



**SUSTAINABLE
FLEET
TECHNOLOGY**

VIRTUAL CONFERENCE 2020

**Session 2: Electrification of MD/HD
Regional Haul Trucking**

July 29, 2020





<https://www.sustainablefleetexpo.com/>





Next Series Dates & Topics:

August 12: Natural Gas + Propane: Trends, Applications & Success Stories for Gaseous Fuels

August 19: The Green Garage Contest Details & Application Review

August 26: The Evolving World of Telematics: Real-Time Information for Fleet Performance

September 09: Green Fleet Award Winners 2020 Announcement

September 23: Best Practices & Lesson Learned in Charging Infrastructure Deployment



Format

- Q&A at the end
- Submit questions and comments to “Panelists”
- Scheduled for 2:00p-3:30p
- Can go beyond, if interest remains
- Slide handout
- Recording



**Sustainable Fleet Technology Virtual Conference Series:
Electrification of MD/HD Regional Haul Trucking
July 29, 2020**

- 2:00-2:10 **Rick Sapienza & Dave Schaller, NC Clean Energy Tech Center & NACFE**—Welcome
- 2:10-2:25 **Dawn Fenton, Volvo Group North America**—Volvo LIGHTS Project and Lessons Learned
- 2:25-2:40 **Alexander Voets, Daimler Trucks North America**—This is Freightliner eMobility
- 2:40-2:55 **Dave Schaller, NACFE**--Electrification & Regional Haul Trucking
- 2:55-3:10 **Steve Bloch, ABB**--EV Charging for Medium and Heavy Duty Vehicles
- 3:10-3:30+ **Q&A**





Rick Sapienza

resapienza@ncsu.edu

Phone: 919-515-2788

- **Clean Transportation Program Director NC Clean Energy Technology Center at NC State University**
- **8 years with NC State**
- **30+ years experience including General Motors, Draper Lab and Great Lakes Pulp & Fibre in both engineering and business management roles**





Electrification of Regional Haul Trucking

Sustainable Fleet Virtual Conference Series – July 29, 2020

Dawn Fenton

Vice President, Government Relations & Public Affairs



Segments to Target with Electromobility

Local Distribution

Regional Distribution

Construction

Regional Haul

Long Haul

Time to market for broad adoption

SOUTH COAST AQMD AWARDS VOLVO CONSTRUCTION EQUIPMENT \$2M TO TEST ELECTRIC HEAVY EQUIPMENT IN CALIFORNIA

4/22/2020

By Press Information

Volvo Construction Equipment (Volvo CE) was awarded a \$2 million grant for a commercial pilot of the company's electric, zero-emissions excavator and electric wheel loader in California. The grant, administered by the South Coast Air Quality Management District (South Coast AQMD), is funded by the U.S. Environmental Protection Agency's (EPA) Targeted Air Shed Grant Program which helps agencies develop plans and conduct projects to reduce air pollution in areas with the highest level of smog and soot in the United States. South Coast AQMD is responsible for attaining state and federal standards by improving air quality in the South Coast Air Basin of California.



Mack Trucks Demonstrates Mack® LR Electric Model for New York City Department of Sanitation

01-09-2020

ALLENTOWN, PA (Jan. 9, 2020) – Mack Trucks today demonstrated the Mack® LR Electric, a fully electric version of the Mack LR refuse model, to officials from the New York City Department of Sanitation (DSNY) at the Allentown, Pennsylvania-based Mack Customer Center. Unveiled in May 2019, the Mack LR Electric will begin realworld testing in Q2 2020 in DSNY's demanding operations.

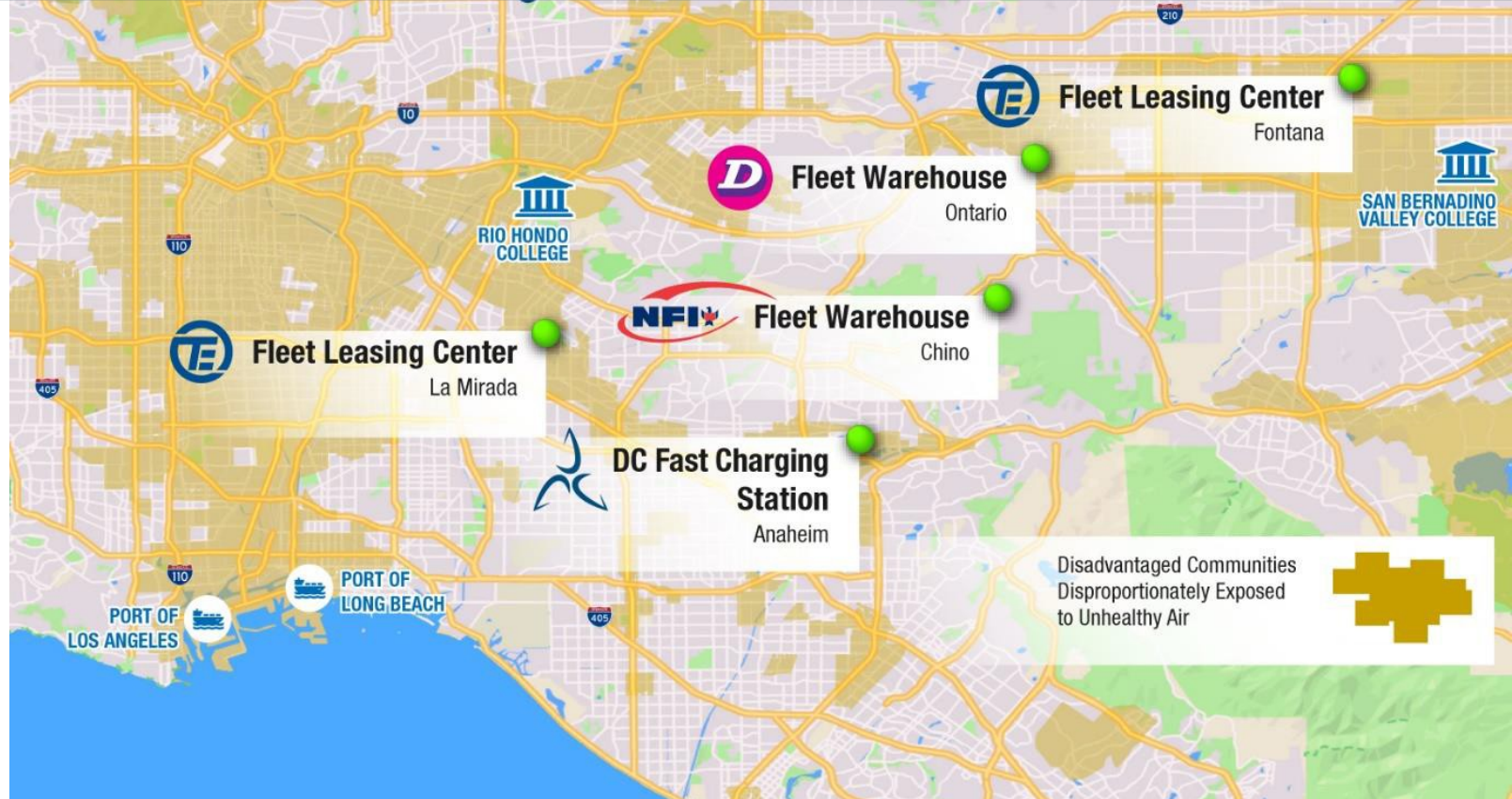


Demonstrating innovations critical to the commercial success of battery electric trucks and equipment for goods movement

