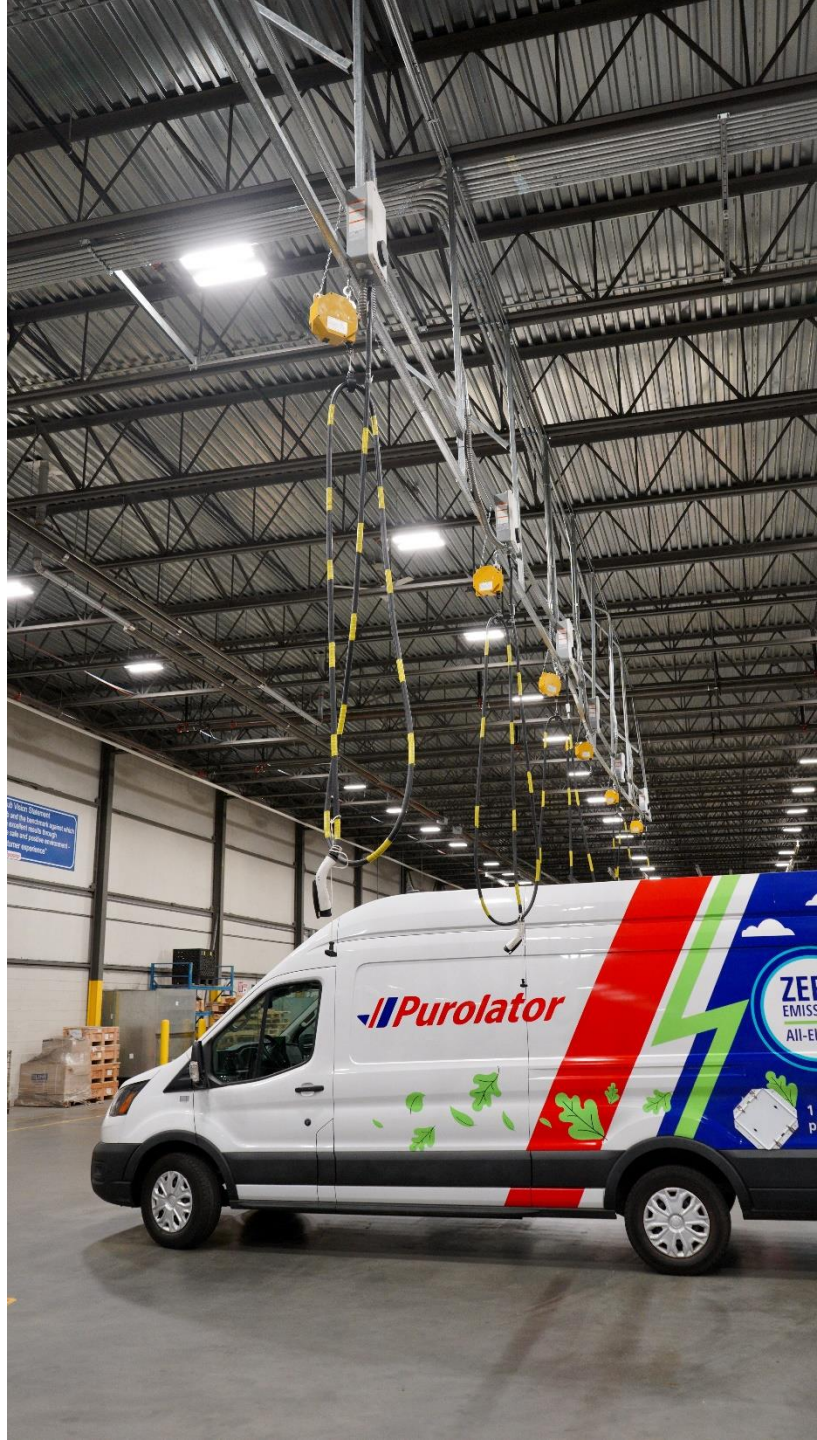
Electrifying Medium and Heavy-Duty Fleets

March 6, 2025

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY



NACFE

NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

Ken North

Emerging Technologies Consultant

Today's Plan

- Who is NACFE?
  - What is it we do, and what are we working on?

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

North American Council for Freight Efficiency

TIRE PRESSURE AERODYNAMIC

SUSTAINABILITY CONFIDENCE

MPG AUTONOMY GUIDING

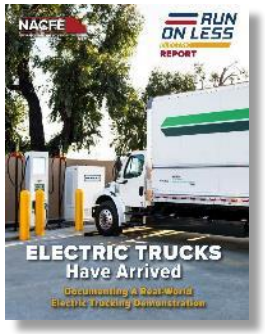
EFFICIENCY BENCHMARKS

ELECTRIFICATION UNBIASED

HYDROGEN IDLE REDUCTION

FUEL AGNOSTIC NON-PROFIT

Key NACFE Reports on ZEV Trucks

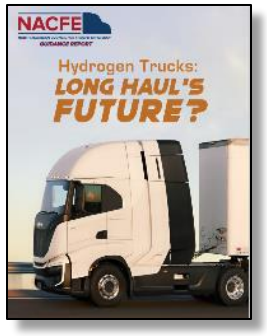


Jan 2022
Review Of Demonstration:
[Electric Trucks Have Arrived]

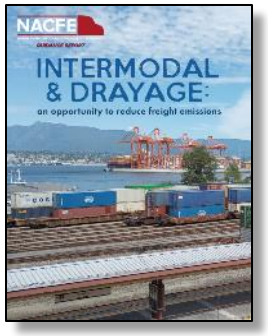
[4 Market Segment Fact Sheets]

Feb 2023
[The Messy Middle:
A Time For Action]

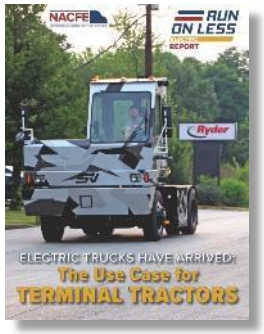
Dec 2020
[Making Sense of Heavy Duty
Hydrogen Fuel Cell Tractors]



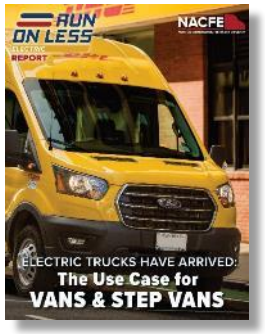
Apr 2023
[Hydrogen Trucks:
Long-Hauls Future?]



Dec 2023
[Intermodal &
Drayage]

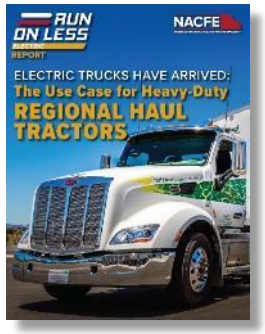


Mar 2022
The Use Case For
[Terminal Tractors]

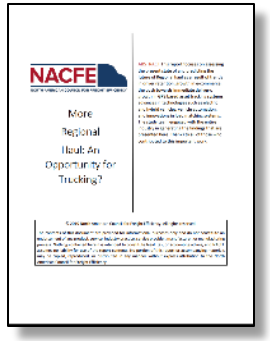


Apr 2022
The Use Case For
[Vans & Step Vans]

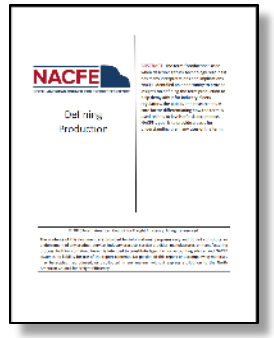
Jun 2022
The Use Case For
[Medium Duty
Box Trucks]



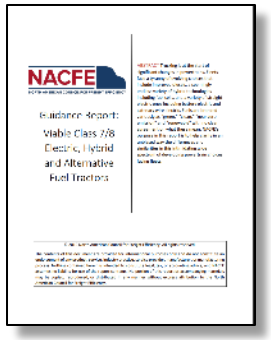
May 2022
The Use Case For
[Regional Haul
Tractors]



Apr 2019
[More Regional Haul:
An Opportunity for
Trucking?]



Jan 2020
[Defining
Production]



Dec 2019
[Viable Class 7/8
Electric, Hybrid and
Alternative Fuel
Tractors]

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

Confidence Reports

Diesel Fuel Savings & Alternative Fuel Range Extenders








1. Tire Pressure Systems
2. Tires: LLR & Wide Based
3. Idle Reduction
4. Automated Transmissions
5. Engine Parameters
6. Lightweighting
7. Downspeeding
8. Maintenance
9. Trailer Aerodynamics
10. Tractor Aerodynamics
11. Lubricants
12. Platooning
13. Solar
14. 6x2 Axles
15. Engine Accessories




Download



Complete, unbiased review of available technologies

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

Run on Less

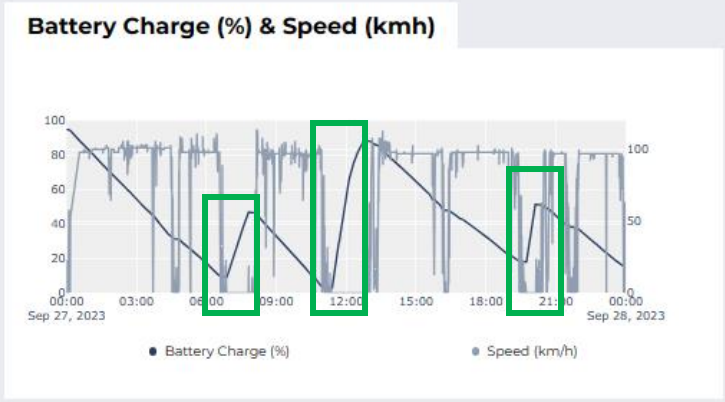
- Tesla Semi at Pepsi
- Sacramento CA depot
- 1076 miles (1,732 kilometers) in 24 hours
- 5 deliveries
- Three charging sessions
- Some regenerative braking
- Most of the day above 50 MPH = 80.5 KPH (55 MPH/88.5 KPH speed limit in California)

