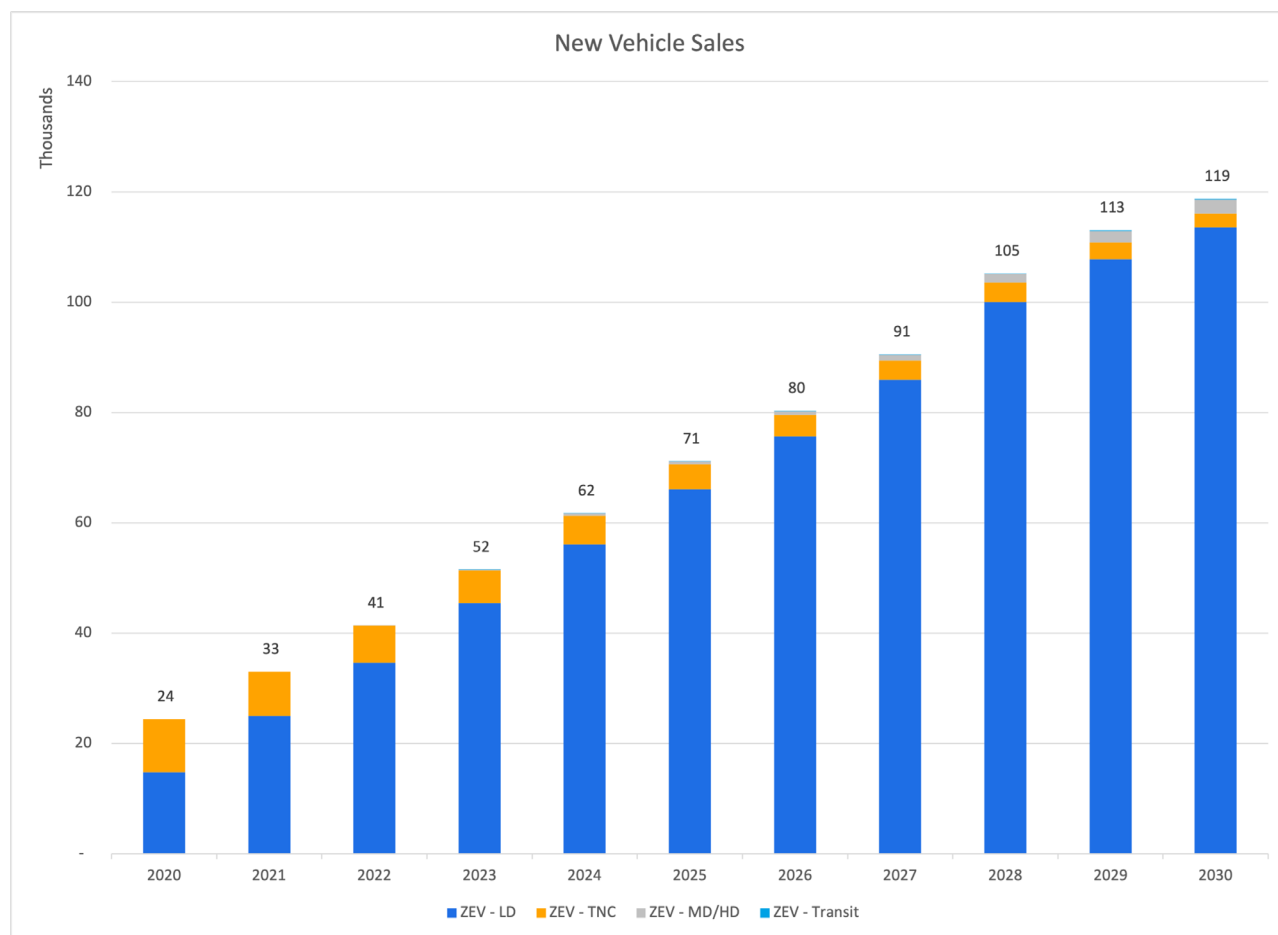
Figure 13: San Diego Region ZEV 10-yr Growth Forecast



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
ZEVs End of Year	69,331	101,084	140,758	188,782	245,617	311,182	385,570	468,883	561,058	661,925	771,090
LD	58,908	82,826	116,038	158,620	210,578	271,852	342,317	421,785	510,007	606,680	711,448
TNC	10,400	18,234	24,667	29,982	34,405	38,117	41,264	43,962	46,302	48,361	50,197
MD/HD	16	16	44	131	545	1,084	1,782	2,854	4,391	6,384	8,812
Transit	8	8	8	49	89	128	207	283	357	501	634

