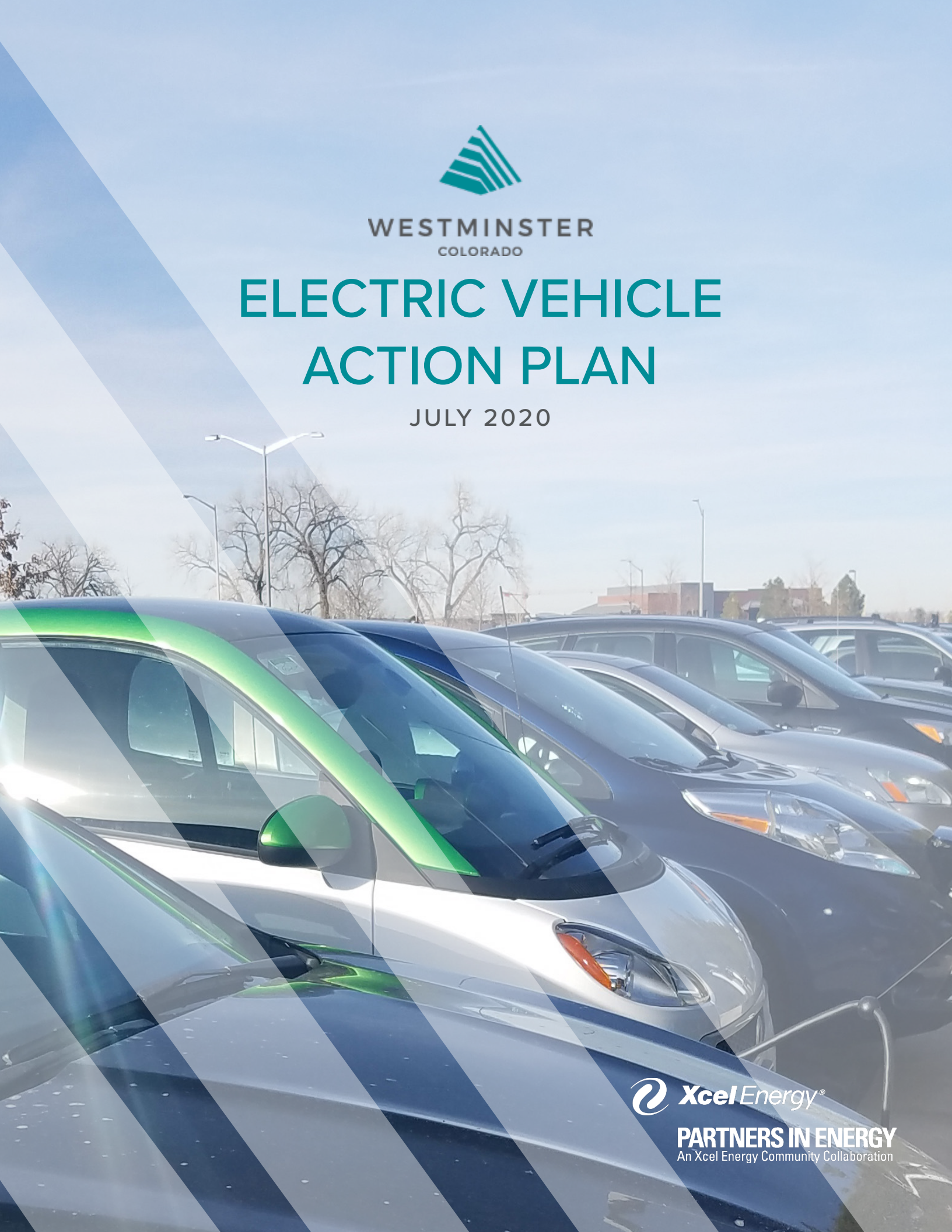
WESTMINSTER
COLORADO

ELECTRIC VEHICLE ACTION PLAN

JULY 2020



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ACKNOWLEDGEMENTS

Thank you to the following individuals who contributed many hours of service to developing this Electric Vehicle (EV) Action Plan.

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This Energy Action Plan was funded by and developed in collaboration with Xcel Energy's Partners in Energy.

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City of Westminster Electric Vehicle Action Plan

About this Plan

This Electric Vehicle Action Plan is a roadmap to strategically guide Westminster action in a manner that supports increased use of EVs throughout the City with a focus on City fleet conversion. The EV goals and strategies outlined in this plan were developed collaboratively with a stakeholder team, including representatives from the City of Westminster Department of General Services, Community Development, and Office of Sustainability.

Our Electric Vehicle Vision & Goal

Vision: The City of Westminster will be a regional leader in EV use by cost-effectively electrifying the City's fleet and paving the way for public adoption of EVs.

Goal: Reduce the emissions of ozone forming pollutants from vehicles in Westminster in support of the State's efforts to improve air quality through EV adoption as outlined in Colorado Electric Vehicle Plan 2020.

Our Roadmap for Achieving this Vision & Goal

To acheive this vision, the City of Westminster Electric Vehicle Action Plan is divided into three focus areas:

1. **Municipal Fleet Electrification**: Strategies aimed at converting the City's fleet vehicles to EVs and providing the requisite support to make this transition seamless for the organization and vehicle users.
2. **Public Charging Provided by the City**: Strategies aimed at increasing access to public charging at City facilities for Westminster residents and visitors.
3. **Encouraging Private Adoption**: Addresses actions the City can take to help increase adoption of EV by encouraging residents to purchase EVs for private use and commercial entities to consider fleet or commercial EV purchases.

Westminster's Electric Vehicle Baseline & Targets

	Municipal Fleet Electrification	Public Charging Provided by the City	Encouraging Private Adoption
2019 Baseline	BEVs made up 1% of the City's light duty fleet	3 of 14 public City facilities have at least one dual-port charger available	There were 4,356 registered EVs in Jefferson and Adams counties
2025 Target	Electrify 25% of the City's light duty fleet by 2025	Add at least one dual-port charger at 5 additional facilities by 2025	Increase the number of registered EVs in Jefferson and Adams counties above the 2019 baseline

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Summary of Strategies

The Westminster Electric Vehicle Action Plan has three focus areas, each with a suite of strategies intended to work toward the overarching plan vision. The following table lists the strategies, by focus area, included in the plan. The table shows how strategies help directly or indirectly acheive components of the plan vision.

Primary impacts of the strategies are marked with a filled circle. ● Secondary impacts are marked with an empty circle. ○	Regional Leadership	Cost Effectiveness	Paving the Way for Public Adoption
Municipal Fleet Electrification			
MF-1 Collect Fleet Telematics Data		●	
MF-2 Conduct a Life Cycle Analysis		●	
MF-3 Incorporate Total Cost of Ownership into Budget Process	●	○	
MF-4 Develop and Execute a Vehicle Replacement Plan	●		
MF-5 Develop an Infrastructure Installation Plan	●		
MF-6 Develop a Time-of-Use Charging Plan		●	
MF-7 Install Fleet Charging Infrastructure	●		
MF-8 Educate Employees on New Parking Restrictions and Use of Fleet EVs	●		
MF-9 Provide Adequate Training to Maintenance Staff	●		
Public Charging Provided by the City			
PC-1 Create and EV Charging Station O&M Budget	●		
PC-2 Identify Charging Station Locations	●		
PC-3 Install EV Charging Stations			●
Encourage Private Adoption			
PA-1 Publicize the City's Leadership	●		
PA-2 Publicize Availability of Charging Stations			●
PA-3 Educate Business Community about Charging Station Funding		○	●
PA-4 Share Information About the Logistics and Benefits of EV Ownership			●
PA-5 Coordinate EV Group Buys for Residents and Businesses		○	●
PA-6 Incorporate Stronger EV Requirements in City Code for New Development		○	●

INTRODUCTION

The content of this plan was derived from a series of planning workshops hosted by Xcel Energy's Partners in Energy. Partners in Energy is a two-year collaboration to develop and implement a community's energy goals. In 2019, Partners in Energy expanded their products to include an Electric Vehicle (EV)-specific planning process for communities to develop targeted plans to meet their electric vehicle adoption related goals, aligned with their overall energy planning efforts. For more information about the planning workshops, see Appendix A: Xcel Energy's Partners in Energy EV Planning Process.

Throughout this process, community facilitators worked closely with City staff and Xcel Energy staff to identify available Xcel Energy programs or rebates - such as the Fleet Electrification Advisory Service (FEAP) or the Electric Vehicle Supply Infrastructure (EVSI) programs - that could be leveraged to support community initiatives. For more information about Xcel Energy EV programs, see Appendix B: Available Resources.

What Is an EV Action Plan?

This Electric Vehicle Action Plan is a roadmap to strategically guide Westminster action in a manner that supports increased use of EVs throughout the city, with a focus on City fleet conversion.

The EV goals and strategies outlined in this plan were developed collaboratively with a stakeholder team, through two planning workshops conducted in March and April of 2020. Since successful deployment of many EV strategies relies on collaboration between the City and Xcel Energy, representatives from both organizations were included. The City of Westminster team included representatives from the municipal fleets, public parking management, and sustainability departments. The Xcel Energy

team included experts in electrical infrastructure, billing, EV fleet advisory programs, and community communications. Team members coordinated throughout the process to share information and identify potential opportunities for partnership during implementation.

Westminster joined more than 29 other Colorado communities that have developed EV and energy action plans through Xcel Energy's Partners in Energy, an offering that provides resources for community energy planning. Partners in Energy also supports 18 months of plan implementation in the form of marketing and communications, data tracking and analysis, program expertise, and project management.

The components of Westminster's EV Plan are detailed below:

Introduction A look at Westminster's motivations for developing an EV Action Plan, and the relevant characteristics of the Westminster community.

Where are We Going? Describes Westminster's EV vision and goals through a planning horizon of 2025.

How are We Going to Get There? Identifies focus areas and strategies to achieve the defined goals, along with targets and metrics that quantify success in each focus area.

How Will We Stay on Course? Outlines how the City will track progress toward targets, goals, and vision, and how it will adapt to a changing landscape during the coming five-year implementation period.

Appendices Provide additional information about the planning process, next steps, EV basics, and current Xcel Energy Programs.

Why an EV Action Plan?

In 2020, the City of Westminster drafted its first Sustainability Plan to provide a guiding framework for achieving a vision of being one of the most sustainable cities in America.

Transportation was identified as one of the Sustainability Plan's key focus areas, given transportation's significant contributions to poor air quality, increased greenhouse gas emissions, and increased cost of living for many Westminster residents. The Sustainability Plan specifically identifies EV adoption as a critical element in reducing greenhouse gas emissions and improving air quality within the city. Furthermore, the Sustainability Plan sets forth targets and high-level strategies for increasing the share of EVs in Westminster. Ultimately, this Electric Vehicle Action Plan seeks to provide a more detailed roadmap for the City to implement these strategies and push Westminster toward a more sustainable future. More information on the key drivers for development of this EV action plan are provided below.

Air Quality

The transportation sector is a major contributor of air pollutants such as particulate matter (PM), Nitrous Oxides (NOx), Carbon Monoxide (CO), and Volatile Organic

Compounds (VOCs). Pollutants like NOx and VOCs contribute to ground-level ozone which, in addition to PM and CO, are harmful to respiratory health. In 2019, the Denver metro area (which includes Westminster) was upgraded by the EPA from "Moderate" to "Serious" nonattainment for the 2008 ozone 8-hour National Ambient Air Quality Standard (EPA, 2019). The Denver metro area falls into the "Serious" nonattainment for CO (EPA, 2020) category. Hybrid Electric Vehicles (HEVs) produce fewer tailpipe pollutants as compared to their internal combustion engine (ICE) counterparts; and in Battery Electric Vehicles (BEVs) these emissions are eliminated completely (Office of Energy Efficiency & Renewable Energy, 2020). Air pollutants are produced as a byproduct of electricity generation using fossil fuels and will vary based on the generation mix, emissions factors, etc. As Xcel Energy works toward its carbon-free goal and more renewable energy sources are added to the generation mix, the magnitude of air quality benefits associated with electrifying transportation will continue to increase.

Greenhouse Gas Emissions

On December 12, 2015 at the United Nations Framework Convention on Climate Change (UNFCCC), the Paris Agreement was reached to "combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low carbon future" (UNFCCC, 2019). In support of this effort, the Intergovernmental Panel on Climate Change (IPCC) published a report in 2018 identifying potential ways to keeping global temperature change less than 1.5°C and emphasized the important role that cities have in the urban transition. Among other strategies, the IPCC stated that "the transport sector must reduce its final energy use by 30% and must supply the majority of energy with low carbon fuels like electricity, hydrogen, and biofuel by 2050 in order to limit global warming to less than 1.5°C and mitigate the worst impacts of climate change" (IPCC, 2018).

Westminster's 2020 Sustainability Plan commits to supporting the State's GHG reduction goal: achieving a 90% reduction in GHG emissions by 2050 from 2005 levels. In 2017, the City of Westminster completed a GHG inventory, which revealed that 48% of Westminster's emissions are from the transportation sector. Thus, the transportation sector represents the greatest area of opportunity for helping support the State's goal.

Transportation Costs

As a community with many inter-city commuters, reducing transportation expenses could yield significant savings for Westminster's community members. Over its lifetime, an EV tends to cost 50% less to own and operate as compared to its ICE counterpart (US DOE, 2019). Though upfront costs of EVs are still greater than ICE vehicles, this gap is expected to decrease as technology matures, production scales, and batteries become more efficient and cost effective to manufacture.

Community Characteristics

This section describes the basic community characteristics used to better understand the opportunities for transportation electrification in Westminster. Factors such as

population growth, demographics, housing, and industry employers help contextualize current and future opportunities for targeted outreach and partnerships. EV-specific baseline data, such as EV ownership and infrastructure, is presented in each subsequent relevant focus area.

Geography

Westminster is a suburb northwest of Denver, Colorado, and is split between Adams and Jefferson counties. Westminster encompasses 34 square miles (Figure 1) and is located adjacent to I-25 and bisected by US-36 and US-287. These transportation features connect Westminster to its surrounding neighbors including Boulder, Broomfield, Thornton, and Denver.

