CALIFORNIA ENERGY COMMISSION

CALIFORNIA NATURAL RESOURCES AGENCY

Clean Transportation Program

FINAL PROJECT REPORT

United Natural Foods, Inc. California Food Logistics System Electrification 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 to provide funding opportunities under the Clean Transportation Program to fund planning "blueprints" that will identify actions and milestones needed for implementation of medium- and heavy-duty zero-emission vehicles and the related electric charging and/or hydrogen refueling infrastructure. In response to GFO-20-601, United Natural Foods, Inc. 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-21-011 on July 15, 2021.

ABSTRACT

The transportation industry is moving towards a zero-emission future and United Natural Foods, Inc. is transitioning its fleet of trucks and trailer refrigeration units from diesel to zero-emission vehicles to meet California Air Resources Board regulations. To help prepare for its transition, United Natural Foods, Inc. partnered with Build Momentum, Inc. to apply for CEC funding for Blueprints for Medium- and Heavy-Duty Zero-Emission Vehicle Infrastructure. United Natural Foods Inc.'s zero-emission vehicle Blueprint aims to enable the company to equip its fleet with heavy-duty zero-emission vehicles and resilient charging or hydrogen refueling infrastructure, provide replicable strategies for deploying zero-emission medium and heavy-duty fleets, and articulate a holistic and futuristic view of transportation planning. The Blueprint accomplished a variety of objectives such as engaging internal and external stakeholders, developing performance specifications, identifying workforce education and training resources, advancing facility site design, developing a phased infrastructure deployment approach, and mapping the ecosystem of strategic partners and business model innovations. Through the Blueprint, United Natural Foods, Inc. was able to achieve its goal of defining a feasible approach and business model for its zero-emission vehicle transition. United Natural Foods, Inc.'s key findings include cautiously optimistic feedback from internal stakeholders, enthusiasm from internal leadership, identification of resources needed for workforce education and training, vetting of facility site designs, creation of a phased infrastructure deployment, and mapping of the ecosystem of strategic partners and business model innovations. The United Natural Foods, Inc. zero-emission vehicle Blueprint concludes that early movers in the medium and heavy-duty zero-emission vehicle space can expect significant benefits, despite some risks.

Keywords: United Natural Foods, Inc., transportation, zero-emission, Build Momentum, Inc., fleet, infrastructure, medium- and heavy-duty.

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Across California, transportation companies are planning a zero-emission future for transporting food. United Natural Foods, Inc., in collaboration with Build Momentum, Inc., seeks to transition its fleet of trucks and trailer refrigeration units from diesel to zero-emission vehicles to reduce their climate impact and meet California Air Resources Board Regulations.

Governor Newsom's Executive Order N-79-20, issued September 23, 2020, requires the California Air Resources Board to develop regulations to achieve 100 percent zero-emission medium and heavy-duty vehicles by 2045. In response, California Air Resources Board adopted the Advanced Clean Fleets regulation, which ends combustion truck sales in the state by 2036 and requires medium- and heavy-duty fleet operators to phase-in zero-emission vehicles. . The CEC is supporting this transition by funding the "Blueprints for Medium- and Heavy-Duty Zero-Emission Vehicle Infrastructure" solicitation under the Clean Transportation Program. Supported by this funding, United Natural Foods, Inc. and its partners created a blueprint for converting a portion of United Natural Foods, Inc.'s heavy-duty fleet from conventional diesel trucks to zero-emission trucks.

The Blueprint has three goals:

1. Enable United Natural Foods, Inc. to equip its fleet with heavy-duty zero-emission vehicles and resilient charging or hydrogen refueling infrastructure.
2. Provide replicable strategies for deploying zero-emission medium- and heavy-duty fleets.
3. Articulate a holistic and futuristic view of transportation planning with a particular focus on food movement and cold supply chain logistics through large distribution centers.

To achieve these goals and ensure the creation of a comprehensive plan, the Blueprint included the following objectives:

1. Engage internal and external stakeholders to develop a comprehensive and economical approach to rapidly deploying medium- and heavy-duty zero-emission vehicle infrastructure.
2. Define internal and third-party fleet operator and driver needs to identify performance specifications critical to United Natural Foods, Inc., customer, and logistics partner needs.
3. Identify workforce education and training resources to prepare maintenance technicians for medium- and heavy-duty zero-emission vehicles.
4. Advance facility site design to vet the design process and identify real-world operability considerations given existing utilization and smart-charging/hydrogen refueling opportunities.
5. Develop a phased approach to infrastructure deployment that maintains the flexibility to react to changes in a nascent market with rapidly evolving technology.
6. Map the ecosystem of strategic partners and business model innovations supported by zero-emission vehicle market adoption.

The following report describes the project's purpose, approach, activities performed, results, and advancements in science and technology. It provides a public assessment of the success of the project as measured by the degree to which goals and objectives were achieved and observations based on results obtained. These observations are drawn up to make recommendations for further projects and improvements to the zero-emission vehicle transition project management processes.

CHAPTER 1: Background

1.1 Problem Statement

The Medium- and Heavy- Duty (MDHD) Zero-Emission Vehicle (ZEV) market is nascent but growing quickly. However, product availability is just the beginning of the challenge for electrification. To accelerate HD ZEV fleet adoption in California and beyond, fleet operators positioned at the center of larger supply chains in key industries must become high-visibility pioneers and catalysts for broader transportation electrification across their ecosystem of influence, inclusive of key customers, suppliers, and logistics partners. As the largest distributor of natural foods in the western United States, and one of the largest food distributors in the nation, United Natural Foods, Inc. (UNFI) is uniquely positioned to lead electrification planning and deployment within California's food distribution ecosystem.

The UNFI Blueprint strategically and systematically gathered information, data, and insights to inform decision-making that may facilitate ZEV-related capital investment, partnership development, and infrastructure deployment.

