COMMUNITIES LEAP
U.S. DEPARTMENT OF ENERGY

Zero-Emission Vehicle Adoption Resource Guide for Government Fleets in Jackson County, Illinois

April 2024

Ryan Frasier, Emily Kotz, Sarah Cardinali, William Scott Carron, and Johanna Jamison

NREL

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National Renewable Energy Laboratory
15013 Denver West Parkway
Golden, CO 80401

303-275-3000 • www.nrel.gov

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Cover Photo Credit: NREL installation of EV ARC 2020 (Electric Vehicle Autonomous Renewable Charger) charging station on its campus in Golden, Colorado. Photo by Dennis Schroeder, NREL.

Acknowledgments

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List of Abbreviations

A	Ampere
AFDC	Alternate Fuels Data Center
DCFC	Direct Current Fast Charging
EV	Electric Vehicle
F	Fahrenheit
ICE	Internal Combustion Engine
IRS	Internal Revenue Service
kW	Kilowatt
kWh	Kilowatt-hour
MPGGE	Miles per Gasoline Gallon Equivalent
MSRP	Manufacturer's Suggested Retail Price
NREL	National Renewable Energy Laboratory
PHEV	Plug-in Hybrid Electric Vehicle
TCO	Total Cost of Ownership
TOU	Time of Use
V	Volt

Table of Contents

Introduction

As part of the Communities Local Energy Action Program (Communities LEAP) Pilot, the National Renewable Energy Laboratory (NREL) provided technical assistance to Jackson County, Illinois to help develop their clean energy transition roadmap. Fleet electrification was identified as a potential pathway that could address the environmental injustices, high energy burden, and local pollution experienced by this former coal community. NREL worked with Jackson County, Illinois to develop a resource guide that can assist fleet managers considering a transition to electric light-duty fleet vehicles. To further understand the unique challenges of fleet electrification in Jackson County, NREL met with three leaders within the county who either managed current fleets or were responsible for fleet purchases. This resource guide includes best practices and resources that address many of the frequently asked questions that arose during these discussions. Interested fleets can then use this resource guide to help identify the initial steps needed to plan for vehicle electrification. The resource guide summarizes the basics of electric vehicle (EV) adoption for fleets, funding and incentive pathways, total cost of ownership in comparison to conventional internal combustion engine (ICE) vehicles, charging infrastructure, and pilot programs.

Electric Vehicle Adoption Basics for Fleets

Light-duty EVs include all-electric vehicles and plug-in hybrid electric vehicles. Municipal and local fleets can provide an optimal use case for EVs because they typically experience low mileage, return to a central location where charging can occur, and have long overnight dwell times (12+ hours). The Alternative Fuels Data Center (AFDC) provides details on EV basics.

Two major items of concern that were brought up during interviews with the Jackson County local fleet stakeholders were how to identify EVs that could be incorporated into their current ICE fleets and understanding real-world EV range impacts including climate and towing. To further address these concerns the resource guide details internet tools that can be used to identify EV candidates, determine EV range requirements, evaluate EV towing capabilities, and explore EV fleet case studies.

Identifying EV Candidates

One of the first steps to fleet electrification is identifying viable EV replacement candidates in a budget category. Use the AFDC to find a current list of vehicles on the market. The tool filters by vehicle/fuel type, and outputs vehicles that meet the selection criteria with basic information, including make/model, MSRP, range, charging and battery information, and drivetrain. Ameren Illinois also maintains a list of available all-electric models on their website.

EV Range

After cost, range is often cited as the biggest concern for fleets considering purchasing EVs. Light-duty all-electric vehicles currently on the market typically have a range of 150 to 400 miles, which meets the majority of government duty cycles and in many cases will only require drivers to charge the EV once every few days.

However, due to the potential of extreme temperature variations within Jackson County, fleet managers should assess how their climate and operations may impact the range of the EV. Range is impacted in both hot and cold temperatures (Geotab 2023), with larger impacts from cold weather, which can significantly reduce range because EVs cannot utilize waste heat from the engine to heat the cabin like internal combustion engine (ICE) vehicles.

