



An Electric Vehicle Charging Station Action Plan for Larimer County

July 2023



PARTNERS IN ENERGY
An Xcel Energy Community Collaboration

ACKNOWLEDGEMENTS

Thank you to the following individuals who contributed many hours of service to developing this Electric Vehicle (EV) Charging Station Action Plan. The content of this plan is derived from a series of planning workshops hosted by Xcel Energy’s Partners in Energy. Xcel Energy is one of the electric utilities serving Larimer County. Partners in Energy is a two-year collaboration to develop and implement a community’s energy goals.

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An Electric Vehicle Charging Station Action Plan for Larimer County



Public electric vehicle (EV) charging installation has been increasing rapidly. Over the last 5 years, in Larimer County, over 170 new Level 2 charging stations were added, more than doubling the total available. A similar trend has been seen in DC Fast charging stations with 23 installed since 2017, bringing the County total up to 35 stations. This planning effort is designed to help coordinate these efforts and continue to accelerate installation in support of the State of Colorado’s vehicle electrification goals and identified public charging needs.

Why an EV Action Plan?

Larimer County developed an Internal Climate Action, Resilience, and Education (ICARE) plan to supplement the community-wide Climate Smart and Future Ready initiative. These efforts aim to provide plans with mitigation and adaptation strategies to lessen climate change impacts on our community members and advance the County’s identified priorities and aspirations. With air quality along the Front Range, including Larimer County, rated as “severe” for ground level ozone and recognition that our largest contribution to this air quality status is transportation activity, Larimer County seeks to decrease the impact on this vital resource by reducing fossil fuel emissions. Focused actions underway in the ICARE plan, and in development within the Climate Smart and Future Ready initiative, point toward the enhancement of an extended EV charging network to assist us in reaching the County’s goals. For additional details about transportation-related sustainability and climate efforts in Larimer County, visit: www.larimer.gov/climate-and-sustainability/transportation.

Our Electric Vehicle Infrastructure Plan Objectives and Goals

Planning Objective

Identify opportunities to build out an EV charging network in Larimer County leveraging resources from Xcel Energy and community partners.

Goal

This is an implementation plan to provide tactical strategies Larimer County can implement to support the State of Colorado’s goal of 940,000 light-duty EVs by 2030. In this EV plan, the state has identified that the County needs to have 1,447 Level 2 public chargers and 309 level 3 public chargers to support the new EVs in the County by 2030 with short-term targets of 420 level 2 and 105 DC Fast chargers by 2025.

Our Near-term Strategies

The plan’s strategies are estimated to close about 10% of the identified gap between the projected EV infrastructure installations under a business-as-usual scenario and the goals set by the state. This plan is one part of the needed collaboration with Larimer County, local municipalities, and the private sector to close the EV charging gap.

STRATEGY	2025 TARGET	2025-2030 TARGET
Promote EV Charging in Population Centers (P)		
Strategy P-1: Create a Local Working Group	4 DC Fast Chargers	<ul style="list-style-type: none"> • 27 Level 2 chargers • 4 DC Fast chargers
Strategy P-2: Develop an EV charging informational packet	Support Strategy P-1: Create a Local Working Group	
Strategy P-3: Develop a County template to develop a community EV roadmap	At least 1 community uses the template to adopt EV friendly programs and/or polities.	<ul style="list-style-type: none"> • 40 Level 2 chargers • 10 DC Fast chargers
Corridor and Destination Charging (CD)		
Strategy CD-1: Create and maintain a ledger of public EV charging opportunities in the County	Support Strategy P-1: Create a Local Working Group and Strategy CD-1: Create and maintain a ledger of public EV charging opportunities	
Strategy CD-2: Install EV charging at high-traffic County locations	4 Level 2 chargers	
Strategy CD-3: Develop and share EV charging policies	Support CD-2	
Strategy CD-4: Explore resiliency hub opportunities	None	<ul style="list-style-type: none"> • 4 Level 2 chargers • 2 DC Fast chargers
Total New Charging Stations	<ul style="list-style-type: none"> • 4 Level 2 chargers • 4 DC Fast chargers 	<ul style="list-style-type: none"> • 75 Level 2 chargers • 20 DC Fast chargers
Estimated Total EV Charging Stations in the goal year¹ (remaining gap to State goals)	<ul style="list-style-type: none"> • 424 Level 2 chargers (0) • 49 DC Fast chargers (31) 	<ul style="list-style-type: none"> • 916 Level 2 chargers (531) • 196 DC Fast chargers (113)

¹Using the high implementation scenario from the projections.



INTRODUCTION



Public electric vehicle (EV) charging installation has been increasing rapidly. Over the last 5 years, in Larimer County, over 170 new Level 2 charging stations were added, more than doubling the total available. A similar trend has been seen in DC Fast charging stations with 23 installed since 2017, bringing the County total up to 35 stations. This planning effort is designed to help coordinate these efforts and continue to accelerate installation in support of the State of Colorado’s vehicle electrification goals and identified public charging needs.

What Is an EV Charging Station Action Plan?

This EV Charging Station Action Plan is a roadmap to strategically guide Larimer County’s action in a manner that supports the public EV charging targets outlined by the State of Colorado to support the goal of 940,000 light-duty EVs on the road by 2030. The strategies outlined in this plan focus on the interim 2025 targets of 420 Level 2 and 105 DC Fast chargers throughout the county. County government is not wholly responsible for these charging stations; rather, Larimer County government will work to collaborate with public and private partners identified throughout this plan to jointly promote EV charging station installation at strategic locations throughout the County. Larimer County government sees its role as promoting EV adoption in areas in the County where market forces are lagging the adoption curves needed to support the state’s goal through direct installation at County facilities, collaboration with public or private partners, and education and outreach initiatives.

The EV goals and strategies outlined in this plan were developed collaboratively with a stakeholder team, through three planning workshops conducted in January through June 2023. Since successful deployment of EV strategies relies on collaboration between many organizations, the planning process was designed to be an opportunity

for collaboration among major players in EV charging infrastructure within the County. For a full list of participants see the Acknowledgements. Team members coordinated throughout the process to share information and identify potential opportunities for partnership during implementation.

Larimer County joins more than 35 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 Larimer County's EV Charging Station Plan are detailed below:

Introduction Explores Larimer County's motivations for developing an EV Charging Station Action Plan.

Where We Are Now Outlines the relevant characteristics of the Larimer County EV landscape.

Where We Are Going Describes Larimer County's EV vision and goals through a planning horizon of 2025.

How We Are 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 We Stay on Course Outlines how Larimer County will track progress toward targets, goals, and vision, and how it will adapt to a changing landscape during the coming 7-year implementation period.

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

Why an EV Charging Station Action Plan?

Larimer County developed an Internal Climate Action, Resilience, and Education (ICARE) plan to supplement the community-wide Climate Smart and Future Ready initiative. These efforts aim to provide plans with mitigation and adaptation strategies to lessen climate change impacts on our community members and advance the County's identified priorities and aspirations. With air quality along the Front Range, including Larimer County, rated as "severe" for ground level ozone and recognition that our largest contribution to this air quality status is transportation activity, Larimer County seeks to decrease the impact on this vital resource by reducing fossil fuel emissions. Focused actions underway in the ICARE plan, and in development within the Climate Smart and Future Ready initiative, point toward the enhancement of an extended EV charging network to assist us in reaching the County's goals. For additional details about transportation-related sustainability and climate efforts in Larimer County, visit: <https://www.larimer.gov/climate-and-sustainability/transportation>

Additional information about the transition to EVs supporting the County’s sustainable transportation goals can be found in the sections below.

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 solutions to keep global temperature change below 1.5°C and the important role that communities must play. Among strategies, the IPCC states 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).

Secondary Climate Impacts



[Photo by Arnav Kainthola from Pexels](#)

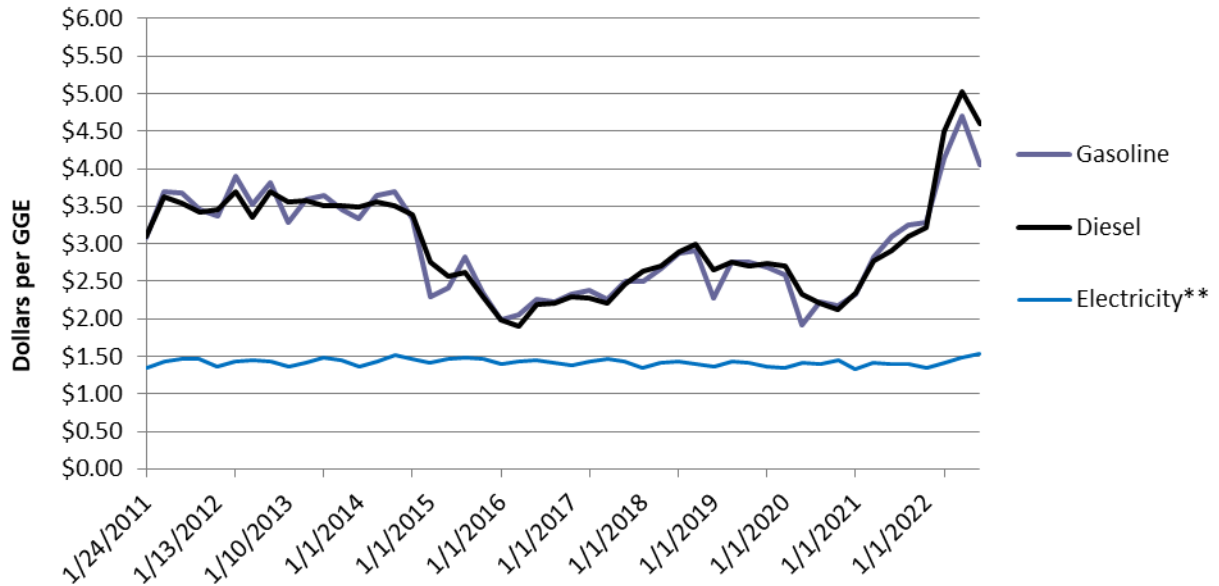
Global climate change is bringing increased temperatures and increased severity and frequency of drought to Colorado. As a result, the frequency and severity of wildfires has been increasing further exacerbating local air quality concerns (National Oceanic and Atmospheric Administration, 2023).

Air Quality

In addition to contributing a significant portion of greenhouse gas emissions, the transportation sector also produces pollutants such as particulate matter (PM), nitric oxides (NOx), carbon monoxide (CO), and volatile organic compounds (VOCs). Pollutants like NOx and VOCs contribute to ground-level ozone, which in addition to PMs and CO, are harmful to respiratory health. Larimer County is rated as “severe” for ground level ozone making it a significant concern in need of immediate action. In general, electric vehicles produce fewer tailpipe pollutants as compared to their internal combustion engine (ICE) counterparts (Office of Energy Efficiency & Renewable Energy, 2020). Since EVs are fueled by electricity, and as the fuel mix for electricity for electricity providers serving Larimer County decarbonizes (i.e., generates fewer greenhouse gas emissions), the magnitude of air quality benefits associated with electrifying transportation will increase.

Energy Independence and Cost Stability

In 2018, over 65% of the petroleum imported to the US 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 1 illustrates the fluctuations in gasoline and diesel prices compared to electricity prices from 2011 to 2022.