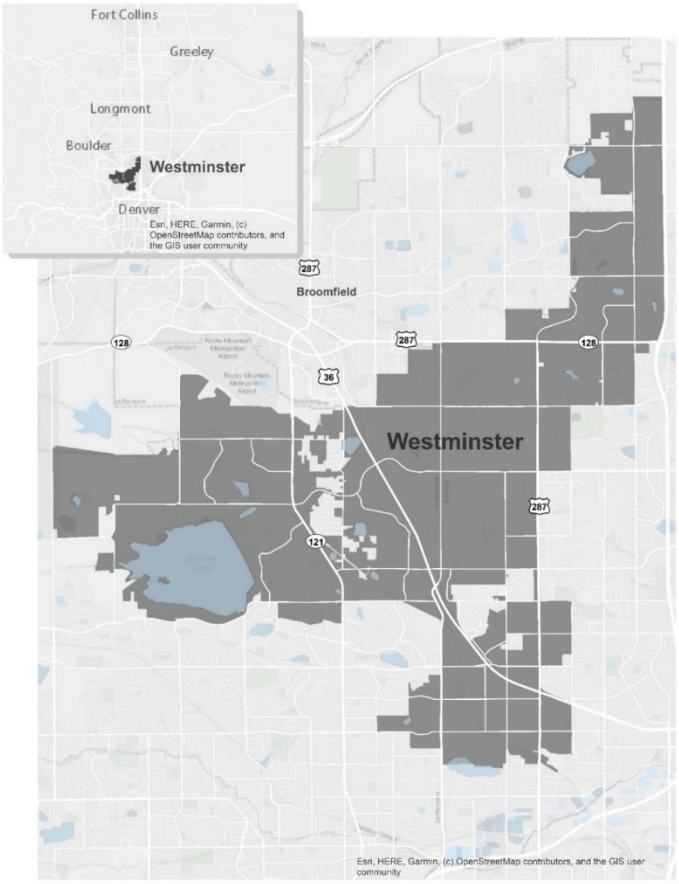


Figure 1: Westminster City Limits

Population

As of 2019, Westminster's population is estimated at over 113,000 people (US Census Bureau, 2019). Westminster saw its largest population growth between 1970 and 1980, as it grew from about 19,500 more than 50,000 (City of Westminster, 2020). Since then, Westminster has seen a slowing of the growth rate - to about 0.9% annually between 2008 and 2018 (Department of Local Affairs, 2018). This slower growth rate has allowed the City to shift its focus from extending infrastructure to accommodate rapid growth, to bolstering and improving existing systems. Adding EV charging options to existing infrastructure is an excellent opportunity for the City to strengthen and adapt its transportation system.

Housing Characteristics

Two major housing factors facilitate a resident's ability to convert their personal vehicle to an EV: home ownership and residence type. Data shows that 80% of current charging takes place at home as opposed to using commercial or public infrastructure (Office of Energy Efficiency & Renewable Energy, 2020). Homeowners experience fewer barriers to installing EV charging infrastructure because they do not need to seek permission of the property owner to do so, and the investment in infrastructure will likely increase the value of their property. Alternatively, renters may not have permission from the homeowner to install charging infrastructure and/or may be reluctant to invest in improving property they do not own. Single-family residences are more likely to have personal garage space or carports to facilitate installation of charging stations rather than relying on street parking or shared parking facilities. In Westminster, 52% of homes are owner-occupied, single-family detached homes (US Census Bureau, 2020). This suggests there are significant opportunities for residents to adopt EVs using at-home charging infrastructure as their primary charging location. Of the single-family homes in Westminster, over 80% are more than 20 years old. This may increase the cost of installing home charging stations, as the panels may need to be upgraded to accommodate the installation of a circuit breaker for the charging equipment (Gaton, 2018). Though many homes in Westminster are both single family and owner occupied, there still exists opportunity to support the adoption of EVs and EV charging infrastructure in both multi-family and rental properties - to support broader EV adoption across demographics.

Commuting Characteristics

Westminster has a significant number of residents who travel to neighboring communities for work. Of Westminster's working population, 90% are employed outside the city (U.S. Census Bureau, 2017). Similarly, almost 90% of Westminster's jobs are held by employees who live outside Westminster. The average commute time for

Workplace Charging

Studies have shown that employees of workplaces with EV charging are six times more likely to own an electric vehicle than those at workplaces without EV charging. Though most of EV charging occurs at home, supporting the adoption of EV charging at commercial facilities is an important strategy to bolster EV adoption overall. (U.S. DOE, 2016)

Westminster's working population is approximately 27 minutes, and 80% of Westminster's working population drives alone to work (U.S. Census Bureau, 2018).

With the significant number of people commuting both in and out of Westminster (for work) in personal vehicles, there is a tremendous opportunity to convert these miles from ICE vehicles to EVs to improve local air quality, reduce GHG emissions, and reduce residents' transportation costs. Westminster can support this transition by supporting residents who want to install at-home charging stations, encouraging and increasing the number of local businesses with charging infrastructure (to provide charging for employees), and adding public infrastructure (to support pass-through motorists).

Transportation and Housing Costs

As with many other communities along the Colorado Front Range, Westminster home values have increased significantly - with 38% growth between 2005 and 2016 (BBC Research & Consulting, 2017). Housing costs are more than 30% of household income for almost 30% of Westminster residents, with an average annual cost of $17,200. In addition to housing costs, resident's transportation costs can have a significant effect on a location's affordability and livability. For Westminster residents, annual transportation costs range between 16% and 25% of annual income, with an average annual cost of $13,400 (CNT, 2020). Combined housing and transportation costs are represented in Figure 2. Since average transportation costs are nearly as much as housing costs for Westminster residents, reducing transportation costs can make the cost of living more affordable; and EVs typically cost about 50% less to own and operate than their ICE counterparts (US DOE, 2019). EVs will have a greater upfront cost than similar ICE vehicles, but group buys, rebates, or low-interest financing for EV purchases or installation of EV infrastructure can help make EV ownership more accessible.

Transportation Cost Savings

EVs provide cost savings primarily through fuel and maintenance savings. For instance, a 2019 Honda Civic may require approximately $900 in fuel and $3000 in annual operating and maintenance costs. A 2019 Chevrolet Bolt with the same driving patterns only requires $400 in fuel and $2,500 in operating and maintenance costs. The lifetime cost of the Civic exceeds that of the Bolt in year six of ownership, when tax credits are applied. (AFDC, 2020)

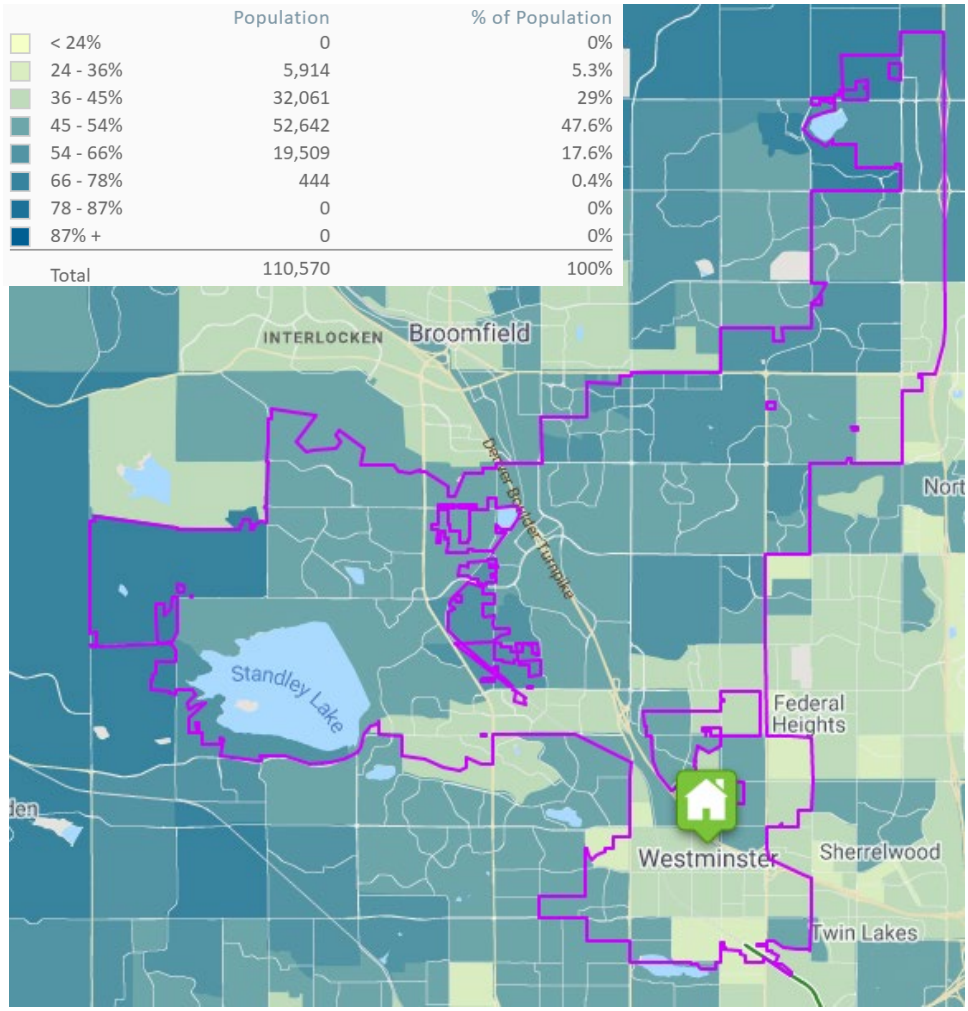


Figure 2. Housing and Transportation Costs as a Percent of Household Income

WHERE ARE WE GOING?

While the previous chapter explores the City of Westminster's motivations for developing an EV Action Plan and the community characteristics important in thinking about EV planning and adoption, this chapter begins to look forward to explore what the City of Westminster values and the City and the community want to be with regard to EV adoption and transit electrification in the next five years. The vision statement created during this planning effort serves as the overarching framework to guide this effort; while the goal helps interpret what success could and should look like. The focus areas prioritized below identify the areas in which the City will leverage specific strategies to make progress toward the vision and goal.

Our Vision Statement

The City of Westminster has been working on a plan to address sustainability more broadly, concurrently with this EV planning process. The following strategies to promote EV adoption were identified through community stakeholder input conducted as part of the Sustainability Planning effort and serve as the foundation for the development of the EV Action Plan.

1. Advance City Fleet Vehicle Electrification and Infrastructure Development on City Property
2. Encourage Private Electric Vehicle Adoption and Infrastructure Development

Based upon these broad EV strategies in the Sustainability Plan and feedback from the EV stakeholder team, the following Electric Vehicle Plan vision statement was created to guide the development of this roadmap.

City of Westminster's Electric Vehicle (EV) Action Plan Vision

The City of Westminster will be a regional leader in EV use by cost-effectively electrifying the City's fleet and paving the way for public adoption of EVs.

EV Action Plan Goal

As noted above, local air quality concerns are a significant driver for the development of Westminster's EV Action Plan. Air pollution can have a variety of detrimental health effects and disproportionately impacts children and residents with asthma or other chronic health conditions. These impacts can result in economic hardships including increased healthcare costs as well as lost workdays. Transportation emissions are the main source of NOx, which become pollution causing ground ozone when exposed to sunlight. This means that reducing tailpipe emissions through EV conversion can be one of the effective means to address air quality concerns.

Westminster is part of a larger transportation network that serves the Denver metro area, so addressing the air quality concerns in the region will require collaboration with other regional communities. The Colorado Electric Vehicle Plan 2020 outlines the State's plan to reduce the amount of ozone pollutants by up to 800 tons of NOx and 800 tons of VOCs, and this planning effort (along with the City's Sustainability Plan) represent the City of Westminster's commitment to supporting the State initiative. To show this commitment, the stakeholder team elected to represent the following goal as singularly representative of achieving EV adoption targets and broader environmental air quality metrics.

City of Westminster's Electric Vehicle (EV) Action Plan Goal

Reduce the emissions of ozone forming pollutants from vehicles in Westminster in support of the State's efforts to improve air quality through EV adoption as outlined in Colorado Electric Vehicle Plan 2020.

Focus Areas

To start building a community-wide commitment to transportation electrification, City staff identified the following focus areas to prioritize strategies and resources. These focus areas were chosen to align with priorities in the community sustainability plan as well as focus on areas of opportunity that City staff can influence directly.

- **Municipal Fleet Electrification**. Convert the City's ICE fleet vehicles to EVs and provide the requisite infrastructure and support to make this transition seamless for vehicle users.
- **Public Charging**. Install charging infrastructure on City properties to show support for EV adoption and increase access to public charging for Westminster residents and visitors.
- **Private Adoption**. Encourage residents to purchase EVs for private use through education and outreach as well as EV-friendly policies.

These focus areas were chosen to provide an overarching approach to vehicle transportation electrification within Westminster, with the focus on "leading the community EV transition by example."

Strategies

For each focus area, City stakeholders identified priority strategies to be implemented over the next 5 years to kick-off Westminster's EV transition. In the following sections, the priority strategies are outlined along with: key milestones necessary for successful implementation, anticipated timeline, and funding resources available. In addition, the following symbols are used to indicate the expected cost to implement the strategy as well as to indicate if 3rd party funding may be available:

This project can be paid for from the standard operating budget.

A special budget ask will be required for this project

Xcel Energy programs or grant money could help fund this strategy.

For more information on available Xcel Energy programs or other 3rd party funding, see Appendix B: Available Resources.

HOW ARE WE GOING TO GET THERE?

For each identified focus area, a thorough analysis of baseline conditions was completed to inform target setting and strategy development. Based on this analysis, the EV Action Team identified targets and metrics to help evaluate progress and success in achieving focus area objectives. The team then identified potential barriers to success in achieving focus area objectives and developed strategies to help overcome those barriers.

The following sections detail the baseline data, potential barriers, identified targets, and strategies selected to achieve those targets for each focus area. Collectively, each focus area serves as a work plan of actionable steps to achieve Westminster's EV Action Plan overarching vision.

Focus Area: Municipal Fleet Electrification

This focus area contains strategies aimed at converting the City's fleet vehicles to EVs and providing the requisite support to make this transition seamless for the organization and vehicle users. This includes installing charging infrastructure, providing appropriate training for vehicle users and maintenance staff, and making any necessary adjustments to budgeting or other City processes in order to facilitate vehicle purchase and operation.

Background

The City of Westminster owns and operates about 400 on-road assets ranging from passenger vehicles to heavy duty construction equipment. Given the current state of EV technology, the City's light duty fleet was identified as the greatest opportunity for electrification over the next five years. The City of Westminster's light duty fleet includes approximately 90 vehicles, ranging from sedans to 4x4 pickup trucks. Figure 3 shows

the light-duty vehicles due for replacement over the next 5 years, based on the age of the vehicle, ongoing maintenances costs, and vehicle mileage.

