UNIVERSITY OF DELAWARE
EARTH, OCEAN &
ENVIRONMENT

ELECTRIFYING UD'S MAINTENANCE FLEET:

FEASIBILITY ASSESSMENT & RECOMMENDATIONS

May 13, 2026

Jude Borden, Lucia Paye-Layleh, Emmie Rossi, and Colden Rother

Executive Summary

The University of Delaware (UD) Parking and Transportation Services is exploring the electrification of the Facilities, Real Estate & Auxiliary Services (FREAS) as a part of broader sustainability and emissions reduction goals. This study evaluates the economic and operational feasibility of transitioning a portion of the existing internal combustion engine (ICE) vehicles to electric vehicles (EVs) through a comparative cost analysis. The analysis compares vehicle purchase cost, resale value, fuel or electricity costs, and maintenance costs for EV and ICE vehicles over a five-year lifecycle. State rebates, chargers, and carbon emissions were also taken into consideration. The analysis was informed by UD fleet data, industry data, stakeholder interviews, and case studies from other universities. This approach allowed for both real-world operational needs and financial considerations to be included in the analysis.

Results indicate that EVs often have higher purchase prices, but lower fuel and maintenance costs due to higher energy efficiency and fewer mechanical components. However, transitioning to an EV will also depend on vehicle type and usage. The vehicle types identified as the most suitable candidates for electrification were the small and midsize pickup trucks.

Our findings suggest that a partial electrification of the fleet can be practical, feasible, and cost-effective. Strategic implementation focused on appropriate vehicle selection and investment in charging infrastructure can enable UD to maximize cost savings while reducing emissions and minimizing operational disruption to current fleet activities.

Table of Contents

Introduction

The University of Delaware (UD) Parking and Transportation Services is exploring the electrification of the Facilities, Real Estate & Auxiliary Services (FREAS) vehicle fleet, including maintenance, parking and transportation enforcement, and motorpool vehicles. UD is one of several universities across the United States that have increasingly explored fleet electrification as a part of their broader sustainability and emission reduction goals. For example the University of Georgia Facilities Management Division conducted a comprehensive study modeling the electrification of 218 trucks and vans in its fleet (University of Georgia, 2025). Studies from the University of Minnesota have found that a substantial portion of fleet vehicles can be converted to electric vehicles (EVs) while reducing emissions and achieving cost savings over time (Lawver & Nelson, 2025). Studies such as these demonstrate fleet electrification is not only technically feasible, but also beneficial in meeting sustainability targets.

Most similar to our study, a feasibility study from Michigan State University found that about 69% of its facilities management fleet could be electrified, resulting in a 76% emissions reduction. Their life-cycle cost analysis found that EVs can significantly reduce fuel and maintenance costs over time, with some vehicle types experiencing substantially lower annual operating costs compared to internal combustion engine (ICE) vehicles. These findings align with the broader literature on EV adoption, which often finds that although EVs have higher upfront costs than ICE vehicles, their lower operating and maintenance costs over the vehicle's lifetime can make them more cost-effective.

Together, these studies suggest that fleet electrification can reduce emissions while lowering long-term operational costs when implemented strategically. This indicates that transitioning to EVs may be a viable and beneficial opportunity for the University of Delaware's FREAS fleet.

Project Overview

The purpose of this study is to evaluate the economic and operational viability of transitioning a portion of the UD’s FREAS fleet to EVs. We assess operational requirements to identify ICE vehicles with suitable EV alternatives, compare the financial costs and environmental benefits of ICE and EVs replacements, and develop purchasing and implementation recommendations.

Research Design

The research design for this study was carried out through five main steps: identifying replacement vehicles, developing cost table variables, conducting data collection, data assumptions and difference in cost comparison.

The analysis began with FREAS’s current fleet list. Vehicles unlikely to have feasible EV alternatives were first eliminated based on technical specifications. Stakeholder interviews were then used to better understand vehicle use requirements and further narrow the list of replacement candidates. These interviews also informed the development of the cost table. Overall, the analysis integrates UD fleet records, industry data, semi-structured stakeholder interviews, and case studies from peer institutions to evaluate the feasibility of fleet electrification.

Several overarching assumptions and limitations should be considered when interpreting the results of this study. First, all vehicle comparisons assume a five year ownership and 50,000 miles driven before resale. Second, resale values were estimated using Kelley Blue Book values based on assumed mileage and years owned. Actual resale values may vary depending on market conditions, vehicle conditions, and future demand of both ICE and EV vehicles. Third, replacement vehicles were selected based on the closest available match in specifications and operational functionality. Since the EV market is still developing, some replacement options may not perfectly replicate the capabilities of the current fleet ICE vehicles. As for limitations, this study did not include full installation or infrastructure costs associated with EV charging. We also had limited long-term maintenance data for some vehicle types, so maintenance costs were estimated using Kelley Blue Book data and the FREAS ICE vehicle maintenance records. Finally, rebate programs, electricity prices, fuel prices, and Social Cost of Carbon estimates made are subject to change over time due to market conditions and policy changes.

