CALIFORNIA ENERGY COMMISSION

CALIFORNIA NATURAL RESOURCES AGENCY

California Energy Commission

Clean Transportation Program

FINAL PROJECT REPORT

San Diego Regional Medium- and Heavy-Duty Zero Emission Vehicle Blueprint Final Report

Prepared for: California Energy Commission

Prepared by: San Diego Association of Governments

SANDAG

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PREFACE

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

The Clean Transportation Program has an annual budget of about $100 million and provides financial support for projects that:

- Reduce California's dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies.
- Produce sustainable alternative and renewable low-carbon fuels in California.
- Expand alternative fueling infrastructure and fueling stations.
- Improve the efficiency, performance, and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- Expand the alternative fueling infrastructure available to existing fleets, public transit, and transportation corridors.
- Establish workforce training programs and conduct public outreach on the benefits of alternative transportation fuels and vehicle technologies.

To be eligible for funding under the Clean Transportation Program, a project must be consistent with the CEC's annual Clean Transportation Program Investment Plan Update. The CEC issued GFO-20-601 to fund projects to guide the transition of medium- and heavy-duty freight and transit vehicles to zero-emission technology while addressing challenges related to technology readiness, infrastructure availability, and cost. In response to GFO-20-601, the recipient submitted an application that proposed funding in the CEC's notice of proposed awards (April 8, 2021), and the agreement was executed as ARV-21-028 on August 11, 2021.

ABSTRACT

Transportation is the leading cause of greenhouse gas emissions in the San Diego region, with trucks and buses disproportionately contributing to local air pollution. This project will lead to many anticipated benefits, including reducing air pollution and emissions and improving the quality of life for those living in communities adjacent to freight and transit. Additionally, it will help meet state goals for transitioning medium- and heavy-duty trucks and buses to zero-emission vehicles (ZEV). This document serves as the Final Report by the San Diego Association of Governments (SANDAG) pursuant to its Agreement ARV-21-028 with the California Energy Commission under solicitation GFO-20-601 for "Blueprints for Medium- and Heavy Duty Zero Emission Vehicle Infrastructure."

The project consists of three primary reports that inform the final *San Diego Regional Medium-Duty and Heavy-Duty Zero Emission Vehicle Blueprint*: *MD/HD ZEV Needs Assessment Report, MD/HD ZEV Technology and Siting Criteria, and a Near- and Long-Term Implementation Strategies*. An accompanying outreach and engagement plan was created for the project to ensure that the team provided regular updates and presentations on project deliverables to key stakeholders and community members.

The blueprint project provided SANDAG and its regional partners with a deeper understanding of the region's existing and future medium- and heavy-duty ZEV landscape and established qualitative and quantitative goals and objectives to accelerate the transition to medium- and heavy-duty ZEV trucks and buses. Through outreach and research, the team identified near- and long-term pilot projects, programs, and policy actions that SANDAG and regional stakeholders can take to address barriers to adoption and equity concerns. The blueprint will serve as an important guide for the San Diego Region as it takes the next steps in transitioning to ZEV trucks and buses.

Keywords: California Energy Commission, San Diego Association of Governments, San Diego, Regional Medium- and Heavy-Duty Zero Emission Vehicle Blueprint, Blueprint, Zero Emission Vehicle, ZEV.

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EXECUTIVE SUMMARY

The state of California is requiring the transition to zero-emission vehicles (ZEV) to mitigate greenhouse gas (GHG) emissions and air pollution from medium- and heavy-duty vehicles. With funding provided by the California Energy Commission, the San Diego Association of Governments (SANDAG) developed the Regional Medium- and Heavy-Duty Zero Emission Vehicle Blueprint (Blueprint) to provide the region with strategies for accelerating the transition of medium- and heavy-duty trucks and buses to ZEVs while addressing technology readiness, infrastructure availability and needs, and cost. The Blueprint provides background on relevant policies and offers projections concerning the number of medium- and heavy-duty ZEVs anticipated to be in the region and the corresponding infrastructure necessary to support them. Regarding siting charging and fueling infrastructure, the project provides a siting criterion that analyzes key factors to consider when selecting an optimal site that prioritizes equity. Additionally, the Blueprint identifies near- and long-term implementation strategies designed to advance the adoption of medium- and heavy-duty ZEVs with an emphasis on reducing air pollution and GHG emissions in low-income and disadvantaged communities.

Through the work conducted via the Blueprint project, it was clear that there are many major barriers to medium- and heavy-duty ZEV adoption, including cost, infrastructure access, grid readiness, and technology readiness. To address these barriers, the Blueprint offers a comprehensive list of six categories with strategies and actions for SANDAG and regional partners. These guidelines have been carefully formulated in collaboration with stakeholders to provide actionable insights and strategic direction. The strategies look to help SANDAG and its collaborators navigate challenges more adeptly, ensuring a cohesive and efficient approach towards regional ZEV infrastructure and development goals. As the region progresses towards more widespread adoption of medium- and heavy-duty ZEVs and supporting infrastructure, SANDAG seeks to monitor and evaluate existing and future projects and programs.