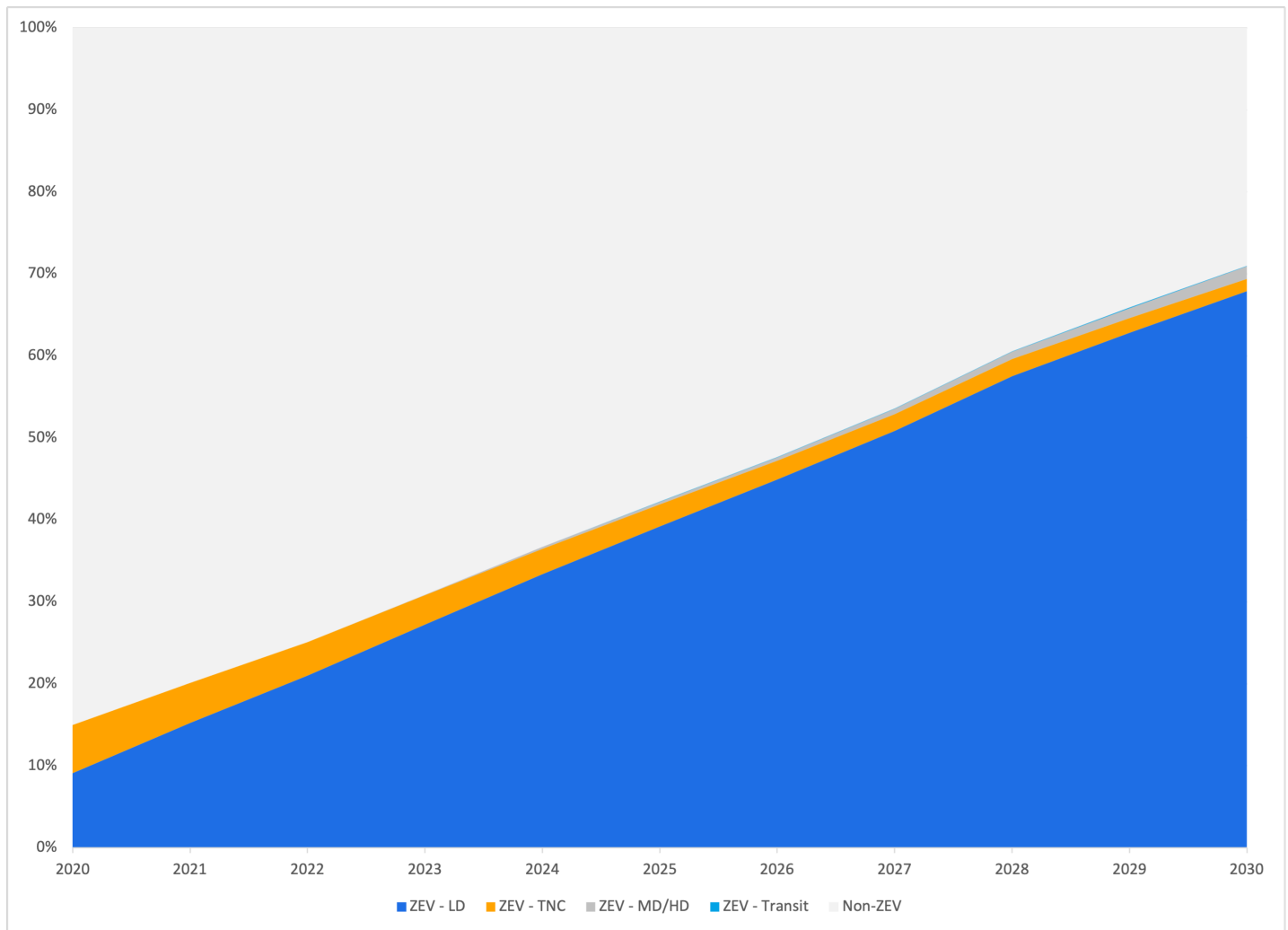
By 2030, BV expects to see ZEVs represent 71 percent of new vehicle sales annually which amounts to approximately 119,000 which is illustrated in Figure 14.

