The City of Boulder and Xcel Energy: Energy Partnership Agreement

2023 – 2025 Overview

CITY OF BOULDER

Xcel Energy®

PARTNERS IN ENERGY

An Xcel Energy Community Collaboration

CONTENTS

SUMMARY

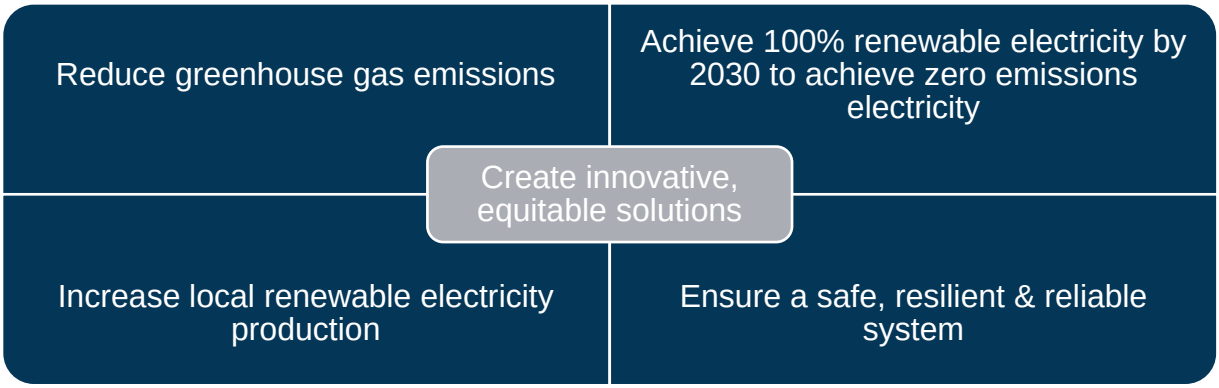
ABOUT THE ENERGY PARTNERSHIP AGREEMENT OVERVIEW

This Energy Partnership Overview was developed collaboratively between the City of Boulder and Xcel Energy as a next step to the Energy Partnership Agreement. It charts the pathway of continued collaboration and innovation between the City of Boulder and Xcel Energy from 2023 through 2025.

This document reflects and builds on the work of the Community Advisory Panel, City of Boulder Electric Mobility Plan, ongoing system reliability efforts, and other strategic initiatives, to reinforce the city and Xcel Energy's partnership commitment. Its development was led by the Xcel Energy Partners in Energy team, with contributions from the City of Boulder and Xcel Energy, plus Community Advisory Panel review.

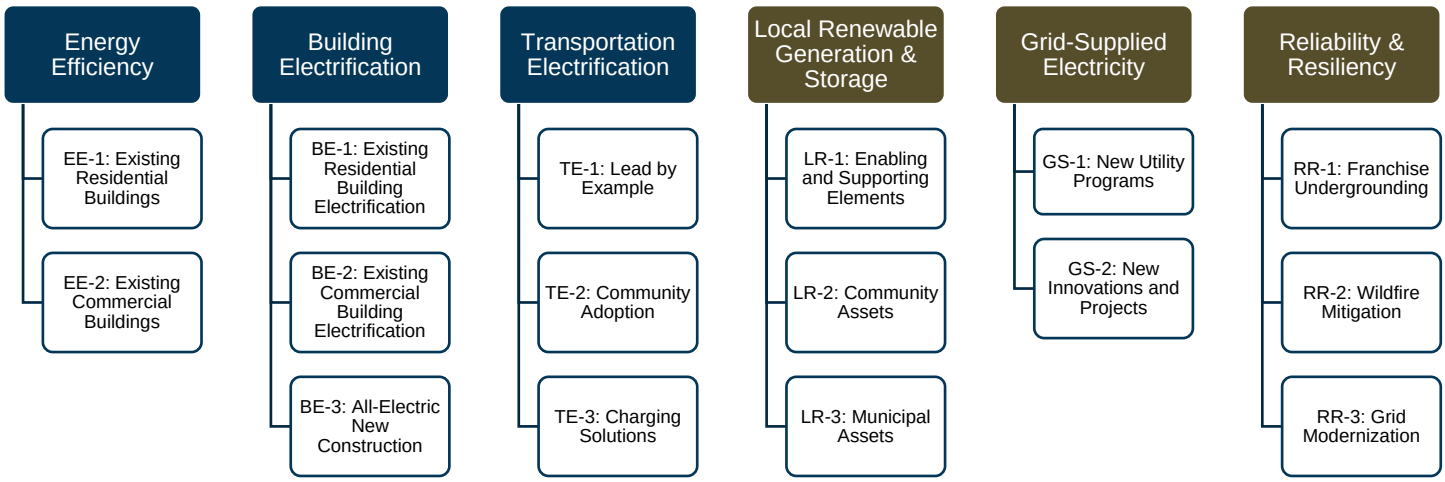
PARTNERSHIP GOALS

This Overview is designed to reflect and advance the goals of the partnership, summarized in the graphic below. Innovative and equitable solutions are at the core of implementing and achieving all the other goals.



2023-2025 FOCUS AREAS AND STRATEGIES

The City of Boulder and Xcel Energy identified six focus areas to organize the myriad strategies and projects that are necessary to achieve these goals. Each focus area includes two or more strategies, which served as the basis for the technical analysis that explores what targets are needed and what level of impact can be anticipated if the strategies and supporting projects are implemented. As shown in the technical analysis, the combined impacts of implementing the strategies have the **potential to eliminate electricity emissions** and reduce overall energy and transportation emissions 68% below 2018 levels by 2030.



NEXT STEPS

Implementation of the strategies and projects detailed in this document will require a commitment to ongoing coordination and communication across the partnership, including the Executive Team, Project Oversight Team, and Community Advisory Panel. Furthermore, the City of Boulder and Xcel Energy will work together to identify and utilize existing and new funding sources to support achieving the goals of the partnership.

A separate Work Plan will provide more specific details to inform implementation of the strategies and projects in this Overview. Working Teams will be responsible for defining and advancing projects to support each strategy.

The Overview will be updated every three years. Progress on key performance metrics and partnership goals will be reported annually. The Community Advisory Panel will continue to meet quarterly, and ongoing community engagement will help shape project implementation.

INTRODUCTION

In 2020, the City of Boulder (city) and Xcel Energy entered into an Energy Partnership Agreement to set a new course for the community's energy future. At the center of the city and Xcel Energy's partnership is **a commitment to collaborate and implement local projects and programs that support a shared vision for reduced energy emissions, improved reliability and resiliency, and innovative solutions that are accessible and equitable.**

Specifically, the city and Xcel Energy will work collaboratively to:

- Make progress towards specific energy and greenhouse gas emissions targets.
- Address the gap between Xcel Energy's 80% carbon emission reduction by 2030 commitment and the city's 2030 goal of 100% renewable electricity (i.e., zero emissions electricity).
- Create processes that engage the Boulder community.

Since the formation of the energy partnership, the city and Xcel Energy have been working together to share information and identify innovative projects for collaboration in support of the partnership's goals. The activities of the partnership are overseen and administered by City of Boulder and Xcel Energy staff, with guidance from the Community Advisory Panel (Panel). The Panel connects the community to the partnership by representing residents, businesses, and key stakeholders; gathering perspectives on community impacts; and making recommendations. In addition to regular quarterly meetings, Panel members have also contributed to the partnership through working groups focused on Equity, 100% Renewable Energy, and Building Electrification.

This Energy Partnership Overview builds on work already done by the City of Boulder and Xcel Energy and is grounded in recommendations provided by the Panel. The overview is designed to clarify the goals of the partnership and chart a strategic pathway for collaboration and innovation from 2023 through 2025.

GOVERNANCE

To deliver on the goals identified in the Energy Partnership Agreement, the city and Xcel Energy developed a governance structure to provide input and oversight of the partnership (Figure 1):

Executive Team. Responsible for the oversight of the partnership agreement, including communication and collaboration between the city and Xcel Energy to achieve the partnership's goals. This team is comprised of the City of Boulder and Xcel Energy leadership and department directors.

Project Oversight Team. Responsible for the oversight and implementation of programs and projects that execute the vision and goals of the partnership agreement. This team is comprised of the City of Boulder and Xcel Energy staff working collaboratively with implementation teams, subject matter experts, and the Community Advisory Panel.

Community Advisory Panel. Connects the community to the partnership by representing residential and commercial customers in Boulder. The Panel is comprised of community stakeholders including residents, businesses, University of Colorado Boulder, and other local organizations. The Panel reviews project proposals, provides insight into community impacts, and makes recommendations to the partnership's Project Oversight Team.

Working Teams. Responsible for defining the project scope to include the creation of project charters, timelines, key performance indicators (KPIs), and project costs. These teams will engage with subject matter experts and work with stakeholders to gain approvals and funding as required.

Figure 1. Achieving the goals of the Partnership Agreement will require ongoing coordination and unprecedented collaboration between these groups, as well as with the entire Boulder community (including the Community Advisory Panel)

COMMUNITY INVOLVEMENT

Efforts to chart a new energy future for Boulder have always been guided by community input and participation. In 2020, Boulder voters made the landmark decision to enter into a new partnership agreement with Xcel Energy, and their voices continue to shape priorities and investments in Boulder's clean energy future.

Community involvement will play an important and ongoing role in guiding and supporting energy partnership implementation. The City of Boulder's Engagement Strategic Framework will guide partnership engagement efforts.

In the initial years of the partnership, community involvement in the partnership took place primarily through the Community Advisory Panel and their meetings. The group's discussions and documents are available for observation on the city's website. In future years, Xcel Energy and the city are developing opportunities to hear directly from the broader Boulder community.

RESOURCES AND FUNDING

The City of Boulder and Xcel Energy will work together to identify and utilize existing and new funding sources to support achieving the goals of the partnership.

The pursuit and execution of the partnership will avoid shifting costs to other Xcel Energy Colorado customers outside of city limits, except to the extent approved, and deemed reasonable by the Colorado Public Utilities Commission (PUC). To the extent that Boulder financially funds 100% of a project or pilot program which is then offered by Xcel Energy, within 10 years of the project or pilot launch, to other Colorado Xcel Energy customers, Xcel Energy will reimburse Boulder as necessary. Reimbursements may be subject to PUC approval.

The partnership offers the opportunity to accelerate investment in the community through Xcel Energy's existing programs and services, driven by increased collaboration, tailored local marketing and outreach, and use of existing pilot programs (Table 1).

Table 1. Existing Xcel Energy plans and funding opportunities to support the Partnership Agreement goals

Energy Efficiency & Beneficial Electrification	Transportation Electrification	Local Renewable Generation & Storage	Other
• 2023 DSM & BE Plan • Demand Side Management Base Rate and Cost Adjustment (DSMCA)	• 2021-2023 Transportation Electrification Plan • Partnerships, Research & Innovation Portfolio	• Proposed 2022-2025 Renewable Energy Standard Plan • Renewable Energy Standard Adjustment (RESA)	• Franchise 1% Undergrounding Fund

Beyond existing Xcel Energy programs, strategies may be funded through a variety of sources, including but not limited to the Boulder Climate Tax, new tariffs approved by the PUC, private and public grants, industry partnerships, and innovative financing mechanisms or payments. The City of Boulder and Xcel Energy will support and collaborate with grants and other funding models to help achieve the goals and strategies of the Partnership Agreement. Examples of funding opportunities and resources to be explored are outlined in Table 2.

Table 2. Examples of potential funding opportunities to support the Partnership Agreement goals

Xcel Energy	City of Boulder	Other
• Xcel Energy administered planning cost-recovery mechanisms such as RESA and DSMCA	• Boulder Climate Tax • Other City of Boulder taxes and revenue sources	• Participant investment • Clean Energy Loans (Elevations Credit Union and Clean Energy Credit Union) • State of Colorado tax credits • Inflation Reduction Act (IRA) tax credits and deductions • Federal Infrastructure Investment and Jobs Act (IIJA) and Inflation Reduction Act (IRA) • Tariff-based financing • Third-party grant funds

NEXT STEPS

The strategies and projects identified in this document will guide the partnership over the next three years and establish a foundation for ongoing progress towards the city and Xcel Energy's partnership goals. The Overview will be updated every three years to reflect progress and identify new opportunities, projects, and programs for the next phase of the partnership.

A separate Work Plan will provide more specific details to inform implementation of the strategies and projects identified in this Overview. Working Teams will manage and update the Work Plan, sharing progress and updates with the Boulder community. Tracking and reporting of energy-related metrics and KPIs for projects will occur annually.

The Panel will continue to meet quarterly to review progress and advise on strategy and project execution. They will use an equity lens (see Appendix C) to generate community benefits and avoid harm.

PARTNERSHIP VISION AND GOALS

The city has long understood the importance of local climate action and has committed to rapidly transitioning to a clean energy economy and lifestyle through innovative strategies that dramatically reduce greenhouse (GHG) emissions, enhance the community's resilience, and support a vital and equitable economy. To guide its energy work within the partnership, the city's energy vision emphasizes the following points:

- **Renewable**: The community will rapidly decrease its dependence on fossil fuels as an energy source, supporting efficient and electrified buildings and vehicles.
- **Local**: Boulder will host a robust energy economy - with more control over its energy supply, investments, and services - that meets the needs and expectations of its diverse community.
- **Accessible**: Competitively priced energy and technology solutions will serve and help improve the lives of all community members.
- **Reliable and Secure**: Boulder will have an energy supply that is stable, resilient, safe, and protected against threats.

Xcel Energy is an electricity and natural gas utility serving customers throughout Colorado, including the Boulder community. Together, Xcel Energy and the city will work as partners towards achieving each other's vision for the benefit of the Boulder community, going beyond existing programs and "business as usual" activities to accelerate innovative, scalable solutions.

In addition to the vision, the partners have established qualitative and quantitative goals that will guide the actions of the partnership (Figure 2). The partners will work together collaboratively to achieve the agreement's goals, which may change over time. Advancing equity-based, innovative solutions is a central goal linked to all partnership goals and efforts, and potential equity considerations are identified throughout this document.

A driving force behind the partnership is eliminating electricity sector emissions by 2030. Related goals include reducing greenhouse gas emissions (especially associated with electricity and gas consumption), increasing local generation of renewable electricity, and ensuring a safe, resilient, and reliable system. The following sections detail the partnership goals.

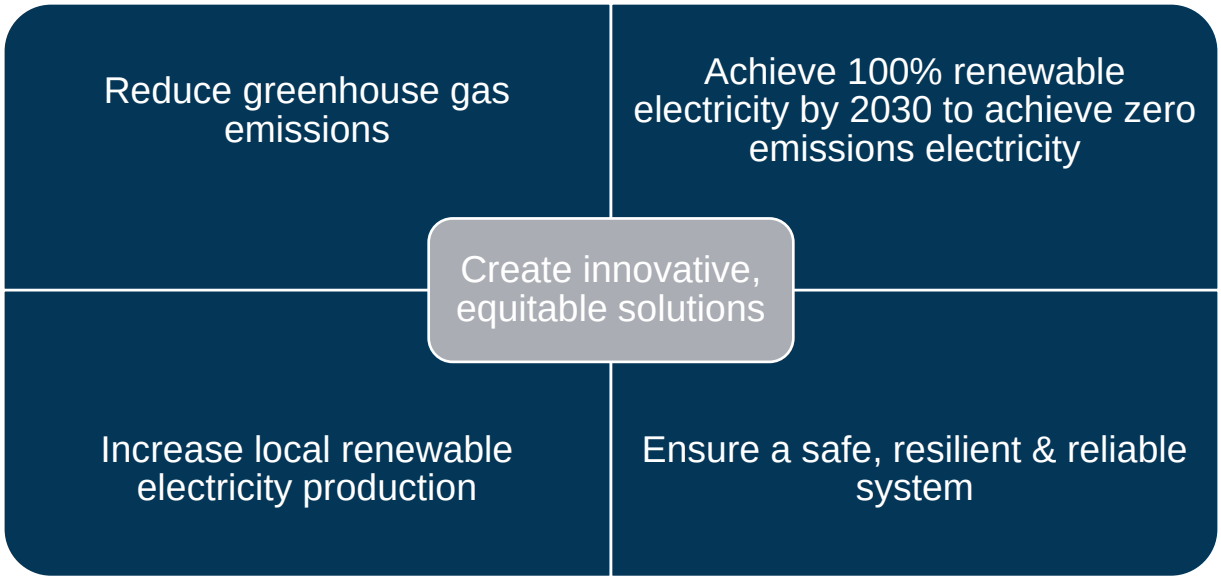


Figure 2. Summary of Energy Partnership Agreement vision and goals

REDUCE GREENHOUSE GAS EMISSIONS ASSOCIATED WITH ELECTRICITY AND GAS CONSUMPTION

Both the City of Boulder and Xcel Energy are working to “decarbonize” (i.e., reduce their carbon/greenhouse gas emissions), and have established independent greenhouse gas (GHG) emissions goals.

City of Boulder

In October 2021, Boulder City Council adopted the following community climate (i.e., GHG emissions) goals (City of Boulder, 2022):

- Reduce emissions by 70% by 2030 against a 2018 baseline
- Become a net-zero emissions city by 2035
- Become a carbon-positive city by 2040

These are community-wide goals and include electricity and fossil fuels used in buildings and transportation (included in the partnership) as well as emissions associated with waste disposal (not included in the partnership). Figure 3 breaks down the sources of Boulder’s 2021 GHG emissions by sector.

This document and supporting analysis address commercial and industrial, residential, and transportation-related emissions only, with <u>emphasis on eliminating electricity sector emissions</u>. Other City of Boulder climate plans and initiatives focus on all city emissions.

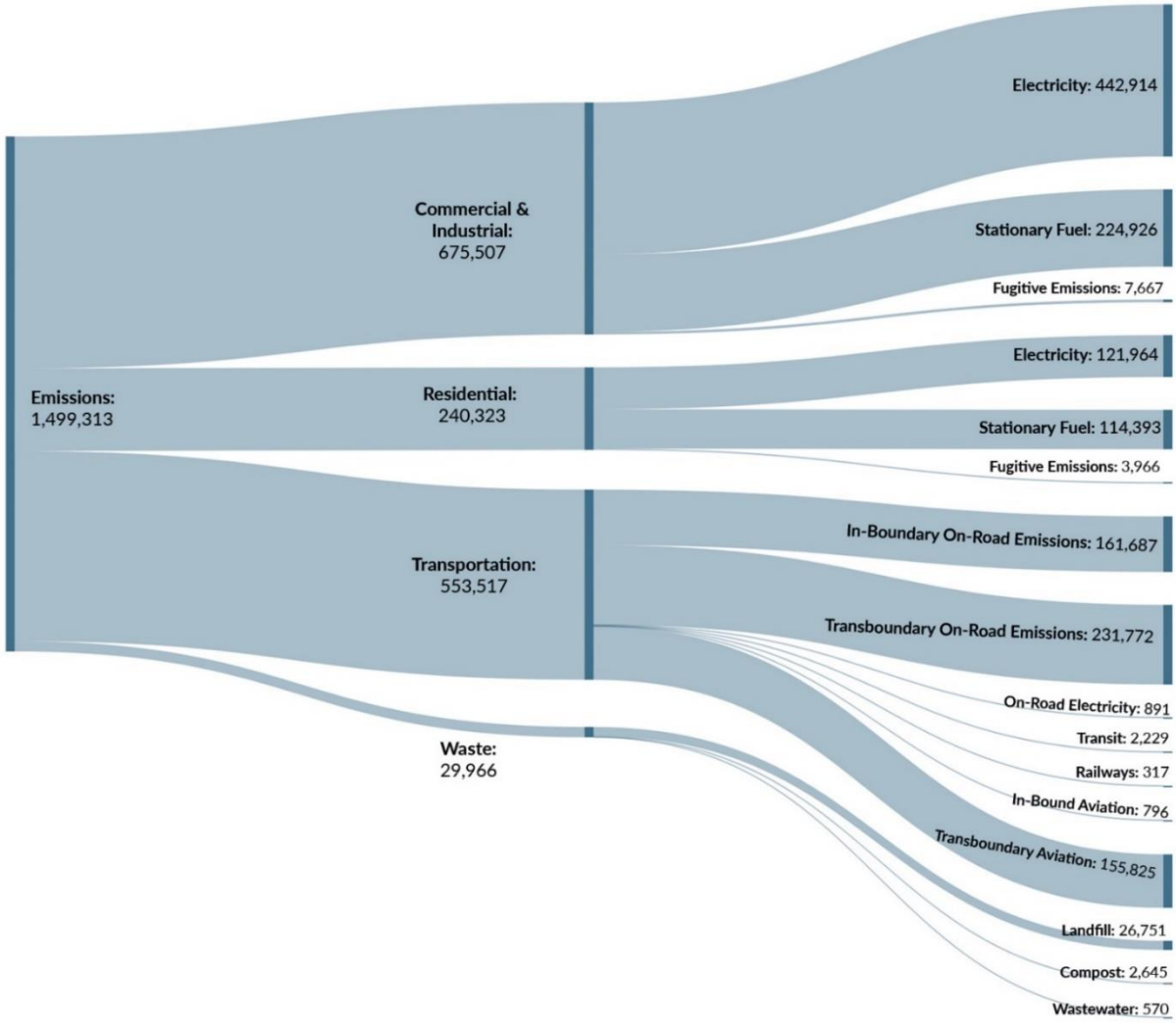


Figure 3. City of Boulder community GHG emissions by source (Metric Tons CO_2e 2021) (City of Boulder, 2022)

As of 2021, Boulder had achieved a 15.5% emissions reduction against the 2018 baseline (Figure 4). Boulder's community emissions reductions were driven in part by a 22% reduction in electricity emissions as the percentage of renewable generation increased and the carbon intensity of Xcel Energy's electricity supply declined by 15% (Figure 5). However, emissions associated with community natural gas use have risen steadily since 2005, consistent with a rising population and gross domestic product (GDP) leading to increased natural gas use over the same period.

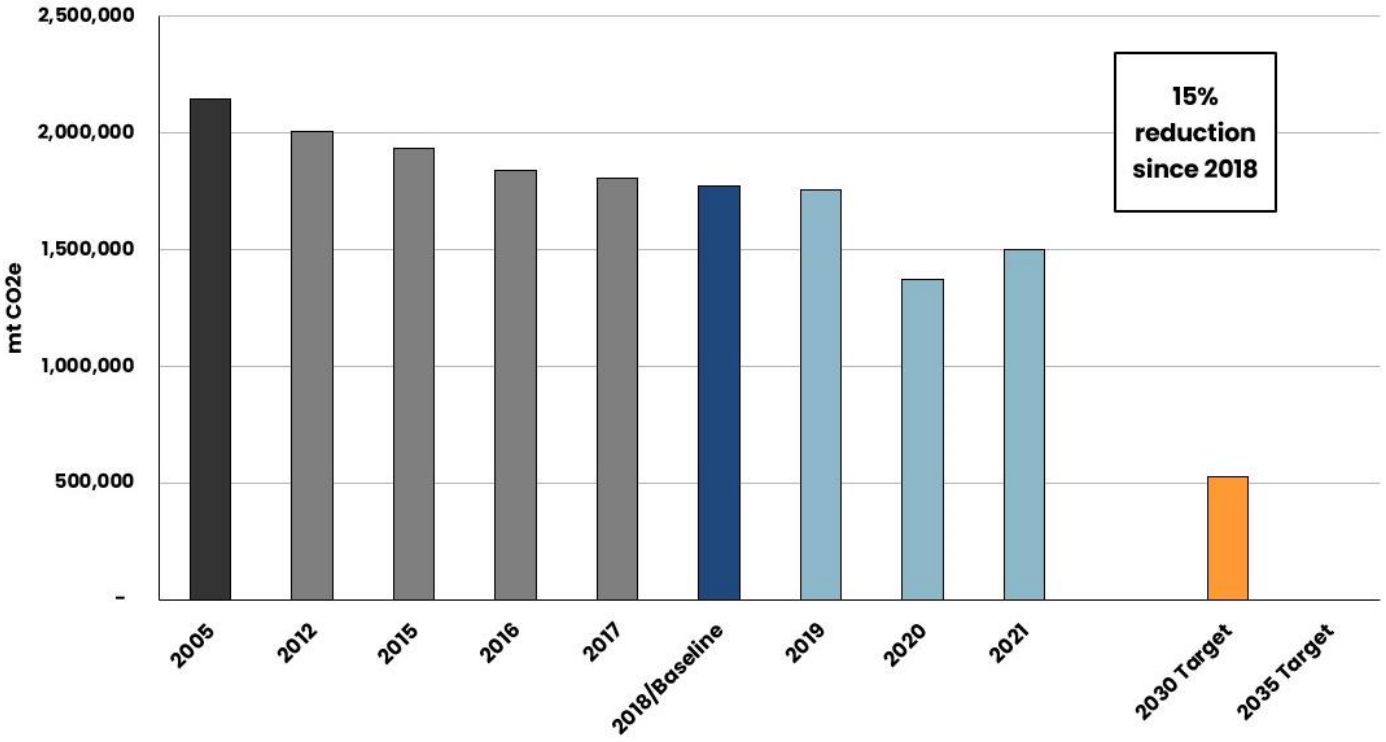


Figure 4. City of Boulder total community GHG emissions (Metric Tons CO_2e 2005-2021)

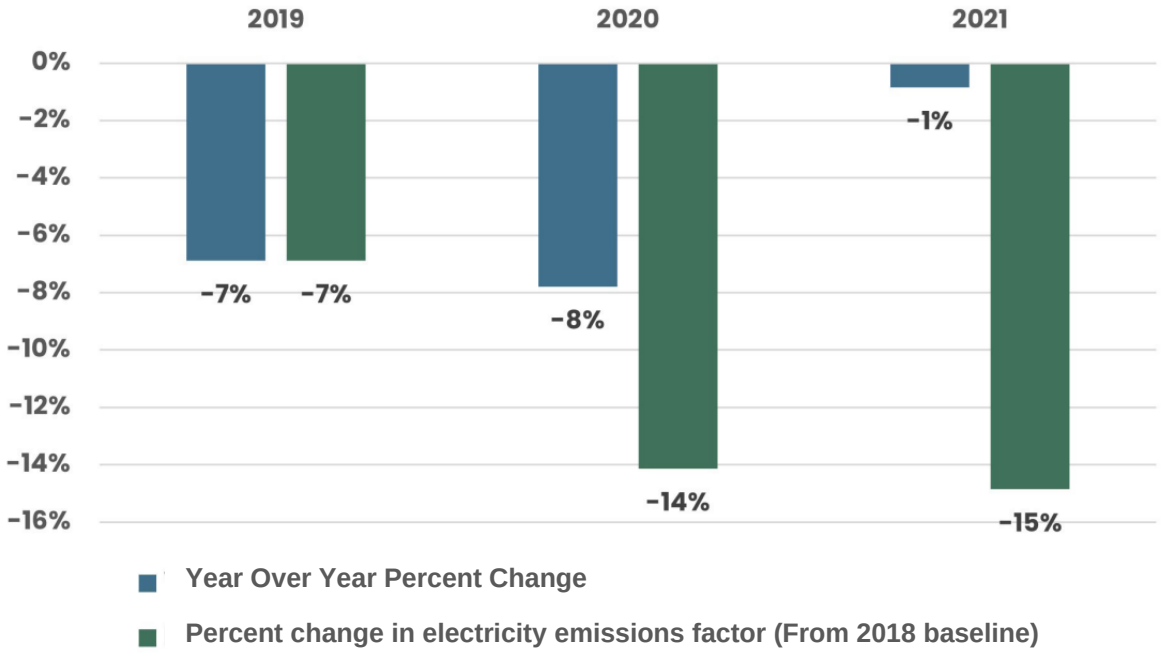


Figure 5. Change in electricity emissions factors since 2018

Achieving Boulder's GHG emissions goals for 2030 and beyond will therefore require a significant reduction in fossil fuel consumption. This will need to be achieved by implementation of aggressive energy efficiency and a shift away from fossil fuels towards zero-emissions electricity to power the community's buildings and transportation. This shift toward electrification will reduce emissions overall but increase the amount of electricity needed.