CHAPTER 1:
Project Purpose and Approach

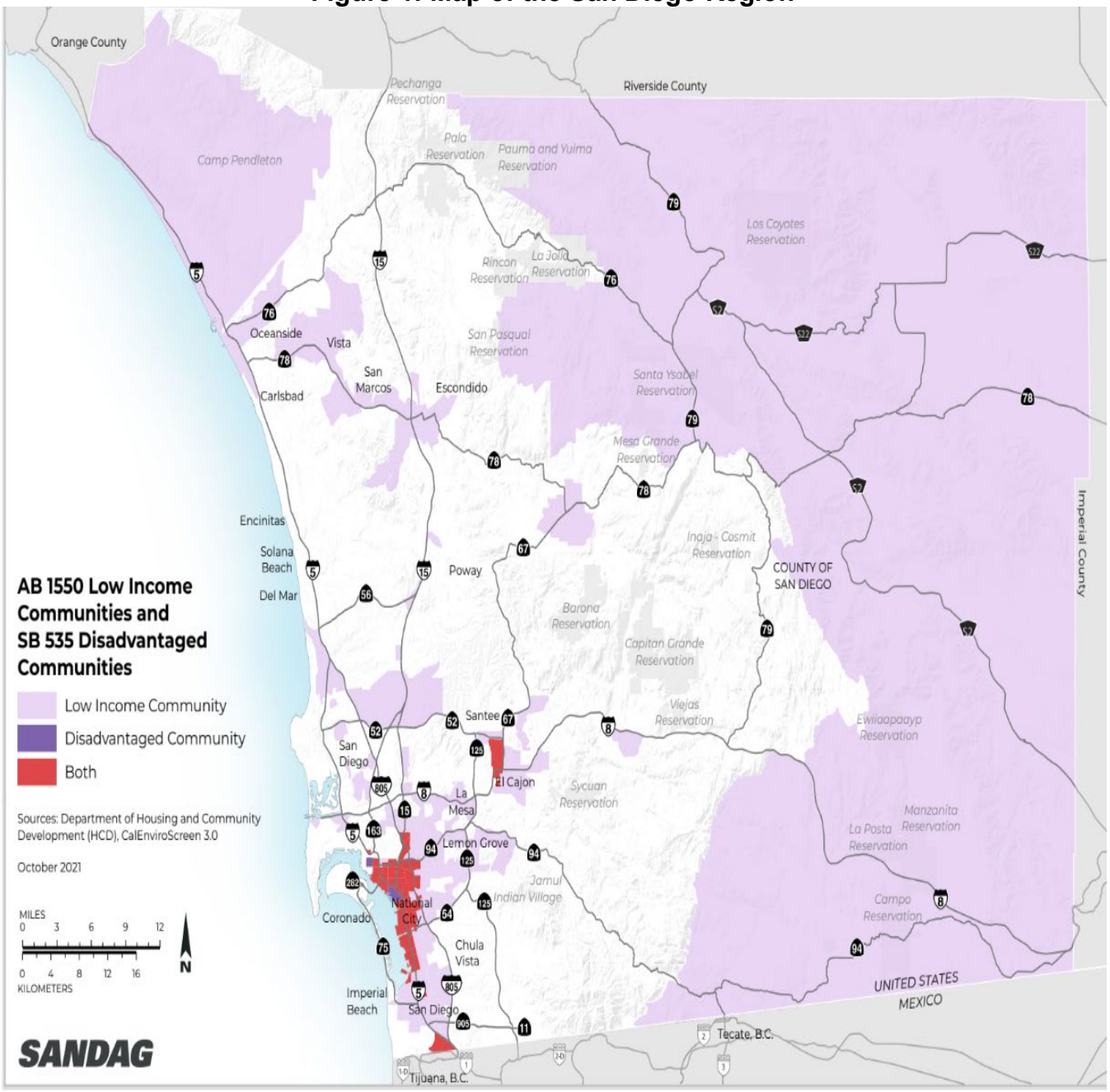
Purpose of the San Diego Regional Medium- and Heavy-Duty Zero-Emission Vehicle Blueprint

With transportation being the main contributor to GHG emissions and air pollution in the San Diego region, there is a need for a shift to ZEVs. No county-wide plan that enables the transition to ZEV for the freight and transit sectors. The San Diego region has two transit agencies that have prepared zero-emission bus rollout plans to implement the Innovative Clean Transit Rule; the San Diego Unified Port District (Port) and San Diego County Air Pollution Control District are leading development of a Community Emissions Reduction Plan for the portside communities impacted most by diesel freight vehicles (Assembly Bill [AB] 617 program); Caltrans and SANDAG are working with federal and binational agencies on a new border crossing with Mexico to support greater goods movement; and the local utility, San Diego Gas & Electric (SDG&E) is supporting individual fleets in the medium- and heavy-duty (MD-HD) vehicles space through their Power Your Drive for Fleets program. Upon receiving CEC funding for the Blueprint project, SANDAG proposed synthesizing these localized planning and program efforts to develop a regional blueprint for MD-HD electrification.

The overall goal of this project was to develop a Blueprint that will guide the transition of goods movement and transit fleets to ZEVs in the San Diego region and prioritize reducing air pollution and GHG emissions in low-income and disadvantaged communities (Figure 1). SANDAG partnered with the Port of San Diego to leverage the Port's existing ZEV planning efforts and outreach experience. The project team also partnered with the Environmental Health Coalition to engage with community members in the region who are disproportionately affected by MD-HD vehicles. To gather input and hear from additional regional partners, a Freight Stakeholders Taskforce (Taskforce) was convened at the start of the project to provide guidance and input on the development of the Blueprint and MD-HD ZEV adoption.