Methods

1. Identification of Replacement Vehicles

The first phase of the analysis screened FREAS vehicles to identify EV replacement options that would preserve the fleet's current operational capacity. FREAS provided a "master list" of currently owned vehicles, which the study used to find potential replacements. Vehicles were categorized into three use categories: maintenance, motorpool, and parking enforcement. Vehicles were also categorized into types: sedans, minivans, small trucks, midsize trucks, small vans, medium vans, cargo vans, and heavy duty vehicles such as large pickups, dump trucks, and snowplow-equipped vehicles.

Heavy duty vehicles were excluded from the analysis because available electric alternatives lacked the torque and battery endurance needed to perform required tasks. A semi-structure interview with the Transportation Services Manager indicated that motorpool vehicles function more like a car rental service. Because these vehicles travel long and uncertain distances, they were not viable candidates for EV replacement and were also excluded from the study.

For the remaining maintenance and parking vehicle types (sedan, small pickup, etc.), we reviewed model specifications using *Edmunds.com* (Edmunds, 2025) and manufacturer websites to identify EV alternatives with similar specifications. Specifications included physical characteristics such as cargo and towing capacity, number of seats and doors, and range, as well as warranty information (see Cost Table - Specs). To ensure a consistent comparison, we selected the latest model of each ICE vehicle to the latest model EV model with similar specifications.

2. Stakeholder Interviews

As part of the research methodology, semi-structured interviews were conducted to better understand the operational use cases of the vehicles identified during the initial screening phase. Interview guides were developed for different departments to reflect variations in vehicle use and responsibilities. The guides focused on key themes, including vehicle usage patterns, maintenance practices, and operational requirements. Following feedback from the client, the interview guides were refined and condensed to improve clarity and relevance. The final version of the interview guide is provided in Appendix 1.

Interviews were conducted with key personnel, including the Director of Parking and Transportation, the Transportation Services Manager, and the Operations Manager. These stakeholders were selected due to their direct oversight and involvement in fleet operations. Insights gathered from the interviews informed both the selection of vehicle types included in the analysis and the development of the cost comparison table, ensuring that the analysis reflected real-world operational conditions and constraints.

3. Development of Cost Table Variables

Cost Table variables were limited to cost categories that were expected to vary between ICE and EV replacement options. For example, because the registration fee would be the same for an ICE vehicle and an EV, it was excluded from the Cost Table. Similarly, equipment such as ladder racks were excluded because they would be required for both ICE and EV replacement options. Variables in the table included purchase price, resale price, vehicle fees, fuel, maintenance, and charger. We separately considered rebates and carbon emissions. *Edmunds.com* (Edmunds, 2025) was used for Manufacturer's Suggested Retail Price (MSRP) and Delaware's vehicle document fee (sales tax) is 5.25% (Delaware Division of Motor Vehicles, 2025). FREAS sells their maintenance vehicles after they are deemed in need of replacement. The resale values were obtained from *Kelly Blue Book* (Kelley Blue Book, n.d.), by assuming the vehicles are resold at 5 years old and 50,000 miles on the odometer. The Department of Motor Vehicles for the state of Delaware charges an annual alternative fuel vehicle (AFV) registration fee to replace lost gas tax revenue for road maintenance. Passenger EVs under 6,000 lbs cost $110/year (Delaware Division of Motor Vehicles, 2025). This price varies for different types and sizes of vehicle.

In the Michigan State study, EVs had a cost advantage in two main areas: propellant (fuel) costs and maintenance costs (Lawver & Nelson, 2025). Local gas and electricity prices were obtained (see section 4 below). If an EV is purchased, the charging infrastructure must also be accounted for. The Electric Vehicle Supply Equipment (EVSE) (i.e. the charging station), software updates, and broken hardware were accounted for and assumed from two of the team members who actively participate in building, maintaining, and researching EVSE's at UD as well as the Michigan State study (Lawver & Nelson, 2025). Rebates were also found to be influential in the Liberty University study (Slusser, 2025), so the state of Delaware rebates were researched. No federally funded rebates were used in this study. Two active rebate programs found to be viable for FREAS were offered by The Department of Natural Resources and Environmental Control (DNREC). One rebate was for the purchase of an electric vehicle (Delaware Clean Vehicle Rebate Program | Electric Vehicle Incentives, 2026) and the other was for the purchase and installation of EV chargers in a commercial setting (Electric Vehicle Charging Equipment Rebates - DNREC, 2026). Both rebates were included in the Cost Table to show how available incentives affect the cost of EV replacements. Another cost offset is the Vertically Integrated Program (VIP) offered through UD's Department of Electrical and Computer Engineering (ECE), that allows students to work under research professors to gain experience and credit hours. With the purchase of specific chargers, the students would be able to help service and maintain chargers on campus and offset charger maintenance costs as well as learn important skills in the EV industry. The final variables added to the Cost Table was the total carbon emissions for each car and the Social Cost of Carbon for each car. This allows for the difference in emissions over the lifetime of a vehicle to be quantified for the study.