Xcel Energy

Xcel Energy's 2021 Clean Energy Plan (2021 CEP, the Company's latest Electric Resource Plan), approved by the Colorado Public Utilities Commission (PUC) in September 2022, outlines a pathway for the company to achieve an estimated 85% reduction in carbon emissions from 2005 levels and deliver more than 80% of energy supplied to customers from renewable resources by 2030 (Xcel Energy, 2021)(Figure 6).

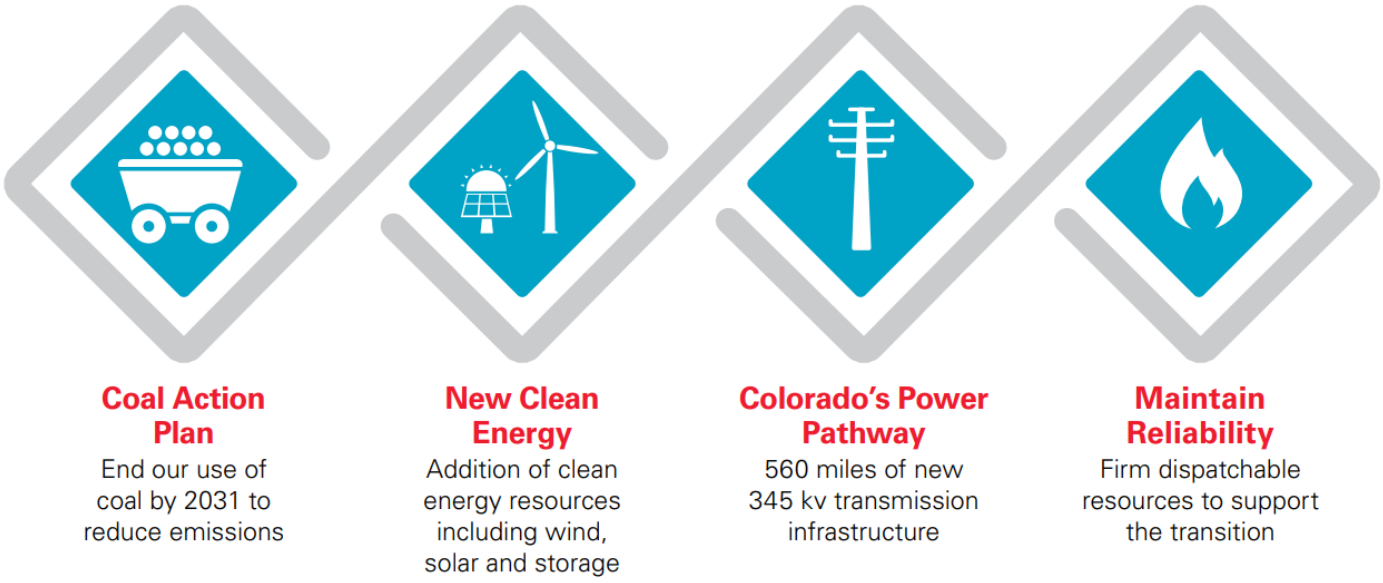


Figure 6. Xcel Energy-Colorado Clean Energy Plan components (Xcel Energy)

Xcel Energy's electricity emissions factor (pounds of carbon dioxide per megawatt-hour) is forecast to decline from 1,849 lbs CO_2 per megawatt-hour in 2005 to less than 300 lbs CO_2 per megawatt-hour in 2030. Xcel Energy will publicly disclose the Colorado energy mix and emissions on an annual basis.

ELIMINATE ELECTRICITY SECTOR EMISSIONS

Achieving 100% renewable electricity (i.e., “zero emissions electricity”) by 2030 is a core goal of the partnership and a steppingstone to meeting the city's overall GHG emissions reduction goals. The zero emissions electricity goal means that every kilowatt-hour of electricity consumption is met with carbon-free electricity sources, every hour, every day.

In considering Boulder’s future electricity needs, it is important to understand that total electricity needs and emissions intensity will vary by time of day and across seasons. Factors like seasonal air conditioning use and weekdays versus weekends impact electricity needs, and the overall electricity needs and generation resources available influence the emissions associated with the electricity use.

The heat maps in Figure 7 show the forecasted average hourly emissions intensity for each month of the year for 2026 (upper) and 2030 (lower) for the City of Boulder’s portion of Xcel Energy’s Public Service Company (PSCo) system. The months are displayed as rows; hours are displayed as columns. Red and orange colors indicate higher emissions times of day, shifting toward yellow and green for lower emissions times of day.

Zero Emissions Electricity

A range of products available today, such as Windsource®, enable customers to make the claim of “100% renewable electricity” even if their electricity supply is not zero emissions. For example, customers may purchase Renewable Energy Credits (RECs) to claim the clean energy attributes of renewable electricity generated to cover their non-renewable electricity usage. But RECs do not quantify emissions reduction, and the purchase of RECs alone may not change the emissions of electricity delivered to customers.

Boulder seeks a fully decarbonized 100% renewable electricity supply, defined as every kilowatt-hour of electricity consumption being met with zero-emissions sources, every hour of the day, without the purchase of RECs.

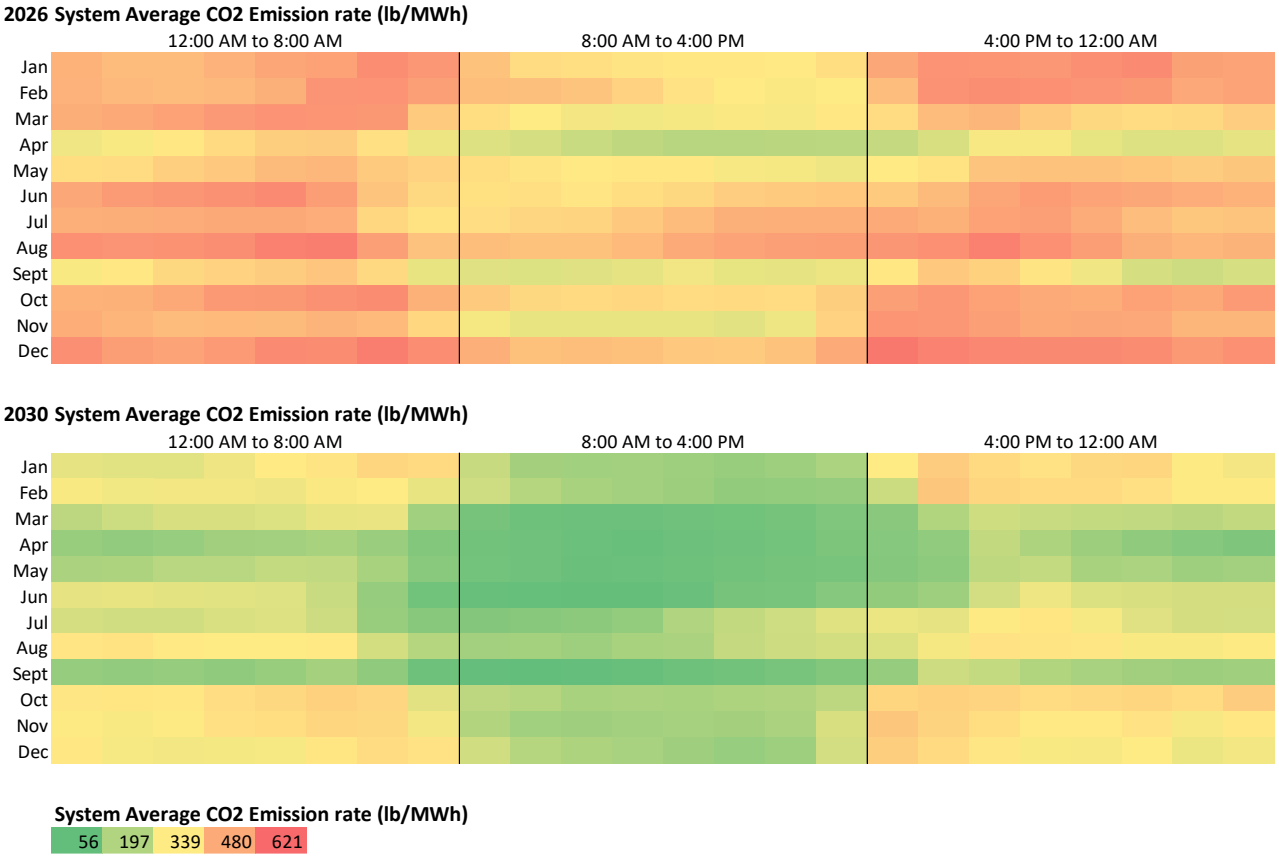


Figure 7. Hourly emissions intensity forecast by month for 2026 (upper) and 2030 (lower)

These factors illuminate two important considerations in eliminating electricity sector emissions 24-hours a day, 365 days a year. First, it is necessary to build zero emissions electricity generation and energy storage to meet the needs of high-emissions times of day and seasons. Second, rate design and demand-side management (DSM) tools may encourage electricity users to shift usage from high emissions times of day to low emissions times of day; but ultimately zero emissions electricity will need to be provided at all hours of all days to achieve this goal.

Estimating the Electricity Emissions Gap

To establish a pathway to achieve the zero emissions electricity goal, it is necessary to (1) forecast future electricity needs, and (2) analyze the estimated "gap" between forecasted emissions associated with electricity use and zero emissions electricity supply. This analysis estimates the gap based on a calculation of annual emissions. Additional work is required to estimate the emissions gap based on hourly usage and emissions. A summary of the technical analysis is provided in the following sections. **See Appendix A: Technical Analysis Details for methodology details and technical assumptions used.**

To understand the potential maximum amount of electricity the Boulder community might consume in 2030, the forecast of future electricity needs begins with baseline electricity consumption in 2021 of 1,194 GWh. Next, the forecast accounts for potential population growth through 2030, which could increase electricity consumption by 77 GWh. Assuming aggressive rates of building electrification and transportation electrification, electricity use could further increase by 1,001 GWh. In summary, by 2030 total maximum annual electricity needs are estimated at 2,272 GWh, an increase of 90% from 2021 levels.

However, the estimation of Boulder's maximum future electricity needs is a demonstrative, hypothetical scenario that does not consider other driving factors or likely conditions, such as energy efficiency improvements or the rate of adoption for electrification. Assuming community-wide adoption of energy efficiency measures, plus more moderate levels of building and transportation electrification adoption, **2030 annual electricity needs are estimated at 1,286 GWh – an increase of 8% from 2021 levels**. This moderate scenario serves as the basis for the strategy analysis throughout this Overview.

The emissions associated with Xcel Energy's grid-supplied electricity are a key determinant of eliminating electricity-sector emissions. Xcel Energy's commitments for grid-supplied renewable energy will help reduce the 2030 emissions from electricity, even if electricity consumption increases significantly. Assuming Xcel Energy's commitments for grid-supplied electricity of 85% carbon-free in 2030 are met (as outlined in the Company's 2021 Electric Resource Plan), **annual electricity emissions in 2030 are estimated to be 171 thousand short tons** (Figure 8) under a moderate growth scenario for electricity use (this may vary when calculated on an hourly basis instead of an annual basis).

These estimated 2030 emissions are what need to be eliminated through strategies such as local generation and storage and new utility programs (described later in this document). The potential pathways to achieve this goal are plentiful; the next sections of this document track with the assumptions in the moderate growth (explained in detail in Appendix A: Technical Analysis Details). Eliminating electricity emissions on an annual basis will be challenging. Achieving carbon free electricity 24/7 will be even more challenging and so energy storage must play an increasing role in helping meet the needs of high-emission times of day and seasons.

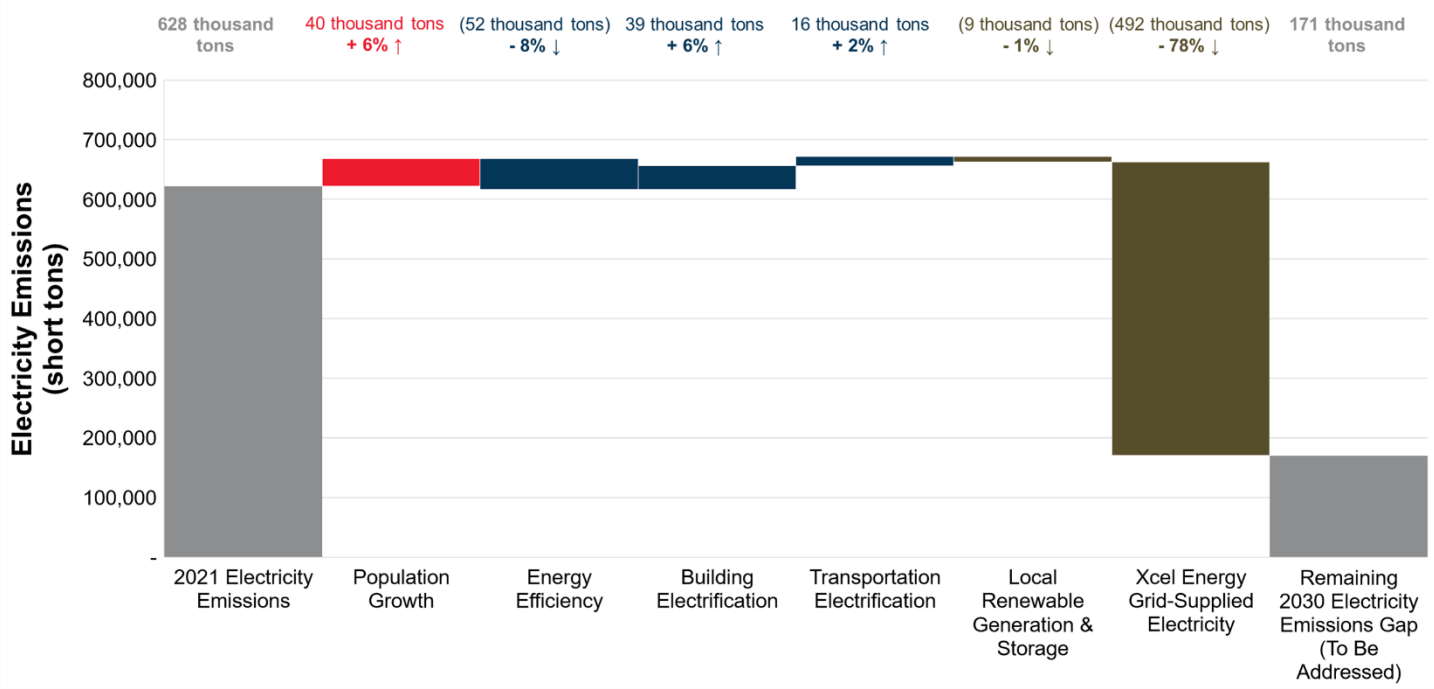


Figure 8. Waterfall diagram showing potential 2030 electricity emissions gap (moderate scenario)

INCREASE LOCAL GENERATION OF RENEWABLE ELECTRICITY

In addition to the emissions and renewable electricity goals, the partnership seeks to empower local action and create benefits for the Boulder community, including through increased local renewable generation. Benefits of increasing local renewable energy generation can include job creation, local revenue generation, and reduced operating costs. When paired with storage, local renewable energy generation can help improve reliability, stabilize costs, and support achievement of the goal to eliminate electricity-sector emissions.

Figure 9. More than 2 MW of solar power is generating renewable energy and reducing operation costs at 19 City of Boulder facilities

The Partnership Agreement includes a vision of 50% locally produced clean energy by 2050, and the city has established targets of 100 MW local generation by 2030 and 175 MW by 2050. As of the end of 2021, the local renewable generation capacity in Boulder was approximately 93.7 MW (including net metering and on-site Solar*Rewards customer as well as Boulder's hydroelectric generation)[1]. If on-site capacity continues to grow at a rate consistent with historical annual averages and no new hydro is added, Boulder is on track to exceed its 100 MW local generation target well before 2030.

Accelerating the pace of local generation beyond 100 MW by 2030 will not only lay the foundation for progress toward the long-term 2050 vision, but when paired with distributed storage, will also contribute to achieving the 24/7 zero emissions electricity goal.

[1] 2021 local renewable generation capacity is calculated based on 7.9 MW of net metering solar systems, 69.8 MW of Solar*Rewards solar systems, and 16 MW of hydro power. Net metering and Solar*Rewards system capacity is based on the 2021 Xcel Energy Community Energy Report, and the hydro power capacity is based on City of Boulder data.

ENSURE A SAFE, RESILIENT, AND RELIABLE SYSTEM

In addition to emissions reduction, local renewable generation, and traditional distribution system planning practices, the partnership strives to evaluate, plan for, and execute projects that support the energy goals and future grid reliability and resilience in Boulder.

These projects are intended to focus collaborative efforts between the City of Boulder and Xcel Energy on improving and modernizing the distribution grid in the city. This includes a focus on improving reliability, bolstering resilience, and planning for a variety of projects intended to deploy innovative technologies to achieve these goals and realize benefits to the community (see Figure 10 as an example). The partnership seeks to improve reliability throughout the system, specifically focusing on improving and replacing aging or inadequate infrastructure.

The Partnership Agreement seeks to ensure that the normal distribution system work planned by Xcel Energy includes engagement with the community and other stakeholders.

Figure 10. The Chautauqua Sustainability & Resilience Strategy will increase reliability and reduce the risk of wildfire

CREATE INNOVATIVE AND EQUITABLE SOLUTIONS FOR A DIVERSE COMMUNITY

The Partnership Agreement frames progress towards a resilient, equitable energy system as a cross-cutting topic, spanning across the focus areas and strategies. Furthermore, the Partnership Agreement goals include identifying projects, programs, and/or initiatives that seek to alleviate inequities among Boulder community members and create opportunities for underrepresented populations to participate in, be heard, and experience benefits. Finally, this goal emphasizes the value of the partnership in accelerating and scaling innovative solutions beyond existing programs and "business as usual" activities.

Identifying and mapping disproportionately impacted communities in Boulder will facilitate the implementation of targeted strategies and projects that support equitable outcomes. For example, the partners have begun to explore an analysis of outages in Boulder and have been gathering data on areas of town with less reliable service due to weather- and/or animal-related outages. The partners are also exploring strategies to equitably address energy costs, access to utility programs and green jobs, and other partnership areas (see Figure 11 as an example).

The Boulder Energy Partnership Community Advisory Panel designed an equity lens (Appendix C) that supports the shift to clean energy and emissions reductions while also avoiding harm and generating benefits for communities of color, and low-income and diverse households. This lens, which provides a series of questions to use, will inform the implementation of partnership projects and decisions. Maps from the Colorado EnviroScreen tool are provided in Appendix D to further inform equitable implementation.

Figure 11. A new solar garden near the Boulder Reservoir is bringing local renewable energy to Ponderosa, a manufactured housing community in the city. Part of the city's efforts to make solar accessible to all, the Ponderosa Solar Garden Pilot Program brings clean energy and savings to customers traditionally left out of the solar market.

2023-2025 WORK PLAN FOCUS AREAS

Work to achieve the goals of the partnership is organized into six focus areas:

- Energy Efficiency (EE)
- Building Electrification (BE)
- Transportation Electrification (TE)
- Local Renewable Generation and Storage (LR)
- Grid-Supplied Electricity (GS)
- Reliability and Resilience (RR)

The estimated cumulative impact of the focus area contributions on Boulder's forecasted 2030 energy and transportation related GHG emissions is illustrated in Figure 12. Through the partnership, the combined impacts of implementing the strategies in these focus areas have the **potential to eliminate electricity emissions** and reduce overall energy and transportation emissions 68% below 2018 levels by 2030. Waste emissions are not considered part of the scope of the partnership.

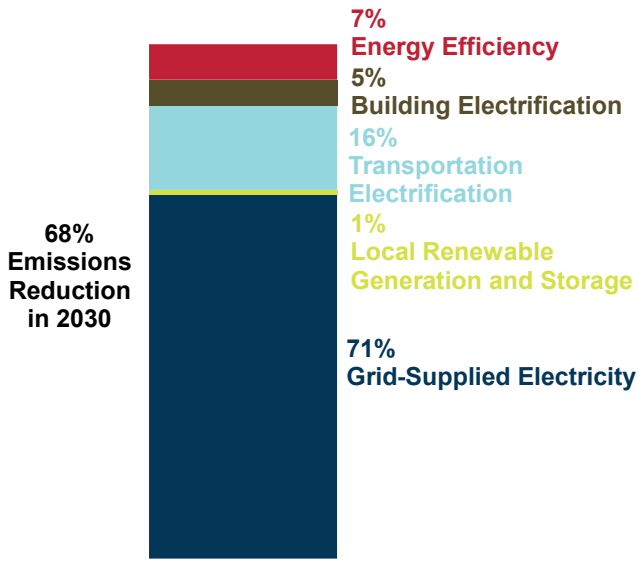


Figure 12. Impact of each focus area on forecasted 2030 energy and transportation emissions (all electricity emissions are eliminated through focus area strategies; natural gas and transportation emissions remain)

In Figure 13, Boulder's actual (2016-2021) and forecasted (2022-2030) energy and transportation emissions are shown as a black line. The estimated emissions reduction contributions from each focus area are shown in colored bands. After accounting for these focus area contributions, the remaining electricity, natural gas, and transportation emissions each year are shown in grey. **All electricity emissions are forecasted to be eliminated by 2030.** The remaining natural gas and transportation emissions will need to be addressed through other City of Boulder climate initiatives.

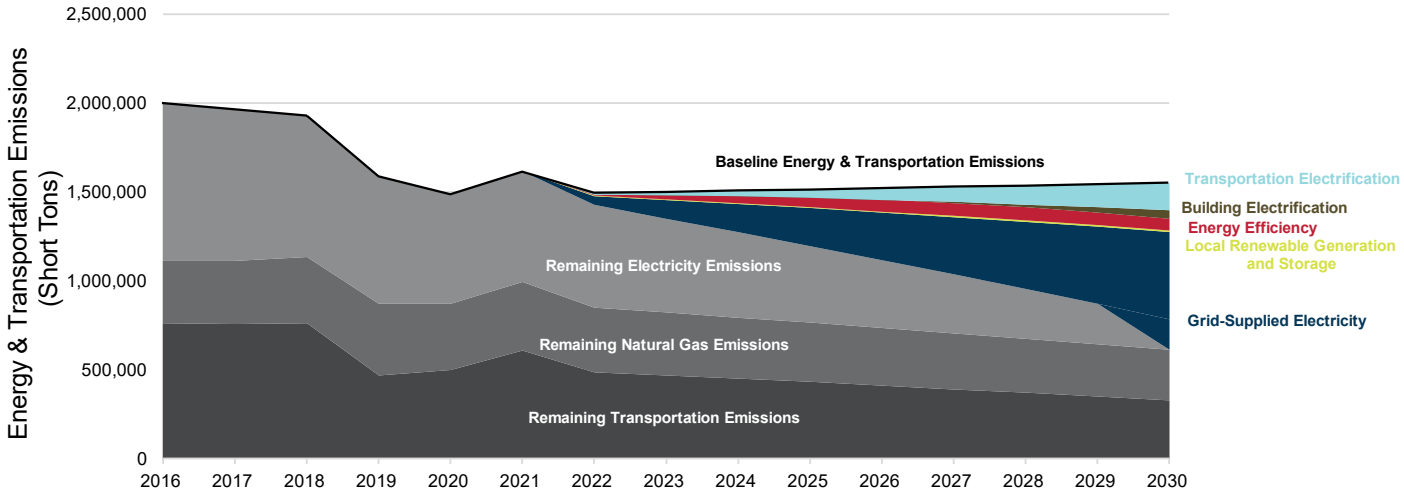


Figure 13. Impact of each of the focus areas on energy and transportation emissions

As illustrated in Figure 14, each focus area is supported by one or more strategies. The technical analysis to estimate future electricity needs, the electricity emissions gap, and local generation was conducted at the strategy level.

