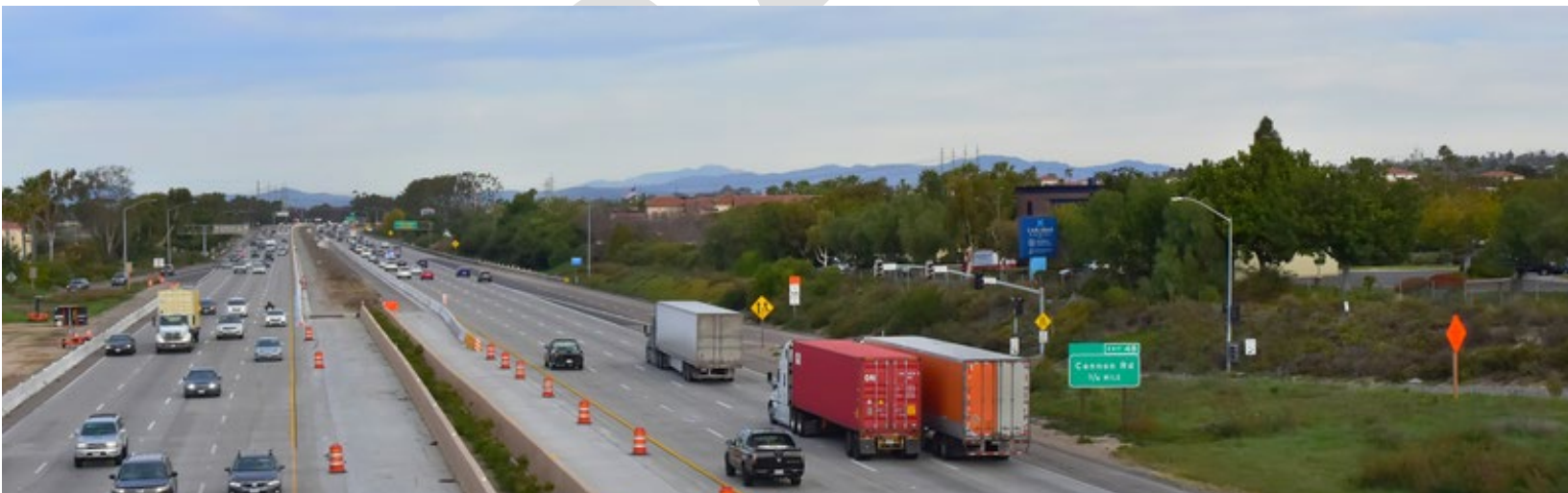




Medium & Heavy-Duty Zero Emission Vehicle Blueprint

May 2023

**DRAFT** Near- and Long-Term Implementation Strategies



# ABSTRACT

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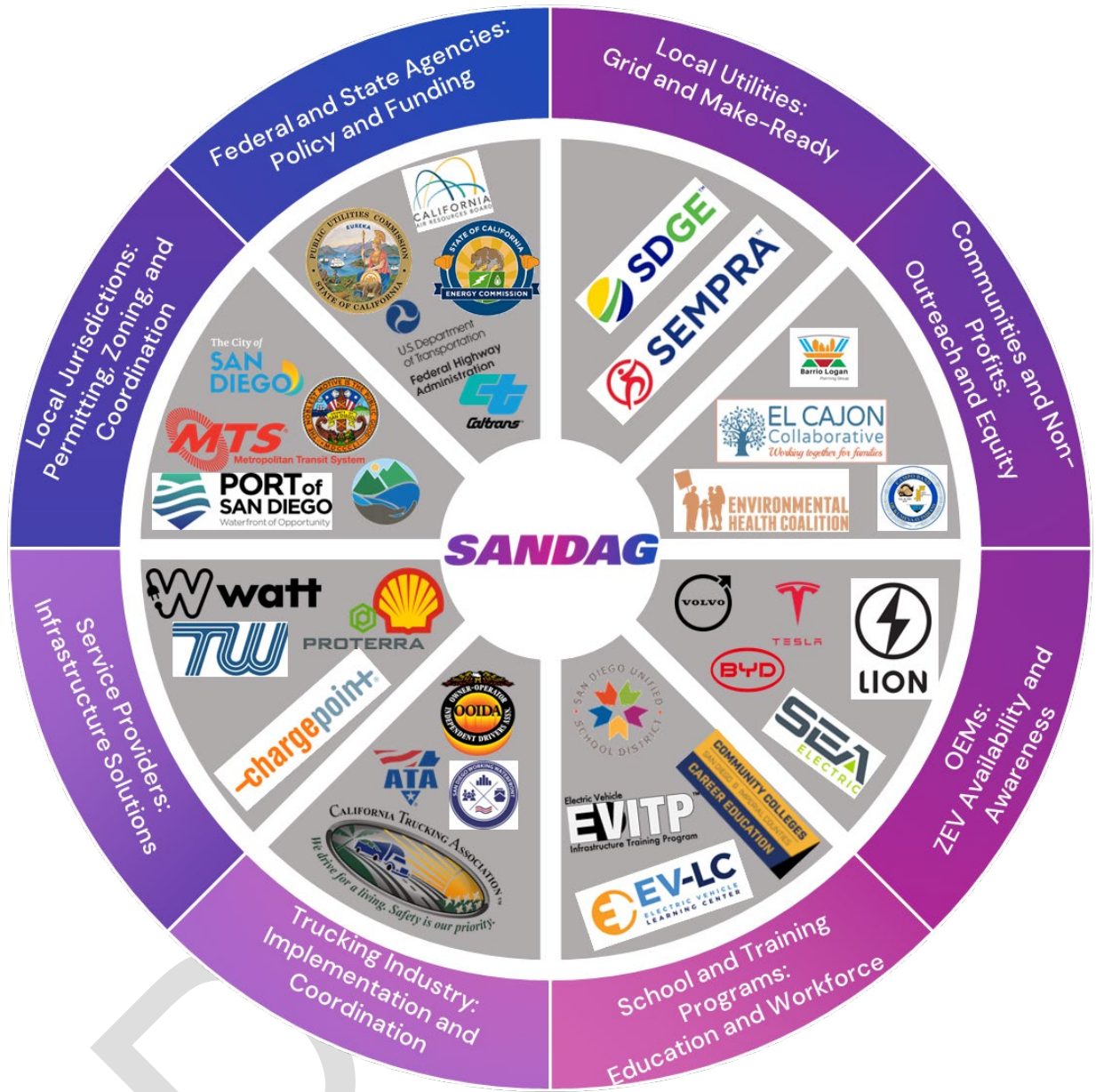
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## EXECUTIVE SUMMARY

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The intent of this report is to provide a comprehensive list of near-term and long-term implementation strategies for SANDAG and its regional partners to consider when deploying MD-HD ZEVs and infrastructure in the San Diego region (herein referred to as the region). This report is an important contribution to the broader undertaking of the San Diego Association of Governments (SANDAG) in developing the medium- and heavy-duty (MD-HD) Zero Emission Vehicle (ZEV) Blueprint. It expands on the previous work accomplished in the ZEV Needs Assessment and Siting and Technology Criteria Reports, which were completed before this particular task.

The strategies described in this report have been developed to address current gaps and barriers associated with adopting MD-HD ZEV technologies in the region, while best leveraging existing programs and resources from federal, state, and local government agencies. The strategies provide practical, actionable, affordable, and equitable solutions in support of a regional vision that meets regulatory requirements. Figure 1 summarizes the roles and responsibilities of SANDAG, as well as examples of its regional partners and stakeholders, including federal and state government agencies, local jurisdictions, communities and non-profit organizations, public utilities, regional freight and trucking industries, school districts and training programs, charging and fueling service providers, and original equipment manufacturers (OEMs). SANDAG, in collaboration with its regional partners, provides regional policy and funding program support, complementary to what has been provided by state and federal agencies. This study provides guidance for MD-HD ZEV deployment, including development requirements for site selection, land use compatibility, zoning, and entitlements processing; funding opportunities consisting of both public dollars and the use of public-private partnerships for deploying ZEV infrastructure; and workforce development, training and educational support that will be necessary to prepare residents, communities, and businesses for the transition to ZEV technologies.