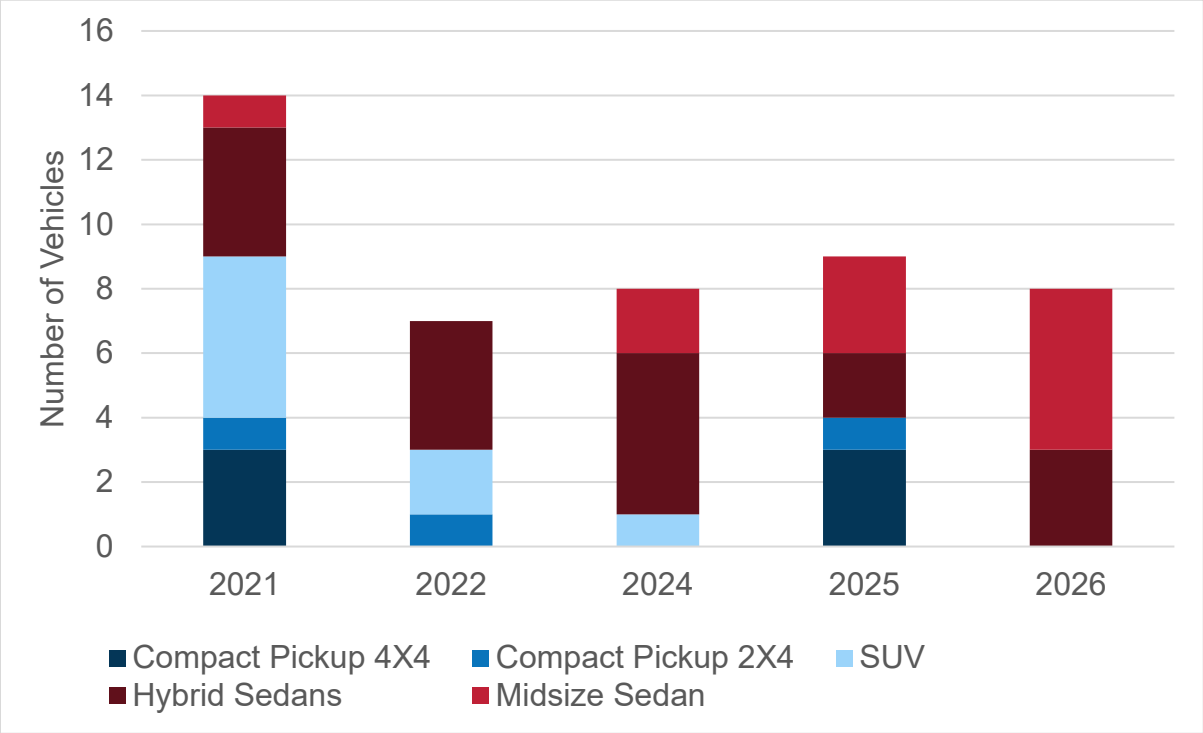


Figure 2. Westminster Vehicle Replacement Plan FY2021-2026 by Vehicle Type

Of the vehicles shown above, the City of Westminster identified 32 potential candidates for electrification over the next five years. These vehicles will be the targets of the strategies outlined in this focus area. Current EV technology provides excellent options for sedans, and some options for SUVs; but pickup truck options are currently limited. Future updates to this plan may consider exploring additional vehicle types for electrification as EV technologies improve and more EV models are commercially available. In order to best determine vehicle priorities and optimal paybacks, using telematics data to analyze usage patterns, duty cycles, and parking locations will be essential to providing a more accurate assessment of which vehicles are ideal for electrification as well as determining EV models that might be appropriate replacements.

Targets and Metrics

To track progress toward municipal vehicle electrification, and based on the analysis above, the Planning Team established the following focus area level target:

Electrify 25% of the City's light duty fleet by 2025.

Baseline: In FY2019, BEVs made up 1% of the City's light duty fleet vehicles.

Data Required:

- Total number of light duty fleet vehicles
- Number of EVs purchased annually

Data Source: Internal Tracking

Responsible Department: General Services

Frequency of Update: Annual

Additional Metrics:

- Operations and maintenance cost savings

Focus Area Timeline

The cumulative timeline for all strategies in this focus area are shown below. Most strategies in this focus area will start in FY2021; several strategies will be ongoing for the time horizon of this plan.

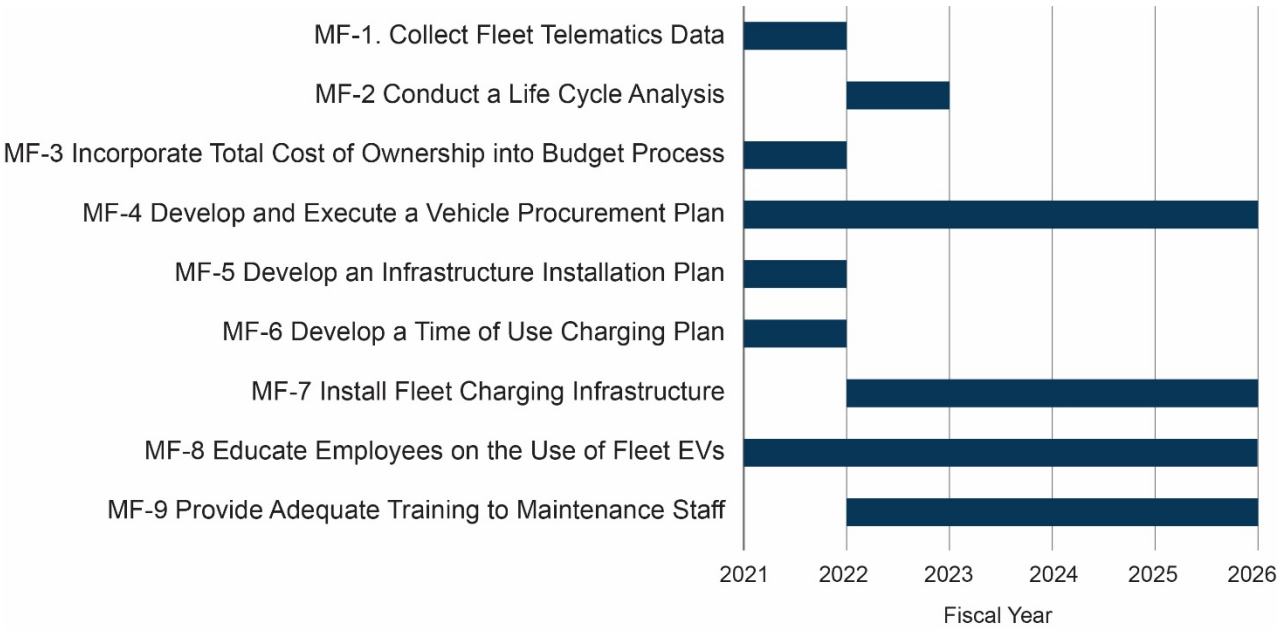


Figure 3. Municipal Fleet Electrification Timeline for All Strategies

MF-1 Collect Fleet Telematics Data

Install telematics on the selected light duty fleet vehicles to track use patterns including miles traveled, parking location, and idling time. Telematics data collection and analysis are key elements for recommending vehicle replacements, determining total cost of vehicle ownership, and identifying ideal charging locations. This data will provide the basis for identification of electrification opportunities within the current fleet.

Implementation

Start Year: FY 2021

City Lead: General Services

Xcel Energy Support: FEAP

Key Milestones

1. Procure and install hardware on selected light duty vehicles.
2. Set up portals for users to view collected data.
3. Complete at least 90 days of tracking and analysis of vehicle data (but a longer data collection period is preferable).
4. Review and analyze the collected data to inform vehicle and charging station recommendations in strategies MF-2, MF-4, and MF-5.

Timeline Considerations

This strategy will begin in early FY2021 so results are available in time to inform budget requests for vehicle replacement. In FY2022, there are four candidates for EV replacement- so it will be important to complete the telematics study in time to inform decision for FY2022 budget requests.

Funding Consideration and Available Resources

The City may need to make a budget request for the purchase of third-party telematics services.

Xcel Energy Programs and other Resources

- Xcel Energy's Fleet Electrification Advisory Program (FEAP) provides free telematics data collection and analysis for program participants. More information about FEAP is provided in Appendix B: Available Resources.
- Xcel Energy Partners in Energy – Implementation resources may be available pending execution of an MOU between the City and Xcel Energy. These resources can provide additional support to help coordinate FEAP participation.

MF-2 Conduct a Life Cycle Analysis

Using the telematics data collected in strategy MF-1, analyze the total cost of ownership (TCO) of a standard ICE vehicle and recommended appropriate EV replacement vehicle(s). This analysis should include acquisition cost, current fuel cost, vehicle use, projected changes in fuel and vehicle maintenance costs over the life of the vehicle, and expected salvage value.

Implementation

Start Year: FY 2021

City Lead: General Services

Xcel Energy Support: FEAP

These results should be used to identify those vehicles for which EV purchases meet the City's life cycle cost requirements, and to inform strategy MF-4.

Key Milestones

1. Calculate estimated life cycle cost for each vehicle, based on telematics data.
2. Flag vehicles that meet the City's criteria for EV replacement.

Timeline Considerations

This strategy will use the data collected in strategy MF-1 but needs to be completed before budget requests for FY2022 are due. As noted in MF-1, there are 6 vehicles due for replacement in FY2022 that may be candidates for EV replacement. This represents 25% of the targeted replacements by 2025, which means that evaluating these vehicles and replacing as appropriate will be an important step to meeting the City's fleet target.

Funding Consideration

City staff could complete these calculations in house or roll into a contract with a 3rd party telematics provider. This analysis should not require a separate budget request or outside funding.

Xcel Energy Programs and other Resources

- Xcel Energy's Fleet Electrification Advisory Program provides free telematics data collection and analysis for program participants. Total cost of ownership is part of the data analysis provided.
- Check with your insurance provider to see if they offer discounts for EVs.

MF-3 Incorporate Total Cost of Ownership into Budget Process

Work with the budget and finance departments to create a strategy that allows the long-term fuel and maintenances savings from EVs to be appropriately accounted for in the capital expenditure request for the purchase of a new vehicle. This may include identifying a total cost of ownership threshold under which the purchase of the EV is recommended.

Implementation

Start Year: FY 2021

City Lead: General Services

Xcel Energy Support: N/A

Key Milestones

1. Identify the conditions under which the purchase of an EV would be recommended (e.g., total cost of ownership (TCO) threshold).
2. Provide TCO information during the Capital Improvement Plan request.
3. Work with senior leadership to identify additional opportunities to adjust the budgeting process, to include consideration of longer-term ROIs.

Timeline Considerations

This strategy needs to be in place before budget requests for FY2022 are due.

Funding Consideration

This strategy will require time commitments from City staff members from a variety of departments, but there are no associated capital costs.

MF-4 Develop and Execute a Vehicle Procurement Plan

The procurement plan should include vehicles identified for replacement, timeline, targeted EV models to be purchased, and any available rebates, grants, or other incentives. The plan should also outline the procurement process, including all of the typical procurement process steps as well as any additional steps needed to take advantage of EV purchasing programs.

Implementation

Start Year: FY 2021

City Lead: General Services

Xcel Energy Support: N/A

Key Milestones

1. Identify vehicles to be replaced with EVs, using telematics data collected in MF-1 and recommend make/model replacement vehicles based on use patterns.
2. Determine timeline for vehicle replacement and timing of necessary budget requests.
3. Identify a timeline for updating telematics data and candidates for EV replacement.
4. **Ongoing:** Make appropriate budget requests based on process developed in strategy MF-3.
5. **Ongoing**: Purchase EVs as outlined in the procurement plan.

Timeline Considerations

The vehicle replacement plan should be developed in Q1 or early Q2 of 2021 to inform FY2022 budget request. There will be an ongoing effort to purchase EVs based on City's planned replacement schedule outlined in Figure 4.

Funding Consideration and Available Resources

This procurement plan can be developed by in-house staff with no additional budget requests; but, as with all vehicle purchases, budget requests will be necessary for vehicle procurement. Be sure to leverage total cost of ownership analysis developed in MF-2 to inform budgeting.

Xcel Energy Programs and other Resources

- The Climate Mayor's EV Purchasing Collaborative provides group-buy discounts for light-duty municipal fleet vehicles.
- Denver Metro Clean Cities (DMCC) may help facilitate a group buy for fleet EVs

MF-5 Develop an Infrastructure Installation Plan

Implementation

Start Year: FY 2021

City Lead: General Services

Xcel Energy Support: EVSI; FEAP; rate advising

Create an implementation plan that details specific steps that will be taken to install EV charging stations and infrastructure for the municipal EV fleet. The plan should cover siting considerations and decisions, equipment choices, grid infrastructure needs, metering, contractor selection, and a timeline aligned with the demand driven by the vehicle replacement plan. [Note: There may be opportunity to combine fleet infrastructure with public infrastructure at the City Hall building.] This plan will consider current and planned EV charging needs by location and will use the telematics data gathered in MF-1 to inform charging infrastructure placement. Additional infrastructure considerations might include metering analysis to determine submetering and rate requirements, necessary electrical service upgrades, and site limitations for infrastructure installation.

Be sure to coordinate with the IT department to understand what charging infrastructure can be integrated with the City's existing controls system.

Key Milestones

1. Use telematics data to identify preferred and secondary charging locations for fleet charging infrastructure.
2. Contract with local installer to provide high level estimates of installation at each site.
3. Communicate with Xcel Energy account representative to understand the necessary electrical service upgrades required.
4. Determine whether the fleet charging needs to be sub-metered or if the charging stations will be powered by existing building electrical service. Work with your Xcel Energy representative to understand the expected costs for each option.
5. Complete the infrastructure installation plan with a timeline for installation that meets the needs of expected vehicle purchases. See strategy MF-7 for more information on the implementation of the infrastructure installation plan.

Timeline Considerations

This strategy will use the data collected in strategy MF-1 but needs to be completed before budget requests for FY2022 are due. Note that it may be advantageous to begin working with your Xcel Energy representative early, to understand electrical capacity of likely charging station sites and then use telematics data, as it becomes available, to confirm site locations.

Funding Consideration

A budget request will need to be made, to contract with an electrician to provide costing estimates that will help inform charging infrastructure location(s).

Xcel Energy Programs and other Resources

- Xcel Energy's Fleet Electrification Advisory Program provides recommendations for infrastructure sites of monitored vehicles as well as submetering and appropriate rates for these chargers.
- Xcel Energy's Infrastructure EV Supply Infrastructure Program provides support for siting and installing infrastructure for fleets not participating in the Fleet Electrification Advisory Program.
- The City's Xcel Energy account representative can help determine if a service upgrade will be necessary to serve the planned EV charging stations, as well as to help determine if submetering will be advantageous based on-site electrical usage patterns.