The focus areas and strategies on the left primarily support the goal of reducing GHG emissions from the building and transportation sectors. They emphasize reducing total energy consumption and shifting away from gas, and gasoline to electricity use. The focus areas and strategies on the right primarily support the goals of eliminating electricity-sector emissions, generating and storing electricity locally, and ensuring a safe, resilient, and reliable system. Because of the linkages to and implications for all strategies, equity is an essential theme that must be considered, incorporated, and prioritized across all focus areas.

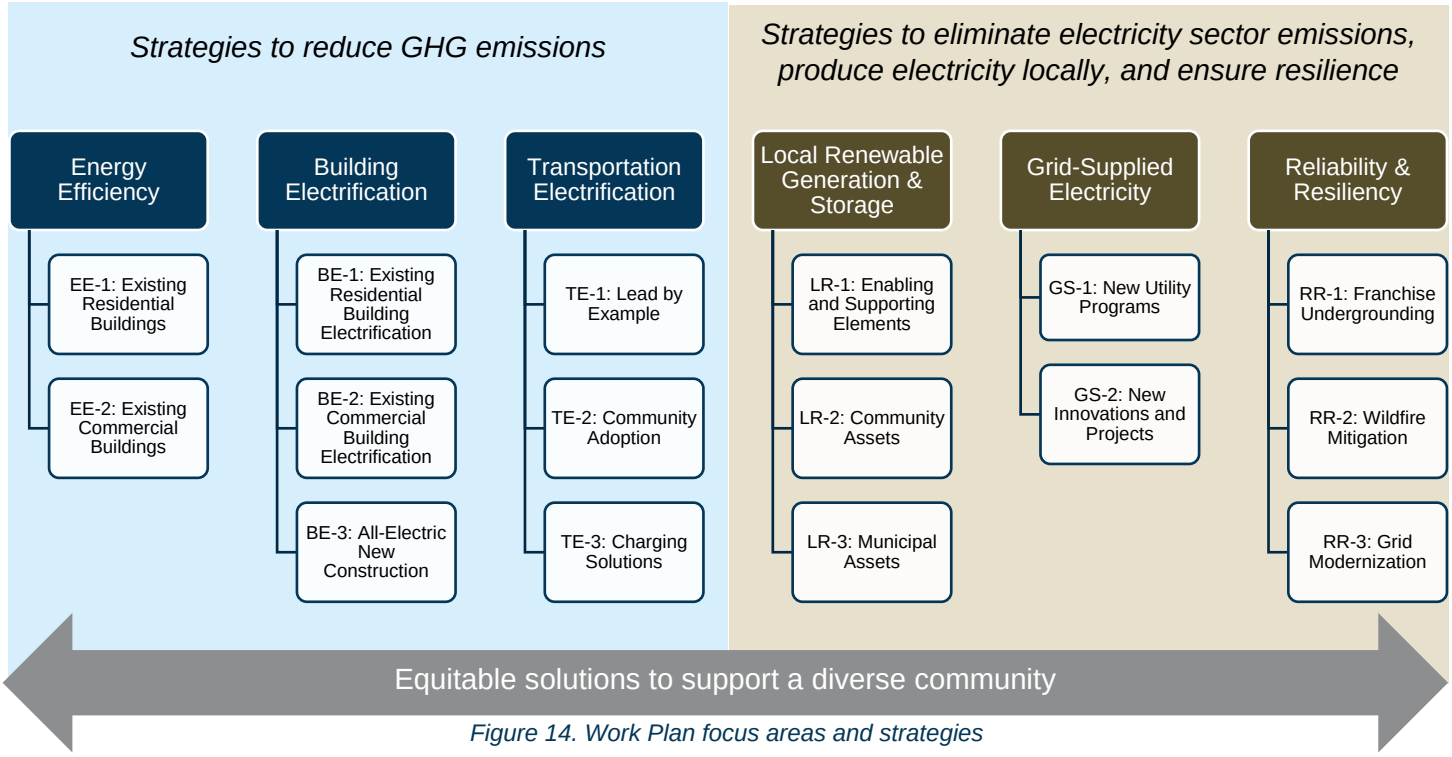


Figure 14. Work Plan focus areas and strategies

As shown in Figure 15, the strategies provide the overarching structure for more tactical projects and programs to be implemented through the partnership. This document provides the details for the focus areas and strategies and identifies the supporting projects for each strategy. A separate Work Plan will provide more specific details to inform implementation of the strategies and projects.

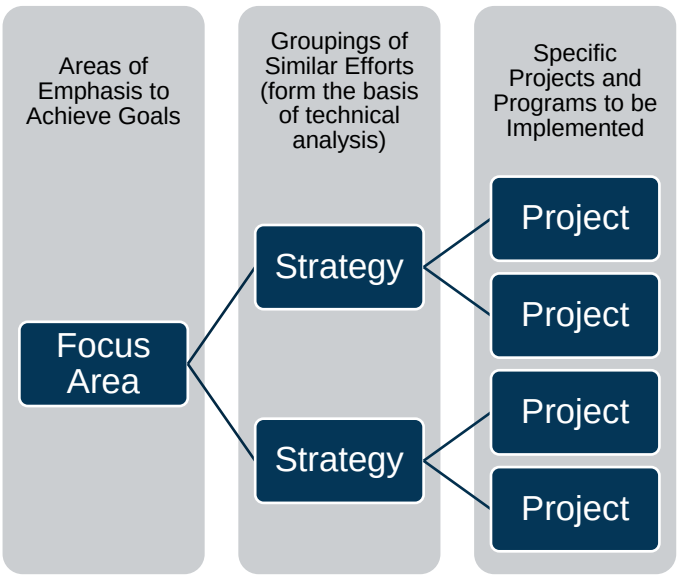


Figure 15. Hierarchy of focus areas, strategies, and projects

ENERGY EFFICIENCY (EE)

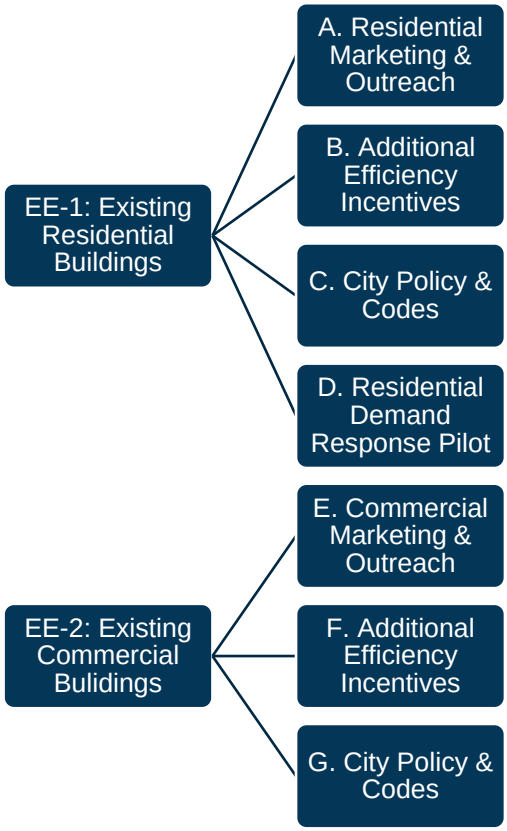
This focus area is foundational to the success of the Energy Partnership Agreement goals. Adoption of energy efficiency community-wide will help reduce both electricity and gas consumption, reducing the amount of energy needed and the resulting emissions from energy use. The City of Boulder already regulates the energy efficiency of new construction through its building and energy conservation codes; therefore, this focus area emphasizes increasing the efficiency of existing residential and commercial buildings. The strategies in this focus area include:

- EE-1: Existing Residential Buildings
- EE-2: Existing Commercial Buildings

See Appendix B for strategy details, including implementation resource information.

Achieving the efficiency impacts identified below will require a nearly three-fold increase in community adoption of energy efficiency. Both Xcel Energy and the city currently have voluntary energy efficiency programs available. Through the partnership, the city and Xcel Energy will undertake coordinated educational campaigns and targeted marketing programs to drive increased awareness and participation. They will also work to support commercial businesses in their compliance with state and local building performance standards.

Strategies & Projects



Targets

3,550 participants annually in energy efficiency programs
(estimated 6.7% annual participation rate) – (see Appendix A for details)

Residential

2,788 participants annually
(approximately 6.5% of Boulder residential premises participating annually)

Example programs include:
- Residential HVAC[2]
- Refrigerator Recycling
- Insulation & Air Sealing

Commercial

762 participants annually
(approximately 9.7% of Boulder commercial premises participating annually)

Example programs include:
- Lighting Efficiency
- HVAC-R[2]
- Multifamily Building Efficiency

[2] Note that efficiency gains associated with heating and water-heating HVAC equipment programs are not included in analysis for this focus area and are instead accounted for in the Building Electrification focus area analysis.

Residential energy efficiency creates opportunities to reduce residential energy consumption; improvements typically yield a positive return on investment (ROI). At scale across Boulder's residential sector, to achieve the impacts below, the estimated upfront cost (before any incentives or additional funding opportunities) could range between $39 million and $114 million annually (Nadel, 2020).

Due to the large amount of energy use by commercial buildings, the opportunity for energy savings can be substantial, with a deep retrofit yielding energy savings of 25-50%. However, the capital cost required to yield those savings can vary significantly. At scale across Boulder's commercial sector, to achieve the impacts below, the estimated upfront cost (before any incentives or additional funding opportunities) could range between $45 million and $270 million annually, based on the level of adoption (Nock & Wheelock, 2010).

Estimated Impacts

In 2030, achieving these targets would result in:

Energy Savings	Energy Use	Overall GHG Emissions	Electricity Emissions
1.7% annual energy savings	**3.5%** annual decrease in electricity use	**3.4%** reduction from 2018 levels	**6.5%** reduction from 2018 levels
357.9 GWh cumulative electricity savings	**0.5%** annual decrease in natural gas use		
2.3 million therms cumulative natural gas savings			

Figure 16 shows the forecasted impact of the energy efficiency focus area on overall community GHG emissions in 2030. Energy efficiency strategies lower electricity and natural gas emissions through a reduction in natural gas and electricity use. Note that Xcel Energy is adding renewable energy resources to the grid, that provide increased GHG benefits to the electricity savings through energy efficiency, and the emissions savings from these Xcel Energy efforts are accounted for in the grid-supplied electricity focus area.

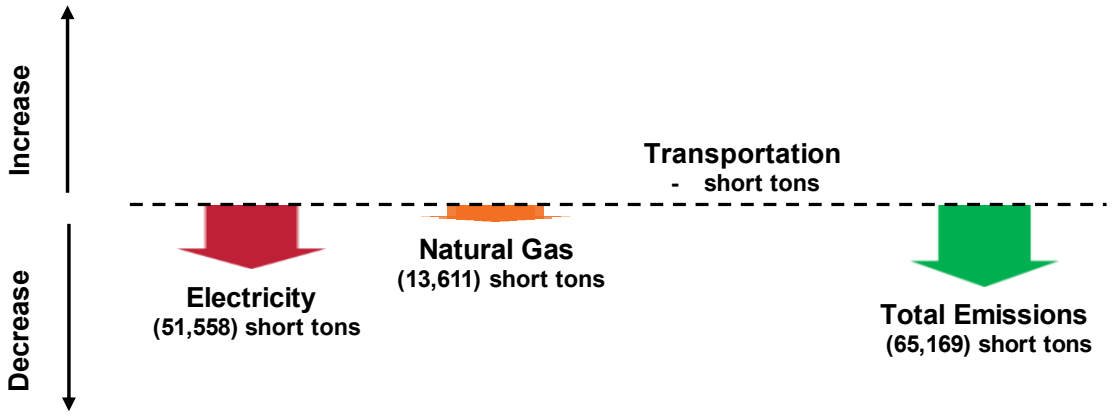


Figure 16. Impact of the energy efficiency focus area on energy and transportation emissions in 2030

See Appendix A: Technical Analysis Details for additional information about the impact analysis methodology and assumptions.

Equity Considerations

Energy bills can be a significant expense for some homeowners, renters, and businesses. A focus on improving energy efficiency can help reduce the burden of utility bills and make buildings more comfortable. However, ensuring that the costs and benefits are equitably distributed will require targeted strategies or incentives to overcome potential barriers to participation, for example:

- Reducing the up-front cost of energy efficiency improvements for low- to moderate-income households, small businesses, and communities facing disproportionate impacts associated with energy cost and environmental justice issues.
- Addressing the split incentive for energy efficiency improvements at rental and multifamily properties through targeted programs for landlords and renters.
- Ensuring that information and engagement opportunities are accessible to all community members.

BUILDING ELECTRIFICATION (BE)

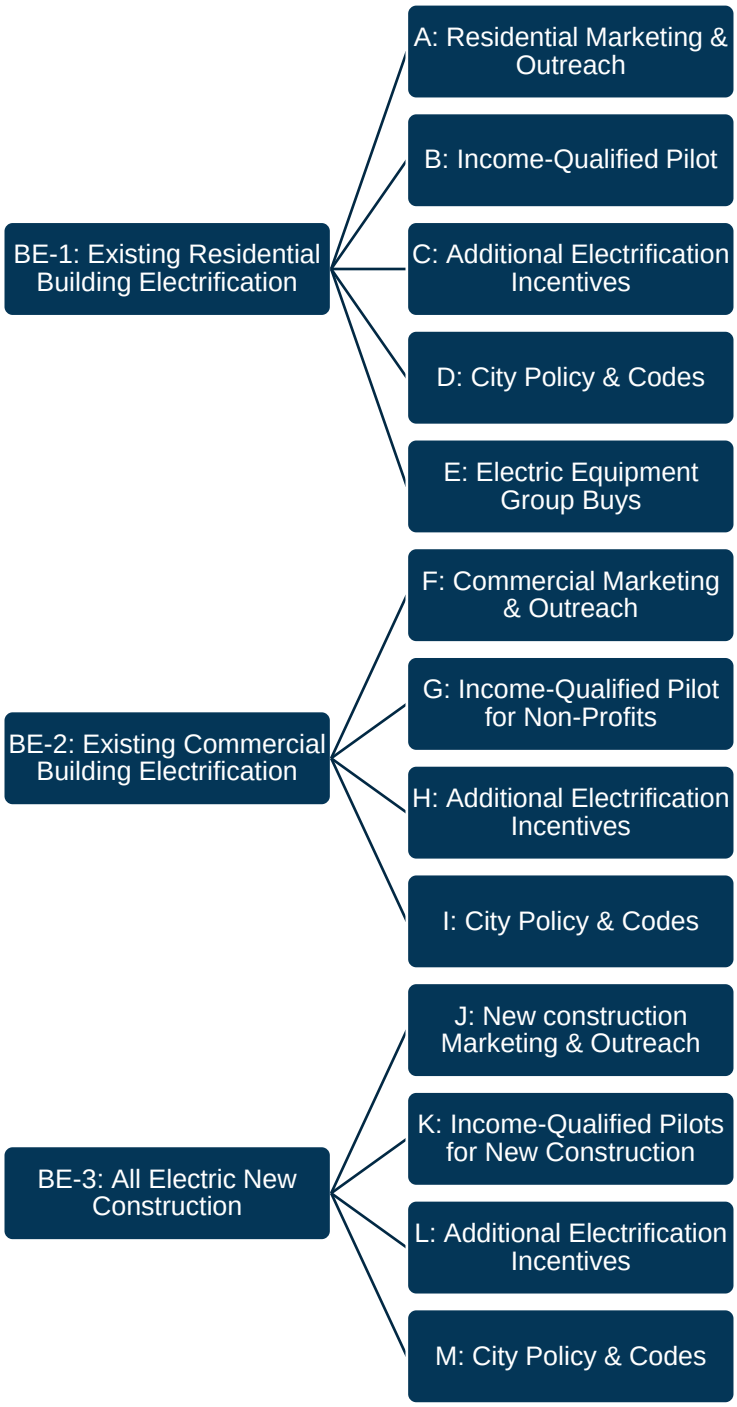
In 2020, natural gas consumption accounted for 25% of total community-wide emissions. Moving away from fossil fuels to power building systems with clean electricity will be critical to meeting Boulder's GHG goals. In addition to reducing GHG emissions, building electrification has the potential to create long-term cost savings and eliminate health and safety impacts of natural gas use.

The primary opportunities for building electrification are heat pumps for space and water heating, as well as electric cooking equipment. While a 2018 study by the Lawrence Berkeley National Laboratory (LBNL) estimated the technical potential for electrification to be almost 100% of all energy use (Deason & et al, 2018), widespread electrification of existing and new buildings will require significant collaborative action. A 2020 Colorado Beneficial Electrification Market Potential Study concluded that capturing the full potential of electrification "will require a fundamental transformation and long-term transition that will need to take place over multiple decades" (Hasselman & et al., 2020). With that in mind, the strategies in this focus area aim to accelerate electrification in Boulder over the next 2-3 years and establish a trajectory for future adoption. The strategies in this focus area include:

- BE-1: Existing Residential Building Electrification
- BE-2: Existing Commercial Building Electrification
- BE-3: All Electric New Construction

See Appendix B for strategy details, including implementation resource information.

Strategies & Projects



Achieving the building electrification impacts identified below will require accelerated electrification of both residential and commercial buildings. The strategies and projects in this focus area reflect recommendations developed by the Community Advisory Panel Building Electrification Working Group. Through the partnership, Xcel Energy and the city will coordinate and lead education and outreach campaigns; develop incentives and programs for income qualified individuals and entities; and explore opportunities for innovation and collaboration to remove barriers to widespread building electrification.

Targets

2,467 premises electrified annually

on average between 2023-2030 (4.5% of premises)
across both residential and commercial & industrial sectors (see Appendix A for details)

Residential	Commercial
2,316 premises annually (approximately 5% of Boulder residential premises electrified annually)	**151** premises annually (approximately 2% of Boulder commercial premises electrified annually)

The annual cost of electrifying Boulder residences at scale could range between $6.5 million – $47.2 million[3], based on an average of 2,316 residential premises electrified annually (note this cost estimate is for equipment only). The cost and ROI of residential electrification retrofits depends on whether electrification is occurring at the end of equipment life or prior to end-of-life. Electrifying equipment at end-of-life has a lower incremental cost and higher ROI (Group14 Engineering, 2020) and, when leveraging rebates and incentives, has the potential to maintain cost parity with fossil fuel options. Residential electrification that involves before end-of-life replacements may represent a significant expense.

The annual cost of electrifying Boulder commercial properties is not yet estimated, due to a lack of data related to commercial building electrification. Electrifying existing commercial buildings generally has a high upfront cost and long payback period, meaning that this strategy will likely require additional funding and incentives to be cost effective.

For new construction, there is an anticipated up-front cost saving of $850 - $6,000 for all-electric single detached residential homes compared to new construction with natural gas systems (Group14 Engineering, 2020) (Southwest Energy Efficiency Project, Colorado Energy Office, 2022). Note that in Boulder, much of the community is already supported by existing natural gas infrastructure.

Estimated Impacts

In 2030, achieving these targets would result in:

Energy Savings	Energy Use	Overall GHG Emissions	Electricity Emissions
0.6% annual energy savings **284.1 GWh** cumulative increase in electricity use **15.1 million therms** cumulative decrease in natural gas use	**2.9%** annual increase in electricity use **2.9%** annual decrease in natural gas use	**2.5%** reduction from 2018 levels	**5.0%** increase from 2018 levels

[3] *This cost estimate utilizes costs from 2020 and may need to be inflated to reflect current day costs.*

Figure 17 shows the estimated impact of the building electrification focus area on overall GHG emissions in 2030. Building electrification strategies lower GHG emissions through shifting energy use from natural gas-based equipment to higher efficiency equipment that uses electricity. Note that Xcel Energy is adding renewable energy resources to the grid that provide increased GHG benefits for increased electricity use associated with building electrification, and the emissions savings from these Xcel Energy efforts are accounted for in the grid-supplied electricity focus area.

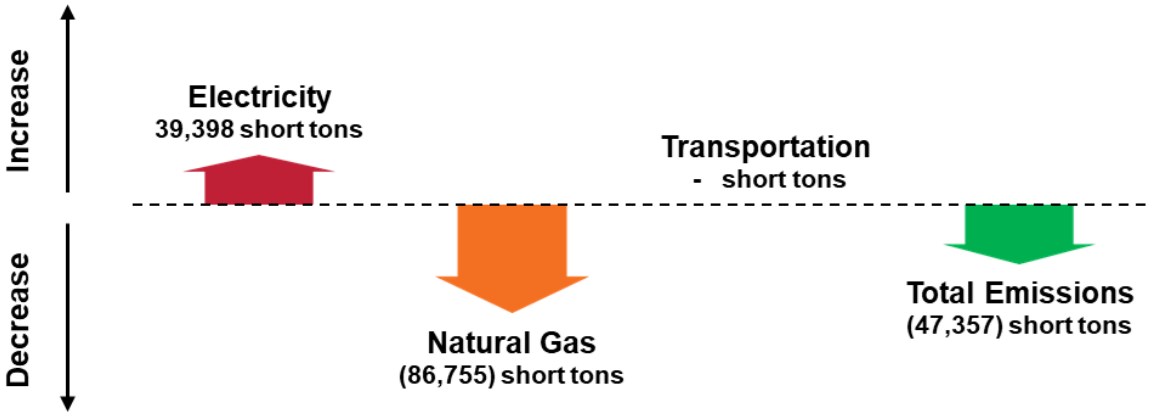


Figure 17. Impact of the building electrification focus area on energy and transportation emissions in 2030

See Appendix A: Technical Analysis Details for additional information about the impact analysis methodology and assumptions.

Equity Considerations

Building electrification has the potential to create health and safety benefits and long-term financial savings for Boulder residents and businesses. However, ensuring that the costs and benefits are equitably distributed will require targeted strategies and incentives, for example:

- Reducing the up-front cost of electrification improvements for low- to moderate-income households, small businesses, and communities facing disproportionate impacts associated with energy cost and environmental justice issues.
- Mitigating for short-term utility bill increases associated with electrification, particularly for low- to moderate-income households and small businesses.
- Addressing the split incentive for building electrification at rental and multifamily properties.
- Ensuring that outreach and information is accessible to all residents.

TRANSPORTATION ELECTRIFICATION (TE)

This focus area centers around the implementation of the City of Boulder Electric Mobility Plan. The Electric Mobility Plan was developed in 2022 through a year-long partnership between the City of Boulder and Xcel Energy to identify and operationalize strategies that support a fully integrated and equitable zero emissions mobility network in Boulder. The plan builds on existing policy and a history of leadership on electric mobility in Boulder to identify opportunities for collaborative action by the city and Xcel Energy in 2023-2024.

Boulder has emerged as a state and national leader in the adoption of electric vehicles (EVs) and charging infrastructure. The City and Xcel Energy are already partnering on innovative projects including a vehicle-to-building equitable carshare pilot that will test emerging EV charging and demand management technologies, and a regional fleet charging hub to support local fleet and transit electrification.

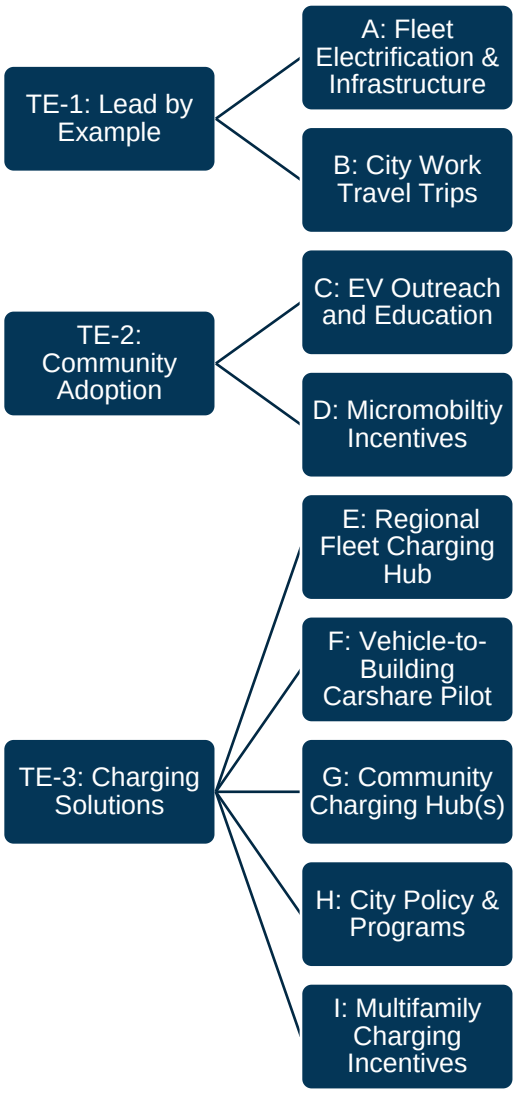
The scope of the Electric Mobility Plan is intentionally broader than EVs alone and is also focused supporting the electrification of micromobility options within the context of Boulder's overarching emissions and transportation goals.

The strategies in this focus area include:

- TE-1: Lead by Example
- TE-2: Community Adoption
- TE-3: Charging Solutions

See Appendix B for strategy details, including implementation resource information.

Strategies & Projects



In 2021, transportation accounted for 37% of Boulder's community-wide GHG emissions. Eliminating emissions associated with transportation will therefore be critical to meeting the community's overarching GHG goals; electrification, combined with a transition to renewable electricity, provides a pathway to do so. However, transportation electrification will also significantly increase electricity consumption, therefore increasing the gap to be reduced or met with new renewable generation.

The strategies in this focus area will enable Xcel Energy and the city to collaboratively address up-front cost and awareness, which were identified as key barriers to electrification by the Community Advisory Panel. Through the partnership, Xcel Energy and the city will develop outreach and education campaigns and explore options to leverage existing and new programs to increase equitable access to electric mobility options. Additionally, the partners will work to implement innovative projects that lead the way on new electric mobility business models and technologies.