First, an evaluation of the regional MD-HD ZEV landscape was developed to understand the effort needed for the transition. A regional MD-HD ZEV *Needs Assessment Report* was completed to expand on previous ZEV planning efforts and analyze existing and planned MD-HD fleets and infrastructure. The project team then analyzed innovative technologies and provided suggested siting criteria for optimal locations for infrastructure deployment throughout the region. With input from the Taskforce, SANDAG Working Groups, and community members, key barriers to adoption were identified. Lastly, a *Near- and Long-Term Implementation Strategies* report was developed that suggests key actions, monitoring and evaluation methods, and potential pilot projects that can address the barriers and accelerate the transition of regional MD-HD fleets. All reports and findings are summarized in the Blueprint.

Figure 1: Map of the San Diego Region



Credit: SANDAG

Objectives of the Project:

The objectives of this Agreement are to:

- Identify barriers to MD-HD ZEV adoption.
- Analyze existing and planned ZEV fleets and routes.
- Create a MD-HD ZEV Working Group to provide regional stakeholder input on the Blueprint.

- Explore available and emerging innovative technologies.
- Develop siting criteria to identify locations where charging can be installed to facilitate transit and goods movement and maximize MD-HD ZEV adoption.
- Identify quantitative and qualitative ZEV infrastructure goals.
- Identify near- and long-term actions that will accelerate the transition of regional MD-HD fleets.
- Enable workforce development for ZEVs and infrastructure.
- Reduce air pollution and GHG emissions in communities of concern.
- Educate the public through an education and outreach campaign and publish fact sheets summarizing the expected and achieved benefits of a Blueprint and resources for use by regional stakeholders.
- Develop a user-friendly Blueprint that outlines a roadmap for the San Diego region to achieve MD-HD ZEV goals.

CHAPTER 2:
Project Activities Performed and Results

Project Tasks

Task 1: Administration

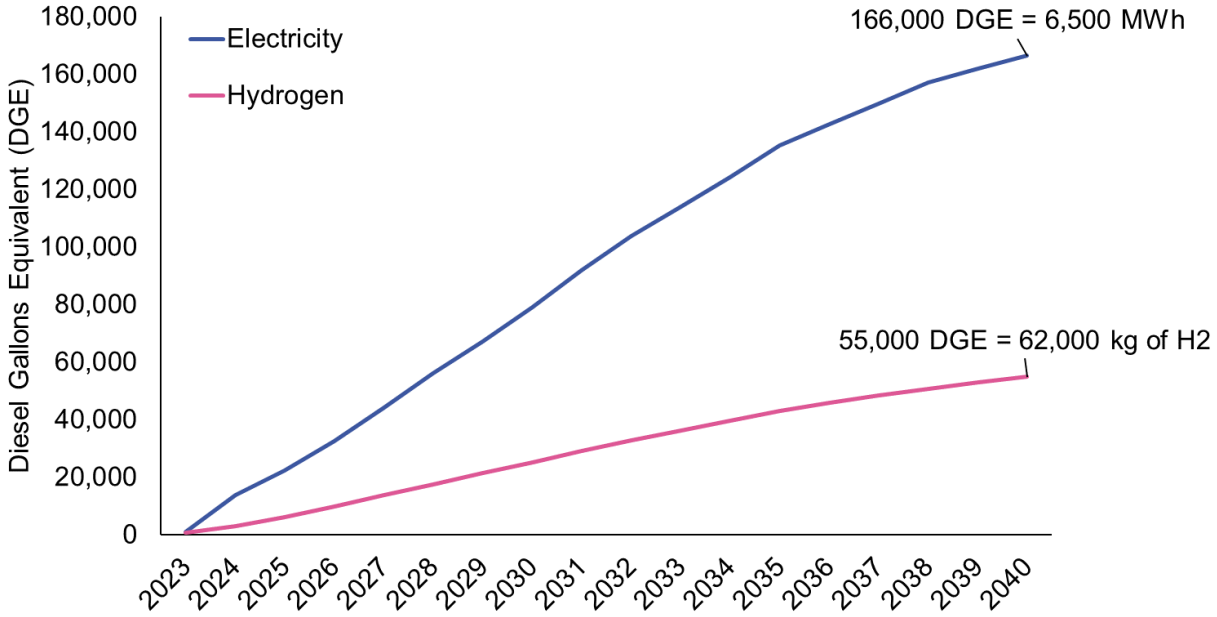
The goal of this task was to manage and oversee all administrative subtasks for the contract, including contract administration, budget and invoice tracking, consultant management, and reporting.

Task 2: MD-HD ZEV Needs Assessment Report

The goal of this task was to review previous ZEV planning efforts, the existing ZEV landscape, and the future landscape of the San Diego region. Through this task, SANDAG and the consultant documented existing conditions and identified barriers and gaps in policy, technology, and infrastructure. The *Needs Assessment Report* provides a comprehensive overview of the regulatory, incentive, technological, and economic aspects of zero-emission medium and heavy-duty vehicles, along with the needed charging and fueling infrastructure to power these vehicles. The report results showed that by 2040, the region will need approximately 23,000 chargers, providing a maximum of 3,800 megawatt (MW) of power to the approximately 64,500 battery-electric MD-HD vehicles (Class 2b – 8) operating within the region. Additionally, the region will likely need to be served by 83 hydrogen fueling stations with a total daily hydrogen capacity of more than 65,000 kilograms per day to serve approximately 5,800 fuel cell electric vehicles (FCEV). These findings were developed by tiering off state targets, and infrastructure targets were modeled by CEC and Lawrence Berkley National Lab's Medium and Heavy-Duty Electric Vehicle Infrastructure – Load Operations and Deployment Modeling Tool (HEVI-LOAD).