While in optimal temperatures, around 70 degrees Fahrenheit (°F), range is on average 15% better than the manufacturer's rated range (Geotab 2023). Fleets in cold weather climates, with temperature lows around 25°F (typical low temperature during winter months in Jackson County) should assume approximately 45% loss of the rated range (Geotab 2023). For more information on range impacts to EVs in hot and cold weather and suggestions for how to maximize the range during cold weather, refer to Geotab's article on temperature impact to EV range. Geotab also has a tool where users can input speed and temperature parameters to estimate impacts to range for different types of vehicles.

EV Towing

Towing and payload capacities are another important consideration for fleets. Towing or adding significant payload to EVs can reduce range by 50%–75% but will be dependent on the amount of weight being towed, the aerodynamics of the load, and the terrain. Towing capacities are similar between EV and ICE platforms, but EV payloads' capacities are reduced due to the weight of the battery. On the positive side, a driver's experience when towing may be improved because of better low-end torque, less shifting, and less noise.

EV Fleet Case Studies

Many universities and municipal fleets around the country have successfully converted some of their fleets to EV's. A collection of these case studies can be found on the Climate Mayors website which has case study write-ups for municipal fleet electrification and public safety vehicles (e.g., police, paratransit, and fire trucks).

Available Funding Incentives

There are funding sources available to reduce the costs of EVs and charging infrastructure. Taking advantage of these incentives can lead to cost parity between ICE and EV purchases and help fleets realize a lower total cost of ownership (TCO) for EVs.

Tax Credits

Tax-exempt organizations, including municipal and local fleets, that buy a qualified commercial EV may qualify for a clean vehicle tax credit of up to $40,000 and for the federal alternative fuel infrastructure tax credit if the infrastructure is located in an eligible census tract. To help determine if an installation location is in an eligible census tract, visit the 30C Tax Credit Eligibility Locator page and mapping tool from Argonne National Laboratory. Tax-exempt fleets can readily access these tax credits through direct pay, including for vehicles purchased in 2023. Tax-exempt fleets can register for direct pay (also referred to as elective pay) on the IRS website. The AFDC Laws & Incentive tool allows users to search for available federal, state, and utility grants/incentives.

Utility Incentives

It is important to engage directly with the local utility to determine current EV incentives. To find local utility contact information, use the EV Utility Finder. Ameren Illinois has multiple incentives and time-of-use rates available to fleets. For information on the Egyptian Electric Cooperative Association, another utility serving Jackson County, refer to their Electric Vehicle page.

Total Cost of Ownership

The cost of EVs is decreasing and nearing cost parity for some light-duty vehicles; the cost of an EV can further be reduced when tax credits or other incentives are used to offset the cost to purchase the vehicle. Fleet managers will be familiar with conducting a TCO analysis for their conventional vehicles. TCO analysis becomes even more important when switching to EVs in order to compare the up front, maintenance, and fuel costs of EVs and ICE vehicles.

TCO Calculator

Argonne National Laboratory provides a free online TCO calculator that allows for comparison between EVs and ICE vehicles. The instructions found in Attachment A can be used to further explore what inputs impact a TCO analysis.

Guidance for EV Infrastructure Planning and Installation

Fleets that are transitioning to EVs will need to plan for and install charging infrastructure. Fleets will need to consider acquisition, placement, and installation of Level 2 or direct-current fast charging (DCFC) stations. For more information including explanations of Level 1, Level 2, DCFC, fleets can refer to the AFDC page on EV charging stations. Other factors to consider are utility coordination, future proofing investments in infrastructure, smart chargers, DC fast charging, EV charging station needs, site assessments, project planning, and utilizing public charging solutions.

Utility Coordination

Engage with the electric utility early in the process. The three primary things that need to be determined are electric rates, incentives, and power requirements.

Rates

The local utilities in Jackson County (Ameren Illinois and Egyptian Electric Cooperative Association) provide several rate structures for EV fleets. Utility representatives can explain what rates may be best for a specific electric fleet profile.

Demand charges or time of use rates (which typically peak during the daytime) will need to be discussed as they can have an impact on operating costs. High demand charges can significantly increase electricity costs.

Incentives

Electric utilities may provide support for EV fleet planning or they may have incentives available to help offset the costs to install EV charging infrastructure and/or EV time of use rates.

Ameren Illinois has several incentives available to EV fleet customers. The Ameren website provides up-to-date information. Ameren also provides customers a free Fleet Assessment to help weigh options and evaluate the benefits of adopting EVs in a fleet. The free assessment includes a cost-benefit comparison for acquiring vehicles, charging needs, fuel and maintenance, and emissions impacts. Contact ElectrifyIL@ameren.com for more information.