Targets

3,125 additional electric vehicles on the road annually
between 2023-2030
(see Appendix A for details)

30% EV adoption by 2030
which translates to a 3% annual increase
(see Appendix A for details)

The incremental cost or savings to electrify 30% of vehicles on the road is dependent on models purchased and replaced, as well as the incentives available to the vehicle purchasers. Similarly, the costs for supporting EV charging infrastructure will be estimated at the project level.

Estimated Impacts

In 2030, achieving these targets would result in:

Energy Use	Overall GHG Emissions	Electric Vehicles
1.2% annual increase in electricity use	**7.9%** reduction from 2018 levels	**29,300 EVs** on the road

Figure 18 shows the forecasted impact of the transportation electrification focus area on overall GHG emissions in 2030. Transportation electrification strategies lower transportation emissions through shifting away from fossil fuel gas-based vehicles to electric vehicles. Note that Xcel Energy is adding to the grid renewable energy resources that provide increased GHG benefits to the increase in electricity use through transportation electrification, and the emissions savings from these Xcel Energy efforts are accounted for in the grid-supplied electricity focus area.

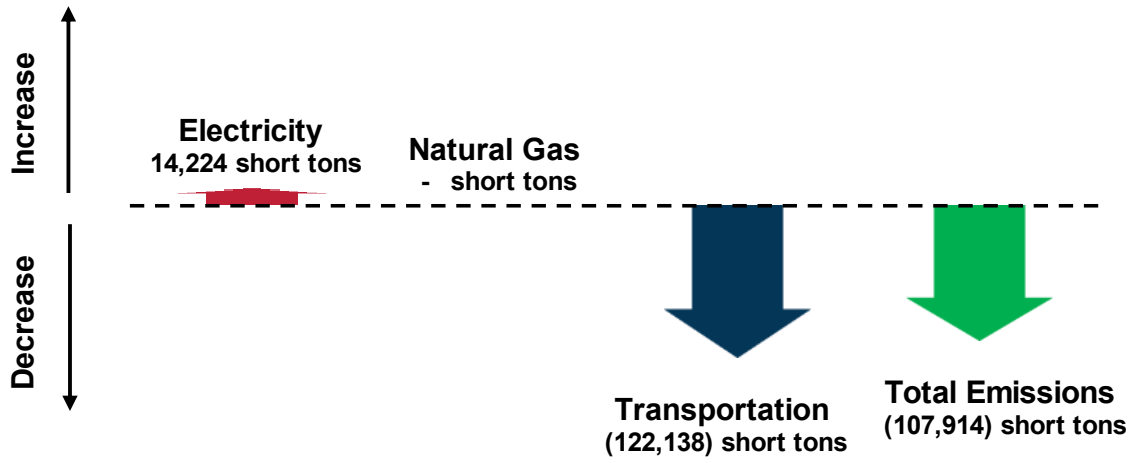


Figure 18. Impact of the transportation electrification focus area on energy and transportation emissions in 2030

See Appendix A: Technical Analysis Details for additional information about the analysis, including the targets and impact of this focus area.

Equity Considerations

In addition to reducing GHG emissions, community-wide transportation electrification has the potential to deliver long-term cost savings, improve air quality, and create opportunities for accessible and sustainable transportation. However, many community members face barriers to EV adoption, and ensuring that the costs and benefits are equitably distributed will require targeted approaches, for example:

- Leveraging existing income-qualified rebates and incentives to help reduce the upfront cost of EV ownership for income qualified residents and businesses.
- Supporting expanded access and connectivity to affordable active transportation options, including e-bikes, electrified transit, and electric carshare.
- Supporting EV and charging access for those without access to home charging and in areas disproportionately impacted by traffic and air pollution.

LOCAL RENEWABLE GENERATION AND STORAGE (LR)

This focus area includes a mix of enabling and supporting initiatives, the physical development of local and city-owned renewable energy and energy storage assets, and the exploration of how to capture additional value from current and future resources (such as for microgrids or virtual power plants – see further discussion in the "Grid-Supplied Electricity" and "Reliability and Resiliency" focus areas). This focus area is intended to support the following criteria, developed by the Community Advisory Panel Renewable Energy Working Group:

Urgency and Action: Move quickly to identify and act on policies, programs, and strategies to meet Boulder's emissions reduction and renewable energy goals.

Authentically Additive: Projects resulting in the addition of new resources beyond what Xcel Energy would otherwise do on their own and are not achieved exclusively through the purchase of renewable energy credits (RECs).

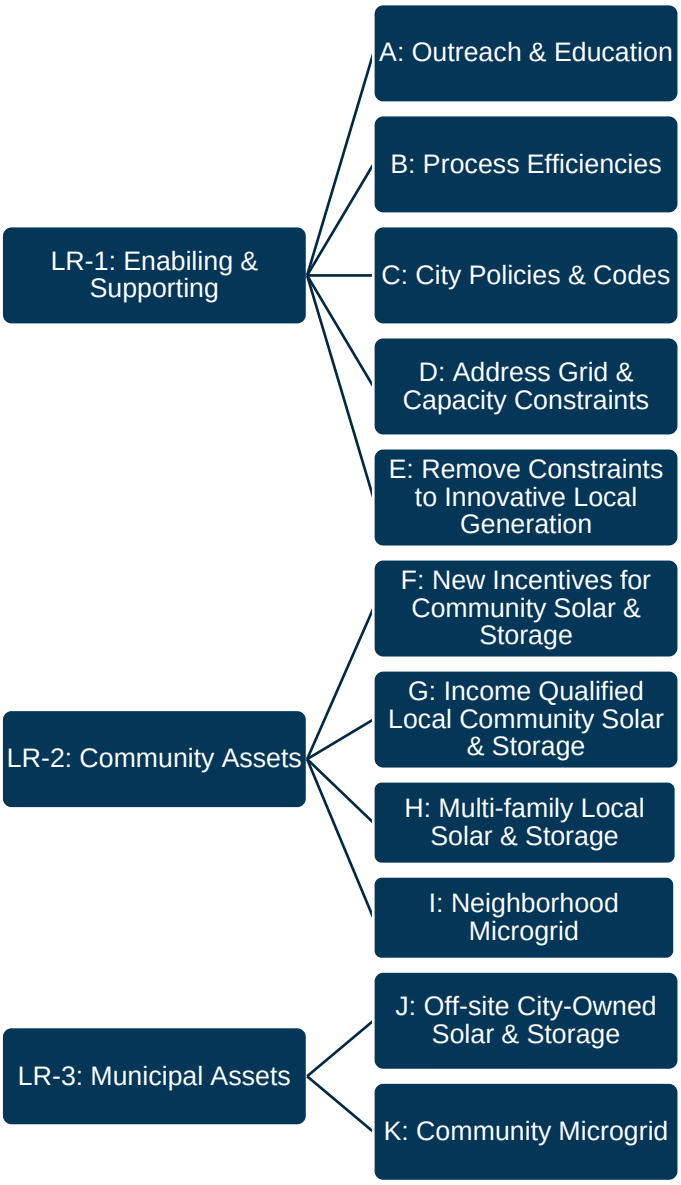
Quantifiable and Traceable: Projects must demonstrate quantifiable emissions reduction for Boulder's electricity consumption.

Local Benefits: Projects should capture many benefits of local generation, including bill savings, emissions reduction, improved air quality, and resilient grid infrastructure.

Equity: Projects should be accessible and affordable to income-qualified residents and businesses.

Scalable: Projects should demonstrate best practices that can be modeled for and adopted by others.

Strategies & Projects



The strategies in this focus area include:

- LR-1: Enabling and Supporting
- LR-2: Community Assets
- LR-3: Municipal Assets

See Appendix B for strategy details, including implementation resource information.

This focus area draws on recommendations developed by the Community Advisory Panel Renewable Energy Working Group and identifies opportunities for the partnership to advance local renewable generation through strategic collaboration. The city and Xcel Energy will work to remove barriers to local renewable energy

installation and participation, expand equitable access to local renewable generation, and pursue innovative projects that contribute to the overarching goals of the partnership.

Achieving the 145 MW local generation target by 2030 will lay the foundation for progress toward the city's vision of 50% local generation by 2050 and, when paired with distributed storage, will also contribute to achieving the 24/7 zero emissions goal. In support of the city's long-term vision, the strategies in this focus area establish an approach for accelerating the physical development of local and city-owned renewable energy and storage assets to 2030 and beyond.

Targets

145 MW local generation and energy storage
by 2030 (see Appendix A for details)

6 MW of local zero emissions resources annually[4]
between 2023-2030
(see Appendix A for details)

The costs for local renewable energy generation depend on myriad factors, including the technology used, site characteristics, and incentives available. The potential costs will be estimated at the project level. Leveraging available incentives and funding, local community renewable energy, and storage has the potential to create long-term financial savings for Boulder.

Estimated Impacts

In 2030, achieving these targets would result in:

Electricity Use	Overall GHG Emissions	Electricity Emissions
18% of total electricity use from a combination of hydro, net metering, and Solar*Rewards	**0.5%** reduction from 2018 levels	**1.1%** reduction from 2018 levels

Figure 19 shows the forecasted impact of the local renewable energy generation and storage focus area on overall GHG emissions in 2030. Local renewable energy generation and storage strategies lower electricity emissions and help support local resilience.

[4] *This level of local zero emissions resources equates to 553 new on-site solar systems (through Xcel Energy's Solar*Rewards and Net Metering programs) annually within Boulder, up from an average of 275 new on-site solar systems each year. For modeling purposes, it is conservatively assumed that all new capacity is solar without storage, and as the level of storage is increased it may reduce the level of overall zero emissions resources needed locally. It is anticipated that over time, the level of storage will increase.*

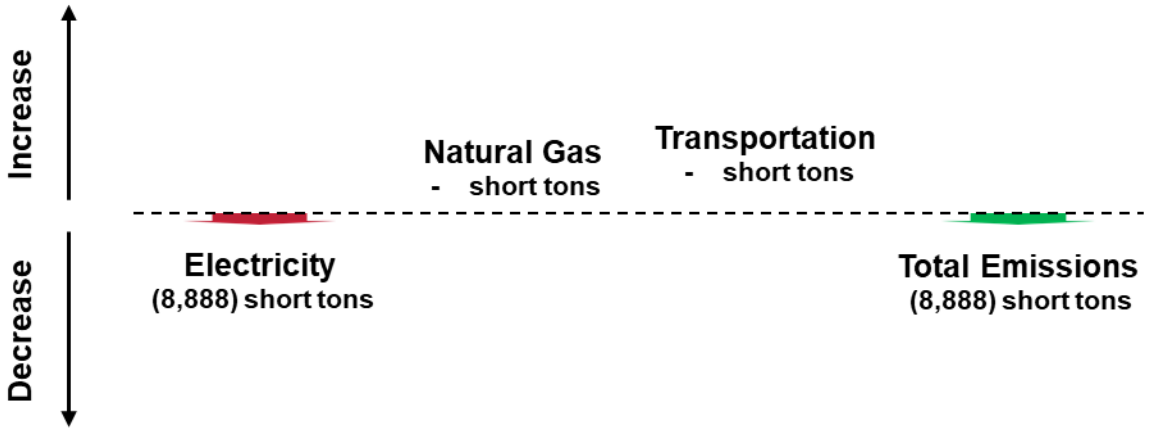


Figure 19. Impact of the local renewable generation and storage focus area on energy and transportation emissions in 2030

See Appendix A: Technical Analysis Details for additional information about the analysis, including the targets and impact of this focus area.

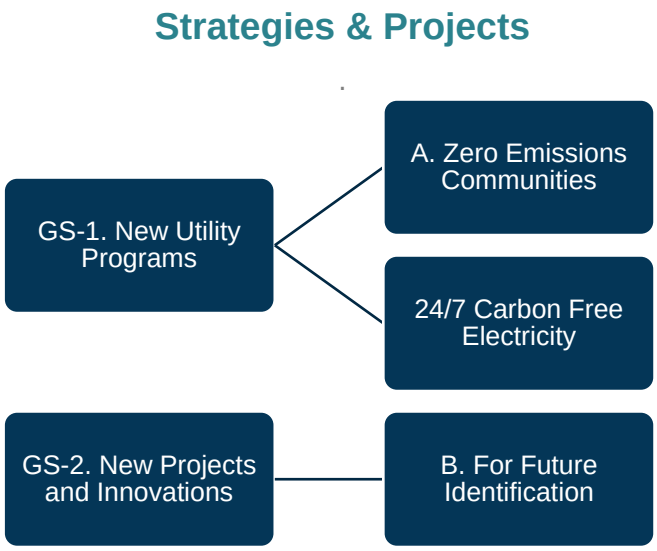
Equity Considerations

Ensuring that local renewable generation is accessible to, and has benefits for, all Boulder community members will require targeted efforts, including:

- Leveraging opportunities to enhance affordable, local, renewable energy access for renters, who make up nearly 54% of Boulder households; multifamily properties, which make up 42% of Boulder's housing stoc (US Census Bureau, 2021); and disproportionately impacted communities.
- Ensuring that outreach and information is accessible to all community members.
- Mitigating the financial impact of any new policy or code requirements on low- to moderate-income and disproportionately impacted communities.
- Prioritizing projects and programs that support and create local jobs.

GRID-SUPPLIED ELECTRICITY (GS)

To reduce the carbon intensity of the electricity that Xcel Energy supplies the City of Boulder, zero-carbon resources are being incorporated into Xcel Energy's grid mix. In 2021, Xcel Energy's grid supplied electricity was 38.2% renewable, representing a 47% reduction in electricity-based carbon emissions from 2005. Xcel Energy's 2021 Clean Energy Plan will reduce carbon emissions at least 85% from 2005 levels by 2030 through adding renewable energy resources and retiring coal operations. In total, 1,600 megawatts of large-scale solar, 1,200 megawatts of distributed solar resources, 400 megawatts of battery storage and 2,400 megawatts of wind energy will be added between 2021-2030 through the Clean Energy Plan. These zero carbon resources will reduce the City of Boulder's electricity-based carbon emissions by a significant margin, however additional large-scale zero-carbon resources are needed to eliminate electricity emissions by 2030.



As part of Xcel Energy's 2021 Electric Resource Plan and Clean Energy Plan (ERP/CEP (Proceeding No. 21A-0141E) Xcel Energy committed to work with the City of Boulder and other interested Parties, to develop a program design for the "Zero Emissions Community Portfolio Program" and, if agreement is reached on program design, Xcel Energy will present it to the Colorado PUC. The original deadline for this was to be June 2022, however the Commission did not approve Xcel Energy's ERP/CEP until September 21, 2022, which adjusts this deadline to March 21, 2023. Xcel Energy is working with Boulder to submit a Notice that nods to the work that has been done on this project, but also acknowledges that both Xcel Energy and Boulder will be continuing on the project. Initial modeling for Zero Emissions Community (ZEC) indicates a high annual cost to customers in order to fully eliminate electricity emissions and as a result, efforts in other focus areas are intended to reduce the needed size and resulting cost of the program.

As indicated, Xcel Energy and Boulder committed to developing this new program model that enables communities to add utility-scale resources (generation and storage) to reduce system-wide emissions at least equal to Boulder's portion of the PSCo system electricity emissions (as currently modeled on a monthly and hourly basis (see Figure 6).

Along with examining utility-scale resources, Xcel Energy and Boulder shared ideas through the 2022-25 Renewable Energy Plan (Proceeding No. 21A-0625EG) and remain open to a variety of solutions that can fit under the program, leading towards reduced carbon emissions that are above and beyond Xcel Energy's business as usual and closing the gap to achieving 24/7 zero emissions electricity supply to Boulder by 2030. Among the potential solutions include advanced storage and hydrogen opportunities, however many of the details for these new solutions and innovations need further development. All new Xcel Energy programs will require regulatory approval through the Colorado PUC, which also indicates a later timeframe for adoption by 2030.

The strategies in this focus area include:

- GS-1: New Utility Programs
- GS-2: New Projects and Innovations

See Appendix B for strategy details, including baseline data.

Targets

24/7 zero emissions electricity

Utility-scale and distributed zero emissions generation and energy storage to power every hour of every day of the year with zero emissions electricity

Advance innovative distributed energy resource projects

(e.g., community microgrids, virtual power plants) to improve reliability and resilience

Estimated Impacts

In 2030, achieving these targets would result in:

Overall GHG Emissions

34.4% reduction from 2018 levels

Electricity Emissions

83.3% reduction from 2018 levels

663,000 short tons
annually in 2030[5]

Figure 20 shows the forecasted impact of the grid-supplied electricity focus area on overall GHG emissions in 2030. Grid-supplied electricity strategies lower electricity emissions by introducing new, large scale renewable and zero-carbon energy resources. Taking into account regulatory processes and to maximize the contributions of other focus area strategies, the timing of new programs such as Zero Emissions Communities would likely come online late in the decade but the specific timing of new program approval and development could occur well before that date. Xcel Energy is also adding renewable energy resources to the grid that provide increased GHG benefits to all customers. See Appendix A: Technical Analysis Details for additional information about the analysis, including the targets and impact of this focus area.

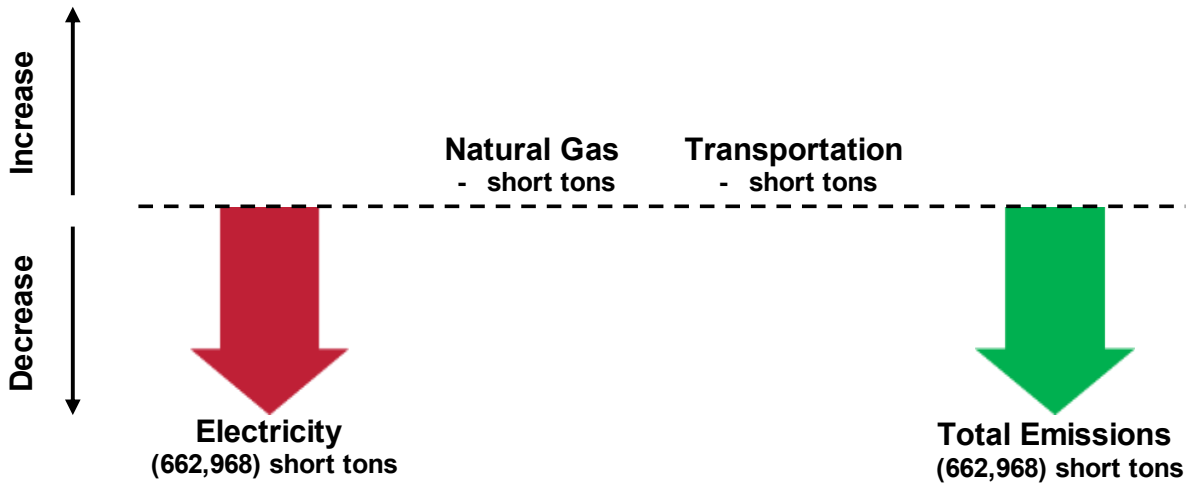


Figure 20. Impact of the grid-supplied electricity focus area on energy and transportation emissions in 2030

[5] *This is the estimated emissions gap in the "Moderate" scenario that needs to be addressed through the development of system-level solutions if other targets in this plan are achieved. The annual percent reduction in 2030 is against a 2018 baseline.*

Equity Considerations

Programs to support carbon-free grid supplied electricity generation and storage will need to be structured to ensure that the costs and benefits are equitably distributed. For example, through:

- Considering the cost implications of any new programs for all community members, particularly in disproportionately impacted communities.
- Mitigating the potential impact of any rate increases and ensuring that any cost savings are shared equitably throughout the community.

RELIABILITY AND RESILIENCY (RR)

The strategies in this focus area center around the evaluation and execution of electric grid capacity, reliability, and undergrounding opportunities at both the distribution and transmission levels. The goal is to create a sustainable system that is ready for future electric demand, supporting the goals of the partnership.

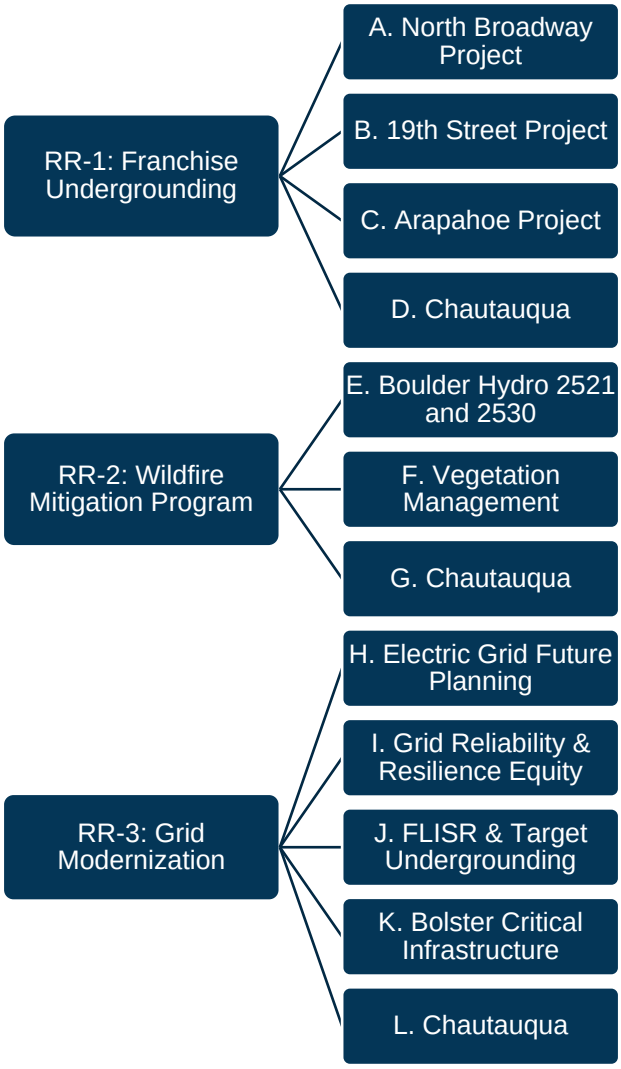
Since the signed Franchise Agreement in 2020, the city and Xcel have worked collaboratively to plan and execute undergrounding projects in support of city improvements. This work will continue, with an estimated $15.5M of spend on overhead to underground conversion projects through 2025.

The strategies in this focus area include:

- RR-1: Franchise Undergrounding
- RR-2: Wildfire Mitigation Program
- RR-3: Grid Modernization

See Appendix B for strategy details.

Strategies & Projects



Targets

Improve reliability and prepare the system for future demand and distributed generation	**Decrease the risk of wildfire within the city limits and surrounding communities**
Improve the aesthetics of the electric grid	**Evaluate and implement technologies that improve system information and response**

As a part of the franchise between Xcel and the city, 1% of gross electric revenue from the City of Boulder is dedicated to burying existing distribution lines that are currently overhead to improve the system's reliability, performance, and aesthetics.

Estimated Impacts

In 2030, achieving these targets would result in:

Grid readiness for future demand	**Increased grid capabilities supportive of future technologies**

Equity Considerations

Strategies to improve the reliability and resiliency of Boulder's electricity supply will benefit residents and businesses. Potential equity considerations include:

- Evaluating and phasing projects in such a manner to ensure that all community members benefit from improved reliability.
- Ensuring that information and outreach is accessible to all community members.

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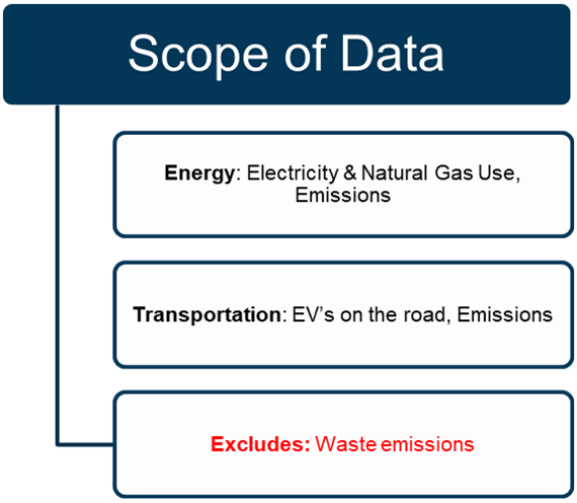
APPENDIX A: TECHNICAL ANALYSIS DETAILS

INTRODUCTION

This appendix summarizes the approach and assumptions used in the technical analysis and modeling for the focus areas and strategies contained in the Energy Partnership Overview.

Scope of the Analysis”

Xcel Energy and the City of Boulder collaborated to develop this analysis to inform the development of strategies that reduce GHG emissions associated with electricity and gas use, eliminate electricity-sector emissions, and increase local renewable energy. While Boulder’s end goal is a fully decarbonized 24/7 zero emissions electricity supply, this analysis was performed on an annual basis using available data.



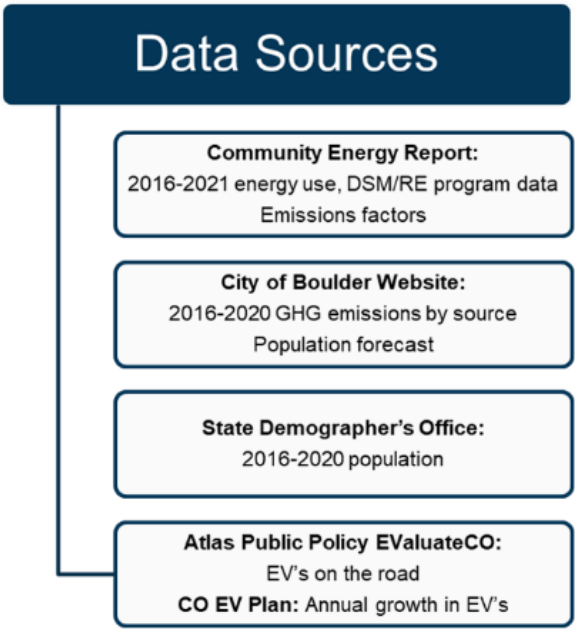
In striving to reduce GHG emissions, a broad reduction in fossil fuel use will be required through a combination of energy efficiency, building electrification, transportation electrification, and renewable energy. The strategies addressed in the analysis defined the scope of emissions considered in the analysis, which included building emissions from both electricity and natural gas as well as transportation emissions from internal combustion engines and electric vehicles. Waste emissions are excluded from this analysis, and in 2020 made up approximately 1.8% of overall community greenhouse gas emissions in the City of Boulder (Community GHG Emissions Data Dashboard, 2022).