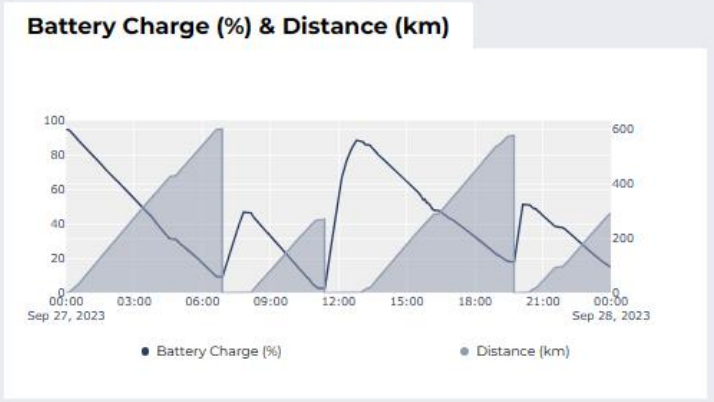
Total Kilometers **1732**

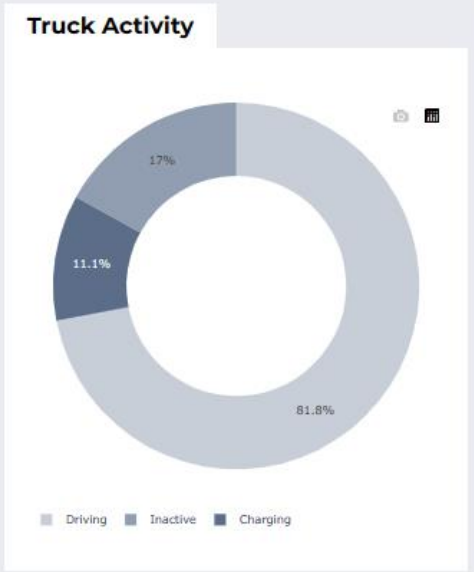
Average Kilometers/Day **1732**

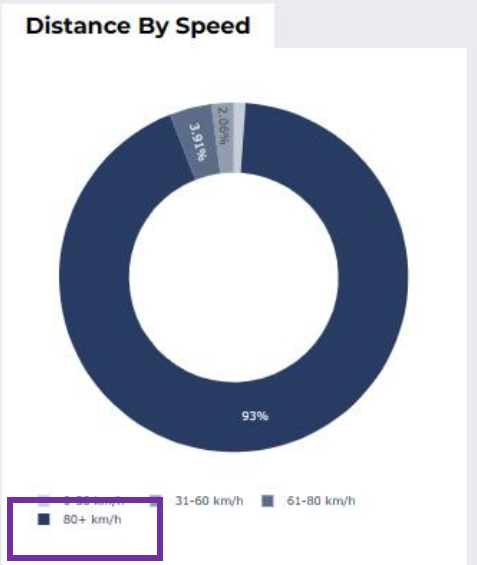
Estimated Deliveries **1**

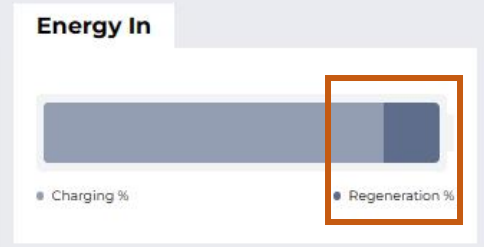
Average Deliveries/Day **1**

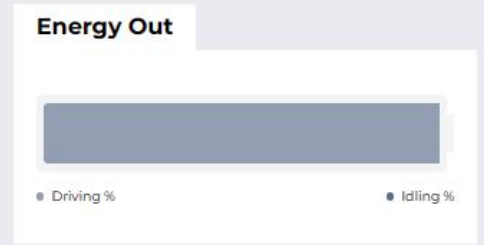












All Videos, Data & Reports are FREE

Executive Level

PEPSICO

Event Level

VOLVO

bp pulse

GEOTAB

FREIGHTLINER

ABB

SmartWay
U.S. Environmental Protection Agency

PROLOGIS

Title Level

Cummins

Supporter Level

NEXTera MOBILITY

ONCOR

LINK

BURNS McDONNELL

THERMO KING

ORSCHELN

ORANGE EV

MICHELIN

Synop

novo

PITTOHIO

zero mission

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

NACFE

NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

Get to know us!
www.nacfe.org

Today's Plan

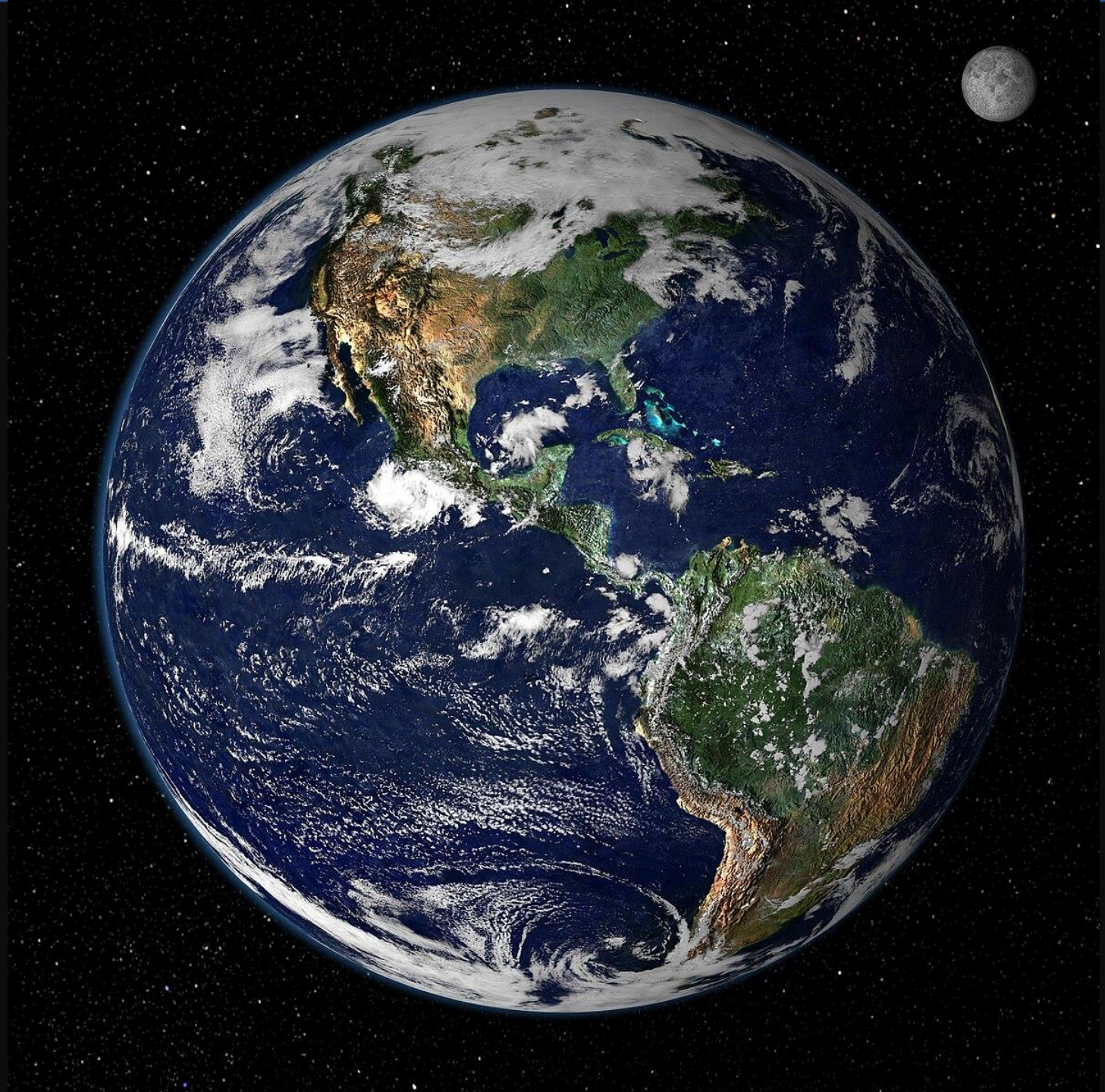
- Who is NACFE
  - What is it we do, and what are we working on

- Update on the road to decarbonization
  - It starts with why
  - Where are we now
  - What direction are we headed

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

“Why on earth” decarbonize transportation?

