CALIFORNIA ENERGY COMMISSION

California Energy Commission

Clean Transportation Program

FINAL PROJECT REPORT

STC Traffic Equity-Driven Public Access ZEV Charging Blueprint

Prepared for: California Energy Commission

Prepared by: Build Momentum, Inc.

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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 use and dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies.
- Produce sustainable alternative and renewable low-carbon fuels in California.
- Expand alternative fueling infrastructure and fueling stations.
- Improve the efficiency, performance and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- 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 entitled "Blueprints for Medium- and Heavy-Duty Zero-Emission Vehicle Infrastructure" under the CEC's Clean Transportation Program. In response to GFO-20-601, the recipient submitted an application which was proposed for funding in the CEC's Notice of Proposed Awards on April 8, 2021, and the agreement was executed as ARV-21-010 on September 16, 2021.

ABSTRACT

The Final Report for the Equity-Driven Public Access ZEV Charging Blueprint project (Blueprint) focuses on outlining and describing the processes of creating the Final Blueprint, as well as a summary of important findings and next steps. The goal of the Blueprint is to support and encourage equity in the marketplace by promoting public access to Medium- and Heavy-Duty (MDHD) Zero Emission Vehicle (ZEV) infrastructure so that small businesses and individuals are not squeezed out of the market during the transition to zero-emission vehicles. The geographic focus of the project is National City, California, specifically candidate sites for charging and hydrogen refueling infrastructure owned by the Port of San Diego (POSD).

Diesel trucks operating near California seaports, including POSD, have been an economic driver for port communities and the state, but at great expense to the climate and the health of people living near ports and along truck routes.

To help solve this problem, POSD has an ambitious goal of having all trucks calling on POSD to be 100 percent ZEV by 2030, with an interim goal of 40 percent of POSD's annual cargo truck trips being performed by zero emission trucks by June 30, 2026. To help achieve these goals, the POSD Board voted at its meeting on November 8, 2022 to issue a Request for Proposals for ZEV infrastructure development on two sites it owns near POSD in National City. The Blueprint capitalizes on the POSD's plan to implement ZEV infrastructure development by providing meaningful research on site locations, financial considerations, and next steps for implementation.

This Blueprint narrowed down its scope to two candidate sites and developed a two-phase site development plan, including site layouts, EVSE and hydrogen infrastructure installations, and truck turning simulations for each site. It also provides thorough financial and business considerations for transitioning these sites. Finally, the Blueprint suggests next steps and considerations for STC Traffic to implement moving forward. The Blueprint is intended to be a replicable roadmap for similar industries looking to equitably transition to electric or hydrogen vehicle infrastructure.

Keywords: Medium-Heavy Duty ZEV, Drayage trucks, ZEV Infrastructure, Ports

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EXECUTIVE SUMMARY

The California Energy Commission awarded STC Traffic, Inc. (STC Traffic) a $200,000 grant to complete a Blueprint evaluating equitable development of public zero-emission vehicle (ZEV) medium- and heavy-duty (MDHD) charging infrastructure. The main goal of the Blueprint is to support and encourage equity in the marketplace by promoting public access to MDHD ZEV infrastructure so that small businesses and individuals are not squeezed out of the market during the zero-emission technology transition.

In the completed Blueprint, STC Traffic Equity-Driven Public Access ZEV Charging Blueprint, STC Traffic created a site development plan for two locations to deploy public electric truck charging and hydrogen refueling infrastructure. The site development plans include two-phase development, site layouts, electric vehicle supply equipment (EVSE) and hydrogen infrastructure installations, and truck turning simulations.

The Blueprint contemplates the increasing use of charging and refueling infrastructure in response to regulatory requirements, as well as financial benefits expected from abundant public funding opportunities and fuel and maintenance savings. To accommodate this growing demand at the Port of San Diego (POSD), the Blueprint maps out deployment of considerable charging and hydrogen refueling infrastructure over the next five years along with an analysis of required electrical capacity.

STC Traffic worked with partners Build Momentum, Inc. (Momentum) and Arup Americas, Inc. (Arup) to achieve all measurable project objectives, including:

- Engaging a broad stakeholder network to develop a comprehensive, economic, and equitable approach to designing and financing MDHD ZEV infrastructure that will be accessible to all industry participants.
- Evaluating the ZEV charging technologies, infrastructure deployment considerations, and associated traffic flows for public access MDHD ZEV infrastructure.
- Creating a credible business case identifying, among other things, key roles and responsibilities for market players (public and private) and strategies to overcome cost and revenue barriers to achieve scalable and replicable networks of MDHD ZEV infrastructure to be deployed throughout neighborhoods that surround freight facilities.
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- Supporting locally based minority business enterprises, woman-owned business enterprises, small businesses, and disabled veteran business enterprises through knowledge transfer and skills training programs to enable organically grown efforts to thrive.

CHAPTER 1: Background

1.1 Problem Statement

The California Energy Commission (CEC) issued GFO-20-601 entitled "Blueprints for Medium- and Heavy-Duty Zero-Emission Vehicle Infrastructure" under the CEC's Clean Transportation Program. To be eligible for funding under GFO-20-601, projects had to be consistent with the CEC's current Clean Transportation Program Investment Plan, updated annually. In response to GFO-20-601, STC Traffic, Inc. submitted an application which was awarded by the CEC in September 2021.

The transition to medium- and heavy-duty (MDHD) Zero Emission Vehicles (ZEVs) create important equity considerations for communities surrounding freight hubs where many Independent Owner Operators (IOOs) live. Fueling paradigms are shifting, and electric charging is increasingly shifting away from public access to private fleet charging in equipment yards. How will IOOs—those with the least ability to pay for their own MDHD ZEV chargers—compete for work in markets where clients will increasingly prefer to hire contractors with ZEVs to meet their own sustainability goals? Without public access to MDHD ZEV infrastructure, IOOs may be forced out of the industry, as large companies and fleet managers—that can better manage technology and financial risk—adopt ZEVs more quickly and capture greater market share.

Goals of the Agreement:

The goal of this Agreement was to support and encourage equity in the marketplace by promoting public access to MDHD ZEV infrastructure so that small businesses and individuals are not squeezed out of the market during the zero-emission technology transition.

Objectives of the Agreement:

The objectives of this Agreement were to:

1. Engage a broad stakeholder network to develop a comprehensive, economic, and equitable approach to designing and financing MDHD ZEV infrastructure that will be accessible to all industry participants.
2. Evaluate the ZEV charging technologies, infrastructure deployment considerations, and associated traffic flows for public access MDHD ZEV infrastructure.
3. Create a credible business case identifying, among other things, key roles and responsibilities for market players (public and private) and strategies to overcome cost and revenue barriers to achieve scalable and replicable networks of MDHD ZEV infrastructure to be deployed throughout neighborhoods that surround freight facilities.
4. Support locally based minority business enterprises, woman-owned business enterprises, small businesses, and disabled veteran business enterprises through knowledge transfer and skills training programs to enable organically grown efforts to thrive.

1.2 Project Team

Project Team Alignment with the Needs of the Project

Planning for the future of democratized ZEV energy requires a holistic skillset of experienced and creative forward-thinkers. The project team brought a unique and complementary skillset to this effort and effectively delivered a comprehensive Blueprint to site publicly available MDHD ZEV charging that considers the needs and economic promise of surrounding communities to equitably transition to a ZEV drayage truck future.