LIGHTSproject.com



PROJECT PARTNERS



23 Battery Electric Heavy-Duty Trucks



29 Battery Electric Equipment



58 Public & Private Chargers



2 Colleges Designing Electric Truck Maintenance Programs



1.8 Solar Energy Generation
(Million KWH)



2 Ports Providing Infrastructure Planning

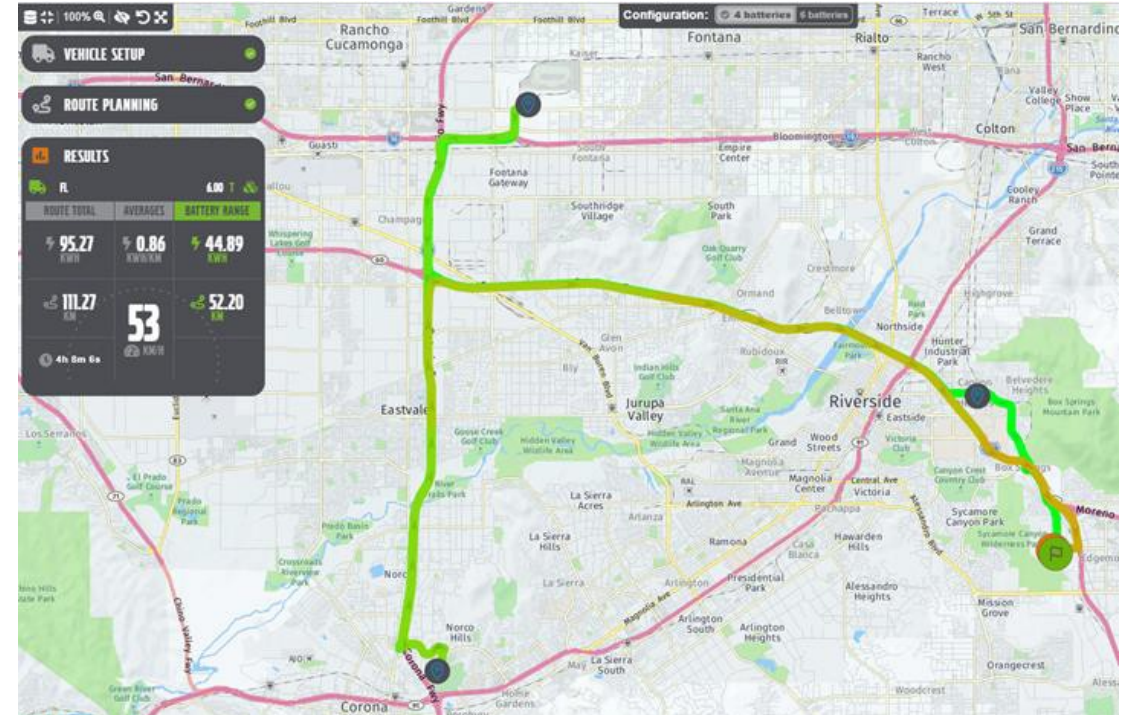
Early Lessons from Volvo LIGHTS

- Engage utilities and local officials early in the infrastructure design process
- Charging infrastructure installation takes longer than expected
- Public funding may be available, but read the fine print, and do plenty of research
- Consider identifying a dedicated point of contact within your company



OEM/Fleet Partnership

- Know the customer
- Understand the duty cycles
- Tool for route assessment
- Optimize energy storage
 - *Payload maximized*
 - *Battery capacity minimized*
 - *Range maximized*



ZEV Market Concerns

- The transition to ZEV vehicles is a paradigm shift – forcing greater interdependence among fleets, utilities, truck manufacturers and policymakers
- The single largest obstacle to success of the heavy-duty ZEV market is charging infrastructure
- Infrastructure availability, timing and cost challenges are all aggravated by the COVID-19 pandemic
- Successful heavy-duty ZEV product adoption requires a coordinated, single point source of public financial support for fleets to take purchase risk



Electrification of Regional Haul Trucking

Sustainable Fleet Virtual Conference Series – July 29, 2020

Thank You & Stay Well



This is Freightliner eMobility

Alexander Voets / eMobility Sales and Marketing Manager / July 2020



Run Smart™

Agenda

Today

GAINING KNOWLEDGE *ELECTRIC INNOVATION FLEET*
Co-creation of Innovation Fleet

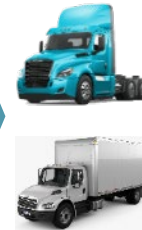


20 eCascadia

10 eM2



PUTTING CUSTOMER READINESS TO THE TEST
Customer Experience (CX) Fleet



6 eCascadia

2 eM2



BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT

SERIES PRODUCTION

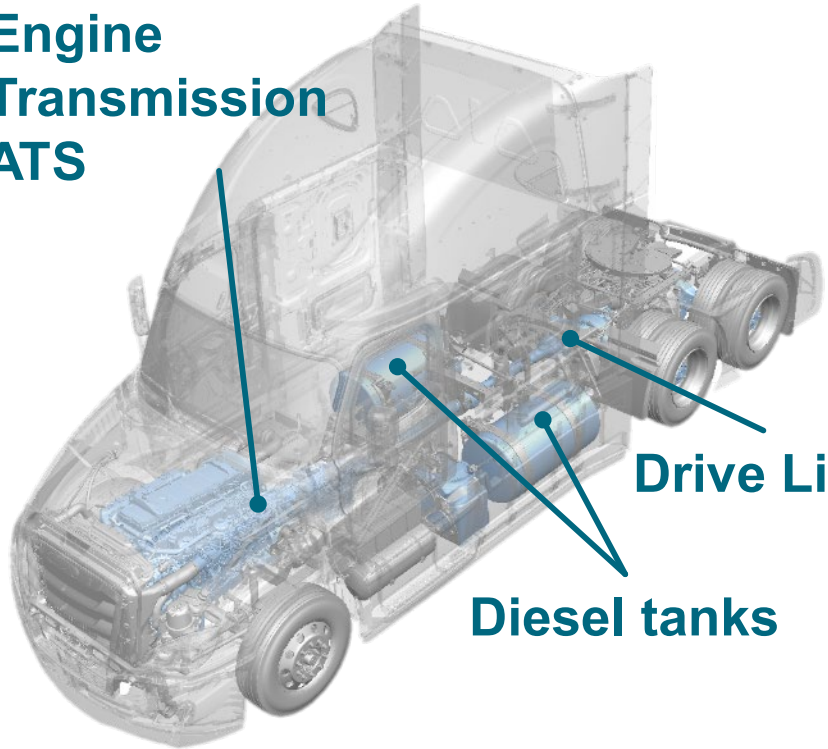
Freightliner Electric Trucks at scale out of our established Portland Truck Manufacturing Plant

eCASCADIA
eM2



From Diesel to eTruck: the Impact of Electrification

**Powertrain:
Engine
Transmission
ATS**



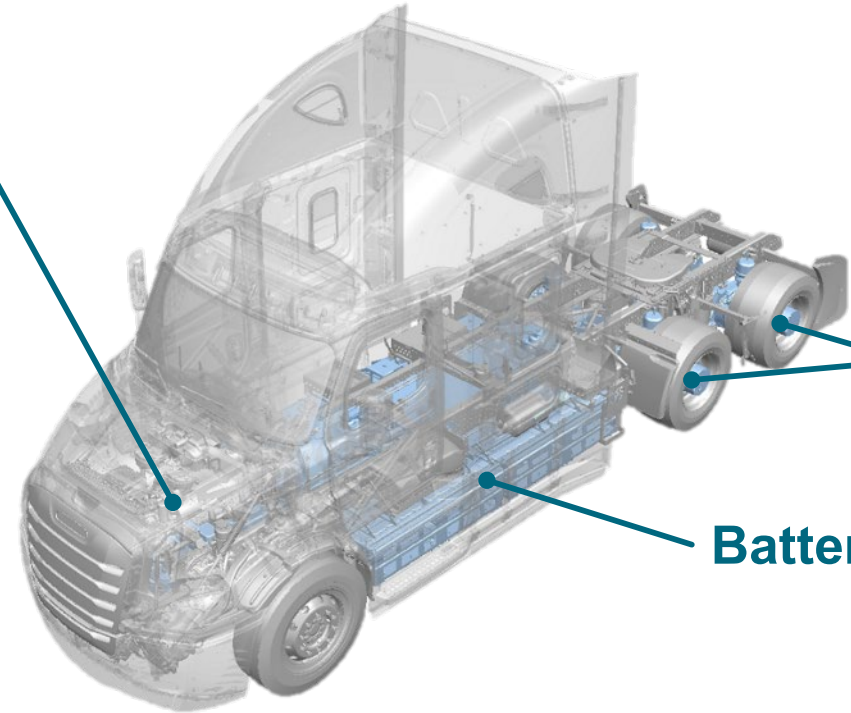
Drive Line

Diesel tanks

**Electric
Auxiliaries**



**ICE TO
BEV**



eAxle

Batteries

Freightliner Electric Innovation Fleet

**ELECTRIC
INNOVATION
FLEET**



- **30 fully battery-electric** medium-duty and heavy-duty trucks; 20 eCascadias and 10 eM2
- Putting electric trucks to the test: **Real Customers, Real Routes, Real Freight**
- **Collaboration and Learning**