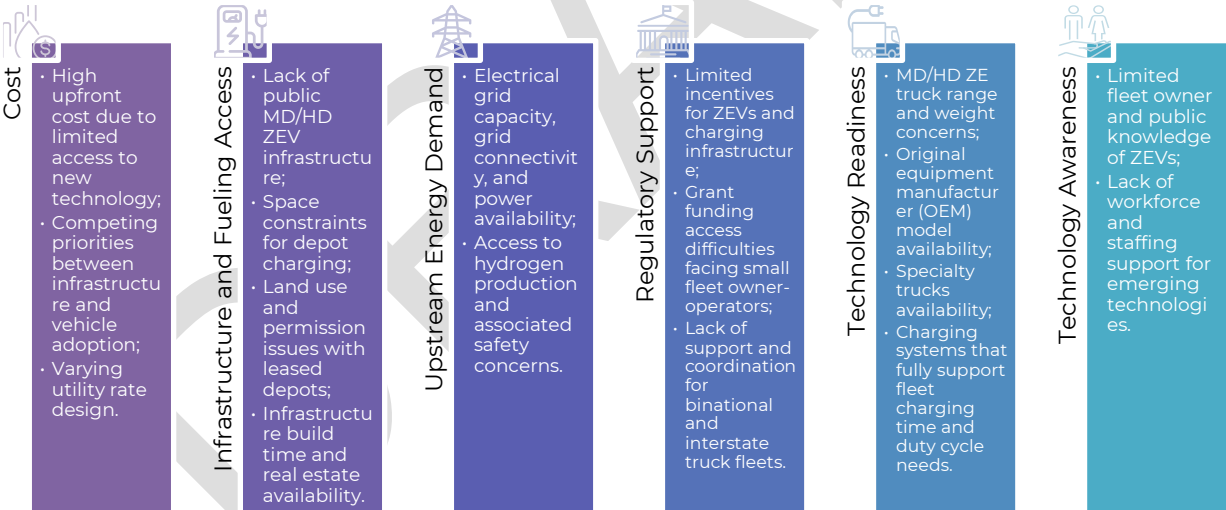


**Figure 1. Roles of SANDAG and Regional Partners in the MD/HD ZEV Deployment Paradigm (Please be aware that this chart serves as an illustrative example of a set of stakeholders and does not present an exhaustive list of all regional partners and stakeholders)**



# INTRODUCTION

With the recent adoption of the Advanced Clean Fleets (ACF) regulation by the California Air Resources Board<sup>1</sup>, the San Diego region is expected to see more than 5,000 new MD-HD ZEVs added to its roadways in 2024. By 2040, more than 45 percent of the total Class 2b through 8 trucks operated in the region are expected to be zero emission. In the ZEV Needs Assessment Report<sup>2</sup>, the project team estimated that by 2040, there will be a need for almost 23,000 chargers with power levels ranging between 19 kW to 1,600 kW, providing a maximum of 3,800 MW of power (if all are plugged in at the same time) to the battery-electric MD-HD vehicles operating within the region. In addition, a total of 83 hydrogen fueling stations providing 65,650 kilograms of hydrogen per day will also be required to support the deployment of fuel-cell electric MD-HD vehicles in the region. The ambitious MD-HD ZEVs and infrastructure goals that the region needs to meet over the next two decades can present a range of pressing challenges for SANDAG and its regional partners. Building upon the comprehensive research and analysis conducted in the ZEV Needs Assessment and Siting and Technology Criteria Reports<sup>3</sup>, as well as extensive public outreach and stakeholder engagement, the project team has compiled a summary of existing barriers and concerns related to the deployment of MD-HD ZEV technologies in the region. These barriers encompass various aspects, including cost, infrastructure and fueling access, upstream energy demand, lack of regulatory support, technology readiness, and technology awareness (Figure 2).



**Figure 2. Regional barriers and concerns facing the deployment of MD-HD ZEV technologies and infrastructure.**

<sup>1</sup> California Air Resources Board, California approves groundbreaking regulation that accelerates the deployment of heavy-duty ZEVs to protect public health, <https://www.gov.ca.gov/2023/04/28/california-approves-worlds-first-regulation-to-phase-out-dirty-combustion-trucks-and-protect-public-health/>, April 2023

<sup>2</sup> Available online: <https://www.sandag.org/-/media/SANDAG/Documents/PDF/projects-and-programs/innovative-mobility/clean-transportation/regional-medium-duty-heavy-duty/md-hd-zev-needs-assessment-report-2023-01-01.pdf>

<sup>3</sup> Available online: <https://www.sandag.org/-/media/SANDAG/Documents/PDF/projects-and-programs/innovative-mobility/clean-transportation/regional-medium-duty-heavy-duty/md-hd-zev-draft-blueprint-2023-04-01.pdf>

This report contains a comprehensive list of strategies for SANDAG and its regional partners to consider. The project team explored and identified multiple near- and long-term strategies, such as programs, policies, and pilot projects, to facilitate transition of the regional MD-HD fleet to zero emission technology (Figure 3). To achieve the regional goals of transitioning MD-HD fleets to ZEV, SANDAG, in collaboration with regional stakeholders, shall continue to work towards addressing a series of pressing concerns, outlined as follows:

- Increasing public understanding and awareness of ZEV technology especially in low- and moderate-income communities;
- Mitigating the high upfront costs associated with purchasing vehicles and constructing ZE charging or fueling infrastructure;
- Establishing necessary partnerships to expand ZEV infrastructure across the region, prioritizing equitable distribution and accessibility
- Enhancing workforce development to ensure equitable opportunities and training for individuals in the ZEV industry; and
- Reinforcing existing regulatory measures at federal, state, and local levels

In addition to these near-term measures, SANDAG and its regional partners shall also consider long-term efforts that aim to:

- Enhance the market competitiveness of MD-HD zero emission technology while gradually transitioning away from government subsidies ensuring equal access and opportunities for all stakeholders and communities
- Support increasing infrastructure utilization and Return on Investment (ROI);
- Integrate ZEV market comprehensive career pathways into various educational levels to promote equitable workforce development and inclusivity;
- Decarbonize electricity generation and hydrogen production;
- Strengthen grid resiliency and reliability, prioritizing equitable distribution of energy resources and ensuring access for all communities; and
- Advocate for regional and binational planning and coordination.

These efforts are founded on a series of actionable, collaborative, and cross-cutting approaches that not only incorporate best practices for expediting the deployment of MD-HD ZEVs in the San Diego region but also address the workforce training and development requirements, as well as the economic considerations related to MD-HD fleets in the region. Considerations to advance equity and environmental justice through ZEV deployment have also been embedded into these actions.

**Figure 3. A summary of near- and long-term strategies for ZEV deployment in the San Diego region.**



In addition to policies and programs, projects for demonstrating technology (both ZEVs and ZE infrastructure) have been identified to help accelerate the next generation of ZE MD-HD vehicle technologies and infrastructure in the region, including:

- Innovative technology demonstrations;
- ZEV infrastructure business models;
- Port technology feasibility assessments;
- Zero emission border-crossing goods movement; and
- ZEV lanes.

Such pilot programs or use case applications will help SANDAG and its regional partners to test logistics, determine feasibility, build confidence, enhance market introduction, and bring down costs for technologies that are not yet fully commercialized or programs that are not ready for large-scale deployment.

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# IMPLEMENTATION STRATEGIES

## Regional Policy and Funding Support

Both the federal government and the California state government have set visions, goals, and policies to encourage ZEV technologies deployment by OEMs and infrastructure service providers and to ensure broader access and greater uptake of the emerging technologies among end users. However, much remains to be done by SANDAG and its regional partners to reinforce these regulatory measures and provide necessary support based on specific regional needs. This section presents six opportunities for SANDAG to facilitate the regional MD-HD fleet transition to ZEVs.