ENERGY AND GREENHOUSE GAS BASELINE & FORECAST

Several data points were gathered to serve as the basis for developing a forecast of overall energy use and associated emissions. Data were gathered through Xcel Energy, the City of Boulder, the State of Colorado, and Atlas Public Policy data sources.

Data Sources

Available data were gathered from various local, regional, and state level sources to understand recent trends in energy use, emissions, and transportation.



- **Xcel Energy** maintains annual Community Energy Reports, available for the City of Boulder for the years 2015-2021. These were used as data sources for energy use, demand side management (DSM) program participation and energy savings, and renewable energy (RE) program participation and generation/subscription levels (Community Energy Reports, 2021).
- **City of Boulder** maintains a dashboard of greenhouse gas emissions by source from which 2016-2020 greenhouse gas emissions were used for electricity, natural gas, and transportation (Community GHG Emissions Data Dashboard, 2022). In addition, population data for 2021 and 2040 were used based on the Boulder Community Profile dashboard (About Us

Boulder Community Profile, 2022). Lastly, 2021 vehicle registration data was provided by the City of Boulder and is in alignment with the City of Boulder Electric Mobility Plan.

- **State of Colorado Department of Local Affairs** maintains an annual historic population from which the City of Boulder populations for 2016-2020 were used (Municipality & Place Data, 2022).
- **Atlas Public Policy** maintains a State of Colorado dashboard called EValuateCO from which annual total number of electric vehicles on the road were gathered for the years 2016-2022 for City of Boulder zip codes of 80301, 80302, 80303, 80304, 80305, 80306, 80307, 80308, 80309, and 80310 (EValuateCO Dashboard, 2021).
- **Colorado Energy Office** projects growth rates for EV adoption, based on the Colorado EV Plan in milestone years, based on business as usual adoption which are used in the Electric Vehicle Baseline & Forecast (Electric Vehicle Growth Analysis Results, 2019).
- **Boulder County** maintains annual vehicle registrations for the City of Boulder, which are used for the historical baseline between 2016-2020 (Motor Vehicle Statistics, 2022).
- **Bureau of Transportation Statistics** maintains average annual fuel efficiency for light duty vehicles, which are used for the historical baseline between 2016-2020. 1990-2020 historic fuel economy data trends were used to forecast future year data (Average Fuel Efficiency of U.S. Light Duty Vehicles, 2022).

Population

The future population was forecast linearly between 2021 (the most recent year of data availability) and the 2040 City of Boulder population forecast. An annual population growth rate was calculated and utilized in forecasting the metrics outlined in Table 3. On average, the forecasted annual population growth between 2022-2030 is 0.7%.

Metric	Forecast Basis (2022-2035)
Residential & Commercial Premises	Population Growth
Residential & Commercial Electricity Use	Population Growth
Streetlight Electricity Use	Constant
Residential & Commercial Natural Gas	Population Growth
Motor Vehicle Registrations	Population Growth

Table 3. Forecast basis for various metrics

Housing Data

Boulder's housing stock includes a mix of 1-unit detached dwellings (37.2%), 1-unit attached dwellings (7.3%), 2-unit dwellings (2.6%), 3- or 4-unit dwellings (6.9%), 5- to 9-unit dwellings (8.8%), 10 to 19-unit dwellings (11.3%), 20- or more unit dwellings (21.9%), and mobile home dwellings (4.2%) (US Census Bureau, 2021). Nearly 54% of Boulder's occupied housing units are renter-occupied, and 46% are owner-occupied (US Census Bureau, 2021).

Energy Data

Historical annual energy data were compiled for 2016-2021 by utility type (electricity and natural gas) and by sector (residential, commercial, and streetlights) through Xcel Energy Community Energy Reports. Energy data were then forecast annually based on annual population growth between 2022-2035. Most recent data were used for the year 2021 to form the basis for future years' forecast.

Demand Side Management Programs & Renewable Energy

Historical annual Demand Side Management Program & Renewable Energy data were compiled for 2016-2021 by sector (residential, commercial, and streetlights) and by program (through Xcel Energy Community Energy Reports) to show participation, electricity savings, natural gas savings, renewable energy subscriptions, on-site solar installations, capacity installed, and energy produced/subscribed to. See Figure 21 for historical actual demand side management program participation data and Figure 22 for historical actual renewable energy participation.

Participation	2016	2017	2018	2019	2020	2021
Residential	1,673	1,239	1,086	2,474	1,042	316
Commercial & Industrial (Municipal Included)	326	267	299	394	193	128
Total	**1,999**	**1,506**	**1,385**	**2,868**	**1,235**	**444**

Electricity Savings	2016	2017	2018	2019	2020	2021
Residential	609,607	850,680	959,385	997,904	640,864	191,717
Commercial & Industrial (Municipal Included)	12,292,391	12,312,054	8,767,600	10,824,395	11,218,227	18,350,366
Total	**12,901,998**	**13,162,734**	**9,726,985**	**11,822,299**	**11,859,091**	**18,542,083**

Natural Gas Savings	2016	2017	2018	2019	2020	2021
Residential	92,879	108,734	132,554	125,084	89,195	20,697
Commercial & Industrial (Municipal Included)	58,751	21,632	102,460	44,045	43,985	56,687
Total	**151,630**	**130,366**	**235,014**	**169,129**	**133,180**	**77,384**

Figure 21. Xcel Energy DSM program participation summary for the City of Boulder, 2016-2021

Total Participation	2016	2017	2018	2019	2020	2021
Net Metering	122	208	374	572	761	964
Solar*Rewards	4,299	4,383	4,460	4,534	4,602	4,632
Solar*Rewards Community	72	64	64	74	90	283
Windsource	3,997	4,099	4,187	4,620	4,900	5,297
Renewable*Connect	-	-	-	178	173	167
Residential Total	**8,490**	**8,754**	**9,085**	**9,978**	**10,526**	**11,343**
Net Metering	1	4	14	15	27	38
Solar*Rewards	645	662	680	695	710	720
Solar*Rewards Community	9	28	32	50	53	122
Windsource	255	250	241	255	249	248
Renewable*Connect	-	-	-	13	9	9
Commercial & Industrial (Municipal Included) Total	**910**	**944**	**967**	**1,028**	**1,048**	**1,137**
Grand Total	**9,400**	**9,698**	**10,052**	**11,006**	**11,574**	**12,480**

Total Energy Generated/Subscribed (kWh)	2016	2017	2018	2019	2020	2021
Net Metering	506,034	915,227	1,732,061	2,693,890	3,637,597	4,688,924
Solar*Rewards	7,678,193	7,857,033	8,008,112	8,201,249	8,355,929	8,439,255
Solar*Rewards Community	340,234	308,185	309,018	359,256	362,457	1,064,575
Windsource	12,784,557	13,165,527	13,901,513	14,860,622	16,378,620	19,419,129
Renewable*Connect	-	-	-	710,425	671,903	589,807
Residential Total	**21,309,017**	**22,245,973**	**23,950,704**	**26,825,443**	**29,406,505**	**34,201,690**
Net Metering	16,673	24,485	362,115	363,966	417,691	444,250
Solar*Rewards	22,212,641	22,449,880	23,292,708	30,207,086	31,577,519	32,084,465
Solar*Rewards Community	543,151	297,639	524,543	5,271,551	7,637,015	10,689,391
Windsource	19,181,092	17,802,714	14,617,661	14,957,003	14,003,419	15,347,312
Renewable*Connect	-	-	-	2,252,555	2,407,422	1,959,933
Commercial & Industrial (Municipal Included) Total	**41,953,557**	**40,574,718**	**38,797,026**	**53,052,161**	**56,043,067**	**60,525,351**
Grand Total	**63,262,574**	**62,820,691**	**62,747,730**	**79,877,604**	**85,449,572**	**94,727,041**

Figure 22. Xcel Energy renewable energy program summary for the City of Boulder, 2016-2021[6]

[6] As a component of the on-site system data, for Solar*Rewards customers, the energy production value shown reflects that of customers who have a dedicated production meter for their photovoltaic system, as well as an estimated value for those who do not. For those customers who do not have a production meter, the estimated production value is based on the average generation per nominal capacity of production-metered systems multiplied by the known nominal capacity of the customer system.

Transportation Data

Using transportation data, a projected electricity load due to modest electric vehicle adoption was forecast. Total motor vehicle registration data were collected for 2016-2021 as well as number of electric vehicles on the road between 2016-2022 (EValuateCO Dashboard, 2021). From these two datapoints, a percent of electric vehicle adoption was calculated to be part of historical trend and future forecast between 2023-2035. The 2022 EVs on the road estimate is based on a snapshot as of September 21, 2022, where the 2016-2021 data represent year-end totals.

PEV Population – Units in Operation

Percentage of Total Population

Scenario	2020	2025	2030
BAU	43,346	249,683	718,787
	0.8%	*4.1%*	*10.2%*
ZEV+	45,701	295,223	838,997
	0.8%	*4.8%*	*11.9%*
High	45,701	363,692	1,037,586
	0.8%	*5.9%*	*14.8%*

Figure 23. Colorado EV Plan Scenarios for Electric Vehicle Adoption

The Colorado Energy Office CO Electric Vehicle Plan includes several electric vehicle adoption scenarios that build from existing policies (Electric Vehicle Growth Analysis Results, 2019). The most modest scenario for electric vehicle adoption is the business as usual (BAU) scenario which projects 10.2% electric vehicle adoption by 2030, as a percentage of total vehicles on the road. Built into the BAU scenario in the CO EV Plan is a continuation of electric vehicle tax credits, and an additional infrastructure investment of $200M toward Level 2 and Level 3 charger installations between 2020-2030. By comparison, the ZEV+ scenario includes all policies of the BAU scenario as well as a marketing campaign and additional zero emissions vehicle model availability. Lastly, the High scenario includes all policies of the ZEV+ scenario as well as a low carbon fuel standard incentive, greater investment in public infrastructure, a larger marketing campaign, and accelerated adoption of additional zero emissions vehicle models.

In 2022, the actual adoption rate for electric vehicles in the City of Boulder was 4.6%, which is a higher level of adoption than the CO EV Plan forecast for 2025, on average, across the State of Colorado. Therefore, between 2023-2025 the forecast projected EV adoption to continue from the City of Boulder's 2022 level of adoption at an annual average rate of 0.66%, calculated from the CO EV Plan projected adoption levels in 2020 and 2025 for the BAU scenario. Between 2026-2030, EV growth was projected to continue at the CO EV Plan BAU scenario annual average rate of 1.22% per year. After 2030, EV adoption was assumed to continue at 0.94%, the average of annual projected growth rates in the CO EV Plan BAU scenario between 2021-2030.

To estimate electricity use from electric vehicle adoption, an assumption was made about annual vehicle miles traveled and EV electricity use per mile, as outlined in Table 44 (US EPA, 2022) (US EPA, 2018) (Eco Cost Savings, 2022).

Metric	Assumption
EV Electricity Use	0.346 kWh/mile
Annual Miles Traveled	11,500 miles/vehicle
Gasoline Emissions Factor	0.008887 MTCO2e/gal

Table 4. Electric vehicle assumptions

Utility Inputs

Historical emissions factors as reported by Xcel Energy were compiled for the years 2016-2021 for natural gas and electricity from Community Energy Reports (Community Energy Reports, 2021). For the years 2022-2035, the annual average electricity and natural gas emissions factors were forecast based on stated goals from Xcel Energy. Natural gas emissions factors were held constant at 2021 levels for the forecasted period, and electricity emissions factors were forecast to reduce linearly to 85% below 2005 levels in 2030, and to 100% below 2005 levels in 2050. A snapshot of 2021 electricity use by source is shown in Figure 24. Emissions factors by utility type and key milestone years are documented in Table 5. The estimate of Boulder's annual emissions is calculated by multiplying the average annual emissions factor by total annual consumption. Actual total emissions may vary when calculating emissions by multiplying hourly consumption by hourly emissions factor. **As work progresses on developing resources to achieve zero emissions electricity for every hour of the year ("24/7 carbon-free"), the partners will work to improve emissions accounting.**

Milestone Emissions Factors	Value
Average annual Natural Gas Emissions Factor (2021-2035)	0.0520 MTCO2e/Dth
Average annual 2021 Electricity Emissions Factor	0.4770 MT/MWh
Average annual 2025 Assumed Electricity Emissions Factor	0.3209 MT/MWh
Average annual 2030 Assumed Electricity Emissions Factor	0.1258 MT/MWh
Average annual 2035 Assumed Electricity Emissions Factor	0.0944 MT/MWh

Table 5. Natural gas and electric grid carbon intensities

Grid emissions factor reductions were included as part of the greenhouse gas emissions forecast affecting overall carbon emissions. The strategy analysis builds upon this reduction in grid emissions to identify the remaining emissions reduction needed as well as renewable energy needed to meet the partnership goals.

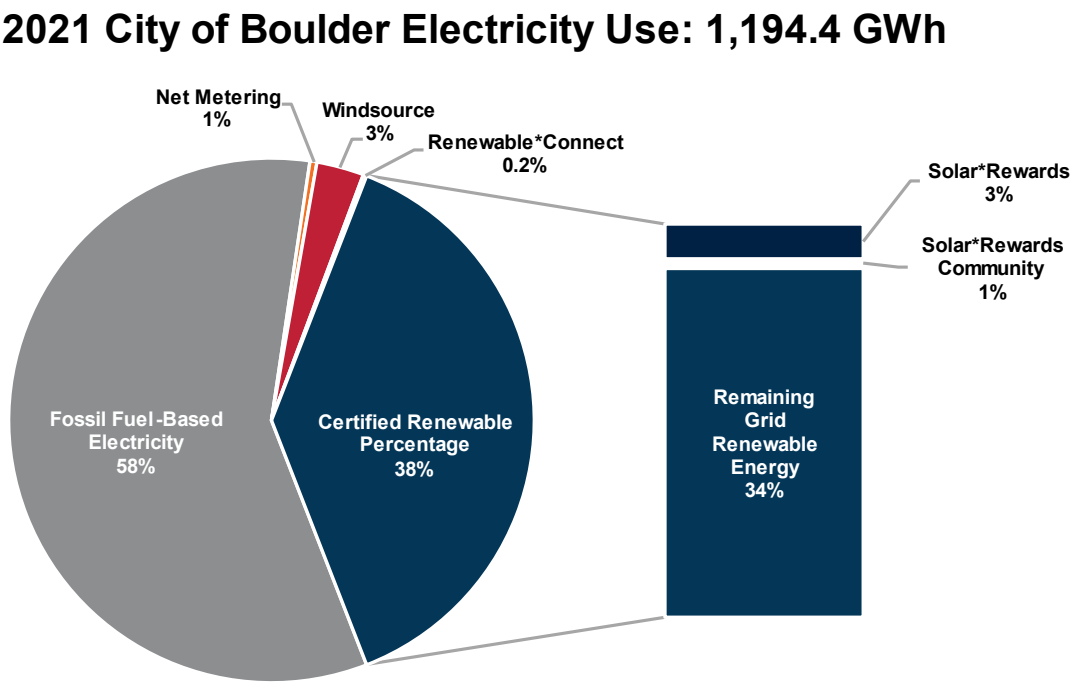


Figure 24. 2021 City of Boulder electricity use by source

Electricity Use Baseline and Forecast

Combining population data, transportation data, and energy data, an initial forecast for total electricity use was created, spanning the years 2022-2030. With increases due to population and modest electric vehicle adoption, electricity is projected to increase from 2021 levels of 1,194.4 GWh to 1,306.8 GWh in 2030, representing an increase of 9.4%. The scenario-based strategy analysis builds upon this baseline and forecast of electricity use to analyze the impacts of energy efficiency, building electrification, and higher levels of transportation electrification on future electricity use.

Greenhouse Gas Baseline and Forecast

The baseline for the City of Boulder's greenhouse gas emissions spanned the years 2016-2020, based on actual emissions data from the City of Boulder's greenhouse gas emissions dashboard (Community GHG Emissions Data Dashboard, 2022). Emissions were broken out into the same categories utilized in the city dashboard: electricity, natural gas, and transportation. Waste emissions were excluded from the overall emissions, as the focus of this Work Plan analysis is on building and transportation emissions.

The forecast for the City of Boulder's greenhouse gas emissions combines population, energy use, renewable energy program, demand side management program, and transportation data, together with utility inputs to project emissions in two scenarios, described in the Strategy Analysis section below.

SCENARIO-BASED STRATEGY ANALYSIS

The annual accounting of three metric "ledgers" was maintained throughout the analysis to track results against the partnership goals: energy use, renewable energy, and greenhouse gas emissions. In forecasting greenhouse gas emissions, it is useful to define two scenarios for analysis, first to understand how high Boulder's energy use, renewable energy, and greenhouse gas emissions might theoretically be, and second what the impact on the three "ledger" metrics might be in a less aggressive scenario aligned with "best-in-class" adoption rates for utility programs, electric vehicle adoption, and building electrification.

The first scenario is intended to be demonstrative and hypothetical and is titled "Maximum Scenario." The second scenario serves as the foundation for the strategy targets and is titled "Moderate Scenario." Additional details on methodology and key assumptions are outlined for each scenario by strategy below.

Maximum Scenario

To help inform how high electricity use may become by 2030, and to determine the maximum amount of zero emissions electricity needed to satisfy the Energy Partnership Agreement's goal of 100% renewable electricity by 2030, this analysis utilized the City of Boulder's goal of net-zero carbon emissions by 2035. For the City of Boulder to achieve its goal of net-zero carbon emissions, fossil fuel use will need to be eliminated from buildings and transportation. To enable fossil fuel reductions on this scale, 100% building electrification and 100% transportation electrification by 2035 are the key assumptions that will increase electricity use significantly while also reducing both natural gas use and overall carbon emissions. A shift by Xcel Energy from fossil-fuel based electricity generation to electricity sourced from zero emissions sources enables beneficial electrification to achieve significant carbon emissions reductions. Based on the increases from building and transportation electrification, the Maximum Scenario forecasts that total electricity needs in 2030 could be as much as 2,272 GWh, an increase of 90% from 2021 levels.

Energy Efficiency

To maximize potential electricity consumption and resulting emissions, no participation in DSM energy efficiency programs is assumed as part of this scenario (Table 6).

Focus Area	2030 Impact on Electricity Use	Percent Change from 2021
Energy Efficiency	No impact	n/a

Table 6. Estimated impact of energy efficiency on electricity use (Maximum Scenario)

Building Electrification

The building electrification strategy focuses on reducing natural gas use through electrification of space heating, water heating, and other end uses in residential and commercial buildings. Conversions from natural gas to electricity were assumed to be linear between 2023-2035 at a pace of 8% of utility premises per year, converting 100% of the remaining natural gas in 2035 to electricity (Table 7).

Maximum Scenario Year	2025	2030	2035
Residential Percent of Premises Electrified	23%	62%	100%
Commercial Percent of Premises Electrified	23%	62%	100%
Weighted Total Percent of Premises Electrified	23%	62%	100%

Table 7. Percent of premises electrified in select years by sector

When electrifying fossil-fuel sources in building spaces, this analysis takes advantage of the efficiency gains by switching from existing less efficient equipment to high-efficiency heat pump technology (ACEEE, 2019). Efficiency gains range from 35% in residential settings to 37% in commercial settings (Table 8). In residential settings, it is assumed that a home has an existing natural gas furnace and a water heater with 80% efficiency, and converts to an all-electric heat pump and heat pump water heater with combined coefficient of performance (COP) of 2.87 (Geller, 2018). In commercial settings, it is assumed that the combined impact of electrification opportunities across the total site energy use in the commercial setting amounted to 37% efficiency gain (Perry, 2020). These opportunities included converting natural gas rooftop packaged systems to electric heat pumps, converting gas furnaces to electric heat pumps, and converting natural gas boilers and space heaters to ductless heat pumps in small buildings, variable refrigerant flow (VRF) heat pumps in medium buildings, and large boilers to large heat pumps in large buildings.

Maximum Scenario Input	Value
Building Electrification Start Year	2023
Building Electrification End Year	2035
Residential Percent Electric Target in End Year	100%
Commercial Percent Electric Target in End Year	100%
Residential Efficiency Gain through Electric Conversion	35%[7]
Commercial Efficiency Gain through Electric Conversion	37%[8]

Table 8. Key inputs to the building electrification analysis

The impact of building electrification on total electricity use in 2030 compared to 2021 levels is summarized in Table 9.

[7] Residential energy efficiency gain through building electrification assumes that, on average, existing natural gas equipment is 80% efficient and that 43% of total energy is used for space heating. The natural gas space and water heating equipment is converted to an electric ductless heat pump/water heater with a combined average coefficient of performance (COP) of 2.87. This is considered to be a conservative estimate of efficiency gain since the actual COP for space heating and water heating may have a higher COP (on the order of COP of 3.5) due to a more favorable ambient temperature around the water heater.

[8] The commercial energy efficiency gain through electrification is based on an ACEEE report finding that the electrification opportunities examined could reduce total commercial-sector site energy use in the portion of the commercial building stock analyzed by about 37%.

Focus Area	2030 Impact on Electricity Use	Percent Change from 2021
Building Electrification	768 GWh increase	64.3% increase

Table 9. Estimated impact of building electrification on electricity use (Maximum Scenario)

Transportation Electrification

The transportation electrification strategy focuses on reducing internal combustion engine (ICE) vehicles and increasing electric vehicle adoption. In accordance with the City of Boulder's net zero carbon emissions goal by 2035, a linear increase in EVs on the road was projected from 2022 levels to 100% of all vehicle registrations in 2035. Table 1010 shows EV adoption at various years in the Maximum Scenario.

Maximum Scenario Year	2022	2025	2030	2035
Total EVs on the Road	4,291	25,144	61,829	100,925
Total Motor Vehicle Registrations	92,375	94,348	97,637	100,925
Percent EV Adoption	4.6%	27%	63%	100%

Table 10. Snapshots of the forecast of EV adoption in various years

As levels of EVs on the road increase over time, gas-powered vehicles are being replaced and retired at the same rate, resulting in emissions savings. As noted in Table 4, the assumptions for annual miles traveled per vehicle, the electricity use per mile of EVs, and the gasoline emissions factor remain constant in all years of the forecast.

The impact of transportation electrification on total electricity use in 2030 compared to 2021 levels is summarized in Table 11.

Focus Area	2030 Impact on Electricity Use	Percent Change from 2021
Transportation Electrification	232 GWh increase	19.4% increase

Table 11. Estimated impact of transportation electrification on electricity use (Maximum Scenario)

Local Renewable Generation and Storage

To maximize potential electricity consumption and resulting emissions, no participation in renewable energy programs of any kind is assumed as part of this scenario (Table 12).

Focus Area	2030 Impact on Electricity Use	Percent Change from 2021
Local Renewable Generation and Storage	No impact	n/a

Table 12. Estimated impact of local renewable generation on electricity use (Maximum Scenario)

Grid-Supplied Electricity

To maximize potential electricity consumption and resulting emissions, no participation in new renewable energy or energy programs of any kind is assumed as part of this scenario (Table 13).

Focus Area	2030 Impact on Electricity Use	Percent Change from 2021
Grid-Supplied Electricity	No impact	n/a

Table 13. Estimated impact of Grid-Supplied Electricity on electricity use (Maximum Scenario)

Moderate Scenario

The Moderate Scenario serves as the foundation for the strategies in the Energy Partnership Overview. The scenario is driven by the City of Boulder's goal of eliminating electricity sector emissions (100% zero emissions electricity) by 2030 and utilizes strategies of energy efficiency, building electrification, transportation electrification, renewable energy, and grid-supplied electricity, to forecast emissions reductions. For purposes of analysis, the renewable energy goal for the City of Boulder is assumed to be achieved through zero-carbon clean energy resources. Targets for each strategy were developed leading up to, and refined collaboratively during a work session on October 25, 2022, with the City of Boulder. The targets aligned with a combination of best-in-class adoption rates and existing targets developed and presented through previous City of Boulder reports and analyses. The assumptions and methodology for resulting emissions reductions through achieving the targets set are described by focus area below. The Moderate Scenario, assuming community-wide adoption of energy efficiency measures, plus more moderate levels of building and transportation electrification adoption, forecasts 2030 electricity needs of approximately 1,286 GWh, an increase of 8% from 2021 levels.

Energy Efficiency

Energy efficiency targets were developed based on a combination of best-in-class demand-side management (DSM) program participation rates achieved in communities involved in Xcel Energy's Partners in Energy program, and alignment with the State of Colorado Building Performance Standard targets.

The annual targeted electricity and natural gas savings is based on average savings per participant across a targeted portion of Xcel Energy's suite of DSM program offerings and the historic participation and savings within the City of Boulder. In order to prevent double counting of efficiency savings through Building Electrification, DSM program residential savings from the Residential Heating and Water Heating programs and commercial savings from the Heating Efficiency program were excluded. These three Xcel Energy DSM programs involve upgrading natural gas-based heating and water heating equipment with higher efficiency natural gas-based equipment. This efficiency gain is accounted for within the Building Electrification strategy, which upgrades natural gas-based heating and water heating equipment to electric heat pump-based equipment. The average energy savings per participant of targeted DSM programs in the City of Boulder is shown in Table 1414.