** Electricity prices are reduced by a factor of 3.54 because electric motors are 3.54 times more efficient than internal combustion engines.

afdc.energy.gov/data

Figure 1. US Average Retail Fuel Prices. Adapted from: (Office of Energy Efficiency and Renewable Energy, 2019)

Lower Fuel and 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. Over its lifetime, an EV tends to cost 50% less to own and operate as compared to its ICE counterpart (US DOE, 2019). Though the upfront costs of EVs are still greater, this gap is expected to decrease as the price of batteries continues to drop.

EV Charging Grid Impacts



[Photo by Kindel Media from Pexels](#)

Xcel Energy is tracking EV adoption in its service territory and is working to align grid infrastructure needs with increasing EV adoption. EV plans like Larimer County's help Xcel Energy and other electric utilities understand the future demand and plan appropriately. As EV adoption grows, solutions including storage and off-peak charging can help support grid stability and lower energy costs (Climate Nexus, 2023).

There are emerging technologies to help manage grid demands. Bidirectional EVs can receive energy as well as provide energy. Vehicle-to-grid charging technology is rapidly advancing and has potential to provide additional grid benefits during peak times.

WHERE WE ARE NOW



To better understand the opportunities for EV adoption in Larimer County, this section summarizes basic community characteristics. 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 by Focus Area in the How We Are Going To Get There section.

Geography

Larimer County is the sixth largest County in Colorado based on population. The County extends from the Continental Divide to the Interstate 25 corridor and includes a mix of incorporated towns and cities and unincorporated communities and places (Table 1). The County encompasses 2,640 square miles that include irrigated farmland as well as vast stretches of ranch lands, forests, and high mountain peaks. Over 50% of Larimer County is publicly owned, most of which is land within Roosevelt National Forest and Rocky Mountain National Park (Figure 2). In addition to these federal lands, Colorado State Parks and Recreation, and Larimer County Parks and Open Spaces provide a wide spectrum of recreational opportunities that are enjoyed by both residents and visitors (Larimer County, 2022). These features are destinations for many potential EV drivers who will need access to public charging.



Key Takeaway

Open space and recreation opportunities attract many visitors, who will need access to public EV charging stations.

Table 1: Larimer County Communities by Type

Towns and Cities	Census Designated Place	Other Unincorporated Communities
Located completely in Larimer County 1. Estes Park 2. Fort Collins 3. Loveland 4. Timnath 5. Wellington	1. LaPorte 2. Red Feather Lakes	1. Bellvue 2. Buckeye 3. Campion 4. Drake 5. Glen Echo 6. Glen Haven 7. Kelim 8. Kinikinik 9. Livermore 10. Masonville 11. Rustic 12. Ted's Place 13. Waverly
Located partially in Larimer County 1. Berthoud 2. Johnstown 3. Windsor		

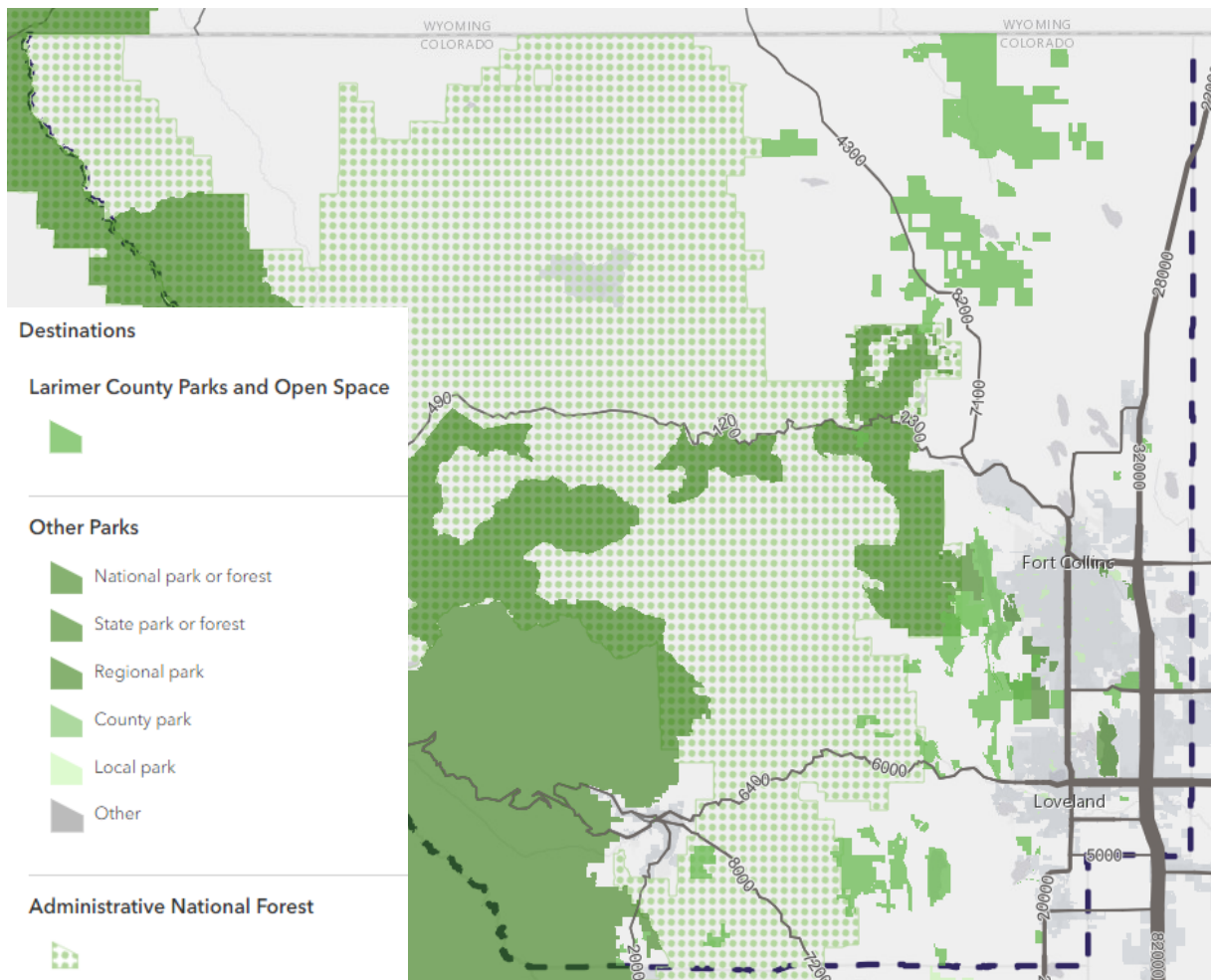


Figure 2: Larimer County's open space.

Population

Larimer County is home to about 359,000 people (American Community Survey, 2023) and the population is forecasted to grow to over 406,000 by 2030 (Colorado Department of Local Affairs, 2022). The population of Larimer County is highly concentrated along the Interstate 25 corridor near Loveland and Fort Collins (Figure 3). These population centers are good places for public charging to support residents that may not have access to charging at home (as described in the Housing Characteristics section).



Key Takeaway

Population centers are concentrated along the I-25 corridor. This is where people who can't install EV charging at home will need access to public EV charging.

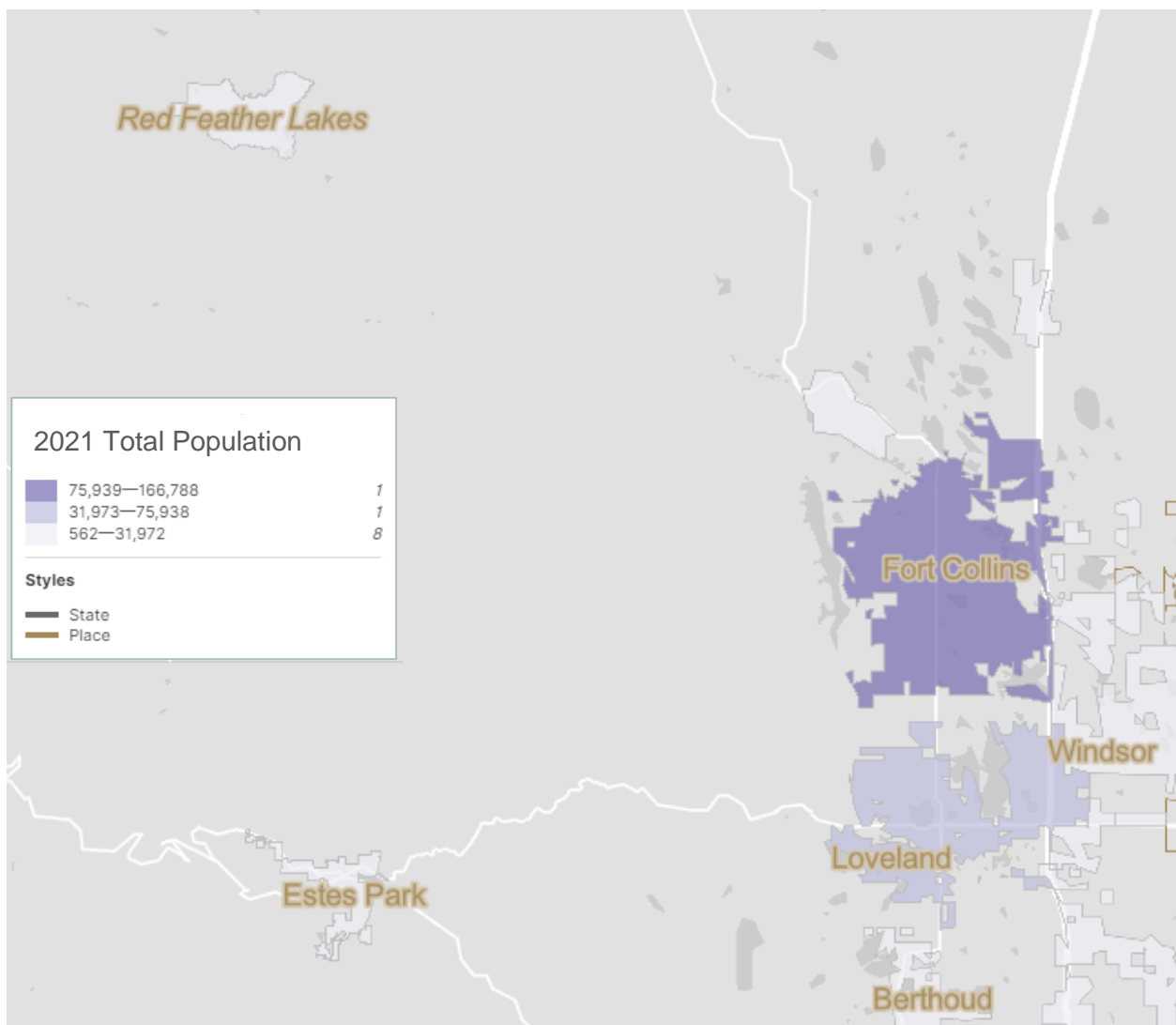



Figure 3: Population by community in Larimer County (US Census Bureau, 2023).

Housing Characteristics

There are two major housing factors that facilitate a resident’s ability to convert their personal vehicle to an EV: home ownership and single-family residence. Homeowners are more able to install EV charging because they do not need to seek permission of a separate 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 property owner to install charging infrastructure and may be reluctant to invest in improving property they do not own. In Larimer County, 65% of the almost 150,000 homes are owner-occupied (US Census Bureau, 2020). This homeownership rate varies significantly by community within the County (Figure 4). The data shows that more public charging may be needed in Estes Park, Fort Collins, and Loveland where homeownership rates are lowest.