### Support for “make-ready” infrastructure programs

Electric vehicle “make-ready” infrastructure programs are often offered by public utilities and electricity providers to install all necessary electrical infrastructure that is needed to operate electric vehicle charging stations (EVCS), including electrical conduits and wires, as well as all necessary concrete work, at discounted rates. In the San Diego region, San Diego Gas & Electric (SDG&E) currently manages the Power Your Drive for Fleets program that aims to support a minimum of 3,000 MD-HD Class 2-8 vehicles at 300 customer sites throughout its service area, offering utility-provided or incentivized make-ready upgrades, plus rebate of up to 50 percent of charger costs in some disadvantaged communities.<sup>4</sup> In order to be eligible for the program, fleets must meet all four criteria as listed in Figure 4.



**Figure 4. Program eligibility for SDG&E Power Your Drive for Fleets.**

These criteria apply regardless of whether fleets operate in disadvantaged communities or are small business fleets. Expanding and enhancing electric vehicle “make-ready” infrastructure programs, such as the Power Your Drive for Fleets program is crucial for accelerating the adoption of MD-HD ZEV and providing the necessary infrastructure. By expanding the availability and accessibility of such programs, more fleets, including those in disadvantaged communities and small businesses, would be eligible for the benefits.

Utility make-ready programs also have the potential to enhance their capabilities in tracking and monitoring electricity usage for the purpose of claiming Low Carbon Fuel Standard (LCFS)

<sup>4</sup> SDG&E, Power Your Drive for Fleet, <https://www.sdge.com/business/electric-vehicles/power-your-drive-for-fleets>

credits. Since 2009, CARB has administered the LCFS program<sup>5</sup> to incentivizes low carbon fuels and to decrease transportation sector's carbon intensity by 20 percent through the 2030 timeframe. Because ZEV infrastructure delivers a low-carbon fuel to transportation vehicles, owners of chargers and hydrogen fueling stations are eligible to LCFS credits based on the amount of electricity or fuel dispensed, including those installed through the Power Your Drive for Fleets program.<sup>6</sup> A key requirement of the LCFS program is that the electricity and fuel dispensed must be monitored, recorded separately from non-fleet operations, such as buildings or other equipment, and reported accurately in order to generate credits. Given the complexity of the credits generation process, SANDAG and regional partners can provide guidance to fleets and infrastructure owners and operators who install chargers through the current make-ready programs to manage LCFS credits and to increase their revenue streams.

**Short-Term Strategy:** Leverage existing regional collaboratives such as the Accelerate to Zero (A2Z) Emissions Collaboration<sup>7</sup> to assist with determining the most effective strategies for managing the credits generated through CARB's LCFS program.

**Medium-Term Strategy:** In partnership with power providers, such as SDG&E, Community Choice Aggregators (CCA),<sup>8</sup> and hydrogen fuel suppliers, develop a plan to streamline approval processes and improve the LCFS program based on the needs and experiences of fleet operators.

**Long-Term Strategy:** As the State of California is expanding opportunities to charge MD-HD fleets<sup>9</sup> to meet evolving regional fleet demand, the partners can consider advocating for policies that bolster the existing make-ready program and provide additional funding by leveraging state funding to obtain private investment and successfully compete for federal discretionary grants.

**Key Partners and Audience:** Local utilities, Fleets, Disadvantaged Communities, California Energy Commission, California Public Utilities Commission, California Air Resources Board, San Diego County Air Pollution Control District, City and County Government.

### ***Consideration of over-the-road weight allowance due to increasing battery-electric vehicle weight***

A significant issue related to transitioning MD-HD fleets to ZEVs is the additional weight associated with battery-electric trucks (BETs). This is primarily due to the substantial weight of the batteries. Given that the weight of the batteries rises in line with the vehicle's range, this

<sup>5</sup> California Air Resources Board, Low Carbon Fuel Standard, <https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard>

<sup>6</sup> SDG&E, Earn Revenue for EVs with California's Low Carbon Fuel Standard (LCFS) Program, <https://www.sdge.com/sites/default/files/documents/SDGE.PYDFF%20-%20LCFS%20Fact%20Sheet.pdf>

<sup>7</sup> Accelerate to Zero Emissions Collaboration, <http://a2zsandiego.com/static/zero/>

<sup>8</sup> SDG&E, CCA Electricity Providers, <https://www.sdge.com/customer-choice/community-choice-aggregation>

<sup>9</sup> California Public Utilities Commission, CPUC Adopts Transportation Electrification Program To Help Accelerate Electric Vehicle Adoption, <https://www.cpuc.ca.gov/news-and-updates/all-news/cpuc-adopts-transportation-electrification-program-to-help-accelerate-electric-vehicle-adoption>, November 2022

can pose a serious challenge for fleets that engage in long-distance operations. With the current over-the-road weight limits, ZEV trucks may not be able to carry as much cargo resulting in either delivery delays or the need to put more trucks on the road. This can lead to an increase in operational costs, vehicles miles traveled (VMT), and tire-wear and break-wear particulate matter (PM) emissions. California currently grants 2,000 pounds weight exemptions for ZEVs<sup>10</sup>, but long-range (>350 miles) truck batteries can increase vehicle weight by up to 10,000 pounds.

While lifting over-the-road weight limits would likely increase roadway maintenance costs and could increase safety risks due to longer braking distance requirements for heavier vehicles, SANDAG should work with federal and state agencies and local jurisdictions to explore solutions. For instance, short-range and limited-term weight allowances along major freight corridors or on roadways close to warehouse clusters and the port area could serve as a potential interim solution to the problem until a long-term, sustainable resolution to this issue is found. For example, the California Department of Transportation (Caltrans) granted a temporary COVID-19 Special Permit for overweighted trucks to address the supply chain and port congestion issues raised during the pandemic.<sup>11</sup> Long-term solutions will depend on technological innovations, such as lighter batteries, enhanced vehicle design to decrease the weight of BETs, and the development of on-route fast charging capabilities. It will also be important to foster dialogue between fleets, OEMs, battery and charger manufacturers, and service providers within the region.

**Short-Term Strategy:** Study the potential for increasing weight limits for BET MD/HD vehicles on Zero Emission Freight Corridors (including first-last mile connections) in alignment with California's proposed Clean Freight Corridor Efficiency Assessment (anticipated to be released in December 2023), and then plan and implement necessary infrastructure improvements to support heavier trucks on these roadways.

**Medium-Term Strategy:** Study the potential for increasing weight limits for BET MD/HD vehicles on all truck routes.

**Long-Term Strategy:** Implement technology solutions that reduce the weights of BET MD/HD vehicles.

**Key Partners and Audience:** Fleets, Original Equipment Manufacturers, Battery Manufacturers, Charging Service Providers, California Department of Transportation, City and County Government, Port of San Diego.

### ***Support vehicle-grid integration and microgrid/grid resiliency opportunities***

To realize the full potential for electric vehicles (EVs) to reduce emissions and combat climate change, electricity decarbonization and grid resiliency must be considered by SANDAG and its regional partners while planning for EVs and infrastructure deployment within the region. Vehicle-grid integration (VGI) refers to technologies, policies, and strategies for EV charging

<sup>10</sup> Stats. 1984, Ch. 646, Sec. 4. California Business and Professions Code 12725

<sup>11</sup> California Department of Transportation, Caltrans Issues Special Permits Authorizing Overweight Trucks to Deliver Emergency COVID-19 Supplies, <https://dot.ca.gov/news-releases/news-release-2020-007#:~:text=These%20permits%20increase%20the%20maximum.%2D5>, April 2020

that alter the time, power level, or location of the charging or discharging in a manner that both benefits the grid and meets fleets' needs. Examples of VGI include managed charging (VIG) and bidirectional charging, such as vehicle-to-home (V2H) and vehicle-to-grid (V2G). In April 2022, the US Department of Energy (DOE) and partners announced the Vehicle-to-Everything (V2X) Memorandum of Understanding (MOU) that brings together cutting-edge resources from DOE, and local governments, utilities, and private entities to evaluate technical and economic feasibility as bidirectional charging is integrated into future energy infrastructure.<sup>12</sup> The MOU aims to facilitate advancements in Smart Charge Management, High Power Charging and Facilities, dynamic Wireless Charging, Codes and Standards, and Cyber Physical Security. As part of the MOU, SDG&E has already initiated a V2G project in collaboration with Cajon Valley Unions School District. However, further regional collaboration will be required to raise awareness about the technology, support V2X deployment, foster microgrid opportunities, and enhance overall grid resiliency.