MF-6 Develop a Time-of-Use Charging Plan

Implementation

Start Year: FY 2021

City Lead: General Services

Xcel Energy Support: Rate advising

Optimize EV operations to take advantage of time-of-use electric rates by charging during off-peak hours, which can keep energy costs low. Xcel Energy's rates are based on several factors which may include energy use, peak demand, and/or time of use. Understanding these factors and the charges associated with each is essential to optimizing the timing of EV charging to minimize fuel costs. Identify the software tools necessary to help fleet operators manage charging costs. Also consider opportunities for staggering EV charging so all vehicles are not charging at the same time.

Work with your Xcel Energy account manager to understand available rates and determine the most cost-effective option for charging your fleet - for each location and across the portfolio.

Key Milestones

1. Choose the most appropriate controls software for City operations.
2. Work with Xcel Energy representative to understand the most advantageous energy rates, based on site location. Be sure to understand if it is necessary to meter separately and use this knowledge to inform the infrastructure plan in strategy MF-5.
3. Outline the controls scheme that will minimize charging costs.
4. Implement the controls scheme as infrastructure is installed through strategy MF-7.

Timeline Considerations

The results from this strategy are necessary to inform MF-7, so the strategy needs to be in place before the fleet charging infrastructure is installed.

Funding Consideration

The costs for this strategy will depend on the control software used by the City but will likely require an annual maintenance cost.

Xcel Energy Programs and other Resources

- The City's Xcel Energy account representative can review the impact of various charging controls schemes on the electrical charges and provide guidance to the City.

MF-7 Install Fleet Charging Infrastructure

Work with local contractors to install the required charging infrastructure for your fleet, based on the plan developed in MF-5. Be sure to coordinate with the IT department to implement charging controls as needed.

Implementation

Start Year: FY 2021

City Lead: General Services

Xcel Energy Support: New service support, EVSI

Key Milestones

1. Apply for grants.
2. Secure necessary City funding.
3. Contract with local contractor to install the necessary EV infrastructure in phases.
4. Ensure signage, parking, and security considerations are addressed.
5. Coordinate with IT department to implement necessary charging controls.

Timeline Considerations

This strategy is ongoing, based on the timeline developed in MF-5.

Funding Consideration

Charging infrastructure will require significant capital investment, but several 3rd party funding opportunities that could be leveraged are outlined below.

Xcel Energy Programs and other Resources

- The City's Xcel Energy account representative can help the City initiate new service for EV infrastructure.
- Xcel Energy's Infrastructure EV Support Infrastructure Program provides support for the installation of EV charging infrastructure.
- The Climate Mayor's EV Purchasing Collaborative provides group-buy discounts for EV charging infrastructure from various manufacturers.
- Charge Ahead Colorado provides grant funding for installation of fleet EV charging stations.
- Colorado Energy Office is launching a grant program July 2020 to support the installation of DC fast charging plazas to support public usage and high-mileage fleets.

MF-8 Educate Employees about New Parking Restrictions and Use of Fleet EVs

Implementation

Start Year: FY 2021

City Lead: General Services

Xcel Energy Support: Partners in Energy Implementation Team

Add training on how to use the EV fleet in the employee onboarding process as an easy way to boost exposure to and engagement with EVs. This training should include general information about EVs and the community charging infrastructure, as well as relevant procedures on how to check out, use, and charge the City's EVs. These trainings may also include hands-on Ride-and-Drive events with fleet vehicles to allow City staff to become comfortable with EV use.

Key Milestones

1. Identify key information that all employees need to safely operate fleet EVs.
2. Develop necessary training material.
3. Provide avenues for employee feedback and questions.
4. Schedule roll out to existing employees.
5. **Ongoing:** Ensure the training is included in onboarding for any new employees.

Timeline Considerations

Necessary training should be developed before EVs are available for staff use; and, there will be ongoing efforts to ensure new employees have appropriate training.

Funding Consideration

This strategy will require collaboration between the fleet team and the Human Resources Department but can be completed within the City's standard operating budget.

Xcel Energy Programs and other Resources

- Xcel Energy's Partners in Energy implementation team can provide support to develop training materials as part of the implementation phase of this offering.

MF-9 Provide Adequate Training to Maintenance Staff

Implementation

Start Year: FY 2022

City Lead: General Services

Xcel Energy Support: N/A

Support employee professional development by providing training to fleet mechanics on EV maintenance and repair. Maintenance staff may need additional certifications, such as the National Institute for Automotive Service Excellence (ASE) certification, to be qualified to work on EVs. It will also be necessary to purchase additional equipment to allow in-house technicians to maintain the EV fleet. New equipment may include personal protective equipment, EV safety-related tooling, diagnostic tooling, and service/repair tooling. In the short term, it may be necessary to contract with a 3rd party for EV maintenance not covered under the vehicle warranty (until sufficient staff have been trained).

Key Milestones

1. Identify staff who will be servicing the new EVs.
2. Develop a professional development plan and timing to provide necessary training.
3. Determine if renovations or adjustments to the layout in the maintenance garage are required, and make any necessary adjustments.
4. Purchase necessary equipment for staff to maintain EVs.
5. **Ongoing:** Provide appropriate training for new staff members.
6. **Ongoing:** Ensure employees are up to date on required training and certifications, especially as EV technology develops.

Timeline Considerations

While the new EVs will be under warranty for the first several years, staff training should begin as soon as possible - to allow in-house staff to provide basic diagnostic and support services as well as ensure the appropriate safety precautions are in place when new EVs arrive.

Funding Consideration

Budget requests may be required to support training and certifications required for maintenance technicians.

Focus Area: Public Charging Provided by the City

In this focus area, strategies aim to increase access to public charging at City facilities - for Westminster residents and visitors.

Background

To understand how many public charging stations will be required to support the growing number of EVs in Westminster, several scenarios were examined. The first scenario is the recommended best practice developed by the International Energy Agency (IEA) that there be one public charging station for every ten EVs in the community. Next, the two most mature EV markets in the world, Norway and California, were examined and found to have between 25 and 30 vehicles for every public charging station.

Scenario Name	EV to Public Charging Station Ratio
IEA Recommendation	10:1
California	25:1
Norway	31:1

The lower ratio of public-EV-charging-station-to-vehicle ratio seen in California and Norway is also consistent with a study by Idaho National Laboratory that looked at the charging habits of EV owners. This study looked at two groups of EV owners: Nissan Leaf owners as a proxy for BEV owners and Chevy Volt owners as a proxy for plug-in hybrid electric vehicle (PHEV) owners. This study found that most charging occurred at home and that when vehicle owners charged away from home, they tended to use the same 1-3 charging stations. In most cases, non-residential charging took place at workplace locations (as shown in Figure 5).

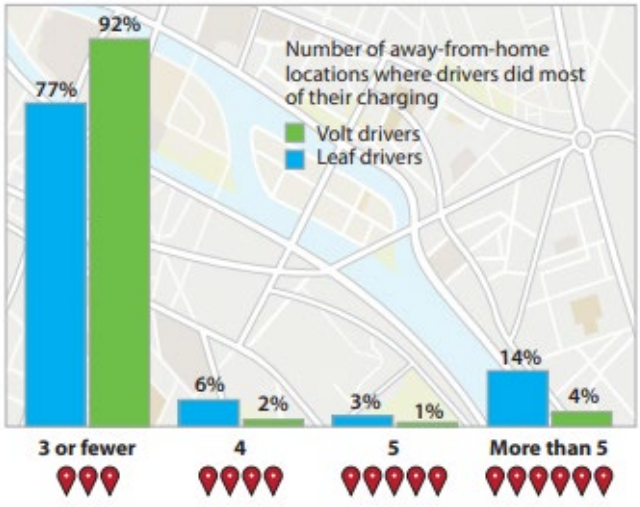


Figure 4: EV Owner Charging Habits (Idaho National Laboratory, 2014)

While most EV owners tend to rely heavily on one charging location, multifamily residents were more likely to us a public charging station near their home as their primary charging location while single family homeowners often had private charging stations installed at their home.

While this early data suggests that public charging infrastructure is a not an essential component in the ability for most residents to charge their vehicle, public charging infrastructure does play an important role in helping residents feel confident that the required infrastructure is in place to support their EV purchase. The 2017 update to the National Renewable Energy Laboratory (NREL) study on barriers to EV adoption found

that survey respondents who were aware of PHEV charging stations were much more likely to consider buying a BEV as their next vehicle (National Renewable Energy Labratory, 2017).

Based on data collected for Adams and Jefferson Counties, there is one Level 2 public charging station per 12 EVs and one DC fast charging station per 95 BEVs (Atlas Public Policy, 2020). Of these charging stations, there are 35 Level 2 public charging stations within the city limits, 20 of which are located at municipal facilities. There are also two public DC fast charging stations in the city. These facilities are shown in Figure 6 to demonstrate the current geographic distribution of publicly available charging throughout the city. Please note that there is more than one charging station at several of the locations.

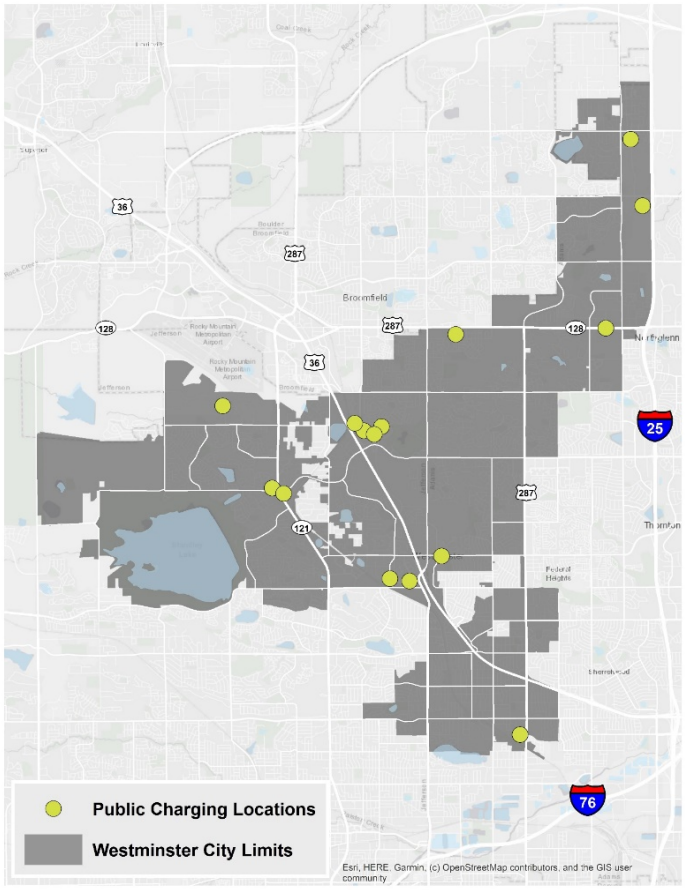


Figure 5: Existing Public Charging Stations

Targets and Metrics

To track progress toward public charging infrastructure, and based on the information above, the Planning Team established the following focus area level target:

Add one dual-port charger to a City facility, annually, until each public City facility has at least one dual-port charger.

Baseline: In FY2019, 3 of the City's 14 facilities have at least two EV parking spaces with access to charging.

Data Required:

- List of City facilities
- Number of charging spaces at each City facility

Data Source: Internal Tracking

Responsible Department: General Services

Frequency of Update: Annual

Additional Metrics:

- Number of annual charging events per station

Focus Area Timeline

The cumulative timeline for all strategies in this focus area are shown below.

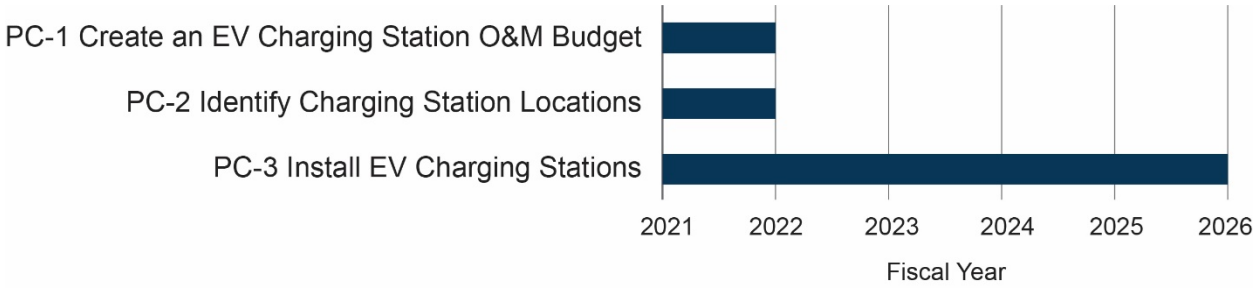


Figure 6. Public Charging Provided by the City Timeline for All Strategies

PC-1 Create an EV Charging Station O&M Budget

Establish a budget for software, upkeep, and energy costs for public charging stations owned and operated by the City - to track income and expenses from City chargers.

Implementation

Start Year: FY 2021

City Lead: Community Development/Parking

Xcel Energy Support: N/A

Key Milestones

1. Establish protocol for tracking ongoing cost for upkeep of charging stations.
2. Every two years evaluate City investment for providing public charging and determine if a usage fee should be charged.
3. Use upkeep costs to determine appropriate usage fee for charging stations.
4. **Ongoing:** Track costs and income, as applicable, from charging stations.

Timeline Considerations
None

Funding Consideration
The data needed to develop this budget is similar to data tracked by the City for other purposes, so this can be completed with existing City resources.

PC-2 Identify Charging Station Locations

Develop a City facility inventory to gauge the best places to locate public stations at each site, and work with Xcel Energy representative to understand the electrical upgrades required at each site, if any, as well as optimal rate structure with expected use patterns. Note: There may be opportunity to combine fleet infrastructure with public infrastructure at the City Hall building.

Implementation

Start Year: FY 2021

City Lead: City Manager's Office, General Services

Xcel Energy Support: EVSI, new service support, rate advising, Partners in Energy Implementations Team

Key Milestones
1. Coordinate with Xcel Energy account manager to understand capacity of existing electrical infrastructure and any necessary service upgrades required.
2. Determine whether station will be metered separately or powered by building electrical service.
3. Estimate cost of installing electric supply infrastructure.
4. Evaluate total cost of operating charging stations.
5. Establish plan for operating stations (e.g., ownership model, fees for charging).

Timeline Considerations
None

Funding Consideration
The City will need to contract with an electrician to estimate the cost of installing charging stations. A budget request may be necessary to complete installation of the charger.

Xcel Energy Programs and other Resources
- Xcel Energy's Infrastructure EV Support Infrastructure Program provides support for the siting of EV charging infrastructure.
- The City's Xcel Energy account representative can help the City understand if a service upgrade or new service might be required to support EV charging stations and can help the City review historical energy use at the facility where the charging stations will be installed - to help determine the most advantageous rate structure and if submetering is recommended.
- The Partners in Energy implementation team will work with the City to develop a tool to quickly determine if the City should consider submetering EV charging stations.