4. Cost Table Structure and Variable Calculations

The analysis applied the following assumptions across all vehicles: each vehicle would be purchased new, have a five-year lifetime, and then be sold by The University of Delaware. This five-year lifetime was selected because EV maintenance data are difficult to find beyond year five and many vehicle warranties expire within five years. Total cost of propellant in a vehicle's lifetime was calculated using this 5-year lifetime assumption. Newark, Delaware gas prices were $4.20 as of May 11, 2026. The price of electricity was based on the University of Delaware's current electricity agreement with the City of Newark (Metz, 2025). Although the rate changes incrementally over time, it is renegotiated every 10 years. Averaging the electricity rate over the five-year study period resulted in an estimated price of $0.153/kWh.

The Cost Table is a Google Sheet. The first tab is a "README" tab that explains how to navigate and use the table, the second tab is the assumptions tab, and subsequent tabs are the cost comparison by vehicle type: Minivan, Small Pickup, Midsize Pickup, Cargo Van, Large Cargo Van, Sedan (with caveat), Small Pickup (*Test Vehicle*), Minivan (*Test Vehicle*). Each vehicle type tab names the vehicle (year, make, model, trim) being replaced in the top left in blue. The first two columns define the variables being compared (specs, sticker price, etc.). Columns C and D show data for the ICE vehicle and EV, respectively. The fifth column shows the cost difference between the ICE and EV for each variable. The sixth column details the assumptions made about the values in that row. Data with a green background have been verified, data with a purple background are unconfirmed or missing data, and an orange background indicates that the value is unknown. Please refer to the color coded key at the top of column J in the table.

The specification section of the table is used to show that the ICE and EV have comparable functionality. This section includes number of seats, warranty on the vehicle, bed length, and towing capacity. This decision was made for example to prevent a vehicle that could tow 7,700 lbs to be compared to one that could tow 1,000 lbs. (See Methods, 2. Developed Cost Table Variables for more details).

For fuel costs, two manufacturer-based assumptions were used: model-specific miles per gallon for ICE vehicles and vehicle range for EVs. We estimated five-year fuel costs, based on 50,000 miles of use, as well as cost per mile using the following equations:

GAS:

ICE Vehicle Cost Lifetime Propellant Cost:

$$Total\ Cost\ (5\ Years):\ \varepsilon\ =\ \varphi ß\sigma\tau \qquad (1)$$

where ε is total gasoline cost for 5 years of ownership, φ is Gas Per Gallon ($/Gallon), ß = Size of Fuel Tank (Gallons), σ = Fill ups Per Year, τ = Years of Ownership

Total Miles ε Can Drive:

$$Total\ Miles\ (5\ Years):\ \delta\ =\ ß\sigma\tau\zeta \qquad (2)$$

where δ is total possible miles driven in 5 years of ownership, ß = Size of Fuel Tank (Gallons), σ is Fill ups Per Year, τ is Years of Ownership, and ζ is Miles Per Gallon (aka fuel efficiency).

Cost Per Mile ($):

$$Cost\ Per\ Mile\ (\$):\ \Gamma\ =\ \varepsilon/\delta \qquad (3)$$

where Γ is the cost per mile to operate the vehicle, ε is total gasoline cost for 5 years of ownership, and δ is total miles driven in 5 years of ownership.

Cost of Propellant (5 Years):

$$Cost\ of\ Propellant\ (5\ Years):\ Ø\ =\ \tau\,\Gamma\Phi \qquad (4)$$

where Ø is total cost of propellant in 5 years of ownership under FREAS assumed use case, τ = Years of Ownership, Γ is the cost per mile to operate the vehicle, and Φ is Amount of Miles Driven in a Year.