 **Key Takeaway**
Public charging access for renters who own EVs may be most important in Fort Collins, Estes Park, and Loveland.

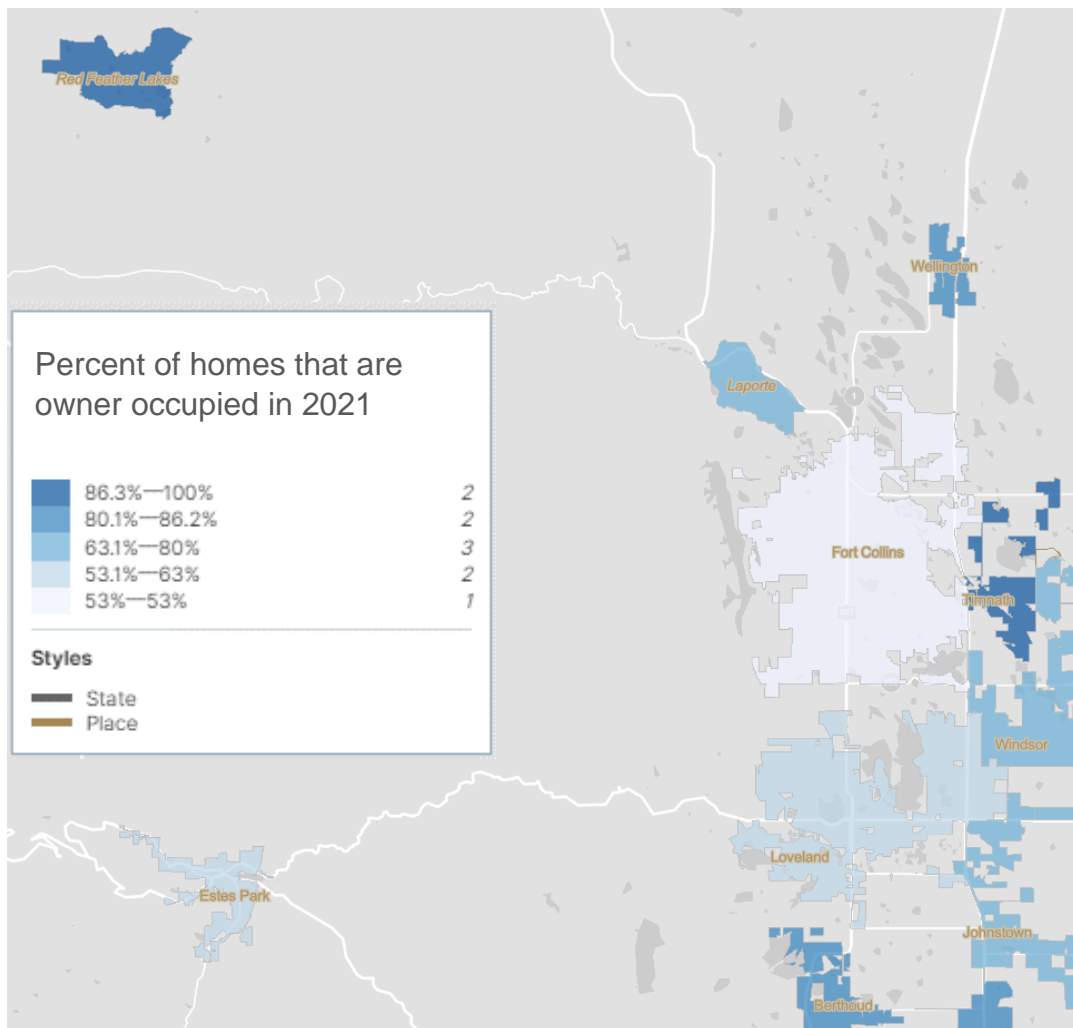


Figure 4: Homeownership rates in communities throughout the County (American Community Survey, 2023)

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. About 72% of the homes in Larimer County are single-family detached homes, which are more likely to have dedicated off-street parking conducive to installation of EV charging infrastructure (US Census Bureau, 2020).

Commuting Characteristics

Employees of workplaces with EV charging are six times more likely to own an electric vehicle than those at workplaces without EV charging (US DOE, 2016). Though most of EV charging occurs at home, supporting the adoption of EV charging at workplaces is an important strategy to bolster EV adoption overall. To better understand typical travel patterns for people who work in Larimer County, distances and direction of travel from work locations within the County to the employee’s home were evaluated using 2020 Census Data (Figure 5). Over 75% of employees in Larimer County travel less than 25 miles to work. For these workers, a round-trip of 50 miles is well within the range of most EVs. Workplace charging may be key to support employees with older or used EVs with reduced range or be an option to lower concerns about reduced range due to colder temperatures in the winter.

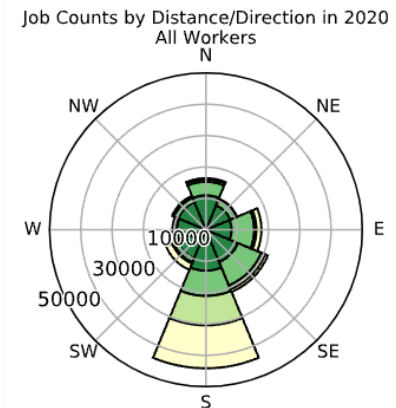


Figure 5: Commuting direction and distance for people who work in Larimer County.

About 15% of the workforce travel more than 50 miles to work in Larimer County. Given the distance of travel, transitioning these trips to electric vehicles would have the greatest environmental impact and have the highest economic benefit from reduced fuel costs.

Transportation Costs

Based on the [H + T Index](#) that measures the housing and transportation costs of communities, Larimer County is a car-dependent location with limited access to public transportation. On average, households within the County travel almost 19,000 miles per year, spending \$14,800 on transportation costs (Center for Neighborhood Technology, 2022). This means that transportation costs make up about 21% of household income on average (Figure 6). Figure 7 shows the distribution of transportation costs from across the County as a percentage of

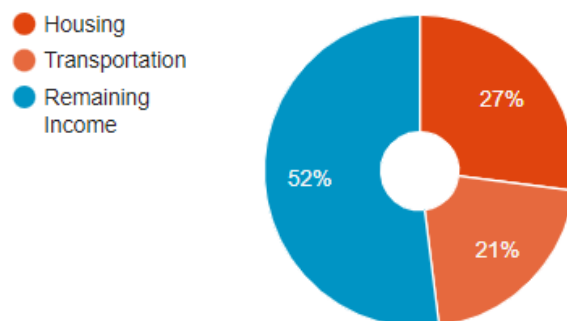


Figure 6: Average household income breakout for Larimer County.

household income. This map shows that in nearly all locations transportation costs make up a significant portion of the household's income making only 2% of the County considered efficient neighborhoods where less than 15% of the household income is spent on transportation.

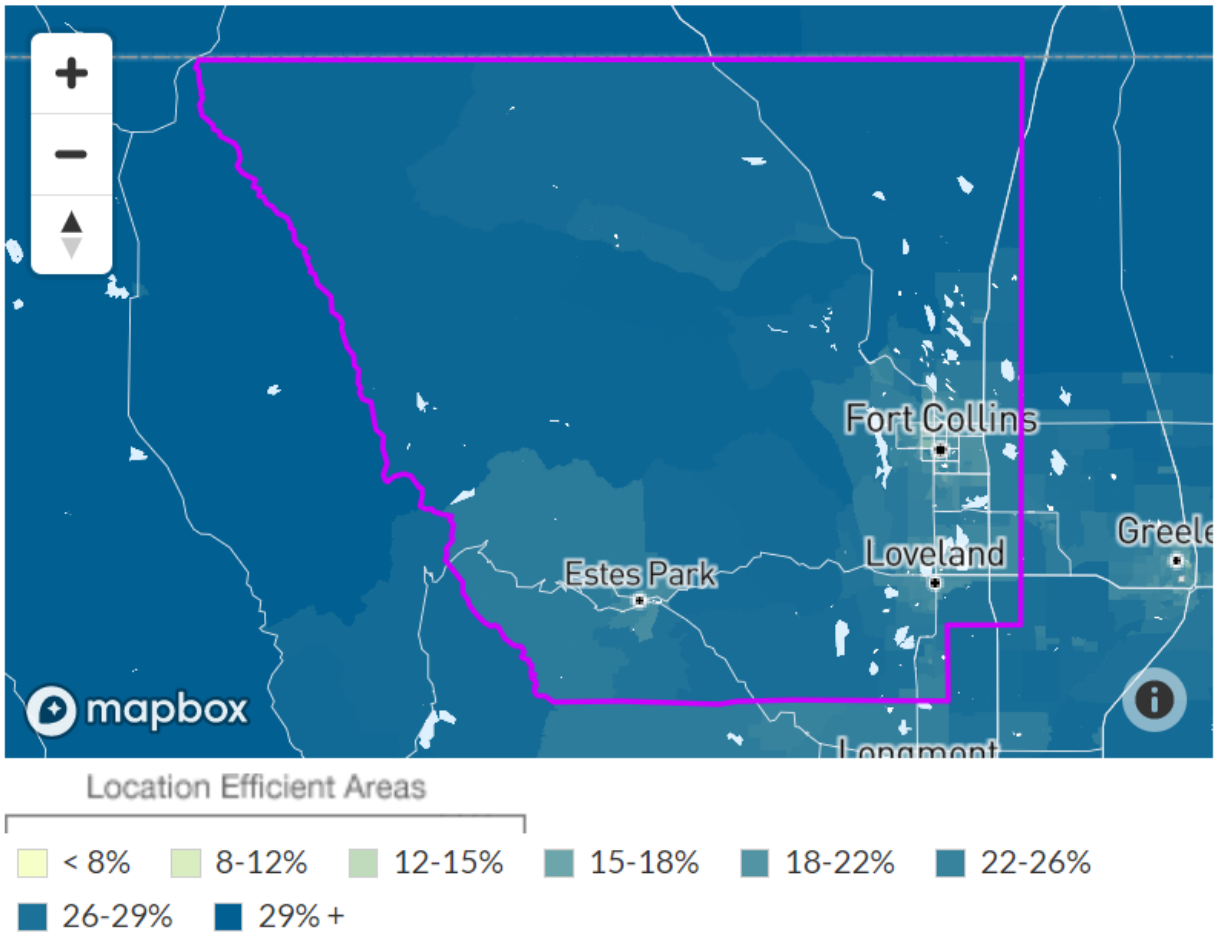


Figure 7: Average transportation costs as a percent of income across the County.

Related Planning Efforts

This EV Charging Station Action Plan is an implementation plan designed to support State and local EV and transportation planning initiatives. Some of the key relevant initiatives are listed below.

Colorado EV Plan 2023

The [2023 Colorado EV Plan](#) is an update to the State's 2018 and 2020 plans and continues to accelerate adoption of EVs of all types in Colorado. The plan builds on the existing goal established of 940,000 light-duty EVs by 2030 and a long-term vision of 100 percent electric light-duty vehicles and 100 percent zero emission medium-duty vehicles. It establishes goals and new actions in four focus areas:

- 1. Light-Duty Vehicles and Infrastructure:**
 - o Increase adoption of EVs in the light-duty sector to approximately 940,000 vehicles by 2030 and pave the way for reaching nearly 100% EVs by 2050.
 - o Work with utilities, private companies, site hosts, local governments, and others to increase the EV infrastructure needed to support the state’s 2030 light-duty vehicle goals and enable travel statewide in an EV.
- 2. Medium- and Heavy-Duty Vehicles and Infrastructure:**
 - o Increase adoption of medium- and heavy-duty zero emission vehicles to at least 30% of new sales by 2030, and 100% of new sales by 2050.
- 3. Electric Mobility (electric micro-mobility and shared electric modes):**
 - o Replace car trips with electric mobility options (electric micromobility and shared electric modes) where feasible.
- 4. Cross-Cutting Initiatives:**
 - o Meet EV directives from the [2022 Greening of State Government Executive Order](#).
 - o Develop equity-centered programming by engaging community-based organizations and disproportionately impacted community members in program design and implementation and increasing investment in these communities.
 - o Work proactively to support a broad and resilient zero emissions vehicle workforce that ensures transportation system safety and reliability, while offering job opportunities to all Coloradans.