- The Partners in Energy: Electric Vehicle Toolkit presents additional information, best practices, and guidance related to siting public stations.

PC-3 Install EV Charging Stations

Work with local contractor to install EV charging station at City facilities, as identified in PC-2. Be sure to consider any planned construction projects, such as parking lot resurfacing, that might be a good opportunity for installing EV infrastructure.

Implementation

Start Year: FY 2022

City Lead: General Services

Xcel Energy Support: EVSI, new service support

Key Milestones

1. Establish standard protocols for charging station type, accessibility, and signage.
2. **Ongoing:** Contract with local provider to install charging station(s) as specified.
3. **Ongoing:** Coordinate with the IT Department to connect charging stations as needed.
4. **Ongoing:** Monitor station use to determine if additional stations are needed at public locations on City property.

Timeline Considerations

None

Funding Consideration

Charging infrastructure could require significant capital investment, but there are several 3rd party opportunities, including Xcel Energy's EV Supply Infrastructure program and Regional Air Quality Council (RAQC) grants, that could be leveraged.

Xcel Energy Programs and other Resources

- Xcel Energy's Infrastructure EV Support Infrastructure Program provides support for the siting and installation of EV charging infrastructure.
- The City's Xcel Energy account representative can help the City initiate new service for EV infrastructure as needed.

Focus Area: Encouraging Private Adoption

Strategies in this Focus Area address actions the City can take to help increase adoption of EV by encouraging residents to purchase EVs for private use and encouraging commercial entities to consider fleet or commercial EV purchases. Efforts include education and outreach events, updating City codes and zoning to encourage/require EV-ready construction, and streamlining City processes to facilitate installation of home charging.

Background

Some of the most common barriers to adoption of privately-owned EVs include lack of familiarity with products and technology, initial incremental procurement costs, and range anxiety (National Renewable Energy Labratory, 2017). The City currently deploys a multi-pronged approach - including education, regional coordination, incentives, and code changes - to overcome some of these barriers and encourage adoption of privately-owned EVs. The City's efforts are summarized in Table 1.

Table 1. City Efforts to Date

Education
• Hosted EV "Ride and Drive" Event • Hosts website providing local information about EVs and Charging Infrastructure
EV-Friendly Code
• EV best practice recommendations to be considered as part of development code update • Standardized signage and regulations • Permitting inspectors have been Electric Vehicle Supply Equipment (EVSE) trained
Regional Coordination
• Public EV charging offered free to users • Awarded Charge Ahead Colorado Grant to install dual-port charging stations • Connected with national outreach programs

Targets and Metrics

Since the City of Westminster is part of the larger Denver Metro community and many people commute to and from the city for work, a larger regional effort is required to increase the number of EVs on the road in Westminster. Furthermore, data to track private EV ownership is not readily available at the city level, so County-level data will be used to track the increase in EV adoption in the region.

To track progress toward adoption of privately-owned EVs, the Planning Team established the following focus area target:

Increase the number of registered EVs in Jefferson and Adams counties above the 2019 baseline.

Baseline: In 2019, there were 4,356 EVs registered in Jefferson and Adams counties.

Data Required:

- Number of EVs registered in Adams and Jefferson County

Data Source: Atlas EV hub or other third-party tracking

Responsible Department: City Manager's Office/Sustainability

Frequency of Update: Annual

Additional Metrics:

- Number of outreach events

Focus Area Timeline

Since this focus area is primarily education focused, many of these strategies will be initiated in FY2021 and will be ongoing outreach and education efforts.

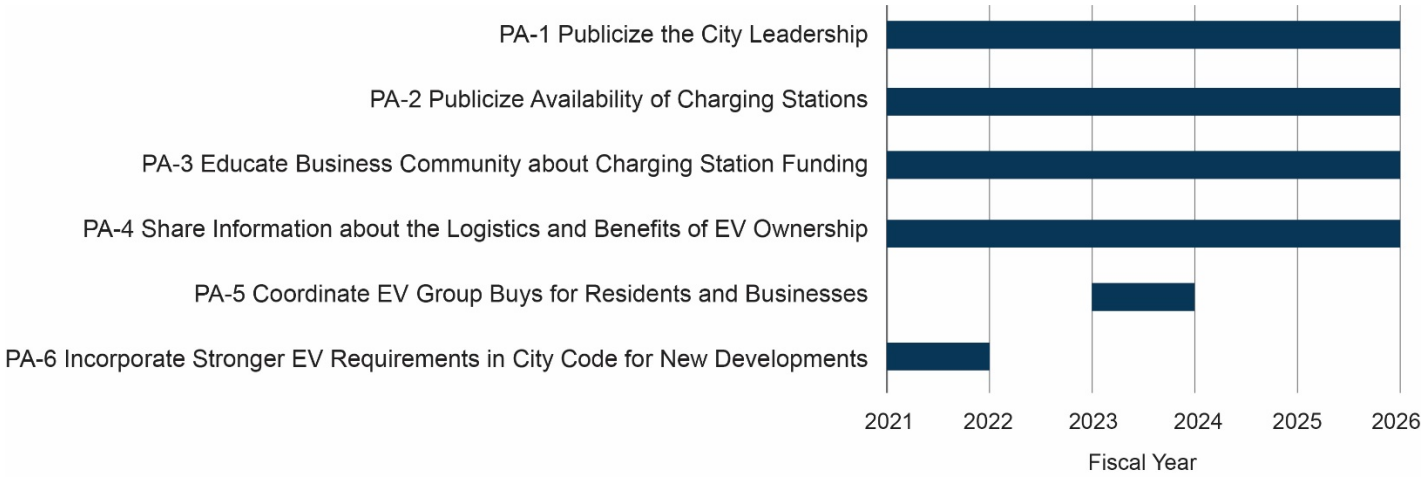


Figure 7. Encourage Private Adoption Timeline for All Strategies

PA-1 Publicize the City's Leadership

By working to electrify the City's fleet and providing public charging stations, the City of Westminster is inherently leading by example. Publicizing this leadership, by adding an EV badge to all EVs in the City's fleet and sharing success stories with the public, can help elevate the City's efforts and presumably expand the impact of these efforts.

Implementation

Start Year: FY 2021

City Lead: City Manager's Office/Sustainability, General Services

Xcel Energy Support: Partners in Energy Implementation Team

Key Milestones

1. Obtain approval of EV badge design.
2. Order badges and brand remaining EVs already in the fleet.
3. Establish policy for incorporating cost of badges in EV procurement requests.
4. Ensure new EVs are badged once purchased.
5. Collect data about cost and performance of EVs.
6. Share out "fun" success stories highlighting how EVs have been leveraged as part of the City's fleet.

Timeline Considerations

This will be an ongoing effort, providing rolling updates as new vehicles are procured and new successes identified.

Funding Consideration

Badges for vehicles are inexpensive and can be rolled into the cost of vehicle procurement or purchased separately within the existing operating budget. Case studies are also relatively inexpensive to produce, especially if they are disseminated electronically. The City's General Services, City Manager's Office, and Community Development departments can provide information to the Communications Division to share out through established channels.

Xcel Energy Programs and other Resources

- The Partners in Energy implementation team will support the development of success stories.

PA-2 Publicize Availability of Charging Stations

Implementation

Start Year: FY 2021

City Lead: City Manager's Office/Sustainability

Xcel Energy Support: Partners in Energy Implementation Team

Range anxiety is another frequently cited obstacle to the widespread adoption of privately-owned EVs. Though most charging for privately-owned vehicles occurs at home, studies have shown that the presence of public charging stations can decrease range anxiety. The City of Westminster can help showcase all publicly available chargers by sharing third-party sites and improving signage and wayfinding.

Sharing third party resources can begin immediately. Social media campaigns and other efforts to publicize new charging stations will be an ongoing effort as new stations are installed. Likewise, the addition of signage should occur concurrently with charging installation. Wayfinding signage efforts can occur in later years as the network of charging stations is more fully built out.

Key Milestones

1. Share third party resources (e.g., PlugShare, google EV maps, etc.) on the City's website and through social media.

2. Partner with the Communications Division to conduct a social media campaign as new charging stations are added.
3. Update the parkwestmisnter.us website and City app as new stations are added.
4. Install EV signage and wayfinding to increase awareness of available stations.
5. Install additional wayfinding signage to direct users to EV charging.

Timeline Considerations

This will be an ongoing effort to ensure up-to-date information is available and wayfinding is provided as new stations are installed.

Funding Consideration

Publicizing existing and new publicly available infrastructure can occur within current operating budget. Comprehensive signage and wayfinding may require additional funding requests. The City may be able to leverage current wayfinding efforts underway for the Downtown area.

Xcel Energy Programs and other Resources

- The Partners in Energy implementation team will support development of collateral to share new charging station locations on social media and through other outreach channels.

PA-3 Educate Business Community about Charging Station Funding

Provide information to developers, property managers, and businesses about availability of EV charging and fleet vehicle funding through Regional Air Quality Council and other sources as they become available (e.g., Xcel Energy's EV Infrastructure program and FEAP). Denver Metro Clean Cities (DMCC) can help provide support and connect the City with new opportunities as they become available.

Implementation

Start Year: FY 2021

City Lead: City Manager's Office/Sustainability

Xcel Energy Support: Partners in Energy Implementation Team

Key Milestones

1. Periodically coordinate with Denver Metro Clean Cities to identify new opportunities for funding support.
2. Work with local businesses to identify a suitable location for one or more DC Fast-Charging Plazas.
3. Leverage the Westminster Sustainable Business Program by sharing information with participating businesses.
4. Provide links, on the City's website, to charging station and fleet information, as well as funding resources.
5. Have one-on-one conversations with key developers and property managers.
    a. Note: Denver Metro Clean Cities can serve as a partner to help lead discussions.
6. Develop outreach campaigns through relevant business organizations.

Timeline Considerations

Ongoing effort to provide continuous education as new opportunities arise, regulations change, and technological advancements are made.

Funding Consideration

This effort can be completed by City staff within the standard operating budget.

Xcel Energy Programs and other Resources

- Xcel Energy's Partners in Energy implementation team can provide support to develop outreach campaigns and materials as part of the implementation phase of this offering.
- Colorado Energy Office (CEO) DC Fast-Charging Plaza Grant Program could help fund a bank of chargers at a private location.

PA-4 Share Information about the Logistics and Benefits of EV Ownership

In some cases, one of the biggest barriers to private EV adoption is a lack of knowledge or the spread of misinformation. Sharing out the real facts and benefits of EV ownership can break down these barriers. Furthermore, community members who have had a direct experience with an EV are more likely to own an EV; so outreach events like Ride and Drives can be an especially powerful education tool.

Implementation

Start Year: FY 2021

City Lead: City Manager's Office/Sustainability

Xcel Energy Support: Partners in Energy implementation team, Electric Vehicle Advisor tool

Identifying regional partners and developing a cohesive plan for education and outreach should start in 2021. Public outreach events should be ongoing, to continue expanding interest and support for EVs, but may require a stronger push in earlier years to get ahead of other strategies such as "EV Group Buys."

Key Milestones

1. Identify regional partners and establish and actively publicize a calendar of local and regional EV events.
2. Conduct additional Ride and Drive events in partnership with Denver Metro Clean Cities (DMCC).
3. Host lunch and learns to answer questions and break down barriers.
4. Partner with the Communications Division to bolster information sharing through the City website and social media.
5. Track participation in outreach events (e.g., number of participants in Ride and Drives).

Timeline Considerations

This will be an ongoing effort to provide continuous updates to the public as regulations change, new resources become available, new technologies emerge, etc.

Funding Consideration

Outreach and education activities can occur within current staffing roles, and therefore would not require a budget request. Partnering with local organizations, such as Denver Metro Clean Cities can significantly enhance total outreach capacity.

Xcel Energy Programs and other Resources

- Xcel Energy's Electric Vehicle Advisor tool can help residents find the right EV to meet their needs.
- Xcel Energy's EV charging rates can help residents keep their fuel costs low, thereby increasing the financial benefits of EV ownership.
- Xcel Energy's Partners in Energy implementation team can help coordinate outreach events with external partners and provide collateral.
- Denver Metro Clean Cities provide a variety of EV outreach events and may be willing to partner with the City on a community event.

PA-5 Coordinate EV Group Buys for Residents and Businesses

Implementation

Start Year: FY 2023

City Lead: City Manager's Office/Sustainability

Xcel Energy Support: N/A

Cost of procurement is often one of the main barriers preventing the widespread adoption of EVs. EV group buys can help lower the initial cost of purchase. Group buys typically negotiate a lower price per vehicle in exchange for a large number of vehicles purchased. To increase the purchasing power of a group buy, the City should consider partnering with neighboring jurisdictions and large employers in the region. Group buys can be oriented toward residents, large businesses with fleets, or both. Local dealerships will play a key role in the successful implementation of this strategy and should be consulted early in the process.

To maximize impact, this strategy should occur after the City has conducted significant public outreach to increase the public's familiarity with EVs (e.g., Ride and Drives) and educate the public on the benefits of EVs.

Key Milestones

1. Partner with Denver Metro Clean Cities to help coordinate an event.
2. Identify partners for outreach and organization of an event (e.g., Boulder County, Thornton, Northglenn).
3. Identify partnering dealerships and/or Utility.
4. Conduct outreach to inform community members and businesses of the group buy (e.g., direct mailers, social media campaigns, information on the City website).
5. Host the group buy.
6. Track the number of vehicles purchased through the group buy.

Timeline Considerations

Group buy activities should occur once significant education and outreach has been completed, to cultivate interest and ensure a high-impact effort.

Funding Consideration

Hosting group buys does not require significant capital or operating costs. Coordination activities, led by the City Manager's Office and shared with other departments at partnering jurisdictions, can occur within the current operating budget.

PA-6 Incorporate Stronger EV Requirements in City Code for New Developments

Implementation

Start Year: FY 2021

City Lead: City Manager's Office/Sustainability and Community Development

Xcel Energy Support: N/A

In support of widespread private EV adoption, the City should work to remove barriers, or even incentivize, EV-ready construction. EV-ready requirements for new construction may include requiring EV charging stations, EV parking spaces, and/or EV-ready construction (e.g., conduit). EV-ready construction requirements can apply to new single-family residential development, multi-family development, commercial development, or a combination. The International Energy Conservation Code 2021 version has requirements for installing EV supply infrastructure, and the City will start adopting the Code in 2021. Where strict standards are not desired, or flexibility is preferred, the City could consider incentives (such as expedited review processes) to encourage the adoption of EV-ready construction. Through a concurrent planning process, recommendations about applicable EV-friendly codes best suited for Westminster are being developed (referred to as Development Code Review in key milestones below).