ELECTRICITY:

EV Cost Lifetime Propellant Cost:

$$Total\ Cost\ (5\ Years):\ \alpha\ =\ \varphi ß\sigma\tau \tag{5}$$

where α is total electricity cost for 5 years of ownership, φ is cost per kWh ($/kWh), ß is battery capacity (kWh), σ is Total number of Plug-ins Per Year, τ is Years of Ownership.

Total Miles α Can Drive:

$$Total\ Miles\ (5\ Years):\ \Sigma\ =\ ß\sigma\tau\zeta \tag{6}$$

where Σ is total possible miles driven in 5 years of ownership, ß is battery capacity (kWh), σ is Total number of Plug-ins Per Year, τ is Years of Ownership, and ζ is Range of Vehicle (miles/kWh).

Cost Per Mile ($):

$$Cost\ Per\ Mile\ (\$):\ \chi\ =\ \alpha/\Sigma \tag{7}$$

where χ is the cost per mile to operate the vehicle, α is total electricity cost for 5 years of ownership, and Σ is total possible miles driven in 5 years of ownership.

Cost of Propellant (5 Years):

$$Cost\ of\ Propellant\ (5\ Years):\ Ø\ =\ \tau\,\chi\Phi \tag{8}$$

where Ø is total cost of electricity in 5 years of ownership under FREAS assumed use case, τ = Years of Ownership, χ is the cost per mile to operate the vehicle, and Φ is Amount of Miles Driven in a Year. Each vehicle type tab in the Cost Table has an Appendix A (scroll towards right on tables) in columns N - Y for rows 7 - 35.

FREAS provided maintenance records for its vehicles from the past two years. This included all its ICE vehicles as well as the two Nissan Leafs used for parking and enforcement. We weren't able to find a reliable source of five-year maintenance records of an EV fleet. Kelly Blue Book offers a five-year expected maintenance cost based on the manufacturer's recommendations. We generated a five-year EV-to- ICE maintenance cost ratio using Kelley Blue book estimates: $\frac{(\,Kelly\ Blue\ Book\ Maintenance\ EV\ (5\ years))}{(Kelly\ Blue\ Book\ Maintenance\ ICE\ \ (5\ years))}$. We then applied this ratio to FREAS's five-year ICE vehicle maintenance costs to estimate five-year maintenance costs for a hypothetical University EV.

$$EV\ Maintenance\ = \frac{(\,Kelly\ Blue\ Book\ Maintenance\ EV\ (5\ years))}{(Kelly\ Blue\ Book\ Maintenance\ ICE\ \ (5\ years))} \times UD\ ICE\ Vehicle\ Maintenance\ (5\ Years)$$

Software updates costs do exist on some cars. The cars in this study didn't, but some could.

The charger needed for the EV adds an additional cost that the ICE vehicle will not have at all. A limitation of this study is we do not account for putting in electrical lines into the ground, the price of infrastructure to support this, or the cost of labor from linesmen. This study explicitly only charges the amount to buy one charger. For this study we used a generic SAE-J3068 charger to install (SAE International | Advancing Mobility Knowledge and Solutions, 2026). Other parameters that come with chargers are software update costs and upkeep costs to make sure the charger is working appropriately. Sometimes the cables at the end of these chargers get worn out over time so yearly maintenance is normally needed when the chargers are in consistent use.

EV rebates and offsets are available for the University when buying an electric vehicle. All of the rebates mentioned in this report are Delaware state rebates and are not federal government rebates. The first rebate is for the purchase of electric vehicles named the *Delaware Clean Vehicle Rebate Program* offered through DNREC (*Delaware Clean Vehicle Rebate Program | Electric Vehicle Incentives*, 2026). This rebate program provides $2,500 for new fully electric vehicles under $40,000 and $1,500 for new fully electric vehicles over $40,000. Another rebate is offered for the purchase and installation of an EV charger. Also provided by DNREC, the *Electric Vehicle Charging Equipment Rebate for Public Access, Fleet and Workplace* allows companies to have up to 90% of the hardware costs and 85% of the installation costs be covered through this program. There is a "... maximum rebate amount is $5,000 for single port chargers and $10,000 for dual port chargers ..." and is "... limited to ten charging ports or five dual-port stations for each location" (Electric Vehicle Charging Equipment Rebates - DNREC, 2026). Attaining these rebates would allow for major costs of EV application to be offset, which makes EV adoption more attainable. These values are current as of May 2026, but it is subject to change later this year.