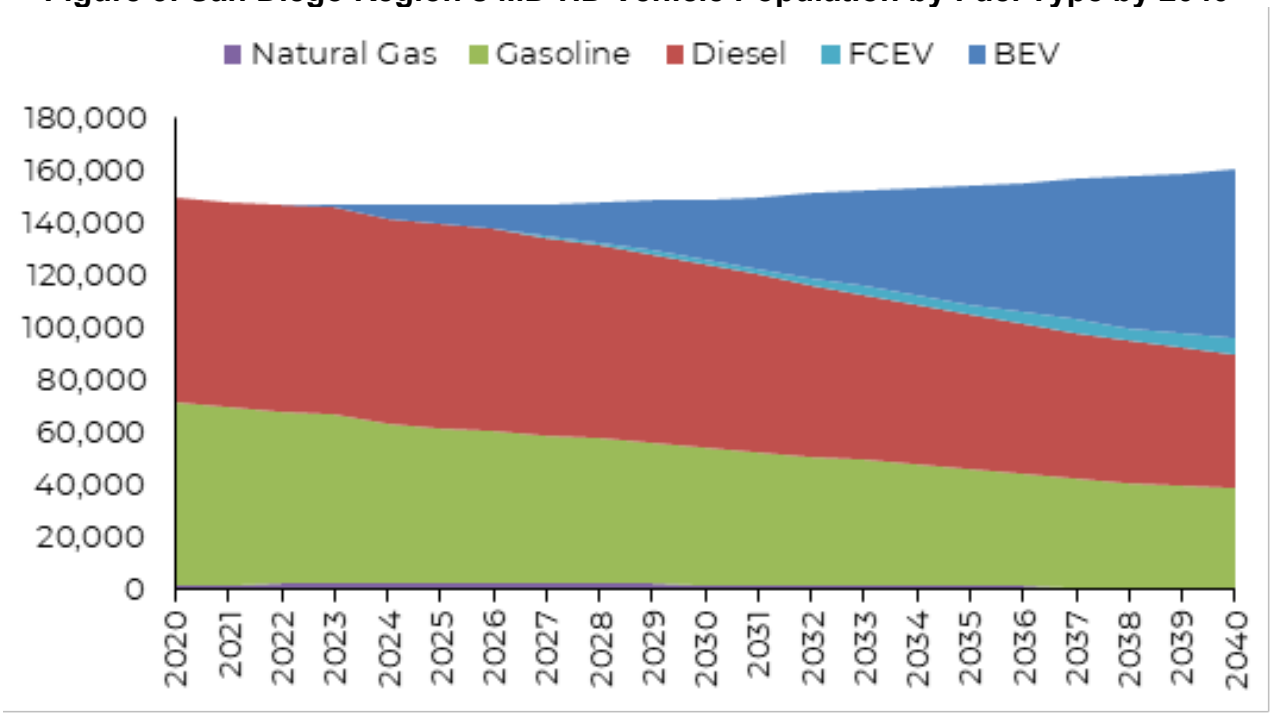
The *Needs Assessment Report* is available at https://www.sandag.org/-/media/SANDAG/Documents/PDF/projects-and-programs/innovative-mobility/clean-transportation/regional-medium-duty-heavy-duty/final-blueprint-needs-assessment-report.pdf on the SANDAG website.

Figure 2: Projected San Diego Region's MD-HD Electricity & Hydrogen Fuel Consumption



Credit: SANDAG

Figure 3: San Diego Region's MD-HD Vehicle Population by Fuel Type by 2040



Credit: SANDAG

Task 3: MD-HD ZEV Working Group

The goal of this task was to collaborate with regional stakeholders to identify best practices, trends, and barriers to ZEV adoption to help inform the development of the Blueprint. The project team held monthly project development team meetings and quarterly meetings with the SANDAG Taskforce to provide updates on the status of the Blueprint and solicit feedback on project progress and deliverables. Additionally, SANDAG presented project updates to the SANDAG Mobility Working Group, Social Equity Working Group, and Transportation Committee throughout the project and gathered feedback on draft deliverables. SANDAG staff also presented Blueprint updates to the AB 617 Portside Community and International Border Community Steering Committees for input.