Key Milestones

1. Finalize Development Code Review in 2020.
2. Revise City Code based on recommendations from code review report (e.g., incorporate additional regulations or incentive system).
3. Adopt the International Energy Conservation Code in 2021.
4. Establish pathways for monitoring and enforcement.
5. Track new charging infrastructure resulting from code changes.

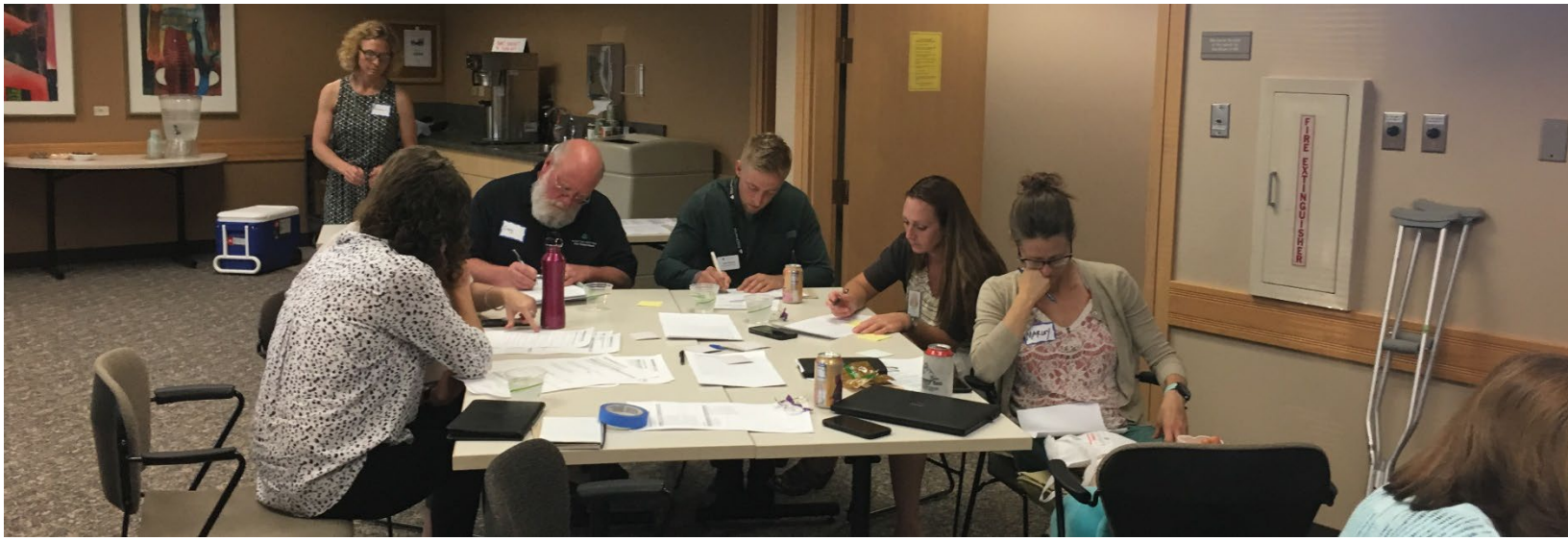
Timeline Considerations

Efforts to amend the City code are already underway and should be complete by FY2022. Enforcing code changes will be an ongoing effort thereafter.

Funding Consideration

A comprehensive code review and update process has already been funded by the City. However, staffing for monitoring and enforcement may require additional budget.

HOW WILL WE STAY ON COURSE?



This EV planning effort yielded ambitious yet achievable goals that align with the City's Sustainability Plan and EV vision. To achieve the targets and EV goals outlined in this plan, the City of Westminster and its partners identified in the strategies above will work to maintain consistent and clear communication among themselves and with the community at large. Each focus area will have sub-teams that will communicate regularly to work out the details of strategy implementation, follow through with identified actions, and share progress and results. As these teams work to implement the strategies outlined in this plan, additional resources to support community EV transition are available at xcelenergycommunities.com/evtoolkit. The most up-to-date information about Xcel Energy's EV programs and offerings, as well as basic information to help support EV adoption, can be found at XcelEnergy.com/EV.

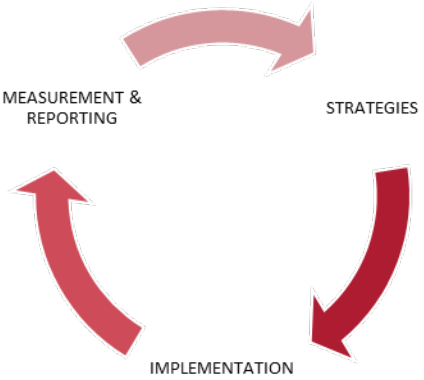


Figure 8. Actions and Tracking

Adapting to a Changing Landscape

Even though this plan outlines strategies to promote EV adoption over the next 5 years, an effective plan is cyclical in nature (see Figure 9). In addition, the nature of implementation requires staging, flexibility, and course adjustment when necessary, to be successful and to sustain progress.

Furthermore, the focus area work plans reflect the current situation for a rapidly evolving technology. It will be important that strategies are evaluated and updated throughout implementation, reflecting advancements and new offerings from the automotive and transportation industry and Xcel Energy. Throughout the planning process, we worked to build relationships between City staff and Xcel Energy staff that will foster the collaboration and cooperation required to successfully navigate the changing EV landscape.

Beyond the Plan Horizon

It is recommended that the City reassess the EV goals and successes achieved over the implementation period. Based on lessons learned over the five-year implementation period, the City will update this EV Action Plan - focusing on increasing City-owned and private EV adoption to improve air quality, reduce greenhouse gas emissions, and lower the cost of transportation for all of Westminster. Additional updates to this plan will be necessary as goals are achieved and new opportunities and technologies emerge. For example, the City could continue to shape its Fleet objectives as newer trucks, heavy duty vehicles, and off-road equipment emerge in the electric marketplace.

APPENDIX A: XCEL ENERGY'S PARTNERS IN ENERGY EV PLANNING PROCESS

About Xcel Energy's Partners in Energy

Xcel Energy is an electric and natural gas utility that provides the energy that powers millions of homes and businesses across eight Western and Midwestern states. Each community Xcel Energy serves has its own unique priorities and vision for energy. Energy is a dynamic topic, and it is changing rapidly with new ways to save, the growth of renewables, EVs, and changing regulations. With these competing priorities and stretched resources, creating and maintaining an energy-conscious culture within your community can be a missed opportunity in meeting energy and sustainability goals. In the summer of 2014, Xcel Energy launched Partners in Energy as a collaborative solution for communities to reach their energy goals. In 2019, Partners in Energy launched an EV-specific planning process to help communities develop plans to meet their EV goals.

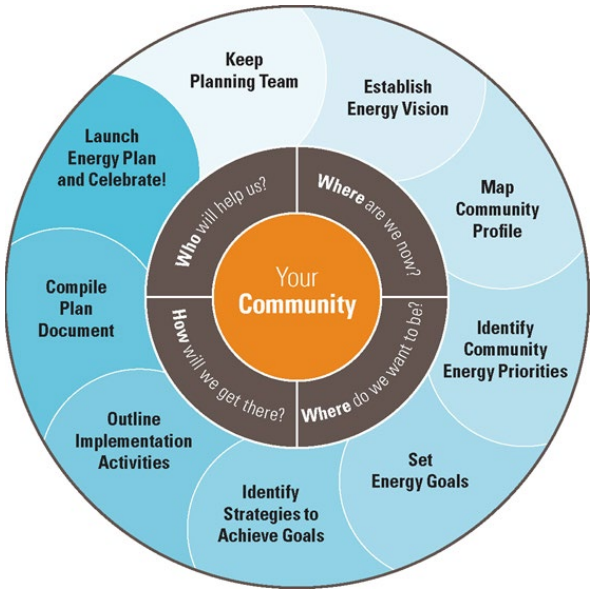


Figure 9: Partners in Energy Process for Success

Plan Development Process

The content of this plan was developed through an expediated planning process to better understand the budget implication of the EV strategies identified in the City's Sustainability Plan and to inform budget request for FY2022.

An in-person kickoff meeting was held January 2020 to provide an overview of the planning process and to help identify the City's preliminary priorities to inform plan development. During this kickoff meeting, the roles and responsibilities of the planning team were confirmed. The planning team included Partners in Energy facilitators, Xcel Energy representatives, and City of Westminster representatives. Participants from the City included representatives from the City Manager's Office and from the General Services, and Community Development departments.

Following this kick-off meeting, Workshop 1 was held virtually, to accommodate the social distancing response to COVID-19. During Workshop 1, City representatives were provided baseline information about EVs, including fleet information, market share, and public charging infrastructure. The planning team used this information to draft a preliminary vision for the EV Action Plan, to confirm focus areas, and to draft preliminary targets for each focus area.

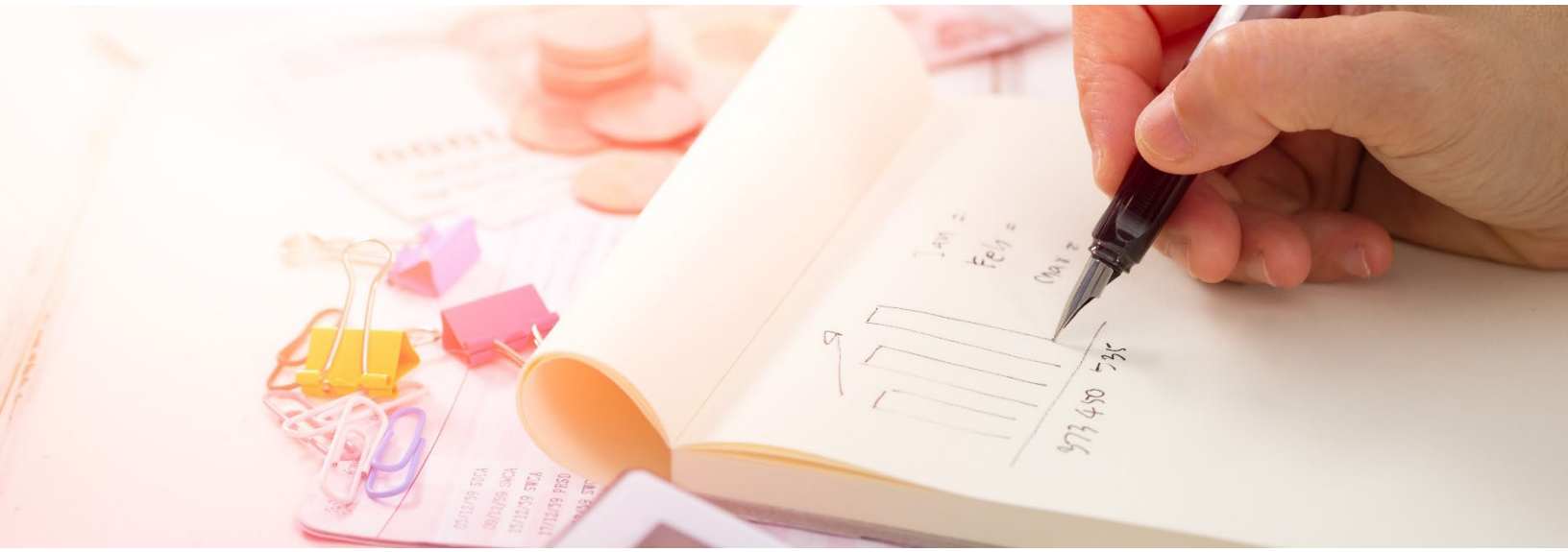
Following Workshop 1, the planning team participated in a survey to identify potential barriers to achieving draft targets as well as to brainstorm strategies to overcome these barriers. During Workshop 2, the planning team prioritized the strategies identified in the survey and drafted key details for the top strategies in each focus area. This EV Action Plan was developed using the information identified during the two workshops and was then reviewed and refined by City Staff.

Plan Implementation

Partners in Energy provides 18 months of support for implementation of an EV action plan. This support is designed to supplement both technical analysis and support that is available through Xcel Energy's other EV offerings such as the FEAP and EVSI programs. Services offered through the Partners in Energy team are shown in Appendix B: Available Resources. Throughout the plan, strategies that will be supported by Partners in Energy staff are identified, and the memorandum of understanding for this support is shown in Appendix C: Implementation Memorandum of Understanding.

Figure 10: Resources from Xcel Energy for Implementation

APPENDIX B: AVAILABLE RESOURCES



The rapidly evolving fabric of electric vehicles (EVs) can make identifying resources challenging. In part, the short horizon of this EV action plan is to facilitate frequent updates as data and resources evolve to support EV adoption. Below is a list and description of resources available at the time this plan was developed. Links may break over time.

Xcel Energy Resources

In 2020, Xcel Energy submitted their Transportation Electrification Plan (TEP) to the Colorado Public Utilities Commission (PUC) for approval. The TEP outlines several programs and services intended to support communities and the State in their progress toward transportation electrification. At the writing of this plan, the TEP had not been adopted. If approved, the offerings presented in the TEP will be evaluated and used to support the strategies outlined in this plan as applicable. Please visit xcelenergy.com/EV for the most up-to-date information and offerings from Xcel Energy.

Tracking Progress and Adjusting Course

To ensure this plan remains on track, the EV Team will track metrics by the focus areas outlined in Table 2 to review progress toward stated focus area targets and plan goals, (on an annual basis) to assess if the efforts appear to be making an impact.

To accommodate the fluid nature of action and implementation as well as to learn from experience early in the process, the focus area groups will schedule team meetings at least annually. This meeting will allow the opportunity to review the relevant metrics, discuss roadblocks, and provide a forum for agreeing on course adjustments or new approaches necessary to hit plan targets. The Xcel Energy EV Toolkit can be a good resource for identifying new strategies to address unexpected barriers that may come

up. Any adjustments will be documented and shared with the broader group and community as they occur.

It will be important to let the wider community know how things are progressing and to recognize the collaborative efforts of those involved in hitting the plan targets. At critical milestones, the City of Westminster will publish updates on progress, share successes, and congratulate participants and partners through various communication channels.

