Los Alamos County Fleet Conversion Plan

The County Fleet Conversion Plan is a comprehensive report guiding strategic decision-making and ensuring a smooth transition to a sustainable fleet.

Prepared for:
Los Alamos County

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Executive Summary

To evaluate how to contribute to the carbon reduction goals outlined in the 2024 Climate Action Plan, Los Alamos County has contracted Stantec to develop a Fleet Conversion Plan. And while the County is not affected by the 2023 Governor's executive order, this Plan indirectly evaluates the feasibility of aligning with New Mexico's order to reach 100% zero-emission (including hybrid and low-emission vehicles) state-owned fleets by 2035. The innovative and progressive environment for Los Alamos County to pursue fleet electrification will be assessed against the operational and capital constraints, all while considering the emission reduction goals of the Climate Action Plan.

Assessment of the County fleet included a Fleet Operational Assessment and an Electric Vehicles (EVs) market scan for all County fleet vehicles. The results of this assessment provided data to determine to what degree currently available EVs could serve the County's operational requirements. While not all County vehicles can currently be transitioned successfully to EVs, the development of Transition Phases enables the County to continue planning for transition over the next 25 years as vehicle technology improves.

- Phase 1: vehicles most suitable for electrification, targeted for transition between 2025-2035.
- Phase 2: vehicles with moderate operational constraints and limited market options, targeted for 2035-2043 transition.
- Phase 3: Vehicles with significant constraints and no available market options, targeted for 2044-2050 transition, when the EV market may have advanced and more EVs may be available.

Critical to planning the deployments of EVs over the next 25 years was the projection of current and future vehicle retirement. Projections of potential vehicle procurement were developed by relying on current vehicle conditions like vehicle age, mileage, and maintenance costs, all while considering the County's Vehicle Replacement Policy. Assuming that the replacement vehicles would be in service for the same length, Stantec developed four cycles of procurement to identify when and which vehicle would need to be replaced through 2050.

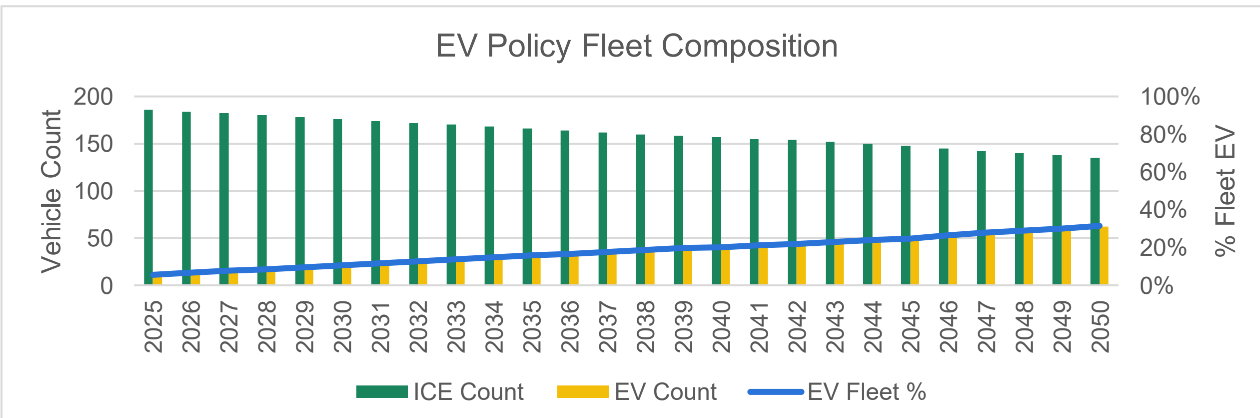
Using the developed Fleet Procurement Timeline two strategies for EV implementation were evaluated:

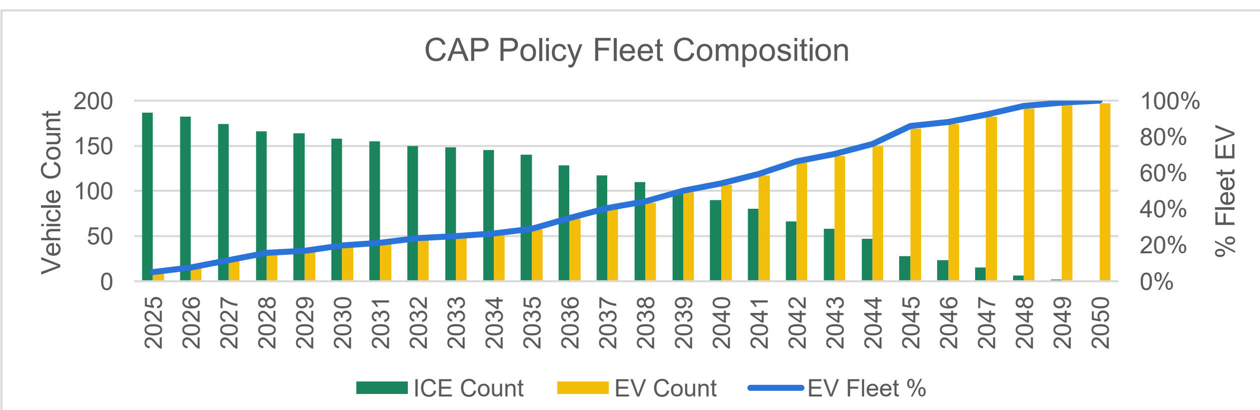
1. Scenario 1: EV Policy – Evaluates the fleet transition to zero-emission vehicles by relying on the County's existing two vehicle per year transition policy
2. Scenario 2: Climate Action Plan (CAP) Policy – Evaluates the fleet transition to zero emission vehicles that aligns with the County's Climate Action Plan Goal of achieving carbon neutrality by 2050.

The EV Policy implementation Scenario 1 sees a steady increase of the total fleet percentage of EVs through 2050 as every year the County transitions two vehicles. The total number of EVs purchased each year varies as the fleet percentage EV increases. In addition to the two vehicles being transitioned each year, older EV ready for retirement are replaced with EVs, thus increasing the number of EV procurements by the number of EVs being replaced in any given year. However, this scenario only reaches an electrification of 31% of the County's fleet by 2050 greatly limiting the potential for emissions reduction. This implementation strategy does exclude 33 vehicles from the transition due to imminent operational constraints such as specialized vehicles that are essential for emergency response.

In Scenario 2, the CAP Policy implementation assumes a more ambitious procurement timeline to achieve full electrification (100%) of all vehicles eligible for transition by 2050, excluding (33) vehicles that are not currently considered transitional due to imminent operational constraints such as specialized vehicles that are essential for emergency response. Operational constraints and defined transition phases dictate which vehicles can transition to an EV instead of a strict number or percentage of vehicles. The developed phasing methodology also ensures that no conventional vehicles will be retired before meeting the County's replacement policy and provides sufficient time for additional vehicle options to become commercially available rather than acquiring early prototype versions.

Scenario 1:





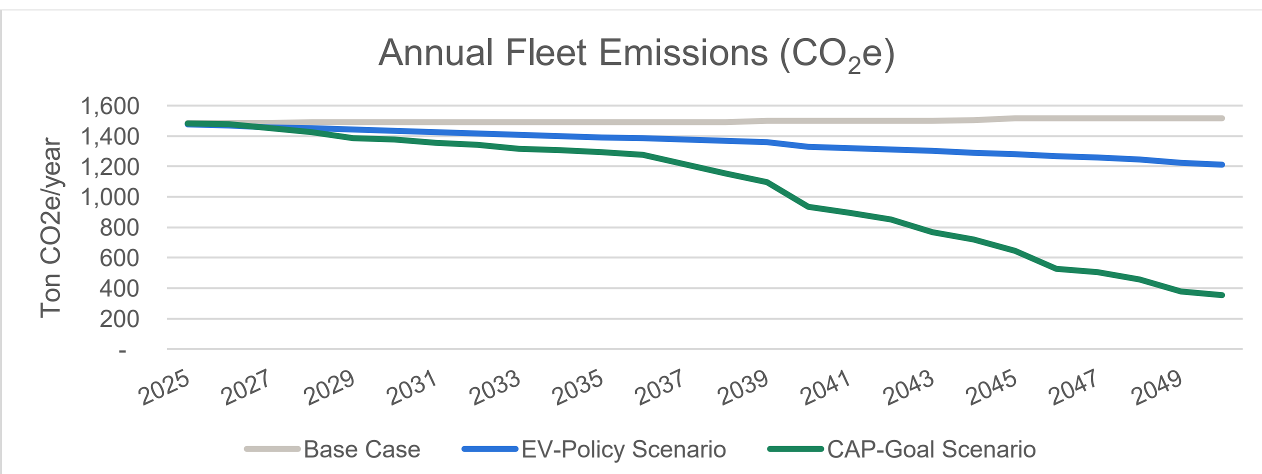
Infrastructure recommendations are based on total build out of facility charging, able to support the 86% of the fleet that can transition to EVs. Transitioning 86% of the County's 229 vehicle fleet represents 197 vehicles with 33 vehicles not included in the fleet transition. As part of a phased approach to charging infrastructure deployment, infrastructure phases align with the timelines developed within the Conversion

Phases. The number of charging infrastructure and type (level 2 or 3) is based on the CAP Policy implementation strategy, to achieve 86% EV fleet. Total power load projections are also provided for each site that houses an EV.

The financial assessment evaluated the capital and operational cost of implementing the EV-Policy and CAP Policy scenarios, using a total cost of ownership assessment that was then compared to a business-as-usual scenario (i.e., no additional transition to EVs). The EV Policy has a 10% increase in the total cost of ownership over the implementation timeline (between 2026 and 2050) when compared against the business-as-usual scenario. The savings in maintenance and fuel economy are not enough to offset the added procurement cost and infrastructure investment. The CAP Policy scenario would represent a 35% increase in the total cost of ownership when compared against the baseline. The total cost of ownership of EVs is due to the significantly higher purchase price of EVs, and the large investment required for the charging infrastructure. While there may be available funding opportunities to mitigate the added purchase price, it will be critical for the County to secure sustainable funding strategies and incentives that would enable the implementation of this Fleet Conversion Plan.

Importantly, the environmental emissions for the two different options were analyzed. If the County were to continue implementing their EV purchase policy of two new electric vehicles per year, reaching a 31% fleet electrification would only eliminate 9% of the total greenhouse gas emissions over the implementation period (2026-2050), and once the County reaches a max 31% EV fleet, (past 2050), there would be a net 18% annual emissions reduction when compared to the ICE-only scenario.

For the CAP Policy scenario, reaching 86% fleet electrification would result in a 30% GHG emissions reduction over the implementation period (2026-2050) and after full implementation (of 86% of the fleet) past 2050, the County would eliminate 76% of the yearly emissions when compared to the ICE-only scenario.



In conclusion, the County Fleet Conversion Plan provides guidance for implementation, charging infrastructure considerations, guidance regarding training, and foundation skills, as well as specifics regarding charging infrastructure equipment and necessary upgrades.

Acronyms / Abbreviations

Acronym / Abbreviation	Full Name
AC	Alternating Current
AHJs	Authorities Having Jurisdiction
ASEP	Automotive Service Educational Program
ASSET	Automotive Student Service Educational Training
BEB	Battery Electric Bus
BEV	Battery Electric Vehicle
CAT III/IV	Category III / Category IV (electrical measurement safety standards)
CO2e	Carbon Dioxide Equivalent
DC	Direct Current
DCFC	Direct Current Fast Charger
ESS	Energy Storage System
EV	Electric Vehicle
FCEV	Fuel Cell Electric Vehicle
GHG	Greenhouse Gases
ICE	Internal Combustion Engine
KPIs	Key Performance Indicators
kW	Kilowatt (power)
kWh	Kilowatt Hour (energy)
LAC	Los Alamos County
L2	Level 2, in reference to a type of charger
NFPA	National Fire Protection Association
OCPP	Open Charge Point Protocol
OEM	Original Equipment Manufacturer
PPE	Personal Protective Equipment
SOC	State of Charge
V2G	Vehicle-to-grid
EV	Zero Emission Vehicle

Glossary

Term	Definition
Arc-flash	A dangerous electrical explosion caused by a short circuit or fault in a high-voltage system, producing intense heat and light.
Burn-out Zones	Designated areas where burning vehicles can be isolated to prevent fire spread and limit damage.
Demand Charges	Utility fees based on the highest level of power drawn during a billing period, often affecting charging costs.
DCFC	Direct Current Fast Charger with a max power output of 150 kW or higher
Fire Isolator Systems	Equipment such as fire blankets or aerosol suppression units designed to contain and slow vehicle fires, particularly in enclosed spaces.
Grid Greening	The process of increasing the share of renewable and low-carbon energy sources in the electrical grid mix.
L2 Charger	Charging equipment with a plug-in type of connection that ranges between 7 kW and 20 kW for the max output capacity.
Multiplexing	A vehicle wiring approach that reduces the number of wires by transmitting multiple signals over a shared pathway.
Oscilloscope	An electronic instrument used to visualize and measure electrical signals over time.
Smart Charging	Software-controlled EV charging that optimizes timing, rate, and energy use based on operational needs and electricity costs.
SOC (State of Charge)	The measurement of the available battery capacity in a vehicle, expressed as a percentage of its total capacity.
Thermal Runaway	A rapid, uncontrolled increase in temperature within a battery cell that can lead to fire or explosion.

1 Introduction

In support of the Climate Action Plan, to reduce greenhouse gas emissions, increase zero emission vehicles, decrease air pollution, and increase fuel efficiency, Los Alamos County (the County) is preparing to transition its fleet to zero-emission vehicles (ZEV) through a phased and strategic approach. Furthering the goals of carbon neutrality by 2050 as part of the County's Climate Action Plan (CAP), this transition plan will assess the strategies available to the County to continue and plan for replacing fossil fuel vehicles that reach the end of their useful lives with electric vehicles (EV).

The pace and direction of this transition are defined by the County's CAP but influenced by a policy environment at both the state and local levels.

Additionally, regulatory drivers provide a supportive environment for transition to EVs. These include the New Mexico Alternative Fuel Acquisition Act, mandating that 75% of light-duty fleet acquisitions meet alternative fuel or hybrid/electric criteria, and the Energy and Fuel Cost Savings Contracts program, enabling fleet owners to finance EVs and charging infrastructure through operational cost savings. While these do not have jurisdiction in Los Alamos County, they indicate the state's support of transitioning to EVs.

Authority over emissions standards between the EPA and individual states is subject to ongoing legal review, New Mexico remains committed to supporting EV adoption through incentives and partnerships, signaling continued momentum for public fleet transitions. Locally, the County's CAP reinforces these efforts with targeted strategies to expand EV infrastructure, integrate EV readiness into building codes, and consider transitioning the County fleet in alignment with the NM state target to achieve a zero-emission vehicle fleet by 2035[1].

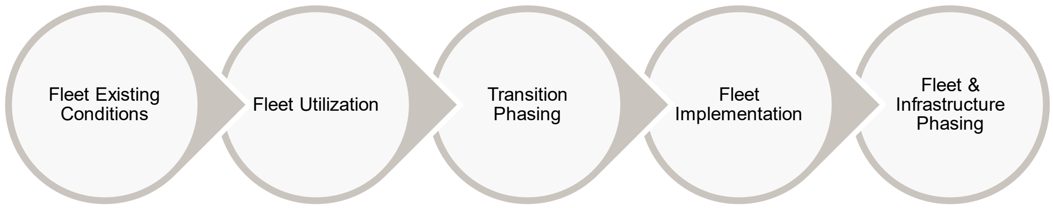
Taken together, these policies create a supportive framework for fleet electrification, ensuring that the County's vehicle replacement planning, infrastructure development, and operational modeling are aligned with community climate goals.

1.1 Conversion Plan Strategy

To support the County's transition to EV technology, a fleet conversion plan was developed to provide the County with appropriately sized and timed deployment of technology and infrastructure. The approach outlined in Figure 1-1 favors a logical transition informed by existing conditions, fleet utilization, and County operational and purchasing constraints. This culminates in a Fleet Implementation Strategy that provides two approaches to EV adoption, permitting the planning and budgeting for the deployment of supporting infrastructure.

[1] 2024 Los Alamos County Climate Action Plan; Strategy T1.4

Figure 1-1: Fleet Conversion Plan Approach



The Existing Conditions and Market Scan Report (Appendix B) identified available battery-electric vehicles (BEVs) and fuel cell electric vehicles (FCEVs) across light-, medium-, and heavy-duty classes. While light-duty BEV options are widely available and align well with the County's operational needs, medium- and heavy-duty offerings may still require interim hybrid or near-zero emissions solutions for certain applications. FCEVs offer potential in electrifying medium- and heavy-duty vehicle propulsion but the existing market lacks availability and proven deployments. Due to the uncertainty of FCEVs, the Fleet Conversion Plan identifies BEVs as a more viable option for fleet transition and are referred to simply as electric vehicle (EV) throughout the plan.

To gain a nuanced understanding of the County's fleet operations, site visits were conducted to observe how each facility functions and to incorporate this information into the infrastructure planning process. The resulting preliminary site plans (Appendix C) identify each facility's full EV buildout and align with the Fleet Implementation plan, providing the County with clear guidance on when and at which sites to implement infrastructure.

In addition to vehicle and infrastructure deployment, County processes will need to support the accompanying changes to operations and maintenance. As part of supporting recommendations, training programs are outlined to help County employees adapt to new EV technologies and maintenance practices, ensuring a smooth and well-supported transition. These programs are oriented towards operators, maintenance staff (including original equipment manufacturer (OEM) provided maintenance trainings), as well as emergency response coordination.

To support fiscal planning for the County's transition, a detailed financial analysis, incorporating all key elements across the vehicle lifecycle, was completed and included:

- Capital Costs: Initial investments in vehicles and charging infrastructure.
- Operational Costs: Ongoing fuel (diesel, gasoline, or electricity) and maintenance costs.

The financial model projects costs in future value, corresponding to dollar value of the expense year, offering an accurate forecast of the overall financial impact. The inclusion of this model can help the County target sources of funding and better prepare to estimate the capital requirements.

2 Fleet &Vehicle Analysis

Leveraging information gained from the existing conditions and market scan review (Appendix B), an approach to how the County could transition its fleet was developed. This first included understanding how the County utilizes its vehicles and where that utilization would be served by existing EV technology. Not all vehicle use cases can be currently served by commercially available technology and therefore it was critical to develop a strategy for the County to consult as they plan vehicle replacements.

To provide a strategy for transitioning to EVs, first the vehicle operations were assessed to determine nuances in composition and how the County uses their fleet. Next, transition phases were developed that incorporated the County's vehicle operations and market research, ensuring implementation occurs without compromising operational effectiveness.

Aiming to provide the County with a long-term tool for EV implementation, an EV Transition Dashboard was developed to view and analyze fleet data from the perspective of fleet implementation. Using the County's fleet list, service life, and operational information, the current condition of the fleet can be viewed.

2.1 Fleet Operational Assessment

Stantec conducted several meetings with fleet managers to identify how the County utilizes its fleet vehicles. From these conversations, ten operational categories were identified including:

- Emergency Response – does the vehicle respond to emergencies?
- Schedule – how frequently is the vehicle used? (infrequently, daily, 24/7)
- Lunch – is a midday break taken at a facility (Municipal, Justice, etc.)?
- Distance – does the vehicle stay within the County?
- External load – is there accessory equipment being powered by the vehicle?
- Added equipment – does the vehicle have a specialized body type?
- Use type – does the vehicle tow, haul, or remove snow?
- Overnight location – is the vehicle taken home?
- User – is the user considered a supervisor or regular user?
- Notes – are there any specific details on utilization that would be valuable to know?

Each operational category was assigned responses based on the understanding of vehicle operation, gained through conversations with fleet users, division managers and department directors. Responses to each category (which are elaborated on below as operational constraints) were then assigned to each vehicle. These operational constraints provide data inputs, which were validated by County division managers

Results from this assessment provided data on how the Transition Phasing was developed and informed fleet insights pertaining to the EV Transition Dashboard.

