ZERO EMISSION FREIGHT FUTURE (ZEFF) REPLICATION PLAYBOOK

Created by project lead:
Clean Fuels Ohio

Project Introduction

The Zero Emission Freight Future (ZEFF) project is designed to demonstrate the real world economic and operational viability of medium- and heavy-duty Electric Vehicles (EVs) in fleets and communities.

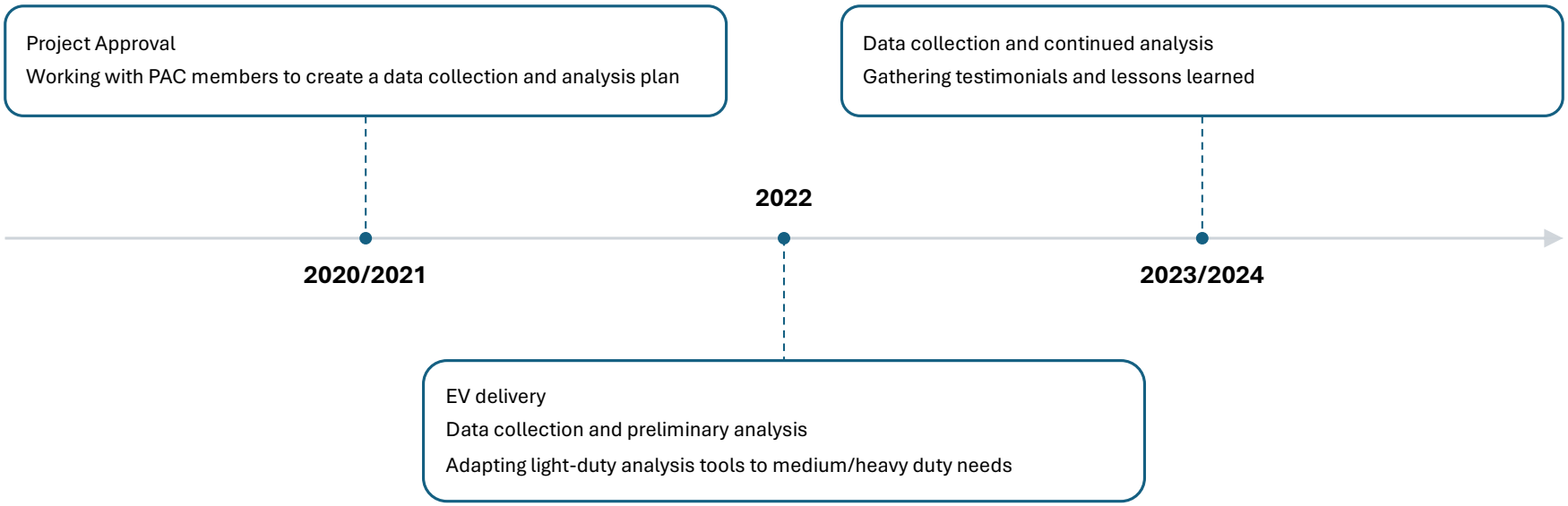
The ZEFF project brings together data sets from a variety of medium- and heavy-duty EVs running real routes in real operations. The relationships built, data collected, and demonstrated solutions seek to inform fleets and other community partners about best practices and lessons learned for successful medium- and heavy-duty EV deployment.

This material is based upon work supported by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) under the Zero Emission Freight Future Program award number DE-EE0009220

Project Partners

Additional Project Advisory Committee Members

Project Timeline



Equipment Procurement – Vehicles in the Project

2 *Class 7, Heavy-Duty Volvo EV Straight Trucks in Midwest Logistics Operations*

1 *Class 6, Medium-Duty Motiv EV Delivery Step Van in Bakery Delivery Operations*

10 *Class 8, Heavy-Duty Freightliner e-Cascadias in West Coast Produce Delivery Operations*

Equipment Procurement – Successes & Lessons Learned

The ZEFF project included data from vehicles that had been deployed specifically for the project AND data from vehicles deployed before the fleet joined the project