Figure 14: ZEV New Vehicle Sales 10-yr Projection



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
ZEV New Vehicle Sales	24,382	32,996	41,369	51,513	61,738	71,180	80,340	90,549	105,187	113,054	118,774
LD	14,792	24,975	34,602	45,459	56,080	66,098	75,683	85,921	99,990	107,787	113,555
TNC	9,590	8,021	6,739	5,926	5,202	4,501	3,878	3,475	3,567	3,068	2,536
MD/HD	-	-	28	87	415	541	699	1,076	1,551	2,047	2,537
Transit	-	-	-	41	41	41	79	77	79	152	146

Figure 15: ZEV Share of New Vehicle Sales

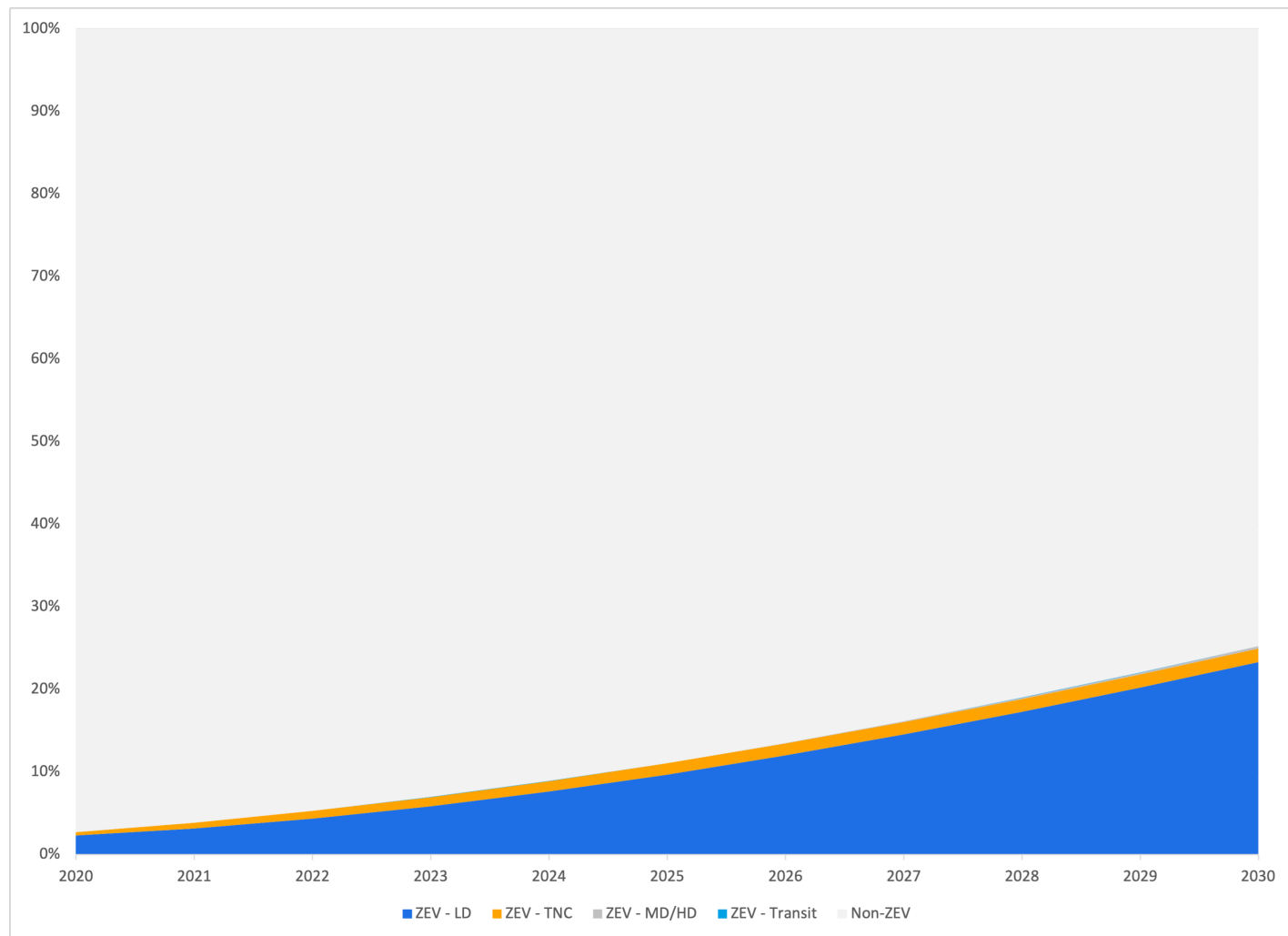


ZEV Share of New Vehicle Sales*	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
LD	9.08%	15.20%	20.98%	27.25%	33.34%	39.19%	44.91%	50.83%	57.55%	62.82%	67.87%
TNC	5.89%	4.88%	4.09%	3.55%	3.09%	2.67%	2.30%	2.06%	2.05%	1.79%	1.52%
MD/HD	0.00%	0.00%	0.02%	0.05%	0.25%	0.32%	0.41%	0.64%	0.89%	1.19%	1.52%
Transit	0.00%	0.00%	0.00%	0.02%	0.02%	0.02%	0.05%	0.05%	0.05%	0.09%	0.09%
Non-ZEV	85.03%	79.92%	74.92%	69.12%	63.30%	57.80%	52.32%	46.43%	39.46%	34.11%	29.01%

*Percentage of total new vehicle sales across all classes of vehicles

BV projections also show that ZEVs will make up 25 percent of overall vehicle stock by 2030 as shown in Figure 16.

Figure 16: ZEV Share of Total Vehicle Stock



ZEV Share of Total Vehicle Stock*	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
LD	2.28%	3.15%	4.34%	5.83%	7.62%	9.67%	11.98%	14.51%	17.26%	20.19%	23.29%
TNC	0.40%	0.69%	0.92%	1.10%	1.24%	1.36%	1.44%	1.51%	1.57%	1.61%	1.64%
MD/HD	0.00%	0.00%	0.00%	0.00%	0.02%	0.04%	0.06%	0.10%	0.15%	0.21%	0.29%
Transit	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%	0.01%	0.02%	0.02%
Non-ZEV	97.32%	96.16%	94.74%	93.06%	91.12%	88.93%	86.51%	83.87%	81.01%	77.97%	74.76%

*Percentage of total vehicle stock across all classes of vehicles

Cost Parity Model