**Short-Term Strategy:** Establish a VGI Working Group to identify regional needs.

**Medium-Term Strategy:** Develop a Regional VGI Strategic Plan.

**Long-Term Strategy:** Develop a Regional VGI Infrastructure Investment Plan.

**Key Partners and Audience:** Local utilities, Fleets, Communities, U.S. Department of Energy, California Energy Commission, California Public Utilities Commission, California Independent System Operator, City and County Government, Charging Service Providers.

### ***Support accessible, clean, and safe hydrogen production***

While the exact future balance between hydrogen and battery electric technology in the MD-HD vehicle sector remains uncertain, it is widely acknowledged that, similar to battery electric vehicles, hydrogen will play a vital role in decarbonizing this sector. However, to fully leverage the decarbonization potential, it is imperative that hydrogen is produced from clean and renewable sources.

Various methods of hydrogen production are currently available, including steam methane reforming (SMR), coal gasification, and electrolysis. The most commonly used method for generating hydrogen is SMR, which involves heating methane from natural gas with water steam to produce a mixture of carbon monoxide and hydrogen. However, SMR is a highly energy-intensive process that requires high temperatures and a significant amount of heat. Moreover, since natural gas is the feedstock for SMR, it can result in significant GHG emissions which is why hydrogen produced through SMR is often referred to as "grey" hydrogen. As the demand for hydrogen expands with the wider deployment of fuel cell electric vehicles (FCEV), it is crucial to encourage early discussions among various regional partners regarding clean hydrogen production. These conversations should prioritize accessible renewable and clean hydrogen generation options to ensure that the transition to hydrogen aligns with the

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<sup>12</sup> U. S. Department of Energy Office of Technology Transitions, Department of Energy Announces First of Its Kind Collaboration to Accelerate "Vehicle-to-Everything" Technologies, <https://www.energy.gov/technologytransitions/articles/department-energy-announces-first-its-kind-collaboration-accelerate>, April 2022



required reductions in GHG emissions. Clean hydrogen production can be achieved through either using carbon capture and storage (CCS) to trap and store carbon emitted from the SMR process (“blue” hydrogen) or water electrolysis. The production of hydrogen through electrolysis is considered “green” when it relies on electricity derived from renewable energy sources, such as solar or wind power. In this environmentally sustainable process, the use of renewable electricity ensures that the production of hydrogen is carbon free, contributing to a cleaner and more sustainable energy system. The partners should consider developing a strategic plan for the establishment and expansion of a regional hydrogen infrastructure network, as well as collaborating with private sector stakeholders, including OEMs, fuel cell manufacturers, and energy companies, to accelerate the deployment of hydrogen infrastructure and the development of clean hydrogen generation.

In addition, due to the flammable and explosive nature of hydrogen, safety protocols and measures need to be developed for fleets and service providers following hydrogen safety codes such as NFPA 2.<sup>13,14</sup> The Hydrogen and Fuel Cell Technology Office of DOE has also published protocols and guidelines for hydrogen handling.<sup>15</sup> Since hydrogen has a lower ignition energy than gasoline or natural gas, it can ignite more easily in the air. Therefore, proper ventilation and leak detection are necessary in the design of hydrogen systems. Unlike most other fuels, hydrogen burns with a nearly invisible flame, and thus special flame detectors will also be needed. In addition, some metals may become easier to crack due to hydrogen absorption. This phenomenon is known as hydrogen embrittlement and it occurs most notably in iron, nickel, titanium, cobalt, and their alloys (e.g., steels), which is certainly noteworthy when selecting materials to handle hydrogen systems. In addition to these established resources, regional partners should consider providing training for fleet operators, service providers, and other relevant stakeholders on these safety measures to ensure they are well-understood and followed.

**Short-Term Strategy:** Establish an FCET Working Group to identify regional needs.

**Medium-Term Strategy:** Develop a Regional FCET Strategic Plan.

**Long-Term Strategy:** Develop a Regional FCET Infrastructure Investment Plan.

**Key Partners and Audience:** Local utilities, Fleets, Communities, U.S. Department of Energy, California Energy Commission, California Public Utilities Commission, City and County Government, Fire Department, Refueling Service Providers, Hydrogen Industry, Natural Gas Industry.

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<sup>13</sup> National Fire Protection Association (NFPA), Hydrogen Technologies Code, <https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=2>

<sup>14</sup> Sandia National Laboratories, Report on General Hydrogen Safety, <https://www.osti.gov/servlets/purl/1870559>, May 2022

<sup>15</sup> U.S. Department of Energy, Hydrogen and Fuel Cell Technology Office, Safety, Codes and Standards, <https://www.energy.gov/eere/fuelcells/safety-codes-and-standards>



## **Advocate for consistent ZE policies across state and national borders**

The disparate regulations and policies to ZEV adoption across states and national borders not only cause confusions to OEMs and service providers, but also raises serious concerns for the cross-border trucking business operating in the San Diego region. The Otay Mesa Port of Entry (POE) is the busiest commercial border crossing in California, processing nearly one million commercial trucks each year,<sup>16</sup> which is critical to the export-oriented maquiladora factories located in Baja California. As more than 90 percent of the cross-border trucking business on the California-Mexico border is performed by Mexican-domiciled motor carriers<sup>17</sup>, binational coordination in ZEV and infrastructure access, as well as charger standardization will be crucial to ensure a successful MD-HD ZEV fleet transition in this region.



**Figure 5. A DC fast charger installed by SDG&E at Truck Net, north of the Otay Mesa Port of Entry in California. Photo: SDG&E**

In 2022, the Commission of the Californias (COMCAL) initiated the conversation between the States of California, Baja California, and Baja California Sur and discussed barriers and opportunities related to ZEV deployment.<sup>18</sup> SDG&E also launched its first public charging station at a border truck stop just north of the Otay Mesa POE (Figure 5).<sup>19</sup>

In addition, SANDAG will continue working with regional partners, such as the Port of San Diego and Caltrans to encourage the Federal Highway Administration (FHWA) to amend the U.S. Code Section 111, of Title 23 and 23 CFR 752.5 that currently prohibits sales of goods and services at rest areas located on the Interstate<sup>20</sup> to allow access to charging infrastructure and facilities along Federal-aid highways. Interstate highway rest areas are conveniently located along major freight corridors and provide critical amenities for truck drivers, such as restrooms, drinking fountains, and limited vending machine options. Charging infrastructure, which is mostly private and not free-of-charge, is considered a commercial activity and therefore currently prohibited.

**Short-Term Strategy:** Continue working with SANDAG's regional partners, such as the City and County of San Diego, the AB 617 International Border Community, and the A2Z

<sup>16</sup> U.S. General Services Administration, Otay Mesa Land Port of Entry, <https://www.gsa.gov/about-us/regions/region-9pacific-rim/land-ports-of-entry/otay-mesa-land-port-of-entry>

<sup>17</sup> SANDAG, 2021 Regional Plan, <https://www.sandag.org/regional-plan/2021-regional-plan>

<sup>18</sup> Institute of the Americas, Commission of the Californias meets to review California's electric vehicle regulatory mandate and cross-border impacts, <https://iamericas.org/commission-of-the-californias-meets-to-review-californias-electric-vehicle-regulatory-mandate-and-cross-border-impacts/>

<sup>19</sup> SDG&E, CA's First Public, DC Fast Chargers For Electric Medium and Heavy-Duty Vehicles at a Truck Stop Open for Public Use, <https://www.sdgenews.com/article/cas-first-public-dc-fast-chargers-electric-medium-and-heavy-duty-vehicles-truck-stop-open>

<sup>20</sup> Federal Highway Administration, Commercial Activities on Interstate Rest Areas, <https://www.federalregister.gov/documents/2016/09/27/2016-23269/commercial-activities-on-interstate-rest-areas>

