

CARB Hydrogen and Fuel Cell Activities in Freight

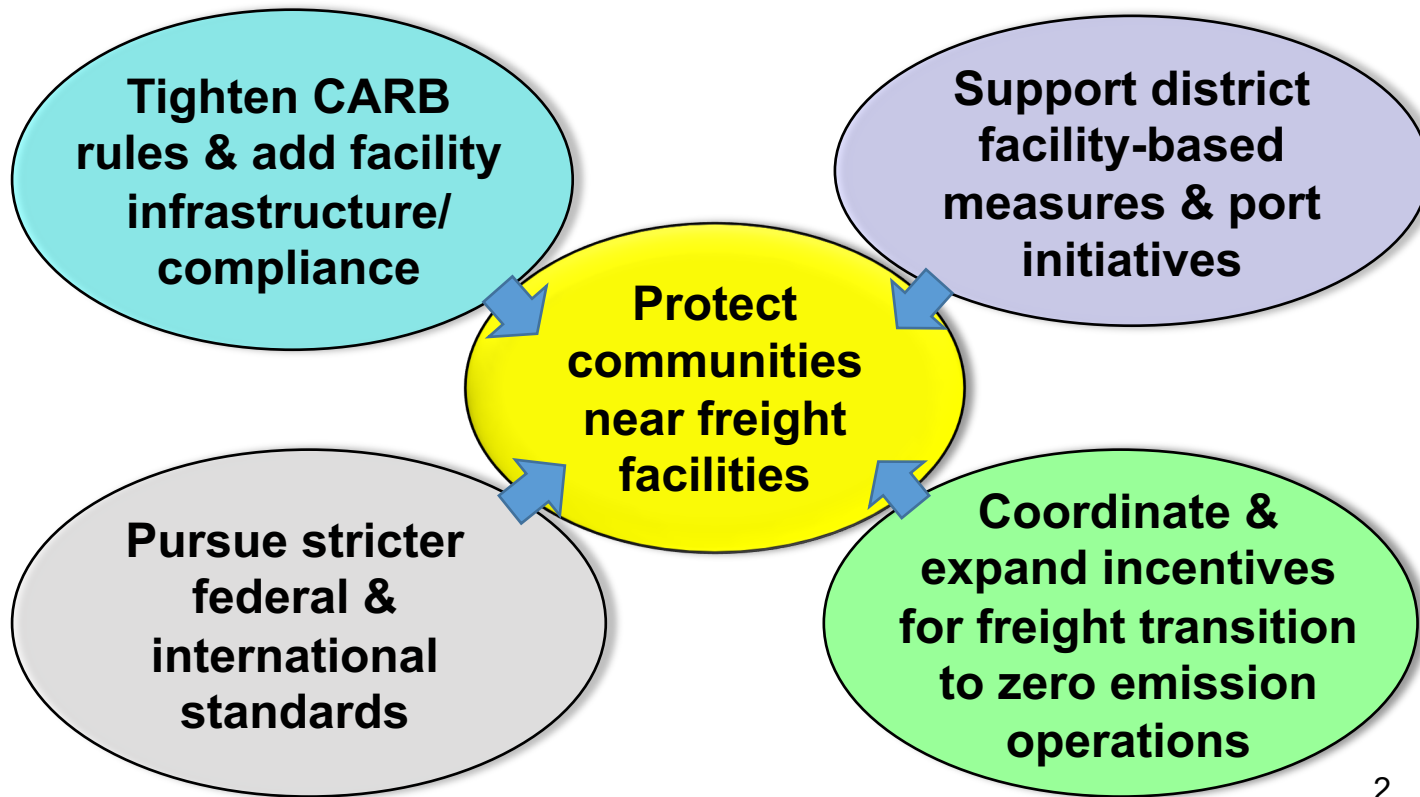
DOE FCTO H2@Ports Workshop
September 10-12, 2019

