



March 16, 2020

Honorable Chair Mary D. Nichols
Honorable Board Members
California Air Resources Board
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Electric Truck Charging Infrastructure

We write today to respond to questions Board Members asked at the December 12, 2019 California Air Resource Board (CARB) meeting, and in support of the strongest possible Advanced Clean Truck Rule. In this letter, we focus on available resources for building out the needed charging infrastructure, as this is key to industry adoption of medium- and heavy-duty (M/HD) electric vehicles (EVs). As you'll see from the material we have assembled below, earmarked utility spending, state and local programs, and a highly trained electrical workforce are all available to successfully address infrastructure requirements and support the transition we need.

The document contains an FAQ followed by details on activities within the state in the short- and long-term. We urge board members to consider this information and vote in support of an aggressive ACT rule with zero-emission truck sales targets that ensures California can meet its statutory climate and clean air requirements.

Frequently Asked Questions

How do trucks charge?

The majority of trucks are Class 2b-3 (62% or 1,040,000 of all trucks) and can charge using the same infrastructure as light-duty EVs: type II chargers at depots and public DC fast chargers (DCFCs) elsewhere. According to CARB, most trucks average below 100 miles per day. Class 4-8 and Class 7-8 tractors with daily routes less than 200 miles will primarily charge at depots and may require higher-power chargers or DCFCs. Class 4-8 and Class 7-8 tractors with daily routes greater than 200 miles will charge at depots and need access to DCFCs along their routes.

Where will the money come from for charging infrastructure?

Utility infrastructure programs approved by the CPUC can pay for much of the near-term depot charging for M/HD vehicles. The investor owned utilities (IOUs) are already approved to invest over \$700 million in M/HD charging infrastructure through 2024 and may invest more via their EV-utility programs subject to approval by the California Public Utilities Commission (CPUC). Other corporate investments include those by Electrify America, ChargePoint and the National Association of Truck Stop Operators, and other electric vehicle service providers. Additionally, numerous state programs provide financial support for charging infrastructure, including the Energy Commission's (CEC) Clean Transportation Program and CARB's Low Carbon Fuel Standard (LCFS).

How many chargers are needed?

The CEC is developing an infrastructure planning tool for M/HD trucks called HEVI-Pro, as part of its infrastructure needs report due by the end of 2020. This tool will help determine how many chargers of what type and where are required to meet future transportation electrification growth. This will inform CPUC and utility infrastructure funding and implementation plans. EVI-Pro is an existing tool that estimates a need for 250,000 charging points (including at least 10,000 DCFCs) by 2025 to support 1.5 million passenger ZEVs.¹ There are currently about 40,000 public chargers

¹ EVI-Pro forecasts light-duty charging infrastructure needs, however, these chargers can also be used by Class 2b-3 trucks.

with funding available for another 128,000 for a total of nearly 170,000. The charging rates of these public chargers would be compatible with electric pickup trucks and many delivery vans.

What state and local efforts exist to support infrastructure deployment?

There are a host of state and local activities to support infrastructure deployment, including the Governor's Office of Business and Economic Development (GO-Biz) permit streamlining efforts as well as the Transportation Electrification Partnership in the Greater Los Angeles region to accelerate zero-emissions goods and people movement and planning for almost 200,000 chargers by 2028.

How are electric M/HD trucks being integrated to the grid?

The large IOUs and POUs all have attractive electricity rates for M/HD EVs approved or pending. There are also several multi-agency working groups, together with industry and stakeholders, exploring ways to extract value from vehicle-grid-integration, improve interconnection processes, and identify actionable policy changes to support M/HD vehicles.

Are there enough trained electricians to build and maintain the infrastructure?

There are 30,471 California state-certified general electricians with most of the necessary skills required for constructing and maintaining EV infrastructure. More than 1,400 California electricians have gained advanced skills through the Electrical Vehicle Infrastructure Training Program (EVITP). Hundreds more graduate annually. There are also 7,937 registered electrical apprentices in the state.