Moderate Scenario Sector	**Average Electricity Savings per Participant (kWh/participant)**	**Average Natural Gas Savings per Participant (therms/participant)**
Residential	444 kWh/participant	49 therms/participant
Commercial	56,972 kWh/participant	195 therms/participant

Table 14. Average energy savings per DSM program participant by sector

The targets for the residential and commercial sectors are shown in Table 15.

Moderate Scenario Sector	Annual Participation Target	Annual Percent Energy Savings Target	Annual Electricity Savings Target (kWh)	Annual Natural Gas Savings Target (therms)	Source of Target
Residential	2,788 (6.5% of residential premises)	0.6%	1,238,946 kWh	136,205 therms	2021 Partners in Energy community DSM participation rates
Commercial	762	2.2%	43,396,455 kWh	148,375 therms	State of Colorado Building Performance Targets
Streetlights	n/a	n/a	96,360 kWh	n/a	Assumption of 100 streetlights converted to LED annually
Community-wide	**3,550**	**1.7%**	**44,731,761 kWh**	**284,580 therms**	**See above**

Table 15. Energy efficiency forecast targets by sector

Historically, between the years 2019-2021, the City of Boulder achieved about 0.6% energy savings per year on average, with 1,298 participants in Xcel Energy DSM program offerings annually (equivalent to a 2.5% program participation rate) yielding 13.9 million kWh and 97.9 thousand therms in energy savings annually. The targets for increased energy efficiency represent a 173% increase in historical annual DSM program participation.

In addition to residential and commercial energy efficiency in buildings, the Energy Efficiency focus area analysis also includes a conversion of streetlights to LED. There are approximately 4,500 Xcel Energy-owned non-LED streetlights in the City of Boulder that are intended to be transferred to city ownership and be converted. This analysis assumes 100 streetlights would be converted annually to LED. The electricity savings analysis includes assumptions that are outlined in Table 16.

Moderate Scenario Streetlight Inputs	Value
Annual streetlights replaced	100
Average streetlight run time per day	12 hours[9]
Assumed wattage of existing non-LED streetlights[10]	320 W
Assumed wattage of new LED streetlights[10]	100 W

Table 16. Streetlight analysis assumptions

[9] Run time hours of streetlights is based on the annual average daily daylight hours in Denver, CO (ClimaTemps.com, 2017).
[10]Existing streetlights were assumed to be typical incandescent wattage and new streetlights were assumed to be typical LED wattage, rounded up to 100W for conservatism (Pacific Lamp Supply Company, 2022).

The impact of energy efficiency on total electricity use in 2030 compared to 2021 levels is summarized in Table 17.

Focus Area	2030 Impact on Electricity Use	Percent Change from 2021
Energy Efficiency	372 GWh decrease	28.6% decrease

Table 17. Estimated impact of energy efficiency on electricity use (Moderate Scenario)

Building Electrification

The building electrification strategies focus on reducing natural gas use through electrification of space heating, water heating, and other end uses in residential and commercial buildings. The Moderate Scenario targets for building electrification by sector are outlined in Table 18. Conversions from natural gas to electricity were assumed at a linear pace of 5% of residential premises per year and 2% of commercial premises per year, to 2030. Between 2031-2050, the assumed pace of conversion to electric slows, with 2% of residential premises per year and 1% of commercial premises per year.

Moderate Scenario Year	2030	2050
Residential Percent of Premises Electrified	40%	85%
Commercial Percent of Premises Electrified	15%	35%
Weighted Total Percent of Premises Electrified	36%	78%

Table 18. Percent of premises electrified in select years by sector

When electrifying fossil-fuel sources in building spaces, this analysis takes advantage of the efficiency gains by switching from existing less-efficient equipment to high-efficiency heat pump technology. Efficiency gains range from 35% in residential settings to 37% in commercial settings. In a residential setting, it is assumed that a home has an existing natural gas furnace and a water heater with 80% efficiency, and converts to an all-electric heat pump and heat pump water heater with combined (COP) of 2.87 (Geller, 2018).

In a commercial setting, it is assumed that the combined impact of electrification opportunities across the total site energy use in the commercial sector amounted to 37% efficiency gain (Perry, 2020). These opportunities included converting natural gas rooftop packaged systems to electric heat pumps, converting gas furnaces to electric heat pumps, and converting natural gas boilers and space heaters to ductless heat pumps in small buildings, variable refrigerant flow (VRF) heat pumps in medium buildings, and large boilers to large heat pumps in large buildings.

Moderate Scenario Input	Value
Building Electrification Start Year	2023
Residential Efficiency Gain through Electric Conversion	35%[11]
Commercial Efficiency Gain through Electric Conversion	37%[12]

Table 19. Key inputs to the building electrification analysis

The impact of building electrification on total electricity use in 2030 compared to 2021 levels is summarized in Table 20.

Focus Area	2030 Impact on Electricity Use	Percent Change from 2021
Building Electrification	284 GWh increase	21.9% increase

Table 20. Estimated impact of building electrification on electricity use (Moderate Scenario)

Transportation Electrification

The transportation electrification strategies focus on reducing internal combustion engine (ICE) vehicles and increasing electric vehicle adoption. Through collaboration with the City of Boulder, a target was set to achieve 30% EV adoption by 2030. For purposes of this analysis, a linear increase in EVs on the road was projected from 2022 levels to 30% of all vehicle registrations in 2030. Table 21 shows EV adoption at various years of the Moderate Scenario.

Moderate Scenario Year	2022	2025	2030
Total EV's on the Road	4,291	13,353	29,291
Total Motor Vehicle Registrations	92,375	94,348	97,637
Percent EV Adoption	4.6%	14%	30%

Table 21. Snapshots of the forecast of EV adoption in various years

As levels of EV's on the road increase over time, gas-powered vehicles are being replaced and retired at the same rate, resulting in emissions savings. As noted in Table 4, the assumptions for annual miles traveled per vehicle, the electricity use per mile of EVs, and the gasoline emissions factor remain constant in all years of the forecast. It is assumed that EV adoption continues past 2030 at the same annual pace as 2025-2030.

[11] Residential energy efficiency gain through building electrification assumes that on average existing natural gas equipment is 80% efficient and that 43% of total energy is used for space heating. The natural gas space and water heating equipment is converted to an electric ductless heat pump/water heater with a combined average COP of 2.87. This is considered to be a conservative estimate of efficiency gain since the actual COP for space heating and water heating may have a higher COP (on the order of COP of 3.5) due to a more favorable ambient temperature around the water heater.

[12] The commercial energy efficiency gain through electrification is based on an ACEEE report finding that the electrification opportunities examined could reduce total commercial-sector site energy use, in the portion of the commercial building stock analyzed, by about 37%.

The impact of transportation electrification on total electricity use in 2030 compared to 2021 levels is summarized in the table below.

Focus Area	2030 Impact on Electricity Use	Percent Change from 2021
Transportation Electrification	103 GWh increase	7.9% increase

Table 22. Estimated impact of transportation electrification on electricity use (Moderate Scenario)

Local Renewable Generation and Storage

Increasing renewable energy in the City of Boulder is an important lever to enable energy efficiency, and building and transportation electrification impacts to reach their full emissions reduction potential. Although Xcel Energy is adding clean energy resources to the electricity grid while planning to retire fossil-fuel based generation, additional renewable energy adoption by the Boulder community can further reduce greenhouse gas emissions from electricity. The renewable energy strategies focus on achieving the 100% renewable electricity goal through increasing adoption of existing renewable energy program offerings by Xcel Energy, targeting programs where the participating customer within the City of Boulder retains ownership of the renewable energy credits (RECs). The existing renewable energy programs and their REC-ownership are outlined below in Table 23.

Moderate Scenario Renewable Energy Program	**REC-Ownership**	**Note**
Solar*Rewards	Xcel Energy	On-site solar, where RECs are accounted for within CRP
Net Metering	Participating Customer	On-site solar, where RECs are in addition to CRP
Windsource®	Participating Customer	Subscription-based program, where RECs are in addition to CRP
Solar*Rewards Community	Xcel Energy	Customers may own or subscribe to community solar gardens. RECs may be accounted for within CRP or retained by customer owner/subscribers.
Renewable*Connect 1.0	Participating Customer	Subscription-based program, where RECs are in addition to CRP

Table 23. Existing renewable energy program offerings from Xcel Energy

Through discussion with the City of Boulder, it was determined that the local renewable energy target of 100MW includes all types of renewable energy owned or located within city limits, including when the customer does not hold the RECs. Solar*Rewards Community is not included in the analysis due to a lack of available data for new solar gardens. A summary of local renewable energy generation capacity in 2021 is shown in Table 24 and includes Net Metering solar systems, Solar*Rewards solar systems, and hydroelectricity capacity.

Local Renewable Energy Resource	Total Capacity (MW)	Estimated Total Generation (GWh)	Data Source
Solar*Rewards	69.8 MW	40.5 GWh	2021 Xcel Energy Community Energy Report
Net Metering	7.9 MW	5.1 GWh	2021 Xcel Energy Community Energy Report
Hydro Power	16 MW	52.0 GWh	City of Boulder data and EIA capacity factor for hydro in 2021
Total	**93.7 MW**	**97.6 GWh**	

Table 24. City of Boulder Local Generation Resources in 2021

For the 100% renewable electricity by 2030 goal, only REC-based programs (Net Metering, Windsource, and Renewable*Connect) are considered to add to the Certified Renewable Percentage. Renewable energy programs in which Xcel Energy owns the RECs are included within the Certified Renewable Percentage. In addition, the City of Boulder has provided guidance that the renewable energy strategy should not explicitly include any new emphasis on the Windsource® program, due to concerns over the additionality of the renewable energy produced. Lastly, the renewable energy capacity through the Renewable*Connect 1.0 program is fully subscribed and is not considered as part of the Strategy Analysis.

The approach for the renewable energy strategy was to increase annual new, incremental participation two-fold from historical levels to ramp up renewable energy adoption in the City of Boulder. The programs considered for overall increased annual new participation included Net Metering and Solar*Rewards; however, only generation from new Net Metering systems were included toward the goal of 100% renewable electricity, as Certified Renewable Percentage is accounted for separately. Generation from both Net Metering and Solar*Rewards was included only toward the goal of 100MW local renewable energy.

In Table 25 below, the historical average new participation, capacity, and electricity generated annually is shown, by program, compared to the targeted levels - representing a two-fold increase in historical levels. The strategy begins to take effect in 2023 at the targeted levels and continues at that level into the future.

Moderate Scenario	Historical Levels (2019-2021 average)			Targeted Levels (Future)			Goal Applicability
Renewable Energy Program	Annual New Participation	Annual New Capacity (MW)	Annual New Generation (kWh)	Annual New Participation	Annual New Capacity (MW)	Annual New Generation (kWh)	Applicability to 100% Renewable Electricity / Local Renewable Energy
Solar*Rewards	72	1.7	1,050,450	143	3.4	2,100,900	Local Renewable Energy
Net Metering	205	1.3	1,012,999	409	2.6	2,025,999	Both
Windsource®	260	n/a	1,326,914	260	n/a	1,326,914	100% Renewable Electricity
Solar*Rewards Community	n/a	n/a	n/a	0	0	0	n/a
Renewable*Connect 1.0	n/a	n/a	n/a	0	n/a	0	n/a

Table 25. Renewable Energy Historical and Targeted Metrics

The new generation associated with each renewable energy program is based upon generation data from the Community Energy Reports, and the relevant capacity factors were assumed to be held constant into the future for new installations. Locally, adding the targeted levels of on-site renewable energy between 2023-2030 would result in approximately 18% of projected 2030 electricity use being sourced from local renewable generation (including Solar*Rewards, Net Metering, and Hydropower). Local renewable generation and storage does not have an impact on total electricity use in 2030 compared to 2021 levels.

Grid Supplied Electricity

This strategy involves the completion of financial, emissions, and engineering analysis to design and develop one or more programs to close the remaining electricity greenhouse gas emissions gap in 2030, to meet the City of Boulder's zero emissions electricity goal in combination with Xcel Energy adoption of grid-wide zero emissions resources. Preliminary analysis suggests that 300 MW of utility-scale wind or 450 MW of utility-scale

paired with 150 MW of 4-hour energy storage can close the emissions gap. Further analysis will refine cost estimates, explore system impacts such as the risk of curtailment, and evaluate additional resource options.

In combination, the impacts of the energy efficiency, building electrification, transportation electrification, and renewable energy strategies against the greenhouse gas forecast for the City of Boulder defined the electricity emissions gap to be approximately 155 thousand $MTCO_2e$ (171 thousand short tons) in 2030.

Grid-supplied electricity does not have an impact on total electricity use in 2030 compared to 2021 levels.

FOCUS AREA IMPACTS

If the targets in the Moderate Scenario are achieved, the City of Boulder will achieve the goals of the Partnership Agreement to reduce GHG emissions associated with electricity and gas use and increase local renewable energy. In addition, under this scenario, annual average electricity emissions will be eliminated. This analysis does not incorporate hourly emissions data and therefore does not quantify progress towards the city's stated 24/7 zero emissions electricity goal.

While building and transportation electrification (also collectively called beneficial electrification) add to total electricity use, the impacts of beneficial electrification, energy efficiency, local renewable generation and storage, and grid-supplied electricity reduce overall energy and transportation emissions. In order of 2030 energy and transportation emissions reduction impact, grid-supplied electricity reduces emissions by 45%, transportation electrification reduces emissions by 10%, energy efficiency reduces emissions by 4%, building electrification reduces emissions by 3% and local renewable generation and storage reduces emissions by less than 1%. See Figure 25 for a visual representation of the impacts of the strategies on energy and transportation emissions by focus area.

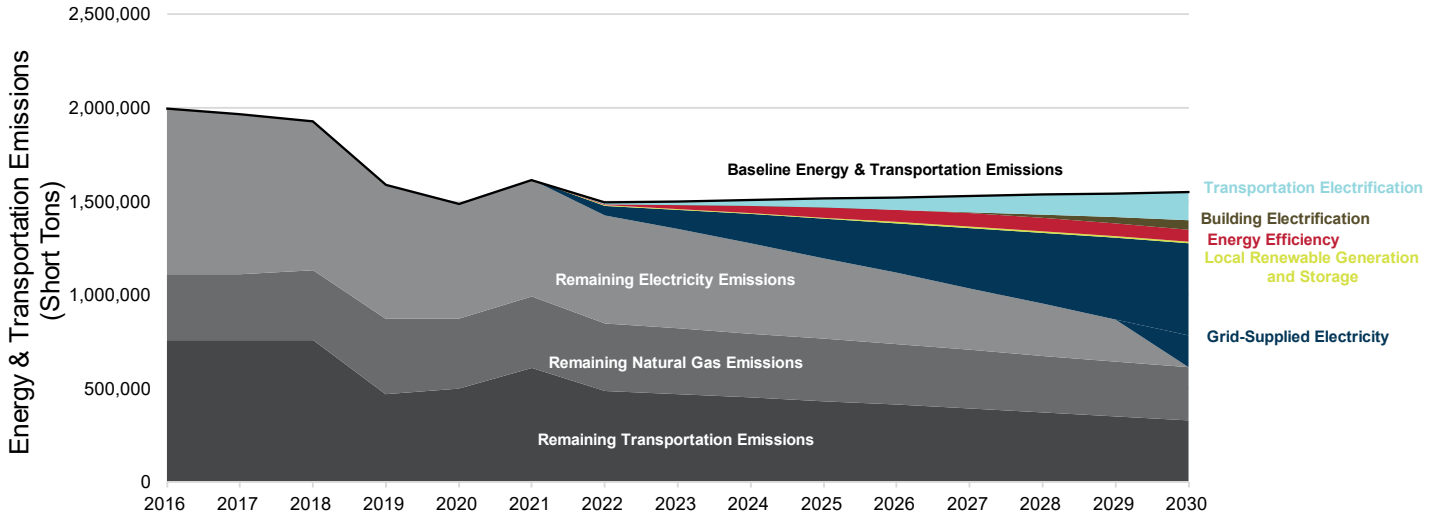


Figure 25. Cumulative impact of focus area strategies on electricity emissions

The impact of the Moderate Scenario on total electricity use by focus area is summarized below in Table 26, while the impact on energy and transportation emissions is summarized in Table 27. The total electricity use impacts of the Moderate Scenario are visualized in the waterfall diagram shown in Figure 26, while energy and transportation emissions impacts are visualized in the waterfall diagram shown in Figure 27.

Focus Area	2030 Impact on 2021 Electricity Use	Percent Change from 2021
Population Growth	77 GWh increase	6.4% increase
Grid-Supplied Electricity	No impact	n/a
Energy Efficiency	372 GWh decrease	31.1% decrease
Building Electrification	284 GWh increase	23.8% increase
Transportation Electrification	103 GWh increase	8.6% increase
Local Renewable Generation and Storage	No impact	n/a
Total	**92 GWh increase**[13]	**7.7% increase**

Table 26. Summary of the impact of the Moderate Scenario on electricity use

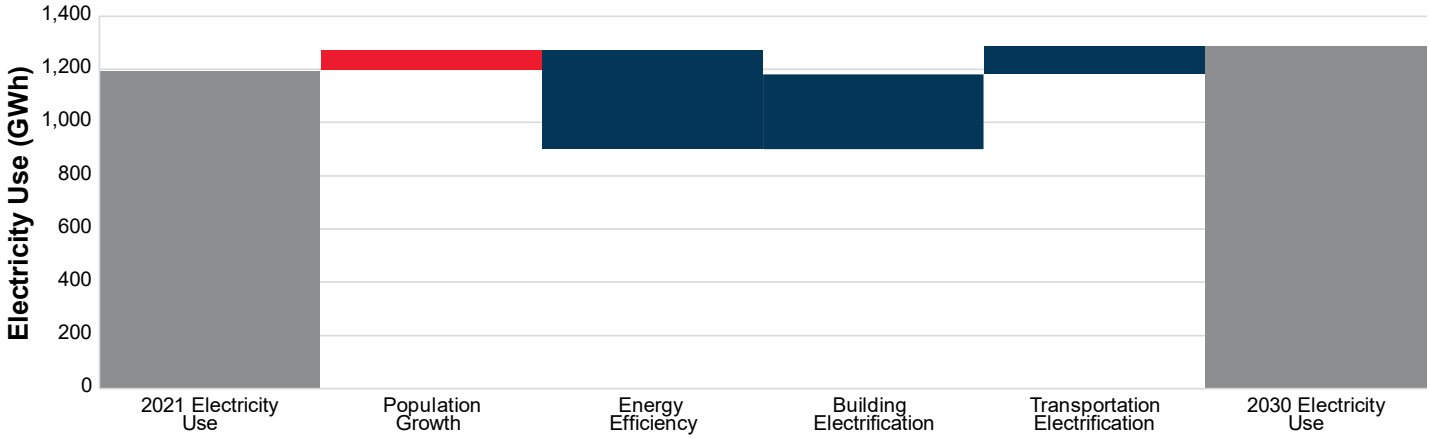


Figure 26. Waterfall diagram showing impact of the Moderate Scenario on electricity use

Focus Area	2030 Impact on 2020 Energy and Transportation Emissions[14] (short tons)	Percent Change from 2020
Population Growth	*65,000 ton increase*	*4.3 increase*
Grid-Supplied Electricity	*663,000 ton decrease*	*44.6% decrease*
Energy Efficiency	65,000 ton decrease	4.4% decrease
Building Electrification	47,000 ton decrease	3.2% decrease
Transportation Electrification	153,000 ton decrease	10.3% decrease
Local Renewable Generation and Storage	9,000 ton decrease	0.6% decrease
Total	**873,000 ton decrease**[13]	**58.7% decrease**

Table 27. Summary of the impact of the Moderate Scenario on energy and transportation emissions

[13] Total impact may not equal the summation of individual focus areas due to rounding.
[14] Total energy and transportation emissions impact is compared against 2020 emissions due to the data availability at the time of analysis, with 2020 actual emissions being the most recent inventory available.

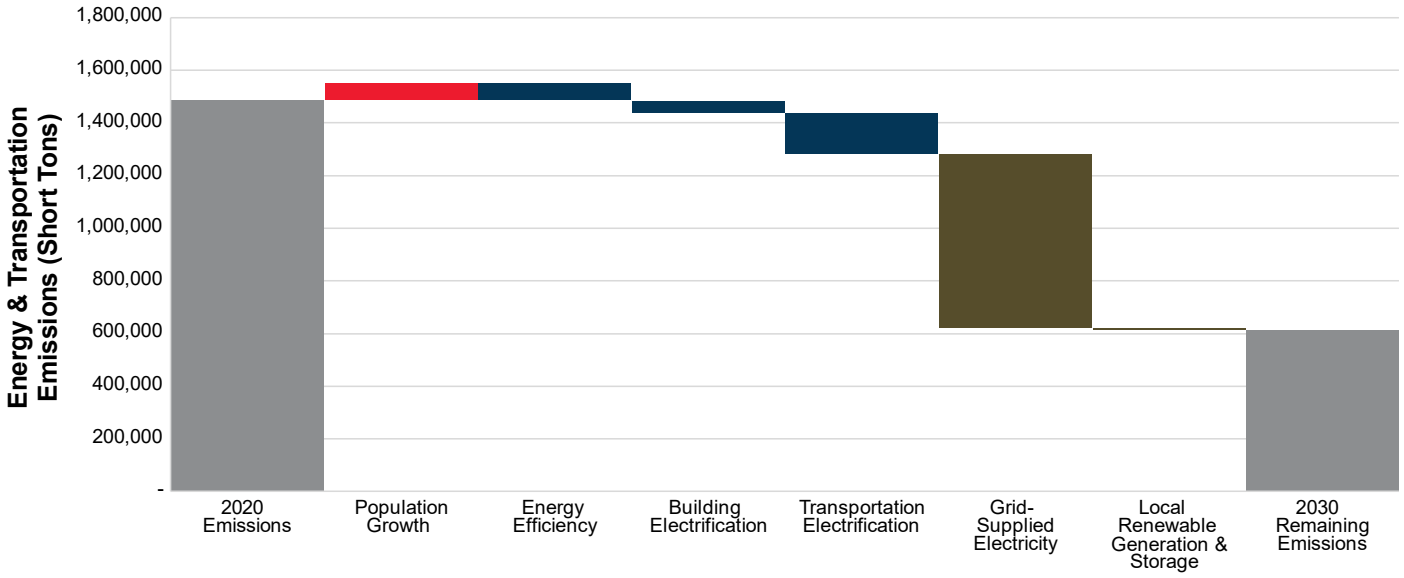


Figure 27. Waterfall diagram showing impact of the Moderate Scenario on energy and transportation emissions

APPENDIX B: FOCUS AREA STRATEGIES

This appendix provides more detail about the proposed strategies to support achievement of the Partnership Agreement goals. Each strategy includes one or more supporting "projects" (i.e., projects to be developed, programs to be designed, policies to establish, and other initiatives to collaborate). For each project, a Project Charter that details the scope, roles and responsibilities, costs, and metrics will be developed to guide project implementation.

ENERGY EFFICIENCY

EE-1: Existing Residential Buildings

Overview	This strategy focuses on enhancing energy efficiency of existing residential buildings in Boulder. Advancing this strategy will require engaging property owners (including homeowners and rental property owners) and rental property tenants in making energy efficiency improvements and adopting energy efficient behaviors.		
Baseline	• 43,516 residential premises in Boulder receiving Xcel Energy electricity service in 2021 • 30,978 residential premises in Boulder receiving Xcel Energy natural gas service in 2021 • 259 Gigawatt Hours (GWh) electricity consumed by residential premises in 2021 • 21.5 million therms natural gas consumed by residential premises in 2021 • 1,277 annual average participants in Xcel Energy residential energy efficiency programs from 2019 - 2021		
Targets[15]	• 2,788 participants in targeted DSM programs annually		

Estimated Impact	• Residential buildings impact
	  ○ 9.9 GWh cumulative electricity savings 2023-2030
	  ○ 1.1 million therms cumulative natural gas savings 2023-2030
	  ○ 0.4% reduction in overall emissions from 2018 in 2030
	  ○ 0.2% reduction in electricity emissions from 2018 in 2030		

Estimated Cost	At scale across Boulder's residential sector, the upfront cost (before any incentives or additional funding opportunities) could range between $39 million and $114 million annually. Residential energy efficiency creates opportunities to reduce residential energy consumption and improvements typically yield a positive return on investment (ROI).		
Implementation Resources	**Xcel Energy**	**City of Boulder**	**Other**
	• Residential programs and rebates • Residential LED kits • Marketing and communications support	• Residential programs and rebates • Boulder Climate Tax	• Clean Energy Loans (Elevations Credit Union and Clean Energy Credit Union) • Federal tax credits for energy efficiency • Inflation Reduction Act Tax Credits and Incentives
Supporting Projects	A. Targeted marketing and outreach to increase residential efficiency program participation. B. Additional residential efficiency incentives. C. City policy and codes to encourage and/or require residential energy efficiency upgrades. D. Residential demand response battery pilot.		

[15] See Appendix A for details.

Equity Considerations	Residential energy efficiency improvements have the potential to improve comfort and create utility bill savings for Boulder residents. However, ensuring that the costs and benefits are equitably distributed will require targeted strategies or incentives to overcome potential barriers to participation, for example: • Strategies to reduce the up-front cost of energy efficiency improvements for low- to moderate-income households, for example through incentives. • Address the split incentive for energy efficiency improvements at rental properties through outreach to landlords and specific programs for renters. • Accessibility of outreach and information to all residents, including translation and interpretation.