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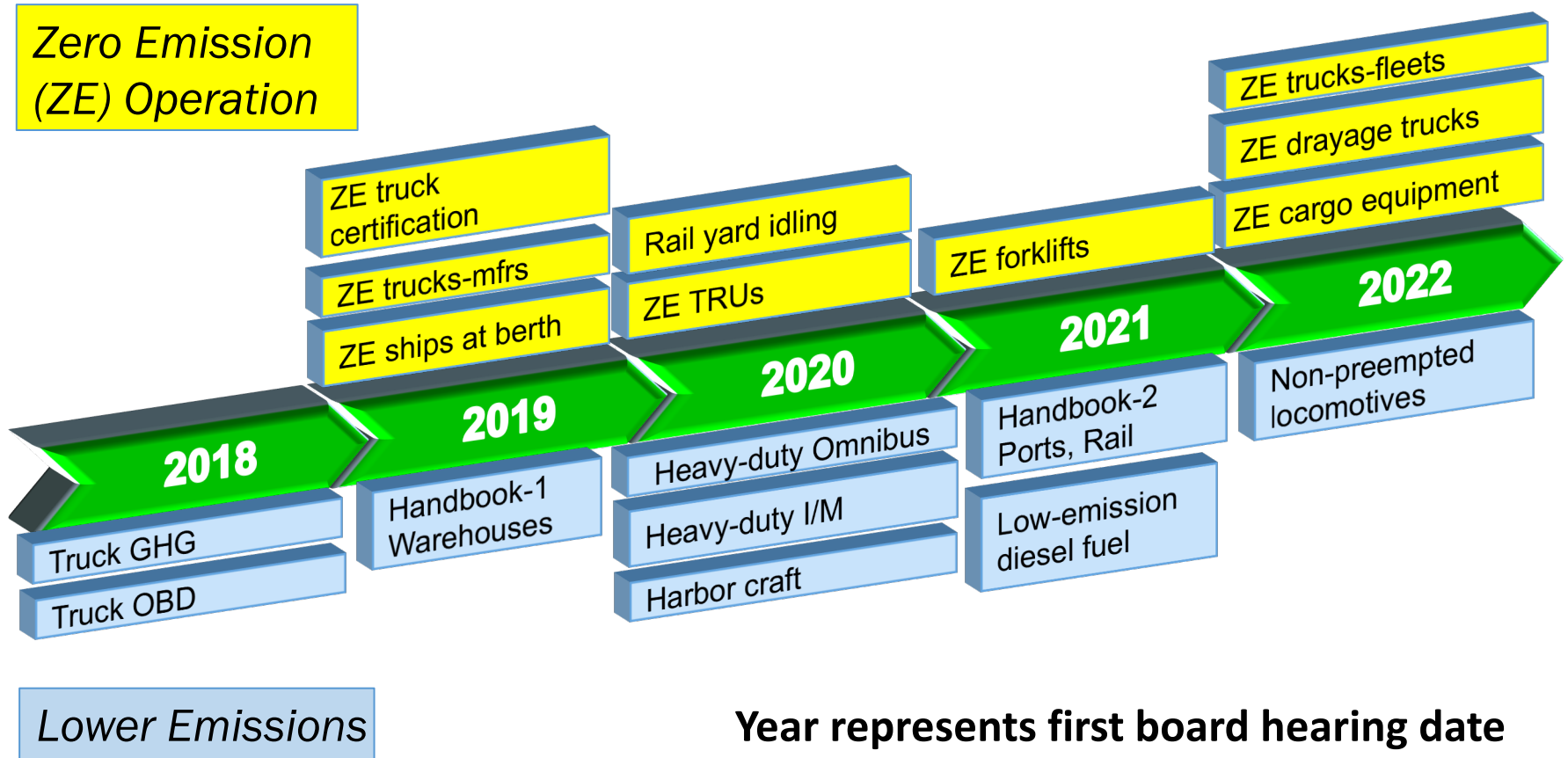
Path Forward on Freight