Carbon emissions and the associated social cost of carbon (SCC) were calculated using cradle-to-grave emissions estimates for each vehicle type, including trucks, vans, and sedans (Woody et al., 2022). Although EV manufacturing typically produces more emissions than ICE vehicle manufacturing, EVs can reduce lifetime emissions through the use of electricity rather than gasoline. This study does not account for the local electricity fuel mix or regional differences in emissions associated with supplying gasoline to the Mid-Atlantic. The SCC represents the estimated economic damages caused by emitting one additional metric ton of carbon dioxide into the atmosphere. For this study, we averaged SCC estimates from the first Trump administration and the Biden administration. The first Trump administration used an SCC estimate of approximately $3 per metric ton, while the Biden administration's 2023 EPA estimate was $190 per metric ton, resulting in an average SCC of $96.50 per metric ton for this analysis. The total carbon cost was calculated by multiplying each vehicle's lifetime CO_2 emissions by the SCC. Current federal guidance under the second Trump administration has moved away from using the SCC in regulatory analysis ($0/ton), so these values are left in their own section of the Cost Table for the purposes of any sustainability initiatives rather than a fixed market cost. This allows FREAS to quantify the environmental costs of carbon emissions in dollar amounts, providing a comprehensive look at the long-term sustainability and economic value of the fleet transition.

5. Cost Difference Calculations

The results are summarized in three financial categories to give FREAS a clear view of the financial and societal impacts of EV replacement. The first category, "Subtotal Cost", represents the purchase and operating costs FREAS would pay upfront and over the vehicle's lifetime, before accounting for external financial assistance. This category *excludes* costs that would be the *same* for both ICE and EV options, such as insurance and accessories. The second category is "Subtotal Cost with Rebates" which includes the previous category, as well as Delaware rebates for the EV purchase and the charging hardware, showing the immediate financial benefit of state subsidies. We then calculate two costs per mile metrics: "Subtotal cost per mile (Including Rebates)", which takes the "Subtotal Cost with Rebates" and divides this by the number of miles driven in a vehicle's lifetime; and the traditional "Fuel cost per mile", which ranged from 13 to 23 cents for ICE vehicles and 4 to 9.5 cents for EVs. Since these costs do not reflect the total cost of an ICE vehicle or EV, the more relevant column is column E, which shows the "Difference in Costs" between an ICE vehicle and EV. The ICE vehicle is taken as a baseline to assume a vehicle must be purchased. The electric vehicle would then have its cost be subtracted from the ICE vehicle cost to display whether the EV or ICE option is less expensive. These differences in costs are displayed for all four financial categories to show which vehicle is cheaper. Positive values show EVs are cheaper and negative values show ICE vehicles are cheaper.

Findings

Overview

ICE vehicles are cheaper across all vehicle comparisons in the “Subtotal Cost” category. Except for the two pickup trucks, where the EV options are cheaper, ICE vehicles are cheaper in the “Subtotal Cost with Rebates” and “Subtotal cost per mile (Including Rebates)” categories. However, all EVs have lower “Fuel cost per mile”, lower lifetime carbon emissions, and lower total social cost of carbon. When the social cost of carbon is included, EVs are more beneficial from a societal perspective, except in the two cargo van categories. More detailed findings are provided below.

Fleet Suitability

From reviewing the fleet database, we found that vehicles for light-duty operations and short distances were most suitable for replacing with comparable EVs alternatives. Vehicles with daily low mileage-driven mostly around the campus had the highest potential for electrification since their usage is more consistent and predictable. In contrast, vehicles for departments such as plumbing weren’t practical to replace with EVs due to usage patterns, transportation of heavy equipment, and operational requirements.

Stakeholder Interviews

The interviews provided additional insight into the vehicle usage, maintenance, and replacement protocol. From the interviews, we found the average mileage for various vehicles which was a key factor in deciding which vehicle could proceed to the next stage of analysis for possible EV replacement. The interview also revealed that though the on-campus vehicles have a relatively low driving mileage, they idle a lot. Heating and cooling during idling is another important factor beyond the typical use case of the vehicle that would be relevant for future analysis.

The interview findings reinforced our initial decision to exclude plumbing and other heavy-duty vehicles that move/carry heavy equipment during the discharge of their duties. Additionally, the interview provided details of the performance of FREAS existing EV fleet, which is made up of two Nissan Leaf vehicles used mostly for enforcing paid parking service on campus. During the interview with one of the managers, we learned that when charged up to 80%, the Leafs can generally serve two 8-hours shifts and return with approximately 25% battery power remaining. The respondent also noted that during winter months, the remaining battery capacity at the end of the shift is lower, ranging between 15% and 5%. These findings didn't just help us to refine our fleet list, but also guided our decision making on EVs to research. When asked about charging, we learned that they were charged overnight so there was no need to stop to charge during or between shifts.

While we couldn't get an exact amount of the typical weight and space the fleet vehicles carries and needs, we were told that it varies and could sustainably affect vehicle performance and operations hence, EVs alternative should have equal carry capacities for any ICE vehicle we intend to recommend to be replaced.