Egyptian Electric Cooperative Association customers can consult their EV website or contact them at info@eeca.coop.

Power Requirements

Determine how many EVs will be added to the fleet and their locations. The utility can help assess if additional power and upgrades will be required. Significant electrification projects, considering the addition of many vehicles, should notify the utility early in the project planning. Large projects often require facilities and grid upgrades which can be expensive and have long lead times.

Future-Proofing

When identifying where to install EV infrastructure, consideration should be given to where fleet vehicles will park and both short- and long-term EV charging needs. Consider future-proofing, such as installing the conduit, wire, and/or electrical panels that will be needed for future EV charging stations when additional EVs are added to the fleet. Consider leveraging opportunities to add EV-ready infrastructure elements during construction to save costs for future installs. Consider if future charging needs will include medium- and heavy-duty fleet vehicles.

Smart Charging

Network enabled chargers (i.e., "smart chargers") can add some conveniences such as real-time monitoring and energy usage reporting capabilities. However, monthly network fees will apply to each charger (typically around $20–$30/month), which will lessen any expected fuel savings. Alternatively, consider non-networked chargers to save on monthly costs and reduce downtime due to networking issues. If energy usage reporting is needed, fleets can utilize telematics systems, track electricity use from the vehicle on-board computers, or install individual meters or submeters on the panel that is used to power the EV charging station(s).

DC Fast Charging (DCFC)

While Level 2 charging is expected to be sufficient for most light-duty fleet vehicles, DCFC may be needed to support fleet charging if the vehicle has a short dwell time (e.g., less than 2 hours) to recharge, such as a law enforcement vehicle. It is important to note that DCFC infrastructure is significantly more expensive and requires three-phase power that may not be readily available at the site.

EV Charging Station Needs

To establish charging needs, determine how many and what type of charging stations will be needed in the near- and long-term by location. Consider the following:

- Group fleet vehicles based on where they park overnight. Identify which of those vehicles are anticipated to be replaced with EVs in the near-term vs. the long-term.
- Determine what type of EV charging is needed, such as Level 1, Level 2, or DCFC, based on how quickly the EV needs to charge. If installing Level 2, consider power sharing to save costs by using one charger or power source to charge multiple vehicles. A simple equation for calculating charger power needs for Level 1 or Level 2 is: Energy Needed (kWh)/Dwell Time (hours) = Charger Power Needed (kW)
- Consider how frequently the fleet vehicles will need to charge (e.g., every day, once a week, etc.) based on how many miles the vehicles travel on average per day. Using this information, determine the charging station-to-vehicle ratio that is needed.
- Develop a timeline to have infrastructure installed for when EVs arrive. Look for opportunities to future-proof to save costs and prepare for future EV acquisitions.
- Before purchasing a charging station, confirm that the connector is compatible with the fleet EV. The Climate Mayor's Purchasing Collaborative lists EV charging station offerings.

Site Assessment

Conduct a site assessment for locations being considered for EV charging infrastructure. The purpose of the site assessment is to identify if the existing electrical infrastructure is sufficient or if upgrades are needed. This assessment should be done with the facility manager and the electrician. Note that standard Level 2 chargers will require 40A to 80A on 240V or 208V.

Project Planning

Once a location has been identified, select the charging equipment, prepare cost estimates, develop line drawings/site plans, and identify a contractor to perform the work. Qualified electrical contractors can be found on the EV Infrastructure Training Program's Find a contractor page.

Public Charging

Find public EV charging stations using the AFDC Fueling Station Locator. This web-based mapping tool allows users to search for alternative fuel stations. It is recommended to check with the fleet fueling card provider, such as WEX, to determine what EV charging station providers are compatible with the fleet card.

Piloting EVs Prior to Full Fleet Electrification

As a first step for vehicle electrification, consider piloting EVs as an opportunity for lessons learned on how to scale up. To get started, identify a vehicle or small set of vehicles that would be the easiest to electrify (i.e., a vehicle with low mileage, that stays local and has a driver or department that would be excited to have an EV placed with them). The vehicle should also return to the same location to park each night, with an identified spot that would be easy to charge (such as utilizing an existing outdoor 120V or 240V receptacle or a location where there is capacity to add a Level 2 EV charging station). If an organization utilizes shared vehicles these can often be ideal for electrification as they can give multiple users and departments the opportunity to drive EVs which can be a catalyst for further adoption.