Specifically, UNFI's Blueprint development process:

- Fostered productive dialogue, planning, and action across UNFI's diverse stakeholder groups, bringing together internal company areas of expertise across departmental siloes to harvest information and ideas from UNFI's diverse customers, logistics and technology providers, sustainability coalition partners, community leaders, and public agencies.
- Identified barriers for early adopters that can be solved with technical innovations – such as solar-enabled refrigeration trailers and complementary solar microgrids to ensure food preservation and electric truck reliability despite increasingly frequent grid outages.
- Created replicable and scalable processes for deploying capital that support accelerated electrification and minimize investment risk.
- Identified and quantified the business case and environmental benefits of MDHD ZEV adoption.

1.2 Recipient Background

United Natural Foods, Inc.

UNFI is a leading distributor of grocery and non-food products, and support services provider to retailers in the United States and Canada. UNFI serves a wide variety of grocery stores in California, including from the three facilities analyzed in the UNFI Blueprint – Gilroy, Riverside, and West Sacramento -- which collectively use over 200 heavy-duty trucks to ship food products. Each facility functions as a transportation hub for UNFI products and is the focal point of the company's transportation electrification efforts.

UNFI has already initiated their transition to zero-emission equipment by acquiring 53 electric Trailer Refrigeration Units, which keep food products cold in transit using power from batteries, rooftop solar panels, and regenerative braking systems instead of diesel. The company has an overarching goal to accelerate the deployment of electric vehicles (EVs) and related infrastructure to decarbonize its logistics chain, advance science-based sustainability targets, and support its partners in doing the same.

Build Momentum, Inc. (Momentum)

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.

1.3 Key Barriers

The primary barriers to ZEV adoption in the MDHD transportation space are cost and uncertainty associated with new technology adoption. Fleet managers and transportation executives are wary of purchasing equipment that relies on new technology and is not widely proven to be effective. Although electric vehicles have been common in the passenger, light-duty vehicle market for over a decade, MDHD ZEVs are only just entering the market. Nearly all ZEV models available on the market have a maximum range between 150 and 300 miles and take anywhere between one and four hours to fully recharge, compared to around 10 minutes with internal combustion engine vehicles. In addition to range concerns, ZEVs typically require operators to install and maintain zero-emission vehicle support equipment, such as EV charging or hydrogen refueling stations. This refueling equipment can increase the electricity consumption of a facility by two to four times and in some cases will necessitate grid upgrades at the facility. Uncertainty over these technical hurdles, along with a suite of additional factors, presents a significant barrier to ZEV adoption in the MDHD transportation sector.

Fleet operators' biggest barriers to adopting MDHD ZEVs and supporting infrastructure include:

- Vehicle availability
- Cost of entry
- Complexity of electrical system integration
- Vehicle range
- Fueling integration with fleet operations
- Space constraints
- Operational inertia

The perceived risks of ZEV financing include:

- Technology obsolescence
- Performance of unproven technology
- Unrealistic performance and cost expectations
- Proliferation of early-stage technology providers

Despite these barriers, transitioning to ZEV operations has the potential to significantly reduce fuel and maintenance costs. A large variety of incentives and grants are expected to bring ZEV vehicles to cost parity with ICE models by 2023 in some cases and early adopters will we able to meet emissions reduction regulations well ahead of schedule, while public funding for ZEV transportation projects is abundant.

1.4 Project Need and Technical Merit

Climate change and poor air quality are already impacting Californians throughout the state, and transportation contributes to more than 40 percent of the state's total greenhouse gas emissions. Because of the barriers to MDHD ZEV adoption mentioned in the previous section, there is a strong need to better understand how to transition fleets to zero-emission vehicles in a manner that is both cost and operational efficient. Identifying viable solutions to the barriers listed above is essential for easing the transition to zero-emission MDHD vehicles in the food distribution industry. In addition to developing an actionable plan for purchasing and implementing ZEVs and ZEVSE for a large food distribution company with national reach, the Blueprint may be used to guide other organizations as they upgrade their fleets to be in compliance with CARB's Advanced Clean Fleets regulation. The Blueprint Team, composed of UNFI sustainability employees and Momentum staff specializing in zero-emission transportation consulting, are well suited to scope and plan large scale MDHD fleet ZEV transitions.

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 ZEVs and supporting infrastructure.

2.1 Summary of Community and Stakeholder Engagement

The project team developed a Community Stakeholder Engagement Plan to identify the purpose of engagement with communities and stakeholders and the goals and intended outcomes of the outreach for each stakeholder segment. The plan was tailored to stakeholders and community organizations and was supported by the creation of education and outreach materials that reflected the multilingual needs of the community and that were appropriate for employees and leaders. Outreach and engagement activities were translated into a report that provides information from the project team's engagement with stakeholders, which included local governments, utilities, workplaces, business owners and operators, community-based organizations, community leaders, Native American Tribes and Tribal communities, local residents, and financial institutions.

Key findings from the report include the following conclusions:

1. Internal collaboration is essential: UNFI's Transportation, Operations, and Sustainability Teams all play a key role in transitioning its distribution fleet to EVs. The Teams need to continue to collaborate with each other and external groups to develop fleet improvement projects.
2. Utility financial subsidies are an important factor in encouraging the EV transition: Utilities broadly support fleet electrification efforts by covering upgrade costs and providing expertise for EV charging. Companies like UNFI take utility subsidies into serious consideration when making the financial case for EV transition and rely on these programs to make the transition cost-effective.
3. Permitting agencies need to have streamlined processes in place to make the permitting process easy for companies transitioning to EVs: All three local planning offices near UNFI facilities have fully implemented ZEV infrastructure permitting processes that require minimal facetime with city planners and provide online portals for submitting construction plans. This will make UNFI's EV transition at their Gilroy, West Sacramento, and Riverside facilities much simpler than at other facilities where permitting agencies have not streamlined their processes.
4. Community Based Organizations need to be engaged in the EV transition: Community Based Organizations are bandwidth constrained and largely unavailable for consultation. This barrier needs to be overcome for there to be real engagement with local communities in the EV transition.
5. Public agency funding is needed to encourage a successful EV transition: A multitude of federal and state regulatory agencies should continue to provide funding and financial incentives for MDHD ZEV fleet adoption.
6. Return on investment, company policy, and state and federal regulations are the primary drivers of ZEV and infrastructure investment: Financial partners and investors

are aware of regulatory changes and are interested in minimizing financial and operational risk and saving money while UNFI transitions to new technologies.

