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Obstacles to Zero-Emission Vehicle Goals: Are We There Yet?

By Kathleen Balthrop Havener

California has the fifth-largest economy in the world. Perhaps the largest segment of the country's interstate commerce flows to, from, and through California. Thus, when California imposes a rule on heavy-duty trucks operating in California, that rule applies to tens of thousands of motor carriers and truck drivers who reside in other states, Canada, and Mexico. California is a leading consumer and producer of agricultural and manufacturing products, and significant portions of the country's imports and exports pass through California seaports. The state accounts for:

- 15 percent of U.S. gross domestic product;
- 23 percent of U.S. agriculture production;
- 15 percent of U.S. manufacturing;
- 40 percent to 50 percent of U.S. import container trade;
- 2 busiest ports in North America (Los Angeles and Long Beach);
- $382 billion worth of goods (178 million tons) imported from other states and $506 billion (90 million tons) exported to other states; and

- $179 billion worth of goods (37 million tons) imported internationally through California to the other 49 states.

Trucks play a significant role in this economic activity. Trucks account for:
- 82 percent (by weight) of all shipments originating in California;
- 12 million tons of goods carried through California for the international market; and
- 788 million tons of goods carried intrastate.

But trucking is reportedly the largest source of ozone and greenhouse gas emissions in California, as it is in most of the United States. Although trucks represent a small subset of the total number of vehicles on the road, they emit disproportionately high percentages of pollutants. California adopted the Advanced Clean Truck Act in 2020 to address those emissions. In 2021, California adopted the Advanced Clean Truck Regulation that requires vehicles ranging from small delivery vans to shuttle buses to 18-wheelers to transition away from diesel fuel in favor of less-polluting battery electrics and hydrogen fuel cells. In August 2022, California's Air Resources Board approved regulations that will prohibit the sale of gasoline- and diesel-powered cars and light-duty trucks by 2035. Starting with 2024 model-year heavy-duty vehicles, the new rule requires truck manufacturers to sell an increasing percentage of electric models annually through 2035. Forty percent of big rigs, half of all cargo and travel vans, and 75 percent of box truck and dump truck sales need to be zero-emissions by 2035. The ultimate goal is for Californians, including heavy-duty truck drivers, to be driving zero-emission vehicles (ZEVs) before midcentury. Other states have instituted or are planning to enact similar rules.

The unprecedented heat of the summer of 2023 should have eliminated doubt from our minds about the ravages humans, and especially industry, have caused to the global environment. California and other states are imposing lofty aspirational goals for reducing the emissions of heavy-duty trucks on our nation's highways. These goals are important ways of encouraging the transition to zero-emission motor vehicles and vastly reducing greenhouse gas emissions.

But is achieving these goals possible? Overlooking the potential dormant Commerce Clause issues of state-by-state imposition of regulations mandating what trucks are permitted to operate on each state's highways, the practical obstacles seem insurmountable, even assuming aggressive efforts to develop the infrastructure necessary to support a ZEV system.

Lack of Charging Stations

Perhaps you drive an electric vehicle. How often do you see electrical plug-in chargers for cars at grocery stores, airports, and parking lots? Of course, you will find them. But in a parking garage, for example, there may be two or three charging centers for every 100 parking spaces. And how long does it take to charge an electric car? The U.S. Department of Transportation says that charging via a common residential 120-volt (120V) AC outlet (Level 1 charging equipment) can take 40 to 50 hours (or more) to charge a battery-powered electric vehicle (BEV) to 80 percent from empty and five to six hours for a plug-in hybrid electric vehicle (PHEV). Level 2 charging equipment offers higher-rate AC charging through 240V (in residential settings) or 208V (in commercial settings) electrical service. Level 2 chargers can charge a BEV to 80 percent from empty in four to ten hours and a PHEV in one or two hours. A third type of charging system, direct current fast charging (DCFC), can perform rapid charging along heavy-traffic corridors at installed charging centers. DCFC equipment can charge a BEV automobile to 80 percent in just 20 minutes to one hour. Note, however, that DCFC equipment doesn't work with most PHEVs (*Charger Types and Speeds*, U.S. Dep't Transp. (June 22, 2023)). But a minimum of 20 minutes to charge a BEV (at a DCFC charging center) or an hour for a plug-in hybrid vehicle (at a Level 2 charging center) is a far cry from a quick stop at the service station to "fill 'er up, please."

The time required for charging doesn't take into account the cost of installing the charging equipment. The higher the level, the quicker the charge, of course, but also, the more expensive it is to install. A public Level 2 charger might cost $2,000 out of the box, and according to a study from the International Council on Clean Transportation, DCFCs can cost between $28,000 to $140,000 to install (Michael Nicholas, *Estimating Electric Vehicle Charging Infrastructure Costs Across Major U.S. Metropolitan Areas* 1–11 (Int'l Council on Clean Transp., Working Paper No. 2019-14, Aug. 2019). Nor do these figures account for the low range predicted for vehicles on a full charge—approximately 200 miles for a heavy-duty truck and perhaps closer to 300 miles for a new top-of-the-line Nissan Ariya. To make matters worse, charging equipment is often dependent on the vehicle manufacturer's design. Tesla chargers work for Teslas but not for Volkswagens, Chevrolets, or Fords. Somehow, the charging equipment must be made consistent, which means overcoming the manufacturers' interests in their protected proprietary information to surmount this obstacle.