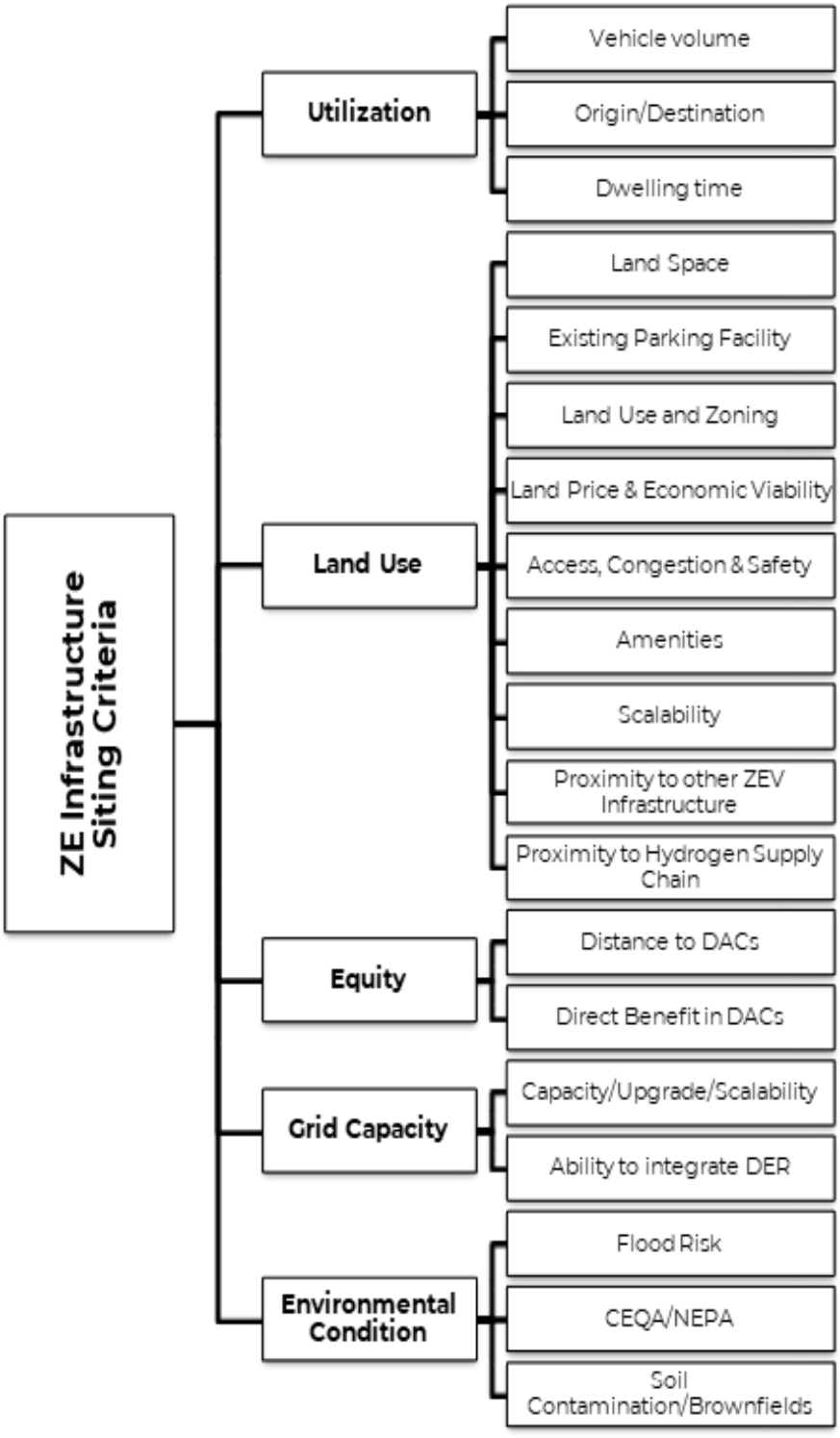
Task 4: MD-HD ZEV Technology & Siting Criteria

The goal of this task was to analyze the existing and planned MD-HD ZEV fleets, routes, and energy/fueling requirements (identified in Task 2) and identify technologies and siting criteria that support best use cases for MD-HD charging and fueling applications throughout the region. The report is divided into two parts: a siting criterion for charging and hydrogen fueling infrastructure and vehicle technology recommendations for fleets. The first part of the report provides details on the siting criteria recommendations for charging and hydrogen fueling infrastructure, highlighting the key criteria that regional planners and infrastructure developers should consider. The five broad criteria groups include utilization, land, equity, grid capacity, and environmental conditions (Figure 4). Each criterion offers sub-categories to review and consider for a location. The report does not identify specific site locations in the region but provides a complete and structured approach for stakeholders to use when selecting a site.

The *MD/HD ZEV Technology and Siting Criteria* *document is available at* https://www.sandag.org/-/media/SANDAG/Documents/PDF/projects-and-programs/innovative-mobility/clean-transportation/regional-medium-duty-heavy-duty/final-blueprint-zev-technology-and-siting-criteria.pdf on the SANDAG website.

The second part of the report provides criteria for fleet owners/operators to consider before investing in new MD-HD ZEVs. The vehicle technology criteria include range, payload capacity, cost of ownership, charging acceptance rate, charging/fueling frequency, power-take-off, and access to charging and fueling infrastructure.

Figure 4. MD-HD ZEV Infrastructure Siting Criteria



Credit: SANDAG

Task 5: Near- and Long-Term Implementation Strategies

The goal of this task was to combine the findings from Tasks 2, 3 and 4 to identify near- and long-term implementation strategies, best practices, and actionable recommendations. The *Near- and Long-Term Implementation Strategies* 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 public-private partnership (P3) models; public outreach and community engagement; and workforce development. The report expands on how SANDAG and regional partners can collaborate to integrate regional ZEV deployment goals into future planning efforts, help 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 and projects that can be implemented and monitored in the San Diego region.

The *Near and Long Term Implementation Strategies* report is available at https://www.sandag.org/-/media/SANDAG/Documents/PDF/projects-and-programs/innovative-mobility/clean-transportation/regional-medium-duty-heavy-duty/final-blueprint-implementation-strategies-report.pdf on the SANDAG website.