7. Identifying and partnering with Original Equipment Manufacturers, which provide solutions that work seamlessly together is essential for transitioning to zero-emission fleets: ZEV and refueling infrastructure Original Equipment Manufacturer are rapidly developing new zero-emission technologies to meet demand. There are a variety of products available on the market and most companies provide incentives to help their customers adjust to the risk of using their new technologies.
8. Education programs for MDHD ZEV technologies are lacking in California and need additional development: There are only two community colleges in the state that offer a ZEV MDHD workforce development program, but several community colleges throughout the state that provide either MDHD or ZEV programs. These would be good targets for state funding to develop MDHD ZEV training programs to meet the needs of the coming transition.
9. Collaboration with customers and business partners in the ZEV transition space requires extensive coordination and clear delineation of partner responsibilities and benefits: UNFI's industry partners are interested in collaborating and sharing knowledge to support their efforts to transition to zero-emission operations.

The large variety of outreach targets identified in the report necessitated a broad engagement strategy which limited deep connections to entities that were directly involved or impacted by the ZEV transition. Future blueprints would benefit from a smaller number of engagement entities, which would allow better defined and targeted approaches designed to foster collaboration. The Blueprint Team was capable of initiating and creating meaningful engagement with all entities that were necessary for successful Blueprint development.

2.2 Summary of Case Study and Strategic Guide

The UNFI Blueprint strategies and initiatives will be highly replicable for other fleets and geographies. To foster replication, UNFI Blueprint team members captured the key elements of fleet transition planning in a UNFI Best Practices in ZEV and ZEV Infrastructure Adoption Case Study and a companion Strategic Guide to Transportation Electrification and Energy Resilience in Food Distribution and Logistics. The Strategic Guide outlines the data needs required to appropriately scope a MDHD ZEV Fleet transition and the partnerships necessary to deploy MDHD ZEVs and supporting infrastructure. It also provides strategies for determining which existing ZEV and ZEVSE match the needs of food logistics and transportation companies. The Case Study applies the concepts outlined in the Strategic Guide to UNFI's specific operations and includes an analysis of the UNFI vehicle routes and operations that dictate their requirements for the new equipment. Both documents provide insight on how to fund the transition and ensure operational success upon implementation by addressing the primary concerns for the ZEV transition identified by stakeholder engagement. The Blueprint recommends that UNFI conduct a post-implementation analysis of its pilot ZEV fleet to further validate the findings of the reports and provide additional context to the challenges of large-scale equipment deployments.

2.3 Technical Advisory Council

The project team formed a Technical Advisory Council consisting of community and industry leaders with knowledge of freight logistics, transportation electrification, and related environmental issues. The Blueprint Team hosted two Technical Advisory Council meetings and numerous one-on-ones with members of the Technical Advisory Council to discuss technical elements of the ZEV transition. The first meeting introduced the project to the members, explained UNFI operations as outlined in the case study and provided an overview of the Task 3 deliverables to be completed over the course of the project. Following this, input on key technical partners, ideal ZEV technologies for analysis, and potential project challenges was garnered from the meeting's participants. The second Technical Advisory Council meeting and subsequent one-on-ones provided an overview of the research and scoping done in support of Task 3 and facilitated input on next steps for the project. The Technical Advisory Council also discussed various technological solutions to help finance the project long term. Generally, the formation of the Technical Advisory Council was beneficial to identifying project partners to support implementation the Blueprint and troubleshoot technical aspects of the various projects associated with it. Subsequent ZEV planning efforts would benefit from including technical advisory councils.

2.4 Financial Advisory Council

The project team engaged financial institutions and partners to ensure education, involvement, and commitment to participate in Blueprint implementation. The Financial Advisory Council reviewed business models designed during the Blueprint process, identified financial risks, and explored ways for the private sector to fund MDHD ZEV infrastructure across UNFI's refueling station network. The Financial Advisory Council's composition and operations functioned in the same way as the Technical Advisory Councils, with two meetings and subsequent one-on-ones aimed at creating a product dialogue about the funding and financing options associated with MDHD ZEV Fleets.

Key findings from the Financial Advisory Council meetings include the following:

- Insight into how UNFI finances vehicles, equipment, and infrastructure: UNFI typically leases trucks and equipment, although they may occasionally purchase vehicles outright. Leases are usually structured to return the vehicle or equipment to the leasing company at the end of the lease, although buyout provisions are possible at the end of a lease term. Infrastructure needs can be met through use of the UNFI Asset Based Lending Credit Facility. UNFI maintains their Asset Brand Lending at a level to meet their needs for inventory, infrastructure, and other expenses. UNFI is open to models used by energy service providers for equipment or microgrids.
- Understanding of UNFI's vehicle procurement decision-making process: The UNFI Transportation team monitors the needs at facilities throughout the country. They will identify the best vehicles to meet needs and will prepare requests as part of an annual budget process. Depending on the overall capacity of UNFI, it is possible that the request could be granted, or the overall cost adjusted. Within that budget, including potential lease costs, purchases will be made. The financial team will rely on the Transportation team to identify the specific makes/models to meet their needs.
- Exploration of charging-as-a-service options: This can be tailored to Time of Use rates to assure the least cost for fueling with electricity.