STC Traffic, Inc. (Recipient)

STC Traffic, Inc. (STC) served as the prime contractor and organizer for the project. In addition to technical services, STC managed and oversaw the Blueprint process, facilitated engagement with project team members, and worked to collaboratively develop a successful and deployable Blueprint. STC is a full-service traffic engineering consulting firm founded in 2007. STC is a leader in the Intelligent Transportation System (ITS) field and is the largest discipline-specific traffic engineering and ITS consulting firm in San Diego County, with the most staff dedicated to ITS in the region. STC Traffic has experience working with drayage truck fleet operators that serve POSD as the lead deployment partner of the Freight Signal Priority corridor at POSD.

Build Momentum, Inc. (Momentum)

Momentum served as the grant administrator and primary Blueprint author for the project. As a convener of participants across the advanced transportation spectrum including on-the-ground experience with key stakeholders at POSD, Momentum ensured that the process was adequately captured in a replicable and scalable manner. Momentum designs, develops, and deploys innovation campaigns for forward-thinking organizations—from entrepreneurs to public agencies to Fortune 500 companies—that research, demonstrate, commercialize, and operate transformative transportation, energy, water, and manufacturing technologies. Momentum has supported the design and development of some of California's most prominent programs, including the Low Carbon Fuel Standard (LCFS), the West Coast Electric Highway, and the California Sustainable Energy Entrepreneur Development Initiative (CalSEED).

Arup Americas, Inc. (Arup)

Arup led the Business Case Development research and framework for the Blueprint. Arup is a global design engineering, planning, and advisory firm at the forefront of the clean, affordable, and resilient energy transition, with 600 staff in California. The company's international, 14,000-person network provides capacity, global perspective, and innovative solutions. Arup's experience with transportation ZEV infrastructure includes feasibility, planning, site assessment, layout, cost/benefit analysis, design, cost estimation, risk management, commercial evaluation and benchmarking delivery models, investor due diligence, scheduling, utilities coordination, and construction administration. Arup combines deep technical knowledge of ZEV infrastructure systems with experienced deal structuring and financial advice to provide integrated solutions for clients and projects that catalyze industry transformation.

e-Mission Control (eMC)

e-Mission Control provided low-carbon fuel standards (LCFS) support to the Blueprint. eMC unlocks new revenue for operators of MDHD ZEV equipment in California through the LCFS program. eMC is a registered opt-in entity within the California Air Resources Board LRT-CBTS system managing a portfolio of more than 2,000 pieces of MDHD ZEV equipment. The LCFS program is expected to be an important financial tool for the acceleration of MDHD ZEV equipment and eMC will evaluate the opportunities to generate, manage, optimize, and deploy credits to engage the third-party investors to support public access deployment. eMC brings real-world experience gathering and monetizing LCFS credits from ZEV equipment and infrastructure and will provide strategic guidance on how to leverage incentive value to accelerate infrastructure deployment.

CHAPTER 2:
Community and Stakeholder Engagement

The overarching goal of this task was to bring together industry participants, stakeholders, and advocates to foster productive dialogue and action to advance the deployment of MDHD ZEV infrastructure. This chapter contains material from the following deliverables submitted to the CEC as part of this project:

- List of Outreach Targets
- Community and Stakeholder Engagement Plan
- Community and Stakeholder Engagement Report

2.1 Summary of Engagement

The purpose of community and stakeholder engagement was to gather the perspectives, opinions, and input of community members and stakeholder groups for use in the development of the final Blueprint. Outreach was designed to create a flexible and adaptable approach that meaningfully fostered a two-way dialogue to share perspectives about challenges, risks, concerns, and opportunities.

Outreach efforts began in February 2022, with the submission of the List of Outreach Targets and the Community and Stakeholder Engagement Plan in late January. Between the winter holidays, COVID-19 surge, and COVID-19-induced labor shortages, the project team struggled to get meetings with outreach targets and held the first meetings with targets in March. It was then that the project team learned that POSD was in the early stages of planning a study very similar in scope to the Blueprint, but on a longer timeline. Additional time was needed to coordinate outreach efforts with those of POSD to avoid duplicating efforts and unnecessarily burdening community members and stakeholders. This unanticipated challenge slowed outreach considerably and delayed the original schedule planned for this project.

The project team's contacts at the POSD and the city of National City facilitated outreach with these key stakeholders on an ongoing and regular basis. In May, outreach efforts advanced significantly at the Advanced Clean Transportation Exposition. This laid the groundwork for follow-up meetings that "cold-calling" might otherwise not have. Meetings were held with vehicle and equipment manufacturers to learn about their product lines as well as charging-as-a-service providers and others.

Generally, private stakeholders seemed most motivated to engage, with OEMs being very happy to meet as often as necessary to paint a complete picture of the ZEV landscape. Many stakeholders shared information about existing and anticipated government policies and regulations to support early adoption of ZEVs which guided their zero-emission strategies. Many manufacturers of heavy-duty vehicles shared that the development of specialty ZEVs such as concrete mixer trucks would follow a wider-scale deployment and commercialization of MDHD ZEVs, such as Class 8 trucks, given the relative distribution of vehicles on the road.

In contrast, community-based organizations showed some signs of outreach fatigue in their lack of enthusiasm to meet with the project team. This, combined with the aforementioned timeline challenges, left the team struggling to gather meaningful community-level perspectives.

CHAPTER 3:
Public Access ZEV Infrastructure Design

The goal of this task was to assess viable technology options, analytical tools, software applications, and data that is needed to evaluate the economic and technological feasibility of MDHD ZEVs and ZEV infrastructure supporting the movement of goods from California's freight hubs. This chapter contains material from the following deliverables submitted to the CEC as part of this project:

- MDHD ZEV Technical Report
- Public Access ZEV Infrastructure Feasibility Study and Technical Report
- Public Access ZEV Infrastructure GIS Maps
- Schematic Design and Simulations

3.1 Site Evaluation Criteria

The project team began assessing public access ZEV infrastructure design by first creating site evaluation criteria. The project team aligned its evaluation of public opportunity charging sites with sites being evaluated by POSD. POSD issued a Request for Information (RFI) in May, 2022 for design concepts and business plans for public ZEV hydrogen fueling and/or electric charging infrastructure at numerous sites in proximity to POSD. This RFI allowed the project team to narrow down their evaluation to one of those proposed sites in the RFI.

Four of those sites were located in National City, California. During the Community and Stakeholder Outreach phase of the project, the project team held several meetings with National City. The City was supportive of efforts to transition to zero-emission trucks, particularly related to activity in and around the working waterfront. The City's support paired with its high scoring for environmental burdens on CalEnvironScreen 4.0 (see Figure 4) further narrowed the considered sites to the four National City sites along Tidelands Avenue in POSD's RFI. The project team then developed and used the following criteria for evaluating the four remaining sites:

- Number of charging stations and hydrogen dispensers the site can accommodate
- Proximity to proposed off-site charging stations along Tidelands Avenue (convenience for truck drivers to access on-site amenities)
- Proximity to truck routes, freeway, National City Marine Terminal, goods, services, and amenities (such as restaurants and hotels)
- Level of electrical infrastructure upgrades or new connections required and construction timeline
- Existing site conditions and level of effort required to prepare the site, including the potential need for environmental remediation
- Capacity to include amenities on-site (such as restrooms, showers, locker rooms)

After using the above criteria on the sites along Tidelands Ave. in National City, three of the four sites were identified for further project consideration.

3.2 Site Buildout Goals

The project team developed initial site designs for three of the four Tidelands Avenue sites identified in the POSD RFI. Sites 3 and 4 were chosen for full evaluation based on the evaluation criteria described in Chapter 3.1. These sites were also the top two choices submitted by the 18 respondents to the POSD RFI and are supported by National City.

The site designs are intended to help guide the development of public ZEV MDHD infrastructure in response to POSD's RFI with accessibility and financial and power burdens in mind. The designs, when paired with the financial findings from the business case framework (see Chapter 4), provide tangible data and next steps for MDHD ZEV infrastructure development in National City.