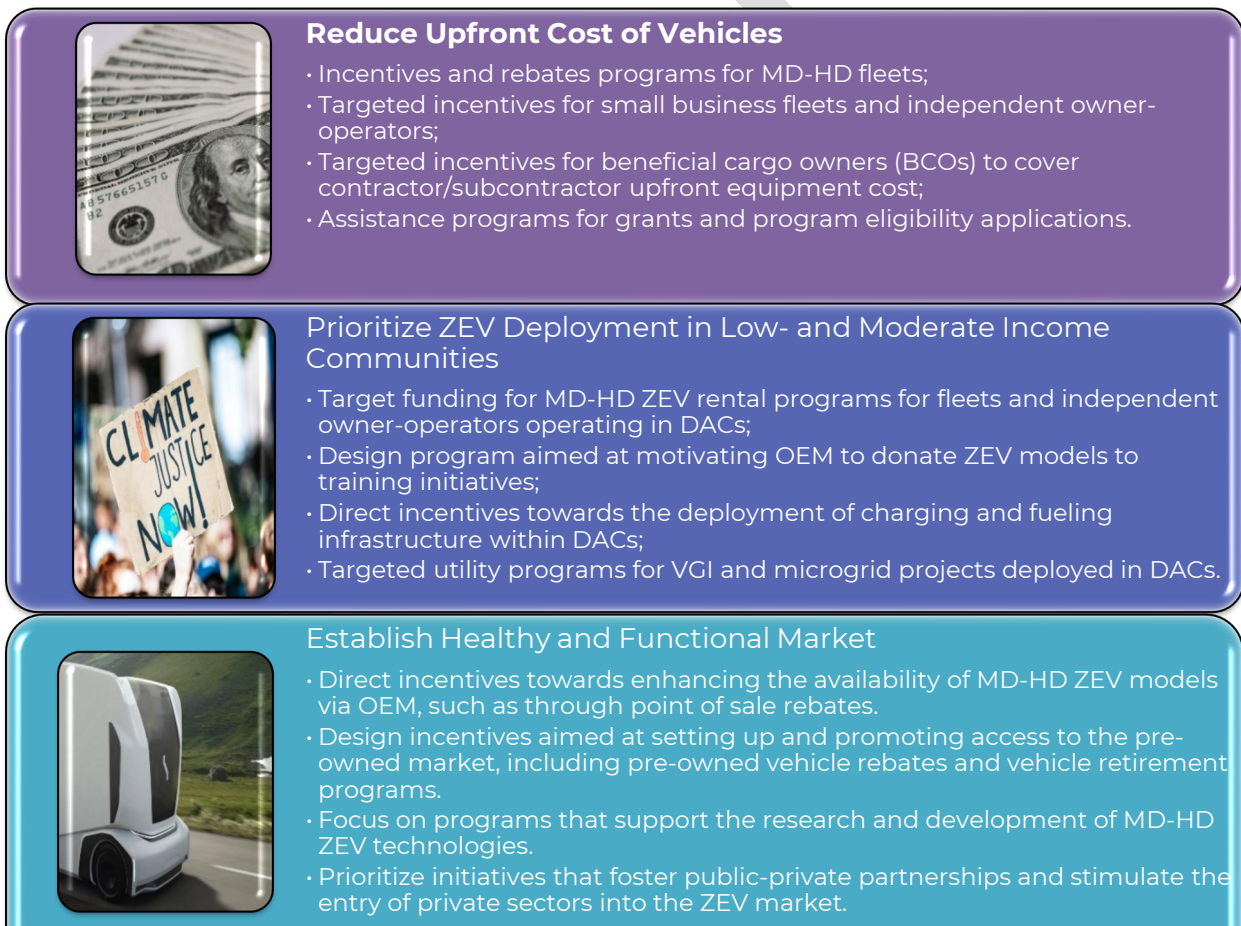
Collaborative to advocate for regional coordination and consistent ZE policies across state and national borders.

**Short-Term Strategy:** Continue working with Federal and state agencies to advocate for U.S. Code update that can assist MD-HD infrastructure deployment.

**Key Partners and Audience:** Binational Fleets, International Border Community, Federal and State Government, San Diego County Air Pollution Control District, City and County of San Diego, Commission of the Californias, Accelerate to Zero Emissions Collaborative.

### **Development of targeted incentives programs**

One of the most pivotal roles that SANDAG plays in regional policy support is to apply for and manage state and federal funding and grants that encourage regional ZEV technologies deployment. In the ZEV Needs Assessment report, the project team examined the currently available incentives and funding programs at federal, state, and local levels and identified their limitations. The near-term focus of these regional incentives and funding programs will aim to bring down the upfront costs of MD-HD ZEV equipment, including both vehicle and



**Figure 6. Target incentive programs identified by SANDAG and its regional partners to facilitate MD-HD ZEV deployment.**

infrastructure and to prioritize ZEV deployment in Disadvantaged Communities (DACs), such as the AB 617 Portside Community and the International Border Community. To meet state mandates, public agencies will need to consider approaches to expand ZEV sales, reduce market entry barriers, and bolster a sustainable ZEV and infrastructure market while gradually phasing out subsidies.

**Short-Term Strategy:** In partnership with member and partner agencies, identify a series of complementary targeted incentives that aim to reduce ZEV deployment costs and prioritize equity in the program design, outreach, and implementation processes (Figure 6). Base incentive selection on both regional needs for ZEV technology adoption and goals and targets of local jurisdictions established in their Climate Action Plans (CAP), EV Roadmaps, and/or other relevant programs/projects.

**Long-Term Strategy:** Coordinate with member and partner agencies to incorporate regional climate goals and targets into local CAPs and ZEV implementation strategies and to establish a sustainable local ZEV market.

**Key Partners and Audience:** Local utilities, Fleets, Communities, Original Equipment Manufacturers, Charging and Fueling Service Providers, Trucking Industry, Federal and State Government, Local Jurisdictions.

## **Siting, Land Use, Zoning, and Permitting**

In the Infrastructure Siting and Technology Criteria report, the project team investigated the best practices in determining the appropriate siting criteria for charging and fueling infrastructure to support the transition to MD-HD ZEVs. Determining factors included regional MD-HD travel patterns, grid interconnection and capacity, land use, environmental conditions, and equity. While ZEV infrastructure requires significant planning, capital outlays, and permitting, SANDAG and its regional partners can provide assistance by identifying subsidies and assisting with development approvals. They can also help fleet owners make informed decisions about vehicle types to purchase based on characteristics, such as costs, duty-cycles, access to charging/fueling infrastructure, and payload capacity.

### ***Leverage existing resources for public infrastructure planning***

Planning for public MD-HD ZEV infrastructure deployment requires methodical assessments to maximize site utilization and ROI, and thus it is crucial to consider the proximity to major truck routes and places where MD-HD ZEVs would likely stop to refuel (Figure 7).<sup>21</sup>

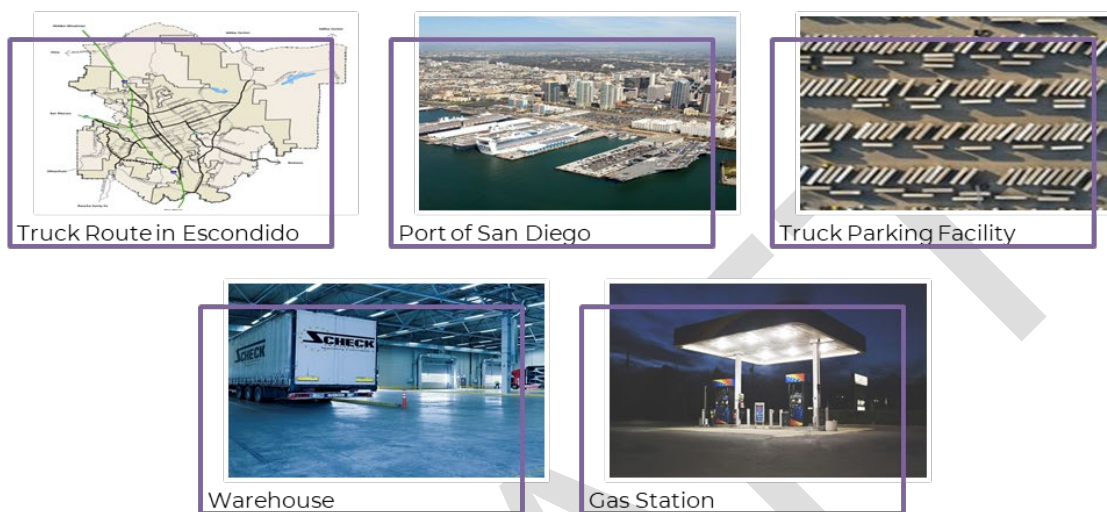
**Short-Term Strategy:** Leverage SANDAG's expertise in regional planning and data analysis, such as its comprehensive modeling of MD-HD travel patterns and Geographic Information System (GIS) land use data to explore grid capacity in areas where charging infrastructure is

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<sup>21</sup> City of Escondido, Escondido General Plan: Truck Routes  
<https://www.escondido.org/Data/Sites/1/media/PDFs/trafficengineering/3-TruckRoutesMap.pdf>

anticipated to be needed. Provide this information in SANDAG's robust GIS portal for use by private industry for siting ZE infrastructure.<sup>22</sup>

**Medium-Term Strategy:** Coordinate with the trucking and freight industries to gather relevant information and develop best approaches to disseminate these resources to the public, including SANDAG's GIS portal.