Pending Freight Regulations

New CARB Freight Actions



Year represents first board hearing date

Freight Regulations

Ocean-Going Vessels at Berth

- Require more visits to reduce emissions at berth
 - Include more visits, vessel types, ports
 - Hold ports, terminals, technology providers accountable for doing their part
- For more information:
<https://ww3.arb.ca.gov/ports/shorepower/shorepower.htm>
- Board Date: Late 2019



Shore Power



Barge-based
Capture & Control



Land-based Capture & Control



Freight Regulations

Commercial Harbor Craft

- Focus on cleaner combustion for in-use and new engines
- Support introduction of zero-emission technologies wherever possible
- Next public meetings: late 2019
- For more information:
<https://ww2.arb.ca.gov/our-work/programs/commercial-harbor-craft>



Freight Regulations

Cargo Handling Equipment



- Focus on Transition to full zero-emission technologies
- Phase-in anticipated to begin in 2026+
- Next public meetings: TBD
- For more information:
<https://ww2.arb.ca.gov/our-work/programs/cargo-handling-equipment>

Freight Regulations

Advanced Clean Trucks

- Manufacturer ZE truck sales requirement
 - 2024-2030 model year
- Large company and fleet reporting requirement
 - Information about vehicles and contracted trucking services
 - Support future fleet rules, ZE truck standard, and/or other
- Board hearing this December, final vote early 2020
- For more information, <https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks>



Freight Regulations

Advanced Clean Trucks

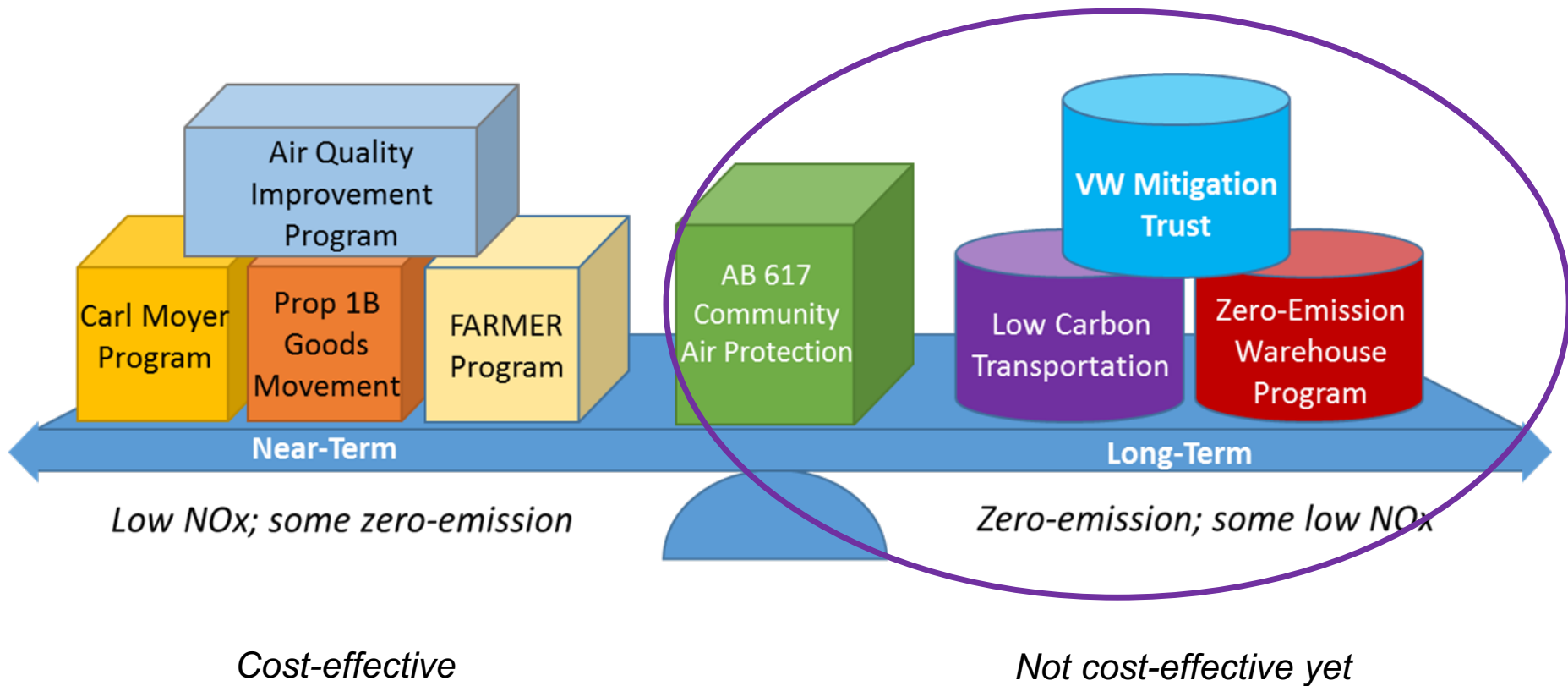
Model Year (MY)	Class 2B-3 ¹	Class 4-8	Class 7-8 Tractors
2024	3%	7%	3%
2025	5%	9%	5%
2026	7%	11%	7%
2027	9%	13%	9%
2028	11%	24%	11%
2029	13%	37%	13%
2030 ²	15%	50%	15%
1. Excludes pickups until 2027 MY 2. 2030 MY requirements continue after 2030			



