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West Coast Clean Transit Corridor Initiative

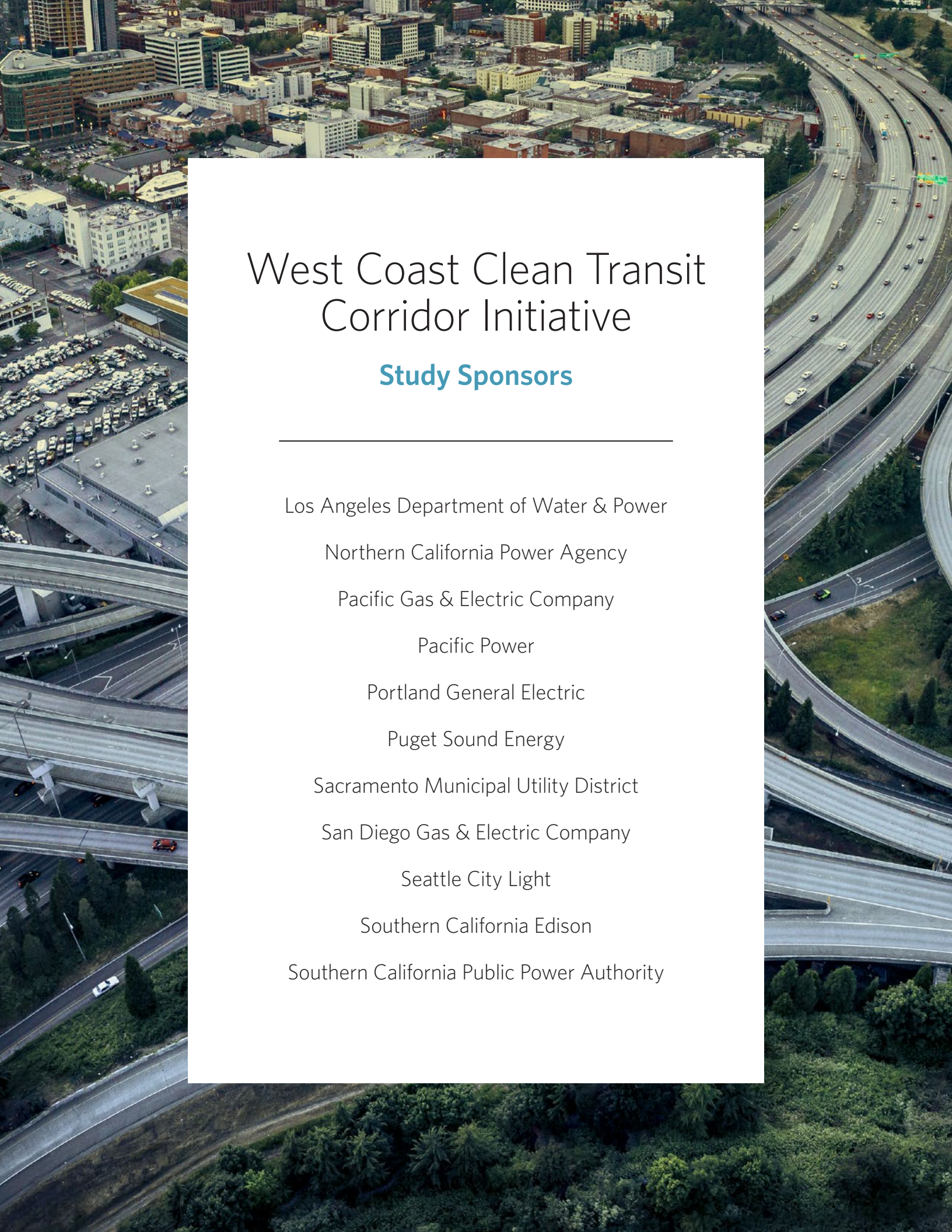
Interstate 5 Corridor

California, Oregon, Washington

FINAL REPORT

June

2020



West Coast Clean Transit Corridor Initiative

Study Sponsors

Los Angeles Department of Water & Power

Northern California Power Agency

Pacific Gas & Electric Company

Pacific Power

Portland General Electric

Puget Sound Energy

Sacramento Municipal Utility District

San Diego Gas & Electric Company

Seattle City Light

Southern California Edison

Southern California Public Power Authority

Executive Summary

As light-duty electric vehicles continue to gain momentum, electric utility companies in the West Coast states of California, Oregon, and Washington have conducted the West Coast Clean Transit Corridor Initiative study to assess the charging infrastructure medium- and heavy-duty electric trucks will need as they travel along the approximately 1,300-mile-long Interstate 5 (I-5) corridor and interconnecting highways.