3.3 Site Development Plan Outcomes

The project team developed a two-phase site development plan, including site layouts, EVSE installations, and truck turning simulations, for the Tidelands Avenue sites 3 and 4. Each site was designed for one-way truck flow in and out of the charging areas. Overnight charging, opportunity charging, and hydrogen refueling were separated, with overnight charging located furthest from Tidelands Avenue for a quieter experience for truckers sleeping in their cabs. Each charging and hydrogen refueling stall was designed to accommodate a Class 8 truck, utilizing distinct charging space recommendations for opportunity and overnight charging. Each site has space allocated for power supply equipment. Sites 3 and 4 include room for restroom facilities. The power demands for EVSE and hydrogen refueling infrastructure and site layouts for sites 3 and 4 are below.

3.3.1 Site 3 Development Plan Power Demands

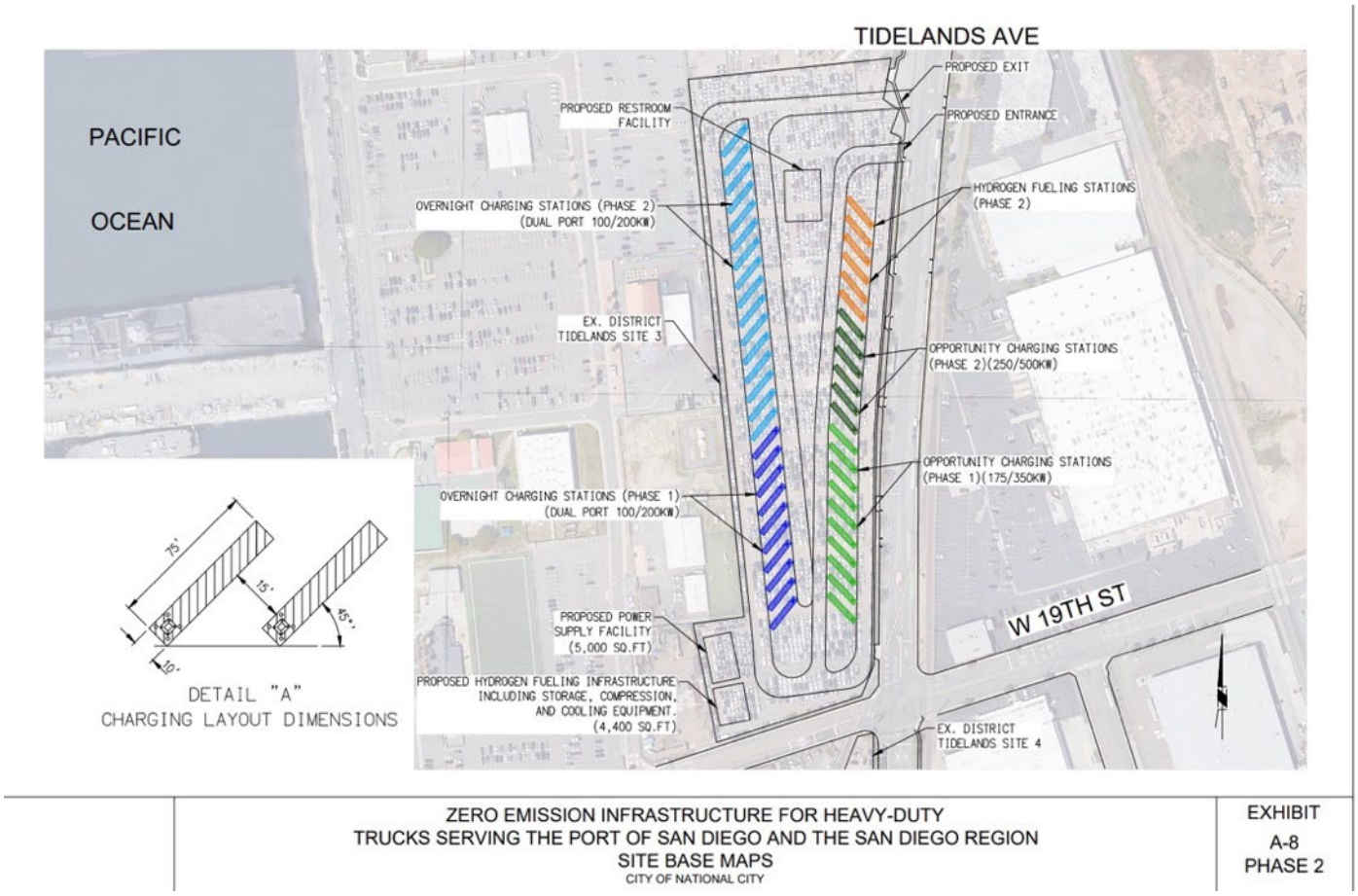
Planning for power demand is an essential piece of ZEV infrastructure development. The site 3 development plan power demand detailed below describes the type of charging and amount of power needed for two phases of infrastructure development at site 3, as well as the total peak electrical demand for the site. The power demand summary for site 3 is:

- Phase 1 (2024-2026): Deploy 10 200 kilowatt (kW) simultaneous charging stations intended for overnight charging. Deploy 10 350 kW simultaneous charging stations intended for opportunity charging.
- Phase 2 (2027-2028): Deploy 16 200 kW simultaneous charging stations intended for overnight charging. Deploy six 500 kW simultaneous charging station, intended for opportunity charging. Deploy six hydrogen dispensers for opportunity refueling.
- Build-Out Demand:
    - 26 overnight charging stations at 200 kW/truck = 5.2 megawatt (MW) Peak Demand
    - 10 opportunity charging stations at 350 kW/truck = 3.5 MW Peak Demand
    - 6 opportunity charging stations at 500 kW/truck = 3 MW Peak Demand
    - Total Peak Electrical Demand = 11.7 MW

Utilization of the charging stations is expected to increase over the five-year period. Peak electrical demand at build-out will be 11.7 MW (26 overnight charging sessions occurring simultaneously at 200 kW/truck. 10 opportunity charging sessions at 350 kW/truck, and six

opportunity charging sessions at 500 kW/truck). For this peak demand level to be reached, trucks charging would all need to be able to accept a 200-kW rate of charge for overnight charging and between a 350-kW and 500-kW rate of charge for opportunity charging). In the peak demand scenario, no trucks would be charging simultaneously on the same charger. See Figure 1 for site 3 layout.

