Medium and Heavy-Duty Markets Gear Up: Latest Finds from Electric Truck Demonstrations and Early Deployments

U.S. Environmental Protection Agency
SmartWay Transport Partnership
March 30, 2022, 2 – 3 PM (ET)
Today’s discussion

- Challenges and Benefits of Electrification in Goods Movement
  - NACFE: Run on Less Electric
    - Results of Real-World Demonstrations
  - NFI
    - Pioneering a Transition to Zero-Emission Good Movement
  - CALSTART
    - Partnerships, incentives, validation, policy
Challenges and Benefits of Electrification in Goods Movement

- In transportation sector, onroad HD/MD trucks represent
  - 6% of all vehicles on the road
  - 26% of transportation petroleum-based fuel use
  - Around 1/2 NOx, 1/4 of GHG emissions
  - Disproportionate community impacts

- Potential benefits of electrification
  - Cleaner, more diverse energy source
  - Zero tailpipe emissions
  - Air quality improvements
  - Stable, historically lower energy cost
  - Lower Total Cost of Ownership, Operations
POLL 1

Does your company currently operate any electric vehicles (fork lift, terminal, PUD, box truck, regional) in its fleets or shipping operations?

- [ ] yes
- [ ] no

Within the next five years, does your company plan on purchasing electric vehicles as an alternative to traditional, petroleum-based equipment?

- [ ] yes
- [ ] no
Medium and Heavy-Duty Markets Gear Up: Latest Findings from Electric Truck Demonstrations & Early Deployments

Dave Schaller
March 2022
Run on Less by NACFE

2017
- Long Haul
  - 7 Fleets
  - 10.1 MPG

2019
- Regional Haul
  - 10 Fleets
  - 8.3 MPG

2021
- All BEVs
  - 13 Fleets
  - New metrics!
Run on Less – Electric Participants

- Anheuser-Busch
  - Operating a BYD Tractor
  - In Los Angeles

- Biagi Bros.
  - Operating a Peterbilt 579EV
  - In Sonoma, CA

- Frito Lay
  - Operating a Cummins Box Truck
  - In Modesto, CA

- Purolator
  - Operating a Motiv-Powered Step Van
  - In Vancouver, BC

- RUAN
  - Operating an Orange EV Terminal Tractor
  - In Otsego, MN

- Servall Electric
  - Operating a Workhorse C1000
  - In Cincinnati, OH

- ANHEUSER-BUSCH
  - Operating a Freightliner eCascadia
  - In Los Angeles

- NFI
  - Operating a Kalmar Ottawa Electric Terminal Tractor
  - In Chino, CA

- NFI
  - Operating a Volvo VNR Electric
  - In Chino, CA

- Ryder
  - Operating a Lonestar Specialty Vehicles Terminal Tractor
  - In Georgetown, KY

- Roush Fenway Racing
  - Operating a ROUSH CleanTech Truck
  - In Concord, NC

- Biagi Bros.
  - Operating a Peterbilt 579EV
  - In Sonoma, CA

- DHL
  - Operating a Lightning eMotors Van
  - In New York City

- Purolator
  - Operating a Motiv-Powered Step Van
  - In Vancouver, BC

- Day & Ross
  - Operating a LION6 Truck
  - In Montreal, QC

- Roush Fenway Racing
  - Operating a ROUSH CleanTech Truck
  - In Concord, NC

- Run On Less – Electric Fleet Locations

March 2022
RoL–E Reports

Review Of Complete Demonstration: Electric Trucks Have Arrived

The Use Case For TERMINAL TRACTORS

The Use Case For MEDIUM DUTY BOX TRUCKS

The Use Case For REGIONAL HAUL TRACTORS

4 Market Segment Fact Sheets

The Use Case For VANS & STEP VANS

March 2022
**Specs: Anheuser-Busch**

**Truck**

- **Truck Class:** Class 8
- **Type:** Heavy-Duty Tractor
- **OEM:** BYD
- **Model:** BTT Tandem Axle
- **Production Level:** In Series Production
- **Battery Capacity:** 435 kWh
- **Estimated Range:** 150 - 200 Miles
- **Components:** Cabover