- Application of zero-emission vehicle incentives and grants. Vendors are aware of the potential for LCFS credits for equipment, vehicles, and infrastructure. Often the vendors will retain the available credits but are willing to release them to the user as part of their arrangements. UNFI is aware of and has utilized LCFS credits. In addition, UNFI is aware of many available grants and can factor these into their financial decision-making processes. In many cases the LCFS credits can be used to cover a substantial portion of the costs of equipment.
- Utilization of OEM's financing: Although some OEMs may have their own financing arms, UNFI does not use them as part of their menu of financing options.
- Awareness of California 2305 rule: The finance teams at UNFI are very aware of the California 2305 rule and the costs associated with continued use of fossil fuel vehicles. There is a recognition that avoiding the 2305 costs is a goal and is a major strategy in transitioning the goods movement industry to cleaner EVs.
- Availability of utility incentives: Much of the charging infrastructure costs can be covered by current utility incentives in the investor-owned service territories. Pacific Gas & Electric Company's (PG&E) EV Fleet program covers all electrical infrastructure costs up to the meter, and SoCal Edison's (SCE) Charge Ready Transport program covers all infrastructure costs on both the utility and customer sides of the meter.
- Financial benefit of charging management software: The software used for managing charging infrastructure is important to assuring costs are kept low. There is available software to integrate charging with Time of Use rates available to customers.
- Predictability of maintenance costs of vehicles and equipment: Some models for leasing, energy as a service, and outright purchase can include predictable and pre-set maintenance contracts to improve the predictability of costs to UNFI.
- Flexibility to accommodate urgent needs and timely decisions: Although UNFI operates on an annual budgeting cycle, it is possible to make expenditure decisions outside of the normal budget process for urgent or emergency needs. It is also possible to make decisions outside of the normal process to take advantage of situations such as grant opportunities.
- Usefulness of subsidies**:** Participants noted that the price of new technology has been largely offset through incentive programs through local, state, and regional programs focused on reducing emissions.

Key concerns raised in the Financial Advisory Council meetings include the following:

- Difficulty predicting lease costs. Lease costs are calculated with assumptions made about the residual value of the vehicle or equipment at the end of the lease. This has been challenging for EVs since there are several unknowns about the residual value. There is little track record on used EVs, so the market is relatively unknown. There are also questions related to the range of vehicles and this will impact the residual value. For example, as the mileage range of new vehicles increases, the value of used vehicles with shorter range decreases disproportionately. During a six-year lease, it is expected that new electric truck models released on the market will have a substantially higher range. Used electric trucks with very short range will have much lower value to customers. Consequently, leasing companies may be valuing the residual value of electric trucks at near zero.

- Reliability of EV cost projections. Although it is generally recognized that operating costs of electric vehicles is much less than diesel vehicles, there is some concern about the reliability of cost figures given the overall lack of experience with Class 8 trucks that have a rated range of over 150 miles.
- Limitations of supply chain. The demand for EVs is high and not immune to the supply chain issues affecting most industries. Participants noted that the only limiting factor we have encountered has been manufacturing capacity—the demand for EV continues to be very strong. What was originally thought to be a slow and tepid introduction quickly shifted to real demand as equipment has been proven to meet customer fleet needs.
- Fluctuating energy costs. UNFI is seeing fluctuations in energy prices at many of their facilities as well as increases in the cost of both electricity and diesel. To the extent that electricity costs for recharging vehicles/equipment can be more predictable/stable than diesel, it would be helpful in their decision-making.
- Inclusion of future planning. In order to right-size the needed electric infrastructure, assumptions should be made as to the size of the electric fleet in 5 or 10 years. Otherwise, transformers and other equipment could be undersized and need expensive upgrades later.

The meetings held by the Financial Advisory Council were successful in developing knowledge about funding ZEV fleets and are an important part of the Blueprint process. Future ZEV Fleet Transition efforts would likely benefit from an informal committee structure to enable issue specific engagement.

CHAPTER 3: Blueprint Development

The goal of this task was to gather the information necessary to develop a replicable and actionable Blueprint that guides future investment in MDHD ZEV infrastructure. Task 3 consisted of the following tasks and responsibilities, along with the reports outlining their completion.

3.1 MDHD ZEV and ZEV Infrastructure Analysis and Goals

The project team developed quantitative goals and specific, realistic timelines for installation and implementation of MDHD EV charging infrastructure within the project.

3.1.1 MDHD ZEV and ZEV Infrastructure Goals

Goal 1: Pilot promising ZEV technologies to validate operational performance, environmental benefits, and total cost of ownership.

Goal 2: Identify how ZEV transition may support UNFI's other strategic initiatives to deliver products more efficiently to our customers.

Goal 3: Incorporate data from existing pilot demonstrations into the ZEV planning process.

Goal 4: Engage with industry to accelerate the transition to EVs and share information to support broad industry adoption.

Goal 5: Chart a pathway to a full ZEV fleet transition.

Goal setting is an important part of any scoping process, and the established objectives from this task served as a guide to all future Blueprint processes.

3.1.2 Summary of Usage Patterns Report

MDHD vehicle usage and driving patterns were evaluated to maximize and optimize the type and placement of ZEV infrastructure to support the MDHD ZEVs. The findings were summarized in the Usage Patterns Report, which included an overview of the routes, duty cycles, and operations of UNFI trucks and trailers. Although much of the report's findings are not public information, the Team was able to determine that more than 50 percent of UNFI routes were within the existing ranges of market ready MDHD EVs. The findings from this report were critical to scoping the needs of replacement vehicles and support equipment.

3.1.3 EVSE Location Decision Matrix

To help determine the ideal placement for infrastructure, the Blueprint Team developed an EVSE Location Decision Matrix, which included a focus on cold supply chain requirements to support lowest-carbon movement of goods and produce across California. The Decision Matrix outlines which considerations are most important for siting EVSE infrastructure at transportation facilities and provides a framework for weighing these considerations. The primary considerations included in the Decision Matrix are as follows:

Feasibility

- Space: Ensure there is adequate space to park and charge electric trucks without limiting the movement of other vehicles. Ideal EV charger locations will allow trucks to easily access loading areas and the entrance of the facility. Fleet managers should determine if there is adequate space to accommodate both the vehicle and trailer during charging sessions, or whether trailers need to be unhitched before the tractor is moved to the charging station.