Learnings and Driver Feedback



“This thing is **whisper quiet**, I don’t need to crank my radio up”

“I don’t **smell** like diesel”

“Other drivers **ask about it** – they can’t believe it”

“I love the **regenerative braking**”

“This rig is **stable** with no turn”

Less fatigue at the end of the day

Easier pre- and post-trip inspection

Low center of gravity provides nice ride comfort – especially when turning



Picture taken Feb 2020

Freightliner Customer Experience (CX) Fleet



- The success of the Innovation Fleet led us to build an **additional 8 fully battery-electric** medium-duty and heavy-duty trucks; 6 eCascadias and 2 eM2
- Cycle through a number of customers to **experience the eTrucks in their own operation**



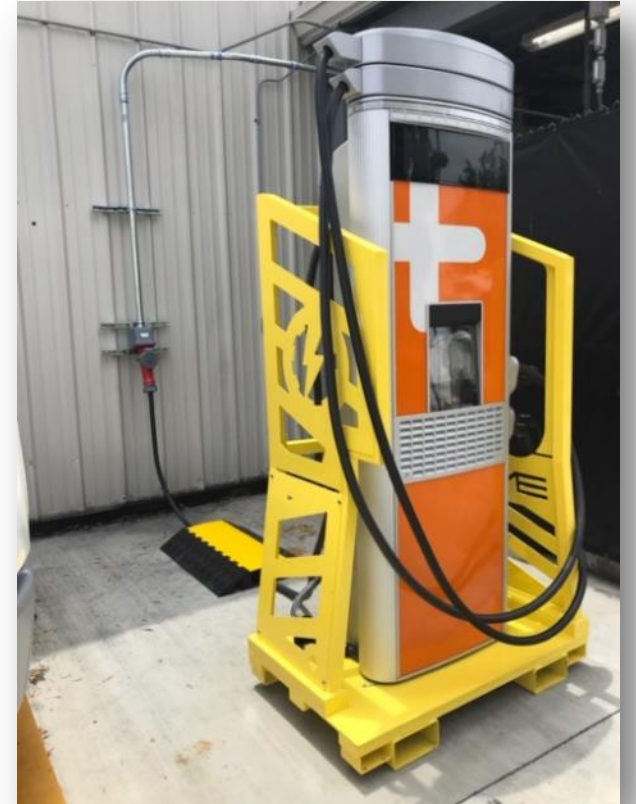
With the CX Fleet we expand the reach of our Pilot Project



Commissioning charger in Fontana, CA. June, 2020

Mobile charger to minimize capital investments for customers in a trial phase

Ability to understand charging, optimal routes, utility inclusion



Compton, CA. June, 2020

Specification targets for series production vehicles from our Portland plant



eM2

Designed for Pick-Up and Delivery Application

Truck Class	6-7	GVWR	26K to 33K lbs
Battery Size	Up to 315 kWh	Horse Power	300 hp (224 kW)
Range	230 miles		



eCascadia Day Cab

Designed for Distribution Application

Truck Class	8	GVWR	80K lbs
Battery Size	Up to 475 kWh	Horse Power	525 hp (391 kW)
Range	250 miles		

*Vehicles pictured are not representative of final series-intent design

THANK YOU.

eCASCADIA

A close-up, low-angle shot of the front of a white Freightliner eCascadia truck. The focus is on the 'eCASCADIA' badge, where the 'e' is blue and the rest is silver. To the right, a glowing amber LED light is visible, casting a warm glow. The background is a plain, light-colored wall.

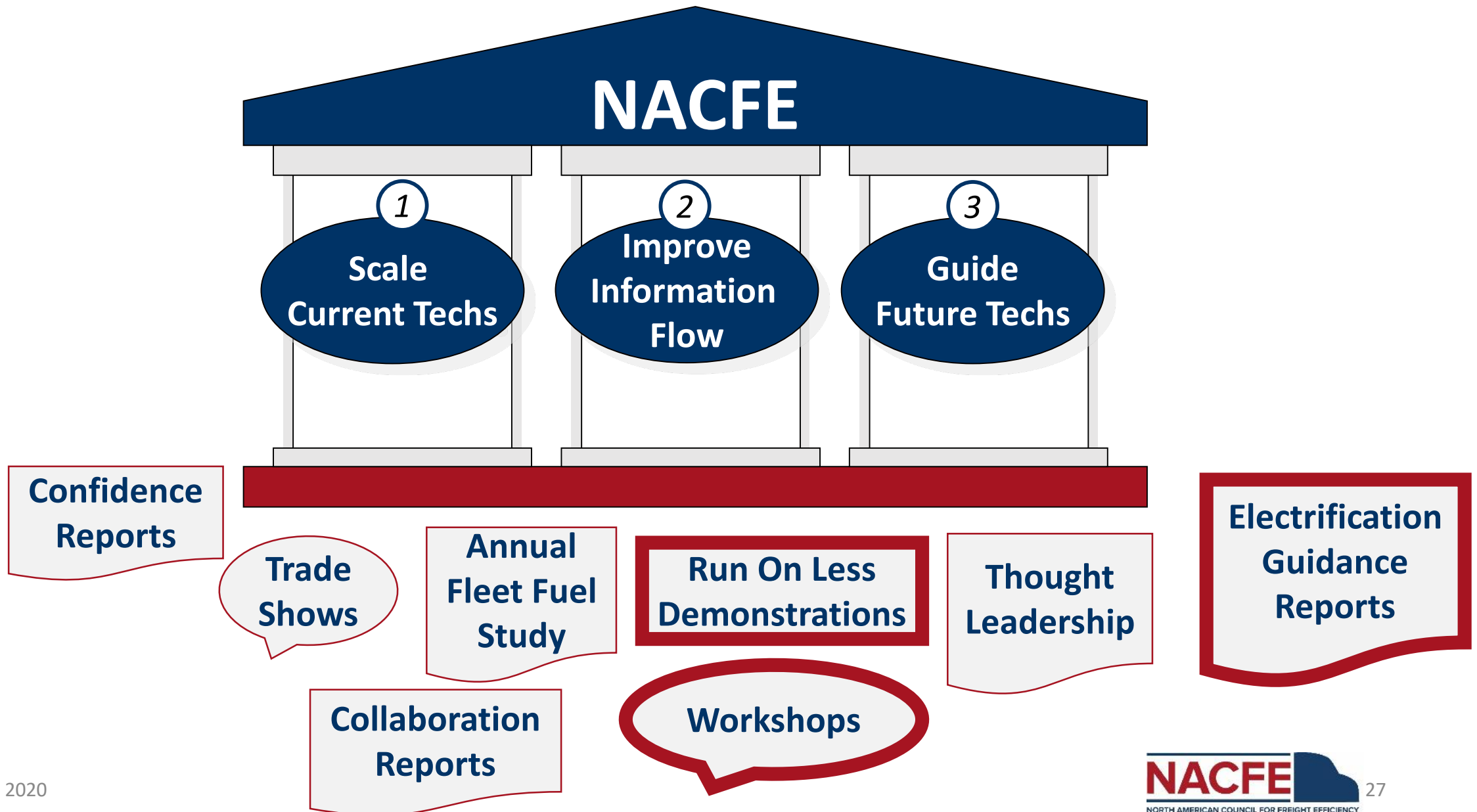


Electrification & Regional Haul Trucking

Dave Schaller
July 29, 2020



Three Pillars of NACFE Work



Run on Less Regional



Results Fleets Technologies Videos News & Events About

Day 18 of 18

Congratulations to Our Drivers!