Incentive Programs

Demonstration Projects

Incentive Portfolio to Balance Investments



Green House Gas Reduction Fund (GGRF)

Funded Hydrogen and Fuel Cell Projects

10 of 30 projects (\$112M) awarded since FY 2014-15 involve hydrogen and fuel cell technology

- SunLine Transit, AC Transit and Orange County Transit
 - 25 FECBs and 3 hydrogen stations/or upgrades
- 10 Class 8 trucks – Kenworth/Toyota – Port of Los Angeles
 - 2 HD Shell hydrogen stations in Wilmington and Ontario
- 5 Class 8 plug-in hybrid fuel cell trucks
- 19 fuel cell delivery vans – 2 projects with UPS
- Fuel Cell Ferry – Golden Gate Marine
- 2 fuel cell 242,000 lb. capacity yard trucks
- Electric top loader with fuel cell and wireless charging
- Fuel cell yard truck and battery yard truck: side-by-side comparison



GGRF Demonstration Project

Fuel Cell Hybrid Electric Top Loader

- Funding: \$6.5M grant, \$8.8M total
- Electric top loader demonstration
 - Hyster-Yale – build and integrate
 - Nuvera – two 45kW fuel cell engines
 - WAVE – 250kW wireless charging systems
- Mobile refueler to provide hydrogen
- Fenix Marine Services will operate the top loader in Port of LA
- Project complete: Spring 2020



GGRF Demonstration Project

Zero-Emission Hydrogen Ferry



- Funding: \$3M grant, \$5.5M total
- Fuel cell ferry – 22 knots top speed and up to 84 passengers
 - BAE Systems – electric propulsion system
 - Hydrogenics – three 120kw fuel cells
 - On-board H2 storage for 2 days of operation
 - 350 bar tube trailer at dock



GGRF Demonstration Project

Port of Los Angeles Shore-to-Store

- Funding: \$41.1M grant, \$82.5M total
- 10 hydrogen fuel cell Class 8 trucks
 - Kenworth truck w/ Toyota FC technology
 - 60 kg on-board storage
 - Developed in partnership with California Energy Commission, DOE and SCAQMD
- Two large-capacity H2 refueling stations
 - Wilmington and Ontario, California
 - Delivered gas, 1500 kg/day capacity, 700 bar
- First truck delivered November 2019
- Stations complete September 2020



GGRF Future Demonstration Funding

Fiscal Year 2019-2020 Heavy-Duty Investments

- Proposed \$40 million allocation for competitive projects:
 - Zero-emission drayage truck pilot
 - Large-scale deployments of zero-emission drayage trucks at one or two fleets
 - Ships-at-berth bonnet system
 - Capture and treat criteria pollutant emissions from OGVs at ports
 - Inducement prize
 - Compete to achieve technological goal in winner-takes-all format
- CARB to consider adopting FY 2019-20 Funding Plan at October Board meeting (Oct. 24)
- Proposed Funding Plan release late September
- For more info: www.arb.ca.gov/aqip