2.2 Transition Phasing

The process to identify an appropriate and realistic timeline for EV transition first requires an understanding of how well EVs can operate under the County's unique service conditions. Analysis of fleet operations (Section 2.2.1) and understanding of the EV market (Section 2.2.2) determines if each vehicle in the fleet could be transitioned to an EV.

Next, to translate operational and market constraints into a timeline, Stantec applied a phased approach to EV transition. This approach (explained in Section 2.2.3) identifies three phases in which first "easy-to-electrify" vehicles (like sedans and pickup trucks) and then increasingly "difficult-to-electrify" vehicles (like incomplete truck chassis with specialized bodies and attached equipment) are eligible for EV transition. By doing this, vehicles are transitioned based on expected improvements in EV technology.

2.2.1 Operational Constraints

To assess operational constraints that could impact EV transition, Stantec created a scoring methodology based on utilization data gathered through fleet user interviews.

The chart below provides a visual representation of the operational assessment, where each operational use attribute was qualitatively scored based on its effect on EV suitability. Scores in green, marked as "No Impact," indicate that this attribute has little to no impact on the vehicle's ability to transition to an EV. This contrasts with the "Considerable Impact" scores in red that indicate this attribute would have significant impact on the vehicle's ability to transition to an EV.

Figure 2-1: Operations scoring options which when selected identified vehicle operational constraints (color coding to indicate scoring metric)

Emergency Response	No	Yes		
Schedule	Daily use	<Daily	On-call	
Lunch	Yes	No	N/A	
Distance	In county	Out of county		
External load	N	Y		
Added equipment	Non-modified	Service body	Specialized	
Use type	N/A	Snow removal	Towing	Hauling
Overnight Location	Facility	Take home		
User	Supervisor	Regular		

No impact
Some Impact
Significant Impact
Considerable Impact

Through interviews with fleet managers each vehicle was "scored" based on the attributes above. Each vehicle attribute (Emergency Response, Schedule, etc.) was assigned

The score values applied to each category vary depending on the importance fleet users placed on operational categories. Therefore, the score 'Service Body' in the 'Added Equipment' score is greater than the 'Take Home' score in the 'Overnight Location' category because the County identified where a vehicle "overnights" as more of a challenge to electrification than the added equipment on a vehicle.

The summation of scores across operational use attributes provided an overall transition score which is paired with the EV market index to provide a transition phase recommendation for each vehicle. Scores range from zero, “very easy to electrify”, to 22, “considerably difficult to electrify”.

2.2.2 EV Market Index

The next step in identifying a transition phase is to develop a recommendation based on the evaluation of external EV market conditions as they apply to the County’s fleet. This EV Market Index utilizes research completed during the Existing Conditions & Market Scan Report (Appendix B) and scores each vehicle type by how well it’s represented by the existing EV market. Vehicles are identified by body type and gross vehicle weight rating (GVWR) or class.

The chart below shows that some vehicle body types are well represented by existing light duty EVs but heavier medium- or heavy-duty vehicles less so. Using a 0-3 rating scale, lower value scores identify vehicles that are well represented in the market and are expected to be transitioned to EVs on a one-to-one basis. As numbers increase in value, the transition becomes harder with fewer or no EV equivalents within the current market.

Figure 2-2: EV Market Index by vehicle class and body type

	Pickup	SUV	Truck	Refuse Truck	Incomplete - Single Cab	Incomplete	Cargo Van	Van	Sedan	Step Van	Cutaway	Minivan	Incomplete - Double Cab
Class 1									0				
Class 1C	0	0											
Class 1D	1	0					0	0					
Class 2												2	
Class 2E	1	1										2	
Class 2F	1	1											
Class 2G	2						1						
Class 2H	2					3	1	1					3
Class 3	3				3	3					0		3
Class 4					3						0		
Class 5			3		3								
Class 6			3	3						3			
Class 7			3										
Class 8			2	2	3								

0	Well Represented
1	Most available
2	Challenging
3	Difficult or N/A

Stantec includes this evaluation because while an EV may appear to be equivalent to an existing fossil fuel vehicle, other user experiences, other specifications or operating capabilities are not equivalent, suggesting that it may be prudent to let the EV market further mature before purchasing.

This is exemplified with incomplete (double or single) cab pickup trucks which could be replaced with an EV of a higher class (due to greater weights from more battery and power requirements to move the same amount of mass) but would not have clearance or idling ability of existing ICE vehicles. Alternatively, while cutaways (specialized incomplete chassis outfitted to carry passengers) are similar classes to the challenging to electrify incomplete chassis, the EV market for these vehicles is well represented due to the proliferation of electrification in transit operations.

2.2.3 Transition Phase Recommendations

Finally, Stantec took the operational constraints paired with the EV Market Index to produce a Transition Phase for each of the County's vehicles. The summation of the Utilization Scoring Matrix (Figure 2-1) and the Market Index (Figure 2-2) produced Transition Scores with ranges shown below in Table 2-1.

The intent of Transition Phases is to strategically and gradually increase the types of vehicles eligible for transitioning to EVs. By assigning timelines to transition scores, considerable time is provided for vehicle technology to mature and adequately meet the operational needs of County vehicles.

Each vehicle's Transition Score determines when it becomes eligible for EV replacement. Phase 1 vehicles (score < 7) can transition to EV at their next replacement, regardless of timing. Phase 2 vehicles (score 7-14) become eligible starting in 2035. Phase 3 vehicles (score > 14) become eligible starting in 2043. Until a vehicle reaches its phase threshold, it will be replaced with another internal combustion vehicle.

Table 2-1: Transition Phase score and timelines

Transition Phase	**Transition Score Range**		**Timeline**
Phase 1	0	7	2025 - 2035
Phase 2	8	13	2036 – 2043
Phase 3	14	23	2044 - 2075

The Transition Phase recommendation pairs with the County's natural vehicle replacement timeline which Stantec has projected in Section 3.1 Fleet Procurement Plan. The Fleet Procurement Plan identifies how many vehicles are expected to transition to EV each year and informs the charging infrastructure Implementation Phases.

3 Fleet Implementation Strategy

Developing an implementation strategy for the County's fleet requires integrating Stantec's vehicle Transition Phasing recommendations with existing fleet procurement timelines and policies. To adequately plan for the installation of charging infrastructure, it is important to know how many and of what type of vehicle will be charging. A replacement timeline through 2050 provides the County with necessary information to ensure charging infrastructure projects are adequately sized for future demand.

First, a replacement timeline projecting four service cycles was developed to project vehicle retirement and replacement through 2050. The first cycle relies on current vehicle conditions: age, mileage, and maintenance costs. The following cycles (two through four) use a projected service life (age in 2025 plus projected years until retirement) to estimate the subsequent retirement years. Where the projected total service life was outside the bounds of reasonable retention, the County's vehicle retention policy provided service life years, which is dependent on the vehicle type and use specified in the retention policy.

Next, Implementation Strategies were developed under two scenarios; implementation through a two EV transitions per year policy and a CAP-based policy to transition 86% of the fleet to EV operations by 2050. Both implementation strategies use the Fleet Procurement Timeline to identify total number of vehicles (internal combustion engine (ICE) and EV) replaced each year as well as previously developed Transition Phases to determine which vehicles are transitioned to EV.

These scenarios provide the County with two actionable options in which to plan their EV deployments. Integrated into the ZEV Transition Dashboard, the Fleet Procurement Timeline identifies when a vehicle needs to be retired, and the Implementation Plans identify what type of vehicle (ICE or EV) to procure. The County will need to use this information to plan vehicle procurements further in advance, ensuring that infrastructure projects (Section 4) are completed before EVs are delivered.

3.1 Fleet Procurement Timeline

Currently, the County plans its vehicle replacements based on several factors including the replacement policy, fleet manager knowledge of the vehicles, and available funds. This approach serves the County well, maximizing vehicle utility, but can be improved to provide long range projections for when vehicles could be retired. Stantec took factors used by the County to determine service life into account to create a projection of when each vehicle could be expected to be retired and replaced.

Stantec's retirement year projection relies on Los Alamos' replacement policy to set vehicle retention benchmarks. Where it differs is in including allowances for retaining a vehicle longer if the total maintenance cost is currently low; below 75% of purchase price. To achieve this projection, vehicle retention benchmarks are averaged, including current age, mileage, and maintenance costs. This provides a measure of the amount of service life a vehicle had consumed and based on the age of the vehicle, an estimation of remaining service years.

Once remaining service years were estimated, a retirement timeline for the County fleet could be projected. This fleet procurement timeline represents the vehicles projected to be retired in any given year based on the service life consumed, and further projects retirements based on the total number of years a vehicle operated to consume all its service years.

This projection provides a timeline that is inclusive of transitioning about 20 vehicles a year and allows integration of Transition Phasing (as outlined in the prior section) to identify the number of EV procurements each year through 2050. This Fleet Procurement Timeline is critical to determine when the appropriate amount of infrastructure is needed to charge EVs and attempts to be more representative of the actual vehicle retention practices of Los Alamos County.

3.2 Implementation Strategies

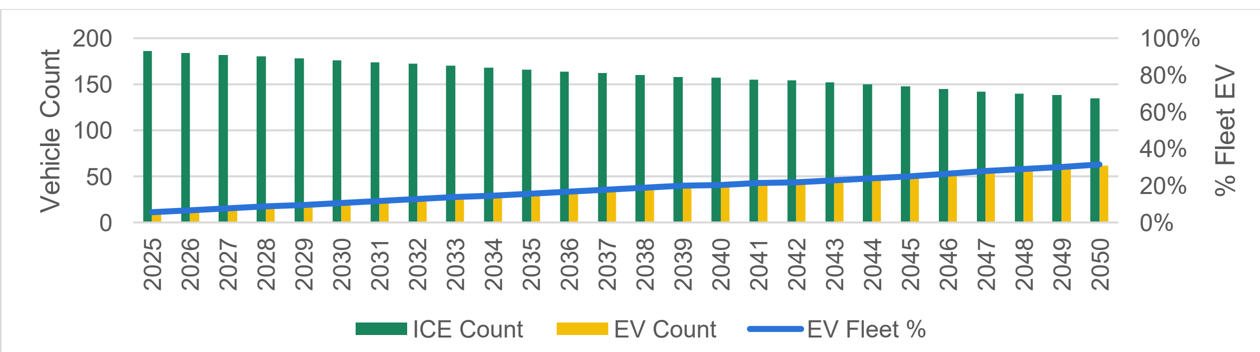
Two 25-year EV transition strategies were developed: an EV Policy plan (gradual, conservative) and CAP Policy plan (accelerated transition, aligned to meet 2050 emission reduction targets).Comparing these two strategies allows the County to balance emission reduction goals against increased capital investment, explored further in the Financial (Section 6) and GHG Emissions (Section 7) analyses.

Both strategies exclude 33 vehicles (14% of the 229-vehicle fleet) deemed infeasible for electrification due to specialized operational requirements like forest firefighting, bomb response, and fuel transportation. Due to the challenging nature of the operations completed by these vehicles, excluding them from transition insures uninterrupted operations. Financial and GHG analyses address the full fleet, including these excluded vehicles in annual costs and emission analysis.

3.2.1 EV Policy Implementation

This scenario (EV Policy) utilizes the County's existing EV implementation policy of transitioning two vehicles from ICE to EV every year. The application of this policy on the procurement timeline, shown in Figure 3-1 results in a steady increase in the percentage of EVs within the County's fleet.

Figure 3-1: EV Policy Fleet Composition through 2050

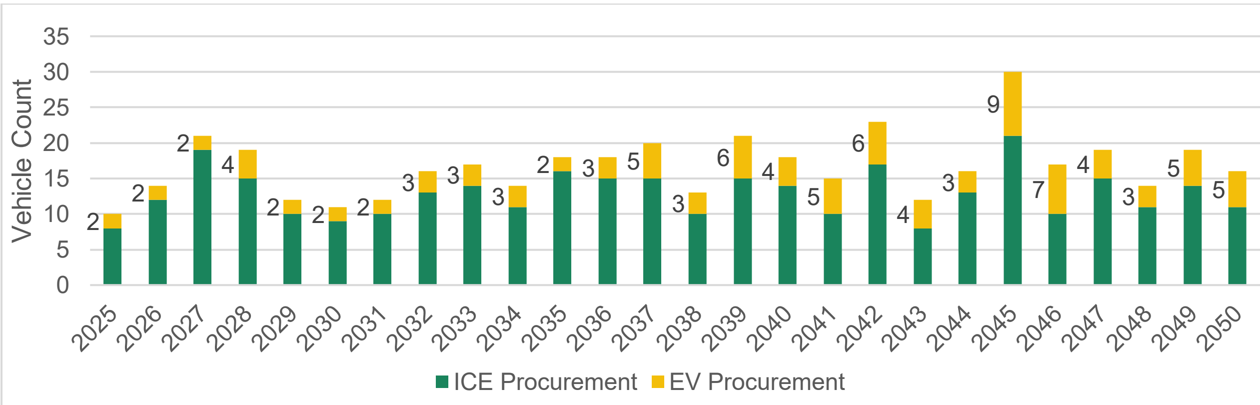


Through this EV Policy timeline, this EV implementation strategy will result in 31% (62 vehicles) of the County's fleet being transitioned to EVs by 2050; well short of the 100% carbon neutral emission goals outlined in the CAP.

Transition Scores (as outlined in Section 2.2) were used to determine which vehicles would be transitioned each year. Of the vehicles projected for retirement, the two with the lowest Transition Score (most suited for transition) were identified to be replaced with EVs.

Each year, the County replaces two gas vehicles with two electric ones. As the number of EVs in the County fleet increases and older EVs wear out, they will also need replacing. Figure 3-2 shows yearly vehicle purchases, with EV purchases highlighted in yellow and labeled. This includes both new EV transitions and replacements of old, worn out EVs.

Figure 3-2: EV Policy Vehicle Procurement through 2050 (count of EV purchases labeled)



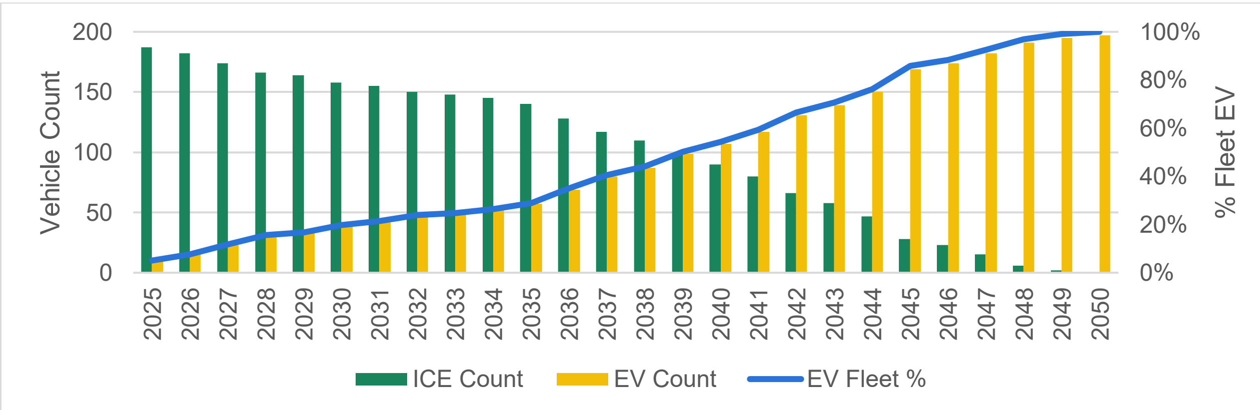
The County's oldest EV is a 2014 Ford C-Max plug-in hybrid-sedan. The County has two of these vehicles which are estimated to be replaced in 2028, which is the first year where more than two EVs are procured. In 2028 two vehicles are transitioned, replaced by EVs and the two 14-year-old plug-in hybrid-sedans are replaced also with EVs. A total of four EVs are purchased in 2028. As a larger percent of the County's fleet are EVs, the number of old, worn out EVs needing to be replaced increases. In any given year, no more than seven EVs are replaced in addition to the two vehicles transitioned for a maximum of nine EV purchased in any given year.

The above figures represent projected vehicle acquisition for each vehicle in the fleet. When the County plans vehicle acquisition and infrastructure development, they can access vehicle specific recommendations via the ZEV Transition Dashboard. The EV Policy timeline provides the County with insight into how their current policy will shape the rate of EV adoption.

3.2.2 CAP Policy Implementation

Los Alamos County has identified targets to achieve carbon neutrality by 2050 and one key strategy is to reduce emissions from the County's fleet . The CAP Policy Implementation scenario (CAP Policy) balances aggressive carbon reductions with operational feasibility, ensuring the County can maintain service delivery and fiscal responsibility while making meaningful progress towards its carbon neutrality goals.

Figure 3-3: CAP Policy Fleet Composition through 2050



This approach sees a more rapid transition to EVs. Through the 25-year timeline, 86% of the County's fleet vehicles are transitioned to EV.

Using the Fleet Procurement Timeline in Section 3.1, the CAP Policy scenario transitions ICE vehicles to EVs based on the Transition Phase Recommendations (described Section 2.2.3) which progressively increases the variety of vehicles eligible to be transitioned to EV.

Figure 3-4: CAP Policy Vehicle Procurement through 2050 (count of EV purchases labeled)

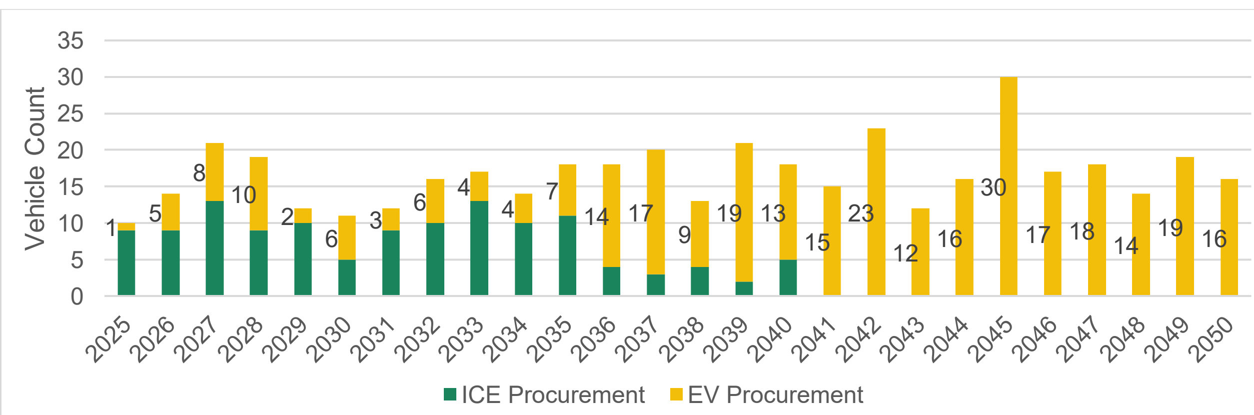


Figure 3-4 above shows the total number of vehicles projected to be procured annually and differentiates between a recommended EV or ICE procurement. Instead of a strict quantity of vehicles or percentage of the fleet, the CAP Policy approach identifies vehicles that operationally can transition to EV and are projected to be replaced. By utilizing a phased implementation of EVs, over the 25-year timeline, vehicles that are more difficult to electrify would be replaced with ICE vehicles early and then transition to an EV in future years as technology matures.

The next section identifies the "final buildout" EV charging infrastructure requirements for 86% EV fleet. To align the amount of infrastructure needed as vehicles transition to an EV fleet, the County will need to determine the most appropriate implementation strategy. Sections 6 and 7 discuss the financial and greenhouse gas reduction impacts to provide additional perspective for the County to chart a path forward.

4 Facilities Assessment and Infrastructure Upgrades

Transitioning to an EV fleet will require substantial infrastructure support and operational changes. The infrastructure assessment is a critical step in evaluating the readiness and suitability of each facility to support current and future operational needs.

This section outlines not only the quantity, phase, and location of charging infrastructure but also the coordination between the County and the Department of Public Utilities (DPU) while deploying EV supportive infrastructure. Including risk assessment, fire protection, electrical safety, and emergency response planning, this creates an integrated plan to protect personnel, property, and operations. By addressing these elements alongside site-specific conditions and phased recommendations, the Facilities Assessment provides a holistic roadmap for a safe and scalable transition to a sustainable fleet.