- Permitting: Assess potential permitting delays or barriers that may affect planned charging station deployment. These could include the presence of environmentally sensitive areas such as wetlands near a facility, zoning laws, or other jurisdictional matters. These should be assessed by speaking with local city or county planning departments. California AB 1236 requires cities and counties to adopt an ordinance that creates an expedited, streamlined permitting process for Electric Vehicle Supply Equipment (EVSE).

Costs

- Transformer/Energy Infrastructure Proximity: Place EV chargers as close as possible to transformers and other electrical infrastructure to minimize trenching distance for conduit installation, as well as to minimize related costs and installation time.
- Weatherization: Locate chargers away from areas that are prone to damage from flooding, landslides, excessive rain or sun, and other hazards that could damage the EVSE. Damage from the elements can increase maintenance costs, reduce the lifetime of equipment, and lead to costly equipment downtimes.

Utilization

- Ease of Access: Ensure that EV charging locations are easily accessible to ensure proper utilization. For overnight charging operations, ease of access is less important if there is a simple and clear path for EVs to access loading docks and the facility entrance. Consider traffic flow in and out of the facility to ensure vehicle charging does not delay vehicles or burden drivers.
- Location of electric Trailer Refrigeration Units chargers: electric Trailer Refrigeration Units chargers should be located where the trailers are usually parked, which is typically backed into loading facilities. Truck chargers should likely be sited elsewhere to avoid charging stations becoming obstacles in the middle of loading bays. Each facility's unique layout will determine how electric Trailer Refrigeration Units and EV charging infrastructure should be positioned relative to each other. Because electric Trailer Refrigeration Units and ZEVs might be implemented on different timelines, it is important to remember to future-proof any zero-emission charging equipment installations for subsequent fleet upgrades.

Other

- Site-specific concerns: Include and address any facility-specific concerns that may arise. These can be classified and ranked with the other elements of the matrix.

Although the EVSE Location Decision Matrix is a useful tool for determining which factors to consider when siting EVSE, a formal method for determining the EVSE placement should serve as a supplement to consultations with facility and fleet managers. EVSE placement should always be evaluated on a site-by-site basis.

3.1.4 Maps of optimal locations for MDHD charging infrastructure

The Blueprint Team identified and mapped optimal locations for MDHD ZEV infrastructure deployment and provided the rationale for being considered optimal. Their reports include potential sites, maps, and accessibility to travel routes identified for proposed MDHD ZEVSE.

The team consulted with EVSE vendors, utilities, and facility managers to determine optimal locations. Each facility considered in the Blueprint was examined on an individual basis that considered the proximity of existing electrical infrastructure to potential charging sites, the movement of vehicles in and out of each facility, space requirements, safety and environmental hazards, and all other considerations outlined in the EVSE Location Decision Matrix. The process of mapping optimal locations for charging infrastructure was valuable for preparing the team for installation and required several iterations of feedback from facility managers and EVSE infrastructure providers to identify optimal locations. This was a crucial step for planning EVSE infrastructure installation.

3.1.5 Microgrid Scoping Analysis

A high-level Microgrid Scoping Analysis was conducted for each priority facility. This analysis includes 1) Utility bill assessment; 2) Site assessment; 3) Storage system sizing calculation and modeling to simulate performance; 4) Financing assessment and pro forma that identifies relevant incentives and financing opportunities, including but not limited to the Self-Generation Incentive Program and other state, local, and federal programs, as well as solar power purchase agreements, tax credits and accelerated depreciation, and other private sector financing strategies.

The estimated return on investment of solar at each facility changed during the Blueprint process when the California Public Utility Commission's restructured its Net Energy Metering program, which drastically cut the value of onsite solar production.

3.1.6 Summary of Smart Charging Assessment

The Blueprint Team developed a Smart Charging Assessment that defines an optimized charging strategy based on 1) utility rates, which includes demand charges and TOU pricing; 2) rates of charge that satisfy operational needs; and 3) UNFI fleet operational needs and constraints and input from UNFI's relevant data streams. The resulting optimization will help minimize operational costs and electrical capacity upgrades and charging capacity requirements and is presented in the Smart Charging Assessment.

3.1.7 Charging Infrastructure Plans for UNFI Depots

The project team partnered with EV charging companies InCharge Energy and WAVE Wireless to create charging infrastructure plans and installation timelines for the UNFI distribution centers analyzed in the Blueprint. The plans provide UNFI two charging technologies, conductive plug-in and inductive wireless charging, for consideration at the three distribution centers identified.

Analysis:

Approximately 25 percent of UNFI routes at each of the three distribution centers, Riverside, Gilroy, and West Sacramento, are under 150 miles, and 65 percent of routes are under 250 miles. At the Gilroy distribution center, the average route is 220 miles per day. Based on currently available battery technology and range, UNFI could electrify at minimum 25 percent of its fleet routes with electric trucks with a range of 150 miles and 50 percent of its fleet routes with electric trucks with a range of 275 miles without stopping to charge enroute. If UNFI were to opt for Tesla Semis, which have an advertised range of 500 miles, over 90 percent of its routes could be electrified without significantly changing its schedule to accommodate for opportunity charging.

Infrastructure Deployment Options:

InCharge developed two charging scenarios for each UNFI distribution center analyzed in the ZEV Blueprint. The first scenario is based on a 1:1 ratio of charger per truck, while the second scenario is based on fewer but more powerful and flexible chargers at a 1:2 ratio. WAVE Wireless modeled scenarios for the deployment of three truck models and provided recommendations for the number of 125 kW or 250 kW chargers needed at UNFI depots to return all trucks to a full state of charge during the 12-hour charging window.