Infrastructure and Charging

Although outside the primary scope of this study, findings also suggested that charging infrastructure availability could serve as a significant limitation factor to potential large-scale EV adoption within the FREAS fleet. Charge duration, charger accessibility and charging infrastructure are important considerations for EVs transitions.

CO_2 Emissions and Social Cost of Carbon

The social cost of carbon (SCC) findings showed that EVs generally had lower cradle-to-grave emissions (MT CO_2) over their five-year lifetime. We also found that emissions differed between vehicle categories and increased as vehicle size increased from sedans to SUVs to pickups. Over their lifetime, EV sedans were estimated to emit 98.13 MT CO_2 less than comparable ICE sedans, while EV SUVs emitted 106.67 MT CO_2 less than comparable ICE SUVs. Lastly, EV pickups were estimated to emit 128.75 MT CO_2 less than comparable ICE pickups.

Overall, including SCC in the analysis highlighted the environmental advantages of EVs. While, at the time of writing this paper, SCC does not provide direct monetary gain, reducing emissions still offers important environmental and public health benefits.

Vehicle Comparison Findings

The following section will go into detail about the cost comparison for each vehicle type and the reason(s) for its outcome. Each finding's explanation for each vehicle can also be applied to any similar vehicle models in the FREAS fleet to that vehicle. See *Methods* section and Cost Table for how values were calculated.

Minivan

For the 2016 Dodge Caravan SV replacement we examined the 2026 Chrysler Pacifica as the ICE option and the 2026 Volkswagen ID Buzz as the EV option. The ICE vehicle was the less expensive option both before and after rebates were included, costing $12,467.16 less than the EV before rebates and $7,467.16 less after rebates. This was primarily due to the higher MSRP of the Volkswagen ID Buzz compared to the Chrysler Pacifica.

Small Truck

The replacement options examined for the 2019 Chevrolet Colorado 4x4 were the 2026 Chevy Colorado as the ICE option and the 2026 Rivian R1T as the EV option. The ICE vehicle was less expensive before rebates, costing $2,635.44 less than the EV. After rebates were applied, the EV became the less expensive option, costing $2,364.56 less than the ICE vehicle. The Rivian having the more favorable differential cost after rebates was due its higher resale value.

Midsize Truck

To replace 2023 Chevrolet Silverado, we looked into the 2026 Chevy Silverado as the ICE option and the 2026 Chevy Silverado EV as the EV option. Similar to the midsize pickup analysis, the ICE vehicle was initially less expensive, costing $2,563.08 less than the EV. However, after rebates were applied, the EV became less expensive, costing $2,436.92 less than the ICE vehicle. The reasoning for this shift was due to the high resale value of the Chevy Silverado EV, as well as its very low fuel cost.

Cargo Van

For the 2017 Ford Transit Connect replacement, we explored the 2026 Ford Transit as the ICE option and the 2026 Rivian Delivery 500 as the EV option. Both before and after rebates, the ICE vehicle was less expensive, costing $30,954.74 less than the EV before rebates and $25,954.74 less after rebates. Calculations were done without including maintenance costs due to limited data of both vehicle types. The primary reason for the ICE vehicle's favorable differential cost was the EV options' high MSRP.

Medium Cargo Van

The replacement options we looked into for the 2011 Ford E-250 Cargo Van were the 2026 Ford Transit 350 High Roof ICE option and the 2026 Chevy Brightdrop 400 EV option. The ICE vehicle was less expensive both before and after rebates, costing $25,894.79 less than the EV before rebates and $20,894.79 less after rebates. Similar to the van analysis, maintenance costs were also excluded in this calculation due to limited data. The primary reason for the ICE vehicle's favorable differential cost was the EV options' high MSRP.

Sedan

To replace the 2022 Toyota PRIUS PRIME LE, we looked into the 2026 Toyota Corolla as the ICE option and the 2026 Nissan Leaf as the EV option. It was understood that the Prius is a hybrid vehicle, but this study only accounts for ICE or electric vehicles only. A Toyota Corolla is similar in physical specifications and intended operational uses with the Toyota Prius. The ICE vehicle was less expensive both before and after rebates, costing $11,741.37 less than the EV before rebates and $6,741.37 less after rebates. This outcome was primarily due to the Nissan Leaf's higher MSRP as well as its lower resale value compared to the Corolla.

Future Recommendations

Charging Station Type

The goal of this study was to quantify, specifically into dollar values, the feasibility of transitioning FREAS vehicles from ICE to EV. Specification and use of vehicles were taken into consideration to find replacements. The infrastructure and type of EV charges were not considered in the study. A standard SAE-J3068 charger (SAE J3068 22kW EV Charger, 2022) was used to estimate a charger cost.