4.1 Infrastructure Assessment

Evaluating the readiness and suitability of each County facility to support current and future operational needs, the necessary upgrades to deploy EVs are outlined in Table 4-1.. Through site visits and desktop reviews, existing assets, deficiencies, and opportunities for charging were identified. Infrastructure development aligns with fleet transition timelines and operational requirements. The analysis includes site-specific conditions, electrical capacity, parking configurations, and phased recommendations for charger installations, all designed to support a strategic and scalable transition to a sustainable fleet.

The following table summarizes observed conditions and relevant notes for each assessed facility, including key operational details, parking lot characteristics, and any ongoing or planned modifications. Of the 21 sites included in the Fleet Conversion Study, 16 received site visits with one unplanned visit to the Aquatic Center which was not initially part of this study. This included a full walkthrough of the Pajarito Cliff Sites (PCS) which comprise PCS 1 through 5.

Table 4-1: Los Alamos County Facilities Assessment Summary with CAP Policy charging recommendations

Facility	Comments	Parking Lot Conditions	Existing Electrical Equipment	Existing Charging Handles/Plugs[2]	Proposed Charging Handles/Plugs

Municipal Building,
1000 Central Ave, Los Alamos
• 27 light-duty vehicles
  ○ 5 EVs (2 PHEV, 3 EV)
• 1 medium-duty vehicle
	• ADA spots are being added with construction project currently occurring in this lot.
	• Recommendations for charging:
	  ○ Fleet charging – RFID
	  ○ Public charging – paid
		• Consistently flat, large parking lot in the center of Los Alamos	• 225kVA transformer	• Level 2 chargers are currently under construction. Once completed there will be (12) Level 2 handles.	• Phase 2: (3) Level 2; one charger shared each among PW Engineering, County Assessor, and Community Development-Building
					• Six vehicles identified as take home

Justice Center 2500 Trinity Drive, Los Alamos • 52 light-duty vehicles • 2 medium-duty vehicles • 1 heavy-duty vehicle	• Fleet charging – rear (W) lot for police • Public charging – front (E) lot • Initial EV deployment planned for traffic enforcement • No EV use planned for prisoner transport • Long-term goals include EVs for road patrol and trucks for off-road use • Employee concerns: Some officers take vehicles home, up to 60+ miles; reduced battery performance in cold weather • Public chargers can use Level 2 equipment	• Side (E) lot and half of front (S) lot – flat, public use • Side (W) lot and half of front (S) lot – flat, fleet/police use	• 480/277kVa Main - 1200 AMP • There is 1 spare breaker on the panel, but it's not enough to support charging. • The backup generator cannot cover EV's if power loss occurs. • Transformer on (W) corner of lot is 750kVA	• No existing charging infrastructure.	• Phase 2: (3) Level 2, LAPD Management. (2) DCFC shared among Emergency Management • Phase 2: 30 vehicles identified as take home transition • Phase 3: 16 vehicles identified as take home transition • 4 vehicles excluded from transition. • (10) Level 2 and (7) DCFC handles proposed as part of Community Infrastructure Plan.
Mesa Public Library 2400 Central Ave, Los Alamos • 1 light-duty vehicle	• Fleet charging – loading dock area • Fleet vehicle used for book transport	• Upper (public) lot graded toward main road; flattest spots are nearest to library • Loading dock slightly graded	• Loading Dock: 1200 amp panel, 480kVA - can support L3 for (1) fleet vehicle.	• Public DCFCs (4) handles are being implemented.	• No additional proposed fleet charging infrastructure; Library Services vehicle assumed to use public DCFC
PCS 1 101 Camino Entrada, Los Alamos • 21 light-duty vehicles • 16 medium-duty vehicles • 9 heavy-duty vehicles	• Shared building and parking lot with Atomic City Transit • Fleet vehicles parked on side (W) lot near building and along back (S) lot • In winter, garage space used for snow plow trucks; common-use fleet vehicles remain outside	• Side (W) lot – flat; rows near building for fleet use, opposite rows for Atomic City Transit • Back (S) lot – flat; located in front of garage doors along rear of building • Front (N) lot – employee parking; relatively flat	• 500kVA transformer, to be replaced with 1000kVA • 1000kVA transformer will be at full capacity for the bus chargers & defrosters • Existing 480AMP panel, need to add another	• 3 EVs are operated out of PCS1 and utilize Level 1 chargers plugged into a 110V wall outlet.	• Phase 1: (6) Level 2; one shared among Transit Division. • Phase 2: (3) Level 2; two shared among Transit Division and one shared among Traffic and Streets. (4) DCFC shared among Traffic and Streets • Phase 3: (3) Level 2; two for Facilities Maintenance and one shared among Transit Division. (12) DCFC • Atomic Transit (not phased in this report): (9) Level 2 and (9) DCFC
PCS 2 101 Camino Entrada, Los Alamos • 0 assigned fleet vehicles	• PCS 2 is used for vehicle maintenance but does not have any vehicles assigned.	• Not reviewed	• Not detailed.	• No existing charging infrastructure.	• No proposed fleet charging infrastructure.
PCS 3 101 Camino Entrada, Los Alamos • 3 light-duty vehicles • 2 medium-duty vehicles • 3 heavy-duty vehicles	• Facility is L-shaped • Backup generator cannot support EV charging load. Stantec mentioned programming the generator to prioritize how energy would be distributed in case of an emergency.	• Side (E) lot – lined with garage doors; some parking for employee/fleet • Loading dock (SE) – flat; contains two NPR vehicles • Common (E) lot – flat; used by LAPS buses and fleet vehicles	• Electrical room near center of the building could support EVs, but the spaces outside would block doors • Bottom of L (SE) has massive (300-1500kVA) transformer, 1600amp panel with pressure switch, additional	• No existing charging infrastructure.	• Phase 2: (1) DCFC shared among Fleet Management. • Phase 3: (1) Level 2. (1) DCFC • Three vehicles excluded from transition

[2] Throughout this report, 'charging handles' or 'plugs' refers to the number of individual charging ports available, each serving one vehicle parking space. A single charger unit many have multiple plugs.

Facility	Comments	Parking Lot Conditions	Existing Electrical Equipment	Existing Charging Handles/Plugs[2]	Proposed Charging Handles/Plugs
			150amp panel w/ block heater on a timer		
PCS 4 (LAPS) 101 Camino Entrada, Los Alamos • 12 light-duty vehicles • 28 medium-duty vehicles • 23 heavy-duty vehicles (school buses)	• Los Alamos Public Schools (LAPS) have not expressed initial interehigh-levelh level analysis was included.	• Bus parking (S) – flat; adjacent to nearby transformer/panel • Side (W & E) lots – flat; used for fleet and employee parking	• Would tie into infrastructure proposed on PCS3 • 480AMPs panel – to be confirmed if separate	• No existing charging infrastructure.	• (20) Level 2 proposed to charge support fleet. (12) DCFC to charge school bus fleet
PCS 5 101 Camino Entrada, Los Alamos • 34 light-duty vehicles • 14 medium-duty vehicles • 5 heavy-duty vehicles	• Employee concern about losing parking spaces to EVs in front (N) lot • Client requests separate meters or cost-tracking for each department • Back row (S of building) fully occupied by fleet vehicles by end of day	• Front (N, NE) lots – flat; employee parking • Back (S) lot – flat; fleet use	• The electric room has a fixed generator • 480/800AMPs Panel • Transient voltage surge suppressor	• 2 EVs are operated out of PCS1 and utilize Level 1 chargers plugged into a 110V wall outlet.	• Phase 1: (13) Level 2; one each shared among Water Production, Parks Maintenance, and Meter Readers, all others dedicated. • Phase 2: (3) Level 2. (8) DCFC; one each shared among GSW, Water Production, Parks Maintenance, and Domestic Water. • Phase 3: (13) DCFC one each shared among Water Production and Parks Maintenance • Three vehicles identified as take home • Six vehicles excluded from transition.
Los Alamos Senior Center 101 Bathtub Row, Los Alamos • 4 light-duty vehicles • 2 medium-duty vehicles	• Back parking lot and overflow lot, behind building (S) commonly used for Senior Citizen Services vehicle parking.	• Back (N) lot – flat; suitable for EVs • Side (E) lot – flat; contains existing ADA spots; has building entrance • Front (S) lot – graded; less ideal for public EV charging; contains existing ADA spots; main entrance to building	• 300kVA transformer (back of building) • 225 amp panel in closet (120/208)	• No existing charging infrastructure.	• Phase 1: (4) Level 2; one shared and three dedicated among Senior Citizen Services.. • Phase 2: (2) Level 2; one shared and one dedicated among Senior Citizen Services. • (4) Level 2 handles proposed as part of Community Infrastructure Plan.
Eco Station 3701 E. Jemez Rd, Los Alamos • 3 light-duty vehicles • 2 medium-duty vehicles • 12 heavy-duty vehicles	• F-150 used for travel between White Rock and this facility • Overnight charging is acceptable at this location	• Side (E) lot – flat; fleet vehicle parking only	• 208/120V 3-Phase 4-Watt 400amps • Small panel can support 1 charger • Main Panel: 800 AMP	• No existing charging infrastructure.	• Phase 1: (1) Level 2 • Phase 2: (5) DCFC: four shared and one dedicated among Environmental Services • Phase 3: (1) Level 2 shared among Environmental Services. (2) DCFC; one shared and one dedicated among Environmental Services. • One vehicle excluded from transition.
Fuller Lodge/Overflow 2132 Central Ave, Los Alamos • 6 light-duty vehicles			• Desktop review; existing electrical unknown.	• No existing charging infrastructure.	• Phase 1: (5) Level 2; one charger shared among PW Custodial and four dedicated. • Phase 2: (1) Level 2
Los Alamos Fire Station 4 4401 Diamond Dr, Los Alamos • 4 light-duty vehicles • 2 medium-duty vehicles • 1 heavy-duty vehicles			• Desktop review; existing electrical unknown.	• No existing charging infrastructure.	• Phase 2: (1) DCFC • Two vehicles identified as take home. • One vehicle excluded from transition.
Fire Department Training Center 132 DP Rd, Los Alamos • 0 assigned fleet vehicles			• Desktop review; existing electrical unknown.	• No existing charging infrastructure.	• No proposed fleet charging infrastructure.
Golf Course 4290 Diamond Dr, Los Alamos • 1 light-duty vehicle • 1 medium-duty vehicle	• Fleet charging – RFID • Public charging – paid • Fleet data won't capture the new golf carts and golf course isn't open. Golf carts have separate charging area.	• Proposed Area (Near dumpster) is slanted towards building. Great spot for EV's but not within ADA requirements • Middle row hase less grade change	• Cart Barn: 208V, 1200 amps (likely using 400amp max) • Front corner: 300kVA - 800 amps	• No existing charging infrastructure.	• Phase 1: (1) Level 2 • Phase 3: (1) DCFC • (6) Level 2 handles proposed as part of Community Infrastructure Plan.

Facility	Comments	Parking Lot Conditions	Existing Electrical Equipment	Existing Charging Handles/Plugs[2]	Proposed Charging Handles/Plugs
		• Parking outside cart barn is relatively flat with existing ADA spots			
Los Alamos Wastewater Treatment Plant 3598 Pueblo Canyon Rd, Los Alamos • 3 light-duty vehicles • 1 medium-duty vehicle • 5 heavy-duty vehicles	• Vehicles shared between White Rock and Los Alamos wastewater facilities	• Side (E) lot – flat; employee and fleet parking • Side (NE) lot – slight grade; employee and fleet parking	• 110amps, 500kVA transformer, 480-volt panel	• No existing charging infrastructure.	• Phase 1: (1) Level 2 • Phase 2: (1) DCFC shared amount Utilities – Waste Water. • Phase 3: (2) DCFC. • Four vehicles excluded from transition.
Ice Rink 4475 West Jemez Rd, Los Alamos • 2 light-duty vehicles	• Vans used daily for travel between locations • Occasionally used for towing • Occasionally driven long distances (e.g., 350 miles to Hobbs, NM	• Front (N) lot – flat; public use • Side (W) lot – slight grade; public and fleet use	• Overhead Lines - primary, transformer, Secondary (Likely won't be used for EV's, will propose a tap off the primary wires and utilize a new transformer)	• No existing charging infrastructure.	• Phase 1: (2) Level 2 • (8) Level 2 handles proposed as part of Community Infrastructure Plan.
LAC Aquatic Center 2760 Canyon Rd, Los Alamos • 0 assigned fleet vehicles	• Side Lot (W, Only); Public & Ice Rink fleet, relatively flat	• Fleet vehicles are shared with ice rink • Add Public charging	• (2) 480/800 amp panels, 750kVA transformer	• No existing charging infrastructure.	• No proposed fleet charging infrastructure.
Los Alamos Airport 1040 Airport Rd, Los Alamos • 2 light-duty vehicles • 1 heavy-duty vehicle	• Two light- and one heavy-duty vehicles make up the Airport fleet. Both light-duty vehicles could be smaller (courtesy car a smaller 4 seat sedan) while the ¾ ton pick-up does snow plowing and hauling but 95% of trips could be done by golf cart. Heavy-duty vehicle plows snow and is excluded from transition.		• Desktop review; existing electrical unknown.	• No existing charging infrastructure.	• Phase 3: (1) Level 2 • One vehicle excluded from transition.
WR Senior Center 133 Longview Dr, White Rock • 2 light-duty vehicles	• Both vehicles are grant funded.		• Desktop review; existing electrical unknown.	• (1) Level 2 charger	• No additional proposed fleet charging infrastructure.
WR Library 10 Sherwood Blvd, White Rock • 0 assigned fleet vehicles			• Desktop review; existing electrical unknown.	• No existing charging infrastructure.	• No proposed fleet charging infrastructure.
WR Visitor Center 115 State Road #4, White Rock • 0 assigned fleet vehicles	• Common parking lot for visitors to Bandelier National Monument • Average visitor stay is 3–5 hours	• Side (W) lot and back (N) lot – public parking; slight grades throughout	• Existing 75 kVA transformer (not big enough to support additional EV Chargers)	• (2) Level 2 charger	• On-route charging for Atomic Transit located at WR Visitor Center; see Appendix A.
WR Fire Station #3 129 State Road #4, White Rock • 0 assigned fleet vehicles	• Public and fleet charging planned • Building used for council meetings; EV chargers can be placed in east lot • Fleet includes three trucks; two (Fire Marshal vehicles) can be converted to EVs	• Side (E) lot – flat; public use • Back (N) lot – employee and fleet parking; gated; grade not observed due to restricted access	• 277/480 60 amps	• No existing charging infrastructure.	• No proposed fleet charging infrastructure. • (4) Level 2 handles proposed as part of Community Infrastructure Plan.
Wastewater Treatment Plant and Parks 580 Overlook Dr, White Rock • 0 assigned fleet vehicles	• Fleet vehicles shared with Los Alamos Wastewater, where vehicles are parked	• Front (SW) lot – flat; small; employee and fleet use only	• Massive brand new Generator • 750kVA transformer • 277/480 1200 amps panel • Eaton Transfer Switch • Main panel: 100 amps • 30kVA transformer (3-phase)	• No existing charging infrastructure.	• No proposed fleet charging infrastructure.

Not included in this study is Los Alamos National Laboratory (LANL) which has implemented significant infrastructure developments for their EV and PHEV deployments. Currently, LANL has 99 Level 2 chargers and 3 Level 3 chargers to support their 67 EVs and 110 PHEV (177 total) fleet. Most of their charging infrastructure has been deployed with ChargePoint with a few exceptions including chargers from Schneider and Leviton. As LANL moves forward with expanding their electric fleet, 14 Level 2 and 4 Level 3 chargers are planned to come online in 2025. Charging infrastructure at LANL is only for LANL employees and not open to the public.

LAPS was involved in the development of the conversion plan but not included in the phased implementation. Review of LAPS specific data showed similar potential for electrification with school buses as “easy” to electrify but more evaluation of topography impacts are needed. The total charger count required to electrify LAPS vehicles operated out of PCS4 were included in planning. Due to the uncertainty of when LAPS vehicles will be electrified, all infrastructure is assumed to be deployed in Phase 3.

Power loads associated with Atomic City Transit were also included in planning. A review of the Atomic City Transit ZE Transition Plan can be found in Appendix A. Sharing parking with PCS1, Atomic City Transit support vehicles were included in charging implementation at PCS1. Transit vehicle loads were included in projections for PSC1. Additionally, the Transition Plan identifies on-route charging at White Rock Visitor Center and Atomic City Transit Center; the power loads at White Rock Visitor Center reflect the added power requirements and assumed to be deployed in Phase 3.

4.2 Infrastructure Implementation Plan

To identify the quantity and level of charging needed to support a future EV fleet, vehicle specifications were used to project the level of power needed from a charger. The underlying assumption is that larger vehicles have and will continue to have larger batteries, providing more energy to move the vehicle throughout a workday. Larger batteries require higher capacity chargers to transfer more energy over a given charging window.

Figure 4-1: Charger assignments by class & make

	Pickup	SUV	Truck	Refuse Truck	Incomplete Single Cab	Incomplete	Cargo Van	Van	Sedan	Step Van	Cutaway	Minivan	Incomplete Double Cab
Class 1									0				
Class 1C	0	0											
Class 1D	1	0					0	0					
Class 2												0	
Class 2E	1	1										0	
Class 2F	1	1											
Class 2G	2						1						
Class 2H	2					3	1	1					3
Class 3	3				3	3					1		3
Class 4					3						1		
Class 5			3	3	3								
Class 6			3							3			
Class 7			3										
Class 8			3	2	3								

0	L2	2-to-1
1	L2	1-to-1
2	DCFC	2-to-1
3	DCFC	1-to-1

The figure above shows the charger level and configuration based on vehicle class and body type. Charger assignments identify between shared and dedicated, as well as between level 2 and direct current fast charging (DCFC) infrastructure. Shared infrastructure indicates that two vehicles would share a single charger. At the implementation level, sharing is only between vehicles operated by the same department.

The Implementation of charging infrastructure requires the determination between continuing the County's current two EV procurement policy (EV Policy) or pursuing a more aggressive decarbonization strategy to align with the CAP Policy transition.

The count, configuration, and year of charging infrastructure available to support EVs for both scenarios are identified below.

Table 4-2: Phased charger implementation (EV-Policy top row, CAP-Policy second row)

Facility	Present Day	Scenario	Phase 1 (2035)		Phase 2 (2043)		Phase 3 (2050)	
	Existing Handles/Plugs		**L2**	**DCFC**	**L2**	**DCFC**	**L2**	**DCFC**
Municipal Building	(12) Level 2 (in progress)	EV-Policy		-	2	-	2	-
		CAP-Policy		-	3	-	-	-
		Community						
Justice Center [3]	-	EV-Policy	-	-	-	-	-	-
		CAP-Policy	-	-	3	2	-	-
		Community			10	7		
Mesa Public Library	(4) DCFC (in progress)	EV-Policy	-	-	-	-	-	-
		CAP-Policy	-	-	-	-	-	-
		Community	-	-	-	-	-	-
PCS1	2 Level 1	EV-Policy	2	-	2	1	3	-
		CAP-Policy	6	-	3	4	3	12
		Atomic Transit	-	-	-	-	9	0
PCS3	-	EV-Policy	-	1	-	1	1	-
		CAP-Policy	-	-		1	1	1
PCS4	-	LAPS		-	-	-	20	12
PCS5	2 Level 1	EV-Policy	2	1	3	-	-	-
		CAP-Policy	13		3	8		13
LA Senior Center	-	EV-Policy	3	-	1	-	1	-
		CAP-Policy	4	-	2	-	-	-
		Community	4					

[3] No immediate need was identified to install DCFC chargers at the Justice Center to support fleet charging at this location. Given that majority of police vehicles are taken home, any future DCFC at this location will provide flexibility and resiliency to the County vehicles at this location and it will help further develop a network of fast chargers across the County that can be shared with the community.

