What I’ll Cover

• Who Are We?

• Why Electric Trucks?

• Electric Truck Work to Date

• Regional Haul Focus
Rocky Mountain Institute

- Independent, nonpartisan nonprofit
- Cofounded in 1982 by Amory Lovins, RMI’s chairman emeritus and chief scientist
- Mission to transform global energy use to create a clean, prosperous, and secure low-carbon future
- Engage businesses, communities, institutions, and entrepreneurs to accelerate the adoption of market-based solutions that cost-effectively shift from fossil fuels to efficiency and renewables

www.RMI.org
North American Council for Freight Efficiency

- Unbiased, non-profit
- Mission to double freight efficiency
- All stakeholders
- Scale available technologies, guide future change and Run on Less demonstrations.
- Primary focus: Tractor-trailers

www.NACFE.org
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Trucks are one of the biggest sources of greenhouse gas emissions.

Source: EPA
I-70 remains shut down for massive fire, truckers warned not to take some detours

By Ashley • August 11, 2020
In addition to zero tailpipe GHG emissions, electric trucks also offer:

• Higher performance (torque)

• Reduced total cost of ownership (TCO) (?)

• Increased uptime

• Zero tailpipe emissions (NOx, PM, etc.)

• Noise reduction

• Driver satisfaction & retention
Heavy-duty electric trucks are gaining popularity.

New Rule in California Will Require Zero-Emissions Trucks

More than half of trucks sold in the state must be zero-emissions by 2035, and all of them by 2045.
The Colorado Department of Transportation (CDOT), Colorado Department of Public Health & Environment (CDPHE), and the Colorado Energy Office (CEO) will host a series of joint online public meetings to discuss Colorado’s Clean Truck Strategy.

Online Public Meetings Details

PUBLIC MEETINGS

August 27  September 16  October 1
Why Electric Trucks

Electric truck sales in US predicted to soar to 54,000 by 2025

AUGUST 14, 2020 • 1 COMMENT • 5 MINUTE READ • JOSHUA S. HILL

Roger Nielsen • 2nd
President and CEO at Daimler Trucks North America

Last year at the ACT Expo, I announced that the future would be electric. Thanks to the work of our engineering team, and co-creation with our customers who are performing real work in the real world with our electric trucks, that vision of the future is closer than ever before. Together with Penske Logistics and NFI, who have been running distribution, delivery and drayage operations for the past year, we have now accumulated more than 300,000 miles of real-world testing on our electric trucks. In addition, in the just the last several weeks, Black Horse Carriers, Inc. CoreMark International, US Foods, EnerSys, Fastenal Company, J.B. Hunt Transport Services, Inc. Ryder System, Inc. and UPS have all joined with adding either Freightliner eCascadia or eM2s to their daily operations. Together with our customers, we are #LeadingTheCharge.
Why Electric Trucks

California city of Santa Monica maps first U.S. zero-emission delivery zone

By Katie Fehrenbacher

June 17, 2020
Why Electric Trucks

NYC DOT in Partnership with the NYCDEC Announces Launch of the New York City Clean Trucks Program

The New York City (NYC) Clean Trucks Program will help replace older, heavily polluting diesel-powered trucks with new, less polluting trucks in environmental justice communities.

The New York City Department of Transportation (NYC DOT) announced today that the NYC Clean Trucks Program will provide $9.8 million to replace older, dirtier diesel-powered trucks in New York City with newer, less polluting trucks. This new initiative will help improve air quality, reduce greenhouse gas emissions that contribute to climate change, and promote investment in cleaner, advanced trucks and transportation technologies.

As part of New York State’s $127.7 million allocation of the federal Volkswagen Settlement, New York State Department of Environmental Conservation (NYSDEC) will direct approximately $9.8 million to the NYC Clean Trucks Program to fund medium- and heavy-duty replacement trucks with an emphasis on all-
Why Electric Trucks

National Coalition of Heavy Truck Leaders Calls for Major Federal Role, Investments to Support U.S. Leadership in Zero-Emission Trucks

For Immediate Release

For More Information Contact:

Katharine Burnham
Kburnham@calstart.org; 626-344-6863

The National Zero-Emission Truck (ZET) Coalition, representing America’s major heavy truck makers, innovators, suppliers and key stakeholders, has released its priority federal recommendations to support this critical sector. The recommendations call for an increased federal role and funding to ensure U.S. tech leadership in this clean air technology, including a national point-of-sale incentive program to help drive the near-term production of zero-emission medium- and heavy-duty vehicles (MHDVs), including clean trucks and buses, in the United States.

