Proposed Advanced Clean Trucks Regulation

STEPS+ Spring Symposium
Davis, California
May 15, 2019
Overview

- Background
- Zero Emission (ZE) Truck and Bus Market Update
- Proposed Advanced Clean Trucks Regulation
- Conclusion
Extreme Nonattainment Areas Are in California

- Key federal attainment deadlines in 2023 and 2031
- Action beyond current programs needed to further reduce NOx emissions

https://www3.epa.gov/airquality/greenbook/map8hr_2008.html
California’s Climate Change Targets

- Achieve 1990 GHG levels by 2020
- 40% below 1990 levels by 2030
- 80% below 1990 levels by 2050
- Cleaner electricity targets (SB 100)
  - 60% renewable by 2030
  - Zero carbon by 2045
- Carbon neutrality by 2045*

* Executive Order B-55-18
Need to Go Beyond Current Programs

**NO\textsubscript{x} Emissions, South Coast Air Basin (All Sources)**

- Current Programs
- 2023 South Coast Target
- 2031 Target

**Source:** CARB, 2016 Mobile Source Strategy

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**Greenhouse Gas Emissions, Statewide (All Sources)**

- 1990 Level
- Reference Scenario
- SB 32 40% Reduction
- Executive Order Carbon Neutrality

**Source:** CARB, 2017 Climate Change Scoping Plan; 2018 Exec. Order B-55-18
Mobile Source Reductions are Key

- Largest contributor to smog-forming, greenhouse gas, and diesel PM emissions
- Requires integrated planning process to assess combination of cleaner technologies, fuels, and system efficiencies to meet multiple goals

![Graph showing emissions contribution]

* Including emissions from fuel production
Clean Air Plans Summary

### Mobile Source Strategy
- Zero emissions (ZE) where well suited
- Near zero everywhere else

### Sustainable Freight Strategy
- 2030 statewide freight targets
  - Increase efficiency 25%
  - 100,000 ZE vehicles and equipment
  - Set economic growth target

### ZEV Action Plan
- 1.5 million ZEVs by 2025
- Expand charging/fueling
- Leverage national markets
- Government to lead by example

### Executive Order B-48-18
- 5 million ZEVs by 2030
Suite of Mobile Source Measures

Zero-Emission (ZE) Operation

- ZE Airport Shuttle
- ZE truck certification
- Advanced Clean Trucks
- Rail yard idling
- ZE TRUs
- ZE forklifts
- ZE truck fleets
- ZE drayage trucks
- ZE cargo equipment

Innovative Clean Transit

- CA GHG Phase 2
- Truck OBD
- Truck Smoke Tests

2018

- CA GHG Phase 2

2019

- Handbook-1 Warehouses
- Heavy-duty Omnibus
- Heavy-duty I/M
- Harbor craft

2020

- Heavy-duty Omnibus
- Heavy-duty I/M
- Harbor craft

2021

- Handbook-2 Ports, Rail
- Low-emission diesel fuel

2022

- Non-preempted locomotives

Lower Emissions

Note: State fleet purchases of Class 6-8 ZE trucks required starting 2025 (AB 739)
Fostering Zero Emission Truck and Bus Deployments

- Support early market development with incentives
- Early candidates for zero emission technologies
  - Centrally fueled, low average speed, stop-and-go duty cycles
- Regulations to accelerate self sustaining market and to provide certainty
- Early experiences benefit the market for other applications
ZE Truck and Bus Market Update
## Heavy-duty Electric Market Growing

<table>
<thead>
<tr>
<th>Commercial Today</th>
<th>Commercial Soon</th>
<th>Demos</th>
</tr>
</thead>
<tbody>
<tr>
<td>2B-3</td>
<td>4-5</td>
<td>6-7</td>
</tr>
<tr>
<td>8</td>
<td></td>
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</tr>
</tbody>
</table>

*Excludes transit buses, not all vehicles shown*
ZE Truck Technology Assessment

- Most straight trucks average less than 100 miles per day
  - EMFAC, Cal-VIUS 2018, VIUS 2002, and other data sources
  - Tractor assessment for local and regional use requires further study
- Variable routes can be met by conventional trucks with small ZE truck deployments in larger fleets until the technology develops further
- AB 2061 (2018) increases the upper weight limit by 2,000 lb.
  - Eliminates weight concerns for most Class 2B-7 vehicles
  - Reduces concerns for local or regional Class 8 vehicles
Technology Outlook for the Future

- Several manufacturers targeting categories assessed as more challenging
- Battery density improvements expected to continue
  - Decrease weight and space constraints, or enable greater range
- Innovative designs reduce barriers
  - Skate board platforms, composite bodies, e-axles
  - Some with better payload than diesel today
- Fueling/charging network development expands market potential
Low Carbon Fuel Standard (LCFS)