Facility	Present Day	Scenario	Phase 1 (2035)		Phase 2 (2043)		Phase 3 (2050)	
	Existing Handles/Plugs		**L2**	**DCFC**	**L2**	**DCFC**	**L2**	**DCFC**
Eco Station	-	EV-Policy	-	1	-	-	-	
		CAP-Policy	1	-	-	5	1	2
Fuller Lodge	-	EV-Policy	3	-	-	-	-	
		CAP-Policy	5	-	1	-	-	-
Fire Station #4	-	EV-Policy	-	-	-	-	-	-
		CAP-Policy	-	-	-	1	-	-
Golf Course	-	EV-Policy	1	-	-	-	-	-
		CAP-Policy	1	-	-	-	-	1
		Community	6	-	-	-	-	-
LA Wastewater Treatment Plant	-	EV-Policy	-	-	-	-	-	-
		CAP-Policy	1	-	-	1	-	2
Ice Rink	-	EV-Policy	-	-	-	-	-	-
		CAP-Policy	2	-	-	-	-	-
		Community	8	-	-	-	-	-
Los Alamos Airport	-	EV-Policy	-	-	-	-	-	-
		CAP-Policy	-	-	-	-	1	-
White Rock Senior Center	-	Community	-	-	-	-	-	-
White Rock Library	-	Community	-	-	-	-	-	-
White Rock Visitor Center	(2) Level 2	Community	-	-	-	-	-	-
		Atomic Transit	-	-	-	-	-	1 on-route
White Rock Fire Department	-	Community	4	-	-	-	-	-
Wastewater Treatment Plant and Parks	-	EV-Policy	-	-	-	-	-	-
		CAP-Policy	-	-	-	-	-	-
Aquatic Center	-	Community	8	-	-	-	-	-
Los Alamos Nature Center	-	Community	-	-	2	-	-	-
North Mesa Sports Complex	-	Community	-	-	6	-	-	-

The recommendations above are based on a total build-out of infrastructure to support EV transition based on an EV-Policy scenario (top row of each facility) compared to CAP-Policy scenario (bottom row of each facility) for a 100% transition of the feasible vehicles by 2050.

On a year-by-year- basis, charging infrastructure deployments are shown below. As high-level estimates the costs below aim to give an indication of how much all-in infrastructure development could cost. This includes electrical upgrades, site work, charger, and labor costs based on the cost sheets and estimates provided by the County from its charger project at Municipal.

Table 4-3: Charging infrastructure cost and deployment timeline for EV-Policy Scenario

	CAP Policy[4]	**Phase**	**Proposed Charging Infrastructure Location**
2026	$965,682	Phase 1	PCS1-PCS5
2027	$592,964		LA Senior Center-Eco Station
2028	$855,311		Fuller Lodge
2030	$24,806		Golf Course
2034	$74,419	Phase 2	PCS5
2035	$220,742		PCS1-PCS3
2036	$49,613		Eco Station-Municipal Building
2041	$24,806		Justice Center
2043	$124,176	Phase 3	Fuller Lodge
2045	$24,806		Fire Station #4
2047	$24,806		LA Senior Center

The implementation under the CAP-Policy Scenario differs substantially as shown below.

Table 4-4: Charging infrastructure cost and deployment timeline for CAP-Policy Scenario

	CAP Policy[5]	**Phase**	**Proposed Charging Infrastructure Location**
2026	$1,252,213	Phase 1	PCS1-PCS5
2027	$539,284		LA Senior Center-Eco Station-LA Wastewater Treatment Facility
2028	$564,090		Ice Rink-Fuller Lodge
2030	$24,806		Golf Course
2034	$1,106,849		PCS5
2035	$655,148		PCS1-PCS3-Fire Station #4
2036	$502,243	Phase 2	Eco Station-Municipal Building
2037	$96,806		Justice Center
2039	$24,806		Fuller Lodge
2040	$85,565		LA Wastewater Treatment Facility

[4] See section 6.1.2.4-Facility Infrastructure and Charging Equipment for cost inputs breakdown
[5] See section 6.1.2.4-Facility Infrastructure and Charging Equipment for cost inputs breakdown

	CAP Policy[5]	Phase	Proposed Charging Infrastructure Location
2041	$49,613		LA Senior Center
2042	$195,936		Eco Station
2043	$1,101,197		PCS1
2045	$281,501	Phase 3	LA Wastewater Treatment Facility-PCS3
2047	$1,112,343		PCS5
2049	$171,130		Golf Course-LA Airport

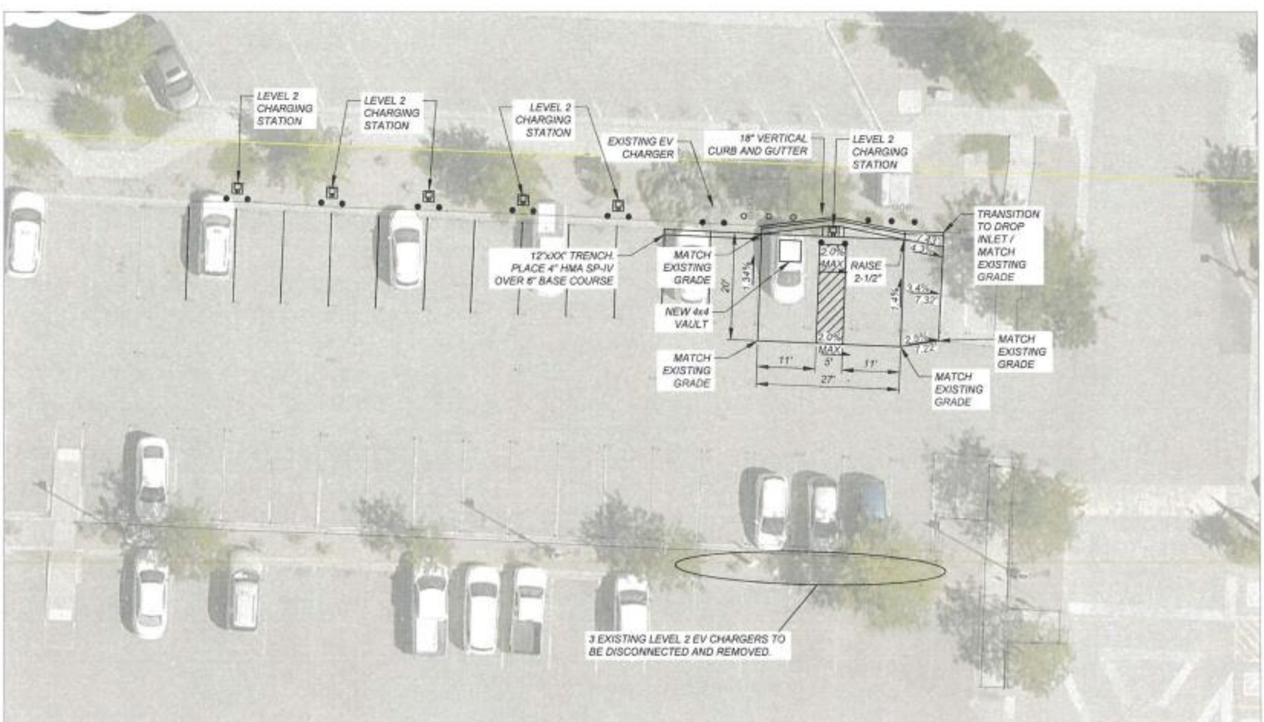
The investment in infrastructure not only depends on deployment of EVs but also the capacity of existing electrical equipment. Due to substantial power needs, electrical systems often need to be upgraded when deploying. Close coordination between the County and DPU will be essential, and EV charging infrastructure needs should be incorporated into general electrification plans for County facilities.

4.2.1 Preliminary Charger Siting

As part of facility site visits and desktop review, a high-level consideration of where charging could be located was developed. Preliminary charging siting was identified for the ten County facilities with charging under the CAP Policy Implementation in Phase 1. Ariel views of these facilities can be found in Appendix C.

Importantly, preliminary charging siting differs substantially from detailed design. Shown in Figure 4-2 are the site plans developed for the 12 charging handles under construction at Municipal.

Figure 4-2: Detailed design for charging at the Municipal Building



The County should pursue the development of facility-specific designs using this Conversion Plan as a framework. Each facility requires a master electrical plan that includes the phases of infrastructure installation. This approach allows the County to construct charging infrastructure incrementally while ensuring designs accommodate full buildout capacity.

4.2.2 Resiliency

To maintain power during both scheduled and unscheduled power outages, one practical approach includes using temporary mobile diesel generators, as these offer a flexible and scalable solution. A generator with sufficient capacity to run for one full day is recommended for short-term outages, while longer durations can be accommodated with additional diesel fuel storage on-site or through scheduled fuel deliveries. The anticipated outage length, local policies, and environmental regulations will influence the total fuel requirements and storage needs.

Whether a permanent or mobile generator is selected, the generator should be positioned close to its distribution panel to streamline the connection process. If the County opts for a permanent generator, protective barriers like bollards are recommended around the equipment yard for security, though mobile generator setups may allow for removable or adjustable barriers to accommodate different scenarios.

Temporary mobile generators are primarily intended for short-term emergency situations, such as imminent or actual blackouts. Backup power generation at the scale the County will need to charge a full EV fleet is substantial. It is recommended that backup power generation is acquired via a mobile generator service.

4.2.3 Take Home Charging

Transitioning take-home vehicles to zero-emission models requires addressing residential charging infrastructure and establishing clear policies for equipment installation, energy cost reimbursement, and employee eligibility. The County has several strategic options to support this transition while managing costs and operational complexity.

The County could pursue one of two primary strategies for take-home EV charging. First, the County could prioritize plug-in hybrid electric vehicles (PHEVs) over BEVs and require all charging to occur at County facilities. This approach minimizes upfront infrastructure investment and maintains centralized control over charging operations. However, this strategy places significant demand on the County's fleet charging network, potentially requiring infrastructure expansion and creating scheduling constraints for employees who must charge vehicles during work hours or return to County facilities specifically for charging.

Alternatively, the County could establish a residential charging program that installs Level 2 charging equipment at eligible employee residences. This approach distributes charging demand, provides greater operational flexibility for employees, and maximizes the electric range utilization of both PHEVs and BEVs. The County should establish clear eligibility criteria including: availability of dedicated off-street parking, home ownership or landlord coordination and approval, adequate electrical service capacity at the residence, and employee commitment to the take-home EV program. The County will need to determine if the charging infrastructure is owned by the county of not and what policies or regulations impact this. This model requires higher upfront capital investment but reduces strain on centralized fleet charging infrastructure and better supports the County's long-term electrification goals.

Regardless of the infrastructure approach selected, vehicle telematics will play a critical role in tracking energy consumption and supporting employee reimbursement for residential charging costs. Telematics-based monitoring is the preferred method for measuring electricity use because it is agnostic to charger type, charging network, or charging location—whether employees use County-provided Level 2 chargers, public charging stations, or standard 120-volt outlets. The telematics system records all charging events with corresponding energy consumption (kWh), enabling accurate calculation of reimbursement amounts. The County would reimburse employees for actual electricity consumed by applying local utility rates, which can be uploaded to the telematics platform to account for variable time-of-use pricing structures. This approach ensures transparency, creates auditable records for compliance, and avoids the administrative complexity and potential inequity of flat-rate stipends.

Successfully integrating take-home vehicles into the County's fleet transition strategy requires clear, comprehensive policy documentation and proactive communication with affected employees and the public. It is strongly recommended that the County develop a formal Take-Home Electric Vehicle Policy prior to assigning any electrified take-home vehicles. This policy should clearly define: eligibility criteria for take-home vehicle assignment, restrictions on commute distance or daily mileage, responsibilities for charging equipment installation and maintenance, procedures for energy cost reimbursement and documentation requirements, allocation of infrastructure costs between the County and employee (if any), equipment return protocols upon separation or reassignment, and insurance and liability considerations. Clear policy communication will help manage employee expectations, ensure equitable treatment across departments, and establish the administrative framework necessary for successful program implementation and scaling as the County's EV fleet expands.

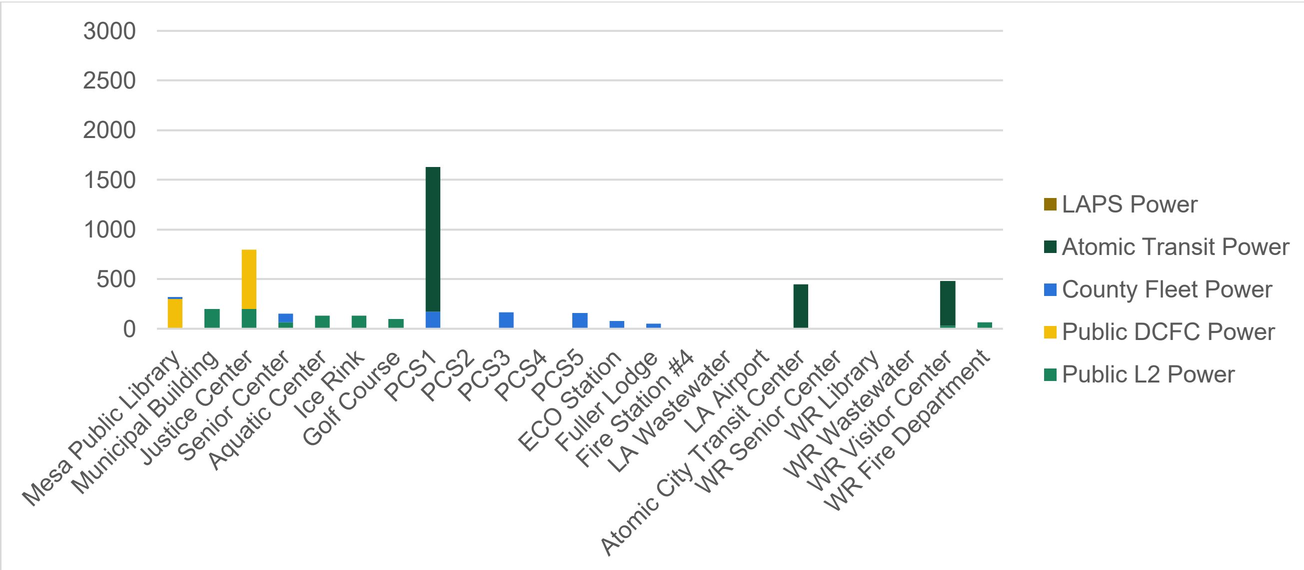
4.3 Utility Coordination

The Los Alamos County 30-Year Electrification Forecast projects substantial load growth driven by the rapid adoption of EVs, building electrification, and distributed energy technologies. The analysis, prepared by Burns & McDonnell 1898 & Co., establishes three scenarios of low, medium, and high adoption spanning residential, commercial, and fleet electrification through 2055.

The forecast supports the County's CAP target of carbon neutrality by 2050 and serves as a foundation for the 30-Year Distribution System Master Plan. The analysis examined how growing electrification will affect energy use and grid demand in Los Alamos County. It looked at expected increases in power consumption, strain on the electrical system, and future investment needs to support the transition. The scenarios were shaped by interstate policies like Advanced Clean Cars II, Advanced Clean Trucks, and the Heavy-Duty Omnibus standards, all of which aim to phase out gasoline and diesel vehicle sales by the mid-2030s.

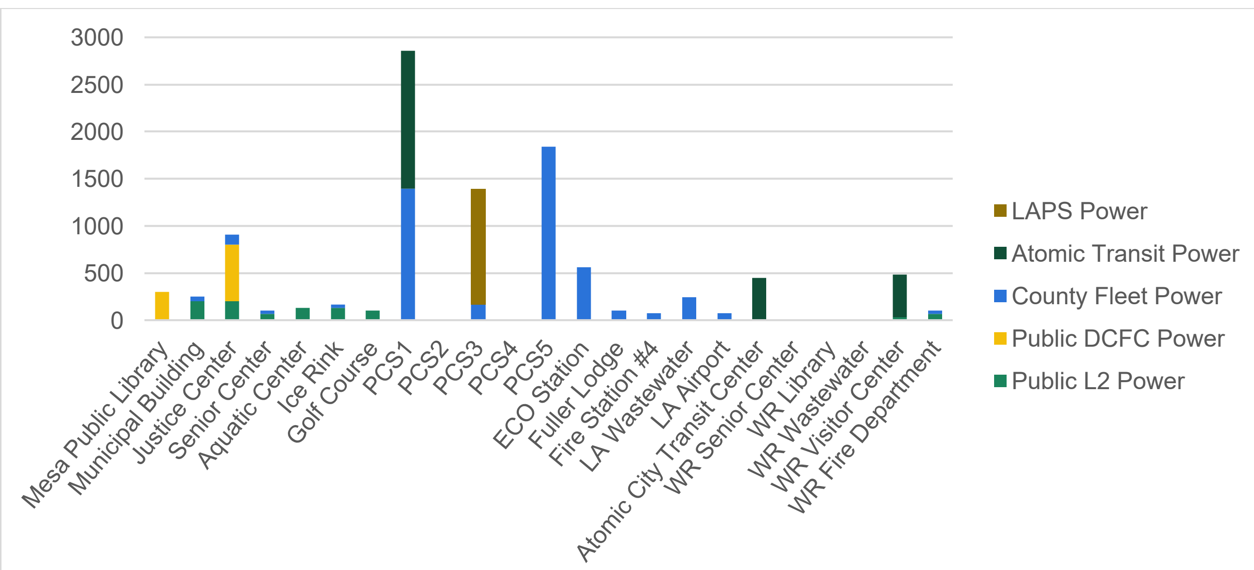
The amount of power demand from County operations from each implementation scenario are identified in the figures below. These projections include the total connected load from Atomic City Transit, which operates out of PCS1, as it was calculated in Zero Emission Transition Plan (Appendix A).

Figure 4-3: EV Policy total projected connected load (kW) by facility and type



The connected load from the EV Policy scenario differs substantially from the CAP Policy as it pertains to the total connected load as shown in Figure 4-3.

Figure 4-4: CAP Policy total projected connected load (kW) by facility and type



The figures above (Figure 4-2 and Figure 4-3) show where the electrification of County fleet will add to the increase in demand. Phase 1 at PCS1 includes the total connected load required from Atomic City Transit for both transition scenarios.

In terms of infrastructure implications, the shift toward electric vehicles will steadily increase electricity demand and influence how the Los Alamos Department of Public Utilities plans future grid capacity. As more medium- and heavy-duty electric vehicles are added, power needs will become concentrated around County facilities and charging hubs. Public charging infrastructure is also expected to expand significantly: by 2040, the County may need between 65 and 217 Level 2 chargers and 6 to 8 fast chargers, growing to about 135-432 Level 2 and 12–36 fast chargers by 2055, depending on how quickly EV adoption occurs (see accompanying Los Alamos Public Charging Infrastructure Readiness Plan.)

4.3.1 Communication Infrastructure Enhancements

The transition to EVs requires upgrades to the County's communication infrastructure to support efficient charging, optimize fleet performance, and enable data-driven decision-making. Effective utility coordination for charging infrastructure extends beyond infrastructure upgrades, it requires advanced communication systems that allow fleets, chargers, and utilities to share real-time information.

Two key technology pillars in this transition are smart charging systems and fleet tracking software (telematics). Together, these tools allow for real-time coordination between vehicles, chargers, and fleet management systems while ensuring secure and reliable data transmission across departments.

4.3.1.1 Smart Charging

Smart charging refers to the integration of software, artificial intelligence, and control systems to determine when and how much charging occurs for each vehicle. Rather than charging all vehicles simultaneously, smart charging platforms strategically manage energy distribution based on factors such as time of day, number of connected EVs, state of charge (SOC), and scheduled dispatch times. This approach optimizes energy use while avoiding excessive demand charges and time of use utility rates.

Key benefits of smart charging include:

- Optimized dispatch readiness: Prioritizing vehicles based on route needs (e.g., charging vehicles scheduled for earlier departure first).
- Reduced utility costs: Minimizing charging during peak-rate periods to lower demand charges and overall electricity expenses.
- Grid-friendly operations: Coordinating vehicle charging to smooth facility power demand and align with utility programs.