**Figure 7. Information from the trucking industry that will be crucial to determine infrastructure sites, including truck route, the Port of San Diego, truck parking facilities, warehouse and other freight facilities, and gas stations.**

**Key Partners and Audience:** Fleets, Communities, Telematics Service Providers, Trucking Industry, Gas Stations, Charging Service Providers, Federal Highway Administration, California Department of Transportation, Port of San Diego, City and County Government, San Diego Geographic Information Source

### **Identifying Grid and Hydrogen Availability and Enhancing Grid Capacity in Advance**

While the actual infrastructure deployment requires incremental steps, which can take years to phase in, work on improving the grid should begin immediately to support ZEVs, as well as the phasing out of natural gas in residential development. A one-time, early grid upgrade that involves trenching and installation of conduits and wires in a single effort presents a significant cost-saving opportunity for fleets and site owners. In conjunction with this process, SANDAG can collaborate with regional partners to assess the practicality and effectiveness of enabling fleets and sites to develop additional electric and fueling capacity beyond their immediate requirements. This approach will facilitate future infrastructure sharing and leasing.

**Short-Term Strategy:** Be a resource for connecting hydrogen fuel equipment manufacturers and infrastructure providers to MD-HD fleet owners and site owners/operators who want to develop fleet- and/or site-specific long-term infrastructure deployment plans, evaluate local

<sup>22</sup> San Diego Open GIS Data Portal, <https://sdgis-sandag.opendata.arcgis.com/>

energy demand, identify energy availability<sup>23</sup>, and facilitate the capacity grid updates with local utilities when necessary.

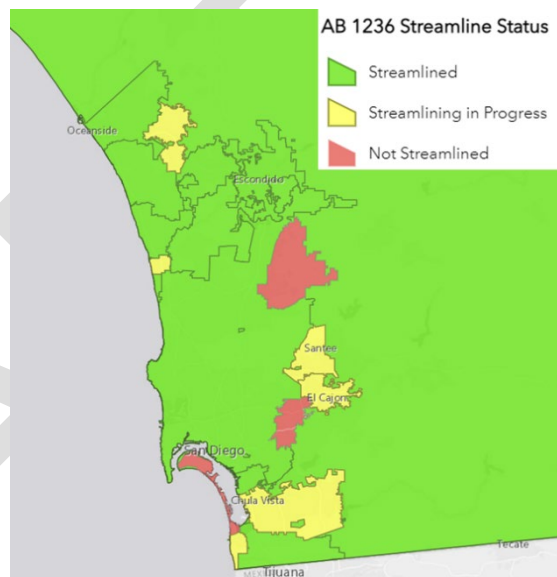
**Long-Term Strategy:** Evaluate potentials for infrastructure sharing and leasing.

**Key Partners and Audience:** Local utilities, Fleets, Communities, Charging and Fueling Service Providers, Trucking Industry, California Energy Commission, California Public Utilities Commission, City and County Government.

### **Streamline permitting and energizing**

AB 1236 (Chiu, 2015), codified in Government Code Section 65850.7, California's permit streamlining law, requires all jurisdictions to enact and implement a streamlined permitting process for charging station applications, including stations serving MD-HD ZEVs.<sup>24</sup> The “EVCS Permit Streamlining Map” shows the current status of permit streamlining across the SANDAG region (Figure 8). Most of the local jurisdictions in the region have already streamlined the permitting process by meeting all the criteria below:

- Streamlining ordinance for expedited EVCS permit process;
- Permitting checklists online chargers;
- Administrative approval of EVCS;
- Approval limited to Health & Safety review;
- Electronic signatures accepted;
- EVCS not subject to association approval; and
- One Complete Deficiency Notice if application is incomplete.



**Figure 8. EVCS Permit Streamlining Map for SANDAG. Accessed May 2023.**

In addition to permitting, local jurisdictions can also amend and update local zoning ordinances and building codes to accelerate infrastructure buildout. For example, the City of San Diego has released a Municipal Energy Implementation Plan and an accompanying policy, the Zero Emissions Municipal Buildings & Operations Policy (ZEMBOP) as an early CAP implementation step, which provides details on current energy performance of City facilities, along with planned and proposed energy projects (e.g. code updates) and their associated impacts on energy performance and the established zero emissions targets.<sup>25</sup> SANDAG will continue to coordinate with local public agencies for similar efforts to better assist the deployment of ZEV infrastructure.

<sup>23</sup> SDG&E, Integration Capacity Analysis (ICA), <https://www.sdge.com/more-information/customer-generation/enhanced-integration-capacity-analysis-ica>

<sup>24</sup> Plug-in Electric Vehicle Charging Station Readiness, <https://business.ca.gov/industries/zero-emission-vehicles/plug-in-readiness/>

<sup>25</sup> City of San Diego, Municipal Energy Strategy and Implementation Plan, <https://www.sandiego.gov/mes>



The concerns of the lead time between a fleet or site submitting an application with their utility to energize chargers to when the chargers receive power have also been addressed through the implementation of AB 841 (Ting, 2020) by the California Public Utilities Commission (CPUC). CPUC issued Resolution E-5247 in December 2022, which establishes an interim 125-business day average service energization timeline for projects taking service under the EV Infrastructure Rules.<sup>26</sup> The Resolution excludes projects that must go through Rule 15 for distribution upgrades, projects above two megawatts, and projects that require upgrades to a substation. SANDAG may coordinate with CPUC and local utilities to further expand the current scope of the Resolution and to shorten the energization process for projects that require distribution line extensions and substation upgrades.

**Short-Term Strategy:** Coordinate with local jurisdictions to streamline the process for MD-HD ZEV infrastructure deployment, including but not limited to zoning, building codes, land use, permitting, and energizing.

**Key Partners and Audience:** California Energy Commission, California Public Utilities Commission, City and County Government.

## **Promote Public-Private Partnership (P3) Models**

Leveraging Public-Private Partnerships (P3) models has been proven to be an effective way to expand ZEV infrastructure deployment by bringing together the resources and expertise of both the public and private sectors. Effective P3 models can provide funding, speed up deployment, expand the network, diversify the business model, and ensure long-term sustainability of the infrastructure service market. This can be done by leveraging public funding and private sector expertise, aligning interests, and combining commercial and regulatory aspects of the project. In addition to the traditional Build-Operate-Transfer, or Design-Build-Finance-Operate-Maintain models, the project team believes emerging P3 examples such as Charging-as-a-Service (CaaS) may also be suitable for SANDAG and its regional partners to deploy MD-HD infrastructure. In addition to public agencies, private fleets and businesses may also consider services like CaaS or Truck-as-a-Service (TaaS) to reduce upfront equipment costs and assimilate new technologies in the initial phase.

### ***Streamline and improve public procurement processes***

Request for Proposals (RFPs) are typically used in the establishment of Public-Private Partnerships (P3) to ensure a fair and transparent selection process. RFPs allow SANDAG to clearly outline their project requirements, objectives, and expectations, and invite private sector entities to submit detailed proposals that demonstrate their qualifications, capabilities, and innovative solutions.