OCTOBER 7 – 25 2019

Run on Less Regional Sets Impressive Efficiency Benchmark



RESULTS

See the results

8.3

Average MPG

\$8,249

Dollars saved

\$9,003,550,961

Annualized Potential Savings

Potential savings represents the savings that are possible across the industry if all regional-haul trucks operated at this level.

June 2020



Results Fleets Technologies Videos News & Events About

All Results

RESULTS BY FLEET

C&S Wholesale Grocers

Hirschbach

Hogan Transportation

J.B. Hunt

Meijer

PepsiCo

Ploger Transportation

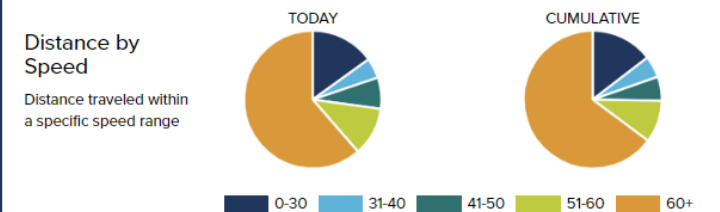
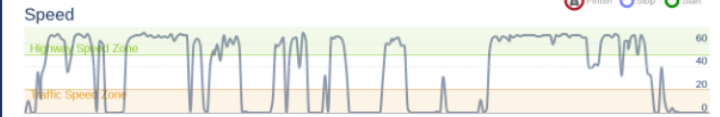
Schneider

Southeastern Freight Lines

United Parcel Service

OCTOBER 16, 2019: DAY 10 OF 18

Day 10



Run on Less Regional Report

Conclusions

1. High efficiency requires commitment
2. Optimize performance using big data and connectivity
3. Understand and act on the variety in duty cycles
4. Drivers are attracted to regional haul
5. Return to base is ideal for electric trucks
6. Growth in Regional Haul is Good

Run On Less Data Benefits

- Run on Less Regional data analysis: [RoLR final report](#)
- NREL/NACFE Report: [Battery Electric Powertrains](#)
- Ballard/NACFE Report: [Hydrogen Fuel Cell Trucks in Regional Haul](#)
- Free [downloadable data set](#)



Guidance On Electric Trucks

1

Electric Trucks: Where They Make Sense

May 2018



Now Free Online at

<https://nacfe.org/emerging-technology/electric-trucks-2/>



MD Electric Trucks: Cost Of Ownership

October 2018

2

Viable Class 7 & 8 Electric, Hybrid & Alt Fuels Tractors



4

December 2019

3

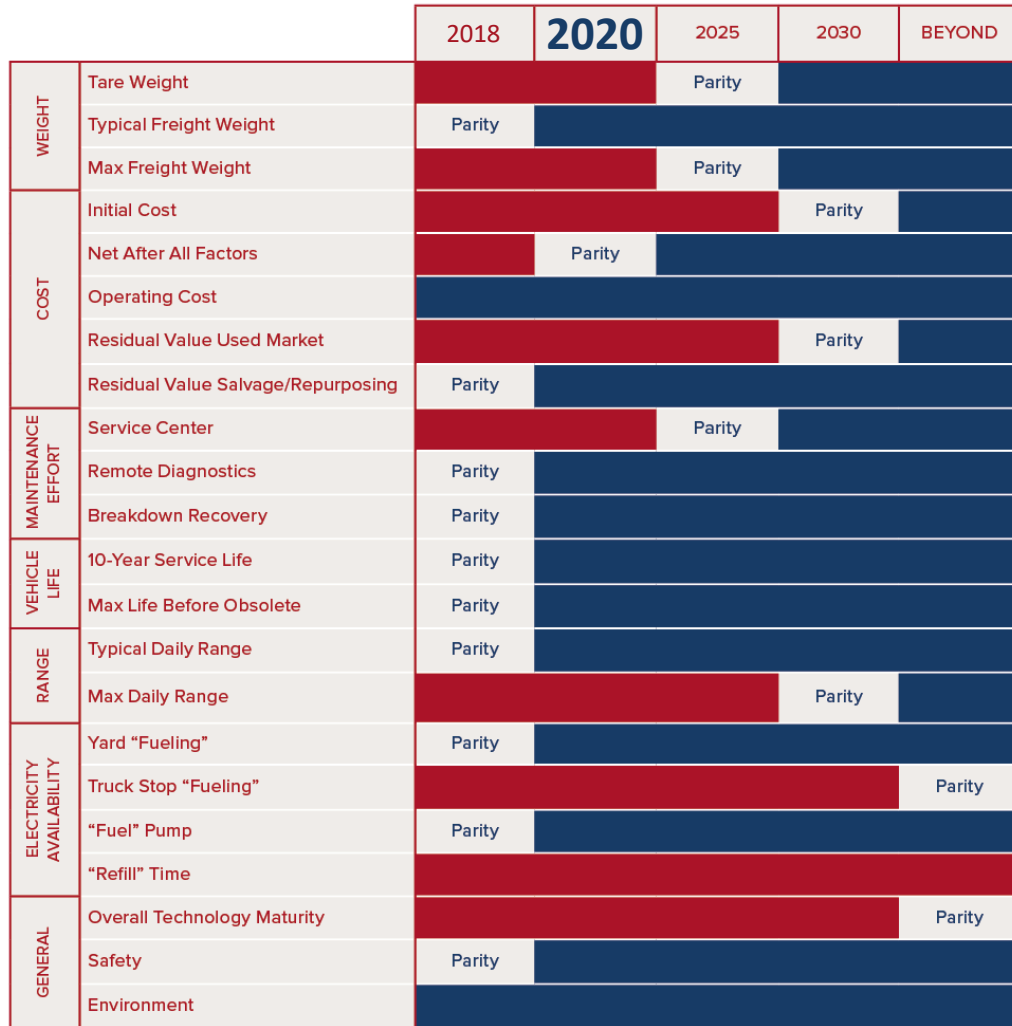
Electric Trucks: Charging Infrastructure

March 2019



Findings: Parity To Diesel

CLASS 3 THROUGH 6 CBEV PARITY VS. DIESEL SYSTEM (NACFE)