To achieve these benefits, chargers must be capable of remote management, and the software must effectively aggregate and control them. Selecting chargers that support the Open Charge Point Protocol (OCPP) is a best practice to ensure interoperability across platforms and vendors.

The County can choose between native charging software (offered by most manufacturers) or third-party fleet charging platforms such as Synop, AMPLY Power, Siemens, and BetterFleet (formerly Evenergi). While native software often integrates seamlessly with chargers, third-party platforms often provide more robust fleet-wide insights, including real-time SOC, charging efficiency, and performance data for vehicles on route. These platforms typically involve per-vehicle subscription fees (often exceeding $100 per vehicle per month) but deliver significant operational and cost-saving advantages. Charging software helps reduce electricity costs by optimizing charging schedules to avoid peak demand charges and take advantage of lower off-peak rates. Operationally, it improves fleet reliability by coordinating charging to ensure vehicle availability, prevents overloading infrastructure, and supports better energy management across the system.

4.3.1.2 Fleet Tracking Software and Telematics

As fleets transition to EVs, fleet tracking software becomes essential for monitoring vehicle and charger performance, managing maintenance, and optimizing operations. These platforms provide real-time data on SOC, charging sessions, energy consumption, mileage, and route performance, allowing operators to make informed decisions regarding scheduling, dispatch, and maintenance planning.

Key performance indicators (KPIs) that telematics can track include:

- EV vs. non-EV miles traveled
- Energy consumption and fuel economy per mile
- EV vs. non-EV fuel/energy costs (per kWh vs. per gallon)
- Fleet availability and mean distance between failures
- Maintenance costs per mile by vehicle type

By leveraging this data, the County can compare EV performance across different routes and environmental conditions, support predictive maintenance, and calculate total cost of ownership.

Examples of leading telematics solutions include Geotab, Synop, Fleet Complete, and RouteSmart, all of which support advanced analytics for electric fleets. When selecting a telematics provider, the County should prioritize platforms adhering to ISO/IEC 27001:2013 information security standards to ensure that sensitive fleet and operational data are encrypted, securely stored, and compliant with municipal cybersecurity requirements.

4.3.1.3 Platform Integration and Scalability

To increase the value of these technologies, smart charging systems and telematics platforms must be integrated into a unified data management ecosystem. This will allow the County to monitor charging infrastructure performance, track fleet energy use, and align operational decisions with utility data.

All EV equipment should be connected to existing municipal data networks using secure, encrypted VPNs and integrated with current data collection architecture. Over time, these systems can be expanded to incorporate advanced features such as vehicle-to-grid (V2G) communications, enabling the fleet to interact dynamically with the electric grid, further optimizing energy use and cost management.

4.4 Safety Considerations

Safety is a paramount concern in the operation and maintenance of any municipal fleet, especially as new technologies introduce different risks and requirements. The transition to EVs necessitates comprehensive planning to protect personnel, facilities, and equipment. This involves conducting thorough risk assessments, developing emergency preparedness procedures, coordinating with emergency services, and implementing robust training and safety protocols.

4.4.1 Risk Assessment and Planning

Conducting a risk assessment is recommended to determine the specific equipment, protocols, and resources required to ensure the safe operation and maintenance of EVs within the County's fleet. This assessment should account for the unique characteristics of electric drivetrains, high-voltage systems, and battery chemistries, and it will serve as the foundation for the development of detailed safety and preparedness measures. Key outcomes of this process include:

- Emergency preparedness procedures tailored to EV-specific risks, such as lithium-ion battery fires, thermal runaway events, and high-voltage electrical hazards. These procedures should integrate both preventative strategies and response protocols to minimize risk to personnel and property.
- Employee training programs for both maintenance staff and operations personnel, emphasizing safe handling practices, proper use of personal protective equipment (PPE), and protocols for responding to EV malfunctions or emergency situations.
- Engagement plans for emergency service providers, including local fire departments and other emergency responders. Early coordination will help align response procedures and possibly identify opportunities for joint training.

Regular reviews of these plans are necessary as EV technology evolves and new vehicle models are introduced into the fleet. Regular reassessments can help the County stay aligned with industry best practices, regulatory requirements, and lessons learned from early adopters of fleet electrification.

4.4.2 Fire Protection

Lithium-ion batteries present unique fire risks due to the potential for thermal runaway. Formal codes specific to EVs and charging infrastructure are still being developed, so agencies should coordinate with local fire authorities for guidance. NFPA 855 can serve as a reference for energy storage systems, but its requirements may exceed what is necessary for outdoor EV charging areas.

Practical measure to enhance safety include:

- Coordination with the local Authorities Having Jurisdiction (AHJs), including the fire marshal and building officials, to determine additional fire protection needs.
- Installing emergency shut-off (shunt) switches to quickly disconnect power to chargers during an incident
- Using physical barriers (bollards) t protect high-voltage equipment
- For enclosed parking structures, consider designated "burn-out" zones for vehicles experiencing thermal events
-

Additionally, fire isolator systems (e.g., EV fire blankets, aerosol suppression units) are supplemental tools and should be used to complement existing safety measures. Coordination with local fire authorities is essential to ensure compliance with evolving standards and site-specific needs. Detailed considerations for fire isolator use during thermal runaway are presented in Table 4-3 and shown in Figure 4-1.

Table 4-5: Key Considerations for Fire Isolator Use During Thermal Runaway

Topic	Key Considerations
Fire Risks in EV charging Areas	Most EV charging stations are outdoors, reducing fire spread risk due to open-air heat dissipation. However, parking garages, especially underground, present greater dangers because: • Limited access to firefighting equipment makes suppression more difficult • Closely parked vehicles increase fire spread potential • Structural integrity concerns arise from prolonged heat exposure in enclosed environments In these locations, traditional fire suppression systems such as sprinklers are still the primary method of controlling fires, but fire isolators serve as an essential supplement to enhance protection.
How Fire Isolators Improve Safety	Fire isolators, including fire blankets and aerosol-based suppression systems, provide an additional layer of fire containment by: • Containing flames and smoke at the source to reduce the risk of fire spreading to other vehicles and structural elements • Minimizing collateral damage to surrounding infrastructure and assets • Enhancing firefighter response by slowing fire progression, giving responders more time to arrive and act effectively Best practices suggest placing fire isolator kits near every 8-10 EV charging station to ensure rapid deployment in case of an emergency.
Components of a Fire Isolator System	A comprehensive fire isolator setup includes: • EV Fire Blanket (9x6 meters) – designed to cover large vehicles, reusable up to six times, withstands temperatures up to 2,950°F • Aerosol Units – Deployed under the fire blanket, directly targeting the battery to reduce fire intensity • Fire Isolator Trolley – Allows for easy transportation of fire suppression equipment within the parking facility • Fire Isolator Standing Cabinet – A dedicated storage unit for quick access to fire blankets and aerosol suppression tools (See Figure 4-1) These fire suppression solutions have already been adopted by various parking garage operators worldwide, providing a proven means of reducing EV fire risks.
Implementation Considerations	While fire isolators provide valuable supplemental protection, they should be integrated alongside existing fire suppression systems, such as sprinklers and fire alarms, to increase safety in EV charging environments. In particular: • Facilities with EV chargers in enclosed parking structures should include fire isolator stations nearby • Staff training is essential to ensure proper deployment • Clear signage and accessibility enhance emergency response efficiency

Figure 4-5: Fire Isolator Cabinet

4.4.3 Electrical

Ensuring electrical safety is critical when transitioning to EVs, as the high voltage charging infrastructure introduces significant risks that are substantially different from those associated with conventional fleets. Without proper safeguards, these risks can result in serious injury, equipment damage, or service disruptions. To mitigate these hazards, a comprehensive electrical safety framework should be established that incorporates the following measures:

- Proper insulation and grounding of all high-voltage equipment, ensuring that stray currents cannot create shock hazards or damage connected systems.
- Clear signage and restricted-access barriers around high-voltage areas to limit exposure to authorized and trained personnel only. Visual warnings and lockout/tagout procedures should be standardized across all facilities.
- Routine maintenance and inspections of charging infrastructure, cables, connectors, and protective devices to detect and resolve issues.
- Strict adherence to safe power-down protocol, including disconnecting 12V batteries, removing high-voltage service disconnects and fuses, verifying zero voltage with CAT III/IV-rated multimeters, and observing OEM-specific discharge waiting periods (often up to 10 minutes)
- Emergency Shunt Switches
- Bollards to protect equipment and users

Beyond these core measures, training and continuous reinforcement of electrical safety practices should be prioritized for maintenance staff, operators, and emergency responders. Establishing clear standard operating procedures, reinforced through recurring safety audits and drills, will further ensure that EV operations remain safe as infrastructure scales and new vehicle technologies are introduced.

4.4.4 Personal Protective Equipment Best Practices

These recommendations reflect widely adopted best practices for personnel working with EVs and high-voltage systems. Staff involved in routine charging or high-voltage maintenance face elevated risks, including potential arc-flash events and battery-related hazards, which require enhanced PPE beyond standard automotive workplace requirements. Essential PPE includes:

- High voltage insulated gloves and tools rated to appropriate voltage levels, with gloves tested regularly for integrity to prevent electrical shock.
- Arc-flash and flame-retardant clothing designed to withstand heat and minimize burn injuries in the event of electrical discharge or battery thermal events.
- Face shields and electrical safety hooks to protect against flying debris, molten metal, and to provide safe distancing during emergency interventions.
- Foot protection designed for high-voltage environments.

In addition to providing PPE, establishing clear protocols for inspection, maintenance, and replacement of protective equipment is essential, as managed or outdated PPE can compromise worker safety. As EV adoption expands and technology evolves, PPE requirements should be reviewed and updated in alignment with OEM guidance and applicable safety regulations. Regular drills, audits, and refresher courses will help embed these practices into daily operations, creating a culture of safety around high-voltage work.

4.4.5 Ventilation

Although EVs do not emit exhaust, batteries may release hazardous gases, particularly during charging or thermal events. These recommendations reflect current best practices for areas where eVs are serviced or maintained, especially indoor maintenance facilities. For enclosed spaces, facilities should incorporate:

- Robust ventilation systems to maintain a continuous flow of fresh air.
- Gas detection systems to provide early warnings of hazardous gas accumulation.
- Regular inspections of ventilation equipment to ensure ongoing performance.

These measures help safeguard both personnel and infrastructure by reducing exposure risks and ensuring compliance with evolving safety standards. While these features are not included in the financial analysis provided in this report, they should be considered during design and planning alongside safety training and other protective measures.

4.4.6 Coordination with Emergency Responders

EV-specific incidents, such as high-voltage fires or collisions, require specialized emergency response. Establishing collaborative protocols with local emergency services is essential. Key considerations include:

- Developing incident response protocols for collisions, fires, and high-voltage malfunctions.
- Sharing critical resources, such as fleet maps, charger layouts, vehicle schematics, and safety data sheets, to streamline response logistics.
- Conduct mock emergency drills to improve preparedness and refine response strategies.

By embedding these measures into emergency preparedness planning, agencies can not only minimize safety risks but also foster confidence among employees, emergency responders, and the public in safe integration of EV technology.

- Backup charging solutions
- Safety protocols and good practices related to installation and maintenance of charging equipment, including facility modifications for fire detection and fire suppression options

In addition, **John Virrey** will collaborate closely with the Los Alamos County Department of Public Utilities (DPU) to identify and implement any necessary upgrades to the grid and charging infrastructure. This will help ensure that the infrastructure can support the increased demand from the new vehicle technology. The assessment will include:

- Evaluating current grid capacity and identifying potential hurdles such as transformer time delivery or substation capacity
- Planning for future scalability to accommodate growing fleet and community needs

5 Training and Foundational Skills

Transitioning to an EV fleet introduces new technologies, safety protocols, and operational requirements that must be supported through comprehensive workforce training. All relevant personnel, including operators, maintenance staff, emergency responders, and management, must be equipped with the knowledge and tools necessary to safely and efficiently operate and maintain the new fleet. This section outlines the training framework, key strategies, and resources to support this transition.

5.1 Training Framework and Approach

A multi-pronged training strategy should be implemented to ensure effective workforce development and long-term institutional knowledge. The following methods form the foundation of a strong training framework:

Table 5-1: Potential Training Methods

Plan	Description
Train-the-Trainer	Small numbers of staff are trained and subsequently train colleagues. This maintains institutional knowledge while reducing the need for external training.
Vehicle Manufacturer Training	OEM training provides critical, equipment-specific operations and maintenance information. Prior to implementing EV technology, staff work with the OEMs to ensure all employees complete necessary training.
Retraining & Refresher Training	Entry level, intermediate, and advanced continuous learning opportunities are offered to all relevant staff.
EV Training from Other Municipalities	The County and its departments leverage the experience of cities/counties who were early EV adopters and collaborate to share lessons learned during their EV transition.
Local Partnerships and Collaborations	The County can partner with local organizations, utilities, and industry groups to host workshops and training sessions that strengthen understanding of EV operations, charging infrastructure, and safety practices.
Professional Associations	Associations such as the EV Alliance[6] offer opportunities for sharing and lessons learned across government agencies. Members collaborate in many areas such as: sharing existing targets for EV deployment; working to establish a shared vision and target for EV leadership jurisdictions; creating and sharing action plans to achieve EV adoption targets; sharing data and best practices to inform target setting and planning; and encouraging and supporting additional jurisdictions to set ambitious EV targets.

Before the initial EV deployment, all staff should undergo a general orientation to familiarize them with new technology, safety protocols, and organizational expectations. This orientation supports a unified understanding of EV operations across departments.

[6] https://EValliance.org/members/

5.2 Operator Training

Operating EVs requires specialized training due to high-voltage systems, regenerative braking, and energy management requirements. The following recommendations reflect current best practices to improve vehicle range and use regenerative braking efficiently.

5.2.1 Operator Training and Skill Development

The handling of electric power systems, regenerative braking, and energy-efficient driving techniques include some unique features of operating EVs. Operators will need to develop proficiency in energy management, maximizing vehicle range through efficient driving practices, managing state-of-charge throughout shifts, and understanding how acceleration and deceleration impact battery life. Familiarity with charging protocols will be essential, including the operation of charging infrastructure, managing charging schedules, and understanding fast-changing requirements. Operators must also be aware of protocols for safely connecting and disconnecting high voltage charging systems for emergency shutoff procedures to disable a vehicle safely in the event of an incident.

Additionally, basic diagnostic awareness will be crucial, as it enables operators to recognize and respond to diagnostic alerts, allowing for proactive issue reporting that helps minimize vehicle downtime.

5.2.2 Adjustments to Operational Schedules

Electric vehicles often have different operational ranges and charging needs compared to conventional vehicles, impacting how daily schedules and routes are managed. Operations personnel will need to adapt in areas including:

- Route Planning and Range Management: Since EVs are limited by battery range, route planning will increasingly depend on factors like distance, elevation, and availability of charging stations. Operational teams will need to coordinate route assignments based on real-time charge levels and charging station accessibility.
- Charging Time Allocation: Charging times, especially during peak demand periods, will require scheduling adjustments to ensure that the vehicles are ready for deployment without delaying operations. Strategic midday, or opportunity, charging intervals may also need to be integrated into shift planning.
- Reduce Idle Times: Unlike combustion vehicles, EVs don’t require idling to keep engines warm, which necessitates adjustments in fleet dispatch and staging areas. New policies will emphasize energy conservation by reducing unnecessary power draw when vehicles are stationary.

Adapting operations to these factors will require not only new scheduling and routing practices but also stronger reliance on data-driven decision-making. Telematics systems and communication technologies (see Section 4.3.1) can provide real-time visibility into vehicle status, battery charge, and route conditions, enabling dispatchers to make timely adjustments and optimize fleet performance.

5.2.3 Impact on Operational Staffing Needs

EV adoption may influence the allocation of operational staff. For instance, fewer support staff may be needed for fueling logistics, while additional staff may be required for managing charging operations, scheduling, and performance monitoring. These roles may be combined with other dispatch responsibilities or developed as specialized positions.

Since EVs provide continuous data on energy usage, charge levels, and vehicle health, operations staff may require new data analysis skills to interpret this information and make data-driven decisions. Real-time monitoring can help prevent battery degradation and increase vehicle utilization.

Operations personnel will need specialized training on handling EV-specific emergencies, such as battery fires, which require safety protocols. Operations teams will need to develop a health and safety framework, ensuring that operators are equipped with necessary protective equipment and are trained to respond to potential hazards. Protocols should educate operators on high-voltage risks and offer safe handling guidelines. As new EV models are introduced, operational protocols and best practices may shift, and the County's operations would benefit from regular training and protocol updates, collaboration with manufacturers, and utilizing newer training programs.

5.3 Maintenance Training

As the County transitions to an EV fleet, ensuring a robust and well-trained maintenance team will be crucial. With EVs, the maintenance landscape shifts significantly through the upkeep of electric-specific components. Maintenance staff must be skilled in both foundational electrical tasks and complex system management, adapting to the unique demands of electric propulsion, energy storage systems, and charging infrastructure.

5.3.1 Safety Protocols and Foundational Skills

Safety is paramount when working with high-voltage systems and large-scale lithium-ion batteries. Mechanics should be trained in handling high-voltage components, batteries, and chargers, as well as understanding specific safety protocols to mitigate risk during inspections and repairs. Essential skills include:

- Reading and interpreting wiring diagrams.
- Safely handling and testing high-voltage batteries.
- Troubleshooting and repairing basic circuit faults.
- Demonstrating proficiency in the use of digital multi-meters.
- Repairing wiring and terminals to prevent faults.

It will be critical for mechanics to operate under defined procedures to ensure safe practices and avoid damage to batteries and components during maintenance. Procedures can include properly de-energizing batteries, potential hazards associated with batteries, and emergency preparedness in the event of thermal runaway and the release of flammable or toxic gases.

Creating a safe work environment for high-voltage EV maintenance begins with the implementation of safety barriers and warning signage. Work areas should also be enclosed using high-visibility tape, barricades, or designated high-voltage work zones to prevent unauthorized access and accidental exposure to electrical hazards. Additionally, warning signs must be placed at all entry points, clearly indicating potential dangers such as high voltage, restricted access, and required protective equipment. These measures serve as constant visual reminders for technicians and help maintain a controlled and hazard-free workspace.

Compliance with occupational safety standards is another essential aspect of high-voltage EV maintenance. Facilities must adhere to regulatory requirements, and OEM-specific safety protocols to ensure proper handling of EV systems. To maintain a high level of safety, organizations should conduct regular safety audits, risk assessments, and continuous training for personnel to keep them updated on evolving best practices and compliance measures. Furthermore, despite safety precautions, emergency preparedness is critical, as high-voltage accidents can be severe. Isolating the power source using emergency shutdown procedures and providing first air for electric injuries are essential. To see further safety considerations for high-voltage systems, including proper power-down procedures, voltage verification, and mandatory discharge times, refer to below.

Table 5-2: Safety Protocols for EV Maintenance

Procedure	Steps and Key Considerations
Safe Power Down and Isolation of High-Voltage Systems[7]	Ensuring a safe working environment when servicing EVs begins with proper high-voltage isolation procedures. Each manufacturer may have specific protocols, but the general steps include: • Disconnect the 12V Battery: This prevents accidental activation of the high-voltage system. • Locate and Remove the High-Voltage Service Disconnect: Each EV has a designated service disconnect that must be removed following OEM guidelines. • Remove High-Voltage Fuses: To ensure the circuits carrying high voltage are completely disconnected. • Isolate the High-Voltage Battery: This may require specialized tools and physical disconnection of key connections as outlined in the manufacturer's service manual.
Verification of Zero Voltage	Before beginning any maintenance on high-voltage components technicians must confirm that the system is fully de-energized: • May use a CAT III or CAT IV-rated digital multimeter designed for high-voltage measurement. • Measure across battery terminals and high-voltage cables to ensure no residual charge remains. • Confirm zero potential across all high-voltage points to prevent electrical shock risks.
Mandatory Waiting Periods for System Discharge	Even after power is disconnected, high-voltage components can retain electricity due to capacitors and energy storage elements. To ensure full discharge:

[7] https://stedmansgarage.co.uk/electric-vehicles/high-voltage-ev-safety/

Procedure	Steps and Key Considerations
	• A waiting period of up to 10 minutes is typically required after disconnecting power, though OEM recommendations may vary. • Follow manufacturer-specific guidelines for discharge times, as some EV models may require longer periods.