The EV infrastructure goals outlined for Larimer County for this plan are shown in Table 2 by charging type Public Level 2 charging stations and DC Fast charging (DCFC) stations. These public charging goals form the basis for the targets and strategies outlined in this plan.

Table 2: Recommended public EV charging in Larimer County based on the Sate Needs assessment (Hsu, Slowik, & Lutsey, 2021).

Larimer County EV charger needs			
Year	Public Level 2	DCFC non-corridor	DCFC corridor
2025	420	78	27
2030	1,447	238	71

Colorado National Electric Vehicle Infrastructure (NEVI) Plan

The [NEVI Plan](#) outlines the state’s strategy for utilizing the National Electric Vehicle Infrastructure (NEVI) formula program funding, which will provide \$5 billion over five years for states to deploy EV chargers along highway corridors. It addresses the establishment and evaluation of build-out goals, the role of contracting with third parties, public engagement, equity for rural and disadvantaged communities, workforce considerations, and cybersecurity concerns. The corridors identified in Larimer County are shown in Figure 8.

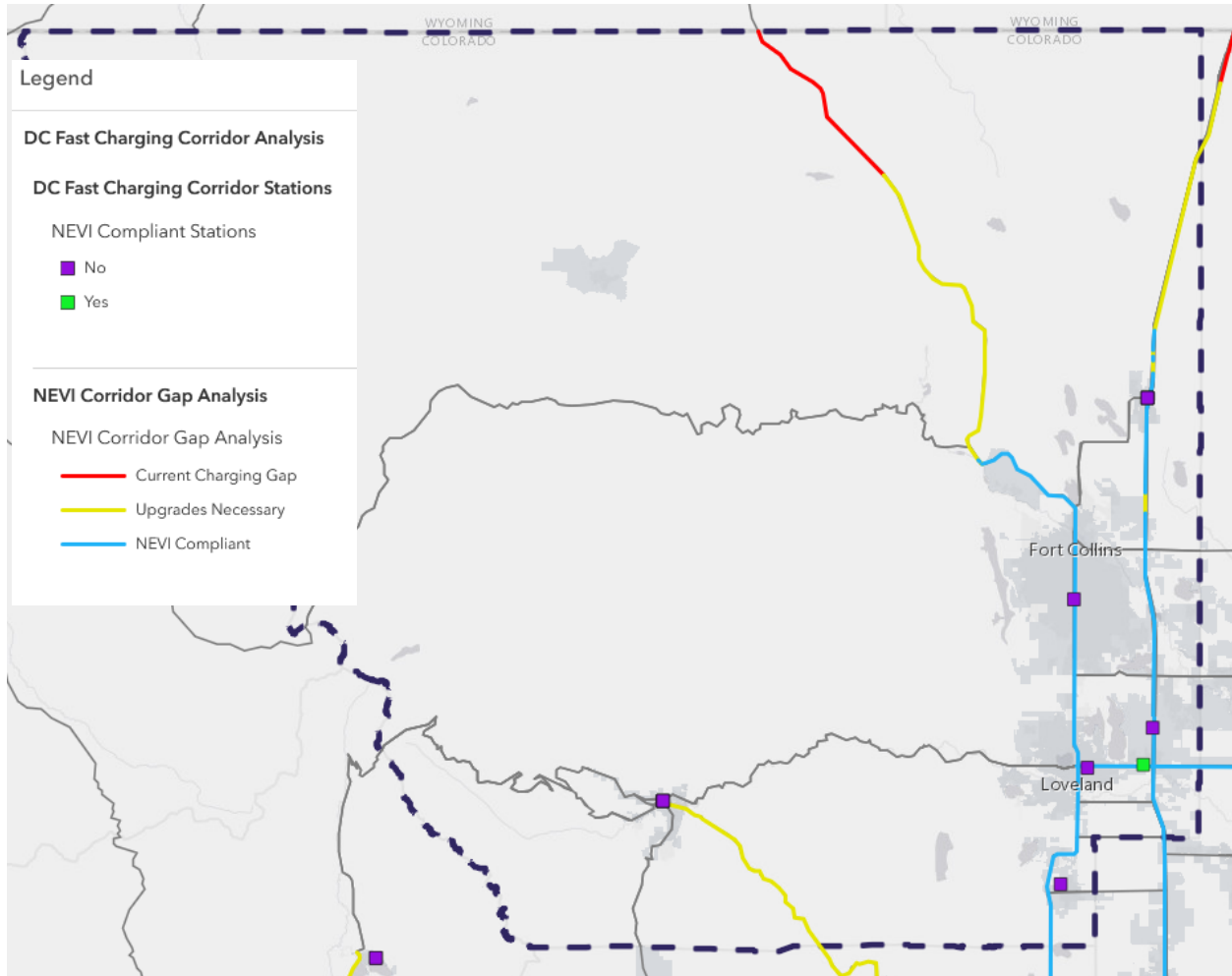


Figure 8: NEVI Corridors identified in Larimer County

Estes Park Electric Vehicle Infrastructure and Readiness Plan

The [Estes Park EV Infrastructure Readiness Plan](#) was developed in 2021 and includes 6 recommendations for promoting EV adoption within Estes Park:

1. Develop and implement EV education and awareness programs.
2. Build and strengthen local and regional partnerships as it relates to EVs.
3. Implement EV charging-focused time of use rates.
4. Adopt a “ZEV first” fleet replacement policy.
5. Adopt codes and policies that support transportation electrification.
6. Expand public charging infrastructure to meet demand.

Fort Collins Electric Vehicle Readiness Roadmap

The [Fort Collins EV Readiness Roadmap](#) was developed in 2018 and includes 8 focus areas to promote EV adoption within Fort Collins:

1. Outreach and Education
2. City Planning and Regional Coordination
 - a. Regional coordination - continue to engage with CC4CA on EV-related issues, including clean vehicle standards.
 - b. Actively participate in the Colorado Electric Vehicle Coalition
 - c. Coordinate with CEO to ensure that DC Fast charging installations in Fort Collins align with FHWA priority corridors.
3. Policies
 - a. The City should support the installation of EV charging infrastructure through policy, education, and incentives, but refrain from owning, operating, and maintaining charging stations.
4. Incorporate EVs and charging infrastructure in the Fort Collins Legislative Policy Agenda
5. Incentives
6. Utilities
7. Leading by Example
8. Emerging Technologies

Northern Colorado Clean Cities (NCCC) EV Action Plan

NCCC developed an [EV Action Plan](#) in 2020 through Partners in Energy with the goal to have 50,000 EVs on the road in Northern Colorado by 2030, assuming a 45% annual increase from 2020 levels. The stretch goal of 145,000 EVs on the road is based on the Colorado Electric Vehicle Plan goal of 940,000 EVs by 2030 scaled to NCCC's population.

Climate Smart and Future Ready initiative for Larimer County

The purpose of the Climate Smart and Future Ready: Strategies for a Sustainable Larimer County (CSFR) initiative is to provide a plan to address climate change with mitigation and adaptation strategies intended to lessen impacts on community members and the County's identified priorities and aspirations.

The County is currently in Phase 3 of this initiative, undertaking a detailed review of existing plans and programs that link to the prioritized strategies to better adapt to and mitigate against the social, economic, and environmental risks that the County faces from climate change. Phase 3 includes development of partnerships and collaborations across Larimer County, as no single entity can tackle climate change on their own. One of the working groups developing implementable actions in this effort is the Mobility of Goods, Services, and People work group. Of the actions in development, the establishment of appropriate infrastructure to facilitate less impact from mobility has been a constant theme and hence will be supported by this EV Charging Station Action Plan. Phase 3 will be completed in the second quarter of 2024.

Larimer County Electric Vehicle Goals

The Internal Climate Action, Resilience, and Education (ICARE) plan includes two goals related to EVs:

- Increase average miles per gallon of the County light-duty fleet by 20% through transition to alternative fuel vehicles, adoption of an idling policy and more fuel-efficient vehicles by 2030; and
- Increase EV infrastructure in unincorporated Larimer County.

Larimer County recognizes the impact of practicing the actions it seeks throughout the community and therefore is working diligently to meet these goals.

WHERE WE ARE GOING



Our Plan Objective

This planning process was designed to support Larimer County in its goal of promoting public EV charging throughout the County. At the outset of this planning effort, the project management team identified the following planning objective to guide stakeholder involvement and strategy development.

Identify opportunities to build out an EV charging network in Larimer County leveraging resources from Xcel Energy and community partners.

EV Charging Station Action Plan Goals

This is an implementation plan to provide tactical strategies Larimer County can implement to support the State of Colorado's goal of 940,000 light-duty EVs by 2030. In this EV Charging Station Plan, the state has identified that the County needs to have 1,447 Level 2 public chargers and 309 level 3 public chargers to support the new EVs in the County by 2030 with short-term targets of 420 level 2 and 105 DC Fast chargers by 2025.

Figure 9 shows historical installations of Level 2 charging stations in Larimer County. This historical rate of installation was used to create an estimated projected range of installed charging stations. The lower end of this range assumes the rate of installation matches historical rates and the upper end assumes a more exponential rate, which has been seen in some EV markets. This range was compared to the implementation goal in 2025 and 2030.