Figure 1 - Tidelands Avenue, Site 3, Phase 2 Site Design



Source: *STC Traffic*

3.3.2 Site 4 Development Plan Power Demands

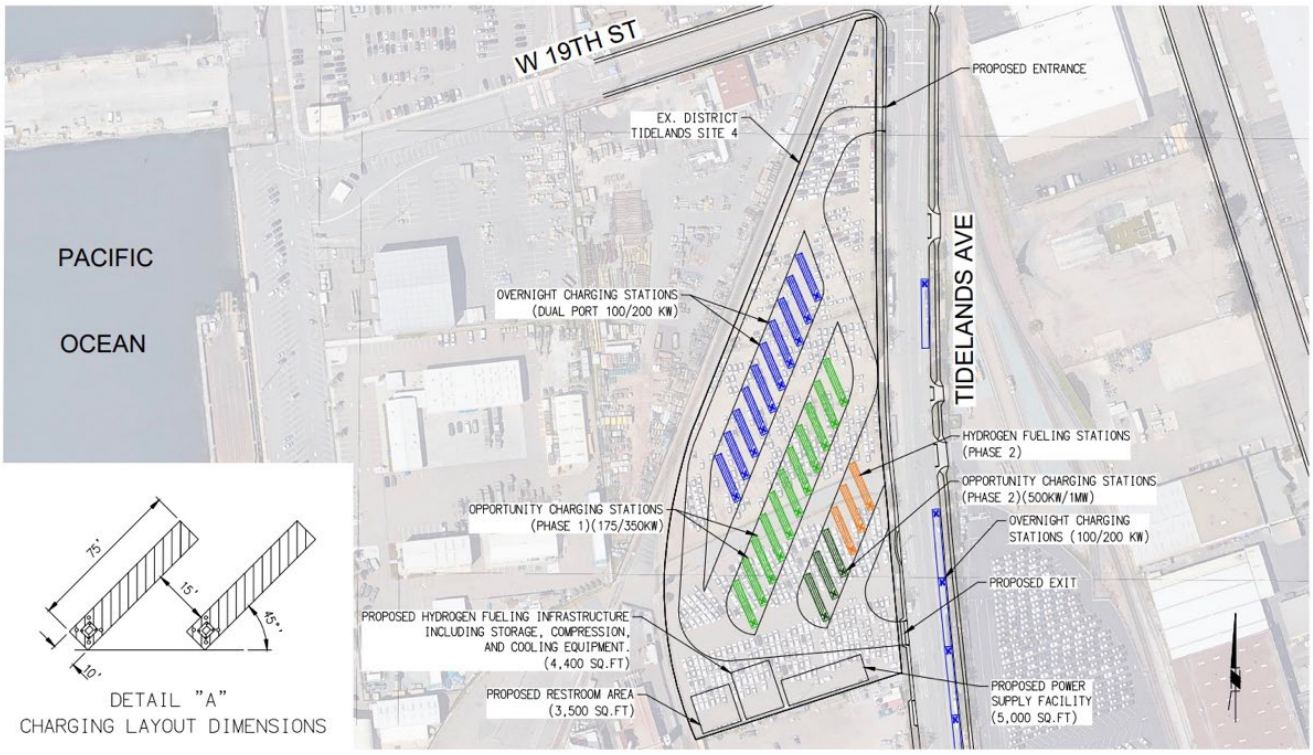
The Blueprint provides the same power demand details for site 4 as it did for site 3. The power demand summary for site 4 is:

- Phase 1 (2024-2026): Deploy 10 200 kW simultaneous charging stations intended for overnight charging. Deploy 10 350 kW simultaneous charging stations intended for opportunity charging.
- Phase 2 (2027-2028): Deploy three 1 MW charging stations intended for opportunity charging. Deploy three hydrogen dispensers for opportunity refueling.
- Build-Out Demand:
    - 10 overnight charging stations at 200 kW/truck = 2 MW Peak Demand
    - 11 opportunity charging stations at 350 kW/truck = 3.85 MW Peak Demand
    - 3 opportunity charging stations at 1 MW/truck = 3 MW Peak Demand

- Total Peak Demand = 8.85 MW

Utilization of the charging stations is expected to increase over the five-year period. Peak electrical demand at build-out will be 10.5 MW (10 overnight charging sessions occurring simultaneously at 200 kW/truck. 10 opportunity charging sessions at 350 kW/truck, and 5 opportunity charging sessions at 1 MW/truck). For this peak demand level to be reached, trucks charging would all need to be able to accept a 200-kW rate of charge for overnight charging, and between a 350-kW and 1-MW rate of charge for opportunity charging). In the peak demand scenario, no trucks would be charging simultaneously on the same charger. See Figure 2 for the site 4 layout.

Figure 2 - Tidelands Avenue, Site 4, Phase 2 Site Design



Source: *STC Traffic*

3.3 Site Development Conclusions

The two sites on Tidelands Avenue in National City identified by the project team as top candidates for development are aligned with the top sites chosen by respondents to POSD's RFI and are supported by National City. Key issues for proceeding to the development stage include completing an assessment of available electrical capacity on the circuit feeding the two sites, and the timeline for San Diego Gas & Electric (SDG&E) to make any necessary electrical upgrades to support the first phase of development. See Chapter 6.3 for further next steps for project deployment.

CHAPTER 4:
Business Case Development

The goal of this task was to create the business case framework for public-access ZEV infrastructure by taking a holistic look at the technology and infrastructure considerations, the public sector objectives, relevant private sector players, existing business model frameworks from comparable sectors, and key risks. This chapter contains material from the following deliverables submitted to the CEC as part of this project:

- Public Access ZEV Infrastructure Business Framework

4.1 Business Case Framework Purpose

The purpose of this business case framework was to assess different business models that a Project Owner—in this case POSD, National City, CA and/or a private developer—can utilize to fund, finance, and deliver charging infrastructure for MDHD ZEVs. The commercial and business models can be used to reduce (in some cases significantly) the high upfront cost of capital associated with deploying charging infrastructure. Each commercial model has a different maturity level and risk allocation profile. This framework focuses on the electrification of drayage trucks. The final cashflow analysis in the framework provides tangible financial assumptions and outcomes associated with developing public ZEV MDHD infrastructure in the San Diego region, which is not only applicable to the site designs in Chapter 3, but is replicable by other interested parties.

4.2 Summary of Business Case Framework

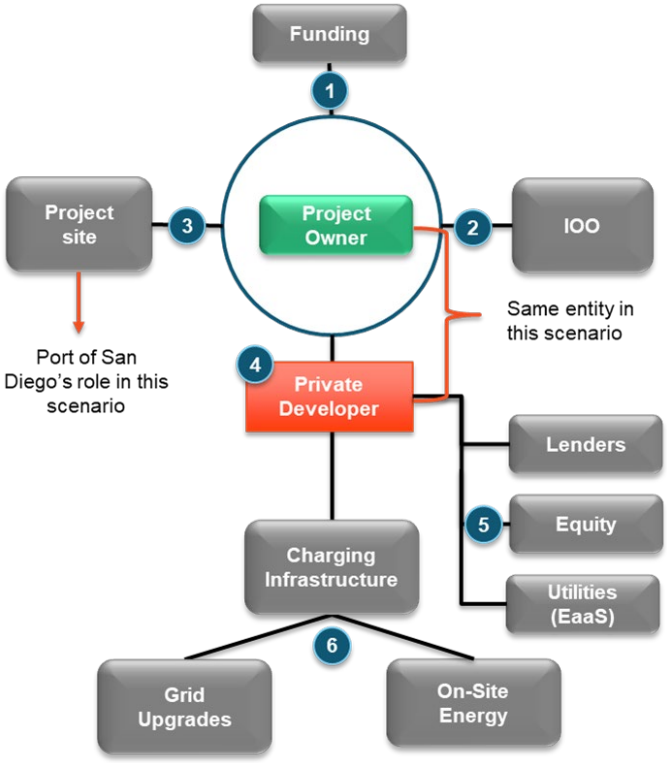
The business case framework discusses key project stakeholders in charging infrastructure projects, three project deliverable business models, potential sources of funding and financing, and a final cashflow analysis for both sites that incorporates the other information in the framework.

4.2.1 Project Stakeholders in Charging Infrastructure Projects

The Business Model Flow Chart shown in Figure 3 presents a map of the key players and project pieces that can be customized to deliver any charging infrastructure project. This flow chart of project stakeholders can serve as a starting point for project teams that are embarking on deploying or developing public ZEV MDHD charging infrastructure. The flow chart of stakeholders is not specific to the San Diego region and can be replicated regardless of location.

As shown in the diagram, the related components of the charging infrastructure system, (i.e., the chargers, grid upgrades, on-site renewable energy production) may be procured as a bundled system by a single Private Developer or separately through multiple Private Developers. Table 1 provides a key to further describe Figure 3.