5.3.2 Advanced System Proficiency

The next layer of training focuses on multiplexing skills, which streamline vehicle electrical systems and replace extensive hard wiring. This skill set includes reading ladder logic diagrams, troubleshooting with LED indicators, and understanding input and output electrical symbols, which are critical for efficient fault resolution.

In addition, maintenance staff will require specialized skills in electronics, as nearly all systems in EVs are controlled by advanced electronic devices. Training in electronic maintenance includes:

- Inspecting and testing capacitors, diodes, and other modules.
- Differentiating between analog and digital signals.
- Understanding data communication protocols.
- Proficiency in using oscilloscopes and graphing multimeters.
- Troubleshooting gateway modules and understanding (Direct Current) DC and AC systems.

Equipping personnel with these capabilities will also necessitate access to specialized diagnostic and testing equipment, ensuring that staff can accurately identify faults and perform safe, effective repairs on complex EV systems.

5.3.3 Energy Storage and Propulsion Systems

The Energy Storage Systems (ESS) requires ongoing monitoring, diagnostics, and preventive care to ensure the longevity and performance of EV batteries. Maintenance staff will be trained in:

- ESS management hardware and software, focusing on maintaining optimal battery health.
- Safe practices for handling, storing, and disposing of high-voltage batteries.

Troubleshooting and servicing electric propulsion systems and other balance-of-plant elements are critical for reliable vehicle operation. Amid the shift to EVs, ensuring a robust and well-trained maintenance team will be crucial. With EVs, the maintenance landscape shifts significantly, placing greater emphasis on high-voltage safety protocols, advanced diagnostics, and the upkeep of electric-specific components. Maintenance staff must be skilled in both foundational electrical tasks and complex system management, adapting to the unique demands of electric propulsion, ESS, and charging infrastructure.

5.3.4 Diagnostic Systems and Preventative Maintenance

EVs come equipped with sophisticated onboard diagnostic systems that alert maintenance teams to performance issues, ensuring quick identification and repair of faults. Technicians will need to be trained to use onboard diagnostic systems effectively, interpreting alerts to prevent potential downtime. They will also need to implement preventative maintenance protocols for both buses and smaller fleet vehicles, focusing on high-wear components like brakes and HVAC systems, which experience reduced wear but still require consistent monitoring and servicing.

Early data suggests that EVs may require less reactive maintenance than combustion vehicles due to having fewer moving parts; however, long-term evidence specific to large-scale heavy-duty fleet deployment in North America remains limited.

In terms of preventative maintenance, EV propulsion systems are inherently more efficient than ICE engines and involve approximately 30% fewer mechanical parts. Key considerations include:

- Fluids – EVs eliminate the need for oil changes, transmission fluid replacements, and exhaust system maintenance due to their simplified drivetrains.
- Braking – Regenerative braking reduces wear on brake pads, though early transit data shows maintenance costs remain concentrated in the cab, body, and accessory systems. It is recommended that OEMs provide detailed preventative maintenance schedules, skills, and parts lists for EV compounds.
- Batteries – Battery systems introduce new requirements, such as monitoring thermal regulation and state of health, which demand periodic servicing.
- Tires – Increased vehicle weight and instant torque can accelerate tire wear, adding costs compared to ICE fleets.

Telematics further supports preventative maintenance by providing continuous monitoring of battery health, high-voltage system performance, motor temperatures, and component stress. Alongside regular diagnostic scans, inspections, preemptive replacement of high-wear parts, and calibration of electrical and mechanical systems, telematics allow maintenance to shift from time- or mileage-based schedules toward precision targeting of emerging issues.

In practice, battery health monitoring could replace traditional oil checks, thermal system diagnostics could substitute for coolant changes, and system performance tracking could stand in for many mechanical inspections, marking a significant evolution in maintenance philosophy.

5.3.5 Charging Infrastructure Maintenance

Maintenance of charging infrastructure will also be essential to fleet operations. Technicians will be responsible for diagnosing and repairing charging equipment to maintain reliable operations, preventative care for chargers, with a focus on components prone to wear from high-frequency usage and managing updates to smart charger software to ensure compatibility and performance.

As operations transition to EVs, decisions regarding the maintenance of charging infrastructure are equally critical as those related to vehicle servicing. Both in-house and outsourced approaches to managing charging infrastructure present distinct trade-offs that impact cost, reliability, and operational control.

5.3.5.1 In-House Maintenance

Maintaining charging infrastructure internally provides the highest degree of operational control. Technicians can address issues quickly, incorporate preventative maintenance into regular service schedules, and build organizational expertise that will be valuable as infrastructure expands. This approach also reduces dependency on third-party contractors and aligns with a preventative maintenance model, minimizing downtime through routine inspections, diagnostics, and component replacements.

However, it requires upfront investment in staff training, electrical safety certifications, and potentially specialized diagnostic tools. Agencies may also need to plan for dedicated space and resources to safely support this work.

5.3.5.2 Outsourced Maintenance

Outsourcing charging infrastructure maintenance can reduce internal workforce and training requirements, making it attractive for agencies with limited technical capacity or smaller deployments. Specialized service providers may also offer advanced diagnostic tools, direct OEM support, and warranties that simplify maintenance planning.

The downside, however, is reliance on external contracts, which can introduce higher long-term costs and slower response times if issues arise during critical operational periods. Outsourcing also limits the opportunity for agencies to build internal expertise, potentially creating knowledge gaps as infrastructure scales.

5.3.5.3 Key Considerations

Most fleet operators find a hybrid approach to be the most effective: handling routine inspections and basic preventative tasks in-house while relying on OEMs or specialty providers for complex or warranty-covered repairs. This balances responsiveness and institutional learning benefits of in-house maintenance with the technical expertise and risk management offered by external service providers.

5.3.6 Ongoing Training and Certification

Given the evolving nature of EV technology, ongoing training will be critical to keep maintenance staff up to date on the latest practices and equipment. The County's maintenance team should undergo regular training sessions covering critical topics, including high-voltage systems, safety protocols, and advanced diagnostics, as well as periodic refresher courses and certification renewals to stay current.

Once vehicles are out of general warranty, the County should document inspection and repair protocols, supplementing OEM manuals with real-world insights gained from fleet operations. Maintenance intervals will be aligned with OEM recommendations, but staff should monitor and adapt routines as necessary, refining them based on observed EV performance characteristics.

5.4 Manufacturer Training Programs

OEM-specific training programs provide critical equipment-based instruction. Examples of existing EV manufacturer training programs are summarized below.

1. **General Motors**[8]: General Motors (GM) offers the Automotive Service Educational Program (ASEP) which is designed to train participants in diagnostic and repair techniques on current and future GM vehicles. It is an accredited apprenticeship program that partners with colleges and technical schools across Canada. Training includes:

    a. Engine repair
    b. Heating and air conditioning
    c. Manual drive train and axles
    d. Suspension and steering
    e. Automatic transmission/transaxles
    f. Brakes
    g. Electrical systems
    h. Engine performance

2. **Ford Motor Company**[9]: Ford Motor Company (Ford) offers the Automotive Student Service Educational Training (ASSET) program which includes a curriculum specifically for EVs. The program is a collaboration between Ford, Ford and Lincoln dealers along with community colleges and technical schools. The training is in-person and hands-on with the goal of providing Ford customers with technicians highly trained in Ford service technologies and diagnostic and repair methods. The Ford EV curriculum includes courses on:

    a. High voltage systems safety
    b. Hybrid vehicle components and operation
    c. Battery electric vehicle components and operation
    d. High voltage battery service
    e. Hybrid and electric vehicle operation and diagnosis

3. **Tesla**: Tesla offers two training programs, including the Tesla START[10] and the Tesla Independent Repair Training Program.[11] Tesla START provides training to develop technical expertise and earn certifications through in-class theory, hands-on labs, and self-paced learning. It is a four-year program where participants receive all levels of provincially accredited technical training and on-

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[8] https://www.gm.ca/en/home/careers/asep.html
[9] https://media.ford.com/content/fordmedia/fna/us/en/news/2022/06/06/ford-technician-training-programs-new-locations.html
[10] https://www.tesla.com/en_ca/careers/tesla-start
[11] https://service.tesla.com/docs/Public/training/

the-job training needed to take the Red Seal Examination.[12] Tesla START partnered with British Columbia Institute of Technology to integrate the program into customized curriculums at the Burnaby campus.

The Tesla Independent Repair Training Program is geared towards technicians and repair shops interested in servicing Tesla vehicles. Training modules include:

a. Tesla introduction: basic repairs and maintenance
b. High voltage and electrical systems
c. Infotainment and driver assist systems
d. Body controls, thermal, and chassis systems
e. Closures and glazing
f. High voltage, electrical system, and Noise, Vibration, and Harshness diagnosis
g. Infotainment and driver assist system diagnosis
h. Body controls, thermal and chassis system diagnosis
i. Model 3 battery repairs

The County will need to strategically decide how to pair maintenance staff with OEM training as their EV fleet grows.

5.5 Emergency Responder Training

As mentioned in Section 4.4.6, proactive coordination with emergency services is critical. Firefighters, paramedics, and other first responders should be trained to manage EV-related incidents safely. Training should include:

- High-voltage Awareness: Identifying and managing EV battery risks.
- Battery Fire Protocols: Handling thermal runaway events using fire isolators, water, or approved extinguishing agents.
- Deactivation Procedures: Safely powering down vehicles to prevent unintended discharge.
- Mock Incident Response: Simulated scenarios to practice EV collision and fire response.

Los Alamos County should provide responders with up-to-date maps, schematics, and safety data sheets and host recurring training sessions to refresh and update response protocols.

[12] Automotive service technicians require a Red Seal License in Canada.

6 Financial and Budget Analysis

The financial evaluation of the County's EV transition consisted of the modeling of three cases through a 2050 horizon:

1. ICE-only Case: the 'business-as-usual' scenario and assumes the continued use of the current County fleet.
2. EV Policy : maintains the County's current EV procurement practices of transitioning two (2) vehicles to EVs each year.
3. Climate Action Plan (CAP) Goal : aligns with the County's goal of achieving 80% carbon neutral operations by 2050. Through the 25-year timeline, 86% of the County's eligible fleet vehicles are transitioned to EV.

The ICE-only case and EV Cases are used for illustrative purposes to determine the comparative financial impacts of a transition to an EV fleet compared to business-as-usual. This in turn can provide insight into budget and funding requirements for capital and operating costs.

The financial modeling process is comprised of several steps. First, Stantec worked with the County to collect all relevant financial data including vehicle purchase prices, vehicle mileage, vehicle maintenance costs, and fuel costs. such as…(LIST IT). The data, coupled with industry research, was used to determine the model inputs. After the model inputs were complete, costs were projected year by year through 2050 using inflation rates and energy price trends[13] where applicable. The financial modeling is expressed in year of expenditure.

It is important to understand the inherent limitations of financial modeling due to assumptions about costs, operations, asset life cycles, and other factors that are difficult to predict. Additionally, it is important to note that the categories modeled are focused on the impacts of a change in propulsion type. They do not account for service delivery costs (such as operator salaries) as these costs would be largely comparable in both scenarios.

6.1 Financial Model Inputs

The financial model consists of several inputs that can largely be divided into fleet and cost information. The fleet inputs include vehicle useful life, vehicle mileage, and fuel efficiency. Cost inputs include vehicle purchase costs, vehicle maintenance, fuel, and charging infrastructure. All inputs and assumptions are described in more detail below.

[13] Energy price projections sourced from U.S. Energy Information Administration (EIA), Annual Energy Outlook https://www.eia.gov/outlooks

6.1.1 Fleet Inputs

To support financial modeling, a set of commonly used fleet vehicles was identified based on body type and duty classification. This selection reflects the overall fleet composition and enables consistent application of financial inputs across vehicle types. Seven vehicles were chosen to serve as representative models for the analysis, summarized in Table 6-1. In addition, Table 6-2 shows a breakdown of LAC's fleet vehicle duty classifications.

Table 6-1: Representative Vehicle groups and most common fleet vehicle

Vehicle Duty	Class	Representative ICE Vehicle	Representative EV
Light-duty Vehicle 1 (LD1)	2E, 2F, 2G	Ford F-150	Ford F-150 Lightning
Light-duty Vehicle 2 (LD2)	1D, 2E	Ford Explorer	Ford Mustang Mach-E
Medium-duty Vehicle 1 (MD1)	2H, 3	Ford F350	Zeus Z-19
Medium-duty Vehicle 2 (MD2)	2H	Ford F-250	Unavailable
Heavy-duty Vehicle 1 (HD1)	6,7	Kenworth T270/T3 Series	Kenworth K270E
Heavy-duty Vehicle 2 (HD2)	8	Peterbilt 520	Peterbilt 520 EV
Heavy-duty Vehicle 3 (HD3)	8	International SA537	Kenworth T880E

Table 6-2: LAC Fleet Vehicle Duty Classification

Vehicle Duty	LAC Fleet Vehicle	Total Vehicle Count
Light-duty Vehicle 1 (LD1)	• CHEVROLET / Silverado • DODGE CREW CAB / 2500 • DODGE PICKUP / 1500 • FORD / F-150 • FORD / Ranger • NISSAN / Frontier	61
Light-duty Vehicle 2 (LD2)	• CHEVROLET / Bolt EV • CHEVROLET / Malibu • CHEVROLET / Tahoe • CHEVROLET / Traverse • CHEVROLET / Uplander • DODGE / Caravan/Grand Caravan • DODGE / Durango • DODGE / Grand Caravan • ELDORADO AMERIV / Grand Caravan • FORD / Crown Victoria • FORD / Escape • FORD / Expedition • FORD / Explorer • FORD / Mustang Mach-E • FORD / Taurus	78

Vehicle Duty	LAC Fleet Vehicle	Total Vehicle Count
	• FORD CARGO VAN / Transit • FORD C-MAX / C-Max • JEEP / Grand Cherokee • JEEP / Renegade • TOYOTA / Camry	
Medium-duty Vehicle 1 (MD1)	• CHEVROLET / Silverado • CHEVROLET / Silverado HD • FORD / E-350 • FORD / E-450 • FORD / F-350 • FORD / F-450 • FORD / F-550 • FORD S/D / F-550 • ISUZU / NQR/NRR • ISUZU / NRR	41
Medium-duty Vehicle 2 (MD2)	• CHEVROLET / Express • DODGE CREW CAB / 2500 • FORD / E-350 • FORD / F-250 • FORD / F-350 • FORD / Transit • RAM / 2500	33
Heavy-duty Vehicle 1 (HD1)	• FREIGHTLINER / FL70 • FREIGHTLINER / MT 55 Chassis • GMC / C7 • INTERNATIONAL / MA025 • INTERNATIONAL / SA537 • KENWORTH / T3 Series • KENWORTH / T4 Series • KENWORTH T270 / T3 Series • KENWORTH T370 / T3 Series	10
Heavy-duty Vehicle 2 (HD2)	• AUTOCAR / ACX Xpeditor • KENWORTH / L770 • KENWORTH T270 / T3 Series • KENWORTH T800 / T8 Series • PETERBILT / 520 • PETERBUILT 520 / 520	10
Heavy-duty Vehicle 3 (HD3)	• ALTEC AM60 / SR525 • FREIGHTLINER / FL112 • INTERNAT SFA / SR525 • INTERNATIONAL / F-2574 • INTERNATIONAL / SA537 • INTERNATIONAL / SA567 • INTERNATIONAL / SF567 • KENWORTH / T880 • KENWORTH DERICK / T8 Series • KENWORTH T470 / T4 Series • KENWORTH T800 / T8 Series • KENWORTH T880 / T880	17

Vehicle Duty	LAC Fleet Vehicle	Total Vehicle Count
	• VACTOR / SA637 • VACTOR / T4 Series	

6.1.1.1 Vehicle Mileage

Annual average vehicle mileage was estimated using fleet data provided by the County. Prior to analysis, the data was cleaned to remove any outliers that appeared unreasonably high or low. For each representative vehicle duty group, the average mileage within that group was used to approximate expected yearly travel distances. EVs were assumed to have the same annual mileage as their fossil fuel equivalents. A summary of these estimates is provided in Table 6-2.

Table 6-3: Annual Vehicle Mileage by Vehicle Type

Vehicle	Annual Mileage
Light-duty Vehicle 1 (LD1)	7,572
Light-duty Vehicle 2 (LD2)	5,803
Medium-duty Vehicle 1 (MD1)	5,684
Medium-duty Vehicle 2 (MD2)	6,429
Heavy-duty Vehicle 1 (HD1)	4,797
Heavy-duty Vehicle 2 (HD2)	6,738
Heavy-duty Vehicle 3 (HD3)	2,545

6.1.1.2 Fuel Efficiency

Fuel efficiency for fossil fuel vehicles was calculated using fleet mileage and fueling data provided by the County. Prior to analysis, the data was reviewed and cleaned to remove values that appeared unreasonably high.

EV efficiencies were estimated based on expected performance of comparable vehicle models. For each duty group, individual vehicle efficiencies were modeled and then averaged to produce a group-level estimate. The resulting values are presented in Table 6-4.

Table 6-4: Fuel Efficiency by Vehicle Type

Vehicle	Fossil Fuel Efficiency (mi/gal)	EV Efficiency (mi/kWh)
Light-duty Vehicle 1 (LD1)	14.47	2.00
Light-duty Vehicle 2 (LD2)	16.58	2.00
Medium-duty Vehicle 1 (MD1)	10.02	1.11
Medium-duty Vehicle 2 (MD2)	10.06	0.67

Vehicle	Fossil Fuel Efficiency (mi/gal)	EV Efficiency (mi/kWh)
Heavy-duty Vehicle 1 (HD1)	5.82	0.67
Heavy-duty Vehicle 2 (HD2)	4.40	0.40
Heavy-duty Vehicle 3 (HD3)	3.74	0.40

6.1.2 Cost Inputs

Cost inputs for the financial analysis were developed using data provided by the County. This included vehicle purchase prices, fueling and charging costs, maintenance, and other operational expenses. These inputs were applied to the selected representative vehicles to support consistent and comparative evaluation across duty groups and fuel types.

6.1.2.1 Vehicle Purchase

Vehicle purchase costs were developed using a combination of data provided by the County and market research. First the dataset was reviewed for accuracy, and entries with clear errors were removed.

Fossil fuel vehicle purchase prices were calculated using County fleet data and adjusted to reflect current market conditions. Only vehicles purchased in 2015 or later were included in the analysis. For vehicles acquired between 2015 and 2020, an average 2% yearly increase was applied to account for inflation and market shifts. Then prices were averaged within each vehicle type group to establish baseline purchase costs for the financial model.

EV purchase prices were estimated by applying a cost ratio to the adjusted fossil fuel vehicle prices. This ratio was calculated by comparing LAC's price of a representative fossil fuel vehicle with a comparable EV within each vehicle type group.

- Light Duty: The Ford F-150 costs $45,364, and the EV equivalent Ford F-150 Lightning costs $66,530. This results in a cost factor of 1.47.
- Medium Duty: The Super Duty F-250 costs $78,000, while the EV equivalent Bollinger B4 costs $158,758. This results in a cost factor of 2.04.
- Heavy Duty: The Peterbilt 520 costs $454,000, while the EV equivalent Peterbilt 520 EV costs $1,000,000. This results in a cost factor of 2.20.

That factor was then applied to the adjusted fossil fuel vehicle price to estimate the EV purchase price for each representative vehicle group.

After establishing the vehicle purchase prices, a 2%[14] annual inflation rate was then applied from 2025 onward within the financial model. The capital costs for each vehicle type are summarized in *Table 6-5*.