- U.S.A. & China = 47% of global fossil fuel consumption.
- Canada = 9%
- 7.9B People on Earth – Wealthiest 10% responsible for 49% of $C0_2$ emissions
- Transport emissions have grown faster than any other sector over the past 50 years.
- Since 1990, emissions from medium and heavy-duty trucks have increased by about 75%.
- Trucking in the USA - 93 billion miles/year (1000+ trips to the sun) – 413 million tons CO_2



Where are we…

Where are we…

Where are we…

- Developing ***practical*** solutions

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

Messy Middle

Where are we…

Practical solutions that work

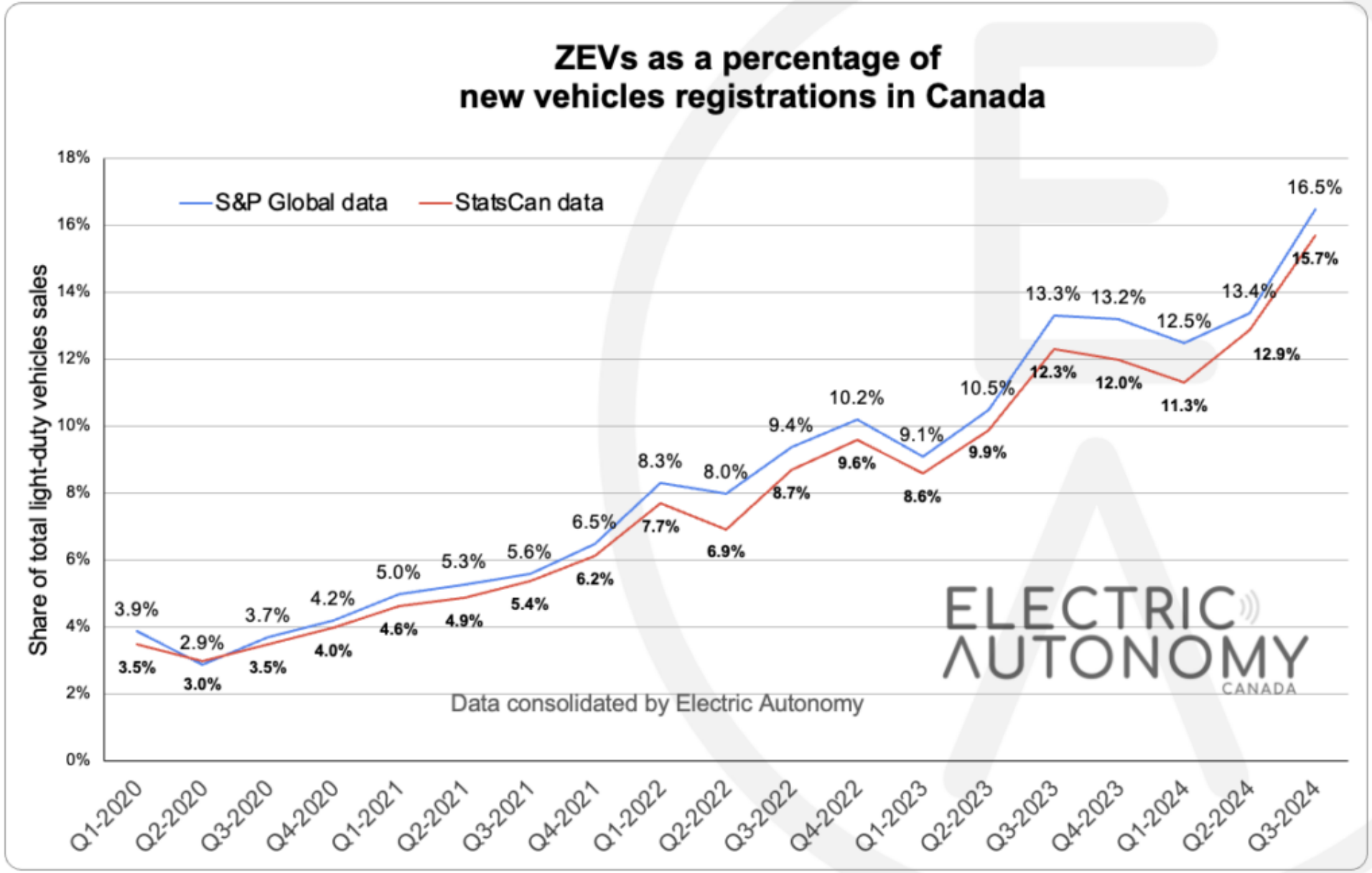
- British Columbia 2024
  - Light duty EV sales 25%
  - EV target reached 2 years in advance.

- Canadian EV registrations 2024
  - Q1 – 48,411
  - Q2 - 65,733
  - Q3 – 75,636

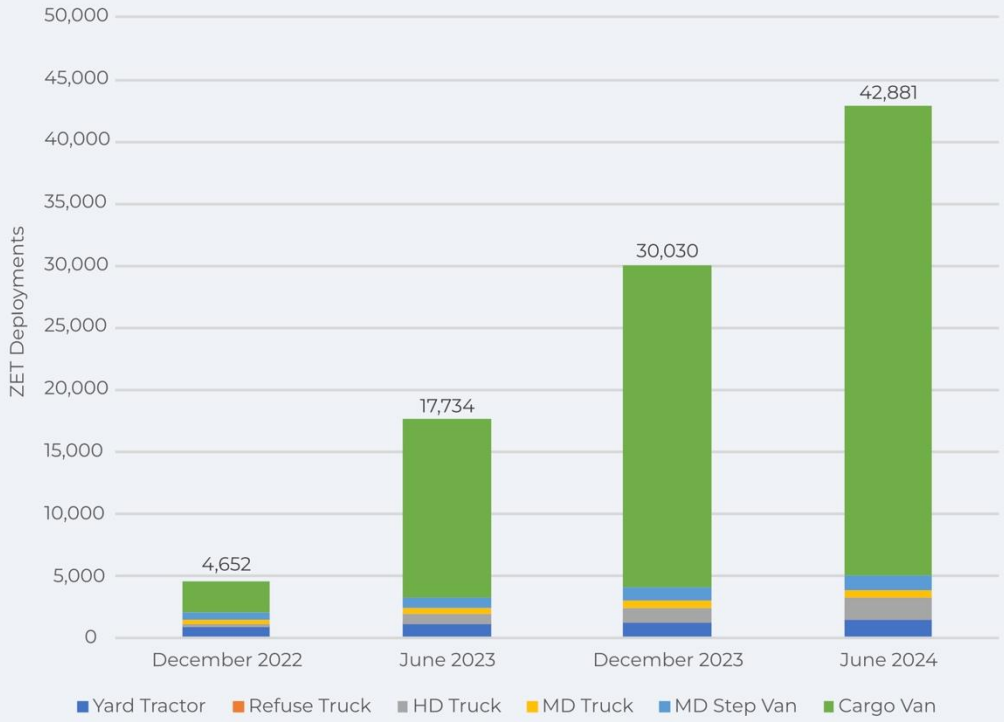
Statistics Canada Statistique Canada

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

Where are we…


ZEVs as a percentage of
new vehicles registrations in Canada
S&P Global data
StatsCan data
Share of total light-duty vehicles sales
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
3.9%
2.9%
3.7%
4.2%
5.0%
5.3%
5.6%
6.5%
8.3%
8.0%
9.4%
10.2%
9.1%
10.5%
13.3%
13.2%
12.5%
13.4%
16.5%
3.5%
3.0%
3.5%
4.0%
4.6%
4.9%
5.4%
6.2%
7.7%
6.9%
8.7%
9.6%
8.6%
9.9%
12.3%
12.0%
11.3%
12.9%
15.7%
Q1-2020
Q2-2020
Q3-2020
Q4-2020
Q1-2021
Q2-2021
Q3-2021
Q4-2021
Q1-2022
Q2-2022
Q3-2022
Q4-2022
Q1-2023
Q2-2023
Q3-2023
Q4-2023
Q1-2024
Q2-2024
Q3-2024
Data consolidated by Electric Autonomy
ELECTRIC AUTONOMY CANADA

EV Truck Deployments

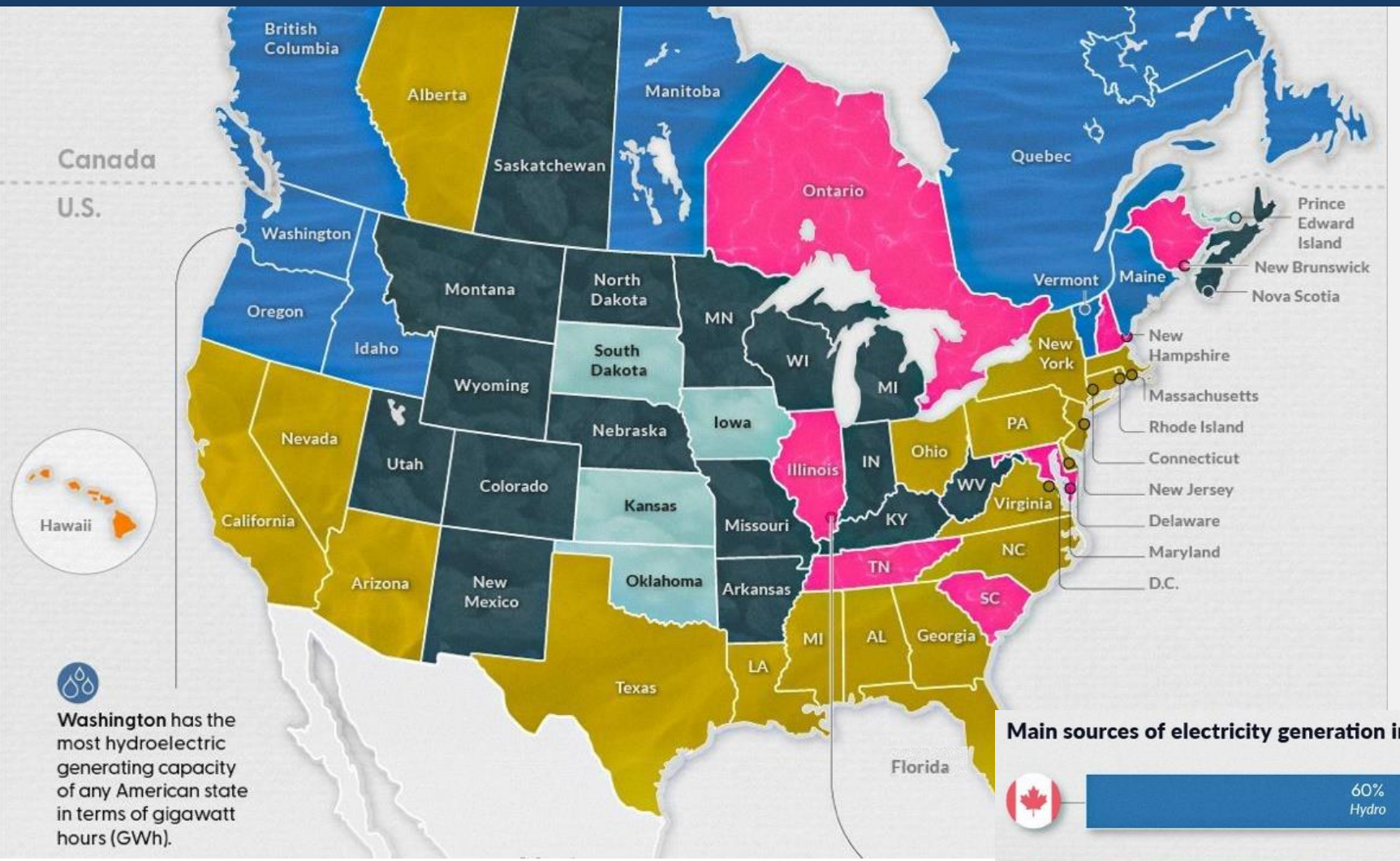


- 42,881 Zero Emission Class 2B->8 Trucks Deployed as of June 2024

"ZETs are now capable of meeting the demands of approximately 65% of all MD truck routes and 49% of all HD truck routes."