Task 6: Project Fact Sheet and Outreach

The goal of this task was to formalize an outreach plan and develop fact sheets that describe the project, highlight benefits, and provide resources to regional stakeholders. Within this task, an outreach and education plan were developed to educate the public and share information and resources with regional stakeholders. This task also included an initial project fact sheet outreach, a final project fact sheet, and a resources fact sheet that provides funding and training resources for property owners and public agencies.

The project *Fact Sheet* is available at https://www.sandag.org/-/media/SANDAG/Documents/PDF/projects-and-programs/innovative-mobility/clean-transportation/regional-medium-duty-heavy-duty/final-blueprint-factsheet.pdf on the SANDAG website.

Task 7: MD-HD ZEV Blueprint

The goal of this task was to summarize the work completed in Tasks 2 through 6 and compile the information in a regional Blueprint. The Blueprint establishes regional ZEV goals and objectives, identifies and recommends avenues to overcome adoption barriers, and identifies implementation strategies and innovative actions and approaches to pursue in the region to enable greater use of ZEV freight and transit vehicles.

The *Regional Medium-Duty & Heavy-Duty ZEV Blueprint* is available at (https://www.sandag.org/projects-and-programs/innovative-mobility/clean-transportation/regional-medium-duty-and-heavy-duty-ZEV-blueprint) on the SANDAG website.

CHAPTER 3:
Project Successes and Observations

Measuring Success of the Project

Overall Project Goal: Develop a guide to aid the transition of goods movement and transit fleets to ZEVs in the San Diego Region.

Objective 1: Identify barriers to MD-HD ZEV Adoption

Barriers were identified in Task 5, *Near- and Long-Term Implementation Strategies* report. Feedback was collected through stakeholder meetings with SANDAG's Freight Stakeholder Task Force, Mobility Working Group, Social Equity Working Group, and Transportation Committee. The main barriers included cost, infrastructure and fueling access, energy demand, regulatory support, technology readiness, and technology awareness.

Objective 2: Analyze existing and planned ZEV fleets and routes

Existing and planned ZEV fleets and routes were analyzed and addressed in Task 2, *Needs Assessment Report*, and Task 4, *MD/HD ZEV Technology and Siting Criteria* report.

Objective 3: Create a MD-HD ZEV Working Group to provide regional stakeholder input on the Blueprint

Under Task 3, the Taskforce was convened to provide guidance and input on developing the Regional Blueprint and provided quarterly presentation updates and deliverables by SANDAG. Objective 4: Explore available and emerging innovative technologies

Existing and emerging ZEV technologies are explored in Task 2, *Needs Assessment Report*. The Blueprint report summarizes the findings of the *Needs Assessment Report* and offers a breakdown of model availability across different vehicle categories and high-level costing. Additionally, the *MD/HD ZEV Technology and Siting Criteria* report (Task 4) includes a detailed overview of vehicle technologies and recommended criteria for owners and operators to use when selecting the best MD-HD vehicle model(s) for their fleets.

Objective 5: Develop siting criteria for planners and developers to look to when identifying charging and fueling locations

SANDAG, with input from stakeholders and industry members, developed a *MD/HD ZEV Technology and Siting Criteria* report (Task 4). The report identifies five groups of criteria to be considered by planning practitioners and project developers for regional charging and fueling infrastructure. These groups include utilization, land, equity, grid capacity, and environmental conditions. The report breaks down each group and provides additional considerations for each criterion.

Objective 6: Identify quantitative and qualitative ZEV infrastructure goals

The *Needs Assessment Report* under Task 2 provides quantitative estimations of the future of ZEVs and ZEV infrastructure in the region and qualitative goals.

Objective 7: Identify near- and long-term actions that will accelerate the transition of regional MD-HD fleets

Building upon the research and analysis conducted in Tasks 2 and 4, along with the feedback from the Taskforce, working groups, and community groups, the *Near- and Long-Term Implementation Strategies* report (Task 5) presents a comprehensive list of strategies and actions to accelerate the transition to MD-HD ZEVs in the San Diego region. 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 public-private partnership models; public outreach and community engagement; and workforce development. Suggestions for monitoring metrics and potential pilot projects and programs are provided.

Objective 8: Enable workforce development for ZEVs and infrastructure

Task 5, *Near- and Long-Term Implementation Strategies* report, identifies actions SANDAG and regional partners can take to advance workforce development for ZEVs and associated infrastructure. SANDAG seeks to collaborate with local jurisdictions, education systems, and original equipment manufacturers (OEMs) to develop and support training programs for the EV workforce.

Objective 9: Reduce air pollution and GHG emissions in communities of concern

The *Needs Assessment Report* (Task 2) addresses air pollution and GHG emissions policy and includes estimations for potential emissions reductions due to transitioning trucks and buses to ZEVs for the region. Additionally, the *Near- and Long-Term Implementation Strategies* report (Task 5) provides actions that SANDAG and regional partners can take to overcome adoption barriers and begin implementation efforts to reduce air pollution and emissions. These strategies include actions that can be taken to prioritize adoption in communities of concern.

Objective 10: Educate the public through an education and outreach campaign and publish fact sheets summarizing the expected and achieved benefits of the Blueprint

Through Task 6, SANDAG developed a project outreach and education plan detailing the project team's methods to inform stakeholders of project findings and deliverables and gather input. SANDAG also published multiple fact sheets under Task 6. An initial fact sheet that summarized the goal of the Blueprint and overall objectives was shared with stakeholders. A final fact sheet was created and includes project findings and recommended actions the region can take to accelerate MD-HD ZEV adoption. Lastly, an owner/operator resource guide was developed that provides information on funding and training opportunities.