**Driver**

- **Name:** Rene Soils
- **Years Driving:** 30 Years
- **Home Base:** Pomona, CA

**Charger & Utility Company**

- **Max Charge Rate:** 40 kW (GB/T)
- **Parking Configuration:** Pull in with Trailer
- **Utility:** Southern California Edison

**Route**

- **Route Type:** Diminishing Load (7-10 stops per day)
- **Goods:** Beer and Seltzer
- **Payload Range:** Usually heavy, up to 82,000 lbs

**March 2022**
1. Select any of the 13 fleets
2. Select a day or range of days
3. Select Units of Measure
4. Enjoy the data!
Run on Less – Electric Videos

Real World, Real Time Case Studies

• Video for each fleet & OEM
• Fleet Interviews: Drivers & Leaders
• OEM Interviews & more

March 2022
"Stories from the Road"

- New video every day
- All commercial truck EV related
- Pulled from several dozen interviews

March 2022
Electric Truck Bootcamp

ELECTRIC TRUCK BOOTCAMP

SESSION
1  Why Electric Trucks?
2  Charging 101 — Planning & Buildout
3  Charging 201 — Power Management & Resilience
4  Working with Your Utility
5  Incentives for Electrification
6  Maintenance, Training & Safety
7  Finance & Innovative Business Models
8  Battery Supply Chains & End of Life
9  Global Perspectives
10  Drivers & Electric Trucks

SCAN for Training Videos, Quizzes and Badges

WWW.RUNONLESS.COM

July 2021
Electric Trucks

Collaboration
• Fleets
• OEMs (Existing & New)
• Suppliers
• Dealerships (Sales/Service)
• Governments
• Charging System Suppliers
• Utility Companies

March 2022
Let’s Stay Connected... 
... And charged up!

NACFE (° Spanish: NACFE LATAM)

RunOnLess.com

Dave Schaller
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260-602-5713
POLL 2

Please rank, in order of importance, the biggest challenge your organization sees in purchasing or transitioning to an electric truck/s in its fleet,

- Truck cost
- Infrastructure cost
- Knowledge of how electric truck performs compared to traditional diesel of gas truck
- Other __________________________

___________________________________
Bill Bliem | Senior Vice President, Fleet Services
About NFI

Privately held by the Brown Family since its inception in 1932, NFI is a fully integrated third-party supply chain solutions provider. Serving customers around the world, across a variety of industries, NFI is dedicated to providing customized, engineered solutions that propel business to succeed.

We deliver logistics solutions that transform the way business gets done.

<table>
<thead>
<tr>
<th>Established in 1932</th>
<th>$3 Billion Annual Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>14,500+ employees</td>
<td>58M+ SF of warehouse space</td>
</tr>
<tr>
<td>4,500+ tractors</td>
<td>12,500+ trailers</td>
</tr>
</tbody>
</table>
Sustainability Timeline