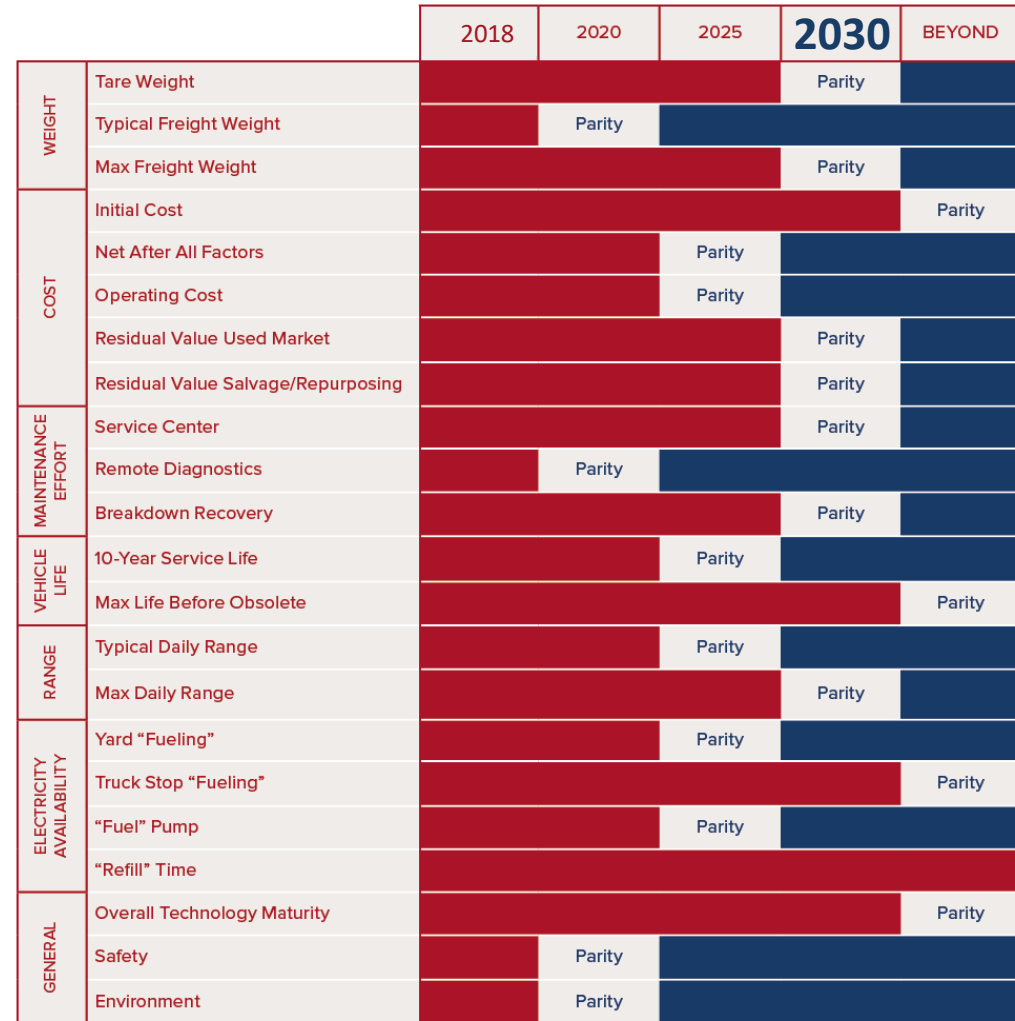


Key: Comparison to 'Equivalent' Diesel Baseline: ■ Worse ■ Parity ■ Better

Class 3 - 6

Dark Blue = EV is Better

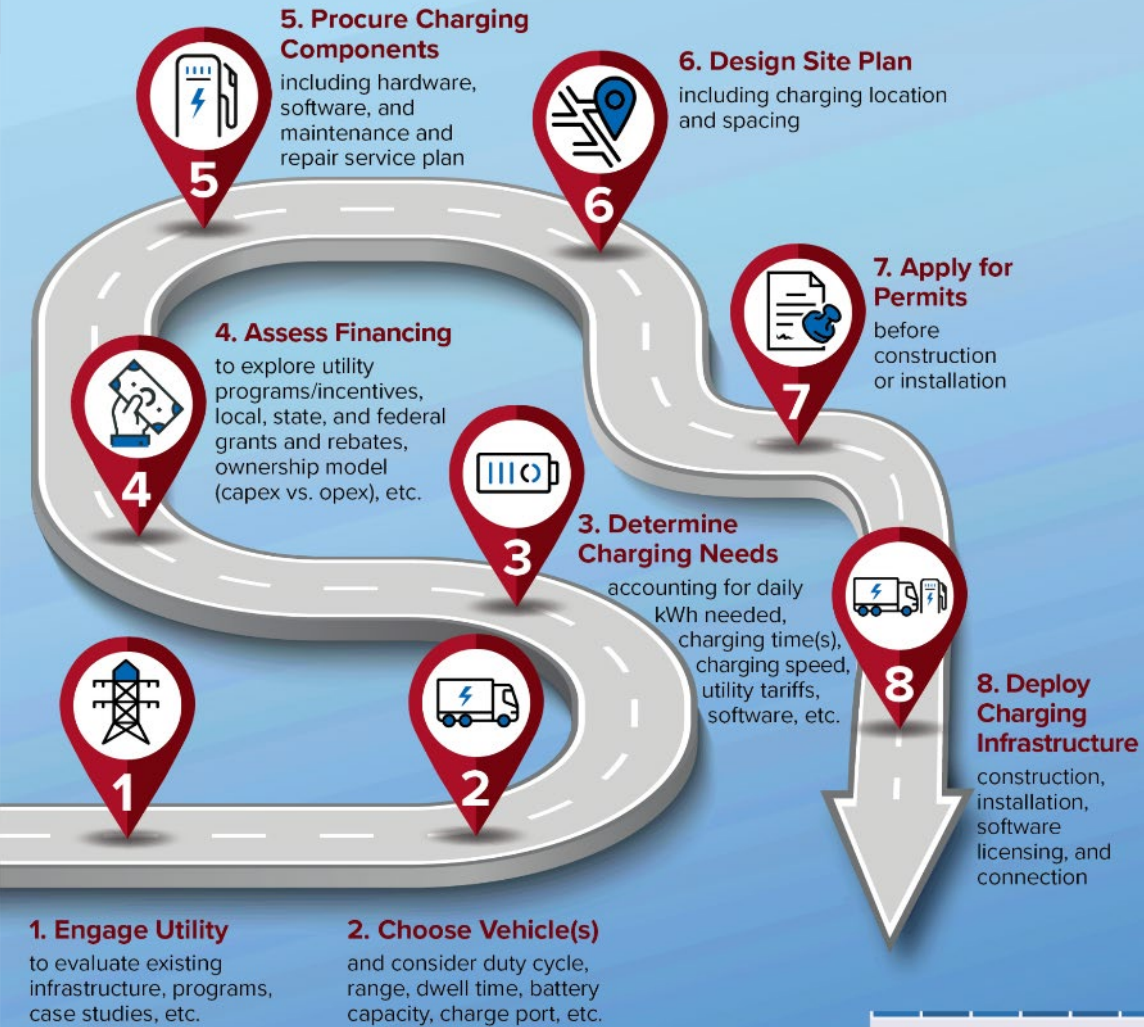
CLASS 7 AND 8 CBEV PARITY VS. DIESEL SYSTEM (NACFE)



Key: Comparison to 'Equivalent' Diesel Baseline: ■ Worse ■ Parity ■ Better

Class 7 & 8

Charging Procurement Roadmap



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



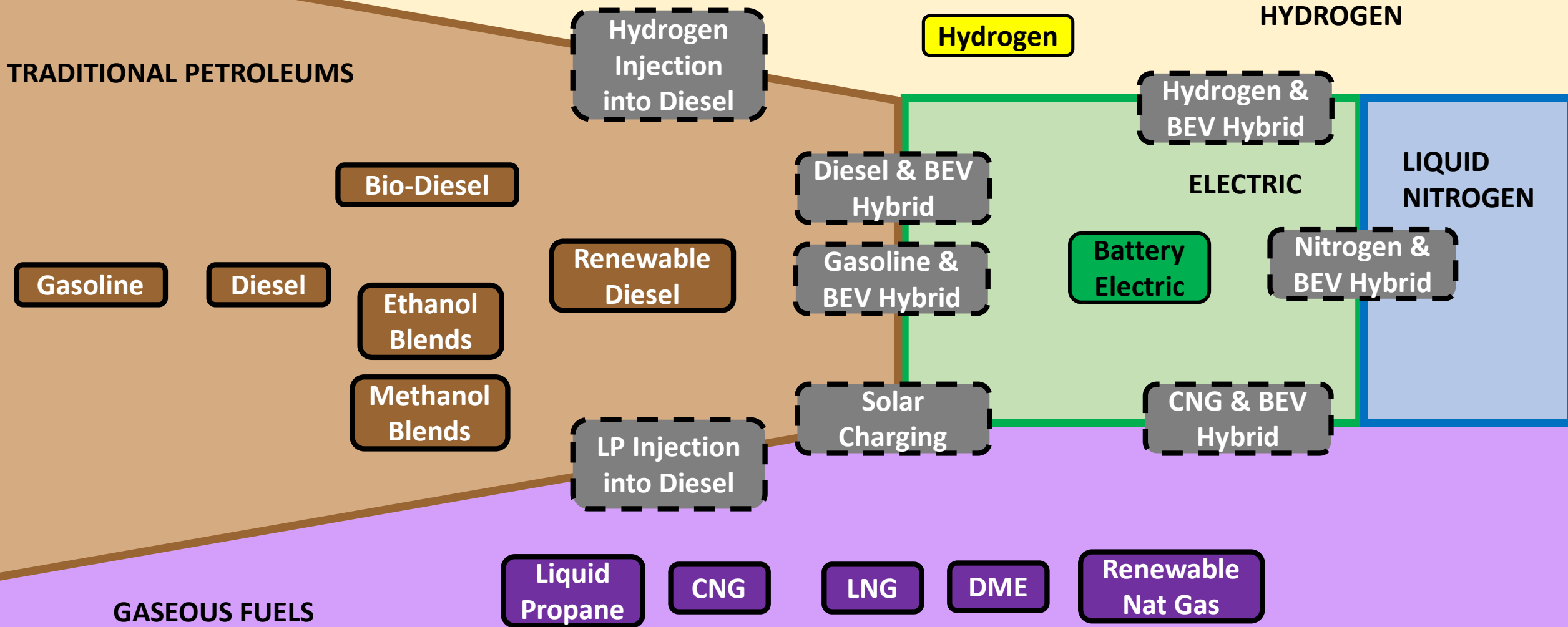
Legacy Diesels
Natural Gas

Diesel Advancements
Natural Gas

Battery Electric
Hydrogen Fuel Cells
Renewable Natural Gas & Diesel

CBEV from
Clean Energy

Alternative Fuels



Focus On Regional Haul Electrification



Run on Less Regional



Identify high-potential regional trucking routes



Regional Haul thought leadership



Support implementation on first- and next-mover deployments



Electric truck guidance reports



Scale best practices in infrastructure deployment



Increase confidence in the value of electrification



Electric Trucks In Regional Haul



School Buses



Transit Buses



Regional Haul Tractors

Population:
(U.S.A)

