Freight Electrification

NASEO Energy Policy Outlook
February 9, 2023
TECHNOLOGY DEVELOPMENT
CALSTART develops and organizes competitive project teams around strategically important technologies to help fund and speed their commercialization.

ASSESSMENT & VALIDATION
CALSTART provides trusted, third-party performance analysis and evaluation of clean vehicles, technologies, and fuels.

MARKET ACCELERATION
CALSTART advises governments and agencies in developing incentive programs supported by fleets and industry to encourage the adoption of advanced technology vehicles and fuels.

PUBLIC POLICY
CALSTART supports industry stakeholders in government to develop and implement public policies that advance the clean transportation technology industry.

MEMBER SUPPORT
CALSTART seeks out and fosters partnership opportunities among our members as well as assistance in obtaining grants and funding.

NETWORKING
CALSTART hosts meetings and conferences so that our members may connect with like-minded professionals and leaders in the industry.
The freight industry is the backbone of our economy.

- Trucks move >72% of the nation's freight.
- The trucking industry employs nearly 8 million people.  
  - This includes ~3.5 million drivers.
- Nearly 39 million trucks are registered and used for business purposes in the U.S.
  - These trucks are registered to nearly 2 million carriers.
  - These trucks travel >302 billion miles annually, consuming over 35 billion gallons of diesel and 9 billion gallons of gasoline.
  - ~10% are Class 8 trucks.
- Commercial trucks paid >$48 billion in federal and state highway-user taxes in 2020.

Source: American Trucking Associations (ATA)
Medium- and heavy-duty vehicles (M/HDVs) disproportionately pollute our communities.

- M/HDVs account for <10% of vehicles on the road.
- M/HDVs account for nearly one-third of on-road vehicle GHG emissions.
- M/HDVs account for 45% of on-road NOx emissions.
- M/HDVs account for 57% of on-road, direct PM2.5 emissions.

Source: UCS
Pollution from M/HDVs disproportionately impacts disadvantaged communities.

Source: EPA EJScreen
The US has committed to 100% of new M/HDV sales being ZE by 2040, with an interim goal of 30% by 2030.

At COP27 on Nov. 16, 2022, the U.S. joined the Global MOU on Zero-Emission Medium- and Heavy-Duty Vehicles.
The 17 signatory states and Washington DC account for roughly 50% of the U.S. economy and 40% of goods moved by truck (by value).

Sources:
U.S Bureau of Economic Analysis https://apps.bea.gov/itable/iTable.cfm?ReqID=70&step=1#reqid=70&step=1&isuri=1;

Ambition: at least 30 percent of new MHD vehicle sales ZEVs by 2030
Technology developments and expanded supply chains drive electrification in increasing vehicle segments.

Market Progress Over Time

- 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

Source: CALSTART
ZE technology is commercially available for all on-road applications.

Source: CARB & CALSTART
Over 200 ZE models are available today.

Source: CALSTART Zero-Emission Technology Inventory (ZETI) Data Explorer
The range of available models is increasing.

Source: CALSTART Drive to Zero
ZET technology is suited for many applications.

Source: UCS, Ready for Work, 2019
Analysis of real-world duty cycle data shows ~65% of MD and ~49% of HD trucks are currently electrifiable with existing technology.
Sales are increasing.

Source: CALSTART Zeroing in on Zero-Emission Trucks
ZET sales are highly correlated to state-level policies and incentives. 

Source: CALSTART Zeroing in on Zero-Emission Trucks
We are learning a lot from these real-world deployments.

- DOE-funded project to collect, validate, analyze, & provide summary results on operational data from ZE M/HDs
  - October 2019 – September 2023
  - Capturing diverse data from 191 vehicles across 11 states and 37 distinct fleets participating in the program

Source: CALSTART & DOE
Preliminary findings show that suitability is growing (but with limitations).

- Based on observable data and fleet interactions, most electric yard tractors, delivery vans and transit buses have been found to perform comparably to the conventional baseline vehicles used on similar duty cycles.