Table 2: Focus Area Tracking Summary

Focus Area	Municipal Fleet Electrification	Public Charging	Encouraging Private Adoption
Target	Electrify 25% of the City's light duty fleet by 2025	Add one dual-port charging station to a City facility annually, until each public City facility has at least one dual-port charging station	Increase the number of EVs in the region
Metric	Number of light-duty EVs in the fleet	Number of dual-port charging stations at City Facilities	Number of registered EVs in Adams and Jefferson County
Data Source	Fleet vehicle inventory	Westminster EV infrastructure inventory	Alternative Fuels Data Center – US Department of Energy (DOE)

Fleet Electrification Advisory Program (FEAP)

Xcel Energy's Fleet Electrification Advisory Program begins with an analysis to help determine the best course of action for fleet electrification. In partnership with Sawatch Labs, participating in FEAP allows fleet operators to assess individual vehicles - to determine if the vehicle owner's driving needs could be met with an electric vehicle (EV). Additionally, FEAP assesses charging site suitability and estimates the cost of infrastructure installation. Finally, FEAP helps advise on rate plans, and pilot programs to lower costs. For more information visit: xcelenergy.com/EV or contact Stacey Simms.

Electric Vehicle Supply Infrastructure (EVSI) Program

Xcel Energy's EVSI is intended to provide financial support to Colorado businesses and organizations that want to install EV charging infrastructure. Charging stations funded by the EVSI program can provide charging to fleet vehicles, customers, or the public. The amount of funding available through this program is yet to be determined. For more information visit: xcelenergy.com/EV or contact Thomas Santori.

Select Manufacturer Rebates

Xcel Energy periodically partners with car manufacturers to offer customers vehicle-specific rebates. Sign up to receive the latest information on Xcel Energy's offerings through its EV Network: xcelenergy.com/EV

Account Representative

The City's Xcel Energy account representative, Kynnie Martin, can help the City navigate specific questions about rate structures as well as questions about how the new electrical loads might affect utility costs.

Federal Resources

Qualified Plug-In Electric Vehicle (PEV) Tax Credit

The Federal government offers an EV tax credit of up to $7,500 and is based on the vehicle's traction battery capacity and the gross vehicle weight rating. Tax credits are administered through the Internal Revenue Service (IRS).

For more information, visit the IRS website: www.irs.gov/businesses/plug-in-electric-vehicle-credit-irc-30-and-irc-30d

Periodic Charging Station Manufacturer Rebates

EV charger manufacturers such as ChargePoint may periodically offer rebates or discounts. For instance, a federal tax credit gives individuals 30% off a ChargePoint Home Flex electric vehicle charging station plus installation costs (up to $1,000). Charging stations must be purchased and installed by December 31, 2020. Additionally, businesses can receive a 30% tax credit of up to $30,000 to purchase and install a ChargePoint EV Charging station by December 31,2020.

For more information on the ChargePoint opportunity used as an example, visit their website: www.chargepoint.com/

Insurance Company Discounts

Insurance companies may offer discounts for EV owners. Check with your insurance provider for more information.

Federal Database of EV incentives

For other programs not included here visit the U.S. Department of Energy's database of EV tax credits and other incentives, from across the country, that include federal programs, state laws and regulations, and utility/private incentives.

For more information visit: afdc.energy.gov/laws/search

State Resources

Colorado Plug-In Electric Vehicle (PEV) Tax Credit

The State of Colorado offers an EV tax credit at the point of sale. The total amount available will decrease from $4,000 for light-duty EVs or PHEVs in 2020 to $2,000 in 2026.

For more information visit: www.colorado.gov/pacific/sites/default/files/Income69.pdf

Charge Ahead Colorado

Colorado Energy Office (CEO) and Regional Air Quality Council (RAQC) fund the Charge Ahead Colorado program that supports installing Level 2 and Level 3 public

chargers, based on various criteria and the ALT Fuels Colorado program that improves air quality, by incentivizing fleet vehicle upgrades. Public and private entities are encouraged to apply. An entity can apply multiple times, as long as each application is for a new charging station. Charge Ahead Colorado can pay up to 80% of the charging station cost, up to $6,000 for fleet chargers, up to $9,000 for Level 2 multiport chargers, and up to $30,000 for Level 3 multiport chargers. Funds may also be applied to EV procurement for organizations excluded from the State PEV Tax Credit but can only be applied to leased vehicles.

For more information visit: cleanairfleets.org/programs/charge-ahead-Colorado

Other Resources

Climate Mayors Electric Vehicle Purchasing Collaborative

The Collaborative represents unprecedented cooperation, among Climate Mayors cities across the country, to leverage collective buying power and accelerate the conversion of public fleets to EVs–sending a powerful signal to the global auto market and helping the United States maintain its commitment to the Paris Climate Agreement. The Collaborative offers a turnkey, one-stop, online procurement portal providing U.S. cities, counties, state governments, and public universities equal access to competitively-bid EVs and charging infrastructure, innovative financing options, and best practices and other forms of expertise.

For more information visit: driveevfleets.org/

APPENDIX C: IMPLEMENTATION MEMORANDUM OF UNDERSTANDING

Memorandum of Understanding
Phase 2 – Plan Implementation

Donald M. Tripp
Deputy City Manager
4800 W. 92nd Ave.
Westminster, CO 80031

The intent of this Memorandum of Understanding is to recognize the achievement of the City of Westminster (the City) in developing an Electric Vehicle Action Plan. Xcel Energy, through its Partners in Energy offering, has supported the development of this Electric Vehicle Action Plan. This document outlines how the City of Westminster and Xcel Energy will continue to work together to implement this Electric Vehicle Action Plan. The term of this joint support, as defined in this document, will extend from August 1, 2020 through December 31, 2021.

Xcel Energy will support the City of Westminster in achieving the goals of its Electric Vehicle Action Plan in the following ways:

Municipal Fleet Electrification

- **Educate Employees on New Parking Restrictions and Use of Fleet EVs**
    - Work with the parking and enforcement to support the development of parking restrictions and guidelines for fleet EVs, including eligible vehicles, designated times of use, and enforcement protocol
    - Develop custom collateral and trainings to share information about new parking restrictions and guidelines with employees

Support funded by Xcel Energy for these strategies is not to exceed 35 hours. These hours will include those provided through our Partners in Energy team from Brendle Group and do not include support provided by Xcel Energy internal program staff.

Public Charging Provided by the City

- **Identify Charging Station Locations**
    - Develop a tool to quickly determine if the City should consider submetering EV charging stations.
    - Use the tool to screen various potential EV charging sites.

Support funded by Xcel Energy for these strategies is not to exceed 35 hours. These hours will include those provided through our Partners in Energy team from Brendle Group and do not include support provided by Xcel Energy internal program staff.

Encouraging Private Adoption

- **Publicize the City's Leadership**
    - Support the development of Westminster-specific case studies to highlight success stories related to transportation electrification.
    - Develop campaigns to share these case studies through appropriate channels
- **Educate Business Community about Charging Station Funding**
    - Support the development of outreach campaigns and materials, such as a business charging social media campaign, flyer, or website content
    - Continue to identify and notify the City of Westminster of relevant funding opportunities to share
- **Share Information About the Logistics and Benefits of EV Ownership**
    - Develop custom collateral to share information on the benefits of EV Ownership, including social media campaigns, flyers, or website content, or webinar content
    - Coordinate outreach events with external partners to share collateral, increase exposure of public to electric vehicles, and otherwise inform them of benefits
    - Continue to identify and share opportunities for the City to partner with external organizations to reduce the cost of informational events

Support funded by Xcel Energy for these strategies is not to exceed 80 hours. These hours will include those provided through our Partners in Energy team from Brendle Group and do not include support provided by Xcel Energy internal program staff.

Project Management and Reimbursed Expenses

- Move strategies forward as outlined in the Electric Vehicle Action Plan
    - Support strategy team organization, meetings, and communication
    - Support tracking and reporting progress to goals
- Serve as point of connection to Xcel Energy programs, including, but not limited to the Fleet Electrification Advisory Program and the EV Supply Infrastructure Program
- Provide updated information to Westminster as new EV programs become available and adjust implementation approach and collateral appropriately.
- Facilitate regular check-in meetings, track and report energy impacts and activities, and help coordinate implementation kick-off activities
- Provide up to $2,000 for reimbursed expenses related to printing and distribution of co-branded marketing materials, venue fees, food, and other related needs associated with outreach and education. Xcel Energy funding will not be provided for the purchase of alcohol

Support funded by Xcel Energy for project management is not to exceed 75 hours. These hours will include those provided through our Partners in Energy team from Brendle Group and do not include support provided by Xcel Energy internal program staff.

The City of Westminster commits to supporting the Electric Vehicle Action Plan to the best of its ability by:

- Achieving the targets outlined in the electric vehicle action plan and shown in the table below:

City of Westminster Electric Vehicle Action Plan Targets and Goal

Focus Area	Target	2019 Baseline
Municipal Fleet Electrification	Electrify 25% of the City's light duty fleet by 2025	1%
Public Charging	Add one dual-port charger to a City facility annually, until each public City facility has at least one dual-port charger	3 of 14 facilities
Encouraging Private Adoption	**Increase the number of registered EVs in Jefferson and Adams counties above the 2019 baseline.**	**4356 EVs**

- Performing the coordination, tracking, and outreach duties as outlined in the Electric Vehicle Action Plan that include but are not limited to the following:

Municipal Fleet Electrification

- **Procuring EVs to Replace Existing Vehicles**
  - Lead the collection of fleet telematics data and life cycle analysis
  - Develop and execute a vehicle procurement plan and the total cost of ownership into the budget process
- **Installing Fleet-Specific EV Chargers**
  - Identify appropriate locations for charging infrastructure
  - Coordinate with Xcel Energy to identify opportunities for EV supply infrastructure funding and to select the appropriate electricity plan
- **Educate and Train Employees and Staff**
  - Educate employees on the appropriate use of fleet EVs, including relevant charging and parking guidelines
  - Train staff or identify partnerships to ensure the appropriate maintenance of EVs and EV infrastructure

Public Charging Provided by the City

- **Install EV Charging Stations at City Facilities**
  - Collaborate with other City departments to establish an EV charging station O&M budget
  - Coordinate with facility managers and Xcel Energy to identify appropriate charging station locations
  - Identify available funding resources and partnerships (e.g., CEO DC Fast-Charging Plaza Grant) to install EV charging stations at identified locations

Encouraging Private Adoption

- **Engage Local Residents Regarding the Benefits of EV Ownership**
    - Identify key information (i.e., availability of Westminster chargers, policies in support of residential EV ownership, etc.) to share
    - Help co-create collateral to share with residents
    - Identify potential partnerships with external organizations to host outreach events
- **Engage Local Businesses Regarding the Benefits of Electrifying Fleets or Supporting EV Ownership Amongst Employees**
    - Identify businesses, points of contact, gauge initial interest in participation
    - Identify key information (i.e., resources available to support business pursing transportation electrification, benefits of EV charging at workplaces, etc.) to share

Project Management

- Participate in coordination and tracking of scheduled check-ins, activities, and events
- Provide Xcel Energy an opportunity to review marketing materials to assure accuracy when they incorporate the Xcel Energy logo or reference any of Xcel Energy's products or services
- Share the plan document, supporting work documents, and implementation results from the Electric Vehicle Action Plan with the public–the experience, successes, and lessons learned from this community will inform others looking at similar or expanded initiatives
- Share progress on upcoming sustainability planning as it relates to activities outlined in the Electric Vehicle Action Plan

Legal Applicability and Waiver

This is a voluntary agreement and not intended to be legally binding for either party. This Memorandum of Understanding has no impact, nor does it alter or modify any existing Franchise Agreement or other existing agreements between Xcel Energy and the City. Parties agree that this Memorandum of Understanding is to memorialize the intent of the Parties regarding Partners in Energy but does not create a legal agreement between the Parties. It is agreed by the Parties that nothing in this Memorandum of Understanding will be deemed or construed as creating a joint venture, trust, partnership, or any other legal relationship among the Parties. This Memorandum of Understanding is for the benefit of the Parties and does not create third party rights. Nothing in this Memorandum of Understanding constitutes a waiver of the City ordinances, the City's regulatory jurisdiction, or Colorado's utility regulatory jurisdiction.

Single Points of Contact

All communications pertaining to this agreement shall be directed to Paul Schmiechen, on behalf of the City of Westminster, and Tami Gunderzik, on behalf of Xcel Energy.

Xcel Energy is excited about this opportunity to support the City of Westminster in advancing its goals. The resources outlined above and provided through Partners in Energy are provided as a part of our commitment to the communities we serve and Xcel Energy's support transportation electrification as important resources to meet your future energy needs.

For the City of Westminster:

Signature: _____

Name: _____

Title: _____

Date: _____

For Xcel Energy:

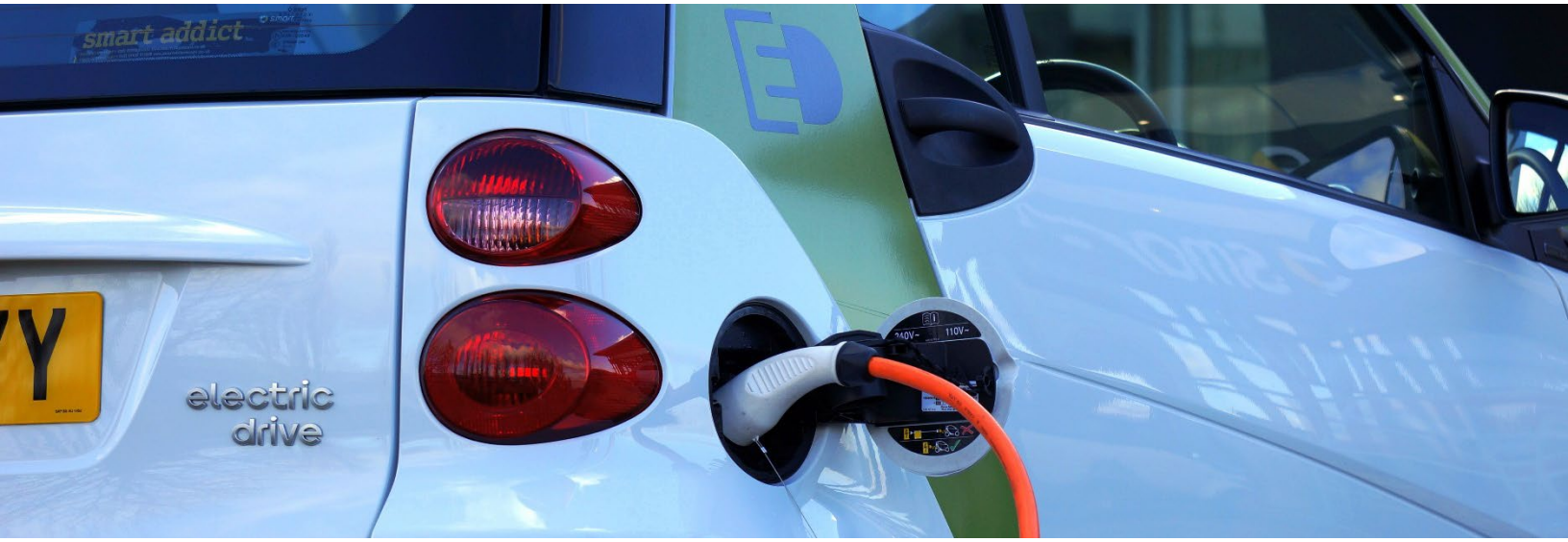
Signature: _____

Name: _____

Title: _____

Date: _____

APPENDIX D: ELECTRIC VEHICLES 101



Since electric vehicles (EVs) are an emerging technology that is rapidly changing, it is important to ensure that everyone has a common understanding of the technology and terminology involved. This section explains the basics of currently available types of vehicles and charging stations and the associated uses, barriers, and benefits. Note, while electric options are available for medium- and heavy-duty vehicles, the descriptions provided in this section apply primarily to light-duty vehicles, which make up most of the EV market today.