Incentive Programs

Commercial and Other Incentives

GGRF Commercial Incentives

Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP)

- Established in 2010: ~7,500 vouchers and \$380M committed
- HVIP-eligible on-road vehicles – 5,001 GVWR and up
 - Transit, school and shuttle buses; utility and delivery trucks
- Over 30 OEMS and 125 models in hybrid, zero-emission and low NOx options currently eligible
- Demand exceeds available funds
- Board to consider program changes this October
- CaliforniaHVIP.org



GGRF Commercial Incentives

Clean Off-Road Equipment Voucher Incentive Project (CORE)

- Launched this year – CaliforniaCORE.org
- Finalizing Implementation Manual
- Proposed equipment:

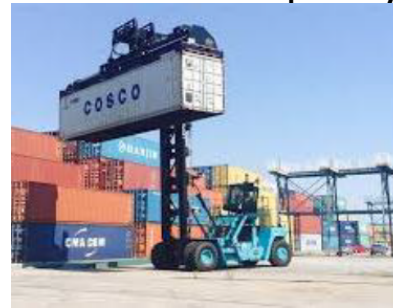
On- and off-road terminal tractors



Transportable Refrigeration Units



Container handling equipment and forklifts >8000 lb lift capacity



Airport Cargo Loaders



Wide-body aircraft tugs



Railcar movers



Rubber-tired gantry cranes



- California's allocation: **\$423 million**
- Approved Beneficiary Mitigation Plan details 5 funding categories, 4 are open to hydrogen & fuel cell technology:
 1. **\$130M** for Zero-emission transit, school and shuttle buses
 2. **\$90M** for Zero-emission Class 8 freight and port drayage
 3. **\$60M** for Combustion Freight/Marine (competitive)
 4. **\$70M** for Zero-emission Freight/Marine (competitive)
 5. **\$5M** for light duty H2 Infrastructure
- Funding available statewide starting this fall
- ww2.arb.ca.gov/vwmitigationtrust



- Administered statewide on behalf of CARB by 2 air districts
- All projects require scrappage of older compliant vehicle or equipment (except shorepower)
- Funds released in 2 installments starting Q4 2019



Class 8 Freight & Port Drayage Trucks

- South Coast AQMD
- First-come, first-served applications
- \$27M in first installment
- Up to \$200k for new truck
- www.aqmd.gov/vw



Freight and Marine Projects

- Bay Area AQMD
- Competitive solicitation
- \$35M in first installment
 - Incremental cost for airport GSE
 - Up to \$175k port CHE & heavy lift (>8,000 lbs)
 - Up to \$2.5M shorepower and ferry, tug or tow boat repower



Community Air Protection (CAP) Incentives

- \$740M appropriated since 2017 to support AB 617
 - Air districts fund projects according to priorities and concerns identified by community members
 - Includes mobile and stationary sources
 - *CAP Incentives 2019 Guidelines* approved in May 2019, and additional options coming soon
 - www.arb.ca.gov/msprog/cap/capfunds.htm

Bay Area AQMD Focus

- Advanced technology at ports, including hybrid gantry cranes
- Zero-emission and low-NOx CNG school buses, and associated infrastructure

www.baaqmd.gov/community-health/community-health-protection-program

San Joaquin Valley APCD Focus

- Agricultural equipment near farming communities
- Zero-emission school buses
- Locomotives

community.valleyair.org/

South Coast AQMD Focus

- Zero-emission and low-NOx trucks
- Off-road equipment, including construction and agricultural
- Marine vessels