BV developed a Cost Parity Model that compares conventional and electric vehicle cost curves to one another to determine when the electric vehicle intersects and reaches at price parity with the conventional vehicle.

General Assumptions and Methodology

The Cost Parity Model is based on the TCO framework. The TCO is a calculation of expenses that apply to ownership of a ZEV and ICE vehicle. This methodology is mainly used to compare the costs of owning a ZEV versus an ICE vehicle. Table 4 outlines the significant aspects of the TCO cost framework. Vehicles were split into light, medium and heavy-duty, as shown in Table 5 based on the US gross vehicle weight rating (GVWR). Various costs in the model were given a flat, declining or escalating value based on industry research or assumptions on transportation trends. When cost futures were available, linear extrapolations were made forward and backwards to fit the time horizon of the study.

Table 4: General TCO Focus Areas

Cost	Type
Upfront Capital	Vehicle
	Fueling Infrastructure
Fuel	Gasoline, diesel, or electricity (kWh)
Maintenance	Cost/Mile

Table 5: TCO Model Vehicle Category

Model Category	GVWR Classes
Light-Duty	Class 1 – 0 to 6,000 lbs.
	Class 2a – 6,001–8,500 lbs.
Medium-Duty	Class 2b – 8,501–10,000 lbs.
	Class 3 – 10,001–14,000 lbs.
	Class 4 – 14,001–16,000 lbs.
	Class 5 – 16,001–19,500 lbs.
	Class 6 – 19,501–26,000 lbs.
Heavy-Duty	Class 7 – 26,001–33,000 lbs.
	Class 8 – 33,001–Beyond lbs.

Results

BV observed that light-duty vehicle cost parity occurred around 2024 without incentives and 2022 with incentives and medium-duty vehicles in early 2032. Heavy-duty vehicles did not have a cross-over point, likely due to the requirement for very large batteries, keeping the costs elevated. As medium and heavy-duty vehicles come to market in the next few years, the cross-over point for heavy-duty will likely occur around the same time as medium-duty as costs decline.