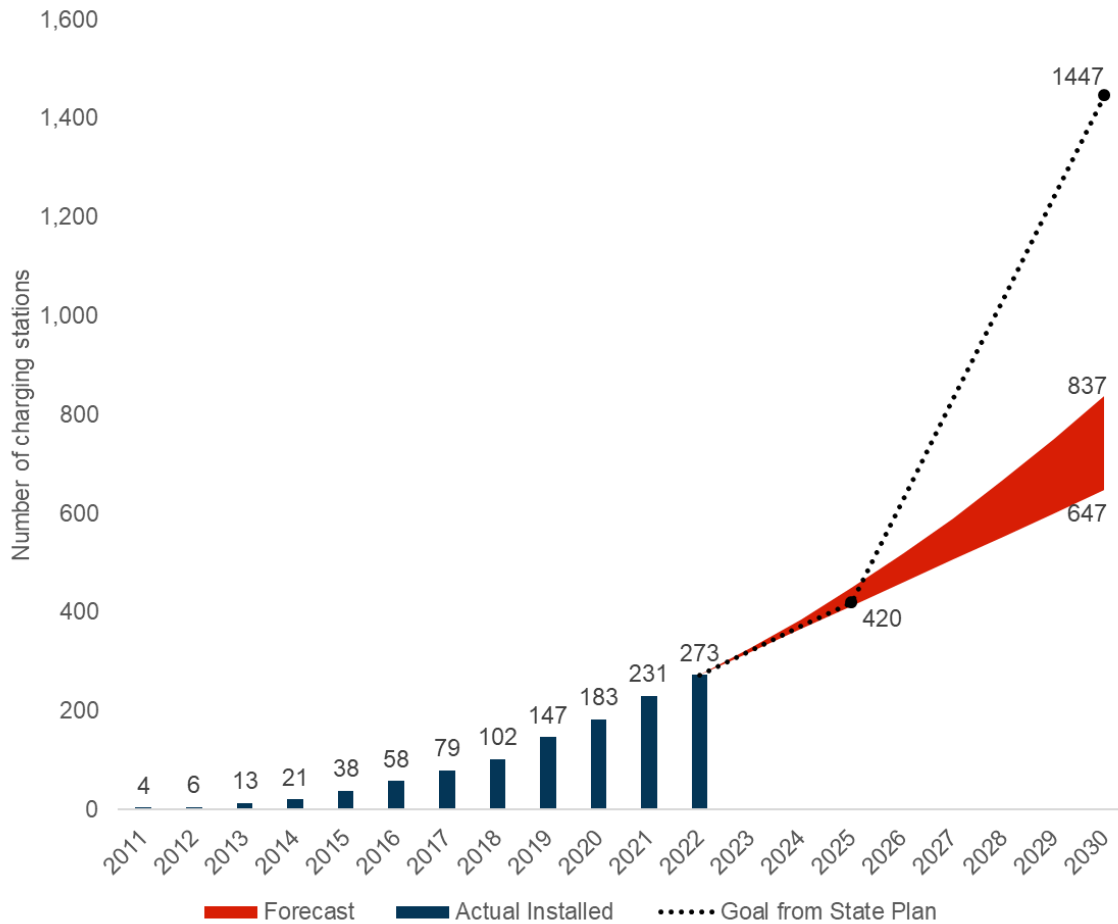


Figure 9: Level 2 EV charging station installation forecast compared to state goal

This analysis suggests that the current rate of Level 2 EV charging station installation is on track to meet the County’s 2025 target, but after 2025, a significant increase in implementation rate will be required to hit the 2030 goal. Based on this analysis, Larimer County should prioritize strategies that will lay the foundation for significant EV charging station installation between 2025 and 2030. These strategies could include encouraging EV friendly policies and encouraging communities to create their own EV adoption plans and goals.

The same analysis was completed for DC Fast charging installations (Figure 10). For DC Fast charging stations, a significant increase in installation rate is required for both short term and long-term targets. Based on this data, the County will need to work with partners to identify opportunities for short-term installation as well as long-term DC fast-charging network strategies.

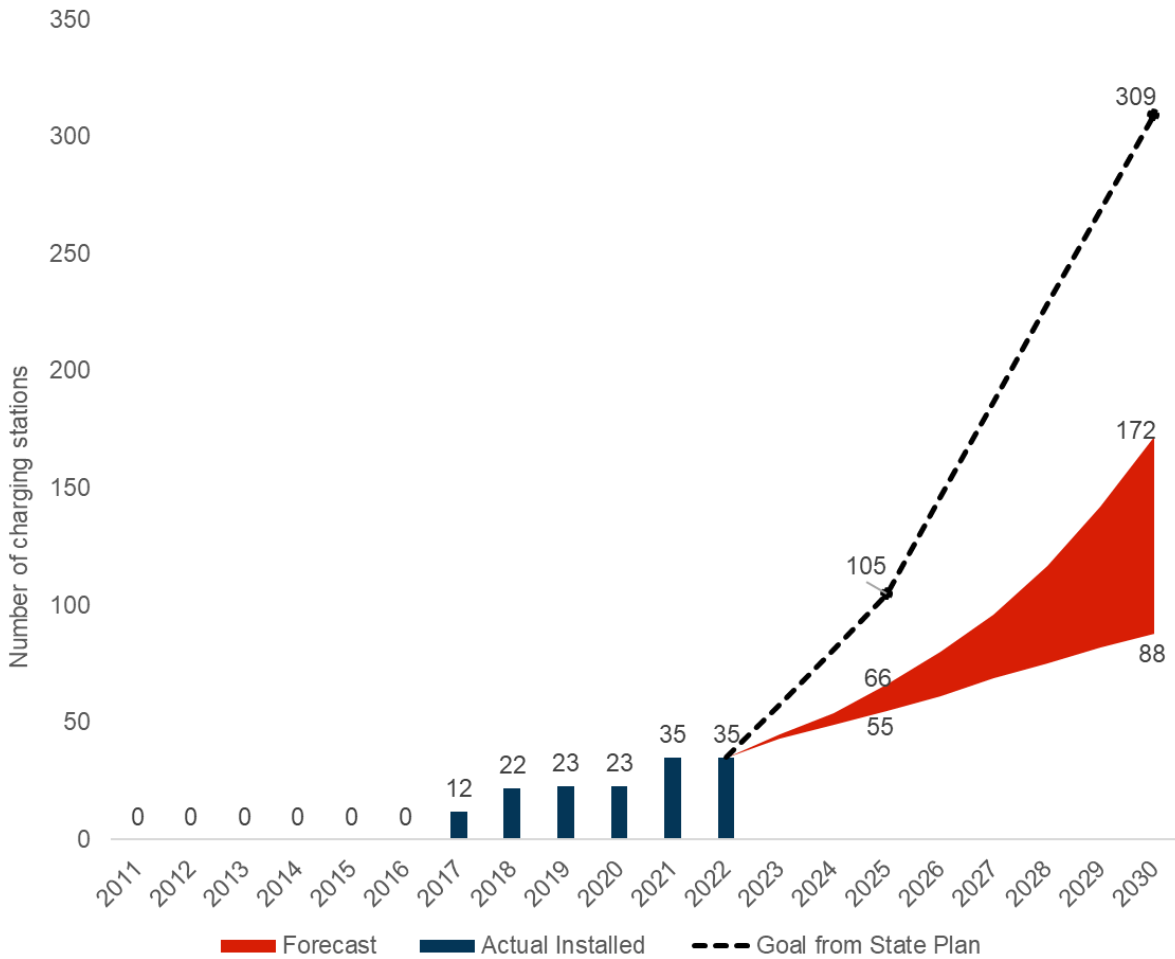


Figure 10: DC Fast charging station installation forecast compared to state goal

Focus Areas

To achieve a community-wide commitment to transportation electrification, the EV Action Team identified the following focus areas to prioritize strategies and resources.

- **Promote EV Charging in Population Centers:** Support communities within Larimer County where EV charging station installation is lagging and/or there is no existing EV plan to catalyze and increase installation of EV infrastructure.
- **Corridor and Destination Charging:** Identify and prioritize areas where people may travel for business or pleasure and/or locations along major travel corridors for EV charging station installation.

These focus areas were chosen to provide a framework to accelerate public EV charging throughout the County to meet the State’s EV adoption goal.

HOW WE ARE GOING TO GET THERE



For each focus area, baseline conditions were analyzed. Based on this analysis, the EV Action Team identified targets and metrics for each focus area to help track progress and evaluate success. The EV Action Team then identified potential barriers to success and developed strategies to 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 (Table 3). Collectively, each focus area serves as a work plan of actionable steps to achieve the Larimer County EV Charging Station Action Plan objective and goals.

Table 3: Near-term Strategies

Strategy	Q3 2023	Q4 2023	Q1 2024	Q2 2024	Q3 2024	Q4 2024
Promote EV Charging in Population Centers						
Strategy P-1: Create a Local Working Group						
Strategy P-2: Develop an EV charging informational packet						
Strategy P-3: Develop a County template to develop a community EV roadmap						
Corridor and Destination Charging						
Strategy CD-1: Create and maintain a ledger of public EV charging opportunities						
Strategy CD-2: Install EV charging at high-traffic County locations						
Strategy CD-3: Develop and share EV charging policies						
Strategy CD-4: Explore resiliency hub opportunities						

Focus Area: Promote EV Charging in Population Centers

This focus area focuses on providing public EV charging in population centers across Larimer County. These charging stations would mostly be to support EV owners who face barriers to installing charging at home, workplace charging, and charging at community businesses for patrons.

Background Data

Larimer County is home to 8 towns and cities as well as 2 Census Designated Places that are considered in this focus area. These population centers are home to about 90% of the people who live in Larimer County. These are the places where people who own EVs or are considering owning EVs live. To accelerate EV adoption, these areas need to invest in public EV charging to support vehicle owners who don't have reliable charging options at home. This is most likely to be renters or residents living in multifamily housing.

To identify the areas within the County where additional support may be required, the total number of Level 2 charging stations per 1,000 people was evaluated and compared to the County average (Table 4).

Table 4: Level 2 charging station evaluation of population centers as of June 16, 2023. (Source: US DOE Alternative Fueling Station Locator)

Location	2020 Population	Level 2 Chargers	Chargers per 1000 people
Estes Park	5,904	29	4.91
Fort Collins	169,810	147	0.87
Loveland	76,378	61	0.80
Berthoud	10,332	8	0.77
Timnath	6,487	4	0.62
Windsor	28,967	10	0.35
Johnstown	9,887	2	0.20
Wellington	9,994	2	0.20
Laporte	2,409	0	0.00
Red Feather Lakes	426	2 (coming soon)	4.69
Larimer County	359,066	290	0.81

Based on this analysis, Estes Park and Fort Collins have the highest rate of Level 2 EV charging station installation. These are also the two communities within the County that have EV Action Plans. Loveland and Berthoud also have above average rates for Level 2 charging station installation. Other communities may benefit from support in encouraging EV infrastructure installation.

Focus Area Target

The goal of this plan is to make up about 10% of the projected infrastructure gaps identified in the EV Charging Station Action Plan Goals section. The contribution of the strategies in this focus area to closing this gap are estimated in Table 5. This table shows the total number of new charging stations, in addition to the business-as-usual projected installations, to be installed by 2025 and then between 2025 and 2030.

Table 5: Targeted number of new chargers as a result of Population Center Strategies.

Strategy	2025 Target	2025 - 2030 Target
Strategy P-1: Create a Local Working Group	4 DC Fast Chargers	27 Level 2 chargers 4 DC Fast chargers
Strategy P-2: Develop an EV charging informational packet	Support Strategy P-1: Create a Local Working Group	
Strategy P-3: Develop a County template to develop a community EV roadmap	At least 1 community uses the template to adopt EV friendly programs and/or policies.	40 Level 2 chargers 10 DC Fast chargers
Total Cumulative Impact	4 DC Fast Chargers	67 Level 2 chargers 14 DC Fast chargers

Strategies

The following short-term strategies will support community EV adoption.

Strategy P-1: Create a Local Working Group

Convene local entities working to support public EV charging stations across Larimer County to coordinate activities and provide important information on funding and other resources.

Target Audience:	Local public and private entities that are installing EV charging stations for public use throughout Larimer County.
Desired Outcomes	Provide an opportunity for collaboration and coordination between entities. This could include combined grant funding applications or coordinated installation projects. The group would meet about once per quarter with a mix of virtual and in-person collaboration opportunities.
Resources	n/a
Communication Channels	Direct outreach via email or phone

Roles and Responsibilities	Partners in Energy <ul style="list-style-type: none"> • Develop group structure • Support group recruitment • Support group meeting agenda and content Larimer County <ul style="list-style-type: none"> • Recruit group members • Lead group meetings • Host group resources
Timeline	Q3 2023 <ul style="list-style-type: none"> • Identify potential group participants • Recruit participants Q4 2023 <ul style="list-style-type: none"> • Hold first group meeting

Strategy P-2: Develop an EV charging informational packet

Develop an informational packet that can be shared with businesses and multifamily housing considering installing EV charging for public use in Larimer County. This packet will help owners determine the most appropriate charging type for their application, the permitting process, and available resources for implementation.