- However, EV models in the HD truck segment proved capable of meeting duty cycles limited to one single shift and less than 200 miles per day. Challenges are found when there is dynamic/unpredictable routing, longer routes, longer idling time or trucks not returning to home base each day to charge.

Source: CALSTART
ZE M/HDVs are more efficient than ICE counterparts (though efficiency impacted by climate).

- MHD EVs were found to be 2-4x more efficient than comparable diesel vehicles.
- Seasonal patterns in vehicle efficiency were observed across different regions, indicating a correlation between ambient temperature and vehicle efficiency.
- Stronger efficiency impacts were observed in colder climates.

Source: CALSTART
Learn more!

Access the Dashboard in Project Website:

Download Data from LiveWire:
https://livewire.energy.gov/project/calstart
We’re also learning from demos and pilots.

- Near-term challenges include costs – both on the vehicle side and related to electricity rates.
  - Demand charges can comprise half of a fleet’s electricity bill
  - Insurance (5.5%), compounded by federal excise tax (12%), CA sales tax (8%), and CA registration fees, sum to an additional $90-100k added to the Class 8 ZETs upfront cost, preventing them from achieving cost parity with diesel trucks in an average vehicle lifetime.

- Fleets can expect insurance and upfront costs to decrease as ZET production increases and battery technology improves; incentives will play a key role in supporting production increases.

- Battery electric trucks (BETs) have many benefits, but they are not yet a like for like replacement for diesel trucks.
  - Shorter driving range
  - Longer refueling time and fewer refueling stations
  - Lower cargo weight capacity

Source: CALSTART
2040 Roadmap

1. ESTABLISH BEACHHEADS
   Launch all beachhead ZE-MHDV applications

2. SECURE POLICY ALIGNMENT
   Secure aligned and ambitious targets and policies

3. LAUNCH LONGHAUL
   Establish priority zero-emission long-haul corridors by 2025

4. SATURATE CITIES
   Reach 100% sales in cities by 2030

5. BUILD BACKBONE
   Build priority freight corridors by 2030

6. COMPLETE NETWORK
   National networks in place by 2035, complete by 2040

Source: CALSTART Drive to Zero
Long-haul routes are shrinking in favor of more regional haul.

- Trucking is changing in favor of hub-to-hub, drop-and-hook, relay, and pony express routing.
- The average dry van truckload length of haul has dropped from about 800 miles 20 years ago to about 500 today. (American Transportation Research Institute)
- Data point: in March 2020, the industry ordered 3,900 Class 8 tractors. The vast majority — 3,300 — were day cabs. (ACT Research)
Tesla Semi begins deliveries, boasts 500-mile range

Nikola Tre FCEV now eligible for HVIP, 500-mile range, 20-min refuel time, order books open
New Investments in Infrastructure

- **Port of Long Beach** installs public HD chargers.
- **WattEV** - network of sites with 47 charge dispenser in Southern California between Bakersfield, the Inland Empire, and the ports of Los Angeles and Long Beach in 2023 capable of charging 94 electric trucks concurrently.
- **TerraWatt** - Announced plans for MHDV charging corridor with stations every 150 miles from Los Angeles, California to El Paso, Texas.
- **Daimler** – announced JV with BlackRock and NextEra to develop MHDV public charging corridors.
- **Electrified Charging Corridor Project** - $2M CEC investment to Volvo, its CA dealers, and Shell Recharge Solutions to develop a publicly accessible MHDV charging network connecting several of California’s largest metro areas.
- **Volvo** - announced partnership with Pilot truck stops for national network of public MHDV stations.
- **Voltera** - will provide turnkey charging solutions for fleets and other customers.
- **Nikola** has announced plans for 60 hydrogen stations by 2026.
- **CPUC** - new $1B program for transportation electrification with focus on MHDVs & infrastructure in disadvantaged communities.
Begin planning for future highway charging sites now.