The planning and design of charging sites for medium- and heavy-duty electric trucks are more complex than for sites that serve electric passenger vehicles.

Trucks such as cargo vans, delivery trucks, shuttle buses, and long-haul tractor-trailers are large motor vehicles usually used for transporting goods and materials. They require more space for maneuverability, serve a wider variety of vehicle types, and consume more electricity at a higher rate, which means they require more planning and coordination with electric utilities to make sure the electric grid is prepared to support them. Although heavy-duty trucks account for only 5 percent of the vehicles on US roads, they contribute a disproportionately high 23 percent of all transportation emissions. Both medium- and heavy-duty electric trucks are, therefore, an essential part of plans to transition to cleaner energy sources, and they are essential to achieving air quality and climate goals.

The West Coast Clean Transit Corridor Initiative, which includes nine electric utility companies and two agencies representing more than two dozen municipal electric utilities, studied how to facilitate the planning of electric charging sites for trucks along the entire length of I-5—a heavily traveled route that begins at the US-Mexico border and travels north along the West Coast to the US-Canada border. This report documents the study findings, and provides background information on the following topics:

- regulations, policies, and programs pertaining to vehicle electrification efforts
- trends in the electric truck market
- truck traffic volumes and trucking facilities along I-5

A technical memorandum was prepared in support of this report: *West Coast Clean Transit Corridor Initiative, Interstate-5 Corridor, Background Research Technical Memorandum*. It provides information on the following topics:

- background research on transportation electrification efforts
- input from electric truck manufacturers, charging technology providers, truck fleet operators, and other stakeholders
- existing and forecast truck market potential, including conventional and electric trucks
- trends in the charging technology market
- existing and planned electric truck charging infrastructure

This report makes recommendations for **27 conceptual locations for public charging sites along I-5**. The charging sites would be located about 50 miles apart, ideally no more than one mile away from the interstate. Through 2025, the study assumes that sites would serve mainly medium-duty (MD) trucks. As the electric truck market grows and the heavy-duty (HD) truck market expands beyond 2025, every other site would be upgraded to also serve HD trucks. This report also identifies a forecast with two time horizons: First, a near-term 2025 forecast with projections of MD electric trucks sales along with the proposed public charging infrastructure along I-5 to support them. Second, a longer-term 2030 forecast with projections of MD electric trucks sales as well as HD electric trucks sales along with the proposed expansion of every other MD charging site to meet the need to support HD electric trucks.

This vision for providing electric charging infrastructure along I-5 will require purposeful commitment and investments from different stakeholders. This report identifies challenges associated with electrification of MD and HD trucks traveling along the highway corridor, and provide recommendations to address these challenges.

The lessons learned from the West Coast Clean Transit Corridor Initiative can be applied to other regions and routes across the West Coast states and the rest of the nation.

Key Findings

Growth in Electric Vehicle Use. The last five years have witnessed extensive growth in light-duty (passenger) electric vehicles (EVs), driven by several factors, including improvements in battery technology. These advances in battery technology are also helping MD electric trucks reach cost parity—in terms of total cost of ownership—with conventionally fueled trucks. The advancements in battery technology have increased range and helped develop use cases for MD EVs while at the same time demonstrating the feasibility of widespread adoption of HD electric trucks in the future. By 2030, it is estimated that MD and HD electric trucks could make up over 8 percent of all trucks on the road in California, Oregon, and Washington. Chapter 3, Electric Truck Market Projections, provides more information regarding the future electric truck market.

Policies and Programs. This study identified more existing MD and HD truck electrification policies and programs in California compared to Oregon and Washington, where policies and programs have primarily focused on light-duty EVs. However, the policy context is changing. Oregon and Washington recently passed legislation that enables electric utilities to develop transportation electrification plans and creates grant and assistance programs for electrified transit. Oregon set a new statewide goal to transition its state-owned motor vehicle fleet to electric by 2035. Clean fuel policies in all three West Coast states continue to drive transportation electrification. Continued government support—through policies, regulations, and incentives—will be essential to advance the adoption of electric trucks by fleet operators.