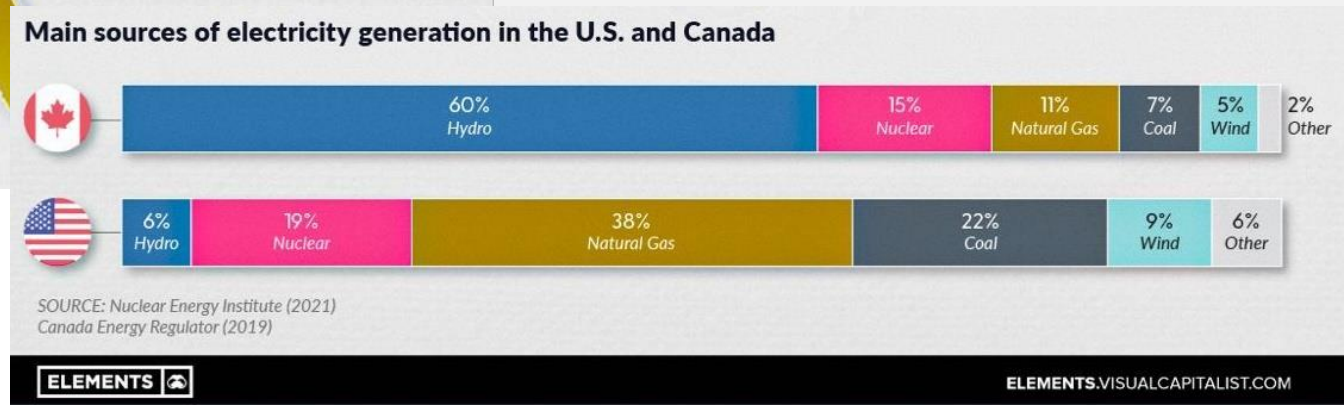
Source: Calstart January 2024
[Zeroing in on Zero-Emission Trucks: The State of the U.S. Market (calstart.org)]

Sources of Electricity



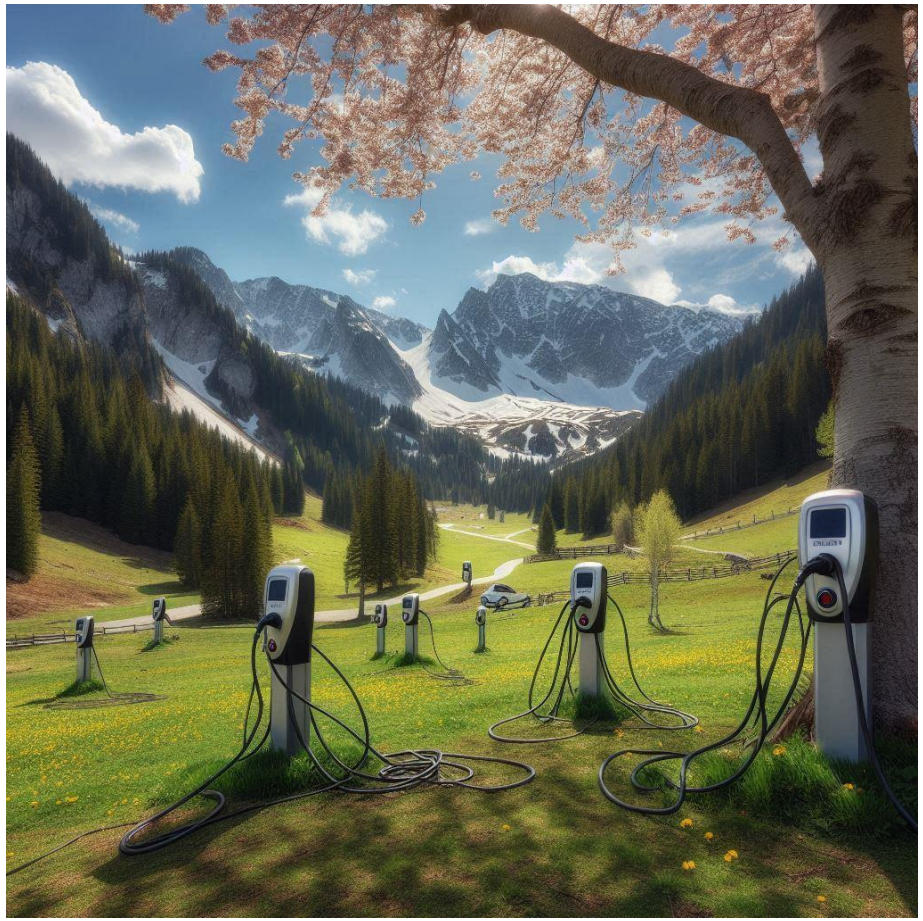
By State & Province

- Natural Gas
- Coal
- Nuclear
- Wind
- Hydro
- Petroleum
- Other



[Mapped: Biggest Sources of Electricity by State and Province (visualcapitalist.com)]

Where are we…



We’re on our way to

fossil free

transportation.

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

What's next…

- What's next?
- What technology is right for your fleet?

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

A Growing Abundance of ZEV Choices

9

19

30

8

7


Cargo Van


MD Step Van


MD Truck


HD Truck


Other


Yard Tractor

> 40 OEMs
> 160 ZEV Models

18

ZEV OEMs
by Vehicle Type
North America

CalStart - https://globaldrivetozero.org/tools/zeti/

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

NACFE

NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

We support your decision making with DATA

Run on Less - “Best of the Best”

2021

RUN ON LESS ELECTRIC

All BEVs

13 Fleets

EV Truck Pilots

2023

RUN ON LESS ELECTRIC DEPOT

BEV Depots

10 Depots

Infrastructure

Results & Data Set

NACFE

NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

Run on Less - Electric DEPOT 2023

- 10 fleet locations
- Each has at least 15 electric trucks
- Fleet videos
- Telematics data

All information at:
RunOnLess.com

Truck Models in Run on Less 2023

1. Vans & Step Vans
2. MD Trucks
3. Terminal Tractors
4. Tractor-Trailers

FORD

FREIGHTLINER

FORD

FREIGHTLINER CUSTOM CHASSIS CORPORATION

ORANGE EV

GM

MOTIV

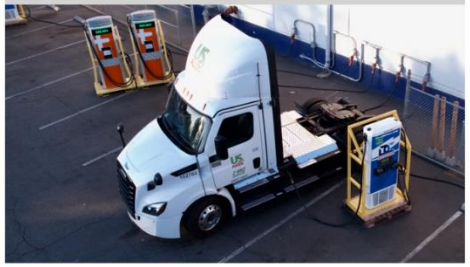
NIKOLA

FREIGHTLINER

INTERNATIONAL

FREIGHTLINER

FREIGHTLINER



TESLA

VOLVO

FREIGHTLINER

RUN ON LESS ELECTRIC DEPOT

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

22 Trucks That Were Monitored

Terminal Tractors

- Orange EV (1)

Vans & Step Vans

- **FCCC** MT50e (1)
- **Ford** E-Transit (4)
- Motiv EPIC (1)

MD Box Trucks

- **Navistar** eMV (1)

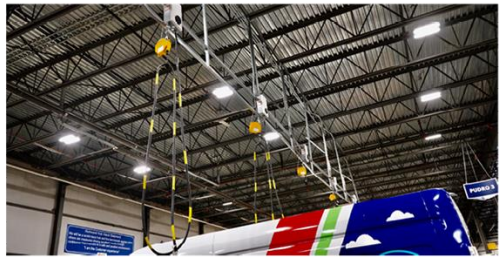
Class 8 Tractors

- Freightliner eCascadia (7)
- Volvo VNR (2)
- **Tesla** Semi (3)
- **Nikola** Tre BEV (1)
- BYD 8TT (1)

Bold = New OEM for 2023 RoL-E DEPOT

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

Chargers (EVSE)



RUN ON LESS ELECTRIC DEPOT

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

- ABB
- BTC Power
- Charge America
- DC Siemens
- Ford Pro
- InCharge Energy
- Heliox
- Power Electronics
- Shell Recharge
- Tesla
- Tritium

Purolator: Richmond BC

Testing Several Different OEMs

- Motiv EPIC Class 6 step van
- Ford E-Transit Class 2 van
- Other models on order
- 15 Overhead Level 2 Chargers
- Diminishing load package delivery
- BC Hydro