EVSE Supplier

SAE-J3068 compliant chargers are suggested to be used on campus based on EV professionals on campus such as Dr. Kempton. Currently all chargers on campus are Nuvve and maintained by CVORG/EVORG, an Electrical and Computer Engineering College EV research group. Purchasing more chargers that are SAE-J3068 compliant, would allow for CVORG/EVORG to continue to maintain on campus chargers for a much lower cost than companies like ChargePoint. Installation of chargers and their infrastructure were also not accounted for in the study. There are potential rebates through DNREC for the purchase and installation of EV chargers offered (Electric Vehicle Charging Equipment Rebates, 2026).

EV Parking Pass Plan

Currently, EV charging and some EV parking are free on campus, which limits the University's ability to recover costs. EVSE companies such as ChargePoint and Blink offer charging and payment systems that are commonly used by large institutions. However, these third-party models can require costly subscription fees and vendor-dependent contracts, which may reduce the financial benefits of installing charging stations. In some cases, these costs can contribute to chargers being abandoned or left unusable.

EV experts on campus recommended charging an hourly rate for EV parking with a limit, similar to non-charging hourly rates across campus. Because these spaces are often located close to buildings, they could be treated as premium parking spaces and priced at a higher rate. Since EVs are generally more expensive vehicles, free charging may disproportionately benefit users with greater ability to pay. Charging a higher rate for EV parking could help recover the cost of charging infrastructure and electricity while supporting greater parking equity across campus. This approach would reduce the software and administrative complexity of a pay-per-kWh model. The rate could account for the parking space, expected electricity use, new charging station installation, and ongoing maintenance. This model would allow UD to maintain control over its charging infrastructure, recover costs more directly, and avoid dependence on unfavorable third-party charging contracts.

Idling

Heating and cooling during idling is another important factor beyond the typical use case of the vehicle that would be relevant for future analysis.

Carry Along Cables

Carry along cables will be the future in electric vehicle charging. This is due to the abundance in vehicle charging inlet types which cause incompatibility between some EVs and EVSE's (EV chargers). Carry along cables will be brought to market in approximately 2 years from the publication of this report. This would solve UDs ever growing adapter melting problem on campus which causes unsafe environments. To mitigate this, every carry-along cord charger on campus would have multiple charging cable types bolted to the station, so when a user would like to charge their vehicle they would choose their charger type based on their vehicle. This will allow a safe charging experience with no unsafe adapters. As carry along cables become more predominant in the market place, UD could set up ways to automate pricing through the cables internal communication. This would allow a contactless payment method that could be directed to a specific user account. This could happen without any hardware changes, it would just be a software update.

V2G Potential Revenue

Currently, there are limited EV alternatives for UD's FREAS fleet. However, future models should be considered in the coming years. Ford Motor Company has announced a small-sized EV pickup that should have a MSRP of about $30,000 (2027 Ford EV Pickup, 2026). This would be a viable replacement for the 2019 Chevy Colorado. If the new pickup had Vehicle-to-Grid (V2G) capabilities, it would provide revenue for the owner of the vehicle. Informed by Dr. Kempton, FREAS would receive a check from PJM with the revenue from V2G which is approximately $1,500/year. This revenue would not be subtracted from UD’s electricity bill. This would be another offset to assist with affordability of EV ownership. In our cost comparison for replacing the 2019 Chevy Colorado, the new Ford EV would cost $3,724.68 less than a new 2026 Chevy Colorado, without rebates or V2G revenue. Including rebates and V2G revenue into the cost calculation, the EV would be $16,224.68 less than the ICE vehicle. There is also a rumored 2028 EV Van from Ford that will also have V2G capability. This could be a replacement option for the 2016 Dodge Caravan SV, or the small Ford Transit maintenance vans. See Cost Table for full cost comparisons.

References

Delaware Clean Vehicle Rebate Program | Electric Vehicle Incentives. (2026). Driveelectricdelaware.org. https://driveelectricdelaware.org/

Delaware Division of Motor Vehicles. (2025). Motor Vehicle Fees. https://dmv.de.gov/Common/DMVFees/index.shtml

Edmunds. (2025). New Cars, Used Cars, Car Reviews and Pricing. Edmunds. https://www.edmunds.com/

Electric Vehicle Charging Equipment Rebates - DNREC. (2026, May). DNREC. https://dnrec.delaware.gov/climate-coastal-energy/clean-transportation/ev-charging-equipment-rebates/

IER. (2023, December 8). EPA Ups Estimates for the Social Cost of Carbon. IER. https://www.instituteforenergyresearch.org/regulation/epa-ups-estimates-for-the-social-cost-of-carbon/

Kelley Blue Book | New and Used Car Price Values, Expert Car Reviews. (n.d.). Kbb.com. https://kbb.com

Lawver, A., & Nelson, K. M. (2025, October 22–24). Charge this: How to electrify and lighten up a heavy duty fleet [Conference session]. AASHE 2025 Conference & Expo, Minneapolis, MN, United States.