Target Audience	Businesses or other private entities in Larimer County that are considering installation of public EV charging on their properties.
Desired Outcomes	Provide an easy-to-follow resource to guide decision making and support the installation process. This packet will include: <ul style="list-style-type: none"> • Types of charging with pros and cons of each • Guidance for matching site characteristics with the best charging opportunities • What to expect from the infrastructure development process • Discussion of cost and benefits • Links to available funding opportunities
Resources	Xcel Energy incentives Charge Ahead Colorado grant Poudre Valley REA incentives Efficiency Works incentives
Communication Channels	The packet will be available for use by County economic development employees, working group members from Strategy P-1: Create a Local Working Group, and municipalities from P-3 for outreach purposes.

Roles and Responsibilities	Partners in Energy <ul style="list-style-type: none"> Outline packet content for review by users Develop packet draft based on user feedback Finalize and design packet Larimer County <ul style="list-style-type: none"> Gather feedback on packet content from target users Review draft and provide feedback Share packet and intended use with target users
Timeline	Q4 2023 <ul style="list-style-type: none"> Outline packet content Provide first draft of content for review Q1 2024 <ul style="list-style-type: none"> Finalize packet content Design handouts Distribute handouts to interested parties within the County or the working group developed in Strategy P-1: Create a Local Working Group

Strategy P-3: Develop a County template to develop a community EV roadmap

Develop a template for developing an EV roadmap including sample or recommended strategies for communities within Larimer County. This template is intended to help Larimer County communities without a plan develop a simple roadmap to guide work and set them up for available grant opportunities.

Target Audience:	Communities within Larimer County without an EV plan.
Desired Outcomes	Larimer County communities will be able to quickly develop a short-term EV roadmap to guide public EV charging in the community. Larimer County will also help promote a predictable EV charging experience across the County by encouraging similar policies in all communities across the County. This packet will include: <ul style="list-style-type: none"> Local government funding opportunities Recommended EV charging codes and development standards EV signage guidelines EV plan guidance
Resources	Xcel Energy Partners in Energy EV Toolkit
Communication Channels	Direct outreach and communication between County staff and City staff at targeted municipalities.

<p>Roles and Responsibilities</p>	<p>Partners in Energy</p> <ul style="list-style-type: none"> • Leverage EV Toolkit to draft a template for municipalities. • Finalize template based on County feedback. • Support conversations with municipalities as needed. <p>Larimer County</p> <ul style="list-style-type: none"> • Provide input on the types of guidance communities have been looking for. • Review preliminary draft and provide feedback. • Share template with municipalities. <p>Save Energy Coalition</p> <ul style="list-style-type: none"> • Share resources with community contacts
<p>Timeline</p>	<p>Q1 2024</p> <ul style="list-style-type: none"> • Develop an outline of potential guide content. • Review with one or two target community representatives. • Revise outline based on feedback. <p>Q2 2024</p> <ul style="list-style-type: none"> • Develop guide content. <p>Q3 2024</p> <ul style="list-style-type: none"> • Share content with target community representatives. <p>Ongoing</p> <ul style="list-style-type: none"> • Provide support as communities use the template to create their own EV plans.

Focus Area: Corridor and Destination Charging

This focus area is intended to support EV charging for drivers traveling to destinations throughout the County and along the major travel corridors. Since the State's NEVI plan is focused on installing infrastructure along the identified NEVI corridors within the state (Figure 8), this plan will focus on other travel corridors not covered by the NEVI plan. Larimer County will work to support the NEVI planning effort as needed based on the goals and strategies in that plan.

Background Data

To better understand the opportunities to support corridor and destination charging, key destinations in Larimer County were mapped along with daily vehicle travel data by travel corridor and existing charging stations (Figure 11).

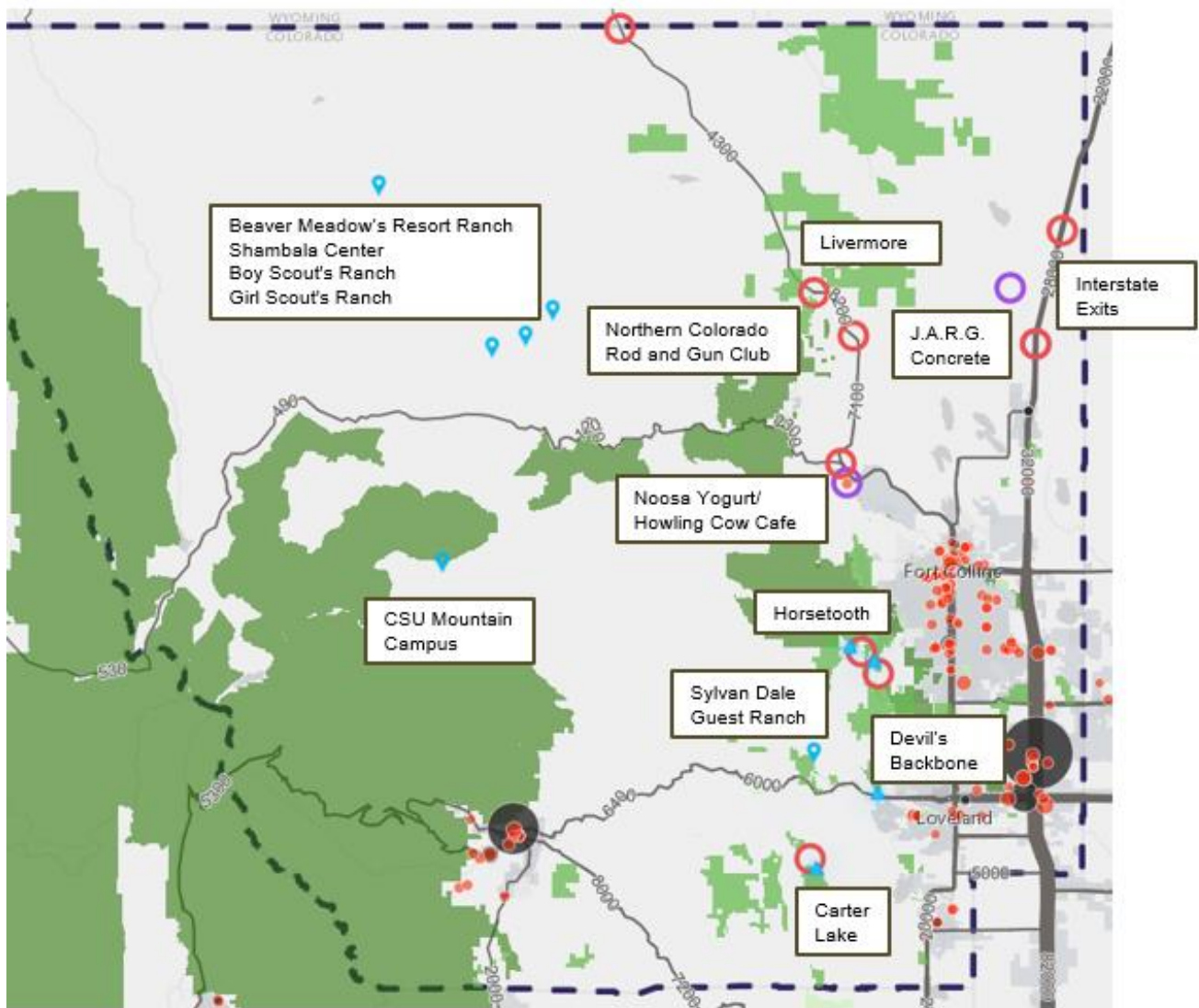


Figure 11: Larimer County travel corridors and destinations compared to current EV charging locations.

This map was used to facilitate an exercise to identify potential locations for EV charging stations to include in the opportunity ledger outlined in strategy CD-1.

Focus Area Target

The strategies in this focus area, when added to the targets outlined in the population centers section, close about 10% of the projected infrastructure gaps identified in the EV Charging Station Action Plan Goals section. The contribution of the strategies in this focus area to close the gap are estimated in Table 5 (see section above). This table shows the total number of new charging stations, in addition to the business-as-usual projected installations, to be installed by 2025 and then between 2025 and 2030.

Table 6: Targeted number of new chargers as a result of Population Center Strategies.

Strategy	2025 Target	2025 - 2030 Target
Strategy CD-1: Create and maintain a ledger of public EV charging opportunities	Support Strategy P-1: Create a Local Working Group and Strategy CD-2: Install EV charging at high-traffic County locations	
Strategy CD-2: Install EV charging at high-traffic County locations	4 Level 2 chargers	6 Level 2 chargers
Strategy CD-3: Develop and share EV charging policies	Support Strategy CD-2: Install EV charging at high-traffic County locations	
Strategy CD-4: Explore resiliency hub opportunities	None	4 Level 2 chargers 2 DC Fast chargers
Total Cumulative Impact	4 Level 2 chargers	10 Level 2 chargers 2 DC Fast chargers

Strategies

The following short-term strategies will support corridor and destination EV charging.

Strategy CD-1: Create and maintain a ledger of public EV charging opportunities

Create a shared resource to track public EV charging needs and opportunities by location. This ledger will include site characteristics to inform grant opportunities, key partners for implementation, and implementation process tracking.

Target Audience	Public EV charging working group from Strategy P-1: Create a Local Working Group can use this tracking mechanism to coordinate projects and outreach.
Desired Outcomes	Set the stage for upcoming grant applications by providing a list of opportunities that could qualify for available funding.
Resources	n/a
Communication Channels	Regular coordination meetings with working group created through Strategy P-1: Create a Local Working Group.
Roles and Responsibilities	Partners in Energy <ul style="list-style-type: none"> Develop draft ledger and site criteria. Revise based on feedback from working group

	Larimer County <ul style="list-style-type: none"> • Host and maintain ledger.
Timeline	Q3 2023 <ul style="list-style-type: none"> • Review draft ledger with working group. • Revise ledger based on feedback. Ongoing <ul style="list-style-type: none"> • Keep ledger up to date and use to inform grant applications.

Strategy CD-2: Install EV charging at high-traffic County locations

Install EV charging stations for public use at key Larimer County properties. Priority locations may include buildings or open spaces with high-visitor numbers or locations with an expectation of charging.

Target Audience:	Internal County working group responsible for identifying key locations and coordinating EV charging station installation.
Desired Outcomes	EV charging stations are available for public use at identified County locations.
Resources	Xcel Energy incentives Charge Ahead Colorado grant PVREA incentives PRPA incentives
Communication Channels	Internal staff working sessions.
Roles and Responsibilities	Partners in Energy <ul style="list-style-type: none"> • Support working group Larimer County <ul style="list-style-type: none"> • Form and engage internal working group to identify key locations. • Apply for funding support as appropriate. • Coordinate installation of charging stations and signage.
Timeline	Q3 2023 <ul style="list-style-type: none"> • Convene internal County working group. • Identify priority locations. Q4 2023 <ul style="list-style-type: none"> • Apply for Charge Ahead Colorado grant as appropriate. 2024 <ul style="list-style-type: none"> • Install charging stations at priority locations with appropriate signage. • Include information about charging station availability to County website.