- **2006**: NFI starts BioFuel research division
- **2008**: Company wins first EPA SmartWay Award
- **2008**: NFI launches *Fit Fleet*
- **2010**: NFI builds solar fields, retrofits solar panels on rooftops, and starts Solar division
- **2011**: NFI institutes 5-min idle rule: A truck engine that idles more than 5-mins in a stationary position is shut down.
- **2011**: NFI announces *NFI Impact*
- **2012**: Battery-powered auxiliary powered units (APUs) installed in sleeper fleets
- **2017**: Started initiative to invest into electric trucks, met with OEMs
- **2017**: NFI partners with Volvo LIGHTS project
- **2018**: Electric Charging infrastructure built in Southern California
- **2018**: NFI partners with Daimler Trucks N.A.
- **2018**: Two NFI vehicles participated in the Run on Less—Electric truck demo
- **2019**: NFI begins piloting 10 Daimler Freightliner eCascadias
- **2019**: NFI Replaces SoCal diesel yard truck fleet with 27 Kalmar Ottawa T2e’s
- **2019**: Awarded funding for the JETSI project
- **2020**: NFI enlists GNA to enhance environmental impact reporting
- **2020**: NFI joins Hyliion’s Hypertruck Innovation Council and commits to piloting the Hypertruck ERX
- **2020**: Two NFI vehicles participated in the Run on Less—Electric truck demo
- **2021**: NFI begins piloting 2 Volvo VNR electric trucks
- **2021**: Partnered with Electrify America and started design of 7MW charging site with microgrid
About the Project
Announced in 2021, the JETSI (Joint Electric Truck Scaling Initiative) Project, funded by CARB and CEC and led by South Coast AQMD, is the largest commercial deployment of battery-electric trucks in North America to date. Helping to significantly increase the number of zero-emission heavy-duty trucks available for goods movement while achieving necessary emission reductions, accomplishments JETSI and NFI will achieve by 2023 include:

- **690,000** Diesel-Gallons Replaced
- **8,247** Metric Tons of GHG Eliminated
- **5 Tons** Pollutants reduced annually
- **30** Class-8 battery-electric Freightliner eCascadias will be deployed by NFI from DTNA
- **30** Volvo VNR electric trucks will be deployed through JETSI and 10 through additional funding
- **1 MW** Solar power installed onsite
- **5 MWh** Energy storage built onsite
- **19** 350 kW Ultra-fast DC Cabinets will be installed, with 38 fast chargers
- **2.4 Million kWh** of zero-emission energy generated annually
Determination of fleet fit

**Ontario Drayage Fleet**

50-55 Miles Empty

10-20 Miles Empty

60-75 Miles Loaded

**Considerations**

- Distance
- Payload
- Efficiency
- Charging locations
- Charging rate
- Time available to charge

![Graph showing miles per day/trips per day](image)
Battery size options vs payload and range

**Efficiency**

1.8 - 2.2 kWh/mi on our 200 mile tractors
(2 kWh/mi average)

50 Miles = 100kWh = 1375 lbs battery weight

275 miles - approx. 8250 lbs (600 kWh)

*Keep in mind the reduction in battery output over time*

**Factors –**

Age – Temperatures - Operating at high and low state of charge - Charging speeds - Usage (energy cycles)
Sustainable Infrastructure

NFI’s charging infrastructure operates from the grid but creates resiliency to charge NFI’s heavy-duty fleet. It’s the single largest charging infrastructure project supporting heavy-duty electric trucks in the U.S.

19
350 kW Ultra-fast DC Cabinets with 38 chargers by 2023

7
150 kW chargers in Chino, CA

5
Plans in progress for 150 kW chargers in Paramount, CA

27
Yard tractor chargers installed in SoCal campuses

NFI’s solar power and storage helps not only to power it’s electric vehicles, but also the warehouses and material handling equipment they sit above.

8 MW
NFI-owned solar power installed on NFI warehouses (including 1MW with the JETS1 Project)

5 MWh
of energy storage will be built through the JETS1 Project
### Lessons Learned so far on BEV’s

<table>
<thead>
<tr>
<th>Efficiency is key ingredient</th>
<th>Range is a factor</th>
<th>Consider infrastructure first</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Don’t forget to include all your mpg improvement specs in your BEV</td>
<td>3. Know your limits, then subtract a percentage</td>
<td>5. Talk to your utility early and often</td>
</tr>
<tr>
<td>2. Driver training is essential</td>
<td>4. Range will not increase</td>
<td>6. Work on future proofing your investment</td>
</tr>
</tbody>
</table>