The Coalition, organized by clean transportation industry organization CALSTART, is also urging that federal funding be targeted at commercial zero-emission vehicle charging and refueling infrastructure and that federal innovation investments be increased for zero-emission technologies to secure U.S. competitiveness over the next decade.
Why Electric Trucks

WEST COAST CLEAN TRANSIT CORRIDOR INITIATIVE STUDY

FOR IMMEDIATE RELEASE: Wed., June 17, 2020
Media Contact: Paul Griffo 626-302-2255

I-5 Electric Truck Charging Sites Mapped Out by Electric Utilities

West Coast Clean Transit Corridor would create jobs, reduce greenhouse gas emissions from freight transportation, help eliminate health-harming diesel emissions from trucks.

Electric utilities in three West Coast states have announced the results of a study that could lead to significant reductions of pollution from freight transportation up and down the Pacific Coast and create jobs in an economy hit hard by the novel coronavirus.

The West Coast Clean Transit Corridor Initiative, a study commissioned by an unprecedented collaboration among nine electric utilities and two agencies representing more than two dozen municipal utilities, recommends adding electric vehicle charging for freight haulers and delivery trucks at 50-mile intervals along Interstate 5 and adjoining highways.
Why Electric Trucks

JULY 16, 2020 | Albany, NY

Governor Cuomo Announces Nation-Leading Initiatives to Expand Electric Vehicle Use to Combat Climate Change
Why Electric Trucks

Power Your Drive for Fleets

EV Charging Infrastructure Program

Our goal is to make it easier for commercial and industrial businesses like yours to transition to driving electric. As part of our commitment to clean transportation and clean air, SDG&E® is implementing a program to help you achieve this by installing the charging infrastructure needed to electrify your medium- and heavy-duty (MD/HD) fleets.

Recent advances in battery technology and increased availability of MD/HD vehicles from original equipment manufacturers (OEMs) have made the transition to an electric fleet a reality. SDG&E can provide charging infrastructure for both on-road and off-road vehicles, helping California meet its ambitious climate action goals.
Why Electric Trucks

Public Fleets Able to Purchase Electric School Buses and Street Sweepers with the Climate Mayors EV Purchasing Collaborative

March 26, 2020

NIKOLA RECEIVES LANDMARK ORDER OF 2,500 BATTERY-ELECTRIC WASTE TRUCKS FROM REPUBLIC SERVICES

Nikola’s Tre electric drivetrain applied in the refuse market

Published August 10, 2020
What I’ll Cover

• Who Are We?

• Why Electric Trucks?

• Electric Truck Work to Date

• Regional Haul Focus
Guidance On Electric Trucks

#1 Electric Trucks: Where They Make Sense
May 2018

#3 Electric Trucks: Charging Infrastructure
March 2019

#2 MD Electric Trucks: Cost Of Ownership
October 2018

#4 Viable Class 7 & 8 Electric, Hybrid & Alt Fuels Tractors
December 2019

Now Free Online at (https://nacfe.org/emerging-technology/electric-trucks-2/)
Electric Trucks

Collaboration
• Fleets
• OEMs (Existing & New)
• Suppliers
• Dealerships (Sales/Service)
• Governments
• Charging System Suppliers
• Utility Companies
### 10 ARGUMENTS FOR AND AGAINST ELECTRIC TRUCKS

**Argument FOR Electric Trucks**

1. Commercial battery electric vehicle (CBEV) weight is not an issue
2. CBEV technology is proven and here now
3. Maintenance will be less costly
4. CBEVs will last beyond 10 years
5. CBEVs will be competitively priced
6. CBEVs will be less expensive to operate
7. CBEVs will command a premium at resale
8. Trust the market to provide CBEV charging solutions
9. Trust the market to provide CBEV charging solutions
10. The grid and market will evolve with CBEVs

**Argument AGAINST Electric Trucks**

1. Vehicle base weight is too high to support my freight needs
2. Technology is not ready
3. Maintenance may not be less costly
4. Vehicle life is too short
5. Vehicle purchase price is too high for a positive ROI
6. Vehicle operating costs are too great for positive ROI
7. Vehicle residual value is questionable
8. Charging infrastructure is not ready
9. Charging infrastructure is not fast enough
10. The electric grid cannot support growth in electric vehicles

---

**Where they make sense?**

- Arguments for and against
  - Reality in the middle
  - Weight
  - Maintenance
  - Cost
  - Market for infrastructure

---

NACFE’s findings on these 10 arguments are discussed in detail in its Electric Truck Guidance Report.
Medium-Duty Trucks

- Close to base
- Limited range
- Consistent, dedicated routes
- Total cost calculator
- “Unknown...difficult to monetize benefits”
  - Noise
  - Design flexibility
  - And on
Infrastructure

- Complex
- Large amount of power fast
- Involve all stakeholders early
- Time to complete with truck availability
- Be flexible
HD Tractors Technology Bridge