Table 6-5: Vehicle Purchase Costs

Vehicle	ICE Purchase Cost	EV Purchase Cost	Cost Factor	Notes
Light-duty Vehicle 1 (LD1)	$38,813	$56,923	1.47	Historical purchase price from 2015 onward and adjusted for inflation
Light-duty Vehicle 2 (LD2)	$41,210	$60,438	1.47	Historical purchase price from 2015 onward and adjusted for inflation
Medium-duty Vehicle 1 (MD1)	$67,876	$138,153	2.04	Historical purchase price from 2015 onward and adjusted for inflation
Medium-duty Vehicle 2 (MD2)	$38,610	$78,585	2.04	Historical purchase price from 2015 onward and adjusted for inflation
Heavy-duty Vehicle 1 (HD1)	$148,646	$327,414	2.20	Historical purchase price from 2015 onward and adjusted for inflation
Heavy-duty Vehicle 2 (HD2)	$277,718	$1,000,000	2.20	Historical purchase price from 2015 onward and adjusted for inflation
Heavy-duty Vehicle 3 (HD3)	$261,722	$576,480	2.20	Average of all class 8 vehicles

6.1.2.2 Vehicle Maintenance

Maintenance cost inputs were developed using annual service data provided by the County. Average costs were calculated for each representative vehicle group and used as baseline values. For EVs, a 10% reduction was applied to reflect lower maintenance needs due to fewer moving parts[15].

Once the cost per mile was established, a 2% annual inflation rate was applied year over year within the financial model. Final values are expressed in dollars per mile, shown in Table 6-6.

[14] Inflation assumption of 2% reflects the Federal Reserve's long-run target and historical averages. https://www.federalreserve.gov/economy-at-a-glance-inflation-pce.htm

[15]

Table 6-6: Vehicle Maintenance Costs

Vehicle	ICE Maintenance ($/mile)	EV Maintenance ($/mile)
Light-duty Vehicle 1 (LD1)	$0.24	$0.22
Light-duty Vehicle 2 (LD2)	$0.27	$0.24
Medium-duty Vehicle 1 (MD1)	$0.51	$0.46
Medium-duty Vehicle 2 (MD2)	$0.34	$0.30
Heavy-duty Vehicle 1 (HD1)	$0.66	$0.60
Heavy-duty Vehicle 2 (HD2)	$3.32	$2.99
Heavy-duty Vehicle 3 (HD3)	$2.85	$2.56

6.1.2.3 Fuel

Fossil fuel costs were determined using data provided by the County and are expressed in dollars per gallon. The Los Alamos Department of Public Utility (DPU)) average on-peak rate was used for the electricity cost based on an electricity bill provided by the County, expressed in dollars per kWh. All fuel types were also forecasted using the US Energy Information Agency trends for the respective energy types.[16]

After the base fuel costs were determined, an inflation rate of 2% was applied. The fuel cost inputs are summarized in Table 6-7.

Table 6-7: Fuel Costs

Fuel Type	Cost	Units
Diesel	$2.64	$/gal
Gasoline	$2.49	$/gal
Electricity	$0.11	$/kWh

6.1.2.4 Facility Infrastructure and Charging Equipment

Estimates for the facility infrastructure and charging equipment were developed based on a combination of sources including recent Los Alamos County project cost breakdown for the installation and equipment cost

[16] https://www.eia.gov/outlooks

of Level 2 chargers at the Municipal building (July 2025). Such estimates were also compared and adjusted based on historical costs from similar project installation that Stantec has conducted. The facility modifications to accommodate charging infrastructure will be phased in overtime in accordance with the vehicle procurement timeline described in Section 3.2-Implementation Strategies and following the equipment and timeline specifications as described in Section 4.2-Infrastructure Implementation Plan. Following the structure of the recent project cost and based on Stantec's experience installing over 800 charger plugs across the US, the infrastructure and charging equipment cost was broken down following the categories and assumptions described in Table 6-8.

Table 6-8: Facility Modifications and Charging Equipment Cost Assumptions.

Cost Category	Cost Type	Included Items	Unit Type	Estimate
Site Preparation, demolition, and construction	Fixed	Site prep/demolition, new concrete and asphalt, landscape, barricades, painting, labor, site clean-up, bonds 3%, mobilization 4%, taxes 7.0625%	Total per site (applied when more than 3 plugs are installed at once)	$290,000
Charger Installation	Per unit	Labor to just install chargers, cost of electrical conduct and related electrical work, charger bases and bollards.	$/plug	$12,000
L2 Charger Equipment Procurement	Per unit	Based on current quote for L2 from Charge Point but assumes a 25% price reduction after standardizing procurement and securing one compatible charge management system.	$/plug	$10,000
DCFC Equipment Procurement	Per unit	Assumes the cost of centralized/ rectifiers units that can be connected between 4 and up to 8 plugs. Power between 75kW and 150kW per plug.	$/plug	$60,000
DPU grid connection upgrade and transformer	Fixed	Power utility related expenses to upgrade connection, cost of transformer and switchgears.	Total per site (applied when more than 50kVA of capacity is needed at once)	$35,000
Contingency	Fixed	Applied as an added percentage to the total site cost estimation.	Total per site	20%

Following this cost assumption breakdown, it was possible to generate an infrastructure related capital investment per site for each year but for simplicity, the aggregated cost estimates per site for each phase are summarized in tables for the EV-policy scenario and for the CAP-policy scenarios, Table 6-9 and Table 6-10 respectively. Additional details about the exact charger count and year of implementation are presented in Section 4.2-Infrastructure Implementation Plan.

Table 6-9: Facility infrastructure and charging equipment costs by year for EV-Policy scenario

Facility	2026- 2035	2036 - 2043	2044 - 2050
Municipal	$-	$49,613	$49,757
Justice Center	$-	$-	$-

Facility	2026- 2035	2036 - 2043	2044 - 2050
Mesa Public Library	$-	$-	$-
PCS1	$440,059	$135,178	$74,419
PCS3	$390,446	$85,565	$24,806
PCS5	$525,623	$74,419	$-
LA Senior Center	$464,865	$24,806	$24,806
ECO Station	$128,099	$-	$-
Fuller Lodge	$464,865	$-	$-
Fire Station at Golf	$-	$-	$-
Golf Course	$24,806	$-	$-
LA Wastewater	$-	$-	$-
Ice Rink	$-	$-	$-
LA Airport	$-	$-	$-

The CAP Policy infrastructure costs are summarized by phase below.

Table 6-10: Facility infrastructure and charging equipment costs by year for CAP-Policy scenario

Facility	2026- 2035	2036 - 2043	2044 - 2050
Municipal	$-	$74,419	$-
Justice Center	$-	$96,806	$-
Mesa Public Library	$-	$-	$-
PCS1	$539,284	$416,678	$1,101,197
PCS3	$-	$152,905	$110,371
PCS5	$712,929	$1,106,849	$1,112,343
LA Senior Center	$489,671	$49,613	$-
ECO Station	$24,806	$427,824	$195,936
Fuller Lodge	$514,478	$24,806	$-
Fire Station at Golf	$-	$85,565	$-
Golf Course	$24,806	$-	$85,565
LA Wastewater	$24,806	$85,565	$171,130
Ice Rink	$49,613	$-	$-
LA Airport	$-	$-	$85,565

6.2 Comparison and Outcomes

The cost comparison between the ICE-only Case, the EV Policy Case, and the CAP Policy Case is presented in Table 6-9, incorporating both capital and operating expenses. Over the 25-year horizon, the ICE-only Case has a total cumulative cost of $82.6 million, the EV Policy Case has a total cumulative cost of $88.3 million, and the CAP Policy Case has a total cumulative cost of $110 million. The EV Policy and CAP Policy Cases are 7% and 33% more expensive than the ICE-only Case, respectively. However, CAP Policy scenario maintenance and fuel costs are $3 million lower than the ICE-only scenario, and EV Policy scenario maintenance and fuel costs are $750,000 lower than the ICE-only scenario over the 25-year timeline. This reflects the lower cost of electricity compared to gasoline and diesel, as well as reduced routine maintenance requirements of EVs compared to conventional vehicles.

The EV Policy scenarioreflects the County's current procurement approach of adding two EVs per year, meaning these costs and benefits would occur under the existing trajectory. In contrast, the CAP Policy scenario represents a more ambitious strategy aligned with the County's climate goals, requiring accelerated fleet electrification and associated infrastructure investments. While this approach is more rigorous and entails higher upfront costs, assuming savings in maintenance and fuel can offset part of the increased purchase price and infrastructure needs. Overall, an additional $27.3 million would be required to achieve the CAP targets, as opposed to following current procurement policy. Is that an average of $1.092M more per year investment?

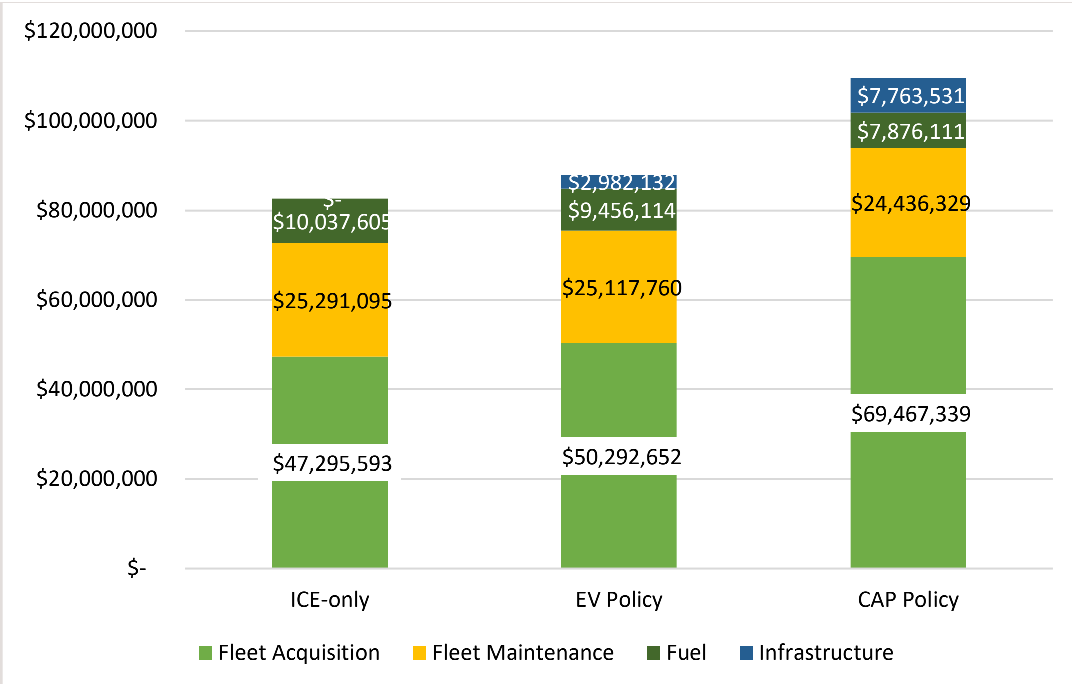
The financial assessment does not consider any grants or other alternative funding mechanisms. Therefore, there may be additional opportunities to offset the difference in the cost between the ICE-only Case and the EV cases.

Table 6-11: ICE-only Scenario, EV Policy Scenario, and EV CAP Scenario Comparison

Vehicle	ICE-only Scenario	EV Policy Scenario	CAP Policy Scenario	EV Policy vs CAP Policy Cost Difference
Fleet Acquisition	$47,295,593	$50,292,652	$69,467,339	$19,174,687
Fleet Maintenance	$25,291,095	$25,117,760	$24,436,329	$(681,432)
Fuel/Electricity	$10,037,605	$9,456,114	$7,876,111	$(1,580,003)
Infrastructure	$-	$3,446,997	$8,206,009	$4,759,012
Total	$82,624,293	$88,313,523	$109,985,788	$21,672,264

Figure 6-1 shows a breakdown of costs between the ICE-only scenario and EV scenarios. The procurement of EVs is $3 - $22 million more than the ICE-only scenarioe due to the higher purchase price of EVs compared to fossil fuel vehicles. Additionally, the conversion and upgrades to the facility for charging infrastructure represents an added cost of $3.5 - $8.2 million. Lastly, the use of electricity represents an economic benefit of $580,000 - $2.1 million over the life of the project when compared to the current use of fossil fuels. These savings are a direct reflection of the improved efficiency that EVs have with respect to legacy technologies, with the added benefit of eliminating tailpipe emissions.

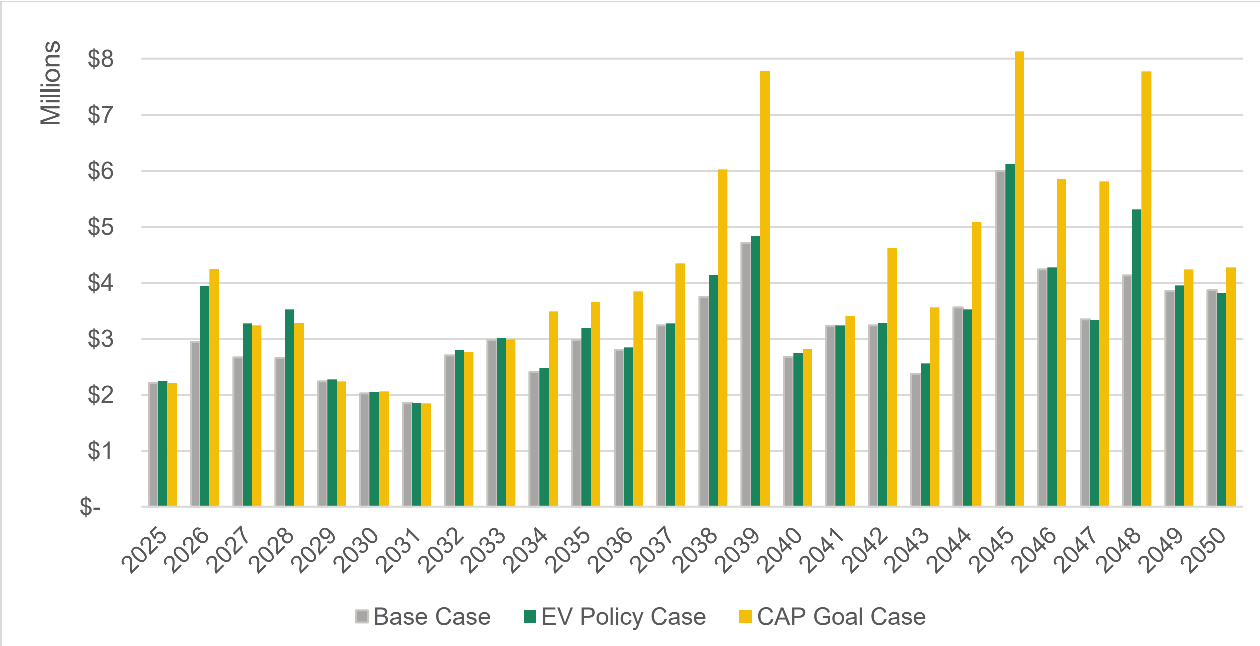
Figure 6-1: Cost breakdown of ICE-only Scenario and EV Scenarios



Finally, Figure 6-2 shows the year-to-year comparison between the ICE-only, the EV Policy, and the CAP Policy scenarios.. The higher costs for the EV scenarios occur during the years that facility modifications are conducted and when a greater number of vehicles are purchased.

The most significant cost increases are expected during high purchase years with added costs due to the installation of new charging infrastructure. The County may be able to offset some of the high costs through shifting some purchases to other years. While this approach reduces “sticker shock,” year that have many EV procurements may be advantageous when applying for large grants.

Figure 6-2: Annual cost comparison 2025-2050



7 Greenhouse Gas Emissions Analysis

One of the chief reasons for transitioning to EVs is to reduce pollution by removing the harmful byproducts of fossil fuel combustion from traditional combustion engines. While EVs eliminate all tailpipe emissions, there may still be upstream carbon emissions associated with the production of energy sources that power EVs. This section assesses the overall impact of the EV transition on harmful emissions.

The approach to model GHG production from the County's fleet considered 7 vehicle categories of 2 light-duty, 2 medium-duty, and 3 heavy-duty vehicles. This approach utilizes averages from each category to approximate what the County could expect to see. As shown in the equation below, the average annual miles per vehicle category was divided by the average vehicle modeled efficiency to provide total annual kWh per vehicle. Carbon intensity based on Los Alamos Department of Public Utilities (DPU) grid was applied to calculate the total converted metric tons[17] of CO_2e produced by each vehicle. Based on the Transition Schedule outlined in Section 4.0, the count of each vehicle category and technology distribution (EV vs Internal Combustion Engine (ICE)) provided an annual metric ton of CO_2e emitted by the County's fleet.

$$\frac{annual\ miles}{vehicle} \div \frac{miles}{kWh} = \frac{kWh}{vehicle} x \frac{gCO_2e}{kWh} = \frac{gCO_2e}{vehicle} x\ vehicle\ count\ x \frac{1}{10^6} = annual\ ton\ CO_2e$$

The annual electricity supply mix for Los Alamos County was established using the DPU FY2025 Q1-Q4 energy supply reports.[18] Reported MWh from each resource were summed to determine total consumption and the proportional share of carbon-emitting (Econ Purchases, Laramie River Station) and non-emitting resources (Mercuria, WAPA, Abiquiu, and EL Vado).

The carbon intensity for the Econ Purchases category was assigned using the U.S EPA eGRID 2022 emission factor for the WECC Southwest (AZNM) subregion.[19] The reported rate of 779.4 lb CO_2e/MWh was converted to 0.352 metric tons CO_2e/MWh and applied to all Econ Purchase MWh, as this supply is not tied to a specific single generation source. The carbon intensity for the Laramie River Station was calculated using 2024 emissions and generation data from the U.S. EPA Clean Air Markets Program Data and applied based on the County's annual share of MWh from this facility.[20]

Emission intensity was adjusted to reflect the planned addition of Foxtail Flats solar project in 2027. Based on projected annual solar generation, it was assumed that this energy will displace an equivalent share of

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[17] All GHG calculations are presented in metric tons of CO_2 equivalent (CO_2e), which is calculated using the short-term 20-year global warming potential of CO_2, methane, black carbon, and particulate matter.

[18] Q1 - https://indd.adobe.com/view/59cafca5-7418-49f4-bbad-6c96cff117e8
Q2 - https://indd.adobe.com/view/f6707156-8858-428f-a6c8-0c5108eba31b
Q3 - https://indd.adobe.com/view/139b8d4f-d3b7-407b-b74b-274084d39e41
Q4 - https://indd.adobe.com/view/f621f01d-6a2e-473f-9997-bb34eb01f7f0

[19] https://www.epa.gov/system/files/documents/2024-01/egrid2022_summary_tables.pdf

[20] https://campd.epa.gov/data/custom-data-download

Econ Purchases, resulting in an estimated 50% reduction in carbon-emitting supply from that category. The resulting grid mix yields an adjusted emissions intensity of approximately 227.8 gCO_2e/kWh for scenario modeling. Additionally, to reflect the DPU's stated goal of achieving a fully carbon-neutral electricity supply by 2040, a second scenario using a green-electricity emissions factor of 90 gCO_2/kWh was incorporated to represent long-term decarbonization. Below, the equations used to calculate energy production from carbon-emitting resources and to account for the Foxtail Flats displacement effect are presented.