### Currently not possible without funding assistance

In total, NFI is committing nearly $23M in investments as a partner in the most significant initiatives advancing zero-emission technology for the transportation industry and has made a concerted effort to win more than $107.7 million in competitive grants with its partners to build a foundation to scale zero-emission technologies.
Lessons Learned on Sustainability

BEV is Part of the Equation

1. BEV will help us achieve a portion of our sustainability goals

2. Exploring additional options to round out our initiatives
   - Hydrogen
   - Hybrid/Range extender

Partnerships are Essential

3. Need partners with a shared commitment to sustainability goals
   - OEMs
   - Agencies
   - Infrastructure

4. Adaptability and flexibility are crucial

Future Predictions are Hard

5. Lessons learned allow us to be better predictors, future proof our investments

6. Need to think about sustainability holistically
   - Equipment
   - Infrastructure
   - Workforce Training

7. How we achieve zero emissions is still to be determined
Get in Contact

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Medium and Heavy-Duty Markets Gear Up:

Latest Findings from Electric Truck Demos and Deployment

U.S. EPA SmartWay Transport Partnership
March 30, 2022

Kevin Walkowicz  CALSTART Sr. Director Truck and Off-Road Program
CALSTART: A National Clean Transportation Organization

CALSTART’s Mission:

• Work with Industry and Government to Develop Clean Transportation Solutions

• Focus on Developing Solutions across 4 Key Transportation Initiatives:
  • Light Duty Passenger Vehicles
  • Trucks and Off-Road Vehicles
  • Buses and Innovative Mobility
  • Clean Fuels and Infrastructure

• 20+ years of Expertise and Capabilities to Develop Solutions:
  • Technology Demonstration and Validation
  • Market Acceleration (Vouchers and Incentives)
  • State and Federal Policy Development
  • Member Support and Services

Over 300 members to advance and accelerate clean transportation solutions

Headquarters in Pasadena, CA with Regional Offices in Detroit, NYC, Denver, Berkeley, San Joaquin Valley
The Advanced Clean Truck (ACT) Rule

- June 2020: CA Enacted the Advanced Clean Truck Rule
- July 2020: 15 additional states sign an MOU to get to 100% zero emissions by 2050 (NESCAUM)
- By End of 2021: 5 additional states have joined CA to enact ACT WA, OR, NY, NY, MA
- More MOU states could take action in 2022:
  - CT, PA, CO, ME, VA?
- CA’s ACT is Mfg sales mandate but other ‘ecosystem’ components are being advocated for:
  - Incentives (vehicles and infrastructure)
  - Advanced Clean Fleet (ACF) regulation – CA will pass this year, others may follow
  - PUC and other utility rate and programs (EV rates, etc)
  - Utility Make Ready Programs (utility side upgrades for charging)
Projected MHD Vehicles on the Road in CA

% of ZETs on the road in CA (~2M total trucks on road)

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>ACT ZEV %</th>
<th>ACT + ACF ZEV %</th>
<th>MSS ZEV %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2024</td>
<td>0%</td>
<td>1%</td>
<td>3%</td>
</tr>
<tr>
<td>2025</td>
<td>1%</td>
<td>1%</td>
<td>4%</td>
</tr>
<tr>
<td>2030</td>
<td>5%</td>
<td>10%</td>
<td>13%</td>
</tr>
<tr>
<td>2035</td>
<td>16%</td>
<td>26%</td>
<td>31%</td>
</tr>
<tr>
<td>2040</td>
<td>27%</td>
<td>40%</td>
<td>54%</td>
</tr>
<tr>
<td>2045</td>
<td>35%</td>
<td>56%</td>
<td>71%</td>
</tr>
</tbody>
</table>

MSS assumes 100% sales by 2035

MSS = Mobile Source Strategy

Yearly ACT Driven Sales Expected

- 2024: 4,300
- 2025: 5,800
- 2026: 8,000
- 2027: 12,200
- 2028: 17,000
- 2029: 22,000
- 2030: 27,000