IBEW/NECA estimates that California may build as many as 300,000 charging stations, of all types, over the next three to five years. A small fraction of state-certified general electricians can easily exceed that goal. 1,400 EVITP electricians, 1,182 non-EVITP electricians, and 2,582 electrical apprentices could install 521,424 charging stations in three years, of which 70,128 are heavy commercial/industrial and DCFCs. That's a total of 5,164 electrical workers, out of a total of 38,408, or only 13%. The current electrical workforce considerably exceeds California's projected EV infrastructure needs in all categories, including trucks.

Do charging standards exist?

Nearly all electric trucks use the Combined Couple Standard or CCS Type 1 standard, which is the same for cars. This standard supports charging levels of up to 350kW. CharIN, an international standard-setting organization that has all the major legacy and new zero-emission truck manufacturers as members, is working on updating the CCS standard to support high-power charging above 350kW, which may be needed in certain use cases.

Connectivity, payment, smart charging, and other standards also exist. The CEC is currently reviewing regulations to require new public chargers to use these standards, among other improvements.

Introduction

Meeting the infrastructure needs to support the deployment of medium- and heavy-duty (M/HD) electric vehicles (EVs) is technically and economically feasible and happening in a growing market today. CARB can confidently adopt a robust rule, knowing that agencies, industry, and other stakeholders are engaged in a comprehensive set of programs to meet the needs of M/HD EVs now, in the short-term, and the years ahead.

Missing from the market are the electric trucks. Robust sales standards in the Advanced Clean Trucks (ACT) Rule that ensures California can meet its statutory climate and clean air requirements will unlock additional resources and infrastructure investments. Zero-emission transportation requirements at ports and municipalities, fleet clean truck goals and future requirements, and air district's indirect source rules for ports, railyards, and distribution hubs are all relying on a robust ACT Rule. The California Air Resources Board (CARB) has a long history of setting ambitious and achievable rules with ongoing reviews as a safeguard.

Technical Feasibility

Building the necessary infrastructure and integrating M/HD electric trucks to the electric grid is both technically feasible and offers a host of potential benefits to the electric system. The expected generation and capacity needs for transportation electrification over the next half-century are below historical annual growth rates. For example, there have been periods of rapid electric demand growth in the U.S. associated with home electrification and addition of household appliances (1970-75) and with the widespread adoption of air conditioning (1990-95). These years saw annual generation increases equal to the needs of tens of millions of EVs.² The challenge of transportation electrification is not technological.

Class 2b-3 trucks make up about 60 percent of California's truck fleet. Many Class 2b-5 electric trucks can charge using low- to medium-power charging stations (6.6-19 kW AC) with the existing standardized connectors that light-duty vehicles use; some may use higher-power (50 kW) direct current fast chargers (DCFCs). Therefore, the potential power needs of the majority of California's trucks exist within the utility realm of familiarity. These vehicles can also take advantage of public charging infrastructure, which will help defray costs and increase utilization rates. For most fleets, charging will occur off-peak during periods of lower demand, therefore increasing usage of existing generation assets and putting downward pressure on rates for all customers.

Near-Term Activities: 2020-2025

Near-term investments in charging infrastructure are already substantial.

Investor Owned Utilities (IOUs): The three largest electric IOUs in California that serve roughly three-quarters of the state, are approved to collectively invest [over \\$700 million in M/HD charging infrastructure by 2024](#) to support 18,000 to 21,000 charge ports at about 2000 sites. Assuming

² [Summary Report on EVs at Scale and the US Electric Power System](#)

customers select the best-fit use cases (e.g., single shift), more than one electric truck can use a charge port each day. After this initial investment, the IOUs may seek another tranche of funding in future proposals before the CPUC, supported in part by a robust ACT rule.