Econ Purchases and Laramie River Station energy production per year:

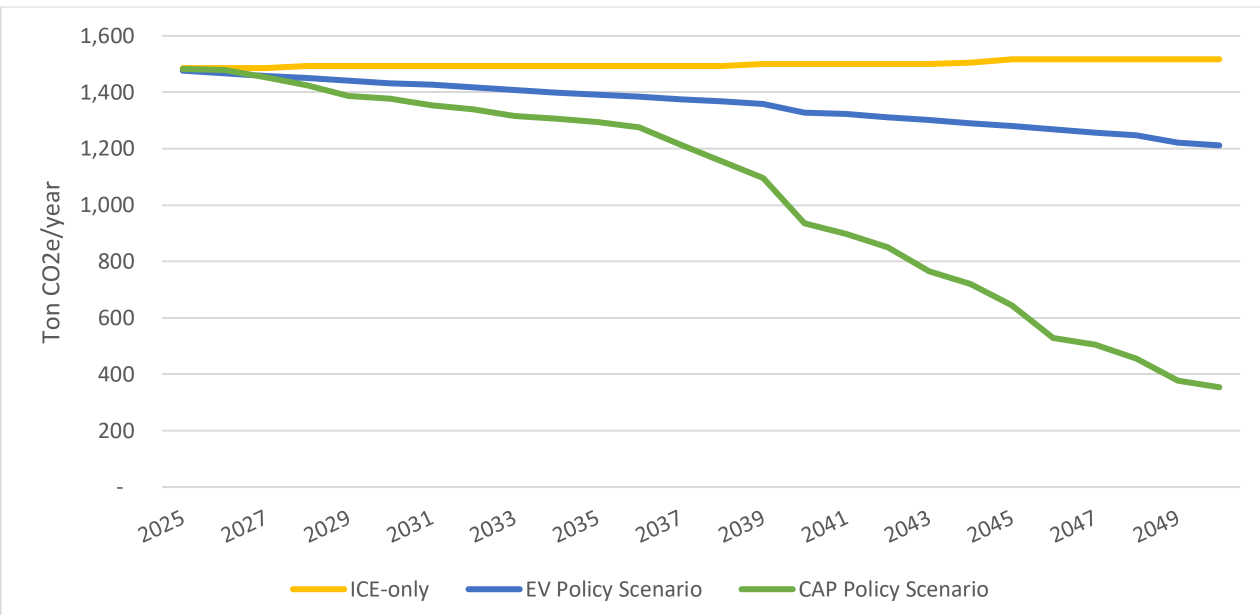
$$(MWhQ1 + MWhQ2 + MWhQ3 + MWhQ4)$$

Foxtail Flats[21] energy production per year:

$$(MWhQ1 + MWhQ2 + MWhQ3 + MWhQ4) \times 0.50$$

Due to the gradual transition to EVs, emissions are reduced as more ICE vehicles are phased out as shown in the figure below.

Figure 7-1: Annual CO_2e Emissions, 2025 - 2050



[21] https://www.losalamosnm.us/Initiatives/Foxtail-Flats-Solar-Power-and-Battery-Storage

Based on the ZEVDecide modeling methodology, the County's current fleet is estimated to emit an average of 1,499 metric tons of CO_2e in a year, inclusive of upstream emissions.[22]

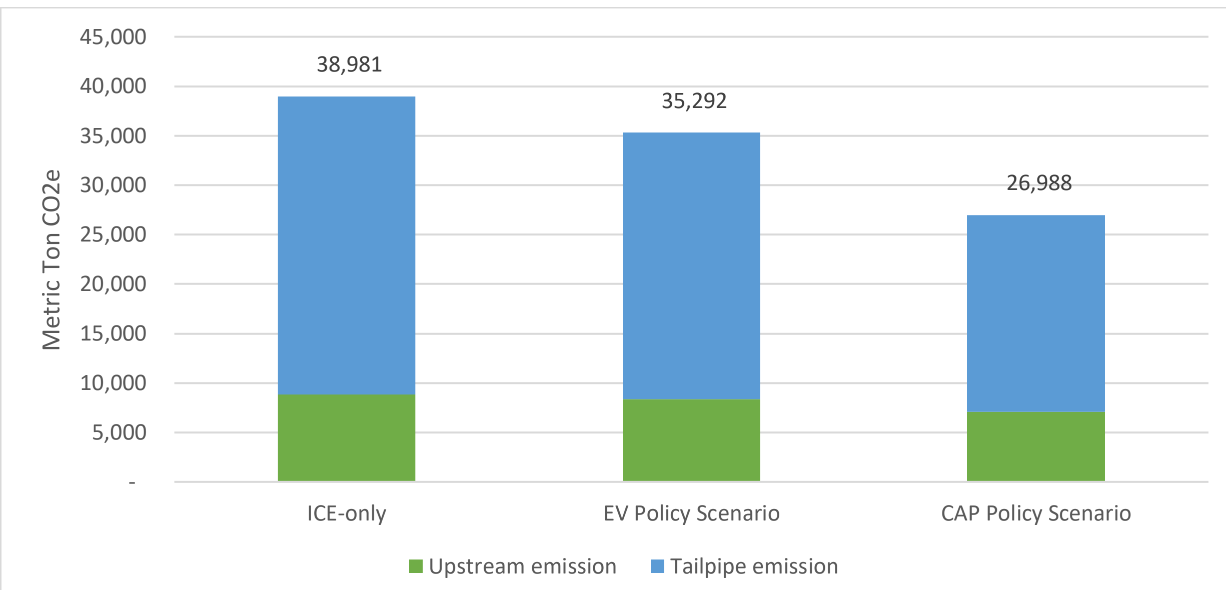
Through the analysis period (2025-2050), it was found that the future EV fleet will emit an approximate average of 1,357 metric tons of CO_2e annually, while the CAP Policy fleet emits 1,038 metric tons of CO_2e annually.

Table 7-1: Total Average Annual CO_2e Emissions (metric tons)

Average Annual Emission (metric ton CO_2e)	ICE-only	EV Policy	CAP Policy
Upstream Emission	340	323	273
Tailpipe Emission	1,159	1,035	765
Total	1,499	1,357	1,038

As shown in the figure below, transitioning to EVs will reduce the County's cumulative emissions from fleet operations by 3,689 metric tons of CO_2e for the policy fleet scenario, and by 11,993 metric tons of CO_2e for the CAP Policy fleet scenario. Of that total amount, 3,237 metric tons for the EV Policy and 10,243 metric tons for the CAP Policy will be tailpipe emissions, directly improving the air quality in the communities served by the Los Alamos County.

Figure 7-2: Cumulative CO_2e Emissions (metric tons) 2025-2050



[22] Upstream emissions are GHG emissions related to the production of the fuel used to power vehicles, such as emissions from the production of electricity used to power vehicles (https://www.epa.gov/greenvehicles/light-duty-vehicle-emissions)

Stantec used the annual emissions that will be displaced by the EV fleet, along with the EPA GHG equivalent calculator[23], to visualize equivalent benefits. As presented, implementing an EV fleet, whether policy or CAP Policy will eliminate emissions equivalent to removing 415,101 – 1, 349, 499 gallons of gasoline per year, recycling 1,304 – 4,238 tons of waste per year, reducing the need to plant 60,998 – 198,305 seedlings to capture carbon, or eliminating the energy use of 495 – 1,611 households in a year.

Figure 7-3: Equivalent GHG benefits of implementing an EV fleet (Policy)

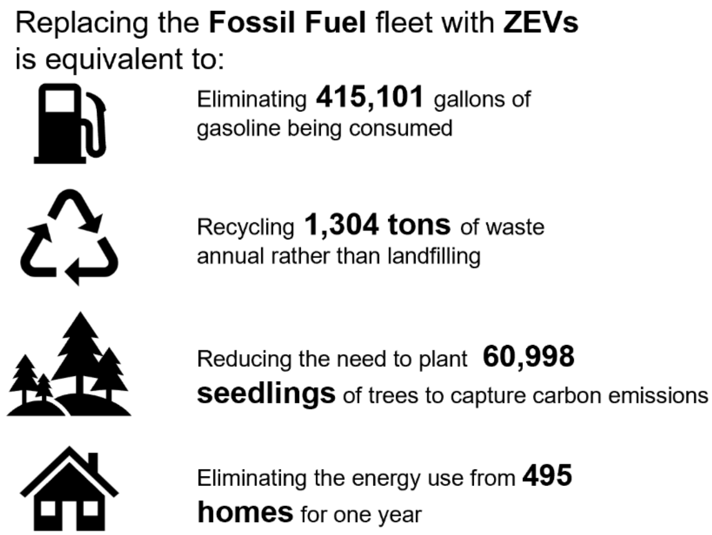
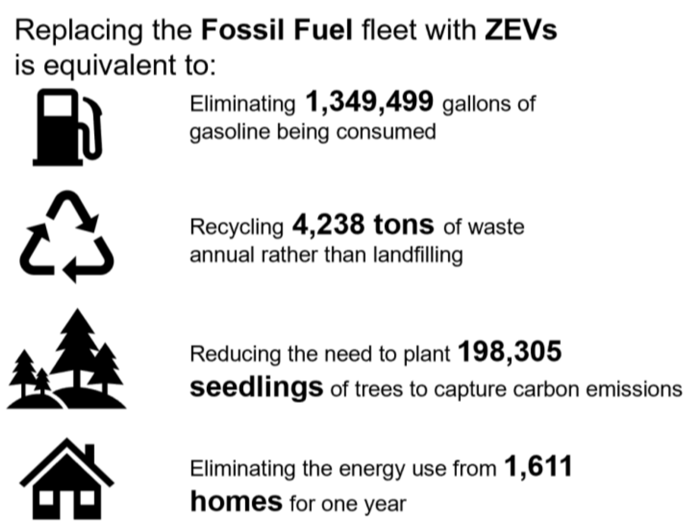


Figure 7-4: Equivalent GHG benefits of implementing an EV fleet (CAP Policy)



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[23] https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

Appendix A Summary of the Atomic City Transit ZE Transition Plan

ACT developed a Zero-Emission Fleet Transition Plan to fulfill the requirements of the Federal Transit Administration's Low or No Emission Grant Program (49 U.S.C. 5339(c)(3)(D)). The plan outlines ACT's strategy to transition to a 100% battery electric vehicle (BEV) fleet by 2045 and supports ACT's FY2025/2026 Low-No funding application. The plan is organized around six elements required by the FTA, summarized in the subsequent sections.

A.1 Fleet Assessment

ACT conducted vehicle performance modeling using operational data to evaluate zero-emission vehicle (ZEV) technologies. While hydrogen fuel cell vehicles demonstrated strong performance, BEVs were selected due to regional fuel supply limitations, infrastructure costs, and vehicle availability.

The transition plan includes operational adjustments such as increasing the fixed-route fleet by one vehicle and installing on-route charging infrastructure. Projected vehicle capital costs through 2045 total approximately $35.1 million, based on ACT's procurement history and industry benchmarks. ACT's fleet composition and estimated annual vehicle procurement costs are shown in Figure 7-4 and Figure 7-5 respectively.

Figure 7-5: Fleet Composition, Fixed Route and Demand Response

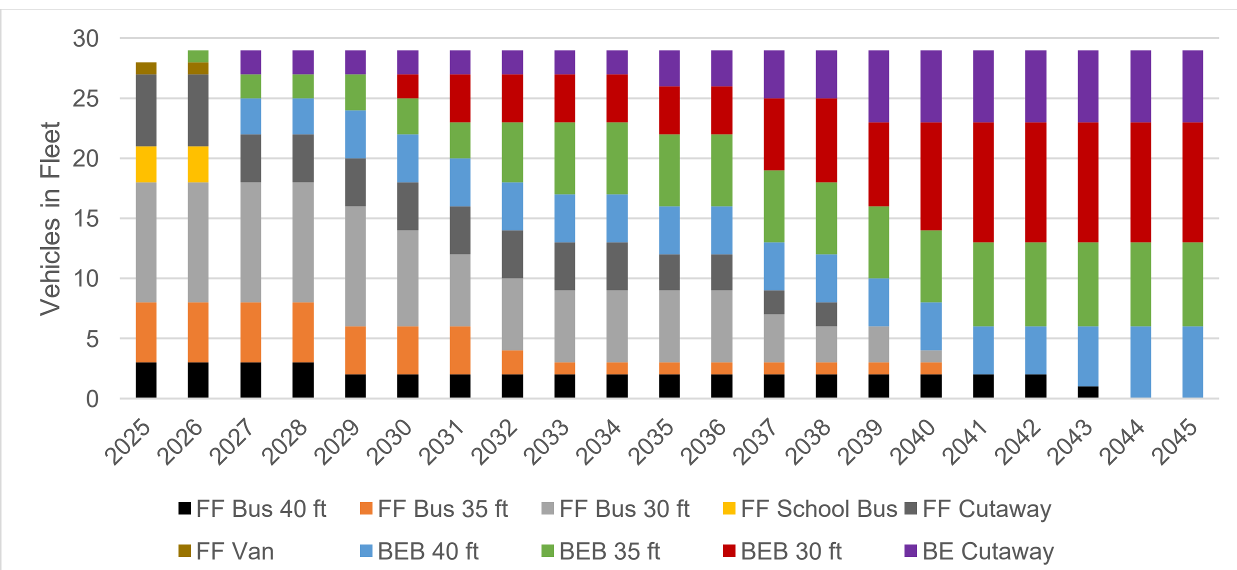
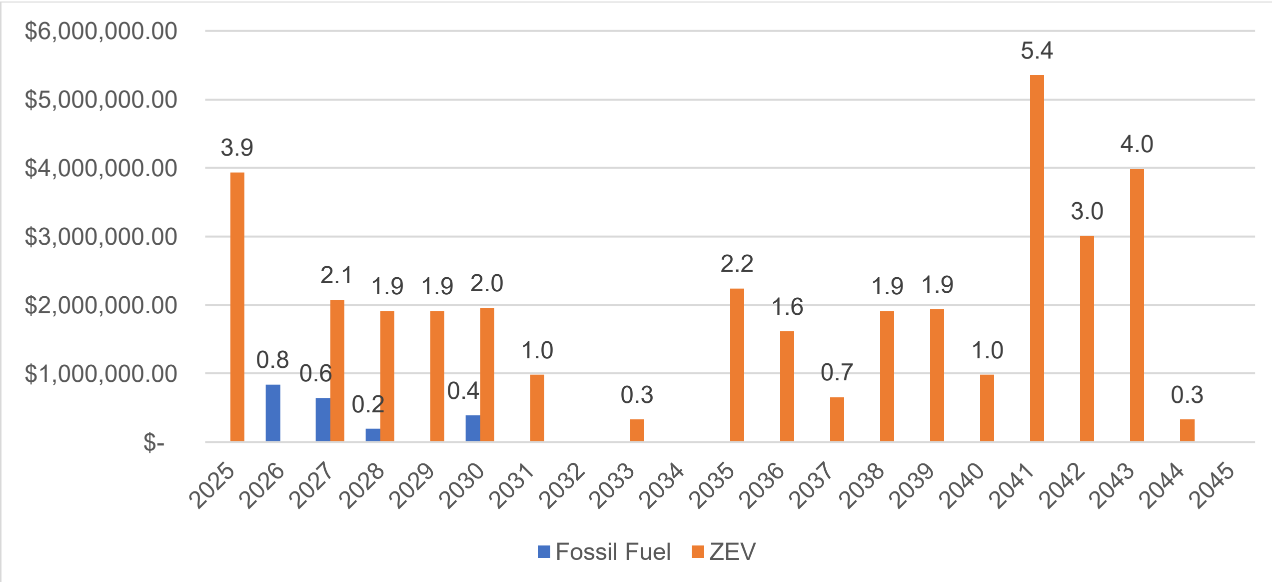


Figure 7-6: Annual Vehicle Procurement Cost



A.2 Funding Needs Assessment

ACT anticipates a total cost of $40.9 million for full fleet transition, including:

- $35.1 million for vehicle procurement
- $5.5 million for infrastructure and facility upgrades

While traditional formula funding may support portions of the transition, ACT expects to pursue additional funding sources to address the gap. The agency has previously received Low-No and state match funding and continues to explore federal, state, and local opportunities.

A.3 Policy Assessment

ACT's transition aligns with federal climate and equity goals, including the Bipartisan Infrastructure Law and Executive Order 14008. At the state level, the plan supports New Mexico's goal of reducing greenhouse gas emissions by 45% from 2005 levels by 2030 and achieving net-zero emissions by 2050. ACT's efforts also align with Los Alamos County's sustainability goals, including a 50% emissions reduction by 2030 and net-zero by 2045.

Relevant state and local policies include:

- New Mexico EV Program and Infrastructure Deployment Plan
- Clean Transportation Fuel Standard

- State fleet ZEV acquisition mandates
- Los Alamos Climate Action Plan and Strategic Leadership Plan
- Regional Electric Vehicle (REV) West collaboration

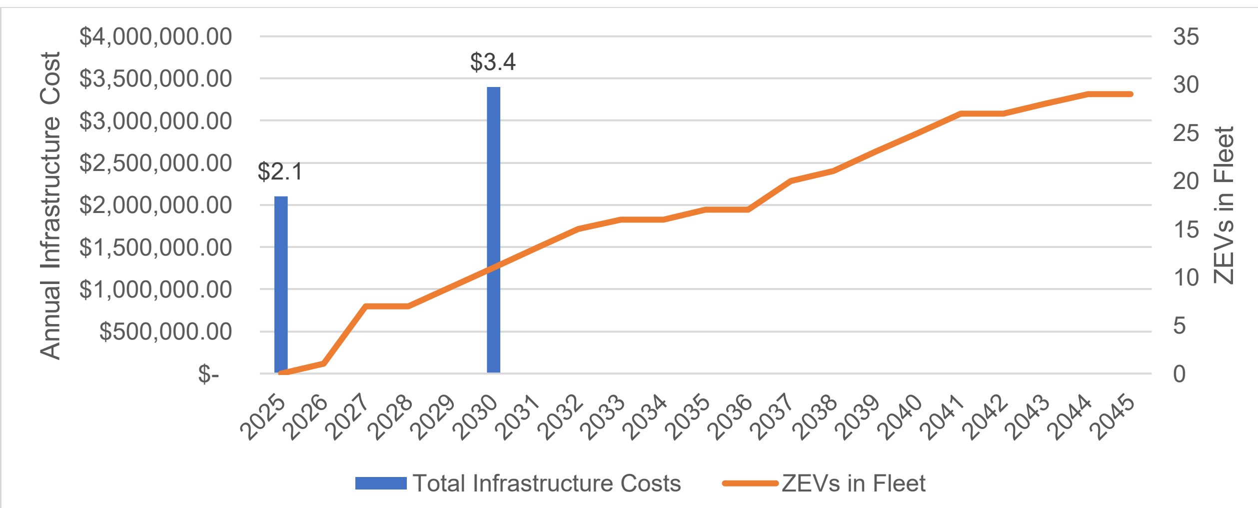
A.4 Facilities Assessment

ACT currently operates out of a shared facility equipped for diesel and gasoline vehicles. Infrastructure upgrades are planned to support 29 BEVs, including:

- Depot charging: 10 fast chargers (150 kW), 20 dispensers, and 6 Level 2 chargers
- On-route charging: 3 DC fast chargers (450 kW) with pantographs

Estimated infrastructure costs total $5.5 million, covering planning, power upgrades, equipment installation, and design engineering costs for the depot as well as on-route charging locations (Figure 7-6).

Figure 7-7: Depot and On-Route Charging Infrastructure Costs



A.5 Partnership Assessment

ACT is coordinating closely with the Los Alamos Department of Public Utilities (DPU) to plan grid-side and facility-side electrical upgrades. DPU has confirmed available capacity and will provide a letter of support. ACT also collaborated with the New Mexico Department of Transportation (NMDOT), which funded the fleet assessment and provided strategic guidance throughout the planning process.

A.6 Workforce Analysis

ACT has identified significant workforce development needs to support the transition. Key strategies include:

- OEM-led training for operators, maintenance staff, and first responders
- Apprenticeship programs and train-the-trainer models
- Use of specialized diagnostic tools and safety equipment
- Partnerships with local colleges and regional transit agencies
- Participation in national training programs and professional associations

ACT is requesting $292,840 in Low-No funding to support workforce development, including training, equipment, and PPE. Workforce development activities are aligned with the fleet transition timeline, with ongoing training planned through 2045.

A.7 Summary and Recommendations

The fleet performance modeling confirms that a full transition to BEVs is feasible and beneficial for ACT. The plan recommends periodic updates every 4–5 years to reflect evolving priorities, technology developments, and funding opportunities. While battery electric vehicles are the recommended technology, ACT will continue monitoring regional hydrogen developments and vehicle availability for future consideration.

Appendix B Existing Conditions & Market Scan

Appendix C County Facility Proposed Charging Siting

Stantec

Stantec is a global leader in sustainable engineering, architecture, and environmental consulting. The diverse perspectives of our partners and interested parties drive us to think beyond what's previously been done on critical issues like climate change, digital transformation, and future-proofing our cities and infrastructure. We innovate at the intersection of community, creativity, and client relationships to advance communities everywhere, so that together we can redefine what's possible.

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