Objective 11: Develop a user-friendly Blueprint that outlines a roadmap for the San Diego region to achieve MD-HD ZEV goals

Under Task 7, SANDAG developed a Blueprint report summarizing the previous project tasks and providing a framework for the San Diego region to follow to achieve and accelerate MD-HD ZEV goals.

Observations

The key observations to come out of the Blueprint process include the following:

Community Feedback and Stakeholder Outreach Methods

The feedback and input gathered from the project development team, community outreach events, and numerous SANDAG taskforce meetings and working groups were incredibly valuable to understanding the barriers to adoption. It was important to create an agenda for meetings and provide questions for each group to spark meaningful discussion. Additionally, the project team used surveying tools and virtual comment/mural boards to identify the priorities of different stakeholders. These were used to draft initial concept ideas for the siting criteria and the near- and long-term implementation strategies.

A Regional Approach

Since this was a Blueprint for the entire San Diego region and not a specific jurisdiction, it was key to create a document that would serve a wide range of stakeholders. As the region's metropolitan transportation planning organization, SANDAG does not have jurisdiction over any land. The Siting Criteria report that was developed as a part of the Blueprint was created to be a useful tool for local agencies and developers to reference and build off when selecting ZEV charging and/or fueling sites. This approach was taken to make the most out of funding resources. The siting criteria were well-received by stakeholders and regional partners, especially those ready to begin developing sites or conducting feasibility studies for siting locations in the region.

Prioritize and Educate the Community on ZEV Technologies and Deployment

Input gathered at community meetings indicated that community members - especially those in disadvantaged communities that are directly impacted by the freight industry - are interested in learning more about ZEV technologies and resulting benefits. Providing resources and knowledge on emerging vehicles and infrastructure, specifically for FCEVs, is an effective way to connect and build trust with residents and community-based organizations (CBO). It is recommended that CBOs be involved from the start of the project and solicit feedback from members, as they are highly knowledgeable about local issues and concerns. For this project, SANDAG partnered with the Environmental Health Coalition and co-presented to local AB 617 community steering committee meetings for the portside and border communities.

CHAPTER 4:
Project Conclusion & Next Steps

Completing the Blueprint was identified as a near-term action in the SANDAG 2021 Regional Plan, and this project has been key to providing SANDAG with a better understanding of adoption barriers and how the region can come together to streamline the transition to zero-emission trucks and buses. Based on outreach and feedback with project stakeholders, it was clear cost is the biggest barrier to local fleet owners and operators. The Blueprint recognizes that the financial burden associated with transitioning fleets will be high. Therefore, it is essential that public agencies and industry members work together to offer funding options for MD-HD ZEVs. Public-private partnerships will also be key to developing the necessary infrastructure to support the influx of ZEVs in the region. As SANDAG develops the 2025 Regional Plan, strategies identified in the Blueprint will be leveraged to inform future SANDAG programs, policies, and projects.

With ZEV projects gaining more traction in the region and state, it is important to highlight new projects and share successes to foster support for future projects and programs. SANDAG will continue to track MD-HD ZEV projects and developments and local planning efforts that promote the transition to ZEVs. This includes partnering with local agencies such as the Port of San Diego and supporting their Maritime Clean Air Strategy that provides a transition plan for trucks and fleets by 2030. Regarding the ZEV transition at the California-Baja California international border, SANDAG recently published a ZEV freight transition whitepaper that focuses on identifying opportunities to facilitate the transition at the border region and includes infrastructure improvements, reducing wait times, expanding upon incentives, pilot projects, hydrogen considerations, and workforce training.

The ZEV freight transition whitepaper, *ZEV Freight Transition at the California-Baja California Border,* is available at https://www.sdapcd.org/content/dam/sdapcd/documents/capp/meetings/int--border/04-19-23/Zero%20Emission%20Freight%20Transition%20at%20the%20California0410.pdf on the SANDAG website. SANDAG will share lessons learned from the Blueprint project and any subsequent projects with those working on the transition at the border.

Through outreach and engagement with stakeholders and community members, it was evident that equity and safety concerns associated with ZEVs and infrastructure should be carefully considered throughout all project phases. This should include planned outreach on new and emerging technologies and the sharing of funding opportunities and training programs with local fleet owners and operators. Additionally, it's important to educate community members and provide clear and easy-to-understand resources on advancements in ZEV technology. Overall, community groups voice their support for accelerated ZEV adoption and implementation actions that will help to improve air quality and the overall health of residents.

Next Steps

In addition to what's above, the Blueprint identifies key near-term actions that SANDAG and local stakeholders can take to implement the report's findings.

Seek Funding to Implement the Blueprint

An essential next step will be to identify and seek funding to accelerate the region's transition to zero-emission trucks and buses based on the Blueprint findings and technical documents, especially to address truck traffic in border and portside communities that are most impacted by diesel truck use.

Share Lessons Learned

Projects in the MD-HD ZEV landscape demonstrating early success and long-term promise should be highlighted and publicized. It is important to be a resource for others to learn from and build off. Sharing achievements helps to illustrate the practical viability and long-lasting environmental benefits of MD-HD ZEVs and encourages continued investment and adoption in the sector.