Attachment A: Total Cost of Ownership Calculator Instructions

A.1 Research Vehicles

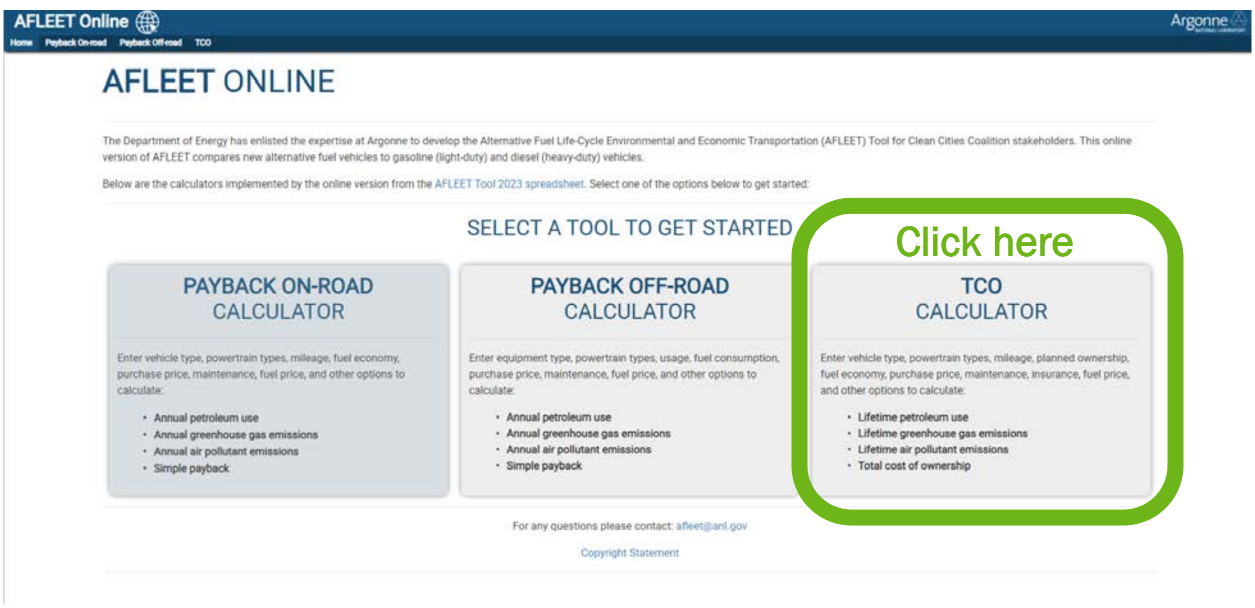
Before using the total cost of ownership (TCO) calculator some preparation is required. The following process is recommended.

1. Identify the vehicle that will be replaced and the average miles the vehicle drives per year.
2. Research what vehicle make/model would be a likely ICE and EV replacement for comparison purposes.
3. Navigate to [Fuel Economy]() to look up the MPGGE (miles per gasoline gallon equivalent) by searching the year/make/model for both the ICE and EV replacement options.
4. Identify the estimated purchase price for the ICE and EV replacement options using either the MSRP as noted in [Fuel Economy]() or from purchasing information provided from the co-op/dealership that provided the vehicle quote.
5. Subtract federal tax credits and any rebates/grants that are anticipated to be utilized to purchase the vehicle.