480,000

150,000

800,000

**Annual
Mileage:**
(typical)

12,000

35,000

65,000

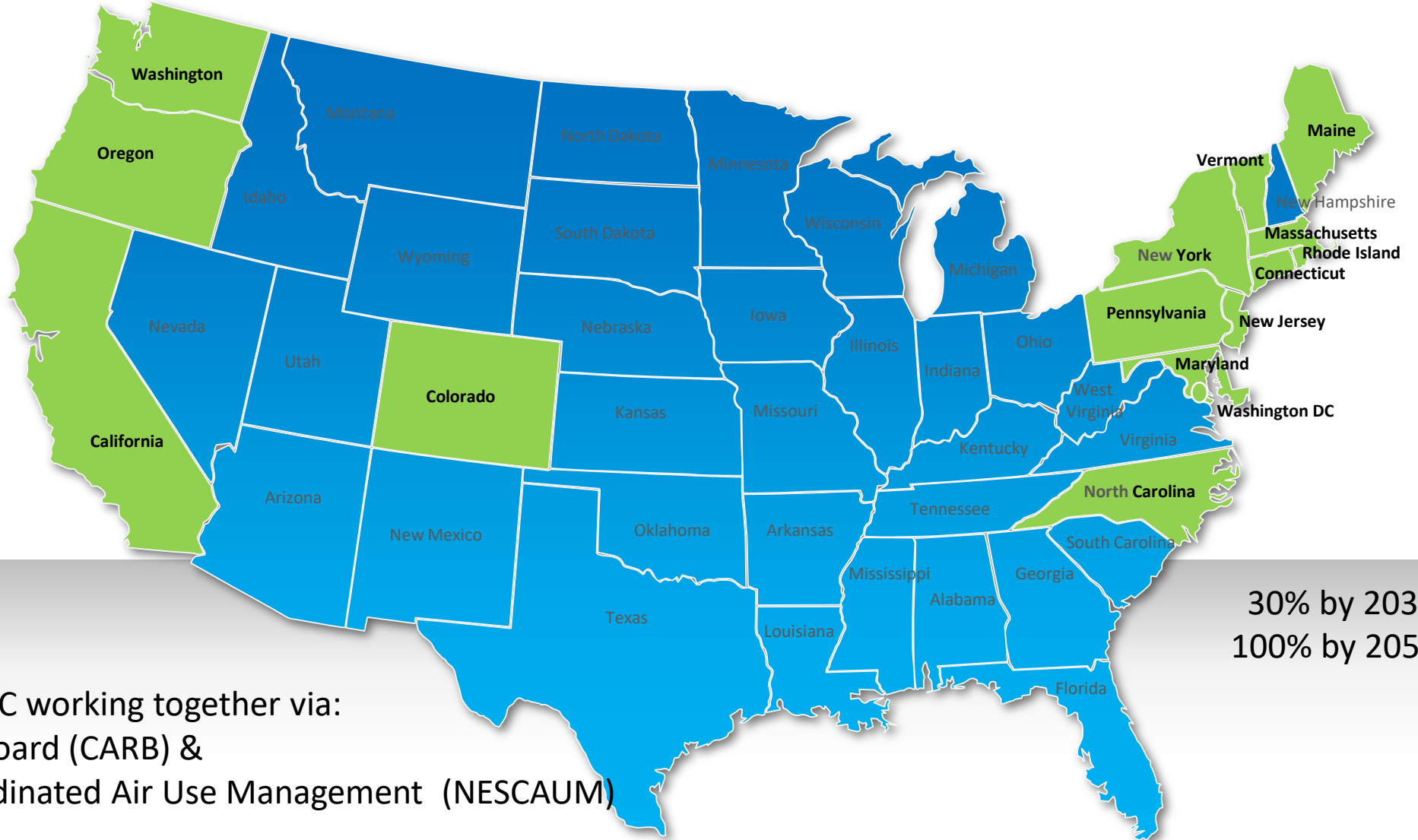
**Total Annual
Mileage:**
(estimate)

5,760,000,000

5,250,000,000

52,000,000,000

Transition to Zero-Emission Trucks (& Buses)



30% by 2030
100% by 2050

15 States & Washington DC working together via:
California Air Resources Board (CARB) &
Northeast States for Coordinated Air Use Management (NESCAUM)

Electric Trucks

Collaboration

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



Getting to Know Each Other



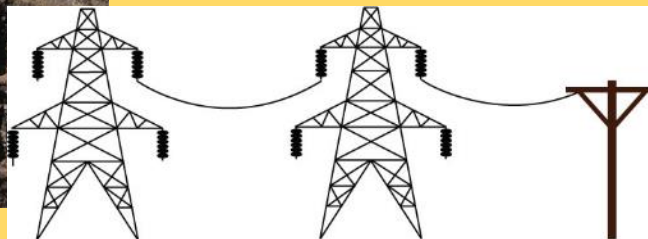
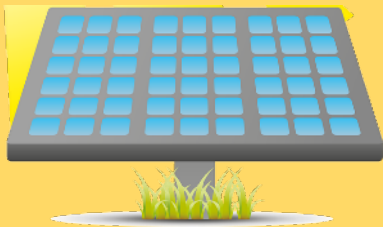
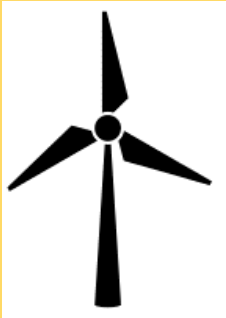
FLEETS



Primer:
FLEETS
on
UTILITIES



Primer:
UTILITIES
on
FLEETS



UTILITIES

June 2020

Why Consider Electrification Now?



Financial

- Incentives are/will be available that can cover some of the costs of conversion

Facilities

- Obtain required power levels BEFORE your neighbors
- Obtaining power/infrastructure can take years
- Might be easier to relocate than upgrade
- Physical layout of your lot will change

Change is Coming: Even with diesel

- Regulations & tech changes for NOx & GHG



Wave Of Changes Coming



Covid-19
Autonomous Vehicles
Driver Retirement
Electrification
IMO 2020
Hours Of Service
2 Truck Platooning
GreenHouse Gas Phase 2
Alternative Fuels
Solar
Cameras
Lightweighting
Parking Shortage
Artificial Intelligence
Driver Retention
Blockchain
BIG DATA

Mike Roeth, 260.750.0106, mike.roeth@nacfe.org

Dave Schaller, 260.602.5713, david.schaller@nacfe.org

Follow NACFE at:



www.NACFE.org

www.RunonLess.com



JULY 29, 2020

EV Charging for Medium and Heavy Duty Vehicles

Steve Bloch – Western Regional Vice President, EV Infrastructure

steve.bloch@us.abb.com



ABB: An electrification leader in power and automation technologies

Leading market positions in utility, industry, transportation and infrastructure businesses



~147,000

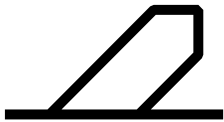
Employees Globally

~25,000

U.S. employees

65

U.S. manufacturing & assembly locations



\$ 28 billion

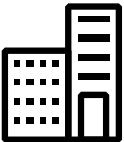
In revenue

Major markets:
utilities, industry, transportation and infrastructure

Major products:
Transformers, switchgear, substations, motors, drives, robotics, marine propulsion, solar inverters, UPS, HVDC, enterprise and automation software, EV infrastructure