Figure 3 - Business Model Flow Chart from 4.1 Public Access ZEV Infrastructure Business Framework



Source: *STC Traffic*

Table 1 - Key to Figure 3

Key	Description
1	The Project Owner should apply for funding opportunities to fund the capital cost of charging infrastructure.
2	The IOOs will pay the Project Owner through a fuel rate that the Project Owner can use to pay back the Private Developer over time and to cover the cost of the energy.
3	The Project Site must be either owned or under a long-term lease. POSD is providing the land in this case.
4	The Project Owner may design, build, finance, operate, and maintain the charging infrastructure and related components as needed and determined by their risk appetite.
5	A combination of debt, equity, and Utilities (Energy-as-a-Service (EaaS)) financing may be used in conjunction with public funding obtained to finance capital costs for the delivery of the site and charging infrastructure.
6	If needed as part of the design specifications, the Private Developer will work with the electric utility to identify any needed grid upgrades, and potentially deploy on-site renewable energy and/or energy storage system resources.

Source: *STC Traffic*

4.2.2 Funding

The framework provides an overview of several funding opportunities at the local (San Diego region), state (California), and federal level. On the federal level, the framework describes funding opportunities from the Department of Transportation, Department of Energy, and Environmental Protection Agency. Local opportunities include SDG&E's Clean Transportation Initiatives and San Diego Air Pollution Control District's Clean Air for All Grant Campaign. California state funding opportunities provide the most diverse and prolific grants and initiatives, many of which stem from CARB. For more information, please see Section 8 or Appendix L of the Blueprint.

4.2.3 Business Models

The framework discusses three business models for implementing charging infrastructure projects.

- System Bundling
- Independent Asset Procurement
- Trucking as a Service (TaaS)

The **System Bundling** model is preferable for a project owner that has a lower appetite for risk and is willing to pay a risk premium.

- The **advantages** of the system bundling model may include:
  - Reduced interface risk between system elements
  - Bundling systems may facilitate third-party financing and may improve the terms of financing
  - Simplified contractual management by the agency
  - Charging system providers may have easier access to financing due to ongoing relationships to debt and equity investors and EaaS providers
- The **challenges** of the system bundling model may include:
  - Few private players have full-service capabilities in current market
  - There may be limitations on agencies to procure complete operations scope due to union arrangements or preexisting contractual agreements
  - Possible risk premium for items that the Project Owner could handle in-house

In the **Independent Asset Procurement Model**, each of the identified services may be delivered and financed separately. The Project Owner should determine its risk appetite and commercial and operational limitations when considering an independent asset procurement.

- The **advantages** of the independent asset procurement model may include:
  - Allowing the project owner to work around existing commercial and/or operational limitations, such as traffic management, and to remain compliant with existing contractual agreements (labor, operations, etc.)
  - It may accelerate delivery of discrete elements of the system that may be more critical
- The **challenges** of the independent asset procurement model may include:
  - Integration risk of the independent elements is retained by the project owner. If project elements are delayed, the project owner will have to manage the challenges

of schedule impacts and cost overruns

- This increases the project management and counterparty coordination responsibilities of the project owner

Trucking as a Service (TaaS) is an emerging business model. In this model, the third-party developer develops, owns, and operates electric vehicles (EV) chargers, as well as owns and maintains EV trucks. IOOs would lease the trucks from the developer for a fixed monthly fee. The truck lease package offering may also be inclusive of low cost/free charging for a limited period. At the end of the lease period, IOOs will have the option to either extend lease at a reduced rate, buy the vehicle at fair market value with option to lease the parking space and extend their charging plan, or terminate the lease. This model will benefit IOOs who might struggle with high upfront costs of purchasing electric trucks. The Blueprint uses the TaaS model in many of its considerations since a focus of the Blueprint is affordable, accessible, public access to ZEV charging and IOOs are individuals of the public and not associated with private ZEV charging infrastructure opportunities.

4.2.4 Final Cashflow Analysis

The framework completed a cashflow analysis of developing public MDHD ZEV infrastructure in sites 3 and 4 by applying the information compiled in the rest of the framework to those sites. Tables 2 and 3 compare the total costs for each site determined by the cashflow analysis. Both tables include a potential +30 percent and -30 percent for charger costs over the next few decades to try and capture the sensitivity of cost assumptions.

Table 2 - Site 3 Total Projected Costs (in U.S. $ million)

Site	Site 3	Site 3 - Chargers 30% More Expensive	Site 3 - Chargers 30% Cheaper
Present Value Project Cost	$6.8	$7.6	$6.1
Present Value Capex	$2.5	$3.6	$1.4
Present Value O&M	$3.5	$3.5	$3.5
Present Value of Electricity Costs	$7.2	$7.2	$7.2
Present Value LCFS	$2.4	$2.4	$2.4
Present Value of Project Cost/Total Energy Demand	$0.215	$0.237	$0.192

Source: *STC Traffic*

Table 3 - Site 4 Total Projected Costs (in U.S. $ million)

Site	Site 4	Site 4 - Chargers 30% More Expensive	Site 4 - Chargers 30% Cheaper
Present Value of Project Cost	$6.8	$7.6	$6.1
Present Value of Capex	$1.3	$2.1	$0.5
Present Value of O&M	$2.2	$2.2	$2.2
Present Value of Electricity Costs	$5.5	$5.5	$5.5
Present Value of LCFS	$2.2	$2.2	$2.2
Present Value of Project Cost/Total Energy Demand	$0.179	$0.199	$0.159

Source: *STC Traffic*

Overall, the cashflow analysis determined the main drivers of the cost difference between the sites are the configurations of the chargers procured during phase 2 of installing chargers, since site 3 has a higher volume of planned chargers in the site design. Sites 3 and 4 have similar costs for phase 1 of infrastructure development. For both, electricity costs are the single largest line-item cost, but the framework discusses potential funding mitigation strategies to offset these costs (see Chapter 4.2.2).

4.3 Business Case Framework Conclusion

Putting people in trucks creates demand for charging and hydrogen refueling infrastructure. Zero-emission truck drivers, particularly IOOs need access to convenient charging stations and hydrogen dispensers, as well as places to park trucks overnight. ZEV infrastructure developers need truckers to utilize the stations and dispensers.

Tying deployment of trucks to public charging and refueling infrastructure, such as proposed in the TaaS model, reduces the risk of deploying under-utilized assets that deter potential investment. The TaaS model offers a promising solution to the challenge of how to best help IOOs participate in the ZEV transition by financing formidable upfront capital costs with operational savings and LCFS edits over time. The TaaS model also provides a way to ensure that proposed POSD ZEV infrastructure sites will be accessible and cost-effective for IOOs. Developing a successful model connecting affordable access to both zero-emission trucks and ZEV-supporting infrastructure for all truck drivers, including IOOs, will set the stage for replication across the state.

In addition to models such as TaaS, funding programs offered by the state of California are increasingly focused on helping IOOs meet forthcoming regulatory requirements to drive ZEVs. In particular, CARB's Innovative Small E-Fleets, Truck Loan Assistance, Flexibility for Small Fleets to Stack Incentives, Zero-Emission Truck Loan Pilot, and Zero-Emission Drayage Truck funding programs are all designed to benefit IOOs and small fleets. Outreach and technical assistance are needed to make IOOs aware of these opportunities, and to help IOOs take advantage of them.

The electrical system buildout required to support charging infrastructure at the recommended POSD sites in National City is substantial. The proposed deployment of 66 overnight and opportunity chargers would have a combined peak demand of 20.55 MW—enough to power a small city. Therefore, early planning with the electric utility, SDG&E, is crucial. Otherwise, time spent waiting for sufficient electrical system upgrades will significantly delay the full proposed project build out.