A.2 Run TCO Calculator

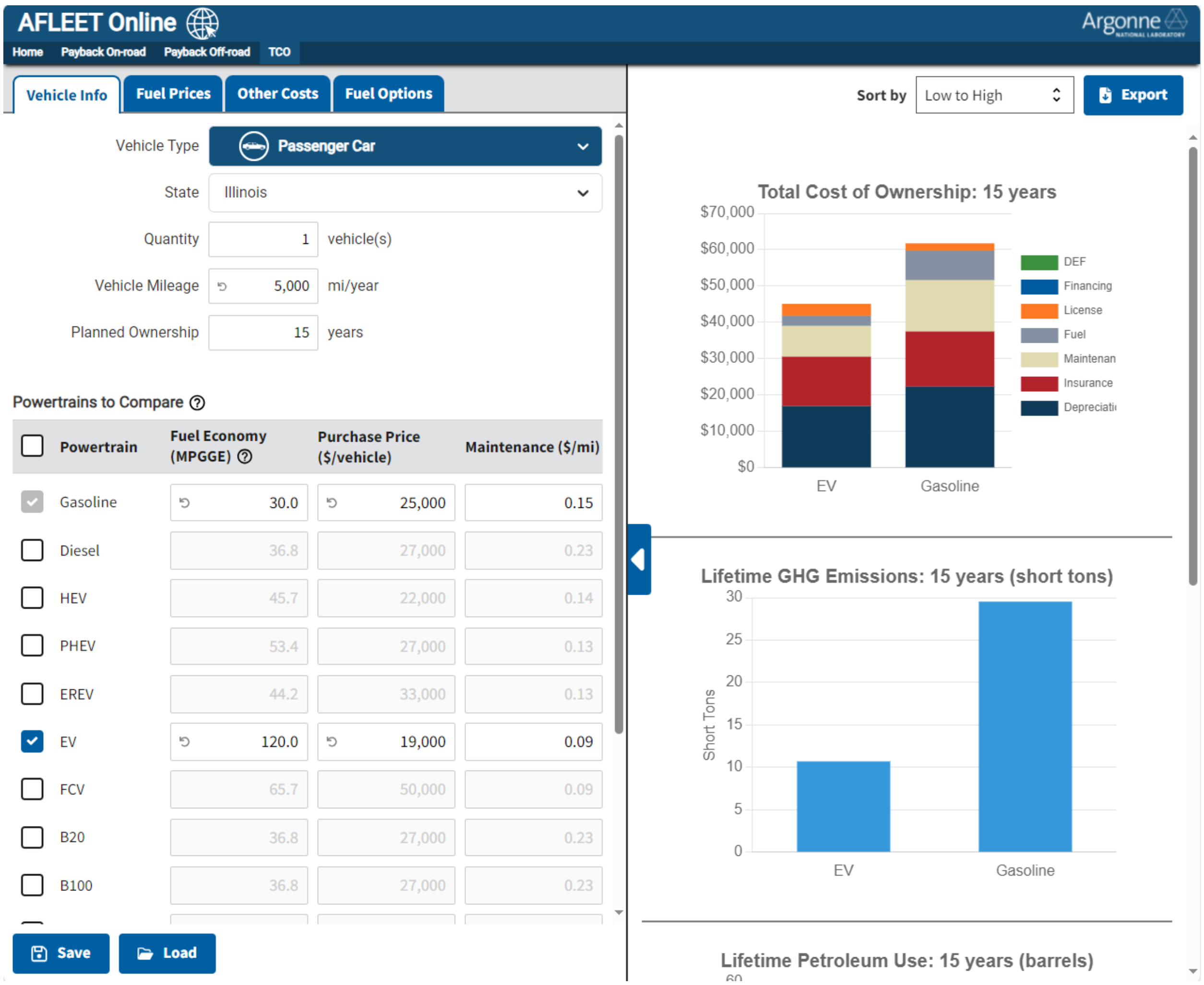
After performing the initial research, the total cost of ownership (TCO) calculator can be run to evaluate an EV or compare an EV against an ICE vehicle. The following process is recommended to run the total cost of ownership (TCO) calculator:

1. Navigate to the calculator: https://afleet.es.anl.gov/afleet/ and select "TCO Calculator."



2. Update "Vehicle Info" tab:
   - Select the vehicle type. Note that when comparing an SUV, select pickup truck defaults.
   - Input the state, quantity = number of fleet vehicles being replaced for the vehicle type, average miles traveled per year, and estimated number of ownership years accordingly.

- Select what powertrains to compare. For example, gas-powered vs EV.
    - Update the MPGGE and purchase price based on the year/make/model of the vehicles being compared (**Note**: Make sure to subtract tax credits and any other anticipated incentives from the purchase price).
    - Update the maintenance estimates for $/mile to reflect the fleet’s maintenance and repair costs on average per mile for ICE vehicles and reduce the costs by 10% for plug-in hybrid electric vehicles (PHEVs) and 40% for EVs.