2025 MSS = 63k
2025 ACT = 10k

2030 MSS = 213k
2030 ACT = 104k
According to CALSTART’s Zero Emission Truck Inventory (ZETI): through 2021 there were over 120 models of MHD trucks available from dozens of mfgs available in US and Canada today – with more coming in 2022 and beyond.
1,215 Class 2b-8 Zero Emission Trucks (on and off road) deployed since 2011

~50% were MD trucks  
~20% were yard tractor  
~500 were from early 2011-2013 pilot projects with many no longer in service

Nationally:
~67% of ZET deployments were from upfitters (Motiv, Lightning eMotors, SEA, etc)  
~13% by ‘ZET only’ mfgs (BYD, Orange EV)  
~20% by conventional mfgs (Daimler, Volvo, Navistar, PACCAR, etc)

Medium and Heavy-Duty Purchase Incentives: HVIP and EnergIIze

Hybrid and Zero Emission Truck and Bus Voucher Incentive Program (HVIP):
- A point-of-sale discount to purchaser to offset incremental cost of clean vehicles – funded through CARB
- CALSTART has administered since 2010
- Over $600M allocated since inception
- Class 2b-8 eligible for incentives
- Truck Voucher amounts of $7,500 (2b)- $150,000 (class 8 drayage)
- 2022 - Additional 15% incentive if deployed in disadvantaged communities (DAC) and less than 100 truck fleet

EnergIIze (CEC funded): MHD Infrastructure
- New program just launched last week with initial $17M
- Additional funding planned
- Four ‘funding lanes’:
  - EV Fast Track – already purchased vehicles
  - EV Public Charging – for publicly available infrastructure
  - H2 Refueling – fleets or station owners deploying H2
  - EV Jump Start – DAC located users
CALIFORNIA HVIP: 2021 SUMMARY / 2022 PROJECTION

Approved Vouchers of $247M for HVIP in 2021

<table>
<thead>
<tr>
<th>Truck Type</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transit Bus</td>
<td>250</td>
</tr>
<tr>
<td>School Bus</td>
<td>400</td>
</tr>
<tr>
<td>Shuttle Bus</td>
<td>100</td>
</tr>
<tr>
<td>Class 8 Tractors</td>
<td>600</td>
</tr>
<tr>
<td>Class 4-8 Trucks</td>
<td>600</td>
</tr>
<tr>
<td>Refuse and Utility</td>
<td>50</td>
</tr>
<tr>
<td>EPTO</td>
<td>36</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>~2,000 trucks and buses</strong></td>
</tr>
</tbody>
</table>

$569.5M in Funding Plan

- Would provide $524.5M in Voucher Funding
- Projected Mix:

<table>
<thead>
<tr>
<th>Truck</th>
<th>Total Quantity</th>
<th>Funding Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck</td>
<td>2,631</td>
<td>280,023,262</td>
</tr>
<tr>
<td>Bus</td>
<td>660</td>
<td>93,840,987</td>
</tr>
<tr>
<td>School Bus</td>
<td>487</td>
<td>148,651,602</td>
</tr>
<tr>
<td>EPTO</td>
<td>76</td>
<td>1,980,222</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>3,854</strong></td>
<td><strong>524,496,072</strong></td>
</tr>
</tbody>
</table>

New for 2022:
- **OPENS on March 30th !!!**
  - Class 2b availability – Ford eTransit, more to follow
  - ~500M available this year
  - Similar amount for next year – pending budget approval
  - New for 2022 is the ‘Innovative Small e-Fleets (ISeF) – $25M to fund fleets
  - Set Asides: $65M for transit buses, $46M for Drayage, $122M for School Buses