One fleet was able to provide multiple vehicle data sets by applying for a state grant and timing the delivery of the vehicle with the beginning of the ZEFF project

Multiple fleets experienced vehicle delivery delays due to supply chain issues after the COVID-19 pandemic

One fleet's motivation for adopting EVs stemmed from leadership culture and an explicit health-, and environment-conscious mission

Each fleet conducted their own assessment to understand which area of operations is best suited for EVs

Equipment Procurement – Recommendations

1. Research available local, state and federal incentives to help offset the initial cost of EVs and infrastructure

The U.S. Department of Energy Office of Energy Efficiency & Renewable Energy has a Laws & Incentives Tool that allows fleets to research Federal and State Laws and Incentives

2. Complete an internal assessment ahead of time to ensure the EV is being placed where it will be most effective in your operations

Unsure of where to start? Contact your local Clean Cities and Communities Coalition by using the U.S. Department of Energy Coalition Locator Tool

The U.S. Department of Energy and Argonne National Lab have developed the publicly available AFLEET tool to help fleets understand their vehicle TCO, emissions, and more.

3. Communicate with vehicle OEM consistently to get ahead of potential vehicle delivery delays

Collecting Data – Determining Data Points

The project's analysis model was adapted from project partner Sawatch Labs' "ezEV" analysis tool for light-duty vehicles

To help inform the analysis model, the following data points were requested:

- Gross Vehicle Weight Rating (GVWR)
- Curb Weight
- Battery Capacity
- Estimated Range (Optional – if available)
- Estimated Manufacturer's Suggested Retail Price (MSRP)
- Motor Count
- Motor kW Draw
- Accessory Equipment Draw

About Sawatch Labs

Founded in 2017

- Acquired by WEX in May 2024
- Fleet electrification analysis
- Emissions reporting
- Trusted by 200+ fleets

Deep expertise

- Energy modeling
- Duty cycle characterization
- Telematics & Operational Data
- Big data

Neutral advisor

- State & Municipal Fleets
- Universities & School Districts
- Fortune 50
- Utilities, Engineering, Consulting Firms