Strategy CD-3: Develop and share EV charging policies

Develop County policies for public EV charging at Larimer County properties including public charging stations at County buildings and public use of available power sources at County campgrounds for EV charging. Develop a strategy to clearly communicate these policies to County staff and to the public. These policies will include guidance on station use

Target Audience	EV drivers visiting County locations.
Desired Outcomes	Information on the appropriate use of EV charging stations at County locations is easy to find and understand.
Resources	Partners in Energy EV Toolkit
Communication Channels	County website Signage
Roles and Responsibilities	Partners in Energy <ul style="list-style-type: none"> • Support internal County working group. • Provide examples of policies for consideration. Larimer County. <ul style="list-style-type: none"> • Convene an internal working group to develop County policies. • Host policy information on the County website. • Train staff at sites with charging stations on policies and enforcement.
Timeline	Q1 2024 <ul style="list-style-type: none"> • Draft policies for charging at County stations identified in Strategy CD-2: Install EV charging at high-traffic County locations. • Review and approve policies. Q2 2024 <ul style="list-style-type: none"> • Develop necessary signage to support policies. • Create parking monitoring programs as needed. Ongoing <ul style="list-style-type: none"> • As charging station locations are added to the County website ensure information on charging policy and price are included.

Strategy CD-4: Explore resiliency hub opportunities

Identify opportunities across the County to install public EV charging paired with battery storage that could also support power backup at a resiliency hub in case of emergency.

Resilience hubs are community-serving facilities augmented to support residents and coordinate resource distribution and services before, during, or after a natural hazard event. They leverage established, trusted, and community-managed facilities that are used year-round as neighborhood centers for community-building activities.

Target Audience	Emergency services and community organizations that function as resiliency hubs.
Desired Outcomes	Identify one location to pilot a resiliency hub installation.
Resources	http://resilience-hub.org/ Colorado Resiliency Office
Communication Channels	Direct communications with emergency services and property owners at target locations.
Roles and Responsibilities	Partners in Energy Team <ul style="list-style-type: none"> • Coordinate meetings with Emergency Services to discuss opportunities. • Reach out to potential site hosts and coordinate introductory meetings. Larimer County <ul style="list-style-type: none"> • Provide outreach contacts. • Attend exploratory meetings. Note that scope and roles for implementation will be determined if a suitable host site is identified.
Timeline	Q3 2024 <ul style="list-style-type: none"> • Meet with Emergency Services to understand opportunities for resiliency hubs. • Meet with potential site hosts to explore resiliency hub opportunities. Q4 2024 <ul style="list-style-type: none"> • Create implementation plans for a pilot resiliency hub including implementation timeline, funding, and responsible parties. 2025 <ul style="list-style-type: none"> • Implement resiliency hub pilot.

Impact of EV Charging Station Action Plan

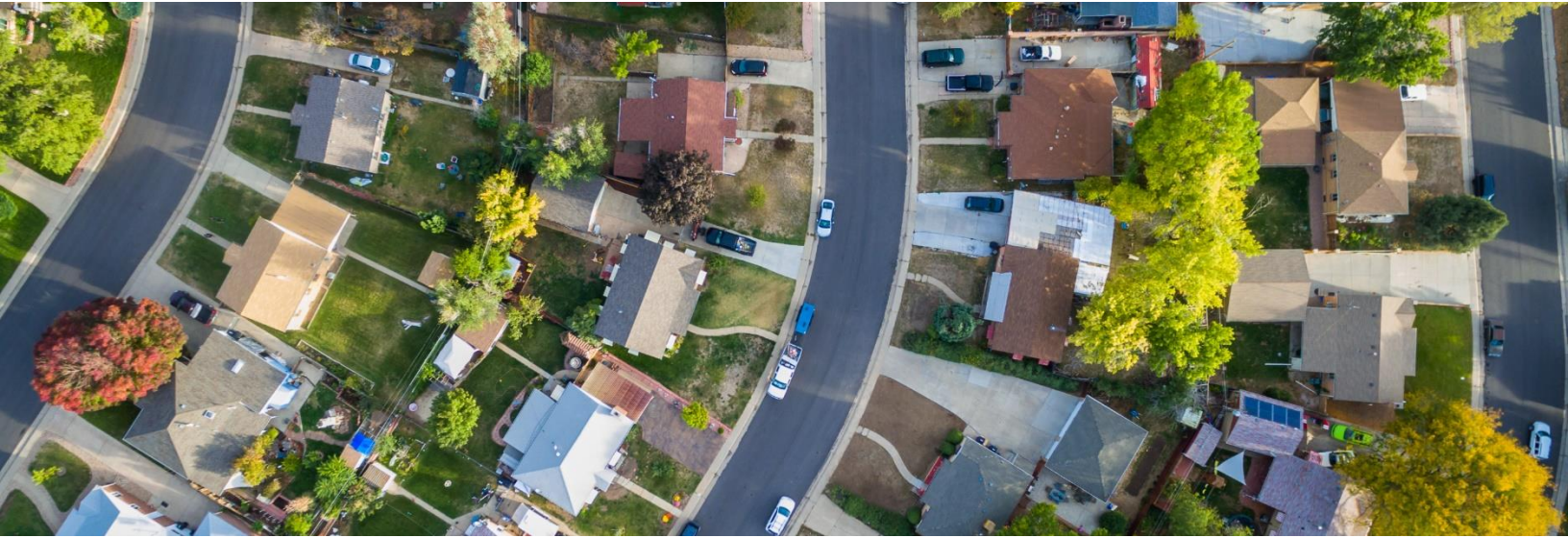
The combined targets and strategies outlined in this plan will account for about 10% of the identified gap between projected EV infrastructure under the business-as-usual scenario and the targets set out by the state for Larimer County. Table 7 shows the additional chargers installed by strategy by 2025 and between 2025 and 2030.

Table 7: Targeted impact by strategy.

Strategy	2025 Target	2025-2030 Target
Strategy P-1: Create a Local Working Group	4 DC Fast Chargers	27 Level 2 chargers 4 DC Fast chargers
Strategy P-2: Develop an EV charging informational packet	Support Strategy P-1: Create a Local Working Group	
Strategy P-3: Develop a County template to develop a community EV roadmap	At least 1 community uses the template to adopt EV friendly programs and/or polities.	40 Level 2 chargers 10 DC Fast chargers
Strategy CD-1: Create and maintain a ledger of public EV charging opportunities in the County	Support Strategy P-1: Create a Local Working Group and Strategy CD-1: Create and maintain a ledger of public EV charging opportunities	
Strategy CD-2: Install EV charging at high-traffic County locations	4 Level 2 chargers	6 Level 2 chargers
Strategy CD-3: Develop and share EV charging policies	Support CD-2	
Strategy CD-4: Explore resiliency hub opportunities	None	4 Level 2 chargers 2 DC Fast chargers
Total New Charging Stations	4 Level 2 chargers 4 DC Fast chargers	81 Level 2 chargers 20 DC Fast chargers
Estimated Total EV Charging Stations in the goal year² (remaining gap to State goals)	424 Level 2 chargers (0) 49 DC Fast chargers (31)	922 Level 2 chargers (525) 196 DC Fast chargers (113)

² Using the high implementation scenario from the projections.

HOW WE STAY ON COURSE



Adapting to a Changing Landscape

This plan outlines strategies to promote EV adoption over the next 2 years (Appendix A). Since an effective plan is cyclical in nature (see Figure 12), the County should review progress after 2 years to determine if the impact desired is being made. The County then can choose to adopt new strategies or adjust the existing strategies to address any gaps or changes in technology. The [Xcel Energy Partners in Energy EV Toolkit](#) can be a good resource for identifying new strategies to address unexpected barriers that may come up. Throughout the planning process, County staff and Xcel Energy staff built relationships that will foster the collaboration and cooperation required to successfully navigate the changing EV landscape.

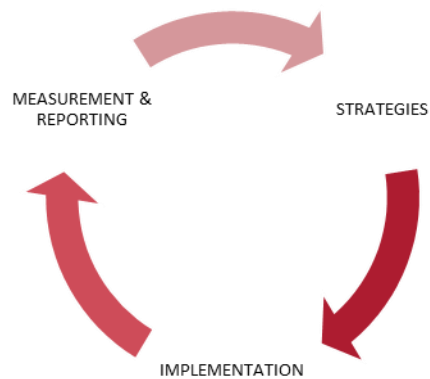


Figure 12. Actions and Tracking

Throughout the planning process, County staff and Xcel Energy staff built relationships that will foster the collaboration and cooperation required to successfully navigate the changing EV landscape.

Implementation Teams

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 available through Xcel Energy's other EV offerings. During this implementation period Partners in Energy facilitators will help to organize and support implementation teams as outlined below.

Team Name	Members	Meeting Frequency	Role
PM Team	Partners in Energy Facilitators County PM	Monthly for 18 months	Track process and impact of all strategies
Internal County Team	County facilities staff	Monthly	Implement internal county strategies
Local Working Group	TBD through implementation of Strategy P-1: Create a Local Working Group	Quarterly	Implement community facing strategies. Coordinate efforts of local organizations.

Tracking Progress and Adjusting Course

To ensure this plan remains on track, the EV Teams will track metrics by the focus areas outlined in How We Are Going To Get There to review progress toward stated focus area targets and plan goals on an annual basis and to assess whether the efforts appear to be making an impact. Data tracked to determine the success of strategies in this plan will come from two main sources:

1. **Opportunity ledger:** This spreadsheet created under strategy CD-1 will track the number and type of any installation of charging stations at County facilities as well as the impact of direct outreach or collaboration efforts with community partners. This can be used for the following strategies:
 - a. Strategy P-1: Create a Local Working Group
 - b. Strategy CD-2: Install EV charging at high-traffic County locations
 - c. Strategy CD-4: Explore resiliency hub opportunities
2. **Atlas EV Hub:** Indirect impact of strategies designed to encourage communities to adopt EV friendly policies or encourage local businesses to install charging will be measured through the total installed charging stations in the country as compared to the business-as-usual forecasts. This data will be used to track the cumulative impact of all the strategies in this plan.

APPENDIX A: STRATEGY IMPLEMENTATION TIMELINE

This table shows the preliminary implementation timeline for all strategies outlined in this plan through the time period supported by Partners in Energy. This timeline may be adjusted based on team capacity, partner availability, and deadlines for grants or other funding.

Strategy	Q3 2023	Q4 2023	Q1 2024	Q2 2024	Q3 2024	Q4 2024
Strategy P-1: Create a Local Working Group	Group development		Quarterly meeting and coordination.			
Strategy P-2: Develop an EV charging informational packet		Content draft	Final material	Outreach using developed materials.		
Strategy P-3: Develop a County template to develop a community EV roadmap			Outline content	Finalize content	Community outreach	
Strategy CD-1: Create and maintain a ledger of public EV charging opportunities	Finalize ledger.	Ledger upkeep and use for tracking and grant applications.				
Strategy CD-2: Install EV charging at high-traffic County locations	Identify locations and procure funding.		Install stations.			
Strategy CD-3: Develop and share EV charging policies			Create and share policy.			
Strategy CD-4: Explore resiliency hub opportunities					Identify locations	Create plan for pilot.

APPENDIX B: 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 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.

Electric Vehicle 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 are outlined in Table 8 and are described in more detail in the following sections.

Table 8. Comparison of Types of Electric Vehicles

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 that 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 anywhere between 30 minutes to 12 hours depending on the type of charger, size of the 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 to 50 miles, at which point, the gasoline engine takes over. The distance that 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 gas station (Drive Change. Drive Electric., 2019).