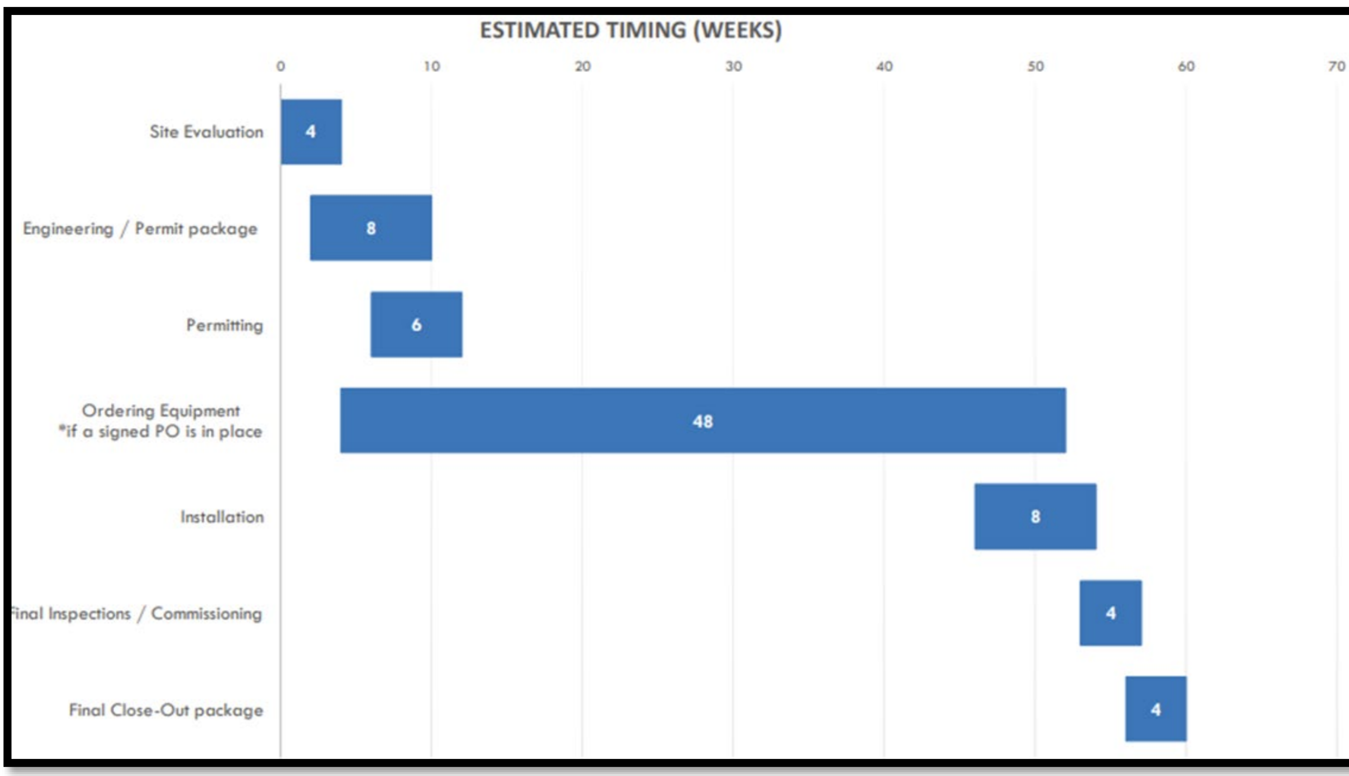
Charging Infrastructure Deployment:

InCharge and WAVE Wireless provided charging infrastructure plans, installation timelines, and maps for each UNFI distribution center analyzed in the ZEV Blueprint. Plug-in charging locations were chosen in parking areas, away from loading docks, to avoid conflicts with trucks and charging equipment, and in consideration of other planning factors. Wireless charging plates were in the ground at loading docks and will not interfere with loading operations.

3.1.8 Installation Timeline

EVSE installation timelines vary by facility. The following Gantt chart indicates the average timing of each step in the installation process. Due to long lead times and delays in acquiring switch gears, installation can take up to 60 weeks. Without long wait times for equipment, the entire process is expected to take around 26 weeks.

Figure 1: Estimated EVSE Installation Timeline Provided by InCharge to UNFI



Source: InCharge

3.2 Technology and System Analysis

To support subsequent Blueprint efforts, the Blueprint team conducted preliminary research conducted on zero-emission HD transportation technologies. The report covers key considerations such as battery specifications, range limitations, and charging infrastructure, including cutting-edge technologies such as vehicle-to-grid integration, megawatt charging standards, and automated charging solutions. The report provides a detailed overview of available technologies and deployment strategies for businesses, including consideration of environmental and economic impacts. These insights can be used to help organizations like UNFI make informed decisions about which technologies to adopt to meet their specific business needs while reducing their carbon footprint. Overall, the report emphasizes the importance of careful planning and strategic thinking when transitioning to zero-emission HD transportation to maximize the benefits of these technologies and mitigate potential challenges.

3.2.1 Summary of System and Technology Presentation

The Blueprint Team summarized their analysis in a report that outlines the possible combinations of technologies and systems that offer the best mix of economic, environmental, and technical performance specific to UNFI and its California operations. The report was successful in familiarizing project members with the array of technologies available to support the MDHD fleet transition. The capabilities of ZEV products are rapidly developing, which will push decision making over the final combination of technologies selected until the moment UNFI is ready to implement the Blueprint. Furthermore, executive decision making over how to fund and allocate capital expenditures is required before committing to any specific vehicles or equipment purchased for the ZEV transition.

3.2.2 Summary of Key Findings on MDHD Technology and Systems

The Usage Patterns Report and Summary of Key findings will guide the Blueprint's implementation. These deliverables, which have been incorporated into the Blueprint, provide insights on the following:

- EV charging behaviors and grid impacts associated with the EV transition.
- Project data requirements for scoping the new MDHD fleet and supporting infrastructure capabilities.
- Project partner responsibilities
- Decision making tools for technological feasibility Contextualizing and mitigating risks Software applications and data sets to scope energy infrastructure and smart charging for MDHD EVs
- Electrical and service capacity available to support new EV charging infrastructure.

The information provided in this subtask was key to the Blueprint's development. Many of the activities to support its creation overlap with activities performed in Task 2.