A regular RFP process can take months before any decision can be made and is often subject to budget limitations. One approach is to establish a bench or pool of pre-qualified private

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<sup>26</sup> California Public Utilities Commission, Distribution Infrastructure and Planning, <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/transportation-electrification/distribution-infrastructure-and-planning>

sector partners with whom SANDAG can collaborate on grant applications and infrastructure projects (similar to California Multiple Award Schedules<sup>27</sup>). By proactively forming partnerships with a diverse range of private sector entities, SANDAG can streamline the procurement process and have ready-to-go teams that can quickly respond to funding opportunities. Having a bench of private sector partners would allow SANDAG to leverage its expertise, resources, and established relationships, enabling faster project implementation. When grant opportunities arise, SANDAG could promptly assemble a team from the bench, utilizing the collective capabilities of these partners to submit competitive proposals within shorter timeframes. In addition, SANDAG could also consider using a combination of requests for information (RFI) to better define the scope of infrastructure projects.<sup>28</sup>

**Short-Term Strategy:** Explore and identify, in coordination with other public agencies like Caltrans and the Port of San Diego, new partnership models and contract types to improve the current public procurement process.

**Medium-Term Strategy:** Partner with other public agencies within the region to identify sites for charging and hydrogen fueling infrastructure.

**Key Partners and Audience: State Government, City and County Government.**

### ***Explore new charging business models***

By fostering stakeholder engagement and collaboration, SANDAG could bring together key industry players, utilities, charging infrastructure providers, and fleet operators to collectively explore and develop innovative charging business models. This collaborative approach allows for the exchange of knowledge, expertise, and best practices, driving the development of effective and sustainable charging solutions. Exploring new charging business models is crucial for advancing the adoption of zero emission MD-HD vehicles and expanding charging infrastructure. These business models often introduce innovative approaches to charging services, promote sustainability, and enhance the user experience. While specific charging business models may vary, here are a few examples:

- **Shared Charging Networks:** Shared charging networks enable multiple charging station owners to collaborate and share access to their infrastructure. This model can be beneficial in expanding charging coverage and reducing costs for both station owners and users. SANDAG could encourage the development of shared charging networks by fostering collaboration among charging infrastructure providers, public agencies, and private entities, facilitating the sharing of infrastructure and promoting interoperability.
- **Charging with Reservations System:** The charging with reservation business model offers enhanced convenience, optimized charging operations, reduced congestion and conflicts, predictable charging costs, and efficient resource allocation. Users can reserve

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<sup>27</sup> California Department of General Services, California Multiple Award Schedules, <https://www.dgs.ca.gov/PD/About/Page-Content/PD-Branch-Intro-Accordion-List/Acquisitions/California-Multiple-Award-Schedules>

<sup>28</sup> Port of Long Beach, Public Truck Charging Request for Information Summary, <https://polb.com/environment/our-zero-emissions-future/#program-details>

specific time slots for charging their electric vehicles in advance, eliminating uncertainties and waiting times while allowing for efficient scheduling and utilization. This model promotes a smoother and more organized charging experience, empowering fleet operators and individual users to plan their charging logistics effectively. Local jurisdictions may need to explore integrate the requirement for reservation systems into the permitting and approval processes for new or existing public EV charging stations. Applicants seeking permits or approvals for charging infrastructure would need to demonstrate their compliance with the reservation system mandate as part of the application process.

**Short-Term Strategy:** Develop innovative business models with private partners to assist infrastructure buildout.

**Key Partners and Audience: Local Utilities, Fleets, Sites and Depot Owners, Charging Service Providers, City and County Government**

### ***Streamline revenue sharing***

Streamlining revenue sharing in the EV charging industry is the process of efficiently distributing charging fees among stakeholders to incentivize investment and foster a sustainable charging ecosystem. Achieving streamlined revenue sharing requires collaboration among various entities. Local governments could establish clear policies and regulations that define revenue sharing guidelines, ensuring transparency and fairness in the charging market. SANDAG, as a regional planning agency, could facilitate stakeholder engagement, provide guidance, and promote best practices for revenue sharing models. Utilities in San Diego could play a role by collaborating with charging infrastructure providers and exploring innovative mechanisms for revenue sharing, considering factors such as grid integration and management costs. SANDAG may also need to explore best approaches to leverage LCFS credits for both public and private sectors. This could involve determining how the credits generated from the adoption of zero emission infrastructure can be leveraged to incentivize and support the charging infrastructure needed for the widespread deployment of MD-HD ZEVs.

**Short-Term Strategy:** Coordinate with local jurisdictions to develop revenue sharing guidelines.

**Long-Term Strategy:** Develop approaches to ensure high infrastructure utilization rates and to boost ROI for P3 models, such as deploying networked infrastructure for easy management and status monitoring, minimizing charger malfunction with routine and rapid-response maintenance, etc.

**Key Partners and Audience: Local Utilities, Sites and Depots Owners, Charging Service Providers, City and County Government.**



## **Public outreach and community engagement**

Communities and the public must be empowered to fully access the opportunities and benefits stemming from MD-HD ZEV deployment throughout the region. The project team has identified several outreach and engagement strategies that play a crucial role in identifying, understanding, and addressing concerns and barriers related to regional ZEV deployment.

### ***Showcase proof of concept and ZEV model demonstration***

Enhancing technology awareness and fostering consumer confidence in emerging MD-HD ZEV technologies is of utmost importance. To achieve this, SANDAG could collaborate with its regional partners to showcase the availability, costs (including capital, operational, and maintenance expenses), and benefits (such as lowered emissions, improved air quality, reduced climate impact, noise reduction, and enhanced road performance) associated with different MD-HD BET and FCET models. Especially, given the existing uncertainties surrounding hydrogen-powered vehicles in the MD-HD space, it becomes crucial to establish proof of concept. Demonstrating the feasibility, safety, and cost-effectiveness of FCET models through collaborative efforts between SANDAG and regional partners can help alleviate concerns and build confidence among stakeholders.

**Short-Term Strategy:** Develop a Technology Advancement Program (TAP) to identify, fund, and assess BET and FCET technologies through demonstrations that help fleet operators, technology developers, funding agencies, and local communities make informed decisions about MD-HD ZEV investments.

**Key Partners and Audience: Fleets, Communities, Original Equipment Manufacturers, Department of Motor Vehicles, Local Jurisdictions, Non-Profits.**

### ***Raise awareness of current regulations and incentive programs***

Informing the public about regulations and incentive programs related to MD-HD ZEV adoption is important as it encourages adoption, ensures compliance, provides financial support, optimizes resource allocation, and fosters collaboration. By raising awareness, stakeholders can make informed decisions, accelerate BET and FCET adoption, and contribute to a cleaner and more sustainable transportation system. SANDAG and its regional partners could collaborate with state and local governments to develop educational campaigns and outreach initiatives to disseminate information about the regulatory landscape and available incentives.

**Short-Term Strategy:** Organize workshops, webinars, and informational sessions to engage stakeholders and provide technical assistance for grant and funding applications. Leverage communication channels, such as websites, social media platforms, and newsletters, to regularly update the public about any changes or new opportunities in regulations and incentives.

**Short-Term Strategy:** Establish a technical assistance program to provide training and resources for grant and funding applications.

**Key Partners and Audience:** Local Utilities, Fleets, Communities, California Air Resources Board, California Energy Commission, California Public Utilities Commission, Local Jurisdictions, Non-Profits.

**Facilitate bidirectional communications**

SANDAG could foster meaningful dialogues between community members, residents, and businesses to comprehensively address their concerns regarding the impacts of new infrastructure and ZEV technology adoption on various aspects like the grid, land use, and traffic patterns within their communities. By providing a platform for open discussions, SANDAG could actively engage with stakeholders to understand their perspectives and gather valuable feedback. Moreover, SANDAG, in collaboration with regional jurisdictions, could establish channels for addressing common concerns raised by communities and owner-operators. These concerns may include issues related to green gentrification, ZEV range, battery lifetime, and replacement costs, among others. To ensure inclusivity, resources and information should be disseminated in multiple languages, prioritizing accessibility, and understanding for all stakeholders.