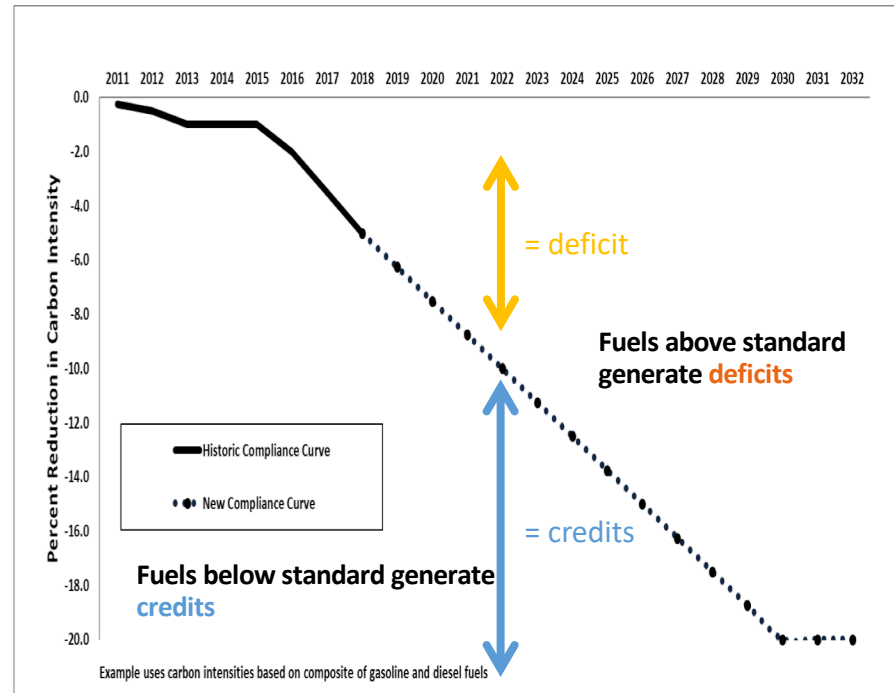
www.aqmd.gov/ab617

Low Carbon Fuel Standard (LCFS)

- Reduce carbon intensity (CI) of transportation fuel 20% by 2030
- Fuel providers can opt-into LCFS to generate credits for using lower-carbon fuels
- Two key inputs affect amount of credits earned per MJ of fuel
 - Carbon intensity (CI) of fuel relative to displacement fuel
 - Efficiency of equipment relative to baseline (EER) – need data to support developing EERs for HD fuel cell powered equipment.

- For more information:

<https://www.arb.ca.gov/fuels/lcfs/lcfs.htm>



EER Values used in LCFS Credit Calcs

EER Values for Fuels Used in Light-, Medium- and Heavy Duty Applications

Fuel/Vehicle Combination	EER Values Relative To Displacement Fuel	Displacement Fuel
Gasoline (including 6% and 10% ethanol blends) Used In Gasoline Vehicles or 85% Ethanol/15% Gasoline Blends Used In Flexible Fuel Vehicles	1	Gasoline
Electricity Used in a Battery Electric or Plug-In Hybrid Electric Vehicle	3.4	Gasoline
On-Road Electric Motorcycle	4.4	Gasoline
Hydrogen Used in a Fuel Cell Vehicle	2.5	Gasoline
Diesel Fuel or Biomass-Based Diesel Blends Used in A Diesel Vehicle	1	Diesel
Electricity Used in a Battery Electric (BEV) or Plug-In Hybrid Electric (PHEV) Heavy-Duty Truck or Bus	5	Diesel
Electricity Used in a Fixed Guideway or Heavy Rail	4.6	Diesel
Electricity Used in a Fixed Guideway or Light Rail	3.3	Diesel
Electricity Used in a Trolley Bus, Cable Car, or Street Car	3.1	Diesel
Electricity Used in Forklifts	3.8	Diesel
eTRU	3.4	Diesel
eCHE	2.7	Diesel
eOGV	2.6	Diesel
Hydrogen Used in a Heavy-Duty Fuel Cell Vehicle	1.9	Diesel
Hydrogen Used in a Fuel Cell Forklift	2.1	Diesel

Source: Credit value calculator at ww3.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm

Contacts

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Volkswagen Mitigation Trust

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