Zero Emissions MHDVs

The Transformation is Accelerating

Colorado Energy Research Collaboratory Webinar
July 14 2020
Freight fuel consumption and GHGs are forecasted to grow four-fold through 2050 and urban regions will suffer the worst impacts of air pollution in an increasingly urbanized world.

Source: ITF (2016)
Commercial vehicles represent a relatively small share of the global on-road fleet but contribute to a disproportionate share of on-road fuel consumption and emissions.

- 11% of global on-road fleet are HDVs
- 46% of on-road fuel consumption by HDVs
- 71% of on-road particulates by HDVs

ICCT (2015): Policies to reduce fuel consumption, air pollution, and carbon emissions from vehicles in G20 nations
COVID Showed Potential for Clean Air, But…

…Truck traffic remained higher than cars; and commercial vehicles are much bigger part of urban pollution load
CARB Approves First-in-World Zero Emission Truck Rule

Advanced Clean Trucks – ACT – passed unanimously

Sets aggressive sales requirements by 2024

Board approves fast action on parallel rule for fleets – and to go faster in those applications which justify it
Continue Ramp-up Past 2030

- Establish pathway to 2045 carbon neutrality goal
- Achieve 15% ZE fleet by 2035
- Aligns with San Pedro Bay Ports goal of roughly 17,000 ZE drayage trucks by 2035

<table>
<thead>
<tr>
<th>Model Year (MY)</th>
<th>Class 2b-3</th>
<th>Class 4-8</th>
<th>Class 7-8 Tractors</th>
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<tr>
<td>2024</td>
<td>3% 5%</td>
<td>7% 9%</td>
<td>3% 5%</td>
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<tr>
<td>2025</td>
<td>5% 7%</td>
<td>9% 11%</td>
<td>5% 7%</td>
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<td>2026</td>
<td>7% 10%</td>
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<td>2027</td>
<td>9% 15%</td>
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<td>2028</td>
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<td>2029</td>
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<td>37% 40%</td>
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<td>2035+</td>
<td>55%</td>
<td>75%</td>
<td>40%</td>
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Zero-emission vehicles are coming in waves – but we must prepare our policy and investment “eco-system” to support them.

**Beachhead: Wave 1 Transit**
- ZE transit buses
  - Available now
- ZE industrial lifts
  - Available now

**Wave 2 Delivery**
- Chanje Class 5 Delivery Van
  - Available now
- Fuso ECanter
  - Available now
- Orange EV yard tractor
  - Available now

**Wave 3 Medium Freight, Service**
- E-Fuso Vision One
  - Demo now Announced 2021
- Freightliner eM2
  - Demo now Announced 2021
- Navistar Class 6
  - Demo now Production 2021

**Wave 4 Heavy Regional Freight**
- Freightliner e-Cascadia
  - Demo Now; Announced 2021
- Kenworth T680e
  - Demo Now Gen 1 Production 2021
- Mack e-Refuse
  - Demo 2020; Coming 2022?
- Tesla demo
  - Coming 2021

**Corridor Longhaul**
- Nikola FC tractor
  - Coming 2022?

**ZE transit buses**
- Available now

**ZE industrial lifts**
- Available now

**Similar drivetrain and component sizing can scale to early near applications**
**Expanded supply chain capabilities and price reductions enable additional applications**
**Steadily increasing volumes and infrastructure strengthen business case and performance confidence**

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We are now tracking >300 zero emission commercial vehicles.
Model availability to double by 2023

Total cumulative vehicle models, U.S. & Canada

https://globaldrivetozero.org/tools/zeti-analytics/
Tackling barriers to ZEFV deployment and uptake will require strong policy, regulatory and investment support

<table>
<thead>
<tr>
<th>BARRIERS</th>
<th>SOLUTIONS</th>
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<tbody>
<tr>
<td>• High vehicle upfront cost</td>
<td>• Supporting policy actions (carrots and sticks)</td>
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<td>• Limited vehicle availability</td>
<td>• Incentives, Benefits</td>
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<td>• Limited availability and access to charging infrastructure</td>
<td>• Zero Emission Areas, fleet rules, regulations</td>
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<tr>
<td>• Limited fleet awareness</td>
<td>• Infrastructure investments</td>
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<tr>
<td>• Lack of competitive zero-emission fuel pricing</td>
<td>• Pilot projects</td>
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<td>• Limited service and support networks</td>
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Truck Leader Coalition Calls for Major Federal Role, Funding to Support US Leadership in ZE Trucks

Purchase Incentives
Infrastructure
Tech Improvement and Innovation
Together with TDA and EV100, Drive to Zero aims to accelerate the targeted growth of zero-emission commercial vehicles.

**2025**

Near- and zero-emission commercial vehicles are cost-competitive and commercially viable in beachhead applications and first-mover regions by 2025.

**2040**

Zero-emission commercial vehicles achieve 80% of new vehicle sales in first-mover regions by 2040.
Thank you!

Bill Van Amburg
Executive Vice President
bvanamburg@calstart.org

For more information:
www.globaldrivetozoero.org
www.calstart.org

@TeamDriveToZero