2022 HVIP
- $569.5M in Funding Plan
- Would provide $524.5M in Voucher Funding
- Projected Mix:
<table>
<thead>
<tr>
<th>Model</th>
<th>Requests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volvo VNR BEV Tractor</td>
<td>222</td>
</tr>
<tr>
<td>Freightliner eCascadia BEV Tractor</td>
<td>172</td>
</tr>
<tr>
<td>Blue Bird All American School Bus</td>
<td>150</td>
</tr>
<tr>
<td>Lightning FT3-86 Battery Electric Truck (Cargo and Bus)</td>
<td>119</td>
</tr>
<tr>
<td>SEA FORD F-59 EV</td>
<td>101</td>
</tr>
<tr>
<td>Xos SV01, battery-electric truck 4x2</td>
<td>99</td>
</tr>
<tr>
<td>BYD 8TT Battery Electric Truck</td>
<td>79</td>
</tr>
<tr>
<td>Motiv Power System EPIC F-59 Step Van, Shuttle Bus, Truck</td>
<td>78</td>
</tr>
<tr>
<td>Micro Bird G5 School Bus</td>
<td>73</td>
</tr>
<tr>
<td>LionD Electric School Bus</td>
<td>61</td>
</tr>
</tbody>
</table>
As of end of 2021:

<table>
<thead>
<tr>
<th>HVIP</th>
<th>CARB CEC Pilot</th>
<th>VW Funds</th>
<th>MSRC</th>
<th>YTD Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>432</td>
<td>70</td>
<td>12</td>
<td>116</td>
<td>630</td>
</tr>
</tbody>
</table>

**HVIP Vouchers**

- **BYD (8TT)**: 50
- **Freightliner (eCascadia)**: 80
- **Kenworth (T680e)**: 36
- **Lion (Lion8)**: 10
- **Peterbilt (579EV)**: 50
- **Volvo (VNR)**: 206

**Total**: 432

Avg HVIP drayage truck purchase price: $420k
Some HVIP Voucher Cancellations in 2021: How to minimize next year

- Infrastructure availability and install expertise/support – need more assistance from utilities or others
- Infrastructure cost and timing - unknowns to install owned infrastructure, lack of public charging for trucks
- Leased Yard Space (installation of infrastructure challenges) – how to get landlord to invest
- Range vs routes and lack of on-route fast charging (+ 200 mi per day needed for some exceeds batteries offered)
- Truck Economics still difficult, even with voucher (2x price of new diesel, even with voucher)
- Unproven / Performance Unknowns: need more demos

Small Fleets: ISeF hoping to solve this starting in 2022

- Typically buying used $50k trucks for lower payments – need similar costs
- Can’t own/install infrastructure, so need a provider
- Lack of ‘spare’ trucks in case service is needed; quicker turnaround with older truck repairs
- Less expertise to navigate incentives, infrastructure, LCFS, brokered deals
- Less dealer attention

<table>
<thead>
<tr>
<th>Project/Fleet(s)</th>
<th>Number of ZEVs Deployed</th>
<th>Truck Manufacturer</th>
<th>Type/Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Coast AQMD / NFI &amp; Schneider</td>
<td>100</td>
<td>Volvo (25), Daimler (50)</td>
<td>VNRe, eCascadia</td>
</tr>
<tr>
<td>Center for Transportation and the Environment / NorCAL Drayage</td>
<td>30</td>
<td>Hyundai</td>
<td>XCIENT Fuel Cell Electric</td>
</tr>
<tr>
<td>San Joaquin Valley APCD / Pepsi</td>
<td>50</td>
<td>Tesla</td>
<td>BET Class 8 Semi</td>
</tr>
<tr>
<td>San Joaquin Valley APCD / Albertsons</td>
<td>50</td>
<td>Volvo</td>
<td>VNRe</td>
</tr>
<tr>
<td>California Hispanic Chamber of Commerce Foundation / Gonzales Logistics Inc</td>
<td>50</td>
<td>Lion</td>
<td>Lion8F Drayage</td>
</tr>
</tbody>
</table>
Thank You!
For More Information:

www.CALSTART.org
kwalkowicz@calstart.org