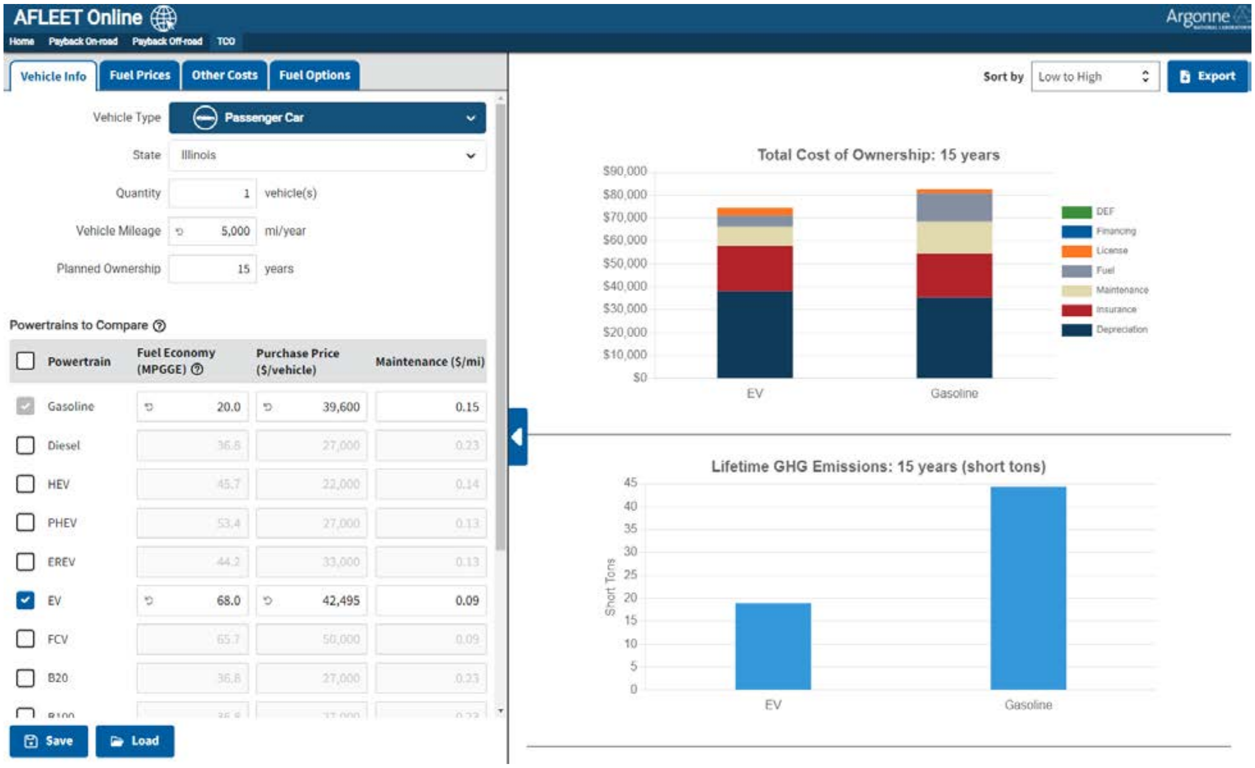


Example 1 for how to use the tool: 2023 Chevy Bolt EV compared to a Chevy Malibu

Chevy Bolt: MSRP = $26,500 – Tax Credit of $7,500 = $19,000

Chevy Malibu: MSRP = $25,000

***Note**: Individual results will vary based on maintenance, fuel, and other vehicle-related costs.*



Example 2 for how to use the tool: 2023 Ford F150 Lightning compared to a Ford F150 4WD

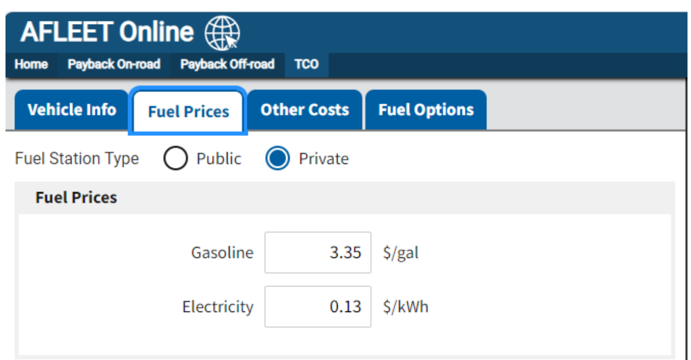
Ford F150 Lightning: MSRP = $49,995 – Tax Credit of $7,500 = $42,495