- Highway fast-charging sites will need ready access to clean electricity.
- By planning ahead, we can meet these power needs—and bring down costs for charging deployment.
- Identify “no-regrets” upgrades at “no-regrets” sites—so we can build grid infrastructure once, and build it right.
Significant Increase in Federal Funding Support

- Bipartisan Infrastructure Law
  - $13.2M CMAQ for Zero-Emission MDHD Vehicles
  - $6.420M Carbon Reduction Fund
  - $500M State Energy Program
  - $5B for corridors and infrastructure

- Inflation Reduction Act
  - 45W Qualified Commercial Clean Vehicle Credit
    - $40,000 or 30% credit for ZEV MDHD vehicles weighing more than 14,000 pounds
  - $1B for Clean Heavy-Duty Vehicle program
  - $2.250M for zero emission equipment and technology at ports
  - $15B for Greenhouse Gas Reduction Fund
  - $60M to reduce diesel emissions in goods movement
  - 30C provides $30K to $100K in tax incentives for alternative fueling station
Optimizing Federal Funds for ZEVs

- The Infrastructure Investment and Jobs Act of 2021 (IIJA) and Inflation Reduction Act of 2022 (IRA) will allocate billions of dollars to states to reduce emissions from the transportation sector, presenting a momentous opportunity for states to significantly grow zero-emission commercial vehicle adoption and improve mobility across the United States through the strategic deployment of funds.

- CALSTART can help support state governments in making resource allocation decisions to accelerate zero-emission technology adoption by advising on:
  - FTA’s LOW-NO transit program,
  - Commercial vehicle, infrastructure, and clean mobility incentive programs;
  - MHD deployment (pilots and planning);
  - Alternative fuel corridors (commercial ZEV infrastructure planning and build out);
  - and more!
IRA commercial vehicle incentives may support ZET sales shares of 39% to 48% by 2030.

Source: ICCT
State Policy is Rapidly Developing

- **CALSTART’s State Outreach on Federal Funding Opportunities**
  - CALSTART led Commercial ZEV and NEVI Webinar Series
  - IIJA Investment Strategies in the Northeast paper (2022)
  - Currently updating MHDV CALSTART voucher paper specific to new federal funding
  - In conversations with various states about MHDV voucher programs

- **Advanced Clean Trucks Rule**
  - **7 states** have adopted ACT (California, Massachusetts, New Jersey, New York, Oregon, Washington, Vermont)
  - Numerous others actively working on regulation

- **Advanced Clean Cars II**
  - **5 states** have adopted ACC II: Washington, Oregon, Vermont, Massachusetts, New York
Commercial ZEV Infrastructure

Top #10 Considerations for NEVI State Deployment Plans & Discretionary Funds

1. Stakeholder Engagement
2. Freight Focus
3. Convenient Fleet Access
4. Higher Power DC Fast Charging
5. Infrastructure and Vehicle Incentives
6. Flexible Fueling
7. Microgrid Deployment
9. Contract with Multiple Suppliers
10. Technical Assistance
Ecosystem of state actions to drive the ZE freight market:

- **Adopting policies like sales & purchase requirements (e.g., ACT, ACF) and ZET weight exemptions**
  - Way to go, CA, OR, WA, NJ, NY, MA & VT!

- **Providing vehicle & infrastructure incentives**
  - E.g., HVIP, EnergIIZE, NYTVIP, Colorado Clean Fleet Vehicle Technology (CFVT) Grant Program
  - Vouchers more effective than grants
  - LCFS

- **Investing in public M/HDV chargers**
  - Look to new federal funding
  - Encourage wide, pull-through stalls
  - Demos and pilots to prove out technology with infrastructure @ scale

- **Streamlining permitting requirements for M/HDV charging infrastructure**

- **Working with utilities, PUC, etc.**
  - Electricity costs (TOU rates, demand charges, etc.)
  - Make-ready infrastructure
  - Proactively upgrade grid

- **Educating stakeholders**

- **Investing in workforce development & training**
Thank You
We change transportation for good.

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