The business framework recommends several next steps for STC Traffic in order to implement the ZEV infrastructure discussed in the Blueprint:

1. Consider responding to the POSD Request for Proposal (RFP) for ZEV infrastructure deployment at the two National City sites evaluated in this Blueprint.
2. Follow up with IOOs to determine interest in the TaaS model, and to support participation in relevant funding opportunities provided by CARB and other agencies.
3. Develop a team that includes a site developer, TaaS provider, fundraising expertise, and other key roles.
4. Perform further outreach with the Environmental Health Coalition (EHC), Barrio Logan, and other community partners around the proposed site development plans.
5. Refine site design and other recommendations developed by STC Traffic.
6. Explore and deploy workforce development and education strategies.

CHAPTER 5:
Knowledge Sharing

The goal of this task was to conduct outreach to key stakeholders across the state so that the Blueprint can be adopted, adapted, utilized, and replicated. This chapter contains material from the following deliverables submitted to the CEC as part of this project:

- Blueprint Findings Presentation
- Summary of Knowledge Transfer Outreach Activities

5.1 Meeting Summary

STC Traffic, Momentum, and Arup collaborated on the Blueprint Findings Presentation. The Presentation was presented at the Blueprint Knowledge Transfer event on December 6, 2022. The event was hosted by Momentum in a virtual format so more individuals would have the chance to participate. The invitee list consisted of individuals and entities STC Traffic reached out to during Task 2 Community and Stakeholder Outreach, as well as other interested parties that project partners had collaborated and networked with since preliminary outreach was completed.

The three presenting organizations were STC Traffic, Momentum, and Arup. The presentation consisted of the Task 5.1 Blueprint Findings Presentation, which is a summary of the technical information found and compiled for Tasks 2, 3, and 4 for the Blueprint.

5.2 Meeting Outcomes

Overall, the event was a success, and turnout was as full as expected with mainly POSD employees participating. Attendees predominantly wanted to know if and how the Blueprint would be implemented in the future and how they could access the Final Blueprint when it was completed. Some of the POSD attendees asked specific questions about who oversees the Blueprint and how the team involved POSD and other stakeholders in the creation of the Blueprint.

5.3 Lessons Learned

Through the implementation of the Knowledge Sharing task, the project team identified the following important lessons learned.

1. Ensure Consistent engagement with Key Stakeholders:
   Early and consistent engagement with stakeholders most impacted by the development of the Blueprint will increase the likelihood of meaningful replicability of the Blueprint. For this project, engagement with POSD was particularly important. Although early engagement was coordinated with POSD, it was not consistent during some of the later technical deliverable phases. POSD involvement was important since the sites chosen for evaluation under this Blueprint were chosen in response to POSD's RFI in order to ensure site development research would have real-world applicability.
2. Plan for Early and Proactive Engagement with Stakeholders:
   Beginning engagement ahead of time can increase a project's network of invitees. Essentially, there is a direct pipeline of individuals engaged during community and stakeholder outreach and individuals who are interested in—and can benefit from—

knowledge transfer activities. Early and thorough plans for community and stakeholder outreach will increase the effectiveness of the outreach efforts which will, in turn, impact the success of all knowledge transfer activities.

3. Create Accessible Pathways for Follow-Up:
   Create accessible pathways for stakeholders and community members to follow-up on information provided during community outreach and knowledge transfer. For example, we needed more definitive answers for how people can access the final Blueprints once the CEC publishes them. Having a central location, like a simple webpage, CEC page of blueprints and associated resources, or social media pages, would be a great tool to provide interested outreach and knowledge transfer participants who want even more information about the project. This would aid blueprint replicability by others in the future.
4. Diversify Presenters at Knowledge Transfer Activities:
   A diverse group of presenters will likely attract a more diverse cross-section of attendees. Including a variety of topics and a variety of organizations presenting will keep the information from growing stale partway through the meeting. This also ensures a robust panel to answers questions from the attendees.
5. Create Opportunities for Engagement within Presentations:
   Use different methods to keep participants engaged throughout presentations. For example, it was helpful to have all organization and activity links ready to put in the chat during the meeting.
6. Choose an Effective Meeting Format:
   One difficulty the project team discovered was juggling the pros and cons of in-person versus online meeting formats. It can be difficult to make the events meaningful when they are online since many people can come and go without participating or engaging. With an increasing number of events like this, it is easy for attendees to join but more difficult to directly engage. However, accessibility can be key to certain meetings, and online meetings are more accessible for attendees regardless of their location, income, availability, etc. For this Blueprint outreach, the project team wanted the event to be as accessible as possible, so an online meeting that more people across the state could access made more sense here. Considering these pros and cons well before establishing the event can help a project achieve its specific goals.
7. Consider Additional Avenues for Advertisement to Attract Participants:
   Seek out opportunities to advertise the event. Effective use of social media and boosting the signal on the project team's websites can also be effective. Including key stakeholders in this engagement is also recommended. The project team also recommends that a CEC webpage advertising events associated with its funding programs could help boost attendance of interested participants.

CHAPTER 6: Blueprint

The goal of this task was to formalize the information gathered through Task 2 and Task 3 into a formal Blueprint that can be shared with key stakeholders. This chapter contains material from the following deliverables submitted to the CEC as part of this project:

- Final Blueprint

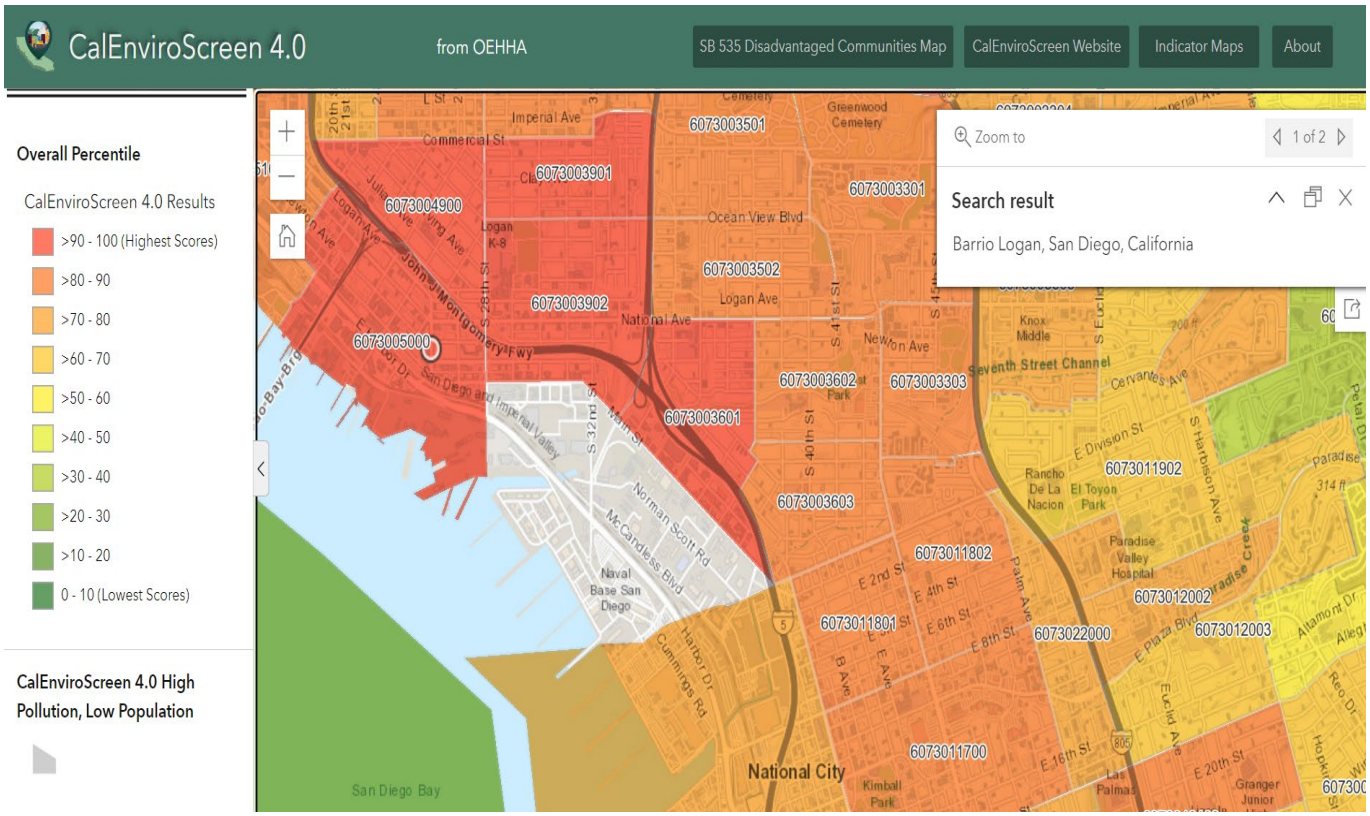
6.1 Purpose and Context for Blueprint

Diesel trucks operating near California seaports, including POSD, have been an economic driver for port communities and the state, but at great expense to the climate, and to the health of people living near ports and along truck routes serving them.

According to the EHC, San Diego residents living in proximity to the POSD are burdened with more pollution than 97 percent of Californians and breathe more diesel-polluted air than 90 percent of the state. The Barrio Logan community adjacent to the POSD, which is predominately LatinX, has a cancer rate that is 95 percent higher than average. Children's asthma hospitalization rates in National City are more than double the San Diego county average. These factors place National City census tracts and neighboring communities such as Barrio Logan in the highest tiers of CalEnviroScreen 4.0 Disadvantaged Communities rankings, where scores are a function of pollution burden and socioeconomic factors. See Figure 4 for a screenshot the CalEnvironScreen 4.0 ranking for Barrio Logan. The impact on climate from diesel emissions is related to health impacts; emissions from heavy-duty trucks generate 20 percent of the state's transportation greenhouse gas (GHG) emissions.[1]

[1] https://www.ucdavis.edu/climate/news/decarbonizing-california-transportation-by-2045

Figure 4 – Screenshot of CalEnvironScreen 4.0 search for Barrio Logan, San Diego, CA



Source: *CalEnvironScreen 4.0*

In response to the climate and health impacts of diesel trucking, California is leading the transition of the industry to ZEVs. CARB has developed a draft Advanced Clean Fleets (ACF) regulation with the primary goal to "accelerate the market for zero-emission trucks, vans, and buses by requiring fleets that are well suited for electrification, to transition to ZEVs where feasible." As part of the draft ACF regulation, all new registrants in CARB's online system must be ZEVs beginning in 2024, whether battery electric trucks, or hydrogen fuel-cell electric trucks. While trucks currently in service may continue to serve ports if they meet certain conditions and register in CARB's online system before 2024, only zero emission trucks will be permitted beginning in 2035.

POSD has an even more ambitious timeline, with a target of 2030 for trucks calling on POSD to be 100 percent ZEV, with an interim goal of 40 percent of POSD's annual cargo truck trips being performed by zero emission trucks by June 30, 2026.[2] To help achieve these goals, the POSD Board voted at its meeting on November 8, 2022, to issue an RFP for ZEV infrastructure development on two sites it owns near POSD in National City, California. The RFP built on the 18 responses that POSD received to an RFI issued in May 2022, for design concepts and business plans for public ZEV hydrogen fueling and/or electric charging infrastructure at numerous sites in proximity to POSD, including two sites in National City subsequently selected for evaluation in the RFP.

The project team aligned its evaluation of public opportunity charging sites identified by the

[2]https://www.portofsandiego.org/mcas#:~:text=A percent20goal percent20of percent20100 percent20percent,in percent20some percent20cases percent2C percent20even percent20more.

POSD RFI in National City. Site evaluation criteria included:

- Number of charging stations the site can accommodate
- Proximity to truck routes, freeway, National City Marine Terminal, goods, services, and amenities (such as restaurants and hotels)
- Level of electrical infrastructure upgrades or new connections required
- Construction timeline
- Existing site conditions and level of effort required to prepare the site, including the potential need for environmental remediation
- Capacity to include amenities on site (such as restrooms, showers, locker rooms)

The two sites on Tidelands Avenue in National City that were chosen by the POSD for its RFP, were also scored highest by the project team as best suited to support deployment of electric truck charging infrastructure. This Blueprint details the proposed placement of charging infrastructure on each of the three National City sites evaluated, for both overnight and opportunity charging, in consideration of traffic patterns through the sites, and access to amenities for truckers utilizing the sites.

6.2 Summary of Blueprint

The project team developed a two-phase site development plan, including site layouts, EVSE installations, and truck turning simulations, for the two chosen sites evaluated along Tidelands Avenue in National City, near the POSD. Each site was designed for one-way truck flow in and out of the charging areas. To provide a quieter experience for truckers sleeping in their cabs, overnight and opportunity charging were separated, with overnight charging located furthest from Tidelands Avenue. Each charging stall was designed to accommodate a Class 8 truck, utilizing distinct charging space recommendations for opportunity and overnight charging.

As the transition to zero-emission trucks accelerates in the years ahead, IOOs as a group are lower income and more diverse than the trucking industry average and they are at risk of being left behind or struggling to keep up with required changes. This equity-driven Blueprint was designed specifically with IOOs in mind to help usher in a truck transformation that works for all.

POSD gathered input from IOOs as it was developing its RFI for ZEV infrastructure to support trucks calling on POSD. The upfront cost of purchasing zero emission trucks emerged as the top concern. Other concerns expressed by IOOs included uncertainty and confusion regarding such issues as vehicle reliability, operations and maintenance, and how technological developments will affect the value of initial investments in charging infrastructure and vehicles.

Independent owner operators report that they can purchase used diesel trucks for about $100,000, while new electric trucks cost several times that amount, putting them out of reach. For this reason, the Blueprint Business Framework highlights an emerging and credible business model, Trucking as a Service (TaaS), and a promising solution for IOOs to overcome the upfront cost barrier.

In the TaaS model, a third-party develops, owns, and operates EV chargers, as well as electric trucks. The truck lease package offering may also be inclusive of low cost or free charging for a limited period. The lessor funds the package with federal and state funding programs (such as new CARB Clean Transportation Investment programs designed to support small fleets and IOOS), fuel and maintenance savings, and Low Carbon Fuel Standard (LCFS) credits. The

significant operational savings gained by the lower cost of electricity compared to diesel are used by lessees to pay back the upfront capital. At the end of the lease period, IOOs would have the option to either extend lease at a reduced rate, buy the vehicle at fair market value with option to lease the parking space and extend their charging plan, or terminate the lease.

Putting people in trucks creates demand for charging infrastructure, which in turn helps provide a reliable customer base and source of income for site developers. Electric truck drivers need access to convenient charging stations and places to park trucks overnight. Charging site developers need truckers to utilize the stations. Tying deployment of trucks to public charging infrastructure, such as proposed in the TaaS model, reduces the risk of deploying under-utilized assets that deter potential investment. Developing a successful model connecting affordable access to both electric trucks and charging equipment will set the stage for replication across the state. One such opportunity is to deploy charging stations at private lots where IOOs currently park overnight, as recommended for consideration by CALSTART.