Support battery-electric vehicle (BEV)/FCEV Demonstrations in the Region

The Blueprint serves as a roadmap for the region with valuable planning and implementation tools. These can be utilized by local agencies that are looking to be early adopters and have set ambitious but necessary targets for MD-HD truck and bus electrification. SANDAG and regional stakeholders can support and enhance these efforts by partnering where feasible and promoting upcoming programs or projects.

Recommend Pilot Projects for the Region

Pilot projects and programs are going to be instrumental in the adoption of MD-HD ZEVs. They offer a controlled environment to trial and adopt new technologies and provide necessary data that helps stakeholders and investors better recognize vehicle and technology performance. The following programs and projects were recommended in the Blueprint:

Table 1: List of Recommended Pilot Programs for Regional MD-HD ZEV Deployment

Program Category	**Proposed Projects**
Innovative technology demonstrations	Charging depot using renewable grid or photovoltaic (PV) technologies with energy storage
Innovative technology demonstrations	Ultra-fast charging techniques
Innovative technology demonstrations	"Vehicle-to-Everything" (V2X) demonstrations
Innovative technology demonstrations	Wireless and dynamic charging application
Innovative technology demonstrations	Clean, renewable hydrogen production sites

Program Category	Proposed Projects
ZEV infrastructure business models	Depot charging facilities with equipment and/or vehicle lease options
ZEV infrastructure business models	MD-HD charging plaza
ZEV infrastructure business models	Charging reservation programs for MD-HD vehicles
ZEV infrastructure business models	Universal payment method for infrastructure usage
Port technology feasibility assessments	Short-haul BEV/FCEV application
Border-crossing goods movement	ZEVs application for fleets operating across U.S./Mexico border
Border-crossing goods movement	Wireless charging for border-crossing battery electric trucks during wait time
Border-crossing goods movement	Toll discounts for MD-HD ZEVs at Port of Entry (POE)
Border-crossing goods movement	Dedicated lane for MD-HD ZEVs at POEs
ZEV Lanes	Exemptions or dedicated lanes for MD-HD ZEVs
ZEV Lanes	Toll discounts for MD-HD ZEVs on highways

Credit: SANDAG

GLOSSARY

BATTERY ELECTRIC VEHICLE (BEV) – Also known as an "All-electric" vehicle (AEV), BEVs utilize energy stored in rechargeable battery packs. BEVs sustain their power through the batteries and, therefore, must be plugged into an external electricity source to recharge.

CALIFORNIA DEPARTMENT OF TRANSPORTATION (Caltrans) – Responsible for the design, construction, maintenance, and operation of the California State Highway System, as well as that portion of the Interstate Highway System within the state's boundaries.

CALIFORNIA ENERGY COMMISSION (CEC) – The state agency established by the Warren Alquist State Energy Resources Conservation and Development Act in 1974 (Public Resources Code, Sections 25000 et seq.) is responsible for energy policy. The Energy Commission's five major areas of responsibility are:

1. Forecasting future statewide energy needs.
2. Licensing power plants sufficient to meet those needs.
3. Promoting energy conservation and efficiency measures.
4. Developing renewable and alternative energy resources, including providing assistance to develop clean transportation fuels.
5. Planning for and directing state response to energy emergencies.

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

FUEL CELL ELECTRIC VEHICLE (FCEV) – A zero-emission vehicle that runs on compressed hydrogen fed into a fuel cell "stack" that produces electricity to power the vehicle.

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

MEDIUM-DUTY (MD) – Vehicles with a GVWR between 10,001 – 26,000 pounds. Includes weight classes 3, 4, 5, and 6.[1]

HEAVY-DUTY (HD) – Vehicles with a GVWR greater than 26,000 pounds. Includes weight classes 7 and 8. [2]

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1 The Medium-Duty definition source, https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics-collection/medium#:~:text=Medium%2DDuty%3A%20Vehicles%20with%20a,GVWR%20greater%20than%2026%2C000%20pounds.

2 The Heavy-Duty definition source, https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics-collection/medium#:~:text=Medium%2DDuty%3A%20Vehicles%20with%20a,GVWR%20greater%20than%2026%2C000%20pounds.

HEVI-LOAD – Refers to the Medium and Heavy-Duty Electric Vehicle Infrastructure – Load Operations and Deployment Modeling Tool.

ORIGINAL EQUIPMENT MANUFACTURER (OEM) – Refers to the manufacturers of complete vehicles or heavy-duty engines, as contrasted with remanufacturers, converters, retrofitters, up-fitters, and re-powering or rebuilding contractors who are overhauling engines, adapting or converting vehicles or engines obtained from the OEMs, or exchanging or rebuilding engines in existing vehicles.

PUBLIC-PRIVATE PARTNERSHIP (P3) – Public private partnerships (P3s) are contractual agreements between a public agency and a private entity that allow for greater private participation in the delivery of projects.[3]

SAN DIEGO ASSOCIATION OF GOVERNMENTS (SANDAG) – A metropolitan planning organization and a council of governments, bringing together local decision-makers to develop solutions to regional issues including improving equity, transportation, air quality, clean energy, economic development, goods movement, public health, public safety, housing, and more.

ZERO-EMISSION VEHICLE (ZEV) – Vehicles that produce no emissions from the on-board source of power (e.g., an electric vehicle).

3 The Public-Private Partnership (P3) definition source, https://www.transportation.gov/buildamerica/p3.