Options for Expanding Infrastructure Programs. State, federal, and private programs that provide funding for charging infrastructure can help accelerate EV adoption. To date, electric utility infrastructure programs that support MD/HD EVs have primarily focused on fleets that charge at a single location (usually their home base). Expanding these programs to support charging for fleets that travel along corridors and rely on public fueling stations could further accelerate electric truck adoption.

Definitions

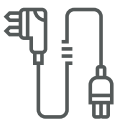
Light-duty electric vehicles are essentially passenger vehicles.

Medium-duty electric trucks include cargo vans, delivery trucks, and shuttle buses.

Heavy-duty electric trucks include long-haul tractor-trailer trucks and transit buses.

Chargers are electric fuel dispenser devices with one or more ports for charging an electric vehicle.

Charging sites are properties featuring electric vehicle chargers and associated equipment, parking spaces, lighting, and other amenities that accommodate electric vehicles and their drivers.



Ports are connector devices or cables that are part of a charger and connect to an electric vehicle when it needs to be charged.

Perspectives of Fleet Operators. Interviewed fleet operators (see the background research technical memorandum) identified the need for publicly available charging infrastructure in the three West Coast states to support their operations. They noted less investment in charging infrastructure in Oregon and Washington to date. Operators with limited funding but with an interest in deploying electric trucks stated that better access to public charging would accelerate deployment of EVs because their trucks could use public sites. Their electric trucks could use the public sites, allowing the fleets to avoid significant capital costs involved with installing charging sites on their own property. This will help drive the adoption of electric trucks.

Standardization of Infrastructure. A network of publicly available charging sites can help promote standardization of electric charging infrastructure for electric trucks. Just as drivers of conventional trucks today utilize standardized diesel fueling equipment at truck stops and gas stations, a standardized system of electric charging equipment for electric trucks would help drivers make the transition to EVs with more ease. Standard charging equipment would also allow fleets to plan their routes, knowing how long each stop would take and how far their vehicles could travel.

Range of Electric Trucks. The MD trucks projected to be on the road during the next five years will have an average range of approximately 90 to 120 miles. The HD electric trucks expected to be on the road during the next 10 years would have a much longer range: between 230 and 325 miles, on average. With a goal of keeping the electric truck batteries at an optimal charge of between 25 and 80 percent, the recommended distance between stops for charging for MD electric trucks is 50 miles, and for HD electric trucks is approximately 100 miles.

Proposed Charging Site Locations and Electric Loads. This study identified conceptual locations for 27 charging sites to support MD electric trucks along I-5 for a 2025 forecast. The sites would be spaced approximately 50 miles apart. Each would be equipped with up to ten 350 kW charging ports, for up to a 3.5 MW peak load.

As part of the 2030 forecast, which could develop sooner based on market conditions, 14 of the 27 MD charging sites would be expanded to accommodate HD electric trucks. These sites would be everyother MD site and thus spaced approximately 100 miles apart. Combined MD/HD charging sites would be equipped with up to an additional ten 2 MW charging ports (using the High Power Charging for Commercial Vehicles standard), for a maximum 23.5 MW peak load. This co-location approach would minimize the need for additional grid upgrades, reduce permit processing times, leverage land availability, and minimize costs.

For both MD and combined MD/HD sites, managed charging techniques or distributed energy resource solutions such as battery energy storage systems could be used to reduce peak load.

Electric Utility Capacity. Most electric utilities in California, Oregon, and Washington have enough capacity in urban areas along the I-5 corridor to support interconnections with the proposed MD charging sites. In rural areas, capacity constraints would be encountered for some electric utilities in the three West Coast states. The potential need to install new distribution circuits in rural areas could significantly increase the cost of a charging site interconnection, and would most likely require additional time and planning. In all locations, most loads over 10 megawatts would require extensive upgrades to the electric grid and, most likely, a new customer-dedicated substation. Therefore, there is a high probability the proposed HD charging sites would require a new substation and a new line interconnection. Load capacity in the grid changes frequently over time, and future load interconnections for electric truck charging infrastructure will require additional current-status coordination with electric utilities.