Present in **100+** countries



135 years of technology leadership in **electrification**

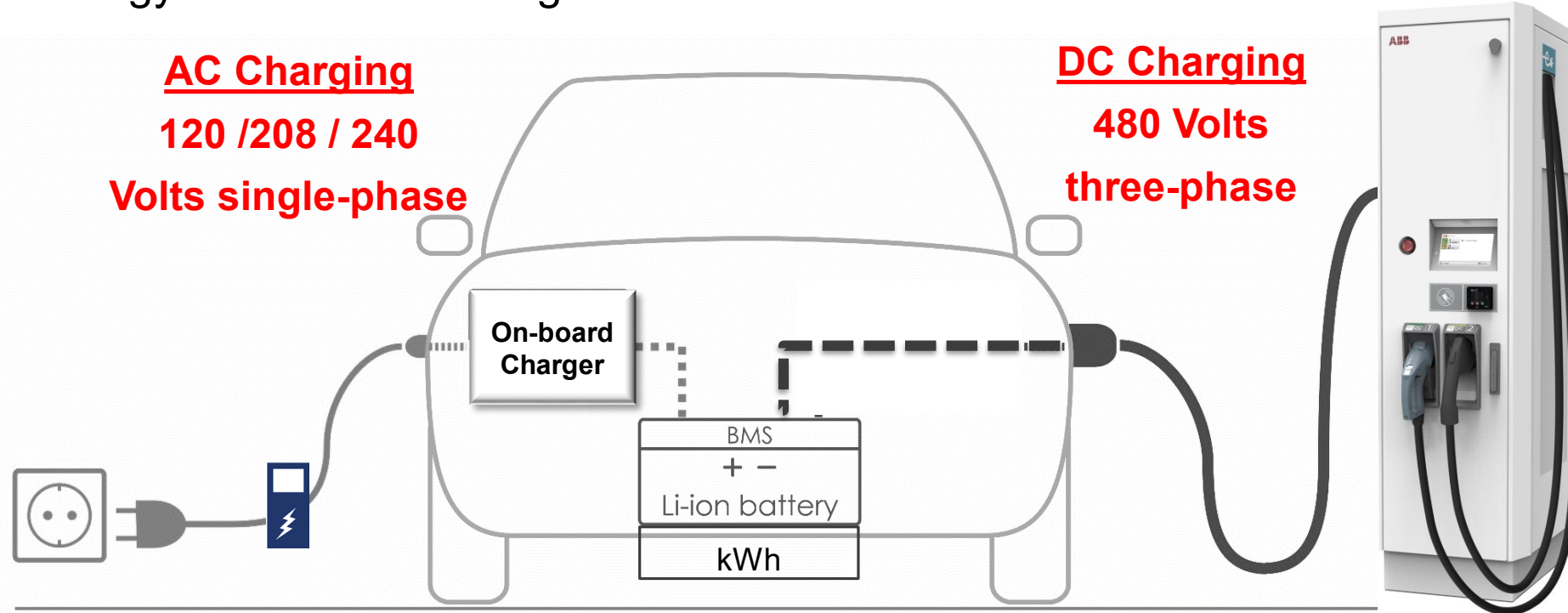
Merger in 1988 of Swiss (BBC, 1891) and Swedish (ASEA, 1883) engineering companies

Single "A" credit rating

Global HQ Zurich / US HQ Raleigh

EV Charging Basics – Power and Energy

- Power = Volts x Amps = 200 Amps x 400 VDC = 80 kW
200 Amps x 800 VDC = 160 kW
- Energy = Power x Time = 80 kW x 1 hour = 80 kWh (40 miles range/hour)
- 1 kWh of Energy = 0.5 miles of range for a truck

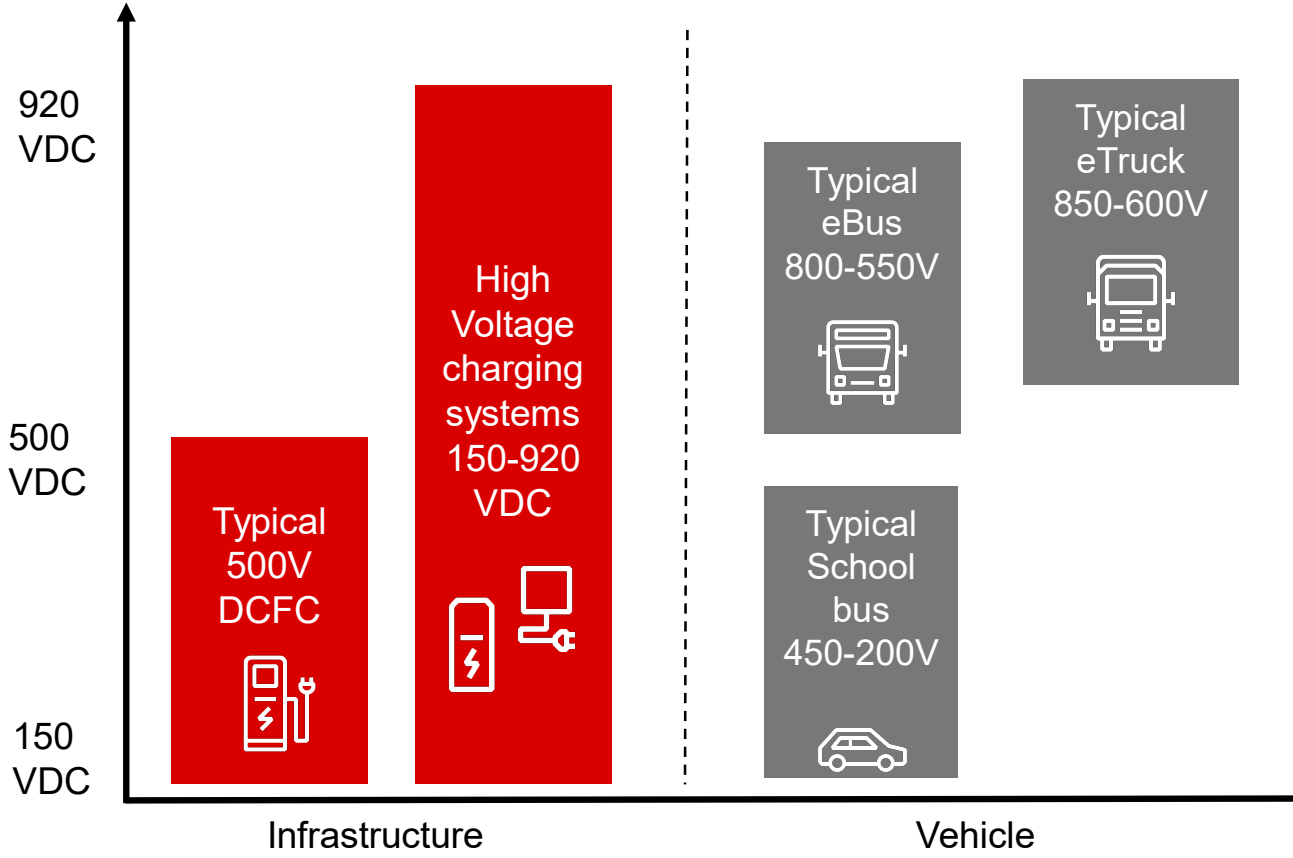


Match Your Vehicle to the Station

What is max charging rate (kW) and battery voltage of the vehicles?