Figure 18: Light-Duty - Annual Cost of Ownership Cost Parity

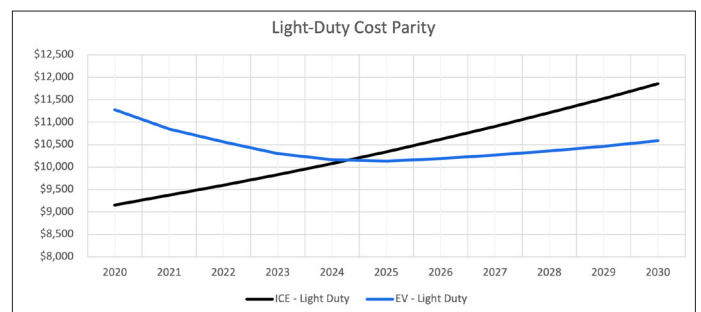


Figure 19: Medium Duty - Annual Cost of Ownership Cost Parity

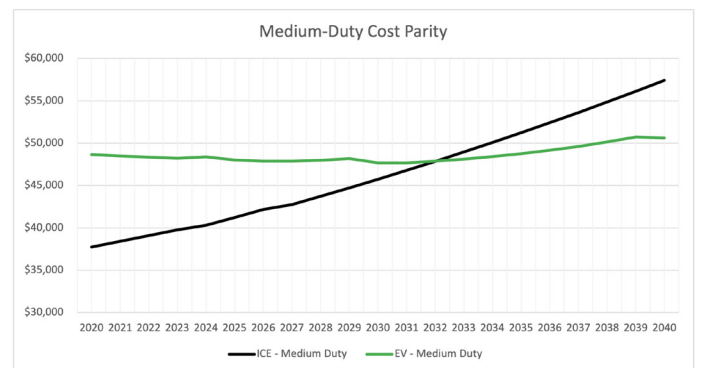
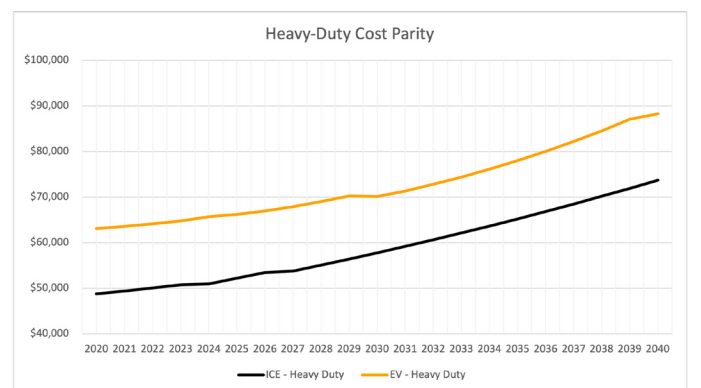


Figure 20: Heavy Duty - Annual Cost of Ownership Cost Parity



EV Infrastructure Gap Analysis

The A2Z Collaboration Regional EV Gap Analysis used the electric vehicle infrastructure projection tool (EVI-Pro) and a BV developed end-use charging model to determine needs for charging infrastructure. AB 2127¹⁹ used an updated version of EVI-Pro and other developed models depending on the vehicle application studied. These models are compared below to illustrate the different applications included in the analyses.

Application	A2Z Collaboration Regional Gap Analysis	AB 2127
Light-Duty (<100 miles)	EVI-Pro	EVI-Pro 2
Light-Duty (>100 miles)	Not Applicable	EVI-Road Trip
Light-Duty (Multi-family)	End-use Charging Model	EVI-Pro 2
Light-Duty (Multi-family CoC)	End-use Charging Model	Not Available
Workplace	EVI-Pro	EVI-Pro 2
Light-Duty Fleet	End-use Charging Model	Not Available
TNC	End-use Charging Model	WIRED
Commercial Transit	End-use Charging Model	Not Available
Good Movement (Freight)	End-use Charging Model	HEVI-LOAD
School Bus	End-use Charging Model	Not Available

Assumptions

The assumptions used for light-duty applications in the A2Z Collaboration Regional EV Gap Analysis and AB 2127 assessment are captured below.