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

Pepsi: Sacramento CA

Long Haul & City Delivery with Tesla Semis

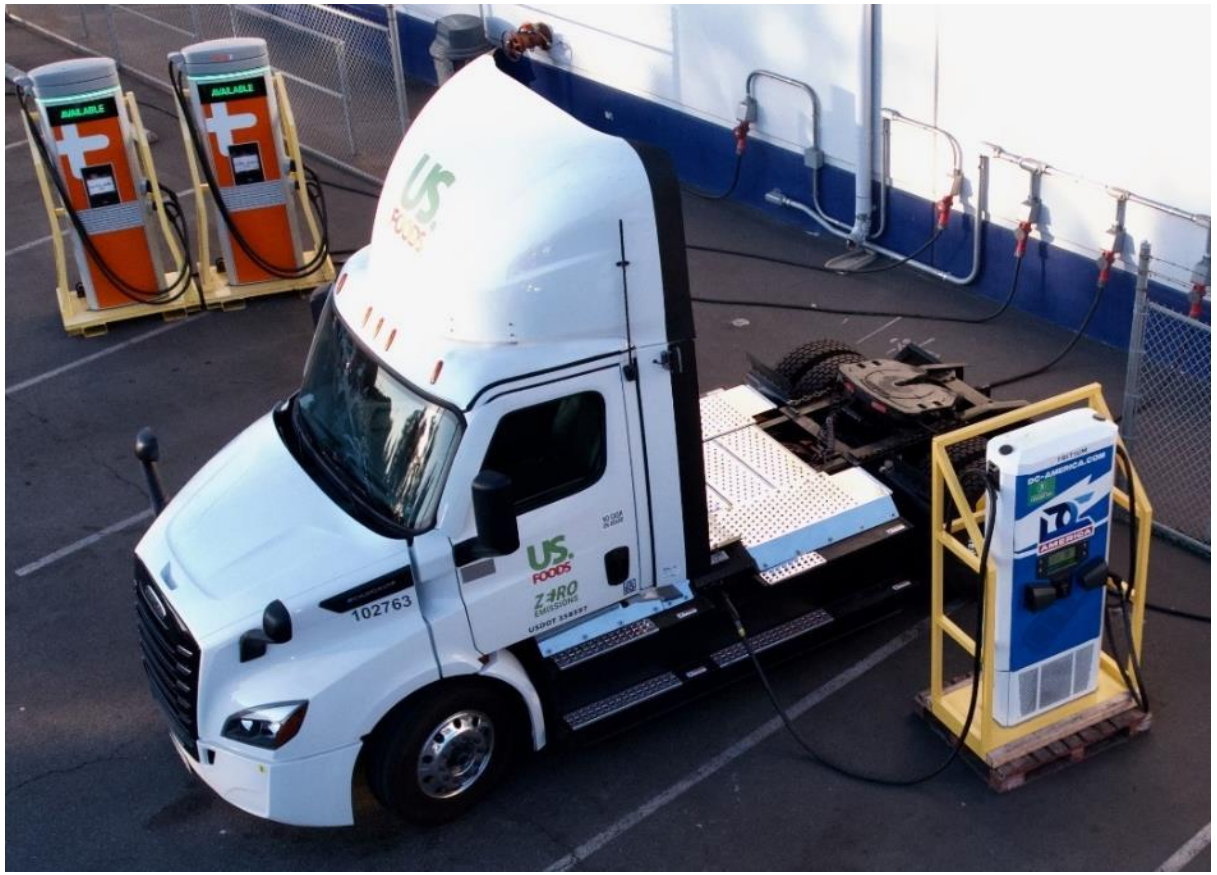
- 21 Teslas (3 LH & 18 City)
- LH Beverages: 250-450 miles/day
- City Beverages: < 75 miles/day
- 4 Tesla 750 kW chargers
- Sacramento Municipal Utility District

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

US Foods: LaMirada CA

Portable/Temporary Infrastructure Can Be First

- 30 Freightliner eCascadias = ~$9M
- Permitting delayed permanent charging, stranding assets
- Portable chargers: Tritium 75kW & ChargePoint 62.5kW
- Food & beverage local delivery to hotels, restaurants, etc.
- Southern Cal Edison



NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

Schneider: South El Monte CA

Fast 100% EV Conversion in Slip Seat Operation

- 82 Freightliner eCascadias
- 16 dual cable 350 kW chargers
- Multi-shift operations (“slip seat”)
- Multiple stop intermodal chassis drop and hook
- Southern Cal Edison

NACFE estimated: up to **44 MWh per day** for the 82 trucks (charging all day long)

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

Frito Lay: New York City/Queens NY

Complete Revitalization: Trucks & Facility in < 1 Year

- Ford E-Transit Class 2b van
- 6 Ford Pro chargers
- Prologis owned & managed site
- Diminishing load routes of snacks in NYC
- Con Edison Utility Co.

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

UPS: Compton CA

Last Mile *inside* & Middle Mile *outside*: 1 CMS

- 15 FCCC MT50e Package Cars: DC 30kW (15) delivering packages
- 10 Freightliner eCascadias: DC 120kW (1 now & 3 soon) Inter-location movements
- InCharge charge management system
- Charger install delayed x3 (permits), so single temporary system in place
- Southern California Edison

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

Penske: Ontario CA

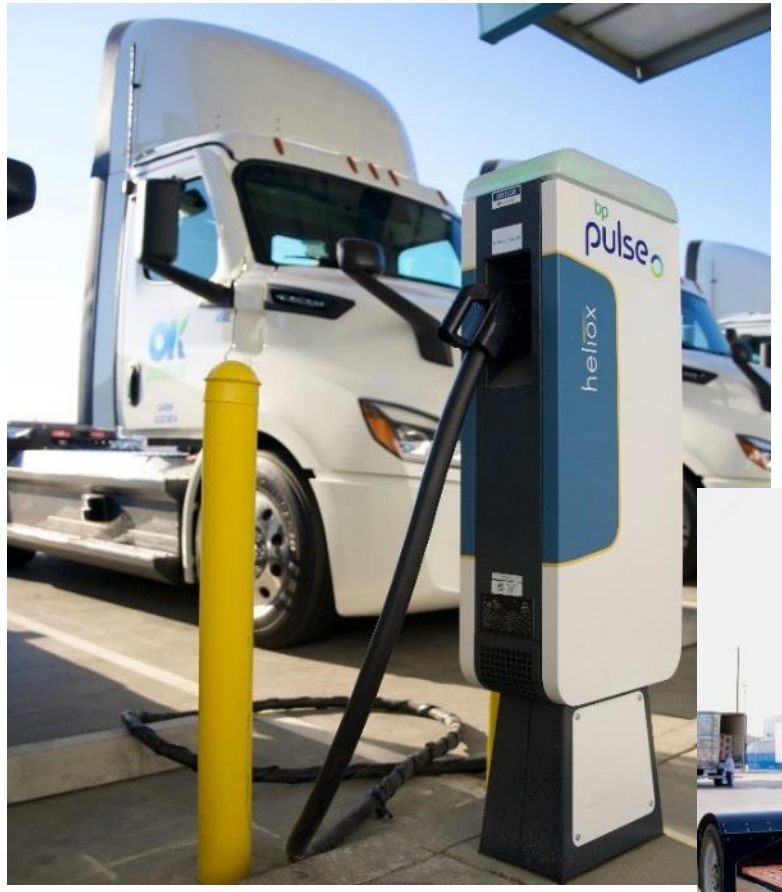
Multiple OEMs & Chargers: *INTEROPERABILITY*!

- Ford E-Transit
- GM BrightDrop ZEVO 600
- Navistar eMVs
- Freightliner eCascadias
- Chargers:
  - 6 – Level 2
  - 2 – Portable 50kW
  - 8 – Stationary 150kW
- On-site Battery Storage: 800 kWh
- Southern California Edison

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

OK Produce: Fresno CA

Perishable Fruits and Vegetables: Uptime Paramount



- Aggressive agenda due to air quality concerns
- 17 Freightliner eCascadias: DC 180 kW
- 3 Orange EV terminal tractors: AC 22 kW
- 4 MW Solar & 150 kWh battery storage

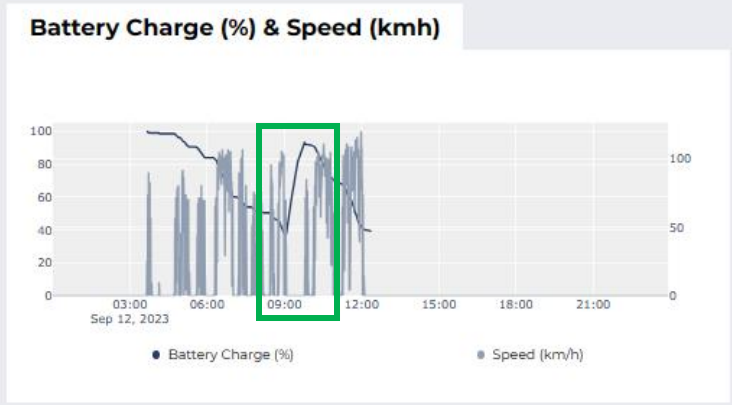
- *bp pulse* Charge Management
- Pacific Gas & Electric

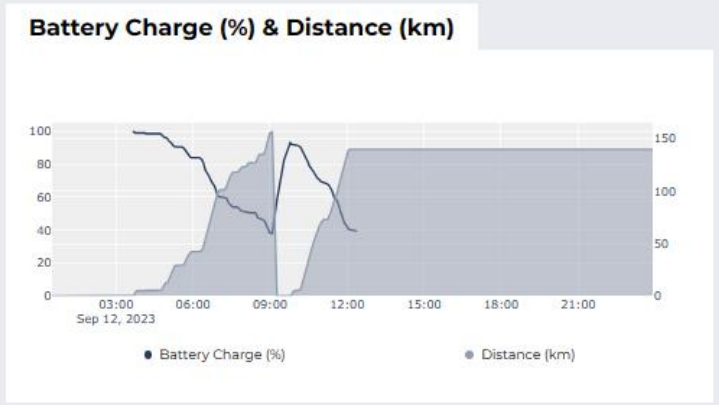
NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