- Lowers carbon intensity of transportation fuels 20% by 2030
- Fleets earn credits if dispensing H2 or electricity for HD ZEVs
- Battery electric credit value goes to EVSE owners
  - $0.10/kWh* for Class 1-3 vehicles
  - $0.16 per kWh* for Class 4-8 vehicles
- Offsets most or all electricity costs for charging

* Assumes LCFS credit price of $125 per credit
LCFS program information: https://www.arb.ca.gov/fuels/lcfs/lcfs.htm
# Fuel Cost Saving Opportunity

<table>
<thead>
<tr>
<th>Service</th>
<th>Battery Electric vs Diesel</th>
<th>with LCFS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airport Shuttle</td>
<td>45%</td>
<td>75%</td>
</tr>
<tr>
<td>Package Delivery</td>
<td>55%</td>
<td>100%</td>
</tr>
<tr>
<td>Local Drayage</td>
<td>70%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Note: Example for 12 year period assumes average of $3.70/gal., about $0.16/kWh, and LCFS at $125 per credit
Total Cost of Ownership (TCO) Comparable in Right Duty Cycles

Draft TCO discussion paper available for comment

By 2024, BEVs* have favorable TCO versus diesel vehicles in many local or vocational applications

By 2030, FCEVs* could approach TCO parity with diesel

Example: Stepvan TCO over 12 Years

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*BEV - Battery electric vehicle, FCEV - Fuel cell electric vehicle

1Draft Fleet TCO paper: [https://ww2.arb.ca.gov/sites/default/files/2019-02/190225tco_0.pdf](https://ww2.arb.ca.gov/sites/default/files/2019-02/190225tco_0.pdf)
SB 350 Transportation Electrification for Medium and Heavy Duty

- California utilities supporting site upgrades and design
  - $579 million approved over the next 5 years (PG&E, SCE)
  - Additional $107 million under review (SDG&E)
- New rates being designed to encourage electric vehicles

Transportation Electrification (SB 350) [www.cpuc.ca.gov/sb350te/](http://www.cpuc.ca.gov/sb350te/)
# Significant Incentives Available Now

<table>
<thead>
<tr>
<th><strong>HVIP</strong></th>
<th><strong>VW</strong></th>
<th><strong>Carl Moyer</strong></th>
<th><strong>AB 617</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Low NO\textsubscript{x} engines, ZEVs plus infrastructure, advanced technology</td>
<td>Zero-emission truck and bus replacements</td>
<td>Cleaner engines &amp; ZEVs plus fueling infrastructure</td>
<td>Engine replacement &amp; infrastructure in DAC</td>
</tr>
<tr>
<td><strong>FY 18-19</strong></td>
<td><strong>$423 M</strong></td>
<td><strong>FY 18-19</strong></td>
<td><strong>$245 M</strong></td>
</tr>
<tr>
<td><strong>$125 M</strong></td>
<td></td>
<td><strong>$79 M</strong></td>
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</table>

## Truck Loans
- Helps small businesses with 10 or fewer trucks upgrade to newer trucks

## Utility Programs
- Charging infrastructure service upgrades and electricity rates (SB350)
- >$579 M

## LCFS
- Credits for using low carbon transportation fuels
- Offsets Most/All Electricity Costs for Trucks and Buses

More information at: [https://ww2.arb.ca.gov/our-work/topics/incentives](https://ww2.arb.ca.gov/our-work/topics/incentives)
Proposed Advanced Clean Trucks Regulations
Advanced Clean Trucks Summary

- Manufacturer sales requirement
  - ZE trucks as a percentage of sales - 2024-2030 model year
  - Return to the board around 2025 for post-2030 action

- Company and fleet reporting requirement*
  - Contracted transportation services (even if no trucks owned)
  - Vehicle and terminal characteristics
  - Future fleet rules, ZE truck standard, and/or other

* Implement Governor Brown directive issued August 1, 2018
Regulated Party

- California sales
  - >500 Class 2B-8
  - 2021-2023 average
- ZE manufacturers may opt in

Vehicle Manufacturer: Pickups, vans, tractors

Chassis Manufacturer: Vocational vehicles
Advanced Clean Trucks Proposed Sales

- Credit system to encourage early action and flexibility starting 2021
- Zero-Emission Powertrain certification required starting 2024