	A2Z Collaboration Gap Analysis (EVI-Pro)	AB 2127 Assessment (EVI-Pro 2 High Scenario)
ZEV Population	771 thousand by 2030 (SD County)	7.9 million in 2030 (Statewide)
Electric / Hydrogen Fuel Cell Electric Split	95/5% in 2030	95/5% in 2030
Within Electric, Hybrid / Battery Split	30/70% in 2030	30/70% in 2030
Charging Behavior Objective	Maximize electric vehicle miles traveled	Mirror observed behavior
Electric with Home Charging	67%	67%
Time-of-Use Rate Participation	Not included	67% in 2030
Infrastructure Utilization	Assumed	Observed

To address additional charging infrastructure needs, BV developed the end-use charging model to perform a bottom-up analysis to estimate infrastructure required to support various transportation charging end uses. Each end-user has unique and shared assumptions to produce the infrastructure requirements based on the number of vehicles produced from the vehicle adoption model.

¹⁹This analysis relied on the AB 2127 analysis released in January 2021 and acknowledge that a revised report was published in May 2021. <https://www.ca.gov/archive/gov39/2018/01/26/governor-brown-takes-action-to-increase-zero-emission-vehicles-fund-new-climate-investments/index.html>

Methodology

The methodology is based on each of the four vehicle adoption model categories: light-duty, TNCs, medium and heavy-duty and transit. The vehicle numbers for each end-user are broke out by percentage based upon analyst assumptions and community concern. Table 6 outlines the high-level percentage breakouts based on the vehicle adoption model.

Table 6: Gap Assessment End Use Summary

Vehicle Adoption Model	Year	Vehicle Adoption Model Percentage	Communities of Concern	Type
Light-Duty	2020	39.07%	N/A	Multi-family – Not Including Communities of Concern
	2025	40.82%		
	2030	42.43%		
	2020	39.07%	43.30%	Multi-family – Communities of Concern
	2025	40.82%		
	2030	42.43%		
	N/A	N/A	43.30%	Communities of Concern – Single Family
	N/A	14%	N/A	Workplace
	N/A	1.19%	N/A	Light-Duty Fleet
TNCs	N/A	100%	N/A	TNC Vehicles
Medium and Heavy-Duty	N/A	100%	N/A	Goods Movement/Freight
Commercial Transit	N/A	100%	N/A	Commercial Transit
School Buses ²⁵	N/A	100%	N/A	School Buses

Results

Table 7 shows the results of the BV analysis outlining the anticipated 2030 needs for infrastructure based on the number of ZEVs that will be present at that time. These results are compared to the AB 2127 assessment data and matched to the categories in the end-use analysis. There is no match as the BV 2127 Assessment has a more narrow focus than the end-use assessment into multiple areas. Numbers have been broken out between publicly available infrastructure and privately available infrastructure.

Table 7: End Use Gap Analysis Results

	AzZ Collaboration Regional Gap Analysis							AB 2127 Assessment*		
Application	Yr. 2030 No. of Vehicles		Level 2 Chargers		DCFCs		Hydrogen Fueling Points	Yr. 2030 No. of ZEVs	Level 2 Chargers	DCFCs
	PEV	FCEV	Count	Private/ Public	Count	Private/ Public	Public	ZEV	Count	Count
Multi-family – Not Including Communities of Concern	162.6K	8.6K	16.3K	Private	N/A	N/A	N/A	711.0K	25.8K	N/A
Multi-family – Communities of Concern	124.2K	6.5K	12.4K	Private	--	--	N/A			
Workplace	94.6K	5.0K	47.3K	Public	N/A	N/A	N/A			
Public	675.9K	35.6K	52.8K	Public	4.7K	Public	41			
Communities of Concern - Single-Family	160.2K	8.4K	160.2K	Private	N/A	N/A	N/A			
Light-Duty Fleet	8.1K	0.4K	8.1K	Private	N/A	N/A	N/A	N/A	N/A	N/A
Transportation Network Companies Vehicles	47.7K	2.5K	0.4K	Public	1.2K	Public	3	24.0K	0.2K	0.6K
Goods Movement/ Freight	8.4K	0.4K	N/A	N/A	8.4K	Private	1	16.2K	N/A	12.7K 50kW 1.44K 350kW
Commercial Transit	0.6K	0.03K	N/A	N/A	0.6K	Private	1	N/A	N/A	N/A
School Buses	1.7K	0.09K	1.7K	Private	N/A	N/A	1	N/A	N/A	N/A
Total			299.2K		14.9K	N/A	47		133.1K	19.7K

*AB 2127 Assessment counts are based on 9 percent of the statewide data. This is based on the San Diego region population relative to the state.