1B+
miles analyzed

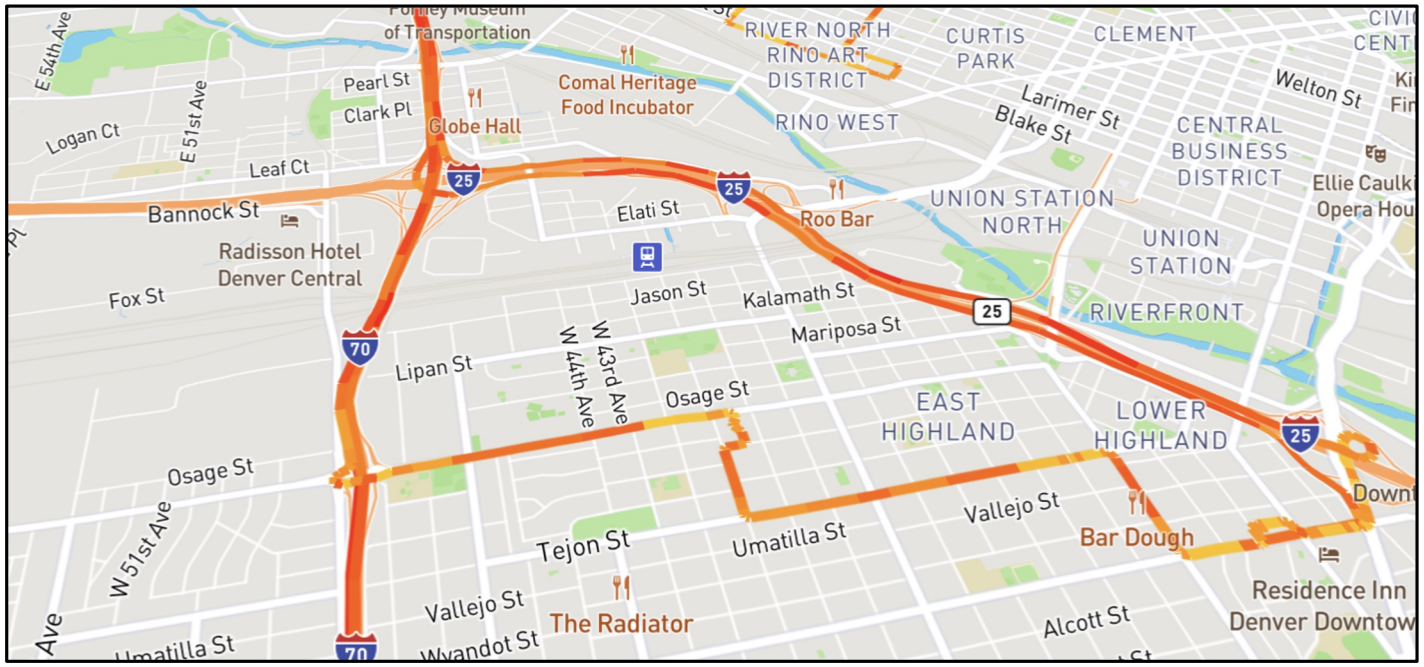
100M
trips accessed

~$600M
savings potential

~6M
annual GHG reduction (tons)

Sawatch Labs - Understanding MD/HD EVs

We use GPS, Vehicle Data, Weather and Geographic Data to model the energy required for the vehicle to complete its duty cycles.



Non-Customer Sample Data

Sawatch Labs

Considerations in modeling vocational MD & HD vehicles:

- Ambient temperature / stop length and cabin thermal requirements
- Derive cargo load estimates from vehicle speed and engine load reporting
- Monitor vehicles for high idle, PTO usage and include aux power usage

Collecting Data – Successes & Lessons Learned

Not all telematics providers are the same. Some telematics providers may not track key metrics like State of Charge. This type of data is important to understanding battery performance, range, operational efficiency and more.

Data collection delays can occur for a variety of reasons (e.g. vehicle delivery delays, no pre-installed telematics before vehicle delivery, installation delays, user error, etc.)

Utilizing public charging with fluctuating rates make charging costs a variable expense, thus making TCO calculations more difficult to run.

Significant differences exist between solutions for light-duty operations and medium- and heavy-duty operations. Software solutions are a helpful addition to monitor data and ensure operational optimization.

Not all OEMs collect and share data in the same way – communication with OEM partners about what data the fleet can and will have access to through the partnership will help ensure deployment success.

Collecting Data – Recommendations

1. Discuss pre-installed telematics or telematics capabilities of vehicle before purchasing. Understand what data the OEM provides, what data the charging equipment provides to the fleet, and what data the fleet needs to access to maximize operational efficiency and report metrics

2. Upon vehicle delivery, ensure data is being received through telematics device or platform

3. Keep lines of communication open with OEM, telematics partner, software provider, and charging company to ensure accurate TCO and other modeling calculations

Vehicle Operation – What Telematics Can Provide

ICE to EV Vehicle Comparison

- Operational Savings
- Fuel Reduction (Gallons)
- Fuel Cost Savings
- GHG Emissions Reductions (lbs)
- Avg Daily Electric Miles
- Avg Operational Savings per EV
- Missed Electric Miles

Vehicle Operation – Emissions Reduction in Detail

Emissions Reduction Information

- GHG Tons Saved (including GHG from kWh gen)
- Carbon Dioxide Tons Saved (Tailpipe)
- Carbon Monoxide lbs Saved (Tailpipe)
- NOx lbs Saved (Tailpipe)
- PM10 in Grams Saved (Tailpipe)
- PM2.5 in Grams Saved (Tailpipe)

Vehicle Operation – Successes & Lessons Learned

Vehicle assessment models are built with good assumptions about missing data (i.e., substituting average price per kWh in order to estimate charging costs) but the more information the fleet can gather to replace these assumptions, the more accurate the assessment.

Technology advances at such a rapid pace that historical data is difficult to rely on. One fleet mentioned that because battery chemistry has changed so significantly, original degradation calculations were much too conservative (i.e., the fleet is seeing higher states of health on their batteries which is changing their TCO calculation).