Live, D. P. (2026). Delaware Gas Prices — Daily AAA Data. Gas Prices Live. https://www.gaspriceslive.com/states/delaware/

Metz, J. G., & Kempton, W. (2024). Vehicle-to-Grid Revenue from Retail Time-of-Day Rates, Compared with Wholesale Market Participation under FERC Order 2222. Energies, 17(11), 2664–2664. https://doi.org/10.3390/en17112664

Metz, J. (2026, April 5). EV electrical specifications and prices for Capstone project [Memorandum]. University of Delaware EV R&D Group.

SAE International | Advancing mobility knowledge and solutions. (2026). Sae.org. https://www.sae.org/standards/j3068_201804-electric-vehicle-power-transfer-system-using-a-three-phase-capable-coupler

SAE J3068 22kW EV Charger 480V / 277V AC 32 Amp 3-Phase Wallbox. (2022). PRIMECOMTECH. https://www.primecom.tech/products/sae-j3068-22kw-ev-charger-400v-32-amp-3-phase-wallbox?srsltid=AfmBOorLbrF9pMETh51rEEylh5F9OP5MtXVtbSkElIwJkQn-0OPT-Wdp

Slusser, V. E. (2025). Optimizing Fleet Management: Evaluating the Feasibility of Electric Vehicles and Leasing Strategies at the UTRGV Police Department. Scholars Crossing. https://digitalcommons.liberty.edu/doctoral/7576/

University of Georgia. (2025, August). University of Georgia fleet electrification study [Case study]. https://cviog.uga.edu/_resources/documents/resources/case-studies/ev-uga-fleet.pdf

Watkins, L. (2024, January 25). EPA Releases Updated, Elevated Estimates for the Social Cost of Greenhouse Gases. Environment, Land & Resources. https://www.globalelr.com/2024/01/epa-releases-updated-elevated-estimates-for-the-social-cost-of-greenhouse-gases/

Woody, M., Vaishnav, P., Keoleian, G. A., De Kleine, R., Kim, H. C., Anderson, J. E., & Wallington, T. J. (2022). Corrigendum: The role of pickup truck electrification in the decarbonization of light-duty vehicles (2022 Environ. Res. Lett. 17 034031). Environmental Research Letters, 17(8), 089501. https://doi.org/10.1088/1748-9326/ac7cfc

2027 Ford EV Pickup: $30k Price, 51 KWh Battery Specs. (2026, February 10). Bike-Ev.com. https://www.bike-ev.com/news/cars/2027-ford-midsize-ev-pickup-30000-price-51-kwh-battery/

Appendix

Appendix 1: Interview Guide

1. What type of vehicle do you drive?
    a. How often do you stop to fuel and for how long?
    b. How many gallons do you get per stop?
2. How many days is your primary vehicle not available due to maintenance? How many days is it in the shop?
3. How much work time do you lose due to the vehicle being in the shop? (hrs and $ to UD)
4. How many miles do you typically drive a day?
5. What is your longest daily trip in a year? (in miles)
6. What do you carry in your vehicle? Typically, what is your daily load? Weight and size.
7. Would it be a problem if you had less storage space? What is the minimum space you could work with?
8. What would be the heaviest load and largest size load in a year?
9. Where do you store your tools? Do you need a lock?
10. Do you tow trailers or transport specialized equipment?
11. Have you ever driven an EV? What was the experience like?
    a. If not them, a friend or family member?
12. What concerns do you have about EVs for UDs use?
    a. (Range, charging time, battery life, cost, safety, none, other)
13. Where is your UD vehicle(s) parked and for how long?
    a. During work hours? Lunch? After work hours? Weekends?
14. Is there a charging station at the location(s) where you park your vehicle?

15. If your car is full in the morning, would you need to charge it during the day?
16. If you needed to carry a cable to charge the vehicle, where would you store it on your vehicle? [describe size]
17. What challenges do you anticipate if your work vehicle switched to an EV?
18. What are some challenges you have encountered since you got assigned an EV as your work vehicle?
19. What would make EV adoption successful for this department?
20. Is there anything else you'd like to discuss that I did not ask about?