Challenges

Site Infrastructure Cost Uncertainty. The costs of building charging sites for electric trucks can be challenging to predict given the numerous variables, such as equipment selection, site location, distance from the electric utility interconnection, electric circuit capacity and associated upgrades, permits, and labor costs. Consequently, individual assessments that require in-person site visits are necessary on a site-by-site basis, making accurate system-wide assumptions difficult and time-consuming.

Public Funding Focuses on Vehicles. Government incentives designed to accelerate early EV deployment such as vouchers or grants, have mainly focused on vehicle cost or private infrastructure and not public infrastructure. Even though some grants provide incentives to invest in charging infrastructure, they are not multi-jurisdictional and available in all the states that a highway corridor crosses.

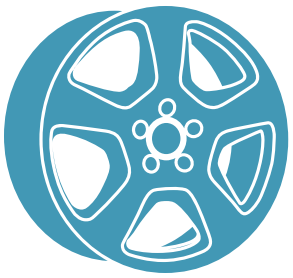
Timing of Infrastructure Upgrades. The proposed charging sites for electric trucks could take significant time to plan, permit, design, and construct presenting a chicken-egg dilemma to prepare infrastructure for future EV adoption. The proposed charging sites for MD electric trucks under the 2025 forecast could each take between one and two years to plan and build. The proposed charging sites to serve HD electric trucks under the 2030 forecast could each take between three and five years to plan and build.

Lack of Knowledge Regarding Electric Trucks. The background research conducted for this study (see the background research technical memorandum) found that fleet operators have difficulty understanding the range of electric trucks currently available and which trucks would work best for them. Fleet operators also struggle to identify the total cost of ownership for electric trucks.

Real Estate Constraints for Charging Sites in Urban Areas. Constraints in the availability of real estate for potential charging site locations in urban areas could pose a challenge. Although most industrial zones have the capacity for additional load interconnections, these areas tend to be densely developed, with limited large areas that would allow ingress and egress of electric trucks for charging. Most existing truck stops are not generally located in metropolitan areas, and identifying real estate in highly dense urban areas will be a challenge to overcome with proper planning.

ZERO EMISSION MD/HD

Electric Truck Availability



BY THE YEAR

2030

8%

MEDIUM & HEAVY-DUTY ELECTRIC TRUCKS

projected to be on the road in

California, Oregon & Washington

Opportunities

Electric Utilities as Drivers of Electric Truck Adoption. By taking a lead role in transportation electrification efforts on the West Coast, electric utilities have the opportunity to be important proponents of electric truck adoption—and the related benefits of cleaner air and reduced greenhouse gas emissions. Stakeholders such as fleet operators and electric truck manufacturers are very interested in infrastructure along I-5 and want to be engaged, and electric utilities could play a leadership role in this clean transit initiative.

Building on Existing EV Programs. Several electric utilities in California— Los Angeles Department of Water & Power, Pacific Gas & Electric Company, San Diego Gas & Electric Company, and Southern California Edison—have programs aimed at supporting the adoption of electric trucks. Other electric utilities in California, Oregon, and Washington may implement similar programs to move forward with the goals set for the I-5 corridor.

Partnerships. Establishing partnerships between electric utilities, electric truck manufacturers, charging equipment providers, fleets, and state agencies can encourage technology growth and adoption. Such partnerships will be essential for the successful implementation of infrastructure improvements. A high-profile corridor with public charging infrastructure, such as I-5, can be a catalyst for fleets to make larger investments in electric trucks. Truck stop operators—such as Love's Travel Spots, Pilot Flying J, TA-Petro, and others—can be essential partners to engage during the planning stages for building out the charging sites identified in the study.

Utility Efforts to Date

Nearly all the utilities interviewed for this study are developing or implementing programs promoting light-duty passenger vehicle electrification.

For electric trucks, several programs are under way:

Pacific Gas & Electric Company
Its EV Fleet program will prepare 700 sites for charging infrastructure to support 6,500 electric trucks—a $236 million investment.

San Diego Gas & Electric Company
Its $107 million electrification program was recently approved to support between 3,000 and 6,000 electric trucks.