Operating an EV is different from operating a diesel vehicle. One fleet mentioned they needed to educate drivers on operational best practices and anti-idling best practices to make sure the vehicle range would last the full route.

Vehicle Operation – Successes & Lessons Learned

One project fleet experienced a 40% reduction in vehicle range (miles per kwh) due to cold weather operations in southwest Ohio. Another project fleet experienced 15-20% reduction in vehicle range due to cold weather operations in northeast Ohio.

One fleet saw significant success by hosting a monthly meeting with all members of the group managing the vehicle deployment including the general contractor, OEM representative, facilities team, utility representative and others.

One fleet printed a tri-fold brochure for drivers to pass out when approached about the vehicle. They cited a lot of public interest when the vehicle was running its route.

This extremely quiet Electric Powered Box Truck is saving 2,500 gallons of diesel fuel per year, or 24 metric tons of carbon dioxide (CO_2).

THAT'S EQUIVALENT TO...

- Charging close to 3,000,000 smartphones!

or...

- Recycling 1,021 bags of trash instead of putting it in a landfill!

or...

- Switching 910 incandescent lamps to LEDs!

or...

- The electricity 4.4 homes use in one year!

BATTERY ELECTRIC VEHICLE

MOVING FORWARD WITH RENEWABLE ENERGY

SCAN THE QR CODE FOR THE PITT OHIO SUSTAINABILITY STORY

www.pittohio.com

PITT OHIO

understands the nature of our business and the impact we have on our communities, our customers, and the environment.

An integral part of our sustainability strategy is our commitment to doing our best to achieve environmental and social responsibility.

Our commitment to renewable energy, fuel efficiency, and our planet as a whole is more critical than ever to reducing our carbon output. Our green fleet management practices start with maintaining and operating a modern fleet, which now includes this electric powered truck.

There are only 30 electric trucks of this kind operating in North America today.[1] ***PITT OHIO is generating the power for these two vehicles to be on the road making pickups and deliveries in the greater Cleveland area.***

1. Numbers at the time of print.

CLASS 7 VNR ELECTRIC BOX TRUCK WITH A 26' BODY WITH A MAXON GPT 3,000 LB. LIFTGATE

FEATURES:

HORSEPOWER

More powerful than a conventional powered truck. Under the hood, you will find two 170 kW[2] electric motors that provide output of 340 kW or 455 horsepower. A normal box truck is 275 horsepower.

BATTERIES

At a full charge, this truck can travel up to 150 miles, handling demanding routes with multiple stops on a single charge. The 4 lithium ion battery packs are 66 kWh[3] for a total of 264 kWh. The battery life is projected to be 8-10 years.

CHARGING

At our Cleveland terminal in Parma, OH, we have a Level 2 Tritium Charger that can recharge the battery in 4 hours. The charger is tied into our renewable microgrid, which is powered by on-site solar and wind, so our terminal is generating the power to charge this truck! The truck is also equipped with regenerative braking to maximize range and brake life. It recovers braking energy and transfers it back to the battery packs.