Ford F150 4WD: MSRP = $39,600

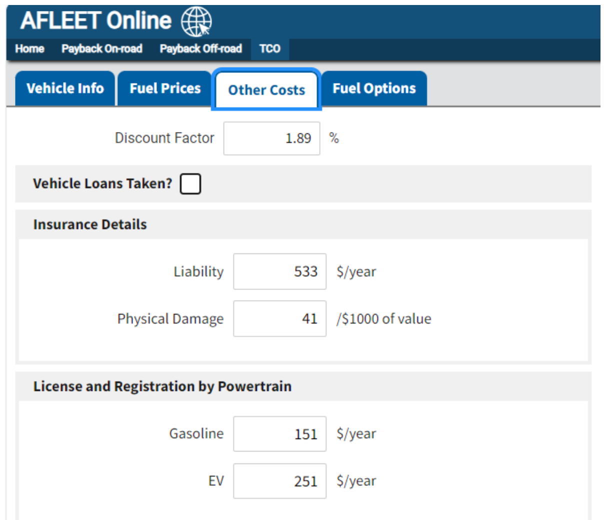
***Note**: Individual results will vary based on maintenance, fuel, and other vehicle-related costs.*

3. Update "Fuel Prices" tab:

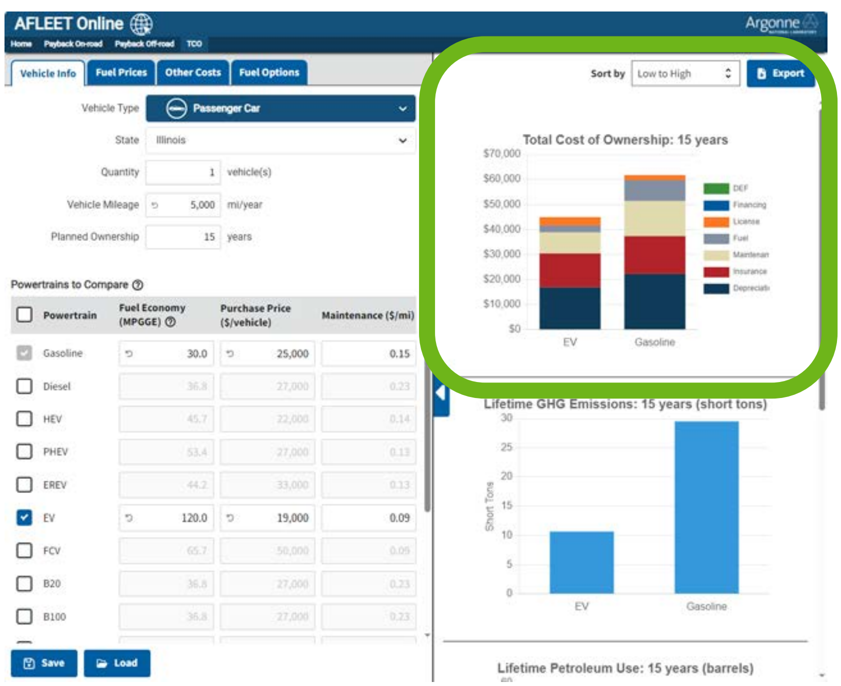
- Input the average $/gallon anticipated over the lifetime of the vehicle.
- Input the average electricity costs ($/kWh) to charge the vehicle. **Note**: If the utility offers an EV time-of-use (TOU) rate and charging is expected to be completed during off-peak hours, then assume an off-peak rate for the electricity use. Otherwise, if charging may occur in the peak periods, it is recommended to use a "blended" rate to be conservative. If there are concerns about potential demand charges, reach out to the facility manager to discuss more.



4. Update “Other Costs” and “Fuel Option” tabs as needed.
   - Under the “Other Costs” tab there is the option to include a discount factor, financing information, and insurance details, but the tool does not have separate cost information by powertrain (note that for fleets that are not self-insured, EVs may have higher monthly rates than conventional vehicles). If the fleet pays license/registration costs, there is the option to add those costs by powertrain. (In some jurisdictions EVs may have higher license/registration costs compared to conventional vehicles).



5. Refer to the “Total Cost of Ownership” chart for a cost comparison between the vehicles selected.



References

Geotab. 2023. “To what degree does temperature impact EV range?” https://www.geotab.com/blog/ev-range/

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