Southern California Edison
Its Charge Ready Transport program will develop 870 charging sites to support 8,490 electric trucks—a $343 million investment.

Los Angeles Department of Water and Power
LADWP's Charge Up L.A. Program now includes rebate incentives to support installation of Medium Duty and Heavy Duty charging infrastructure for Class 3 through Class 8 Electric Trucks.

Recommendations for Moving Forward

As infrastructure providers, market facilitators, and trusted advisors, electric utilities are uniquely positioned to leverage this report's key findings and build on opportunities to overcome the challenges identified above. This report supports the proposal to develop 27 charging sites located 50 miles apart along I-5 to support MD electric trucks by 2025, with the ability to expand 14 of those sites to accommodate HD electric trucks by 2030.

Three areas of recommendations focus on electric system planning, building stakeholder collaboration, and the electric utility role promoting EV business cases, with specific next-step actions in each area. The 10 next-step actions detailed below are general across all three western states, and across all electric utilities in the study. Each state and each electric utility have their own regulatory environments, business goals and planning processes, which means the implementation of these steps will vary by state and electric utility. None of the recommendations are intended to be directed at any particular state or electric utility.

1) Begin long-term system planning and detailed site evaluations for development of corridor charging sites.

Begin a proactive approach to electric grid planning needs, irrespective of ownership models and exact site locations, to avoid electric utility lead times from becoming a barrier to charging deployment. *(Additional discussion may be found in Chapter 3, Electric Truck Market Projections, and in Chapter 5, Proposed Charging Site Locations Along the I-5 Corridor.)*

Prioritize deployment of MD charging sites close to the I-5 corridor while also planning for future expansion of those sites to accommodate HD charging. *(Additional discussion may be found in Chapter 3, Electric Truck Market Projections, and in Chapter 5, Proposed Charging Site Locations Along the I-5 Corridor.)*

Leverage results from this study to identify specific sites and begin conducting interconnection studies, right-of-way analyses, examination of real estate records for ownership and zoning, and specific site development cost estimates. *(Additional discussion may be found in Chapter 4, Truck Network Along the I-5 Corridor, Chapter 5, Proposed Charging Site Locations Along the I-5 Corridor, and in the background research technical memorandum in Chapter 4, Truck Market Overview.)*

2) Leverage the electric utility role as an Energy Advisor to enhance collaboration and engagement across a broad range of stakeholders.

Collaborate across the broad range of industry stakeholders through the creation of working groups, task forces, and joint pilot programs to plan infrastructure, determine use cases and charging patterns, and identify priority regions and locations for deployment. *(Additional discussion may be found in the background research technical memorandum in Chapter 3, Stakeholder Engagement.)*

Serve as a trusted infrastructure provider by developing a charging site design guideline document to educate site hosts on site design, safety standards, and charging station configuration to help lower site development costs. *(Additional discussion may be found in the background research technical memorandum in Chapter 2, Overview of Electric Vehicle Technology and Investment, Chapter 3, Stakeholder Engagement, Chapter 5, Electric Truck Charger Market Overview, and Chapter 6, Existing and Planned Electric Truck Charging Infrastructure.)*

3) Leverage electric utilities' expertise to develop ways of improving the experiences of site customers, fleet owners, and drivers and build positive business cases for MD and HD EVs.

Support the creation of robust, dependable, and long-term funding of incentive programs for electric truck technology. *(Additional discussion may be found in Chapter 2, Regulatory and Political Landscape, and in the background research technical memorandum in Chapter 6, Existing and Planned Electric Truck Charging Infrastructure.)*

Work closely with commercial customers to develop electrification program designs to help accelerate MD/HD EV adoption. *(Additional discussion may be found in the background research technical memorandum in Chapter 2, Overview of Electric Vehicle Technology and Investment.)*

Develop informational materials to help educate fleet operators on the grid regarding vehicle total cost of ownership tools as a means for fleet operators to gain a better understanding of how electric trucks would work for them. *(Additional discussion may be found in the background research technical memorandum in Chapter 3, Stakeholder Engagement.)*

Investigate the business case for potential ways to manage site peak loads (i.e., managed charging and Distributed Energy Resource solutions) and reduce costs for charging sites. *(Additional discussion may be found in Chapter 5, Proposed Charging Site Locations Along the I-5 Corridor.)*