ROOFTOP SOLAR

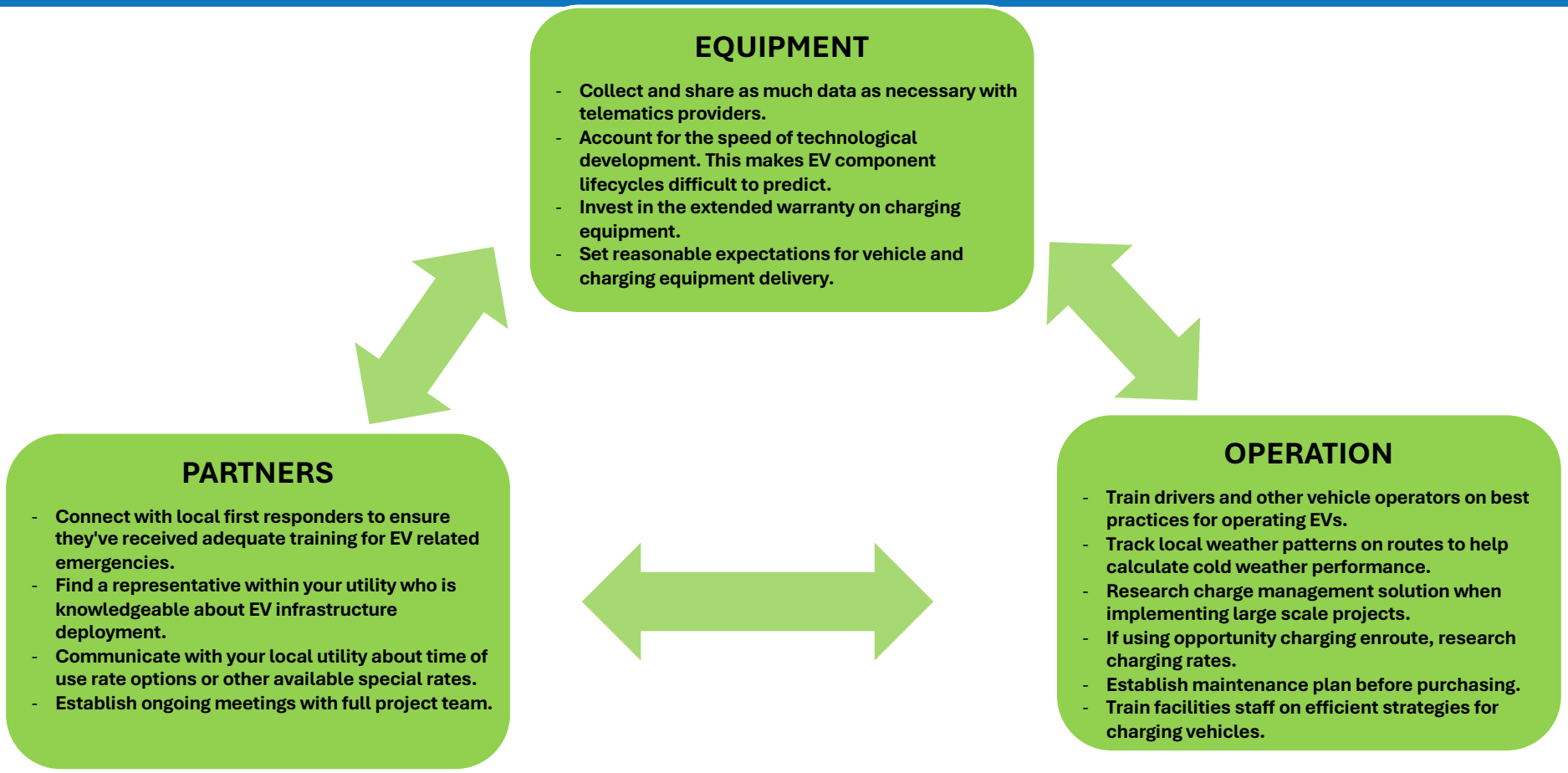
A small solar strip can be found on the roof of the truck, which assists with liftgate power needs.