EE-2: Existing Commercial Buildings

Overview	This strategy focuses on increasing the energy efficiency of Boulder's existing commercial and industrial buildings, including multifamily properties. This strategy will be advanced through ongoing enforcement of Boulder's Building Performance Ordinance, a set of rating, reporting, and energy efficiency requirements that aims to reduce energy use and improve the quality of Boulder's commercial and industrial building stock. Additionally, this strategy will also create opportunities to leverage other funding sources and will require collaboration and clear communication.		
Baseline	• 7,567 commercial & industrial (C&I) premises in Boulder receiving Xcel Energy electricity service in 2021 • 5,019 C&I premises in Boulder receiving Xcel Energy natural gas service in 2021 • 935 GWh electricity consumed by C&I premises, including streetlights in 2021 • 41.5 million therms natural gas consumed by C&I premises in 2021 • 238 annual average C&I participants in Xcel Energy energy efficiency programs (2019 – 2021)		
Targets[15]	• 762 participants in targeted DSM programs annually		

Estimated Impact	• C&I buildings impact
	  ○ 347.9 GWh cumulative electricity savings 2023-2030
	  ○ 1.2 million therms cumulative natural gas savings 2023-2030
	  ○ 3.0% reduction in overall emissions from 2018 in 2030
	  ○ 6.3% reduction in electricity emissions from 2018 in 2030		

Estimated Cost	At scale across Boulder's commercial sector, the upfront cost (before any incentives or additional funding opportunities) could range between $45 million and $270 million annually, based on the level of adoption. Due to the large energy use of commercial buildings, the opportunity for energy savings can be substantial, with a deep retrofit yielding energy savings 25-50%. However, the capital cost required to yield those savings can vary significantly.		
Implementation Resources	**Xcel Energy**	**City of Boulder**	**Other**
	• Business programs and rebates • Marketing and communications support • Account management support for large energy users	• Commercial programs and rebates • Boulder Climate Tax • Building Performance Ordinance • SmartRegs Rental Licensing Requirements	• Clean Energy Loans (Elevations Credit Union and Clean Energy Credit Union) • C-PACE Financing • Federal tax credits for energy efficiency • Inflation Reduction Act Tax Credits and Incentives

Supporting Projects	E. Targeted marketing and outreach to increase commercial efficiency program participation. F. Additional commercial efficiency incentives. G. City policy and codes to encourage and/or require commercial energy efficiency upgrades.
Equity Considerations	Commercial energy efficiency improvement have the potential to improve comfort and create utility bill savings for Boulder businesses and multifamily residents. However, ensuring that the costs and benefits are equitably distributed will require targeted strategies or incentives, for example: • Strategies that prioritize energy efficiency upgrades for small businesses, which typically spend 2-3 times more on energy costs per foot than larger businesses. • Address the split incentive and specific barriers to energy efficiency improvements at multifamily properties through targeted programs. • Accessibility of outreach and information to all residents, including translation and interpretation.

BUILDING ELECTRIFICATION

BE-1: Existing Residential Building Electrification

Overview	This strategy focuses on transitioning Boulder's existing residential buildings to clean electricity and away from fossil fuels through a combination of policy requirements, incentives, and outreach. Advancing this strategy will require collaboration to leverage city and Xcel Energy programs, including rebates and pilot projects proposed in the 2023 Demand Side Management and Beneficial Electrification Plan. Additionally, engagement with homeowners, landlords, and tenants will be necessary to support accelerated voluntary uptake of new and existing electrification programs.		
Baseline	• 43,516 residential premises in Boulder receiving Xcel Energy electricity service in 2021 (Xcel Energy, 2021) • 30,978 residential premises in Boulder receiving Xcel Energy natural gas service in 2021 (Xcel Energy, 2021) • 259 GWh electricity consumed by residential premises in 2021 • 21.5 million therms natural gas consumed by residential premises in 2021 • Nearly 61% of Boulder's occupied housing units currently use utility supplied natural gas for heating, 36% use electricity and 3% use another or no heating fuel (US Census Bureau, 2021)		
Targets[15]	• 5% residential premises electrified annually[16] • Average of 2,316 residential premises electrified annually between 2023-2030		

Estimated Impact	• Residential buildings impact
	  ○ 8.7 million therms cumulative reduction in natural gas use 2023-2030
	  ○ 165.1 GWh cumulative increase in electricity use 2023-2030
	  ○ 1.4% reduction in overall emissions from 2018 in 2030
	  ○ 2.9% increase in overall electricity emissions from 2018 in 2030		

Estimated Cost	The annual cost of electrifying Boulder residences at scale could range between $6.5 million – $47.2 million[17], based on an average of 2,316 residential premises electrified annually (note this cost estimate is for equipment only). The cost and ROI of residential electrification retrofits depends on whether electrification is occurring at the end of equipment life or prior to end-of-life. Electrifying equipment at end-of-life has a lower incremental cost and higher ROI (Group14 Engineering, 2020) and, when leveraging rebates and incentives, has the potential to maintain cost parity with fossil fuel options. Residential electrification that involves before end-of-life replacements may represent a significant expense.		
Implementation Resources	**Xcel Energy**	**City of Boulder**	**Other**
	• Residential programs and rebates • Marketing and communications support	• Boulder Climate Tax • 2020 City of Boulder Energy Conservation Code • Boulder County EnergySmart • Boulder County Partners for a Clean Environment (PACE)	• Clean Energy Loans (Elevations Credit Union and Clean Energy Credit Union) • CHFA • Federal tax credits for clean energy and building electrification

[16] *This level of electrification results in 40% electrification of residential premises by 2030.*
[17] *This cost estimate utilizes costs from 2020 and may need to be inflated to reflect current day costs.*

			• Inflation Reduction Act Tax Credits and Incentives
Supporting Projects	A. Residential electrification education and outreach. B. Income-qualified electrification pilot for residents. C. Additional incentives for existing residential building electrification. D. Policy and code to encourage and/or require electrification of existing residential buildings. E. Residential electric equipment group buys.		
Equity Considerations	Building electrification has the potential to create health and safety benefits and long-term financial savings for Boulder residents. However, ensuring that the costs and benefits are equitably distributed will require targeted strategies and incentives, for example: • Strategies to reduce the up-front cost of building electrification improvements for low-to-moderate income households and disproportionately impacted communities, including through leveraging Xcel Energy income-qualified programs. • Strategies to mitigate for potential short-term utility bill increases associated with electrification for low-to-moderate income households. • Address the split incentive for building electrification improvements at rental properties through outreach to landlords and specific programs for renters. • Ensuring that outreach and information is accessible to all residents, including through the provision of translation and interpretation.		

BE-2: Existing Commercial Building Electrification

Overview	This strategy focuses on transitioning Boulder's existing commercial buildings to clean energy and away from fossil fuels. Accelerating commercial building electrification will be an important factor in advancing the community's overarching emissions goals and can be an effective strategy for commercial building owners who must comply with the Boulder Building Performance Ordinance and statewide Building Performance Standard. Advancing this strategy will require engagement with property and business owners to increase awareness and uptake of new and existing commercial building electrification programs. In addition, this strategy creates opportunities for innovative and pilot projects in collaboration with partners.
Baseline	• 7,567 C&I premises in Boulder receiving Xcel Energy electricity service in 2021. • 5,019 C&I premises in Boulder receiving Xcel Energy natural gas service in 2021. • 935 GWh electricity consumed by C&I premises, including streetlights in 2021 • 41.5 million therms natural gas consumed by C&I premises in 2021
Targets[15]	• 2% C&I premises electrified annually[18], equivalent to an average of 151 premises electrified annually between 2023-2030

Estimated Impact	• C&I buildings impact
	  ○ 6.4 million therms cumulative reduction in natural gas use 2023-2030
	  ○ 119.0 GWh cumulative increase in electricity use 2023-2030
	  ○ 1.1% reduction in overall emissions from 2018 in 2030
	  ○ 2.1% increase in overall electricity emissions from 2018 in 2030

[18] *This level of electrification results in 15% electrification of commercial premises by 2030.*

Estimated Cost	Not quantified at the strategy level due to a lack of data related to commercial building electrification. Electrifying existing commercial buildings generally has a high upfront cost and long payback period, meaning that this strategy will likely require additional funding and incentives to be cost effective.		
Implementation Resources	**Xcel Energy** • Business programs and rebates • Marketing and communications support	**City of Boulder** • Boulder Climate Tax • Boulder County EnergySmart • Boulder County Partners for a Clean Environment (PACE) • Boulder Building Performance Ordinance	**Other** • Clean Energy Loans (Elevations Credit Union and Clean Energy Credit Union) • C-PACE Financing • State and Federal tax credits for clean energy and building electrification • Inflation Reduction Act Tax Credits and Incentives • Colorado Building Performance Standard
Supporting Projects	F. Commercial electrification education and outreach G. Income-qualified electrification pilot for non-profit organizations H. Additional incentives for existing commercial building electrification I. Policy and code to encourage and/or require electrification of existing commercial buildings		
Equity Considerations	Building electrification has the potential to create health and safety benefits and long-term financial savings for Boulder businesses. However, ensuring that the costs and benefits are equitably distributed will require targeted strategies and incentives to overcome potential barriers to participation, for example: • Strategies to reduce the up-front cost of building electrification improvements for small businesses, non-profits, and multifamily developments • Strategies to mitigate for potential short-term utility bill increases associated with electrification for small businesses • Address the split incentive for building electrification improvements at rental properties through outreach to landlords and specific programs commercial tenants • Ensure that outreach and information is accessible to all residents, including through the provision of translation and interpretation		

BE-3: All-Electric New Construction

Overview	This strategy focuses on opportunities to ensure that new development in Boulder is supportive of the community's greenhouse gas emissions and energy goals through electrification. Advancing this strategy will require engagement with developers and contractors to increase participation in new construction programs and incentives. Additionally, this strategy will be driven in part by energy code requirements. The city updates the energy code on a three-year cycle and has a goal of attaining a net-zero energy,

<table>
<tr><td></td><td colspan="3">outcome-verified code by 2031, to meet the city's overarching climate goals (City of Boulder, 2022).</td></tr>
<tr><td>Baseline</td><td colspan="3">• The City of Boulder is currently using the 2020 City of Boulder Energy Conservation Code, a localized version of the 2018 International Energy Conservation Code that is 20% more efficient than the national code (City of Boulder, 2022)</td></tr>
<tr><td>Targets</td><td colspan="3">• 100% all-electric new construction from 2031</td></tr>
<tr><td>Estimated Impact</td><td colspan="3">• Impacts of All-Electric New Construction are included within BE-1 & BE-2</td></tr>
<tr><td>Estimated Cost</td><td colspan="3">Anticipated up-front cost saving of $850 - $6,000 for all-electric single detached residential homes compared to new construction with natural gas systems (Group14 Engineering, 2020) (Southwest Energy Efficiency Project, Colorado Energy Office, 2022). Note that in Boulder, much of the community is already supported by existing natural gas infrastructure.</td></tr>
<tr><td rowspan="2">Implementation Resources</td><td>Xcel Energy</td><td>City of Boulder</td><td>Other</td></tr>
<tr><td>• New Construction Rebates and programs
• Marketing and communications support
• Account management support for large energy users</td><td>• Boulder Climate Tax
• 2020 City of Boulder Energy Conservation Code</td><td>• C-PACE Financing
• Inflation Reduction Act tax credit for Energy Efficient Homes</td></tr>
<tr><td>Supporting Projects</td><td colspan="3">J. New construction education and outreach.
K. Income-qualified electrification pilots for new construction.
L. Additional incentives to support new building electrification.
M. Policy and code to encourage and/or require electrification of new buildings.</td></tr>
<tr><td>Equity Considerations</td><td colspan="3">All-electric new construction has the potential to realize cost savings and increase the safety of new buildings. Targeted strategies will help to maximize the benefits and create equitable outcomes, including:
• Ensuring that all outreach and communication is accessible to developers, contractors and other stakeholders, including through provision of translation and interpretation.
• Targeted outreach and incentives for development and construction of new affordable housing and community services.</td></tr>
</table>

TRANSPORTATION ELECTRIFICATION

TE-1: Lead by Example

Overview	This strategy focuses on implementation of the "Lead by Example" focus area in the City of Boulder Electric Mobility Plan. Advancing this strategy will position the City of Boulder as a leader for its residents, commuters, and visitors; with actions focused on opportunities for the city to reduce emissions associated with its own municipal fleet and employee trips. The city's fleet policy currently requires purchase of an electric vehicle where financially and operationally feasible and implementation of this strategy will demonstrate solutions while providing valuable learning opportunities to further electrified mobility throughout the community.		
Baseline	• The City of Boulder municipal fleet currently includes 40 electric vehicles		
Targets	• 200 electric fleet vehicles by 2030 (from Electric Mobility Plan)		
Estimated Impact	• The impact of municipal fleet electrification is captured in the overall impact of community adoption of electric mobility option (TE-2)		
Estimated Cost	The cost of municipal fleet electrification and work travel trip efficiency has not been estimated at the strategy level. Cost estimates will be developed within Project Charters.		
Implementation Resources	**Xcel Energy**	**City of Boulder**	**Other**
	• Commercial transportation electrification incentives and services, including electric vehicle supply infrastructure (EVSI)	• Municipal funding to support municipal fleet electrification and charging infrastructure	• State funding through the Clean Fleet Vehicle & Technology Project Portfolio identified in the Community Access Enterprise Ten--Year Plan • Colorado Energy Office Charge Ahead Grants
Supporting Projects	A. Fleet electrification and EV supply infrastructure. B. City of Boulder work travel trips.		
Equity Considerations	This strategy is focused on city fleet and work travel trips, with no direct community equity impacts.		

TE-2: Community Adoption

Overview	This strategy focuses on implementation of the "Community Adoption" focus area in the City of Boulder Electric Mobility Plan. While Boulder has seen high rates of EV adoption compared to both the state of Colorado and national average, accelerated adoption will be required to meet the community's adopted goals. This strategy is also broader than EVs alone and includes efforts to support micromobility options such as e-bikes and scooters. Advancing this strategy will require collaboration on education and outreach combined with incentives to reduce the cost of electrified mobility options.

Baseline	• EVs accounted for approximately 5% of all vehicle registrations in Boulder in 2022		

Targets[15]	• 30% community EV adoption by 2030
	  ○ Average of 3,125 additional EVs on the road each year through 2030
	  ○ 29,300 EVs on the road by 2030		

Estimated Impact	• Community Adoption impact
	  ○ 99.5 GWh cumulative increase in electricity use 2023-2030
	  ○ 7.9% reduction in overall emissions from 2018 in 2030
	  ○ 2.0% increase in overall electricity emissions from 2018 in 2030		

Estimated Cost	Not quantified at the strategy level. Incremental cost or savings to electrify 30% of vehicles on the road dependent on models purchased and replaced.		
Implementation Resources	**Xcel Energy**	**City of Boulder**	**Other**
	• Residential transportation electrification incentives and services, including income qualified vehicle rebates • Business transportation electrification incentives and services • Marketing and outreach	• Boulder Climate Tax	• State funding through Community Accelerated Mobility Projects identified in the Community Access Enterprise Ten--Year Plan • EVCO outreach and education campaign and resources
Supporting Projects	C. EV outreach and education. D. Micromobiltiy incentives.		
Equity Considerations	Community-wide adoption of electric mobility has the potential to improve air quality and reduce the cost of vehicle ownership for Boulder residents. However, many residents face barriers to EV adoption and ensuring that the costs and benefits are equitably distributed will require targeted approaches, for example: • Leveraging existing rebates and incentives to help reduce the upfront cost of EV ownership for income qualified and disproportionately impacted communities. • Expanding access and connectivity to affordable active transportation options, including e-bikes and electrified transit. • Considering alternative models to support electric vehicle adoption for multifamily residents, such as CarShare.		

TE-3: Charging Solutions

Overview	This strategy focuses on implementation of the “Charging Solutions” focus area in the City of Boulder Electric Mobility Plan. The availability of charging ports in Boulder is currently keeping pace with high levels of EV adoption. While 80% of EV owners do most of their charging at home, public Level 2 and DC fast charging stations ensure access for longer-distance commuters, visitors, those without access to home charging, and transportation services such as ride hailing and delivery fleets. Advancing this strategy will increase charging access for individuals and fleets and will require collaboration to explore opportunities for innovative pilot projects that

<table>
<tr><td></td><td colspan="3">support a fully integrated zero emissions transportation network. This strategy will both create new charging models</td></tr>
<tr><td>Baseline</td><td colspan="3">• In February 2022, there were 376 total public charging ports in Boulder zip codes
  ○ 354 Level 2 ports
  ○ 22 DC fast charging ports</td></tr>
<tr><td>Targets</td><td colspan="3">Not quantified at the strategy level. The Electric Mobility Plan focuses on access and innovative charging solutions.</td></tr>
<tr><td>Estimated Impact</td><td colspan="3">The impact of this strategy is captured in emissions savings associated with community-wide transportation electrification.</td></tr>
<tr><td>Estimated Cost</td><td colspan="3">Not quantified at the strategy level. The cost for individual charging projects will be identified in the project charter.</td></tr>
<tr><td>Implementation Resources</td><td>Xcel Energy</td><td>City of Boulder</td><td>Other</td></tr>
<tr><td></td><td>• Transportation Electrification Plan programs, including Electric Vehicle Infrastructure rebates; charger rebates for Higher Emissions Communities; and Partnerships, Research, and Innovation funding for pilot projects
• Marketing and outreach
• Translation services to support equitable outreach and education</td><td>• Boulder Climate Tax</td><td>• Regional funding mechanism to support Regional Fleet Charging Hub
• Colorado Energy Office Charge Ahead Grants
• State funding through Community Accelerated Mobility Projects identified in the Community Access Enterprise Ten--Year Plan
• Federal National Electric Vehicle Infrastructure (NEVI) Program</td></tr>
<tr><td>Supporting Projects</td><td colspan="3">E. Regional fleet charging hub.
F. Vehicle-to-building carshare pilot.
G. Community charging hub(s).
H. Curbside / neighborhood charging policies and program.
I. Multifamily charging incentives.</td></tr>
<tr><td>Equity Considerations</td><td colspan="3">Increased access to convenient and affordable charging has the potential to remove barriers to EV ownership and maximize the benefits of transportation electrification. However, ensuring that the costs and benefits are equitably distributed will require targeted approaches, for example:
• Leveraging existing and new strategies and incentives to support charging in areas disproportionately impacted by traffic and air pollution.
• Leveraging existing and new strategies and incentives to support charging for low-to-moderate income households and those without access to home charging, such as multifamily residents.</td></tr>
</table>

LOCAL RENEWABLE GENERATION AND STORAGE

LR-1: Enabling and Supporting

Overview	This strategy emphasizes enabling and supporting actions to reduce barriers to, and maximize participation in, local renewable energy and storage adoption, including in new applications such as microgrids and virtual power plants. Advancing projects to enable local renewable generation and storage will include making both City of Boulder and Xcel Energy renewable energy processes and policies more efficient, predictable, and easier to navigate; reducing barriers to participation for multi-unit properties; and addressing electric system capacity to support more local renewable energy generation and storage. Supporting projects include providing education and outreach on renewable energy opportunities; sharing information about financial tools and resources for the adoption of renewable energy and storage, exploring 24/7 data tracking and reporting for further development, implementing advanced metering infrastructure, and addressing the split-incentives barrier for building owners and tenants.		

2021 Baseline	• In 2021 there was 93.7 MW of local renewable generation in Boulder, including:
	  ○ 7.9 MW of net metered solar
	  ○ 69.8 MW of Solar*Rewards
	  ○ 16 MW of hydro power[19]		

Targets	None identified		
Estimated Impact	Indirect impacts associated with this strategy (see LR-2 and LR-3 for details about impact from local renewable adoption)		
Estimated Cost	The cost for Enabling and Supporting local renewable generation and storage is not quantified at the strategy level. The cost for individual projects will be identified in the project charter.		
Implementation Resources	**Xcel Energy**	**City of Boulder**	**Other**
	• Marketing and communications support • Pilot project/program opportunities	• Boulder Climate Tax • Boulder County EnergySmart • Boulder County Partners for a Clean Environment (PACE)	
Supporting Projects	A. Outreach and education B. Process efficiencies C. City policy and codes D. Identify and address grid and/or panel capacity constraints E. Identify legal, regulatory, financial and operational constraints of innovative local generation products such as microgrids and virtual power plants.		
Equity Considerations	Ensuring that local renewable generation is accessible to, and has benefits for, all Boulder residents and businesses will require targeted efforts, including: • Ensuring that outreach and information related to local renewable generation opportunities is accessible to all residents. • Mitigating the financial impact of any policy and/or code requirements on low income and disproportionately impacted communities within Boulder.		

[19] Net metering and Solar*Rewards system capacity is based on the 2021 Xcel Energy Community Energy Report, and the hydro power capacity is based on City of Boulder data.

	• Prioritizing process efficiencies and grid capacity improvements that benefit underserved and disproportionately impacted communities.

LR-2: Community Assets

Overview	This strategy focuses on renewable energy development within and for the Boulder community. Advancing this strategy will involve exploring additional local incentives for renewable energy generation and storage projects, including for individual properties and community-scale systems. It will also require collaboration to develop solar and storge projects, for example through a group purchase opportunity for households and/or businesses, as well as exploring projects to support solar and storage that benefits income-qualified and multifamily residents. Finally, this strategy will explore the creation of neighborhood microgrid and virtual power plant pilot projects to match local renewable generation and storage with local electricity consumption while boosting resilience.		

Baseline	• In 2021 there was 93.7 MW of local renewable generation in Boulder, including:
	  ○ 7.9 MW of net metered solar
	  ○ 69.8 MW of Solar*Rewards
	  ○ 16 MW of hydro power[20]
	• Between 2019 and 2021, the Boulder community installed an average of 275 new on-site systems each year.		

Targets[15]	• 553 new on-site renewable generation systems annually, equivalent to 6 MW of new local zero emissions resources annually		

Estimated Impact	• Community Assets impact
	  ○ 0.5% reduction in overall emissions from 2018 in 2030
	  ○ 1.1% reduction in electricity emissions from 2018 in 2030		

Estimated Cost	*Not quantified at the strategy level. The cost for individual projects will be identified in the project charter.* *Leveraging available incentives and funding, local community renewable energy and storage has the potential to create long-term financial savings for Boulder.*		
Implementation Resources	**Xcel Energy**	**City of Boulder**	**Other**
	• Renewable energy programs and rebates • Marketing and communications support • Pilot project/program opportunities	• Boulder Climate Tax • Boulder County EnergySmart • Boulder County Partners for a Clean Environment (PACE) • Solar Grants • Solar Gardens	• Clean Energy Loans (Elevations Credit Union and Clean Energy Credit Union) • C-PACE Financing • IRA • State and Federal tax credits for clean energy
Supporting Projects	F. New incentives and financing for community solar and/or storage. G. Income qualified local community solar and storage. H. Multi-family local solar and storage I. Neighborhood microgrid.		
Equity Considerations	Ensuring that the benefits of renewable development within Boulder are equitably distributed will require targeted efforts, including:		

[20] Net metering and Solar*Rewards system capacity is based on the 2021 Xcel Energy Community Energy Report, and the hydro power capacity is based on City of Boulder data.

	• Ensuring that outreach and information related to local renewable generation opportunities and programs is accessible. • Prioritizing projects and programs that support and create local jobs. • Developing targeted incentives and programs that support participation in local renewable projects and programs, particularly for low-to-moderate income households, multifamily residents, and disproportionately impacted communities.

LR-3: Municipal Assets

Overview	This strategy focuses on the role of local renewable energy and storage assets owned by the City of Boulder. Advancing this strategy will include pursuing new solar and storage projects at city facilities and collaborating with other agencies to realize cost-efficiencies and build on lessons learned. It also looks at opportunities to leverage city-owned land for community solar garden development and/or other renewable energy technology pilot projects. Finally, it includes exploration of public/private partnerships and/or off-site locations for municipally owned solar and storage.		
Baseline	• 7MW solar on city facilities		
Targets	• > 1 MW of new solar		
Estimated Impact	• To be determined MW of storage		
Estimated Cost	The cost to advance renewable energy generation and storage at municipal facilities will depend on the type and size of systems installed as well as the financing mechanism deployed. Leveraging available resources and funding, increasing renewable generation and storage at city facilities has the potential to create long term financial savings.		
Implementation Resources	**Xcel Energy**	**City of Boulder**	**Other**
	• Renewable energy programs and rebates • Pilot project/program opportunities	• Boulder Climate Tax • Other city taxes and revenues	• Private partner financing • Energy Performance Contracting • Energy Efficiency and Conservation Block Grant
Supporting Projects	J. Off-site city-owned solar and storage K. Community microgrid		
Equity Considerations	This strategy focuses on municipal buildings, with no direct community equity impacts.		

GRID-SUPPLIED ELECTRICITY

GS-1: New Utility Programs

Overview	This strategy involves the completion of financial, emissions, and engineering analysis to design and develop local and system-level solutions in combination with utility-scale efforts included in Xcel Energy's 2021 Clean Energy Plan to close the remaining gap between Xcel Energy and the City of Boulder's renewable electricity, emissions reduction and reliability and resilience goals. Projects in this strategy will require collaboration to develop new and innovative programs such as utility-scale resource acquisition, rate design and demand management tools that encourage residents and businesses to shift usage to times when emissions are low. This strategy has a longer lead-time than many others in this Overview since any new Xcel Energy programs will require regulatory approval through the Colorado PUC.		
Baseline	Not applicable		
Targets	• Utility-scale and distributed zero emissions generation and energy storage to power every hour of every day of the year with zero emissions electricity ("24/7 zero emissions electricity"). • Innovative distributed energy resource projects (e.g., community microgrids, virtual power plants) that can improve reliability and resilience.		
Estimated Impact	• 663,000 short tons annual electricity emissions avoided in 2030, including 171,000 short tons[21] avoided from new utility programs • 34.4% reduction in overall emissions from 2018 in 2030, including grid impacts and new utility programs • 83.3% reduction in overall electricity emissions from 2018 in 2030, including grid impacts and new utility programs		
Estimated Cost	The cost for new program development will vary based on the approach taken and will be identified in the project charter. Additionally, the funding needs to close the 100% renewable electricity gap will depend on the level of implementation of the other strategies completed.		
Implementation Resources	**Xcel Energy**	**City of Boulder**	**Other**
	• Program development and filing • 2021 Clean Energy Plan	• Boulder Climate Tax	• EPA Greenhouse Gas Reduction Fund (i.e., Green Bank) • Inflation Reduction Act
Supporting Projects	A. Zero Emissions Community (ZEC) This project could include several contributing sub-projects: • Utility-Scale Resource Acquisition (2021 ERP/CEP) • Community Energy Storage • Community Micro-Grids / Virtual Power Plants B. 24/7 Carbon Free Electricity • Production/Forecasting Production Tracking		
Equity Considerations	Any new programs to add utility-scale renewable generation and energy storage will need to be structured to ensure that the costs and benefits are equitably distributed, for example through: • Consideration of the cost implications for all residents and businesses, particularly disproportionately impacted communities.		