- *Pacific Gas & Electric*: make-ready infrastructure and charging station rebates approved for M/HD EVs and forklifts³ at \$236.3 million for at least 640 sites. The approved investment is through 2023. An additional \$7.3 million is approved for three pilot projects.⁴
- *Southern California Edison*: make-ready infrastructure and charging station rebates for M/HD EVs and forklifts approved at \$342.6 million for at least 870 sites.⁵ An additional \$4 million pilot program is approved for transit bus infrastructure. The approved investment is through mid-2024.
- *San Diego Gas & Electric*: make-ready infrastructure and charging station rebates for M/HD EVs and forklifts approved at \$150.5 million for about 300-600 sites. The approved investment is through 2024. An additional \$11 million is approved for four pilot projects.⁶

Public Owned Utilities (POUs): POUs supply roughly a quarter of California's population and load and are developing their own M/HD programs. For example, large POUs such as the Los Angeles Department of Water and Power (\$15 million to the Port of Los Angeles over five years and \$13 million spent on commercial chargers) and the Sacramento Municipal Utility District have programs to support M/HD charging infrastructure.

Additional Investments:

- CARB's [Low Carbon Transportation Program](#) funds several competitive grant programs that may pay for infrastructure. In FY 2019-2020, \$40 million was allocated for the Heavy-Duty Demonstration and Pilot Projects and another \$14 million from several smaller programs, as well as a portion of the one-time \$135 million FARMER program.
- CARB's [Community Air Protection Program](#) expanded to include M/HD charging infrastructure when the legislature appropriated an additional \$245 million in FY 2018-19. This adds to the original \$250 million one-time appropriation.
- CEC's [Clean Transportation Program](#) offers roughly \$30 million/year for HD EV infrastructure and \$32 million/year for light-duty EV infrastructure. The program also provides about \$2.5 million/year for workforce development.
- California air districts grants include funding for M/HD infrastructure but vary annually. For example, the South Coast Air Quality Management District provides about \$2-4 million/year.
- The [Carl Moyer Memorial Air Quality Standards Attainment Program](#) is expected to provide about \$94 million/year to fund on- and off-road clean transportation projects. Funds may be used for HD infrastructure. However, the program historically has not been a significant source of funding for electrification.

³ The three IOUs' expenditures on forklifts are limited to 10%. A site may have both electric trucks and electric forklifts.

⁴ For Idle Reduction pilot (25 charge ports under construction), for infrastructure for EV School Bus pilot, and the Medium/Heavy Duty Fleet Customer Demonstration.

⁵ SCE also completed two pilots at the Port of Long Beach (cranes and yard trucks).

⁶ For a Port Electrification pilot, Green Shuttle pilot, School Bus pilot, and Fleet Delivery pilot.

- Electric Vehicle Service Providers (EVSP), such as EVGo, Greenlots, and ChargePoint, are continuing to install private and public chargers throughout the state.
- Electrify America installed chargers at 400 stations nationally, with another 220 in process, and plans to install 800 by 2022. Recent installations include high-power 350 kW chargers.
- ChargePoint and the National Association of Truck Stop Operators (NATSO) signed an MOU to leverage \$1 billion of public and private financing to install charging infrastructure at 4,000 truck stops nationally over the next ten years.
- Low Carbon Fuel Standard (LCFS) credits go to the owners or tenants of the property where charging occurs, or to a designated aggregator or charging network provider. The LCFS was [recently enhanced](#) to incentivize DCFC deployments at public locations.
- Separate incentives for truck purchases help ensure other funding sources can focus on infrastructure. Vehicle purchase programs include the [Volkswagen Environmental Mitigation Trust](#), [Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project](#) (HVIP), and the \$7,500 federal tax credit for Class 2b-3 EVs.⁷

Transportation Electrification Planning: State agencies and industry stakeholders are actively planning for widespread EV adoption and grid integration to address gaps and maximize benefits. Efforts include:

- The CEC, as required by AB 2127, will complete by the end of 2020 a transportation electrification infrastructure needs assessment in collaboration with CARB and the CPUC. For the assessment, the CEC is working with Lawrence Berkeley National Lab to develop a tool to model future M/HD infrastructure needs to be called HEVI-Pro. This tool will help determine how many chargers of what type and where are needed to meet future growth. This will inform CPUC and utility infrastructure funding and implementation plans. This builds on the successful EVI-Pro, which estimates a need for 250,000 charging points (including at least 10,000 DCFCs) by 2025 to support 1.5 million ZEVs.⁸ There are currently about 40,000 public chargers with funding available for another 128,000 for a total of nearly 170,000. The assessment will inventory existing infrastructure and identify where additional deployments are necessary for light-, medium-, and heavy-duty as well as off-road vehicles to meet the state's transportation electrification goals.
- The CEC has launched a [Load Management Rulemaking](#) to evaluate, among other things, ways to integrate M/HD EVs to improve grid operations and support high renewable penetration.
- CARB is [required to update the 2016 Mobile Source Strategy](#) by the end of 2020. The update will contain a comprehensive state strategy for M/HD in which infrastructure impacts and electricity demand will feature prominently.
- The CEC and CPUC's [Electric Program Investment Charge Program](#) (EPIC) provides roughly \$162 million/year for research to accelerate the transformation of the electricity sector to integrate clean energy technologies.
- Several multi-agency working groups, together with industry and stakeholders, are identifying ways to extract economic value from vehicle-grid-integration, improve

⁷ Unless the manufacturer reaches the 200,000-unit cap.

⁸ EVI-Pro forecasts light-duty charging infrastructure needs, however, these chargers can also be used by Class 2b-3 trucks.

interconnection processes, and identify actionable policy changes for M/HD vehicles. This includes the [Vehicle-Grid Integration](#) (VGI) working group, the recently completed Vehicle-to-Grid (V2G) alternating current interconnection working group, and Rule 21 (Interconnection) Working Group.

- By the end of 2020, the CPUC is required by SB 676 to adopt strategies and metrics to maximize the use of cost-effective EV grid integration, including M/HD vehicles.
- The large IOUs and POUs have attractive rates for M/HD EVs approved or pending.⁹ For example, customers charging on PG&E's reformed commercial EV rate will pay about 50 percent less than if they used gas or diesel and will save about 30-50 percent on their monthly bills compared to previous commercial rates.

Permit Streamlining: Per AB 1236, cities and counties must adopt an ordinance that creates an expedited, streamlined permitting process for EV charging infrastructure. However, compliance has varied, in part due to a lack of awareness. To improve compliance, GO-BIZ released a [permitting guidebook](#) in 2019, shares [best practices](#), hosts public workshops, and is [mapping and scoring](#) each jurisdiction. Importantly, the compliance score helps inform funding awards from the [On-Road Heavy-Duty Voucher Incentive Program](#).

Workforce: The substantial infrastructure investments are a tremendous economic engine and leading to a growing demand for a highly-skilled workforce. Potential concerns about training a new EV infrastructure workforce are misplaced. While charging infrastructure includes emerging technology elements, EV projects are primarily comprised of conventional electrical construction skills. In California, those skills are largely held by C-10 electrical contractors and their electrical employees who are state-certified general electricians. In fact, according to California law, electrical work—including EV infrastructure—must be performed by those contractors and electricians.

Are there enough to meet current and future needs? There are currently 30,471 California state-certified general electricians (including union and non-union).¹⁰ They have most of the necessary skills required for EV infrastructure. Electricians are also gaining additional EV charging infrastructure electrical technology skills through the [Electrical Vehicle Infrastructure Training Program](#) (EVITP). More than 1,400 California electricians¹¹ have these advanced EVITP certified skills, with hundreds more graduating annually. There are also currently 7,937 registered electrical apprentices in the state.¹²

IBEW/NECA estimates that California may build as many as 300,000 charging stations, of all types, over the next three to five years. That goal can be exceeded easily with a small fraction of state-certified general electricians in the following categories:

⁹ SCE, SMUD, LADWP, and Liberty have approved rates. PG&E's is approved and will be implemented by Oct 2020. SDG&E's proposed commercial rate for EVs is pending before the CPUC.