SAFETY

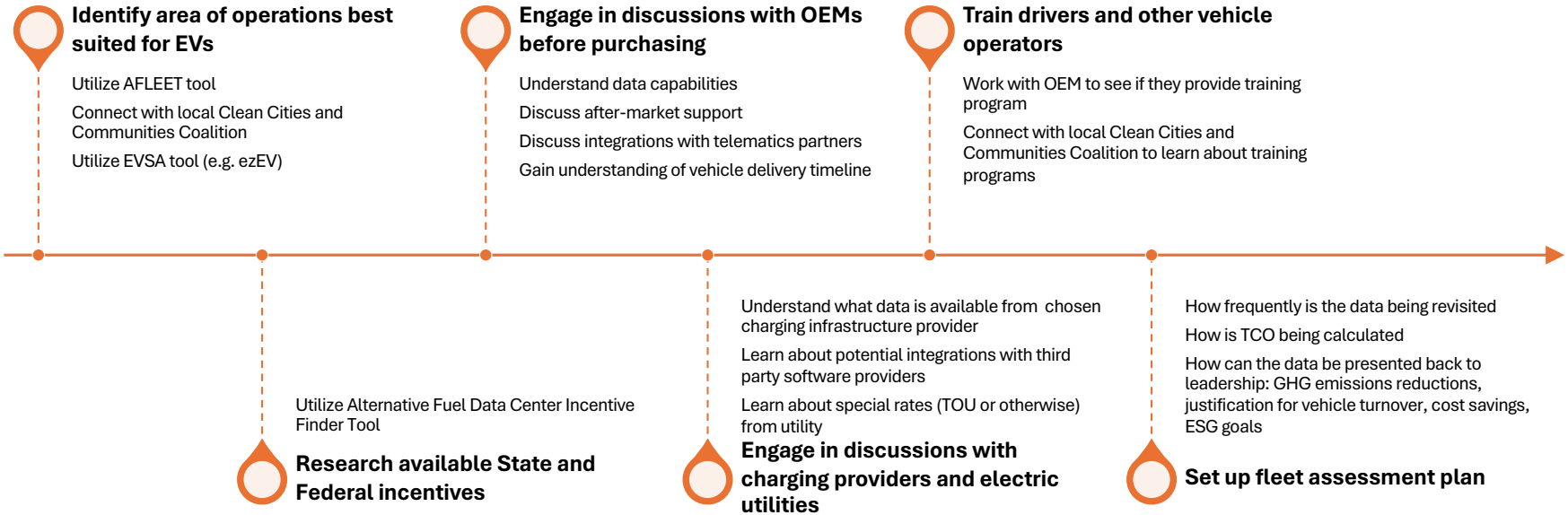
The safety of our drivers and those we share the road with is our top priority. This truck is equipped with a collision mitigation safety system called Volvo Active Driver Assist. The electric truck is not only saving the planet, but with this technology, it is also safe on the road.

2. kW reflects the rate of electricity you use.
3. kWh indicates the amount of electricity you use.

Vehicle Operation – Recommendations



Summary


Identify area of operations best suited for EVs
Utilize AFLEET tool
Connect with local Clean Cities and Communities Coalition
Utilize EVSA tool (e.g. ezEV)
Utilize Alternative Fuel Data Center Incentive Finder Tool
Research available State and Federal incentives
Engage in discussions with OEMs before purchasing
Understand data capabilities
Discuss after-market support
Discuss integrations with telematics partners
Gain understanding of vehicle delivery timeline
Understand what data is available from chosen charging infrastructure provider
Learn about potential integrations with third party software providers
Learn about special rates (TOU or otherwise) from utility
Engage in discussions with charging providers and electric utilities
Train drivers and other vehicle operators
Work with OEM to see if they provide training program
Connect with local Clean Cities and Communities Coalition to learn about training programs
How frequently is the data being revisited
How is TCO being calculated
How can the data be presented back to leadership: GHG emissions reductions, justification for vehicle turnover, cost savings, ESG goals
Set up fleet assessment plan

Resources

- AFLEET Tool
- Joint Office of Energy & Transportation Drive Electric Website
- Clean Cities and Communities Locator
- Alternative Fuels Data Center Federal Laws & Incentives Search
- Alternative Fuels Data Center Electric Vehicle for Fleets Information
- Alternative Fuels Data Center Electric Vehicle Infrastructure Toolbox

Acronym Deck

- AFLEET Tool: Alternative Fuel Life-Cycle Environmental and Economic Transportation Tool
- GHG: Greenhouse Gas
- ICE: Internal Combustion Engine
- kWh: Kilowatt-Hour
- NOx: Nitrogen Oxides
- OEM: Original Equipment Manufacturer
- PAC: Project Advisory Committee
- PM10: Particulate Matter with diameter of 10 micrometers
- PM2.5: Particulate Matter with diameter of 2.4 micrometers
- TCO: Total Cost of Ownership
- TOU: Time of Use