3.3 Projected Electrification Impacts and Stakeholder Benefits Report

The project team developed a Projected Electrification Impacts and Stakeholder Benefit Report that summarizes the expected benefits of the ZEV transition, including:

- Types of jobs that will be created for the local community and regional industries
- Strategies that will enable training, education, and readiness for the local workforce to obtain the skills, knowledge, and ability to develop, support, and maintain MDHD ZEV fleets and participate in the broader zero-emission industry
- Goals to reduce GHG emissions, criteria air pollutants, and toxic air contaminants for the region, and the emitters at the local level that would need to be targeted

- Economic, health and safety, and consumer benefits that will accrue to low-income, disadvantaged communities, and priority populations in the vicinity of leading UNFI Distribution Centers

Broadly, workforce development associated with ZEV transitions should be tailored to address eight knowledge gaps that were identified:

1. Zero-emission technology
2. Battery theory
3. Battery safety
4. Electrical connections in corrosive environments
5. Charging components
6. Mechanical aptitude
7. Equipment maintenance
8. General electrical

The Blueprint team found that organizations that employ workforce development strategies to reskill workers and build worker resilience will equip workers and the organization with the strategies and tools needed to adapt to a range of uncertain futures. They recommend that to address current knowledge gaps, UNFI should build on its existing program to upskill its workforce proactively. UNFI currently employs a multitude of training programs covering topics such as driver education, electric Trailer Refrigeration Units, safety protocols, and operations. Expanding its training programs to include ZEV and EVSE content, and empowering employees to train themselves on the job can help upskill UNFI's workforce to the level required for the ZEV transition. The team also identified strategies, partnerships, and trainings to facilitate workforce development outside of the knowledge gaps that were identified.

UNFI has well developed GHG and other emissions reduction goals, which were identified in the report and contextualized with the MDHD ZEV transition. CalEPA priority populations near UNFI facilities that could benefit from the transition were identified and mapped. This included an assessment of the health and economic benefits that were included, and the types of jobs that would be supported by MDHD ZEV fleets. Broadly these jobs fit 10 categories:

1. Maintenance
2. Manufacturing
3. Civil and road work
4. Grid connection and electrical
5. Grid reinforcement
6. Electricity generation
7. EVSE installation
8. ZEV and EVSE operation
9. Battery recycling
10. Vehicle and equipment sales

The tasks outlined in this report were beneficial to developing an understanding of community impacts. Despite the volume of useful information that can be used to better understand community benefits, much of the information derived in this task is not directly relevant to the implementation of the Blueprint.

CHAPTER 4: Project Fact Sheet

The goal of this task was to develop an initial and final project fact sheet that describes the CEC-funded project and the benefits resulting from the project for the public and key decision makers. This fact sheet identifies the way the Blueprint supports innovation in the MDHD transportation space and the anticipated benefits to California.

Innovations in the MDHD transportation space that were identified include:

- Productive dialogue, planning, and action across UNFI's diverse stakeholder group, bringing together internal company areas of expertise across departmental siloes to harvest information and ideas from UNFI's diverse customers, logistics and technology providers, sustainability coalition partners, community leaders, and public agencies.
- Barriers for early adopters that can be solved with technical innovations, such as solar-enabled refrigeration trailers and complementary solar microgrids to ensure food preservation and electric truck reliability despite grid outages.
- Replicable and scalable processes for deploying capital that support accelerated electrification and minimize investment risk.
- Siting requirements and opportunities to ensure charging access for users of intermodal rail to truck transfer facilities (where feasible and appropriate).
- Identification of the business case and environmental benefits of MDHD ZEV adoption.

Benefits that were expected to accrue to California and Californians include:

- Decreased utilization of petroleum-based fuels through the adoption of ZEV technologies.
- Reduced climate pollutants associated with tailpipe emissions as ZEV technologies do not have any mobile emissions.
- Lowered GHG emissions and lifecycle carbon intensity of ZEVs in comparison to traditional fossil fuels vehicles.
- Reduced environmental burden on low income and disadvantaged communities who are often located along major transit routes and disproportionately exposed to tailpipe emissions and air contaminants that affect respiratory health.

CHAPTER 5: 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.

5.1 Blueprint Overview

The final Blueprint compiles all the information held in the reports and analyses that were identified in the previous sections into a single document that can be used to holistically understand electrification of food distribution fleets. This task represents the culmination of the entire Blueprint.

The final Blueprint process proceeded as follows:

- Integrate findings from the Technical Tasks into the Blueprint Outline
- Complete Draft Blueprint
- Incorporate feedback as provided by the CAM
- Prepare Final Blueprint

For the Final Blueprint, the project team synthesized the significant outcomes and information derived from all outreach and technical tasks listed in the SOW. The Blueprint includes important takeaways and lessons learned from outreach, technical analysis, and financial planning (summarized in Chapters 2-3 above). The Blueprint also provides a set of recommended activities for UNFI to pursue, to ensure it and its stakeholders successfully overcome the hurdles and barriers to fleet electrification that the Blueprint identifies.

5.2 Blueprint Conclusions

The UNFI ZEV Blueprint concludes that early movers in the MDHD ZEV space can expect significant benefits, despite some risks. The potential rewards outweigh the risks, especially with implementation strategies that minimize risk, such as a phased-in approach that starts with pilot projects at UNFI distribution facilities like Gilroy that have truck routes suited for electrification.

One of the most challenging risks to control is delay in deployments. EV fleet deployments can often take longer to implement than originally planned due to lead times in securing electrical capacity from utilities and equipment delivery lead times for both the vehicles and EVSE components. As more of the industry transitions to required ZEVs, it is reasonable to expect that the scale and availability of utility incentive programs, federal and state grants, vouchers, and tax incentives will diminish, like what happened in the solar industry. Thus, there are risks associated with inaction since delaying ZEV deployment may lead to missed opportunities for supporting funds.

On the other hand, the cost of EVs and EV-related components is decreasing, and technology is continuously improving, leading to a more favorable total cost of ownership. This trend is demonstrated by the CARB forecast, which suggests that as components and battery prices fall, total cost of ownership is expected to become more favorable.