¹⁰ California Contractors State Licensing Board as of February 3, 2020

¹¹ Electrical Vehicle Infrastructure Training Program as of January 27, 2020

¹² California Department of Apprenticeship Standards as of February 21, 2020

- Residential single family, level 2: Crews consist of one EVITP certified electrician and one apprentice. They can install at least eight chargers per week or 1,152 in three years. 218 EVITP electricians and 218 apprentices will install 251,136 units in three years.
- Multi-family residential and commercial, level 2: Crews consist of one EVITP certified electrician, one non-EVITP electrician, and two apprentices. They can install at least two commercial chargers per week or 288 in three years. 695 EVITP electricians, 695 non-EVITP electricians, and 1,390 apprentices will install 200,160 units in three years.
- Commercial/industrial and DCFCs: Crews consist of one EVITP certified electrician, one non-EVITP electrician, and two apprentices. They can install at least one charger per week or 144 in three years. 487 EVITP electricians, 487 non-EVITP electricians, and 974 apprentices will install 70,128 units in three years.

In summary, 1,400 EVITP electricians, 1,182 non-EVITP electricians, and 2,582 electrical apprentices would install 521,424 charging stations in three years. That's a total of 5,164 electrical workers, out of a total of 38,408, or 13.4%. Therefore, the current electrical workforce and training considerably exceed California's projected EV infrastructure needs.

Additional Efforts:

- The Transportation Electrification Partnership is a multi-year partnership among local, regional, and state stakeholders to accelerate transportation electrification and zero emissions goods movement in the Greater Los Angeles region in advance of the 2028 Olympic and Paralympic Games. A goal is to have 84,000 chargers installed for people movement and 96,000 chargers for goods movement by 2028.
- The San Pedro Ports' are gaining experience from pilot projects to deploy infrastructure to support their 100% zero-emission ground equipment by 2030 and 100% zero-emission drayage by 2035 targets.
- Over a dozen firms are providing infrastructure services (e.g., trusted energy advisor role or turnkey solutions), including large corporations such as Black & Veatch and Burns & MacDonald.

Long-Term Activities: Beyond 2025

Long-term infrastructure investments and programs to manage grid integration are substantial and signal an increasing preparedness to scale up M/HD EV deployment. Moreover, as the market matures, economies of scale increase, and industry participants become more familiar with electric vehicle technology, many issues or perceived issues will be resolved. Fleets, focused on cost, will self-select the best-fit, low-cost use cases too.

- M/HD EV TCO studies show no need for incentives (except the continued LCFS) after 2030 and in some classes even well before 2030.¹³
- The state activities listed above, such as the Mobile Source Strategy update, infrastructure needs assessment, and permit streamlining, will continue to enable M/HD electric truck

¹³ Low-mileage fleets such as refuse trucks and school buses may need additional assistance.

deployment. At the same time, efforts to unlock the value of vehicle-grid integration will progress at the CEC, CPUC, and with industry stakeholders.

- Programs such as the Clean Transportation program and EPIC will continue to fund infrastructure development. Future appropriations are likely as the state looks increasingly to transportation electrification to meet its climate and clean air objectives.
- With almost eight thousand electrical apprentices currently registered in California, workforce training will continue and expand as needed.

Conclusion

Although the infrastructure to meet the expected demand from large-scale M/HD vehicle electrification is significant, similar expansions have occurred in the past. Hundreds of millions of dollars in approved investments stand ready; money that must be spent before the ACT rule comes into effect and only represents the first tranche of spending. Meanwhile, new commercial rates are either approved or pending that will further save fleets money and better integrate M/HD EVs onto the grid. State agencies such as GOBiz are working to streamline infrastructure permitting and the CEC is assessing infrastructure needs--all with robust engagement from a wide range of experts and stakeholders. Legitimate concerns exist; however, numerous efforts are underway within California and nationwide to address these challenges.

A strong ACT and fleet rule will remove uncertainty and send a clear regulatory signal to other agencies and stakeholders. Aggressive zero-emission truck targets will further drive infrastructure planning and investment.

Sincerely,

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