



## Envisioning a path to zero emission trucks in California

**Government:** California, United States

**Region:** North America

**Sector(s):** Clean transportation

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### Summary

Heavy-duty trucks are a major contributor to air pollution and climate change in California and are still overwhelmingly powered by diesel engines. In line with its goal of becoming carbon-neutral by 2045, the state is working to transition the heavy-duty truck sector to zero emission vehicles. This transition is grounded in the Advanced Clean Trucks Regulation, which sets requirements for zero emission truck sales and reporting.

At the same time, the government is demonstrating the feasibility of these technologies in applications ranging from port drayage<sup>1</sup> trucks to inter-city delivery trucks. It is also working with partners in the public and private sector to plan infrastructure deployments, raise awareness, and understand the costs and benefits of these technologies. Although the adoption of zero emission freight trucks will take several decades, California is planning ahead for a successful transition and setting an example for other jurisdictions to follow.

### Long-term policy

California's long-term transition to zero emission trucks will be driven by firm policy signals, led by the Advanced Clean Truck Regulation. This regulation, still in proposal stage, sets requirements for the share of zero emission trucks in different segments for the years 2024–2030. By 2030, 50% of class 4-8 (7 tons or greater) straight truck sales must be zero emission, as well as 15% of all other trucks. These requirements are accompanied with extensive reporting requirements regarding freight activity and vehicle stock in order to inform future policies.

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<sup>1</sup> Drayage trucks are on-road, diesel-fueled, heavy duty trucks that transport containers and bulk to and from the ports and intermodal railyards as well as to many other locations.



The Advanced Clean Trucks program under development by the California Air Resources Board (CARB) follows the example of the Advanced Clean Cars program and its Zero Emission Vehicle (ZEV) program, which has spurred California to become the leading passenger electric vehicle market in North America. In particular, the ZEV regulation has encouraged car manufacturers to make ZEV models available in California, creating a more competitive marketplace and allowing customers to select the models which best fit their needs. A zero emission truck regulation may encourage a similar dynamic for medium- and heavy-duty trucks.

### Learning by doing

In order to evaluate the barriers to transitioning to zero emission trucks, as well as their benefits, California has supported trials and demonstrations of numerous technologies and applications. Table 1 below provides details of several demonstration projects funded by California.

Location	Application	Powertrain	State funding	Key partners
Carson (Interstate 710)	Tractor trailer, on-highway	Overhead catenary electric; some hybrid powertrains	\$3 million from CEC	South Coast Air Quality Management District (SCAQMD), Port of Long Beach, LA Metro
Ports of Oakland, Los Angeles, Long Beach, San Diego, and Stockton	Port drayage trucks	Battery electric and plug-in diesel hybrid	\$20 million from CARB	SCAQMD, other state air districts, ports
Fresno, Bakersfield, Stockton, Merced	Class 6 linen delivery trucks	Battery electric	\$7.1 million from CARB	San Joaquin Valley Air Pollution Control District, Motiv, CALSTART
San Bernardino and Los Angeles rail yards	Rail yard tractors	Battery electric	\$9.1 million from CARB	BNSF railway, BYD, CALSTART
Los Angeles and Riverside counties	Heavy-duty straight trucks, yard tractors	Battery electric	\$45 million from CARB	Volvo, SCAQMD, Southern California Edison
Port of Los Angeles and Los Angeles metro area	Regional tractor-trailers	Fuel cell	\$41 million from CARB	Port of LA, Toyota, Kenworth, UPS,

### Infrastructure

As with light-duty vehicles, charging or fueling infrastructure is critical for the transition to zero emission trucks. Additionally, the higher power usage of zero emission trucks requires novel solutions and poses additional challenges for the power grid, construction, and safety. Recent research indicates that, at high scale, electric charging infrastructure could cost roughly \$27,000 per medium-duty delivery truck and \$70,000 per long-haul freight truck, about 10% of the total cost of ownership.<sup>2</sup>

The state government and several partners have helped to fund heavy-duty charging and refueling infrastructure:

- The HVIP (Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project) has been funded by cap and trade revenue through CARB and implemented in partnership with CALSTART since 2009. The project provides incentives of up to \$30,000 per vehicle for charging equipment or \$100,000 per vehicle for hydrogen fueling equipment for fleets purchasing heavy-duty ZEVs.