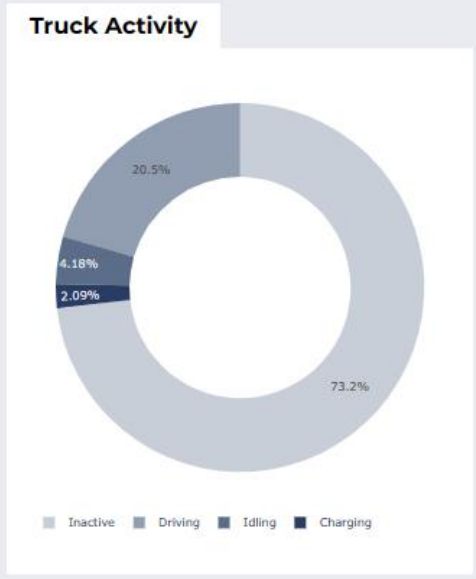
ROL-E DEPOT

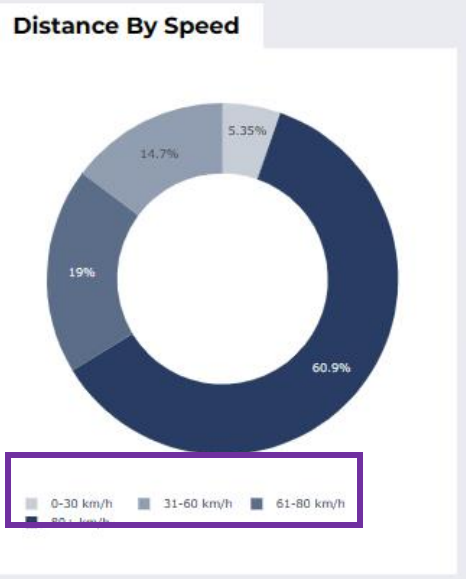
- Penske Day 2 eTransit
- **297 km in a single shift**
- 54 deliveries
- Fully charged with another charge middle of the day
- A lot of regenerative braking
- 41% of miles under 80 kph

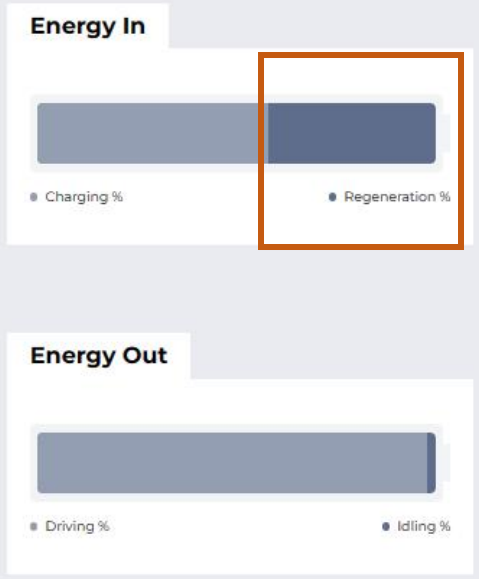
Total Kilometers	297	Average Kilometers/Day	297
Estimated Deliveries	54	Average Deliveries/Day	54











What did we learn?

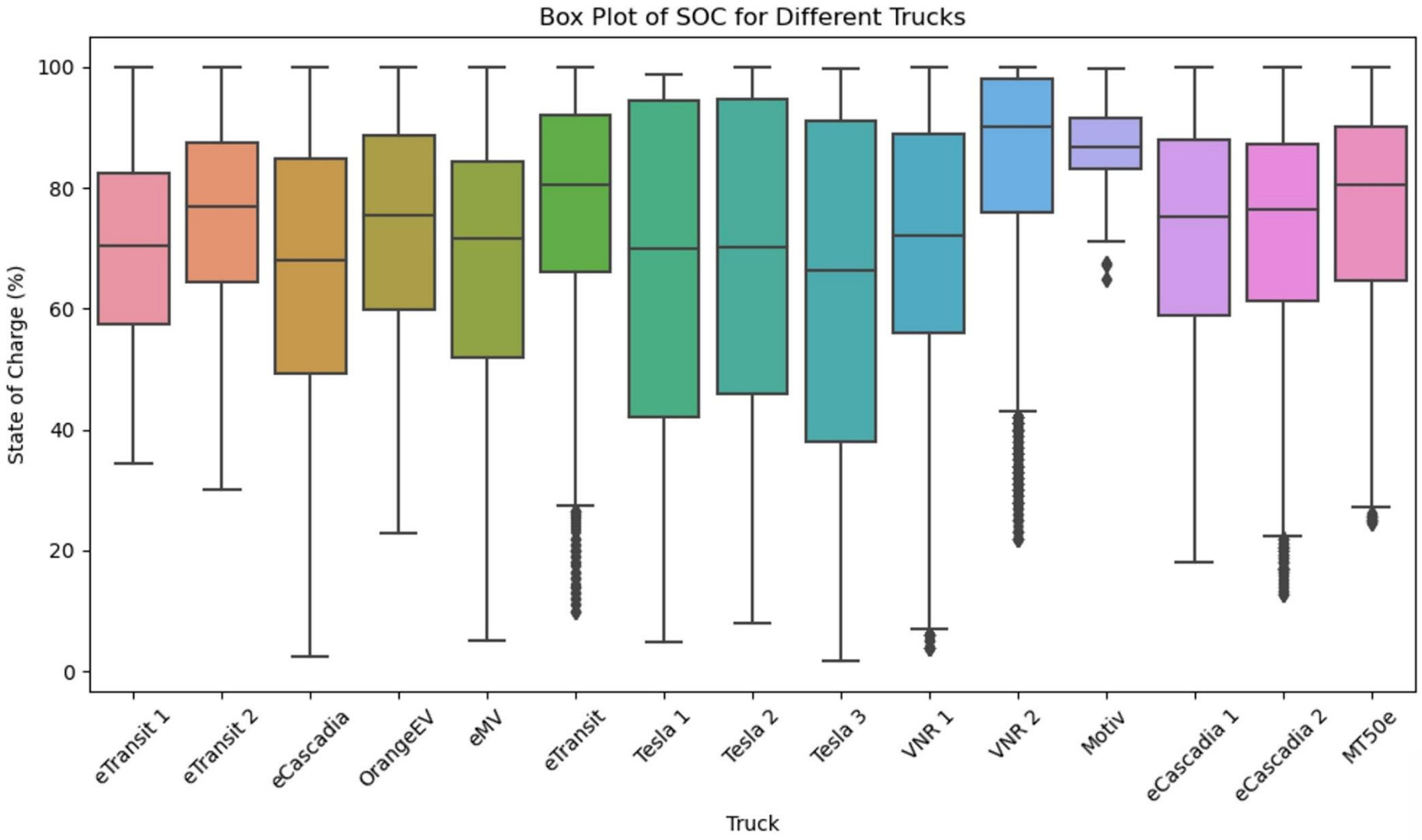
Key findings from Run on Less 2023

Drivers Love Electric Trucks

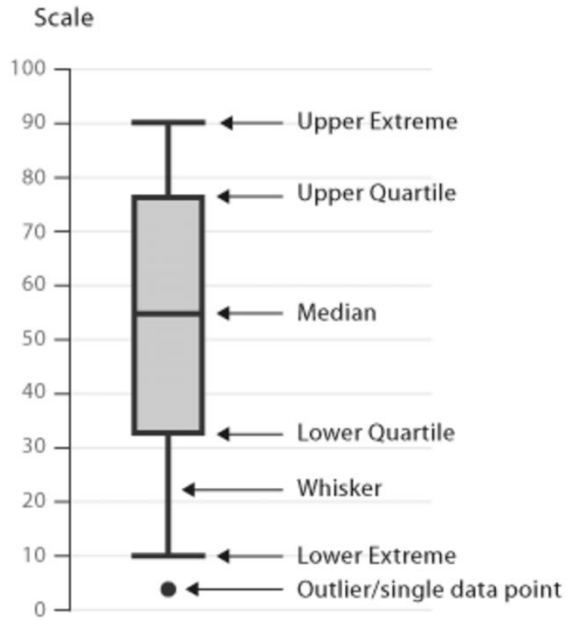
Regardless of their initial feelings, drivers LOVE ZEV's once they drive one!