**Short-Term Strategy:** Establish a platform for public education and open discussions.

**Long-Term Strategy:** Address community needs and concerns in future regional planning efforts.

**Key Partners and Audience:** Fleets, Communities, State Government, Local Jurisdictions, Non-Profits.

**Workforce development**

With the transition to ZEVs, the skills and knowledge required by workers in the freight and trucking industry will significantly differ from those needed in traditional diesel fleets. SANDAG, in collaboration with regional partners, should closely collaborate to ensure that training opportunities and effective workforce recruitment strategies occur in tandem with ZEV deployment. This entails identifying the specific skills and competencies required for the evolving industry and coordinating with educational institutions, training centers,



**Figure 9. San Diego-Imperial Counties Region Electric Vehicle Sector Strategy.**

and industry stakeholders to develop comprehensive training programs.

### ***Develop workforce training programs for the emerging technologies***

To ensure a functional freight industry after transition to ZEV, SANDAG should coordinate with various education and training programs to identify resources and educational supplies needed to create the MD-HD industry workforce. The San Diego and Imperial Counties Community College Regional Consortium has already examined the currently available EV training opportunities offered by local community colleges and identified additional courses necessary to prepare the automotive service technicians and mechanics workforce for large-scale EV deployment (Figure 9).<sup>29</sup> In addition to EV technicians, the region also needs to consider training opportunities for first responders, dealerships, charger and fueling infrastructure operation and maintenance crews, truck drivers, fleet logistics staff, electricians, etc. Training programs in DACs to address community needs should be prioritized in this process.

**Short-Term Strategy:** Collaborate with OEMs and community colleges to develop training programs for EV workforce, and targeted programs for DACs.

**Short-Term Strategy:** Establish partnerships with OEMs to encourage donation of ZEV models to training programs.

**Key Partners and Audience:** Local Utilities, Fleets, Communities, Original Equipment Manufacturers, Dealerships, California Energy Commission, California Workforce Development Board, Governor's Office of Planning and Research, City and County Government, Vocational Rehabilitation Programs, Non-Profits, High School Districts, Community College Consortium.

### ***Integrate ZEV-comprehensive career pathways into educational system***

In order to enhance the sustainable development of the ZEV industry and foster technological innovations, ongoing efforts are necessary by SANDAG and its regional partners to seamlessly integrate comprehensive ZEV career pathways into the educational system. This integration involves creating a continuum of educational opportunities that span from kindergarten to higher education, nurturing interests and skills relevant to ZEV-related careers. By implementing curriculum and programs that progressively build toward occupations in ZEV scientific research, design, and development, such as planners, engineers, and material scientists, students at all educational levels can be equipped with the knowledge and expertise required for successful careers in the ZEV industry.

**Long-Term Strategy:** Collaborate with regional partners to integrate comprehensive ZEV career pathways into the educational system.

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<sup>29</sup> San Diego and Imperial Counties Community Colleges Regional Consortium, San Diego-Imperial Counties Region Electric Vehicle Sector Strategy, <https://myworkforceconnection.org/wp-content/uploads/2022/09/San-Diego-CC-EV-Strategy-9.9.23.pdf>

## Lead by example

In addition to the extensive regional collaborations with state, county, and city government, SANDAG will also consider integrating regional MD-HD ZEV deployment goals and targets into future planning efforts<sup>30</sup> and providing assistance to local jurisdictions to set and update ZEV adoption targets through EV Roadmap<sup>31</sup> or CAPs<sup>32</sup> (Figure 10), building out infrastructure on public lands, and converting its own fleets to zero emission on expedited timelines. Converting public fleets can create an



**Figure 10. Examples of local planning efforts to accelerate ZEV adoption (County and City of San Diego).**

early market for emerging technology providers, demonstrate the effectiveness of new technologies, and showcase business case and revenue sharing opportunities. SANDAG and its regional partners can proactively convert their own public fleets to zero emission vehicles, demonstrating their commitment to sustainability and showcasing the practicality and effectiveness of new technologies. Ultimately, they can also share lessons learned from their own fleet transitions with the public, providing valuable insights and fostering a greater understanding of the benefits and challenges associated with adopting zero emission vehicles.

**Short-Term Strategy:** Adopt ZEV targets through EV Roadmap, CAPs, and Regional Plan.

**Short-Term Strategy:** Develop ZEV transition plan for public fleets.

**Mid-Term Strategy:** Convert public fleets to zero emission and share lessons learned.

**Mid-Term Strategy:** Build accessible infrastructure on public lands.

**Long-Term Strategy:** Collaborate with the San Diego Air Pollution Control District, the Port of San Diego, and other local jurisdictions to monitor the impact of ZEV deployment on local air quality.

<sup>30</sup> SANDAG, Regional Plan, <https://www.sandag.org/regional-plan>

<sup>31</sup> County of San Diego, Electric Vehicle Roadmap, <https://www.sandiegocounty.gov/content/dam/sdc/sustainability/EV-Roadmap/EV-Roadmap-October-2019.pdf>

<sup>32</sup> City of San Diego, 2022 Climate Action Plan, <https://www.sandiego.gov/sustainability/climate-action-plan>

# PILOT PROGRAM AND USE CASE APPLICATION RECOMMENDATIONS

Pilot programs are short-term use case applications that can help to demonstrate feasibility of new technologies and determine best approaches to ensure successful large-scale implementation. The project team has identified five different pilot programs that could facilitate the transition of MD-HD fleets to ZEV. They create unique opportunities for SANDAG and its regional partners to test logistics and spot any potential deficiencies when deploying MD-HD ZEV technologies. The listed programs mainly target technologies that are not ready for market entry and programs that face challenges for full implementation (Table 1).

**Table 1. List of recommended pilot programs for regional MD-HD ZEV deployment.**

| Program Category                        | Detailed Proposed Projects  |
|---|---|
| Innovative technology demonstrations    | Charging depot using renewable grid or photovoltaic (PV) technologies with energy storage |
|   | Ultra-fast charging techniques  |
|   | V2X demonstration   |
|   | Wireless and dynamic charging application   |
|   | Onsite hydrogen production  |
| ZEV infrastructure business models      | Depot charging facilities with equipment and/or vehicle lease options                     |
|   | Multi-use charging site/MD-HD charging plaza  |
|   | Valet EV charging program   |
|   | Universal payment method for infrastructure usage   |
| Port technology feasibility assessments | Short-haul BET/FCET application   |
| Border-crossing goods movement          | Binational fleets ZEVs application  |
|   | Wireless charging for border-crossing BETs during wait time                               |
|   | Toll discounts for ZEVs at POEs   |
|   | Dedicated lane for ZEVs at POEs   |
| ZEV Lanes                               | Exemptions or dedicated lane for ZEVs   |
|   | Toll discounts for ZEVs on highways   |

## SUMMARY AND CONCLUSION

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Building upon the comprehensive research and analysis conducted in the ZEV Needs Assessment and Siting and Technology Criteria Reports, as well as extensive public outreach and stakeholder engagement, this report presents a comprehensive compilation of near- and long-term strategies, programs, and policies to accelerate the transition of the region's MD-HD fleet to zero emission technology. These opportunities include regional policy and funding support to promote the deployment of MD-HD ZEV technologies, siting, land use, zoning, and permitting considerations; the promotion of P3 models; public outreach and community engagement; and workforce development. Additionally, SANDAG and its regional partners are encouraged to integrate regional ZEV deployment goals into future planning efforts, provide assistance to local jurisdictions, convert their own fleets to zero-emission vehicles, and share insights and lessons learned to foster a better understanding of ZEV adoption.

Additionally, the report provides recommendations for potential pilot programs that can be implemented in the San Diego region. These programs aim to accelerate the development and adoption of the next generation of zero emission MD-HD vehicle technologies that are not yet fully commercialized.

Following the completion of the SANDAG Near- and Long-Term Implementation Strategies Report, the project team will move forward with developing a clean, concise, and user-friendly MD-HD ZEV Blueprint summarizing the research and analysis conducted in previous tasks on policy landscape around MD-HD ZEVs, market readiness, infrastructure needs, technology and infrastructure gaps, and criteria for technology and infrastructure siting. The document will also include a summary of the process for public outreach and stakeholder engagement, including feedback from stakeholders. In developing the Blueprint, the project team will also summarize the strategies for SANDAG and its regional partners to implement in order to overcome the barriers in deployment of MD-HD ZEVs and to meet the regional goals.