Through this Blueprint, UNFI was able to achieve its goals of engaging its stakeholders, exploring partnerships, defining a feasible approach, and mapping a business model of a ZEV transition. Its key findings for each of these goals are summarized below:

- Internal stakeholder groups provided cautiously optimistic feedback on the ability of ZEVs to meet service requirements.
- Internal leadership showed enthusiasm for managing the change in how the organization delivers its service in alignment with the capabilities of ZEVs.
- External stakeholders were contacted and included in identifying critical performance specifications needed to meet UNFI, customer, and logistics partner needs.
- The resources needed to accommodate workforce education and training were identified to support maintenance technicians for MDHD ZEVs.
- The facility site designs were vetted to resolve any real-world operability considerations to meet mixed utilization between ZEVs and ICEVs.
- A phased infrastructure deployment was created that maintained the flexibility to react to changes in a nascent market with rapidly evolving technology.
- The ecosystem of strategic partners and business model innovations supported by ZEV market adoption were mapped to facilitate ongoing collaboration.

5.3 Blueprint Next Steps

The following list of next steps provides an actionable roadmap for UNFI to pursue upon completion of the Blueprint. They are included in the Blueprint after the conclusions.

1. Determine which regulatory pathway to pursue to comply with the draft Advanced Clean Fleet regulation.
2. Evaluate zero-emission truck options, starting with readily available battery-electric trucks, to pilot at one or more of the three distribution centers analyzed in this Blueprint.
3. Secure funding for the chosen trucks from HVIP and other funding programs.
4. Evaluate charging infrastructure technology options and initial deployment. recommendations at the three distribution centers to support pilot trucks.
5. Select vendor for charging infrastructure for pilot trucks, with future proofing considerations to support future infrastructure. Ensure vendors can deliver electric supply equipment on schedule.
6. In coordination with chosen EVSE vendor, apply to SCE Charge Ready Transport and/or PG&E EV Fleet program to begin EVSE installation planning and process for charging infrastructure.
7. Engage SCE and PG&E to coordinate the reservation of spare capacity on circuits and begin preparation and coordination to provide new line drops or upgraded transformers as needed to support new electrical demand.
8. Secure funding for the chosen charging infrastructure from EnergIIZE and other funding programs.
9. Select placement for initial EVSE, with consideration for placement of future infrastructure as the ZEV fleet grows.
10. Develop a UNFI fleet transition schedule, with corresponding infrastructure deployment.

11. Determine capital budget required for initial infrastructure and vehicle deployment, including grant funding, finance, and LCFS options.
12. Evaluate expected savings from conversion to zero-emission equipment to determine return on investment from the transition.
13. Continue to monitor all available and anticipated funding, voucher, and tax credit sources.
14. Work with the authorities having jurisdiction to streamline approval process for selected ZEV infrastructure.
15. Determine operations and maintenance plans for the deployed vehicles and infrastructure.
16. Deploy EV charging management strategies to improve the financial advantage of electric vs. diesel trucks.
17. Evaluate benefits of deploying solar and/or battery energy storage systems to offset new electricity usage from truck electrification.

GLOSSARY

ALTERNATING CURRENT (AC)—Flow of electricity that constantly changes direction between positive and negative sides. Almost all power produced by electric utilities in the United States moves in current that shifts direction at a rate of 60 times per second.

BATTERY ELECTRIC VEHICLE (BEV)—Also known as an "All-electric" vehicle (AEV), BEVs utilize energy that is stored in rechargeable battery packs. BEVs sustain their power through the batteries and therefore must be plugged into an external electricity source in order 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.) responsible for energy policy. The Energy Commission's five major areas of responsibilities 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.

COMPRESSED NATURAL GAS (CNG)—Natural gas that has been compressed under high pressure, typically between 2,000 and 3,600 pounds per square inch, held in a container. The gas expands when released for use as a fuel.

DIRECT CURRENT (DC)—A charge of electricity that flows in one direction and is the type of power that comes from a battery.

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

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE)—Infrastructure designed to supply power to EVs. EVSE can charge a wide variety of EVs, including BEVs and PHEVs.

INTERNATIONAL BROTHERHOOD OF ELECTRICAL WORKERS (IBEW)—Acronym for International Brotherhood of Electrical, a labor union with a local chapter in the Ontario, CA region.

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 emissions. The LCFS standards are expressed in terms of the carbon intensity of gasoline and diesel fuel and their respective substitutes. The LCFS is a key part of a comprehensive set of programs in California that aim cut greenhouse gas emissions and other smog-forming and toxic air pollutants by improving vehicle technology, reducing fuel consumption, and increasing transportation mobility options. v

MEDIUM- AND HEAVY-DUTY (MDHD)—Vehicles that are classified based on their gross vehicle weight rating. Medium-duty vehicles have a gross vehicle weight rating between 10,001 and 26,000 pounds. Heavy-duty vehicles have a gross vehicle weight rating greater than 26,000 pounds.

MEMORANDUM OF UNDERSTANDING (MOU)—a formal agreement between two or more parties. It outlines the parties' intentions to act, conduct a business transaction, or form a new partnership. These agreements are not legally binding, but they signal the parties' willingness to move forward with a contract.

NATIONAL RENEWABLE ENERGY LABORATORY (NREL)—The United States' primary laboratory for renewable energy and energy efficiency research and development. NREL is the only Federal laboratory dedicated to the research, development, commercialization, and deployment of renewable energy and energy efficiency technologies. Located in Golden, Colorado.

SOUTHERN CALIFORNIA EDISON (SCE)—One of the nation's largest electric utilities, which delivers power to 15 million people in 50,000 square miles across central, coastal, and Southern California, excluding the City of Los Angeles and some other cities.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)—The air pollution control agency for all of Orange County and the urban portions of Los Angeles, Riverside, and San Bernardino counties. This area of 10,740 square miles is home to over 17 million people—about half the population of the whole state of California. It is the second most populated urban area in the United States and one of the smoggiest. Its mission is to clean the air and protect the health of all residents in the South Coast Air District through practical and innovative strategies.

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