Hybrid Electric Vehicle (HEV)

Similar to the PHEV, an HEV has 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 set up is that the ICE can run at a constant speed and greatly increase the vehicles fuel efficiency compared to traditional ICE vehicles. However, the battery cannot be charged by an external electricity source, which means that 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 9 provides a brief explanation along with the pros and cons of both types. All currently available EVs can use either charger type.



Table 9. Residential Electric Vehicle 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	<ul style="list-style-type: none"> • Uses standard residential wall outlet. • Little to no investment in infrastructure required. 	<ul style="list-style-type: none"> • 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, a property manager could manage the controls.
Drawbacks	<ul style="list-style-type: none"> • Slower charging rate, but usually sufficient for residents who charge overnight. 	<ul style="list-style-type: none"> • Requires 240 Volt outlet or hardwired charger. • Electrician likely required to install. • Higher infrastructure cost investment.
Estimated Costs	Low to no cost	\$500 to \$2,000 (US DOE, 2019)

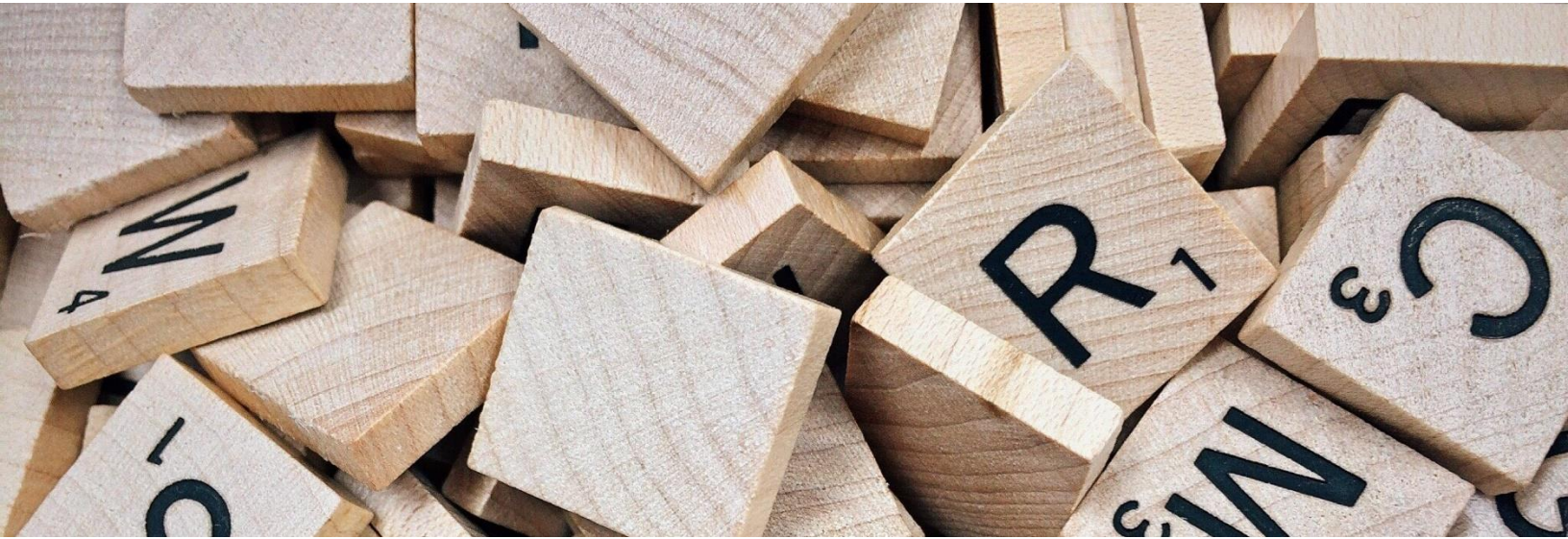
Commercial Charging Stations

Commercial Level 2 and Level 3 chargers are most appropriate for commercial applications since EVs are generally parked for shorter periods of time compared to residential applications. Level 2 chargers are the same as the 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 10** shows the advantages and disadvantages of Level 2 and Level 3 chargers.

Table 10. 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	<ul style="list-style-type: none"> • More economical than Level 3 • Safe for long-term use 	<ul style="list-style-type: none"> • Fastest charging option available
Drawbacks	<ul style="list-style-type: none"> • Slower charging 	<ul style="list-style-type: none"> • Expensive to purchase and install • Can cause degradation to EV batteries with frequent use
Estimated Equipment Costs	\$2,500 to \$6,000 (ICF, 2022)	\$20,000 to \$150,000 (ICF, 2022)
Estimated Installation Costs	\$2,500 to \$9,000 (ICF, 2022)	\$20,000 to \$138,200 (ICF, 2022)

APPENDIX C: GLOSSARY OF TERMS



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.

Carbon-free: Carbon-free refers to sources of energy that will not emit additional carbon dioxide into the air. Wind, solar and nuclear energy are all carbon free sources but only wind and solar are renewable.

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.

Direct Installation: Free energy-saving equipment installed by Xcel Energy or other organizations for program participants that produces immediate energy savings.

Electric vehicle (EV): A vehicle that uses an electric engine for all or part of its propulsion.

Energy Burden: Percentage of gross household income spent on energy costs.

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 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.

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 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.

Resilience: The ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions. Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents.

Volts: A measurement of the force pushing the flow of energy through a charger. This measurement is determined by the electricity supply. Standard household outlets provide 120 volts; outlets for dryers or other high-powered household equipment supply 240 volts.

WORKS CITED

- American Community Survey. (2023, February 13). *Quick Facts*. Retrieved from Larimer County, Colorado:
<https://www.census.gov/quickfacts/fact/table/larimercountycolorado/PST040221#PST040221>
- Center for Neighborhood Technology. (2022, September 20). *Municipality: Larimer County, CO*. Retrieved from H+T Index: <https://htaindex.cnt.org/map/>
- Climate Nexus. (2023, June 15). *Electric Vehicles and the Power Grid 2023*. Retrieved from <https://climatenexus.org/climate-issues/electric-vehicles-power-grid-2023/>
- Colorado Department of Local Affairs. (2022, February 13). *State Demography Office*. Retrieved from DOLA Divisions and Programs:
<https://demography.dola.colorado.gov/>
- Drive Change. Drive Electric. (2019). *Learn the Facts*. Retrieved August 8, 2019, from Drive Change. Drive Electric. Web site: <https://driveelectricus.com/learn-the-facts/>
- Environmental Protection Agency. (2019, August 23). *Greenhouse Gas Inventory Data Explorer*. Retrieved from Greenhouse Gas Emissions:
<https://cfpub.epa.gov/ghgdata/inventoryexplorer/>
- EPA. (2019, December 16). *EPA reclassifies Denver area to "Serious" nonattainment for ozone*. Retrieved from News Releases:
<https://www.epa.gov/newsreleases/epa-reclassifies-denver-area-serious-nonattainment-ozone>
- EPA. (2020, April 30). *Carbon Monoxide (1971) Maintenance Areas (Redesignated from Nonattainment) by State/County/Area*. Retrieved from Green Book:
https://www3.epa.gov/airquality/greenbook/anayo_co.html
- Hsu, C.-W., Slowik, P., & Lutsey, N. (2021). *Colorado Charging Infrastructure Needs to Reach Electric Vehicle Goals*. The International Council on Clean Transportation. Retrieved from <https://theicct.org/publication/colorado-charging-infrastructure-needs-to-reach-electric-vehicle-goals/>
- ICF. (2022, January 25). *How much does electric vehicle charging infrastructure actually cost?* Retrieved from ICF:
<https://www.icf.com/insights/transportation/electric-vehicle-charging-infrastructure-costs>
- Institute for Transportation And Development Policy. (2019, May 23). *The High Cost of Transportation in the United States*. Retrieved from Institute for Transportation And Development Policy Web site: <https://www.itdp.org/2019/05/23/high-cost-transportation-united-states/>

- IPCC. (2018). *Summary for Urban Policy: What the IPCC Special Report on Global Warming of 1.5C Means for Cities*. Intergovernmental Panel on Climate Change.
- Larimer County. (2022, February 13). *About Larimer County*. Retrieved from Larimer County: <https://www.larimer.gov/about-larimer-county>
- National Oceanic and Atmospheric Administration. (2023, June 15). *State Climate Summaries 2022*. Retrieved from Colorado: <https://statesummaries.ncics.org/chapter/co/>
- Office of Energy Efficiency & Renewable Energy. (2020). *Reducing Pollution with Electric Vehicles*. Retrieved from Electric Vehicles: <https://www.energy.gov/eere/electricvehicles/reducing-pollution-electric-vehicles>
- Office of Energy Efficiency and Renewable Energy. (2018, August 23). *Electric Vehicle Benefits*. Retrieved from Electric Vehicles: <https://www.energy.gov/eere/electricvehicles/electric-vehicle-benefits>
- Office of Energy Efficiency and Renewable Energy. (2019, September 27). *Alternative Fuels Data Center*. Retrieved from United States Department of Energy Web site: <https://afdc.energy.gov/fuels/prices.html>
- Office of Energy Efficiency and Renewable Energy. (2019, August 23). *Saving on Fuel and Vehicle Costs*. Retrieved from Electric Vehicles: <https://www.energy.gov/eere/electricvehicles/saving-fuel-and-vehicle-costs>
- Pan, S., Roy, A., Choi, Y., Eslami, E., Thomas, S., Jiang, X., & Gao, O. (2019, June 15). Potential impacts of electric vehicles on air quality and health endpoints in the Greater Houston Area in 2040. *Atmospheric Environment*, 207, 38-51. Retrieved from <https://www.sciencedirect.com/science/article/pii/S1352231019301840?via%3Dihub>
- UNFCCC. (2019). *What is the Paris Agreement?* Retrieved from United Nations Framework Convention on Climate Change Web site: <https://unfccc.int/process-and-meetings/the-paris-agreement/what-is-the-paris-agreement>
- US Census Bureau. (2020, April 22). *Tenure by Units in Structure*. Retrieved from 2018: ACS 1-year Estimates Detailed Tables: https://data.census.gov/cedsci/table?q=B25032%3A%20TENURE%20BY%20UNITS%20IN%20STRUCTURE&g=1600000US0883835&tid=ACSDT1Y2018.B25032&hidePreview=false&vintage=2017&layer=VT_2018_160_00_PY_D1&cid=DP05_0001E&t=Units%20and%20Stories%20in%20Structure%3AOwner%2FR
- US Census Bureau. (2023, May 31). *Total Population Estimate*. Retrieved from 2021: ACS 5-year Subject Tables: <https://data.census.gov/map?q=160XX00US0806255,0825115,0827425,0839855,0843220,0846465,0863320,0877510,0883230,0885485&tid=ACSST5Y2021.S>

0101&cid=S0101_C01_001E&layer=VT_2021_160_00_PY_D1&palette=Purples
&breaks=Natural(3)&mode=thematic&loc=40.5544,-105.364

US DOE. (2016). *Workplace Charging Challenge: Progress Update 2016: A New Sustainable Commute*.

US DOE. (2019, September 20). *Charging at Home*. Retrieved from US Office of Energy Efficiency & Renewable Energy Web site:
<https://www.energy.gov/eere/electricvehicles/charging-home>

Xcel Energy. (2019). *Carbon Free 2050*. Retrieved from Xcel Energy Web site:
https://www.xcelenergy.com/carbon_free_2050