<sup>2</sup> Dale Hall and Nic Lutsey. *Estimating the infrastructure needs and costs for the launch of zero-emission trucks [White Paper]* (ICCT: Washington DC, 2019). <https://theicct.org/publications/zero-emission-truck-infrastructure>



- Many of the demonstration programs funded by cap and trade funds include provisions for infrastructure. For example, the \$45 million Low Impact Green Heavy Transport Solutions (LIGHTS) project with Volvo and Greenlots includes charging stations integrated with onsite solar and storage installed at warehouses across Southern California.
- In 2018, the California Energy Commission (CEC) awarded \$23 million for hydrogen and charging infrastructure for freight vehicles at the Ports of Los Angeles and Long Beach.
- With the approval of the California Public Utilities Commission, California's three largest investor-owned utilities – Southern California Edison, Pacific Gas & Electric, and San Diego Gas & Electric – are investing close to \$700 million in medium- and heavy-duty charging infrastructure, potentially covering up to 18,000 charge points.

### Collaboration

The state government is working closely with a number of public and private stakeholders to set the long-term transition in motion by creating local strategies, raising awareness with businesses, and building accompanying infrastructure.

- Los Angeles, California's largest city, was an initial signatory to the [Fossil Fuel Free Streets Declaration](#) and is working to develop zero emission freight solutions to promote air quality and climate goals. The nearby cities of Santa Monica and West Hollywood are also signatories to the Declaration.
- The Ports of Los Angeles and Long Beach are testing zero emission drayage trucks and charging stations and have promoted low emission trucks through their Clean Trucks Programs for over a decade. The ports have set a goal of transitioning to 100% zero emission drayage trucks by 2035.
- Utilities in the states of Oregon and Washington are partnering to design a corridor of electric fast-charging stations along the length of the U.S. west coast.
- Several of the state's Air Pollution Control Districts are actively promoting low and zero emission trucks, including the Bay Area Air Quality Management District, South Coast Air Quality Management District, and San Joaquin Valley Air Pollution Control District. Their support has included providing funding, managing incentive programs, and working with local industry to set long-term pathways.

### Enabling conditions

California's transition to zero emission freight follows decades of strong vehicle policy, including the light-duty ZEV regulation as well as heavy-duty greenhouse gas and NO<sub>x</sub> emissions standards. Through this experience with long-term policymaking, agencies have formed strong relationships with manufacturers, suppliers, fleets, and research organizations. The state has robust sources of revenue from the Cap and Trade system and the Low Carbon Fuel Standard, which support demonstrations and incentive programs.

### Key lessons learned

- The transition to zero emission trucks is a decades-long endeavor. Long-term policy goals will be key for manufacturers and fleets to plan their vehicle lineups and purchases.
- Infrastructure will be a key hurdle to the widespread adoption of zero emission trucks. Advance planning and consultation with fleets will be needed to ensure that this does not slow adoption. Electric utilities can help to deploy this infrastructure at a reasonable cost.
- Early demonstrations in partnership with key allies – including local governments, ports, fleets, utilities, and NGOs – are crucial to proving the technology, generating awareness, and determining a path toward the long-term transition.



This case study was developed as part of the ZEV Community, an initiative co-hosted by the Under2 Coalition and the ZEV Alliance Secretariats, in partnership with C40 Cities and the U.S. Climate Alliance.

The ZEV (zero emission vehicle) Community brings together all levels of governments to share and learn about exciting ZEV initiatives taking place around the world. All participants and members of these networks are invited to take part in the ZEV Community.

#### **More information**

To get involved in the ZEV Community or to receive more information, please contact Alice Ryan, Under2 Transport Policy Manger: [aryan@theclimategroup.org](mailto:aryan@theclimategroup.org)

For more information on California's Advanced Clean Trucks program, please visit the program website at [ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks](http://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks) or contact Paul Arneja, Air Resources Engineer at the California Air Resources Board ([Paul.Arneja@arb.ca.gov](mailto:Paul.Arneja@arb.ca.gov)).