Power Level

- Can the station output the maximum DC voltage required by vehicle battery?
- Does the station support the kW charge rate of the vehicle?
- Charging connection
 - CCS-1 & CCS-2
 - Chademo
 - Pantograph overhead charging capability for transit buses
 - Other



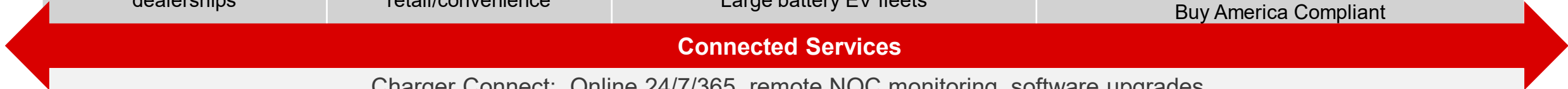
Ask station manufacturer for the output current (amps) at the specific battery voltage

ABB EV Infrastructure Product Portfolio

**Installed base (DCFC):
Globally = 14,000+**



Terra DC Wallbox 20-24 kW	Terra 53/54 50 kW	Terra HP (High power) 175-350 kW	HVC 150-300-450-600 kW eBus + MD/HD charging
Launched in Q3 2020	Flagship: 10,000+ installed	First 350kW systems in US and EU	Depot and opportunity charging systems
Slower DC fast charging limited space or power	'metro charging' 15-90 minute charge times	Liquid cooled CCS cable under 15 min charge times	Bus/transit and MD/HD vehicle fleets ~5 min OppCharge + depot overnight solutions
Fleets, commercial, dealerships	Commercial, malls, fleets, retail/convenience	Highway corridors, Large battery EV fleets	OEM bus manufacturers / transit municipalities, large fleets Buy America Compliant



Connected Services

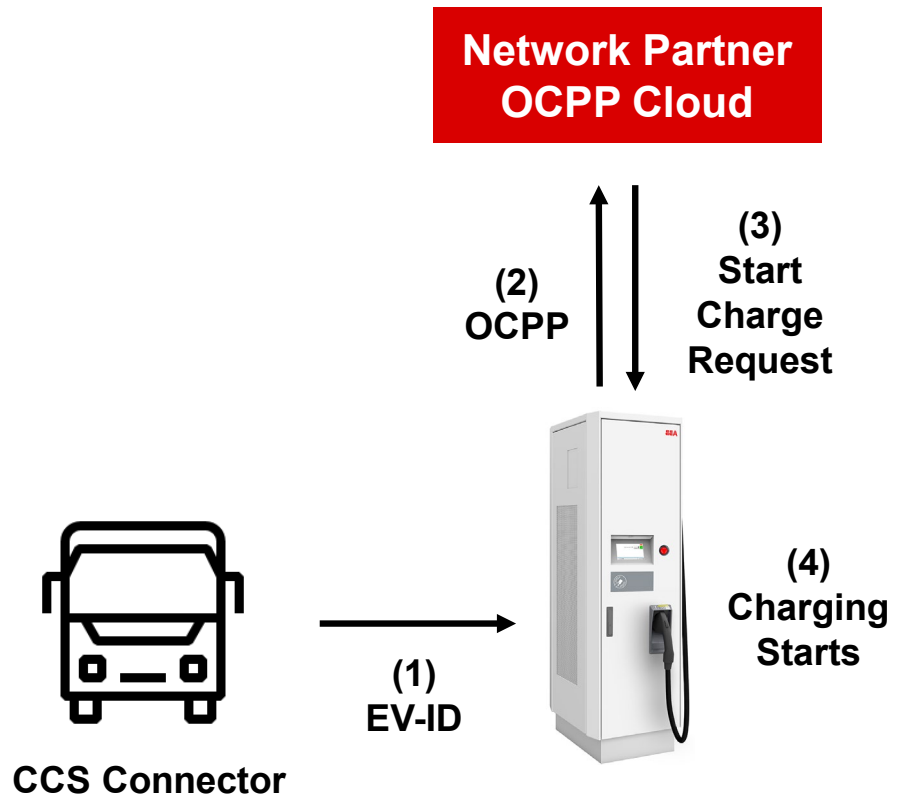
Charger Connect: Online 24/7/365, remote NOC monitoring, software upgrades

Charger Care: Advanced remote diagnostics supporting non-OCPP commands, trouble ticketing, etc.

Custom APIs, OCPP 1.5 and 1.6, credit card readers

Authorization and Usage Data

How will the drivers interact with the station?



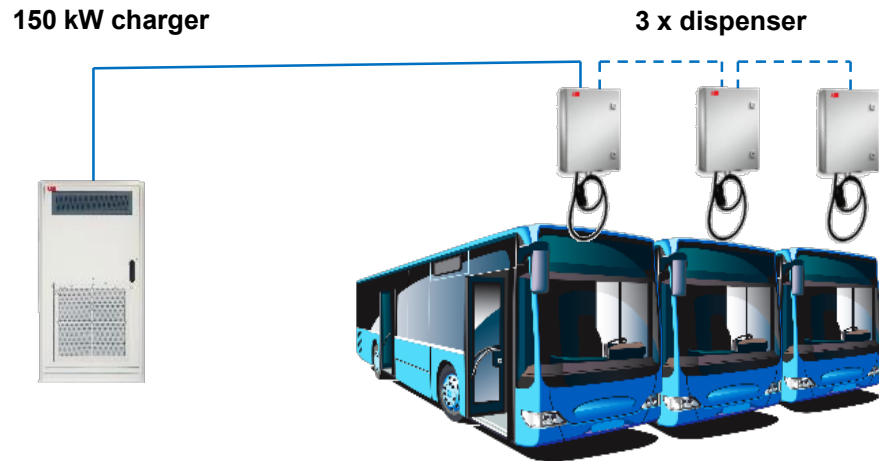
- **Open Access**: Anyone can use station
- **RFID**: Identify the driver
- **Mobile App**: Identify the driver (driver gets real-time usage data via app)
- **AutoCharge**: “plug-and-charge” (no need for driver to do anything)

Selecting the Right kW Size and Number of Stations



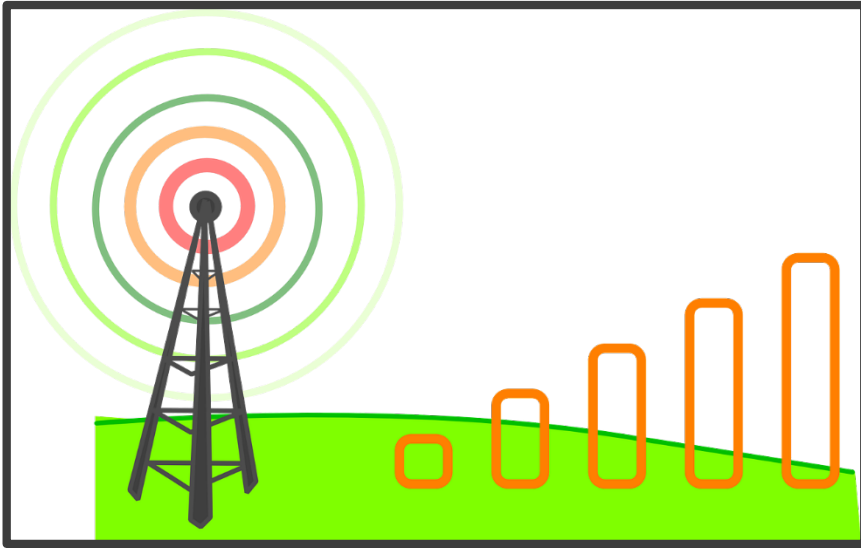
- How many vehicles?
- Battery size of the vehicles (kWh)?
- How many miles of driving per day?
- How many hours available to charge the vehicles?
- Charging at night only to save electricity costs?
- Station redundancy needed?
- Need to charge fast during day and slow at night?
- Availability of power at site?
- Need/want to minimize electricity costs?

Site Layout Considerations



- Where is the charging port on the vehicle?
- Head in or island parking design?
- Pedestal or wall-mounted stations?
- How long do the cables need to be?
- How much space is available at the depot for the stations?
- Cable management?

Cellular Connectivity



- Major carriers: Verizon, AT&T, T-mobile
- Ethernet option?
- Will a cell booster help?

Future Proofing



- Transformer and/or switch gear sized for future expansion?
- Liquid cooled versus non-liquid cooled cables?
- DC output voltage of station to support other vehicles?
- Add “make-ready” stubs during construction
- Physical space to add more stations?



Thank You

Steve Bloch

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Email: steve.bloch@us.abb.com





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TECHNOLOGY**

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**Session 2: Electrification of MD/HD
Short Haul Trucking**

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