**Proposed ZEV Percent of Sales**

<table>
<thead>
<tr>
<th>Model Year</th>
<th>Class 2B-3*</th>
<th>Class 4-8 Straight Trucks</th>
<th>Class 7-8 Tractors</th>
</tr>
</thead>
<tbody>
<tr>
<td>2024</td>
<td>3%</td>
<td>7%</td>
<td>0%</td>
</tr>
<tr>
<td>2025</td>
<td>5%</td>
<td>9%</td>
<td>0%</td>
</tr>
<tr>
<td>2026</td>
<td>7%</td>
<td>11%</td>
<td>0%</td>
</tr>
<tr>
<td>2027</td>
<td>9%</td>
<td>13%</td>
<td>9%</td>
</tr>
<tr>
<td>2028</td>
<td>11%</td>
<td>24%</td>
<td>11%</td>
</tr>
<tr>
<td>2029</td>
<td>13%</td>
<td>37%</td>
<td>13%</td>
</tr>
<tr>
<td>2030</td>
<td>15%</td>
<td>50%</td>
<td>15%</td>
</tr>
</tbody>
</table>

*Excludes pickups until 2027 MY

Advanced Clean Trucks: [https://www.arb.ca.gov/msprog/actruck/actruck.htm](https://www.arb.ca.gov/msprog/actruck/actruck.htm)
ZEV Fleet Assessment Workshop: [https://www.arb.ca.gov/msprog/zevprog/zevprog.htm](https://www.arb.ca.gov/msprog/zevprog/zevprog.htm)
Credit System Provides Flexibility

- One credit represents one zero-emission vehicle
- Credits starting with 2021 MY may be banked or traded
- Awarded to manufacturer of record
- Can use credits to match requirements with product rollout timelines
- Plug-in hybrids (PHEV) earn partial credit
Credit Transfers Between Vehicle Groups

- Class 2B-3 and Class 4-8 Vocational Truck requirements may be met with any credits
- The tractor requirement must be met with tractor credits
  - Support drayage plans and ZE freight market expansion
- Credit transfer based on weighting factor

<table>
<thead>
<tr>
<th>Vehicle Class</th>
<th>Class 2B-3</th>
<th>Class 4-8 Vocational</th>
<th>Class 7-8 Tractors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight Factor</td>
<td>0.5</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
PHEV Credit Generation

- PHEV equivalent to 1/3 of ZEV
- Same PHEV definition as CA GHG Phase 2
- Up to half of the annual sales requirement can be met by PHEV credits

CA PHEV Minimum All-Electric Range (AER) Requirement

<table>
<thead>
<tr>
<th>Vehicle MY</th>
<th>Slow-charge AER (Miles)</th>
<th>Fast-charge* AER (Miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021-2023</td>
<td>10+</td>
<td>10+</td>
</tr>
<tr>
<td>2024-2026</td>
<td>20+</td>
<td>15+</td>
</tr>
<tr>
<td>2027+</td>
<td>35+</td>
<td>20+</td>
</tr>
</tbody>
</table>

*Fast-charge PHEVs must be able to 1) charge from 15% to 85% state-of-charge in under half an hour and 2) demonstrate that typical operating time is eight times typical charging time.
Overlap with GHG Phase 2 Regulation

- Advanced technology multiplier gives additional credit for PHEV, BEV, and FCEV technologies through 2027 MY
- Potential double counting GHG emission benefits
- Considering options to mitigate issue for required ZEV sales
Company and Fleet Reporting Requirement

- Entities with California gross receipts > $50 million annually
- Motor carriers, freight forwarders, and brokers that own or dispatch 100 or more trucks/year
- Port terminal operators
- Federal, state, county, and city fleets
- Utilities, refuse/recycling services
ZEV Fleet Rule Concepts Overview

- Develop rules to require use of ZEV in 2022
  - Initial implementation in 2024
- Last-mile delivery, public, utility, refuse fleets, drayage, other
  - No plans for school bus fleet rule
- Potential strategies focused on large entities
  - A percentage of cargo shipments with zero-emission vehicles
  - ZE trucks for company-owned vehicles and contracted services
  - Potential infrastructure requirements
Principles for Developing Fleet Rules

- Expand ZE truck market to meet air quality and GHG goals
- Provide benefits in disadvantaged communities
- Maximize the total number of ZEVs deployed
- Match vehicle capabilities with fleet operational needs
  - Initially, urban, stop-and-go driving, return to base
  - Support market expansion to other applications
- Ensure level playing field between types of fleet operators
- Expand infrastructure availability to enable new markets
- Support and enable workforce training
Conclusion

- Major NOx and GHG reductions needed
- Zero emission solutions needed everywhere feasible
- California supporting cleanest available technologies

Advanced Clean Trucks: https://www.arb.ca.gov/msprog/actruck/actruck.htm
ZEV Fleet Assessment Workshop: https://www.arb.ca.gov/msprog/zevprog/zevprog.htm