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

State of Charge Ranges: Depots

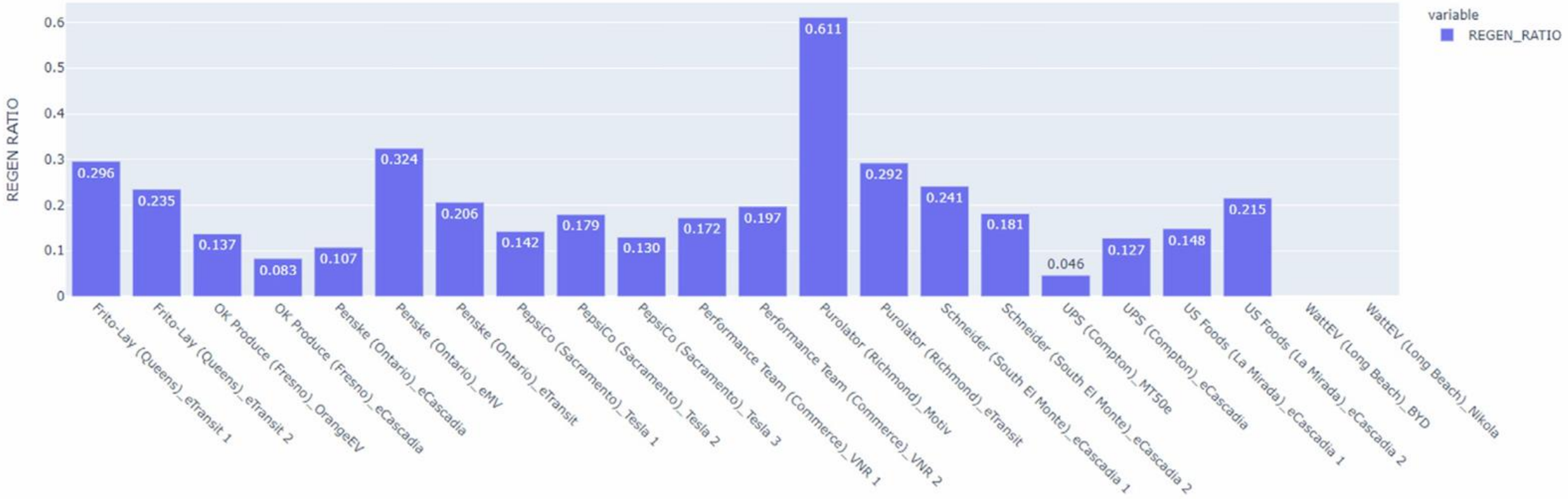


KEY:



RUN ON LESS ELECTRIC DEPOT

Regenerative Braking in DEPOTs



16 % Average across 20 EV trucks: amount of regen energy recovered in braking versus the total energy used in driving

Numerous variables impact the regen braking energy recovery including but not limited to: load weight, driver, route, traffic, terrain, wind and temperatures.

RUN ON LESS ELECTRIC DEPOT

Electrical Consumption

Segment	Consumption at Meter (kWh/mi)
Class 2b/3	0.4 - 0.5
Class 6	1.3 - 1.5
Class 8 Terminal Tractor	2.5 - 4.0
Class 8 Day Cab	1.6 - 2.4

Assumptions:

1. truck in standard environmental conditions of 68°F at sea level with nominal wind conditions.
2. there will be energy losses at the charger and between the charger and the vehicle, and losses inside the vehicle.
3. at the meter numbers assume a level of regenerative braking energy recovery while driving as that contributes to range.

RUN ON LESS ELECTRIC DEPOT

OVER Estimation Challenges

1. Overestimating kWh/mi consumption for vehicles based on out-of-date data
2. Ignoring energy recovery from regenerative braking
3. Ignoring reduced out-of-route miles and driver time made possible from depot charging
4. Requiring one charger for every vehicle
5. Assuming the highest charger rating for every charging event
6. Ignoring the benefits derived from managed charging
7. Assuming vehicles require 100% charging at each charging event
8. Assuming vehicles require daily charging
9. Assuming loads are reaching maximum gross vehicle weight (GVW) on every vehicle for every trip
10. Assuming vehicles are driven the maximum miles every trip
11. Assuming only one charge per day is possible
12. Assuming enroute charging is not feasible at delivery points

RUN ON LESS ELECTRIC DEPOT

UNDER Estimation Challenges

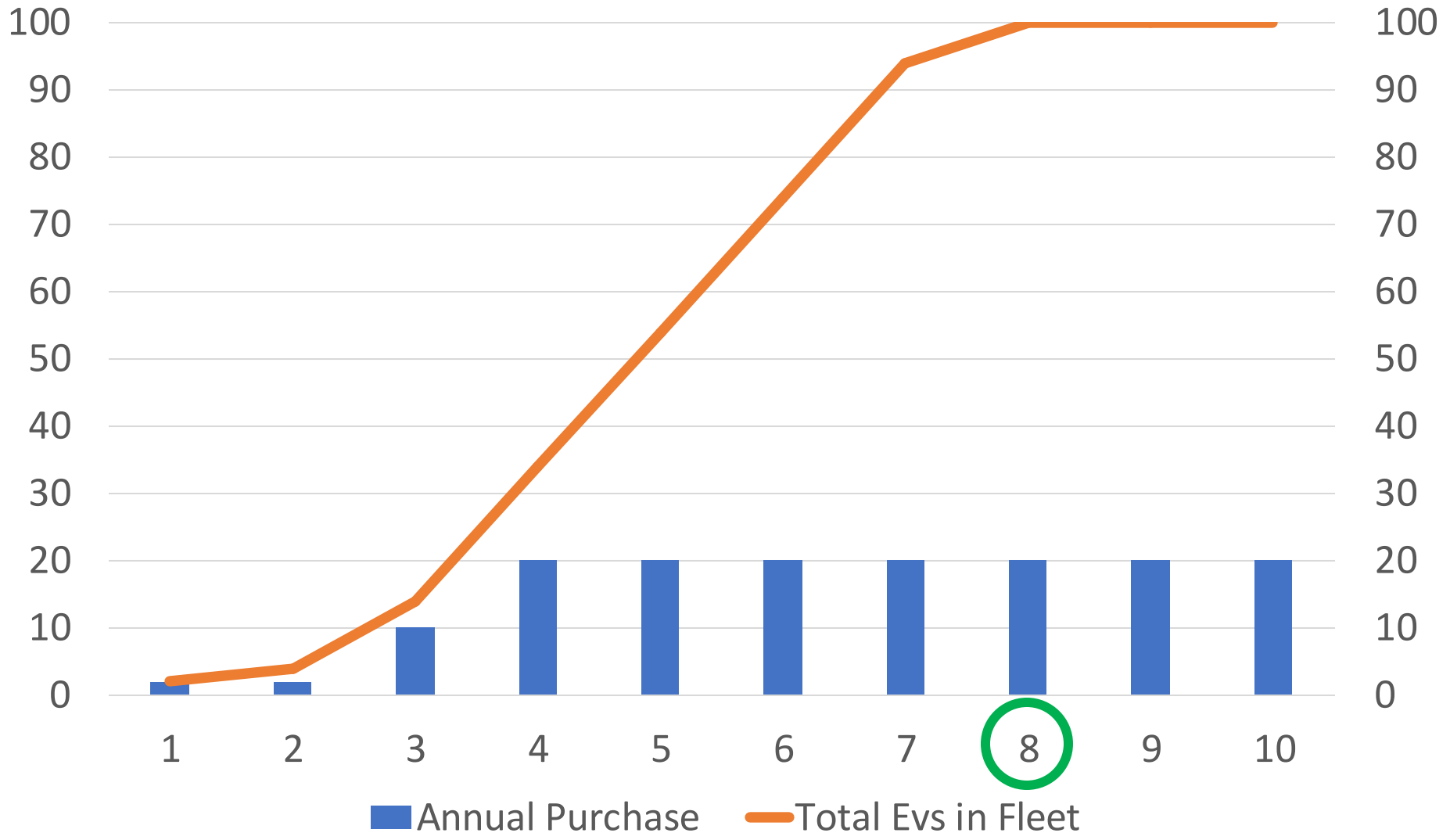
1. Not considering cold and hot weather effects in battery sizing and charging
2. Not considering the impact of road grades
3. Not considering battery degradation possible over years of ownership
4. Overestimating maintenance cost savings from early generation BEVs
5. Ignoring charger losses (efficiency) in estimating power needs
6. Ignoring increased tire wear from heavier, more agile BEVs
7. Assuming the driver has no impact on performance
8. Assuming tractor and trailer aerodynamics don’t matter

RUN ON LESS ELECTRIC DEPOT

Adoption Timing: 5 Year Trade Cycle

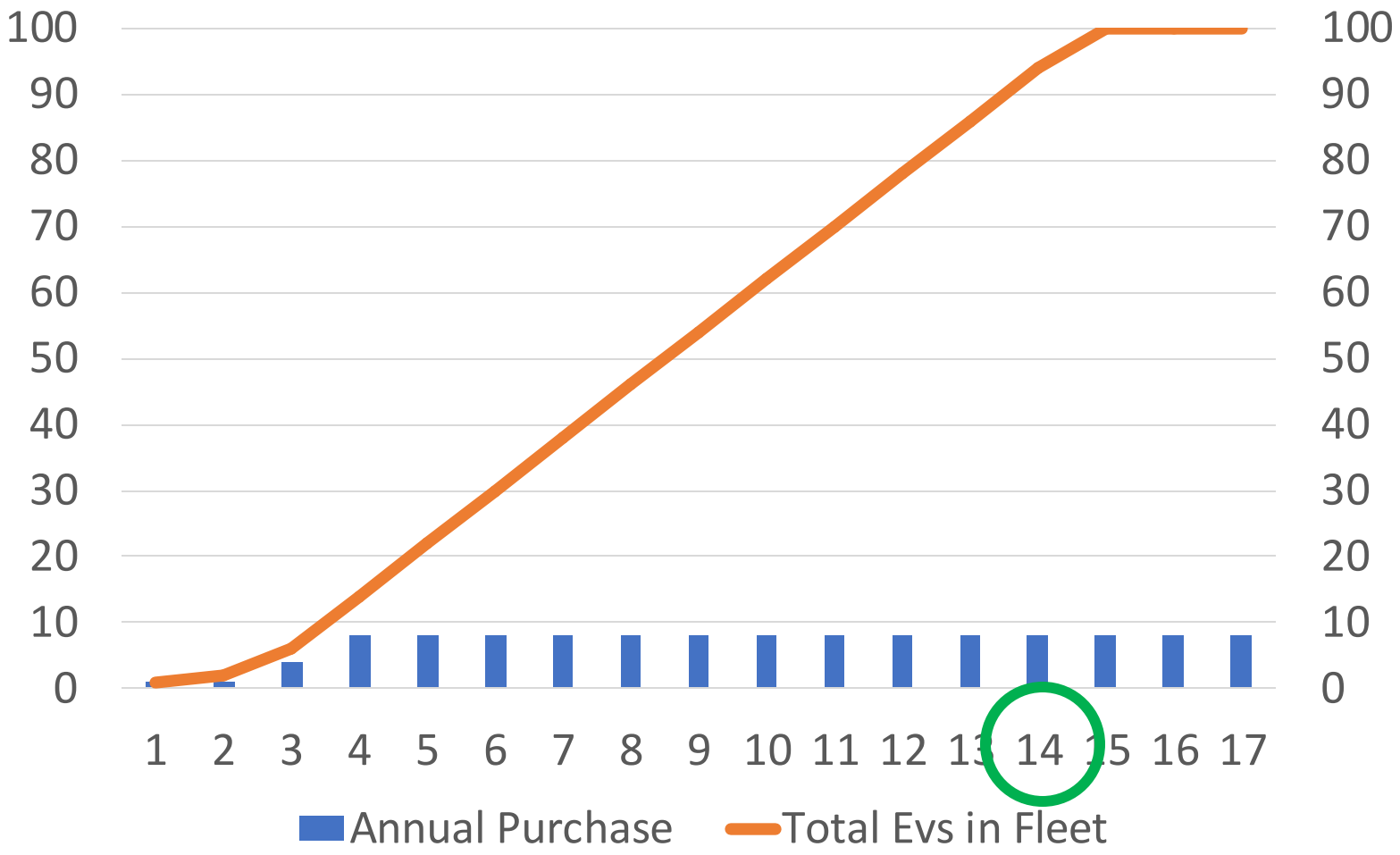
Assumptions:

- 5 Years = 20% of fleet replaced yearly
- Years 1 & 2 validating a few trucks
- Year 3 = Half of the annual order
- Year 4 = Full adoption in order



NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

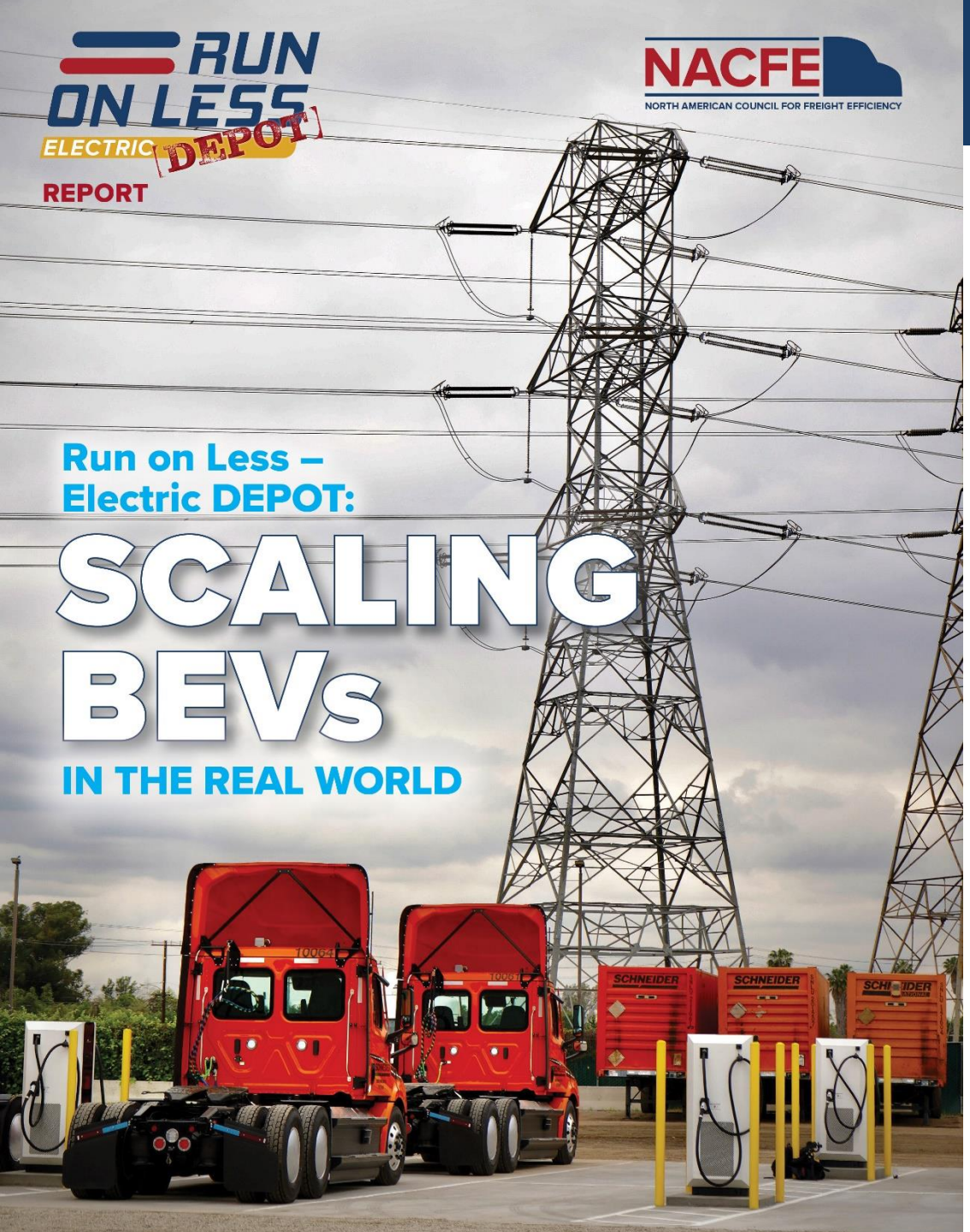
Adoption Timing: 12 Year Life Cycle



Assumptions:

- Truck considered “dead” at 12 years
- 12 Year Life equates to 8% new trucks every year
- Years 1 & 2 validating a few trucks
- Year 3 = Half of the annual order
- Year 4 = Full adoption in order

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY



DEPOT Report

- New video: https://runonless.com/run-on-less-electric-depot-reports/
- Detailed analysis of 22 EV trucks at 10 fleets over three weeks.
- Initial and Final Findings, executive summary or full report.
- Contains new research including summaries of 30 current electric truck depots.

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

Run on Less - “Best of the Best”

RUN ON LESS BY NACFE

ROL Series

About Participants Messy Middle Bootcamp Sponsors News Videos

COMING SEPTEMBER 2025

RUN ON LESS — MESSY MIDDLE

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

Run on Less 2025

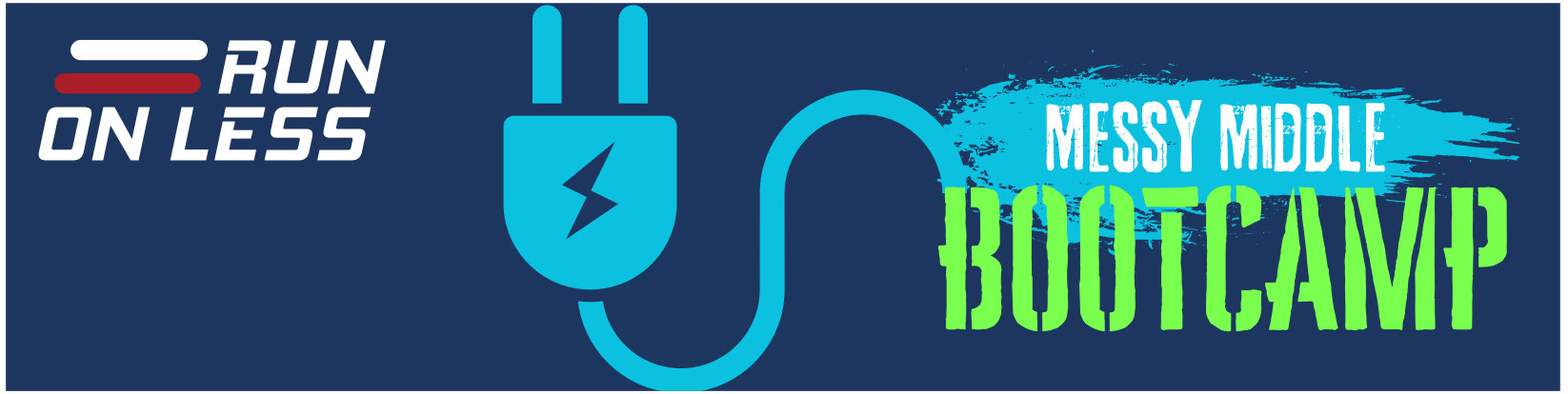
The “Messy Middle” in Long Haul Freight

- All trucks will be Class 8 heavy-duty tractors
- Focus on alternative fuels in long return-to base operations and long-haul over-the road using day cabs and/or sleepers
- Multiple solutions will be featured:
  - battery electric,
  - hydrogen fuel cells and engines,
  - renewable natural gas,
  - renewable and bio diesel,
  - hybrids and
  - energy efficiency features for all fuel types

Additional Information

Run on Less - “Best of the Best”

3 NEW webinars for EV



1. The Current State of HD BEV: Technologies and Capabilities - April 8, 2025

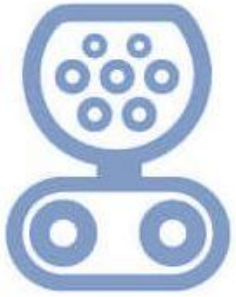
2. Strategizing Successful HD BEV Adoption – April 22, 2025

3. Charging Depots, Networks & the Economics of Fleet Electrification – May 6, 2025

**** (Bonus FREE online workshop for all Bootcamp attendees)***

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY


CCS1


CCS2


NACS/Tesla


MCS or CharIN

NACFE

NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

NACFE.org

Let's Stay Connected…

RUN ON LESS MESSY MIDDLE

RunOnLess.com

LinkedIn NACFE

NACFE

@NACFE_Freight & @RunOnLess

NACFE

Ken North

Ken.North@NACFE.org

778-689-8731

NACFE

NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

THANK YOU