EV Basics

EVs refer to any vehicle that uses an electric motor. An EV can have a fully electric motor or can contain an internal combustion engine (ICE) that supports the electric motor. The travel range of each type is outlined in Table 3 and described in more detail in the following sections.

Table 3: Comparison of Types of EVs

Electric Vehicle Type	Power Source	Travel Range
Battery Electric Vehicle (BEV)	Electric Motor	80 – 345 miles
Plug-in Hybrid Electric Vehicle (PHEV)	Electric Motor & Gasoline Engine	350 – 600 miles
Hybrid Electric Vehicle (HEV)	Electric Motor & Gasoline Engine	350 – 600 miles

Battery Electric Vehicle (BEV)

A BEV is an all-electric vehicle that does not require gasoline and, thus, has no tailpipe emissions. BEVs are fueled by plugging into charging stations. Energy is stored in the battery - to be used when the car is running. Distances a BEV can travel on a single charge range from 80 to 345 miles, with longer distances promised in the future through continual advancements in battery technology. Recharging can take between 30 minutes to 12 hours, depending on the type of charger, size of battery, and level of depletion in the battery (Drive Change. Drive Electric., 2019).

Plug-In Hybrid Electric Vehicle (PHEV)

A PHEV provides a combination of both an electric motor and a gasoline engine, and produces less tailpipe emissions than a traditional ICE. PHEVs use energy from the electric motor until the battery charge is fully depleted, which can occur between 15 and 50 miles; at this point, the gasoline engine takes over. The distance a PHEV can travel on a single charge and full tank of gasoline ranges between 350 and 600 miles. The battery is charged similarly to the BEV (through a plug), and the fuel tank is filled by traditional gasoline (at a station) (Drive Change. Drive Electric., 2019).

Hybrid Electric Vehicle (HEV)

Like PHEVs, HEVs have both an electric motor and a gasoline engine. In an HEV, the gasoline engine is used to power a generator, which powers the electric motor. The benefit of this configuration is that the ICE can run at a constant speed and greatly increase the vehicle's fuel efficiency (compared to traditional ICE vehicles). However, the battery cannot be charged by an external electricity source, which means the vehicle always relies on the gasoline engine.

Charging Stations

EV charging stations are separated into three categories, based on the speed at which the vehicle is charged: Levels 1, 2, and 3. Level 3 chargers are also known as DC fast chargers. The sections below detail the appropriate application for each charger type.

Residential Charging Stations

Residents have two options for charging at home. Level 1 chargers use standard 120-volt AC outlets and can take 8 to 12 hours to fully charge a depleted battery. Level 2 chargers require a 240-volt AC outlet and can fully charge a depleted battery in 4 to 6 hours. Residents can charge during off-peak hours to reduce the impact on the grid. Table 4 provides a brief explanation, along with the pros and cons of both types. All currently available EVs can use either charger type.

Table 4. Residential EV Charging Types

	LEVEL 1	LEVEL 2
Electric Current (AC)	120 volts; 20 amps	208/240 volt; 30 amps
Charging Rate (miles range per hour of charging)	2 to 5	10 to 20
Benefits	• Uses standard residential wall outlet • Little to no investment in infrastructure required	• Quicker charging • Some models have available Wi-Fi controls to allow residents to take advantage of time-of-day electric rates • In the case of multifamily housing, the controls could be managed by a

	LEVEL 1	LEVEL 2
		property manager.
Drawbacks	• Slower charging rate, but usually sufficient for residents who charge overnight	• Requires 240 Volt outlet or hardwired charger • Electrician likely required for installation • Higher infrastructure cost investment
Estimated Costs	Low to no cost	$500 to $2,000 (US DOE, 2019)

Commercial Charging Stations

Commercial Level 2 and Level 3 chargers are most appropriate for commercial applications since the EVs are generally parked for shorter periods of time than in residential applications. Level 2 chargers are the same as residential chargers and often have the option to include two charging ports at one station. Level 3, or DC fast chargers require an industrial DC outlet of 480 volts and can charge batteries in 20 to 30 minutes. Many commercial chargers also come equipped with software that allows the user to control when vehicles are charging and may facilitate payment in public applications. Table 5 shows the advantages and disadvantages of Level 2 and Level 3 chargers.

Table 5. Levels 2 and 3 Charging Infrastructure

	LEVEL 2	LEVEL 3 (DC Fast Charger)
Electric Current	208/240 volt; 30 amps (AC)	480 volts DC
Charging Rate (miles range per hour of charging)	10 to 25	Up to 180
Benefits	• More economical than Level 3 • Safe for long-term use	• The fastest charging option available
Drawbacks	• Slower charging	• Expensive to purchase and install • Can cause degradation to EV batteries with frequent use
Estimated Costs	$500 to $5,000 (US DOE, 2019)	As high as $50,000

Benefits of EVs

Benefits of EVs are both environmental and economic. By replacing ICE vehicles with EVs, transportation-related GHG emissions are significantly reduced and air quality is improved. As the need for imported petroleum to support transportation is decreased through the integration of EVs, domestically available fuel sources can shift into focus, resulting in energy independence and domestically regulated fuel prices. Furthermore,

the individual consumer will experience lower fuel and maintenance costs with the transition to EVs and through continued advancements in battery and charging technologies. The sections below provide additional details regarding the benefits of EVs.

Reduce GHG Emissions

EVs can significantly decrease GHG emissions associated with on-road transportation, which overtook electricity generation as the largest source of GHG emissions in the US in 2017 (Environmental Protection Agency, 2019). The amount of emissions reduction depends on the electricity generation fuel mix of the local electricity grid. National trends suggest that electric utilities are improving the emissions from electricity generation at a faster rate than fuel economy is improving in ICE vehicles. EV charging can be paired with residential roof-top solar, commercial solar parking structures, and community solar to further reduce associated GHG emissions. Xcel Energy has goals to reduce carbon emissions 80% by 2030 and to be carbon free by 2050 (Xcel Energy, 2019). By transitioning to cleaner energy sources, Xcel Energy is supporting its customers in reaching their own community goals of achieving carbon neutrality.

Air Quality

Use of traditional ICE vehicles contribute to Ozone and fine particulate ($PM_{2.5}$) air pollutants, especially along heavily traveled routes. These pollutants have been linked to respiratory problems such as asthma, cardiopulmonary disease, and premature death for people with chronic exposure. These pollutants are significantly reduced in the case of HEVs and PHEVs, and eliminated in BEVs. A study of the Houston area found that moderate to complete vehicle electrification would reduce Ozone by 1 to 4 parts per billion (ppb) and $PM_{2.5}$ by 0.5 to 2 micrograms per cubic meter ($\mu gm^{-3)}$. This change was estimated to prevent 114 to 246 premature deaths annually, significantly reduce asthma exacerbation by 7,500 cases, and reduce school loss days by 5,500 (Pan, et al., 2019).

Energy Independence and Cost Stability

More than 65% of the petroleum imported to the US in 2018 was used for transportation fuel. Transitioning to EVs shifts the fuel source to more domestically available sources such as coal, nuclear, natural gas, and renewable energy. Integration of EVs is an important strategy for reducing dependence on fuel imports, and isolates transportation costs from the volatile petroleum market (Office of Energy Efficiency and Renewable Energy, 2018). Figure 12 illustrates the fluctuations in gasoline and diesel prices, compared to electricity prices, from 2000 to 2019.

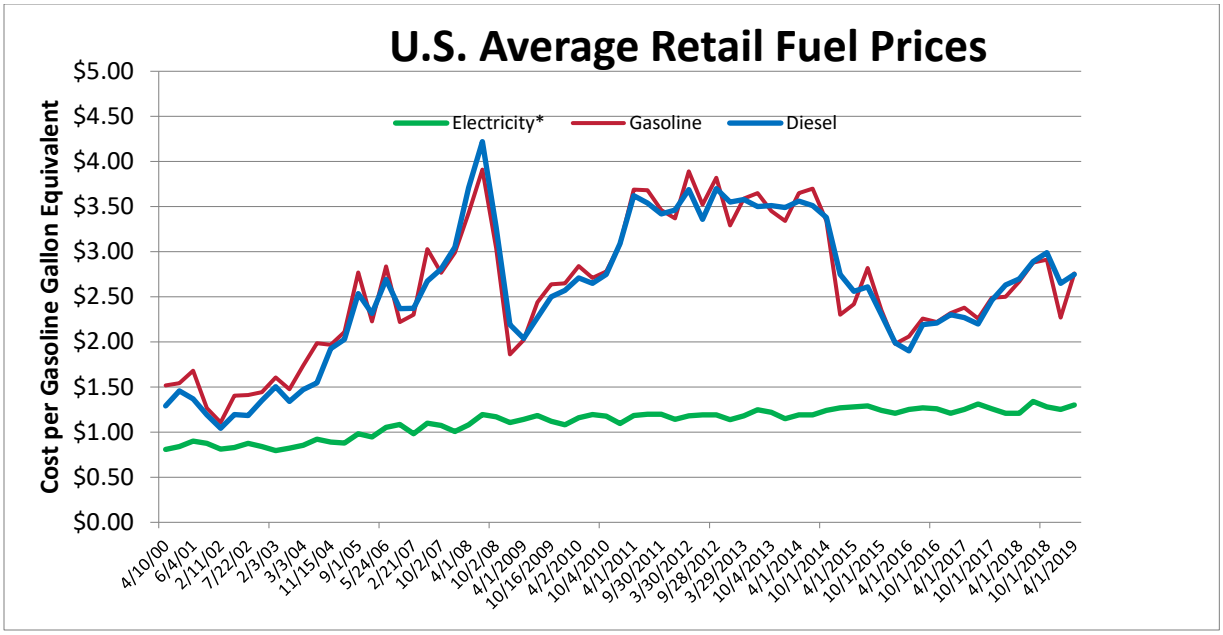


Figure 11. US Average Retail Fuel Prices. Adapted from: (Office of Energy Efficiency and Renewable Energy, 2019)

Lower Fuel & Maintenance Costs

While cost savings vary based on vehicle type, driving patterns, and geographic region, the average driver spends about half as much money in fuel and maintenance costs by driving an EV compared to a traditional ICE (Office of Energy Efficiency and Renewable Energy, 2019). The average US household spends about 13% of their annual income on transportation costs, while low-income households spend an average of 29% of their annual income on transportation costs (Institute for Transportation And Development Policy, 2019). The transition to EVs would result in significant savings for the individual consumer.

APPENDIX E: GLOSSARY OF TERMS

Term	Definition
Alternating current (AC)	The most common form of electricity used in homes and businesses uses alternating current where the current periodically changes direction. Batteries require DC electricity to charge, so EV chargers must convert the supplied AC electricity to DC power.
Amps	The measurement of the amount of electrical energy "flowing" through a charger. This is determined by the electrical load required by the equipment and can vary over time.
Battery Electric Vehicle (BEV)	An all-electric vehicle, fueled by plugging into an external charger, that has no tailpipe emissions. Requires low maintenance costs.
Direct current (DC)	The form of electricity where the current only flows in one direction. This is the type of electricity that batteries supply and require to charge. EV chargers must convert the supplied AC electricity to DC power.
Electricity consumption	Measured in kilowatt-hours (kWh) and represents the amount of electricity that has been consumed over a certain time period.
Electric demand	Measured in kilowatts (kW) and represents the rate at which electricity is consumed. Most commercial energy rates incorporate a charge for electric demand as well as electric consumption.
Electric vehicle (EV)	A vehicle that uses an electric engine for all or part of its propulsion.
Electric vehicle supply equipment (EVSE)	Infrastructure required to support EVs such as chargers, electrical supplies, etc.
Heavy-duty vehicles	Commercial vehicles over a minimum Gross Vehicle Weight Rating (GVRW) of 8,500 lbs.
Hybrid Electric Vehicle (HEV)	Contains both an electric motor and a gasoline engine. The gasoline engine powers a generator that charges the electric motor. No

Term	Definition
	external battery charger is used. Runs at a constant speed, which increases fuel efficiency.
Internal combustion engine (ICE)	Traditional vehicle engine that uses the direct combustion of gasoline, diesel, or other fuels.
Kilowatt-hour (kWh)	The amount of electricity being sent to the EV battery from the charger in one hour. This is calculated by volts times amps divided by 1,000.
Level 1 charging station	Uses a standard 120-volt AC outlet and can take 8 to 12 hours to fully charge a depleted battery; intended for residential use only.
Level 2 charging station	Uses a 220-volt or 240-volt AC outlet and can fully charge a depleted battery in 4 to 6 hours; can be used in both residential and commercial settings.
Level 3/DC Fast charging station	Uses an industrial 480-volt DC outlet and can charge a battery to 80% in 20 to 30 minutes; used in commercial settings where the anticipated charge time is limited (e.g., supermarket, gas station, etc.); will be used on Alternative Fuel Corridors – a national network of major thoroughfares supporting EVs and other alternative fuels.
Light-duty vehicles	Passenger cars with a maximum Gross Vehicle Weight Rating (GVRW) of 8,500 lbs.
Plug-in Hybrid Electric Vehicle (PHEV/PEV)	Contains both an electric motor and a gasoline engine. An external plug is used to fuel the electric motor. The electric motor is used until the battery is depleted, at this point the gasoline engine takes over. Lower tailpipe emissions than traditional ICE and longer ranges than most BEVs.
Range Anxiety	Fear of running out of power in an EV before reaching a charging station or desired destination.
Range per hour (RPH)	A measurement of the miles an EV can travel on one hour of charge. This is generally applied to EV charging stations and expressed in terms of typical EV efficiency.
Vehicle miles traveled (VMT)	A way of measuring integration of EVs and associated reduction in GHG emissions by considering electric miles that replace traditional vehicle miles.
Volts	A measurement of the force pushing the flow of energy through a charger. This measurement is determined by electricity supply. Standard household outlets provide 120 volts; outlets for dryers or other high-powered household equipment supply 240 volts.

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