**PRESENT: 2020**
Technology immature
Many unknowns & challenges

**“MESSY MIDDLE”: 2030**
Many optimized solutions
Growing infrastructure
Multi fuel choices

**Innovation & maturation**
Facts replace estimates
Learning curves

**FUTURE: 2040**
Fast charging everywhere
Long life, low cost batteries
Acceptable weights

Legacy Diesels
Dominate Market

CNG/LNG
Hybrid Diesel Electric
1st Gen CBEV & FCEV
Advanced Diesel

Renewable Natural Gas & Diesel
Next Gen CBEV & FCEV from all generators

Mature CBEV & FCEV from Clean Energy

CBEV from Clean Energy
Findings: Parity To Diesel

Class 3 - 6
Dark Blue = EV is Better

Class 7 & 8
Findings: Parity To Diesel

### 2020

<table>
<thead>
<tr>
<th>Class 3 - 6</th>
<th>Weight</th>
<th>Tare Weight</th>
<th>Parity</th>
<th>Typical Weight</th>
<th>Parity</th>
<th>Max Weight</th>
<th>Parity</th>
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<tbody>
<tr>
<td></td>
<td>Cost</td>
<td>Initial Cost</td>
<td>Parity</td>
<td>Net After All</td>
<td>Parity</td>
<td>Operating Cost</td>
<td>Parity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Residual Value</td>
<td>Parity</td>
<td>Value Salvage</td>
<td>Parity</td>
<td>Reconditioning</td>
<td>Parity</td>
</tr>
</tbody>
</table>

### 2030

<table>
<thead>
<tr>
<th>Class 7 &amp; 8</th>
<th>Weight</th>
<th>Tare Weight</th>
<th>Parity</th>
<th>Typical Weight</th>
<th>Parity</th>
<th>Max Weight</th>
<th>Parity</th>
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</tr>
</tbody>
</table>

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY
Electric Truck Guidance – To Date

• MD Electric Trucks will be first – close to base, smaller, emission zones, growth of e-commerce and other factors.

• Generally unknown factors in cost modeling – many of which are cost benefits

• Charging infrastructure is biggest barrier.

• Fleets choosing electric trucks now will be on the early learning curve.

• For HD tractors, electric will dominate by 2040 with a messy middle until then.

• Dedicated route day-cab duty cycle is the biggest early opportunity.
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• Why Electric Trucks?

• Electric Truck Work to Date

• Regional Haul Focus
Focus On Regional Haul Electrification

**Past Accomplishments**
- Run on Less Regional
- Regional Haul thought leadership
- Electric truck guidance reports

**New Workstreams**
- Identify high-potential regional trucking routes
- Support implementation on first- and next-mover deployments
- Scale best practices in infrastructure deployment
- Increase confidence in the value of electrification

- NACFE (North American Council for Freight Efficiency)
More Regional Haul: An Opportunity for Trucking?

- Drop in Length of Haul
- Warehousing
- Technology Trends
- An Opportunity
  - Drivers
  - Alternative Fuels
  - Others?


https://nacfe.org/regional-haul/
High-Potential Regions

Technology
- Range (climate, grade, etc.)
- Electricity pricing
- Regenerative braking

Need
- Air quality
- Equity & environmental justice
- Freight flows

Support
- State & city policies & incentives
- Utility programs & rates
- Training programs

NACFE
North American Council for Freight Efficiency
# High-Potential Regions

## Technology

<table>
<thead>
<tr>
<th>Climate</th>
<th>Electricity Pricing</th>
</tr>
</thead>
</table>
| - Where is the climate most conducive to electric trucks?  
- Where is extreme heat and cold—which reduce range by adding auxiliary power loads and decreasing battery performance—least frequent? | - Where are volumetric charges for electricity the cheapest and where do they have the biggest potential for savings compared with diesel prices? |

## Need

<table>
<thead>
<tr>
<th>Air Quality</th>
<th>Life-cycle GHG Emissions Benefits</th>
<th>Freight Flow</th>
</tr>
</thead>
</table>
| - Where is air quality the worst, particularly with respect to ozone?  
- How many people in each of these regions are negatively impacted by this pollution? | - Where is the generation mix of the electricity grid the cleanest?  
- Where do electric trucks represent the biggest opportunity for reducing greenhouse gas emissions, compared with diesel vehicles? | - Where is the most freight being moved? |

## Support

<table>
<thead>
<tr>
<th>Supportive Policies and Incentives</th>
<th>Expressed Interest</th>
<th>Funding Availability</th>
</tr>
</thead>
</table>
| - Where are legislative and regulatory conditions most favorable?  
- Where have they approved policies and incentives such as grants, rebates, income tax credits, and financing options? | - Where have policymakers expressed interest in supporting electric truck deployments?  
- Where are states most committed to a successful transition to electric heavy-duty vehicles? | - Where has VW settlement funding been set aside or made available to support electric truck deployments?  
- Where have utility “make-ready” programs been approved to help with funding for charging infrastructure? |
High-Potential Regions
Wave Of Changes Coming

Jessie Lund, 314.276.0125, jlund@rmi.org
Mike Roeth, 260.750.0106, mike.roeth@nacfe.org

Learn more at: www.RMI.org www.NACFE.org www.RunonLess.com