Lack of Public Infrastructure

The infrastructure currently does not exist on a scale necessary to efficiently recharge an ever-increasing number of electric vehicles, from cars to heavy-duty commercial trucks engaged in interstate hauling. To accommodate heavy-duty ZEVs, recharging centers would need to have sufficient electrical power and equipment to simultaneously recharge numerous heavy-duty trucks both expediently and continually. Data regarding the availability of recharging centers is demonstrably uneven: As of 2019, California was home to 22,620 public recharging centers, or fully one-third of the 68,800 recharging centers in the United States (John Coulter, *USA – 68,800 EV Chargers; CA – 22,620 EV Chargers; LA – 1,959 EV Chargers*, Current EV (July 22, 2019)). Other states have few. In 2019, North Dakota had 36 public chargers, Alaska just 26 (Elaine S. Povich, *Got an Electric Car? Great! Where Do You Plug It In?*, Stateline (Jan. 2, 2020)).

As one industry product manager opined:

> If there were 10 electric heavy-duty trucks, all charging at 1 MW [megawatt], that's 10 MW—about the same as a semiconductor plant. So that's kind of the scale that we're looking at—when something that used to show up on our grid as a few hundred kilowatts, a truck stop, says, "Hey we're gonna be installing two-megawatt chargers," now that truck stop looks like a semiconductor plant. That means that the grid has to grow in different ways that might not be part of the plan yet. The grid to support that demand might be in industrial parks, not at a fueling station next to the highway.

Bengt Halvorson, *Electric Island: First US Charging Station for Electric Semis Is Ready for Megawatt Fast-Charging*, Green Car Reps. (Apr. 22, 2021) (quoting Joe Colett, product manager for emerging technologies at PGE).

Forgive me for this errant thought. Won't the production of all that energy have its own large carbon footprint? Is a zero-emission vehicle actually zero-emission if every time it's charged, it's consuming electricity derived from fossil fuels? We are far from achieving 100 percent renewable electric power.

Consider, too, the strain in recent years on the North American power grid. The media reports rolling blackouts that occur especially as temperatures soar and air conditioning units are gobbling up electricity. In 2021, there were approximately 1,600 heat-related deaths in the United States, a 59 percent uptick from only four years earlier and a 439 percent increase from 2004 (*How Many People Die from Extreme Heat in the US?*, USAFacts (Aug. 22, 2023)). *Newsweek* estimates that the number of heat-related deaths in the United States in 2022 exceeded 1,700 (Giulia Carbonaro, *Extreme Heat Is Killing More Americans*

Than Ever, Newsweek (July 8, 2023)). Many of us have experienced power outages during and after natural disasters. How will we get necessary food, water, and other assistance to communities in need if there is no power at charging centers to accommodate an all-electric fleet?

Lack of Vehicles

In 2022, only 60,000 heavy-duty ZEVs were sold globally, and 52,000 of those were sold in China (Int'l Energy Agency, Global EV Outlook 2023 (Apr. 2023)). Compare that figure to the approximately 11 million diesel-powered commercial vehicles operating on U.S. roads today (*43% of US Commercial Trucks Powered by Diesel*, MH&L (Nov. 13, 2019)). Can heavy-duty truck manufacturers meet the demand if 40 percent of big rigs sold in California (and elsewhere) must be ZEVs only 11 years from now?

A typical new Class 8 diesel truck with a sleeper cab costs approximately $150,000 to $160,000. In contrast, current estimates for a comparable ZEV truck range from $250,000 to $300,000—nearly double the cost of a diesel-powered truck. The zero-emission mandate will force interstate motor carriers and truck drivers to purchase entirely new ZEV vehicles at a cost of well over $200,000 per truck. It is difficult to imagine that small-business motor carriers or independent drivers will be able to bear the costs of replacing their vehicles at the ambitious rate that regulators are imposing. And because their current diesel-powered trucks are being phased out, those truck owners will lose the resale value of those vehicles.

A truck owner relies heavily on the life expectancy of a diesel truck. For instance, truck manufacturer Paccar says its 12.9-liter MX diesel has a rating of 1 million miles. This means that 90 percent of those engines will make it to 1 million miles before they will need rebuilding (10 percent will not). Truck manufacturer Detroit also claims that its diesel DD13's rating is 1 million miles, although only 50 percent of those engines will actually hit the 1-million-mile mark without rebuilding. Requiring truck owners to prematurely replace their non-ZEV trucks will cost them their investments in their diesel-powered trucks.

Moreover, the most significant maintenance cost in a ZEV truck is the replacement of the batteries, which are currently predicted to last five years or less. Trucks based in states with extreme cold temperatures will likely require replacement batteries much sooner as cold temperatures adversely affect battery life.

Battery-powered vehicles are also heavier than diesel-powered vehicles. The new Ford Lightning electric pickup truck weighs 6,500 pounds—more than 35 percent more than the gas-powered model, largely because of an essential weight at its core: an 1,800-pound battery. In a large truck, the battery weight may be multiple tons. And because regulations in most states have an upper limit on gross vehicle weight allowed on particular highways, the weight of the battery will decrease the amount of freight each truck can carry. And another thing about those batteries: The biggest impact of electric vehicles (EVs) on greenhouse gas emissions is the production of EV batteries, which requires energy-intensive mining and processing and generates twice as much carbon emissions as the manufacture of an internal combustion engine.

Conclusion

Because many motor carriers across the United States rely on cargo going into and out of California, and because California's regulations currently extend to every trucker in the country that does business in California, the regulations will have far-reaching and potentially cataclysmic consequences on the California and national economy overall. California's regulations are admirably idealistic and perhaps should be imposed everywhere. I devoutly hope they can be enforced. But my hope is tempered with realistic concerns about how we, as a nation—especially with the shocking political divisions that have

become evident during the last decade—can possibly meet the manifold difficulties that we need to overcome to achieve the ambitious goals the regulations represent.

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