The Blueprint contemplates the increasing use of charging infrastructure in response to regulatory requirements, as well as financial benefits expected from abundant public funding opportunities, and fuel and maintenance savings. To accommodate this growing demand at POSD, the Blueprint maps out deployment of considerable charging infrastructure over the next five years along with an analysis of required electrical capacity to support the recommended charging infrastructure.

The Blueprint details a buildout scenario at the two selected sites in National City that would total 66 charging stations, ranging from 200 kW in capacity for overnight charging to 1 MW opportunity charging stations. One site would include 26 overnight, 200-kilowatt (kW) charging stations, 10 350-kW opportunity charging stations, and six 500-kW charging stations. Total peak demand for this site would be 11.7 MW. The second site would place 10, 200-kW overnight charging stations, 11 350-kW opportunity charging stations, and three 1-MW charging stations. Total peak demand for this site would be 8.85 MW. The two sites combined would have 20.55 MW total peak demand, the equivalent demand for approximately 10,000 homes, equivalent to a small California city. Therefore, early planning with SDG&E, is crucial. Otherwise, delays in waiting for sufficient electrical system upgrades will significantly delay the full proposed project build out.

A report released by National Grid, CALSTART, and others in November 2022, emphasizes the importance of planning for the expected built out capacity of sites: "By implementing the right-sized interconnection upfront, rather than investing in a series of smaller distribution upgrades that will soon need to be replaced, we can avoid duplicative investments, reduce total costs, and futureproof high-traffic sites for accelerated charging deployment. Taking this long-term perspective will allow site operators and utilities to design for future demand, like growth in MDHDV charging." [3]

6.3 Lessons Learned and Next Steps

Over the course of developing the Blueprint, the project team identified the following important lessons learned and recommended next steps.

- Lessons Learned:

[3] https://calstart.org/electric-highways-study/

- Start community outreach earlier to ensure the project team has enough time to meaningfully engage with community organizations and stakeholders. Many individuals from CBOs and stakeholders organizations are already extremely busy and receive increasing requests to respond to proposed projects. Giving these individuals more time to respond takes the pressure off them, which allows them to provide more meaningful and long-term input.
- Collaborating with POSD for the length of the Blueprint would have strengthened both groups' efforts.
- Early coordination with the electric utility is critical to planning for and meeting this level of electrical demand.

- Next Steps:
  - Complete an assessment of:
    a) available electrical capacity for chosen sites, and
    b) the timeline for SDG&E to make any necessary electrical upgrades to support the first and second phases of development.
  - Consider responding to the POSD RFP for ZEV infrastructure deployment at the two National City sites evaluated in this Blueprint.
  - Follow up with IOOs to determine interest in the TaaS model.
  - Develop a team that includes a site developer, TaaS provider, fundraising expertise, and other key roles.
  - Do further outreach with EHC, Barrio Logan, and other community partners on the proposed site development plans.
  - Refine site design and other recommendations developed by STC Traffic.
  - Explore and deploy workforce development and education strategies, especially green job opportunities for local businesses, including minority business enterprises, woman-owned business enterprises, small businesses, and disabled veteran business enterprises.

Glossary

CaaS -- Charging as a service[4]

CAEATFA -- California Alternative Energy and Advanced Transportation Financing Authority[5]

CALIFORNIA AIR RESOURCES BOARD (CARB) -- The "clean air agency" in the government of California, whose main goals include attaining and maintaining healthy air quality; protecting the public from exposure to toxic air contaminants; and providing innovative approaches for complying with air pollution rules and regulations.

CALIFORNIA ENERGY COMMISSION -- The state's primary energy policy and planning agency. The agency was established by the California Legislature through the Warren-Alquist Act in 1974. It has seven core responsibilities:

- Developing renewable energy
- Transforming transportation
- Increasing energy efficiency
- Investing in energy innovation
- Advancing state energy policy
- Certifying thermal power plants
- Preparing for energy emergencies

CALIFORNIA PUBLIC UTILITIES COMMISSION (CPUC) -- A state agency created by constitutional amendment in 1911 to regulate the rates and services of more than 1,500 privately owned utilities and 20,000 transportation companies. The CPUC is an administrative agency that exercises both legislative and judicial powers; its decisions and orders may be appealed only to the California Supreme Court. The major duties of the CPUC are to regulate privately owned utilities, securing adequate service to the public at rates that are just and reasonable both to customers and shareholders of the utilities; including rates, electricity transmission lines and natural gas pipelines. The CPUC also provides electricity and natural gas forecasting, and analysis and planning of energy supply and resources. Its main headquarters are in San Francisco.

CTP -- Clean Transportation Program[6]

[4] https://www.forbes.com/sites/stevetengler/2022/02/16/charging-as-a-service-for-electric-vehicles-growing-as-a-market-offering/?sh=7942ad775939

[5] https://www.treasurer.ca.gov/caeatfa/

[6] https://www.energy.ca.gov/programs-and-topics/programs/clean-transportation-program

EaaS -- Energy as a service[7]

EHC -- Environmental Health Coalition

ELECTRIC VEHICLES (EV) -- A broad category that includes all vehicles that are fully powered by Electricity or an Electric Motor.

ELECTRIC VEHICLE CHARGING STATION (EVSE) -- Infrastructure designed to supply power to EVs. EVSE can charge a wide variety of EVs including BEVs and PHEVs.

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

INDEPENDENT OWNER OPERATORS (IOOS) – Self-employed truck drivers who own and operate his or her own drayage trucks.[8]

KILOWATT (kW) -- One thousand (1,000) watts. A unit of measure of the amount of electricity needed to operate given equipment. On a hot summer afternoon a typical home, with central air conditioning and other equipment in use, might have a demand of four kW each hour.

KILOWATT-HOUR (kWh) -- The most commonly-used unit of measure telling the amount of electricity consumed over time. It means one kilowatt of electricity supplied for one hour. In 1989, a typical California household consumes 534 kWh in an average month.

LOW CARBON FUEL STANDARD (LCFS) -- A set of standards designed to encourage the use of cleaner low-carbon fuels in California, encourage the production of those fuels, and therefore, reduce greenhouse gas (GHG) emissions. The LCFS standards are expressed in terms of the "carbon intensity" (CI) of gasoline and diesel fuel and their respective substitutes. The LCFS is a key part of a comprehensive set of programs in California to cut greenhouse gas emission and other smog-forming and toxic air pollutants by improving vehicle technology, reducing fuel consumption, and increasing transportation mobility options.

MDHD -- Medium- and Heavy-duty[9]

MEGAWATT (MW) - One-thousand kilowatts (1,000 kW) or one million (1,000,000) watts. One megawatt is enough electrical capacity to power 1,000 average California homes. (Assuming a loading factor of 0.5 and an average California home having a 2-kilowatt peak capacity.)

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

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[7] https://www.rff.org/publications/issue-briefs/energy-service-business-model-expanding-deployment-low-carbon-technologies/#:~:text=Energy percent2Das percent2Da percent2Dservice percent20(EaaS) percent20is percent20a,deliver percent20the percent20desired percent20energy percent20service.

[8] https://www.lawinsider.com/dictionary/independent-owner-operator

[9] https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics/medium-and-heavy#:~:text=Medium percent2DDuty percent3A percent20Vehicles percent20with percent20a,weight percent20classes percent207 percent20and percent208.

converting vehicles or engines obtained from the OEMs, or exchanging or rebuilding engines in existing vehicles.

PORT OF SAN DIEGO (POSD) -- The Port of San Diego who owns the two evaluated sites in the Blueprint.

RFI -- Request for Information

RFP -- Request for Proposals

TAAS -- Trucking as a Service

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