[21] *This is the estimated emissions gap in the "Moderate" scenario that needs to be addressed through the development of system-level solutions if other targets in this plan are achieved.*

	• Consideration of programs to ensure that new programs are beneficial for all residents and businesses, for example by mitigating the impact of any cost increases as well as sharing any cost savings, with a particular focus on disproportionately impacted communities.

GS-2: New Innovations and Projects

Overview	This strategy includes the exploration of new innovations and projects to advance the partnership goals. During 2022-2025, focus will be exploring ideas and identifying preliminary project concepts that could become priorities in future years. Examples may include advanced storage, hydrogen pilot, etc.		
Baseline	Not applicable		
Targets	For future identification		
Estimated Impact	For future identification		
Estimated Cost	For future identification		
Implementation Resources	**Xcel Energy**	**City of Boulder**	**Other**
	For future identification	For future identification	For future identification
Supporting Projects	C. For future identification		
Equity Considerations	Any new innovations and projects to add renewable grid supplied electricity and storage will need to be structured to ensure that the costs and benefits are equitably distributed, for example through: • Consideration of the cost implications for all residents and businesses, particularly disproportionately impacted communities. • Consideration to ensure that new projects are beneficial for all residents and businesses, for example by mitigating the impact of any cost increases as well as sharing any cost savings, with a particular focus on disproportionately impacted communities.		

RELIABILITY AND RESILIENCY

RR-1: Franchise Undergrounding

Overview	As a part of the franchise between Xcel Energy and the city, 1% of the gross electric revenues from the City of Boulder is dedicated to burying existing distribution lines that are currently overhead to improve the system's reliability, performance, and aesthetics.		
Baseline	• The 1% funds are planned for prioritization on burying high impact circuits of which support city improvement projects and reliability opportunities		
Targets	• Typical 1% project implementation entails coordination with other ongoing planned project efforts		
Estimated Impact	• Reduction of wildfire risk • Improved reliability and resilience • Improved aesthetics		
Estimated Cost	• The cost for each project will vary based on the location, scope, and unique project requirements. Typical project costs include but are not limited to material, labor, permitting, traffic control, and restoration requirements. • Franchise funds can be directed at the City's discretion and currently accrue at an estimated rate of approximately $1.1M per year. • Ineligible expenses include but are not limited to, telecommunications undergrounding, easements, customer service conversion and associated customer related expenses		
Implementation Resources	**Xcel Energy**	**City of Boulder**	**Other**
	• Franchise 1% Funding • Distribution Operations • Project Oversight Team • Undergrounding Guide	• Climate Tax • Undergrounding Guide	• Private Investment
Supporting Projects	A. North Broadway Project B. 19th Street Project C. Arapahoe Project D. Chautauqua		
Equity Considerations	Undergrounding of distribution lines has the potential to increase electricity supply resilience and reliability for Boulder residents and businesses. Potential equity considerations include: • Equitable phasing and prioritization of undergrounding projects • Areas of Boulder that see benefits		

RR-2: Wildfire Mitigation Program

<table>
<tr><td>Overview</td><td colspan="3">Xcel Energy developed a comprehensive fire risk mitigation program designed to help protect lives, homes, and property from the threat of wildfire. This program includes but is not limited to new and enhanced inspection and overhead equipment, enhanced vegetation management, improvement of protocols and fire safe work practices, and community outreach.

For 2023-2024, the wildfire fire mitigation program will focus on the replacement of fuses/cutouts/arrestors, poles, small wire primary conductor, and open wire secondary. Identified work will start in 2023 and wrap up in 2024 pending no major issues. 2024 work and beyond work is still being identified based on risk. 2024-2025 work and associated cost estimates should be available no later than Q1 of 2024.</td></tr>
<tr><td>Baseline</td><td colspan="3">• Not applicable</td></tr>
<tr><td>Targets</td><td colspan="3">• High wildfire risk zones are of priority</td></tr>
<tr><td>Estimated Impact</td><td colspan="3">• Increase reliability and resiliency
• Reduce wildfire risk
• System Hardening</td></tr>
<tr><td>Estimated Cost</td><td colspan="3">• Boulder Hydro 2530: Estimated at $2.7M
• Boulder Hydro 2537: Estimated at $6.4M
• Eldorado 1161: Estimated at $0.34M
• Sunshine 1413: Estimated at $0.35M</td></tr>
<tr><td rowspan="2">Implementation Resources</td><td>Xcel Energy</td><td>City of Boulder</td><td>Other</td></tr>
<tr><td>• Distribution Operations
• Vegetation Management
• Regulatory
• Electric Rate Case Filings</td><td>• N/A</td><td></td></tr>
<tr><td>Supporting Projects</td><td colspan="3">E. Wildfire Mitigation Plan work. Wildfire mitigation of the following feeders: Boulder Hydro 2530 and 2537, Eldorado 1161, and Sunshine 1413.
F. Vegetation Management
G. Chautauqua</td></tr>
<tr><td>Equity Considerations</td><td colspan="3">• Community engagement with organizations in wildfire risk areas. To learn more please go to https://www.xcelenergywildfireprotection.com/</td></tr>
</table>

RR-3: Grid Modernization

Overview	This effort is a broad overarching category that includes all work being conducted surrounding the distribution system and efforts to modernize the grid and take innovative approaches to improving grid performance, reliability, and resilience. This will entail innovative planning steps and deployments of new technologies and will include several sub-projects.		
Baseline	• Not applicable – Current state of the grid		
Targets	• Improvement of Critical Facility and Associated Grid Resilience • Deployment of Innovative Storage Solutions (including but not limited to battery, hydro, pressurized containers, etc.) • Innovative pilot projects (potential for microgrids, system protection/sectionalizing, paired opportunities with Xcel initiatives such as AGIS< FLISR, etc.) • Improvement of reliability across Boulder and the surrounding areas, with a focus on some of the less reliable feeders • Strategic undergrounding and infrastructure replacement incorporating future planning		
Estimated Impact	• Improved Reliability and Resilience of City Operations • Identification of high impact pilot projects that can be expanded/replicated		
Estimated Cost	• The cost for each project will vary based on the location, scope, and unique project requirements.		
Implementation Resources	**Xcel Energy**	**City of Boulder**	**Other**
	• Advanced Grid Intelligence and Security (AGIS) • Fault Location Isolation and Service Restoration (FLISR) • Distribution System Planning	• Climate Tax • Other city taxes and revenues	• Private Investment • Federal Grants
Supporting Projects	H. Electric Grid Future Planning I. Grid Reliability and Resilience Equity J. FLISR and Strategic Undergrounding K. Bolster Critical Infrastructure L. Chautauqua		
Equity Considerations	Reliability improvements focus on some less reliable feeders in and around Boulder. This means that improvements can bring better reliability to customers who currently do not experience as great reliability as their neighbors. Additionally, systemwide improvements and pilots can improve system performance, reliability, the city's ability to deliver core services (such as reliable water treatment), and the costs to do so.		

APPENDIX C: EQUITY LENS

Recommendation Being Evaluated:

Recommendation Description:

Who is Responsible for Implementation:

STEP 1: ESTABLISH OUTCOMES.

Identify the desired result, outcomes, and indicators toward achieving equity.

1a. Desired Community Result: a community-level condition of well-being. "All Boulder residents..."

Example desired community result: All Boulder residents have access to electrification technology.

1b. Desired Partnership Outcome: what will happen as a result of an action under the partnership.

Example partnership outcome: Increased participation in electrification programs.

1c. Desired Equity Outcome: desired equity outcome for Boulder residents.

Example equity outcome: All Boulder community members can afford to electrify their homes.

1d. Indicators: measures which helps quantify the equitable achievement of a desired result and outcomes.

Example indicators: Number of households participating in electrification programs citywide by populations, income, and zip code.

1e. What equity issue areas might be most affected by this proposal?

- ☐ Rates
  - Protection against utility shutoffs
  - Access to energy assistance
  - Reasonable energy costs
  - Cross-subsidization
- ☐ Language access
- ☐ Environmental Justice
  - Indoor Air Quality
  - Outdoor Air Quality
  - Proximity to coal plants
  - Proximity to natural gas plants
  - Proximity to fracking facilities
  - Access to cooling
  - Proximity to overhead power lines
  - Proximity to substations
- ☐ Access to opportunity
  - Access to green jobs
  - Access to workforce development
  - Just transition from oil and gas economy
- ☐ Reliability
  - Access to back up power
  - Proximity to community hubs
  - Risk of power outages
  - Vulnerability to power outages
- ☐ Access to clean energy technology
- ☐ Access to capital/financing

STEP 2: COLLECT DATA.

Sample Data Sources:

- Xcel 2021 Community Energy Report
- City of Boulder Community Profile
- Colorado EnviroScreen
- Colorado Energy Office Energy Affordability Report

Gather data relevant to equity and the proposal. What do the data say?

2a. Will the proposal impact specific geographic areas in Boulder (neighborhoods, areas or regions)? (see Figure 28)

- ☐ All of Boulder
- ☐ Boulder Civic Area

- ☐ Boulder Plaza Subarea
- ☐ Crossroads East/Sunrise Center Area
- ☐ Gunbarrel Community Center
- ☐ Junior Academy Area
- ☐ North Boulder
- ☐ Transit Village Area Plan/Boulder Junction
- ☐ University Hill Area Plan
- ☐ Other (ex: manufactured home community)

2b. What populations might be *most* impacted by the recommendation?

Choose either entire groups or key intersections.

Residents

	☐ Low-Income	☐ Low English Proficiency	☐ Undocumented	☐ Disabled	☐ People of Color
☐ Homeowners	☐	☐	☐	☐	☐
☐ Students	☐	☐	☐	☐	☐
☐ Older Adults	☐	☐	☐	☐	☐
☐ Renters	☐	☐	☐	☐	☐

Businesses

	☐ Non-Profit	☐ Owner-Occupied	☐ Renter	☐ Minority-Owned
☐ Industrial Businesses	☐	☐	☐	☐
☐ Commercial Businesses	☐	☐	☐	☐

2c. What other quantitative data would help understand disparities associated with this issue?

2d. What qualitative data – including community conversations, public meeting comments -- should be taken into consideration? Based on that data, what concerns or experience with the proposal might certain populations have?

2e. What data gaps exist? If you lack adequate data, how can you obtain more or better data to analyze the proposal with an equity lens?

STEP 3: DETERMINE BENEFIT AND BURDEN.

Example: The advisory panel might initially think that a marketing campaign is the most effective way to boost adoption of electric heat pumps in Boulder; however, focusing on individual behavior change could limit adoption to only those with adequate ability to invest in new technologies. Cost and workforce limitations are systemic barriers the partnership can address.

3a. How might the policy, program, or budget issue increase or decrease equity? Who benefits? Who is burdened?

3d. Given your answer, are the potential benefits aligned with the desired community results that were defined in Step 1? If not, how might you modify the partnership outcome to avoid creating an additional burden?

STEP 4: MODIFY RECOMMENDED STRATEGY

4. **Given your equity analysis, how should the Advisory Panel modify the recommended strategy to better address equity?**

Step 5: Implementation and Evaluation

5a. How should the partnership track progress and determine impact of the proposed strategy?

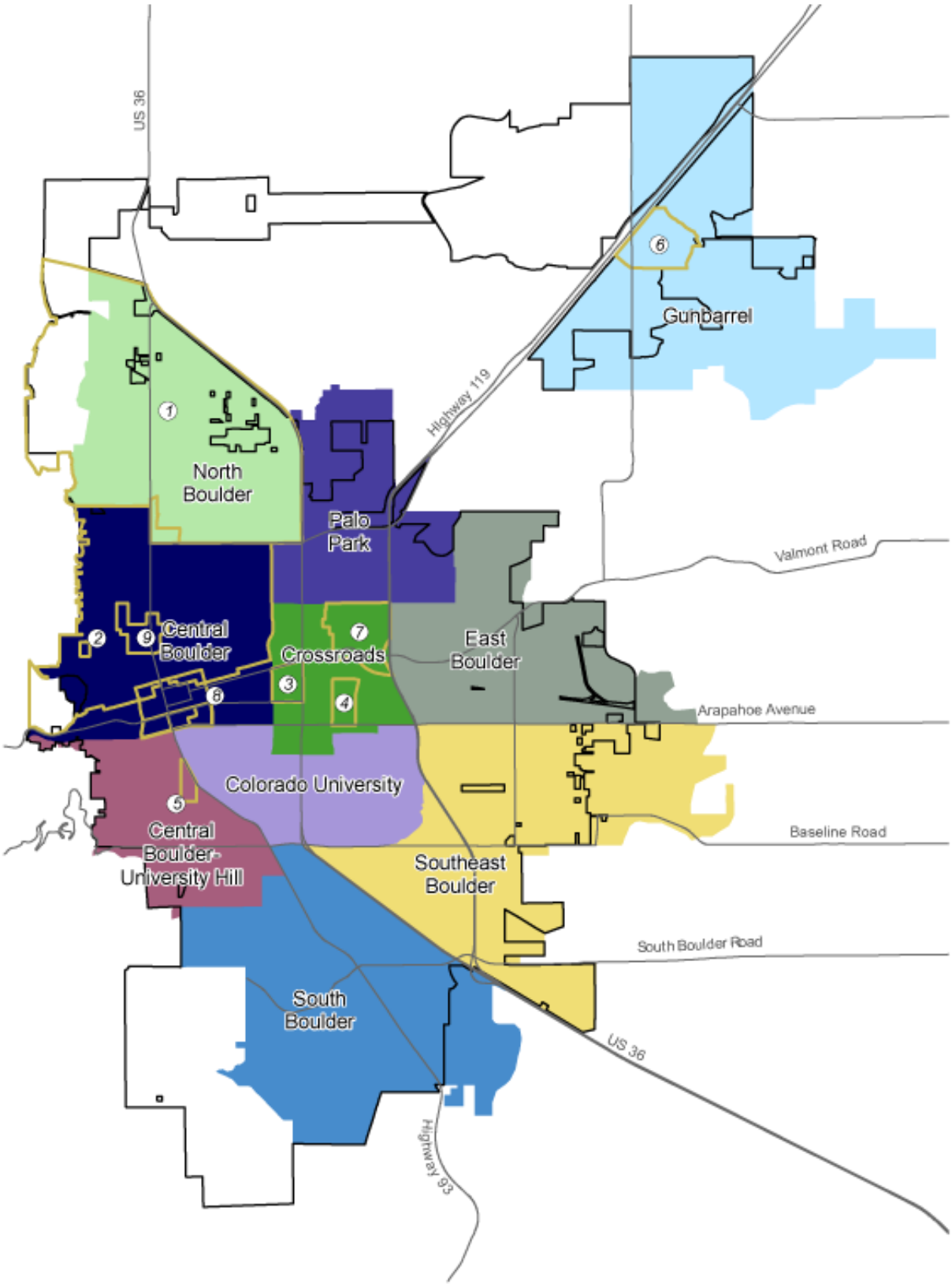


Figure 28. Boulder subcommunities map

APPENDIX D: ENVIROSCREEN INFORMATION

The EnviroScreen tool developed by the Colorado Department for Public Health and Environment (CDPHE) can be used to support the identification of underserved areas and is being used by Xcel Energy to develop strategies, including targeted outreach and education.

The tool maps indices that may be used to identify priority areas for investment within Boulder, including the EnviroScreen Score." The score is calculated based on population characteristics and environmental burdens, with high scores denoting areas facing high social and environmental burdens. Figure 29 is a map of EnviroScreen Scores for census block groups in the Boulder area, showing that areas to the East of Boulder have higher scores and are facing the greatest environmental and social burden. The EnviroScreen tool also identifies census block groups that meet the definition of "Disproportionately Impacted Community" under the Colorado Environmental Justice Act (HB21-1266). These census block groups, shown in Figure 29, are those where more than 40% of the population are low-income, housing cost-burdened, people of color, and/or have an EnviroScreen Score above the 80th percentile, signifying high rates of cumulative impacts.

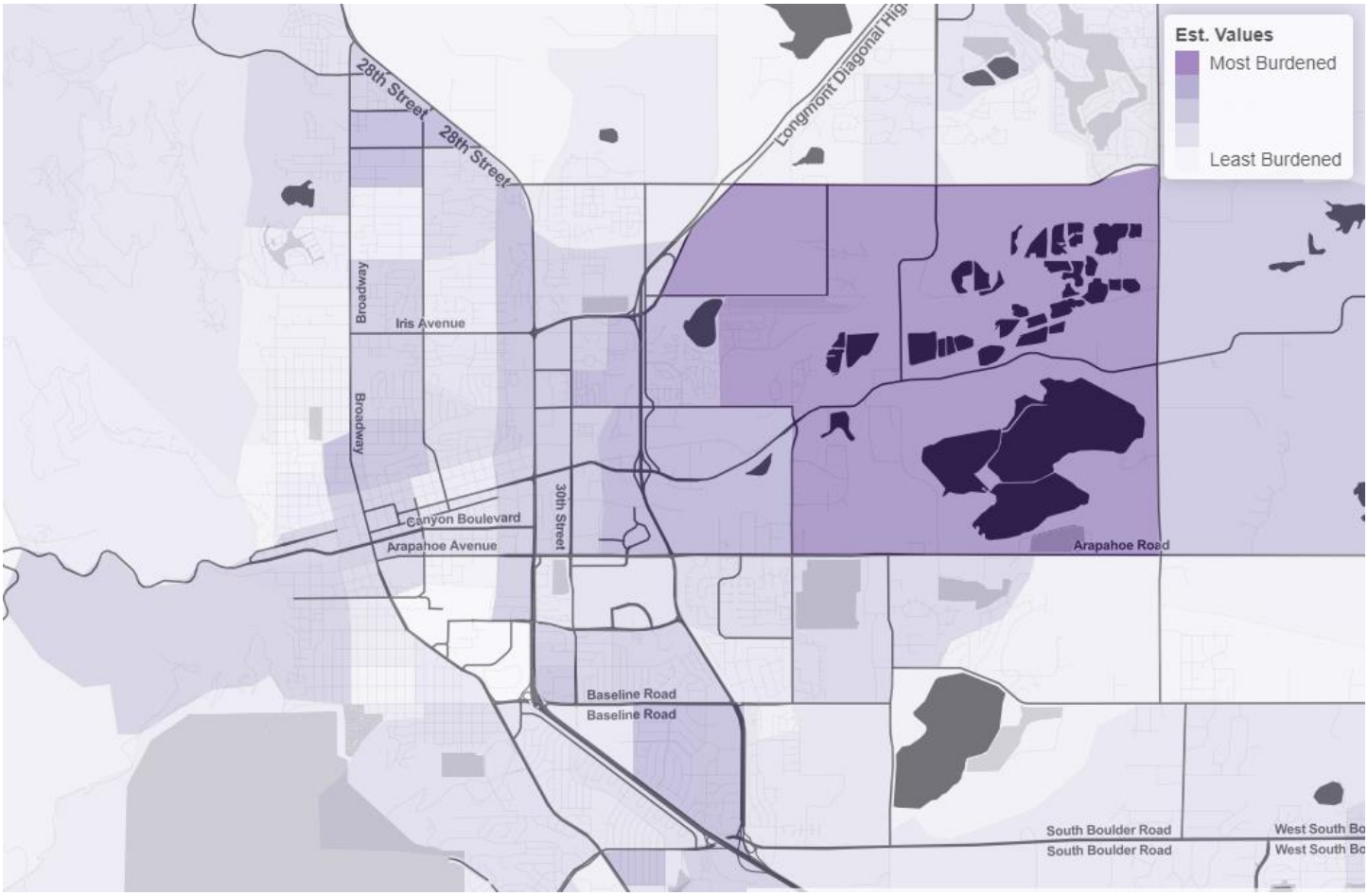


Figure 29., Boulder EnviroScreen Score

Other important socioeconomic factors to consider during strategy and project implementation include, but are not limited to, housing tenure and type, age, race, educational attainment, language(s) spoken at home, and employment status. Successful implementation will require consideration of the unique needs, barriers, and opportunities of different groups within the community.

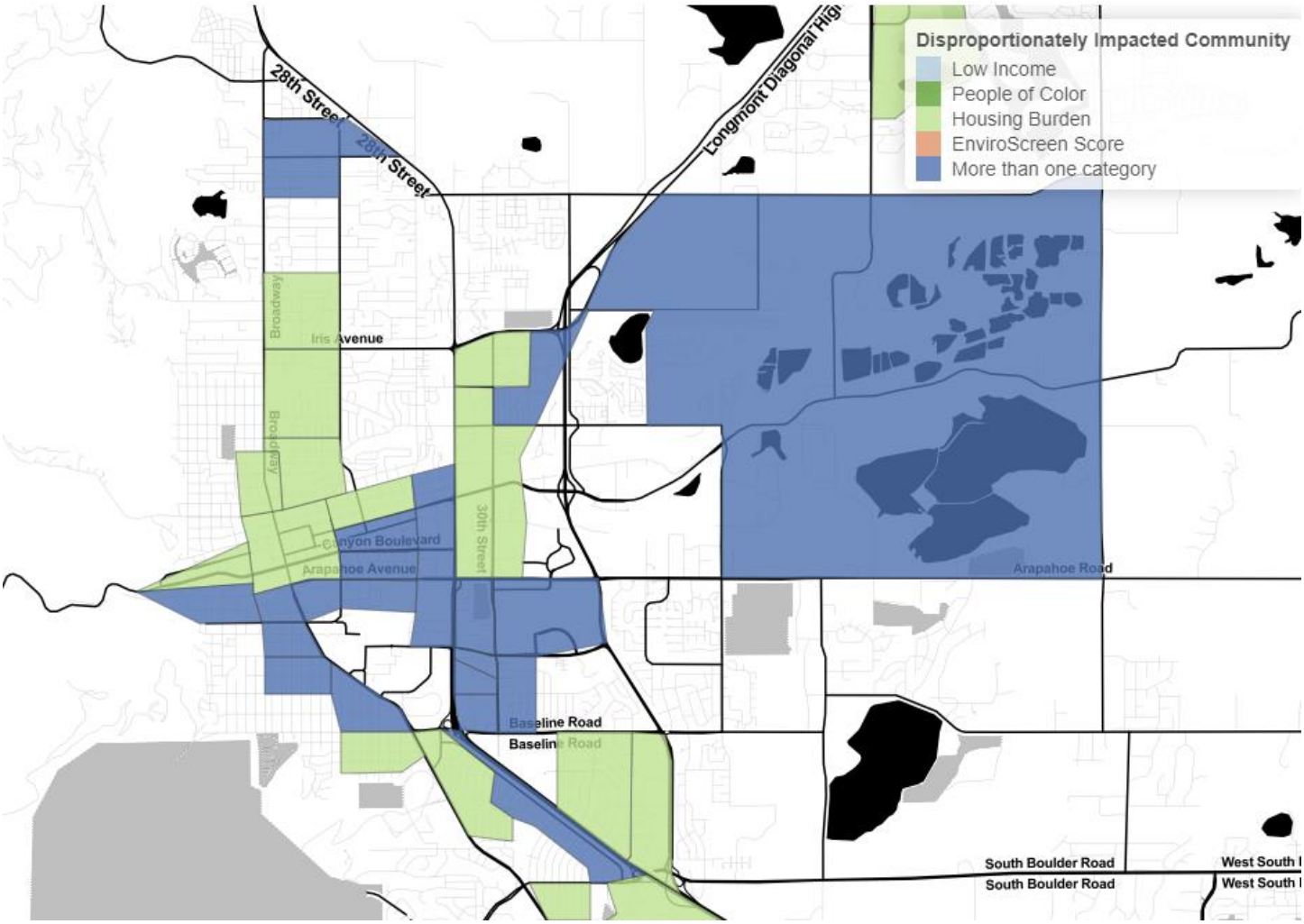


Figure 30. Boulder Area Disproportionately Impacted Communities (note that "more than one category" means that the area has 40% of the population in at least two of the following categories: low income, people of color, housing burden)

APPENDIX E: GLOSSARY OF TERMS

24/7 Carbon-Free Electricity: Electricity supply where every kilowatt-hour of consumption is met with carbon-free electricity sources, every hour of every day.

British Thermal Unit (BTU): the amount of heat needed to raise one pound of water at maximum density through one degree Fahrenheit

Carbon-Free Energy: Carbon-free refers to sources of energy that will not emit additional carbon dioxide into the air. Wind, solar, hydro, geothermal, biomass, fuel cells using hydrogen derived from carbon-free sources and nuclear energy are all carbon-free sources.

Carbon-Neutral Energy: Carbon-neutral, also described as “net zero”, could include carbon-free sources but is broader and refers to energy that removes or avoids as much carbon dioxide as is released over a set period of time. Carbon-neutral is sometimes used to describe a site that produces an excess amount of electricity from a renewable energy source, such as solar, compared to what it consumes. That excess energy is put back into the grid in an amount that offsets the carbon dioxide produced from the electricity it draws from the grid when it is not producing renewable energy.

Carbon-Positive City: Boulder’s goal to become a carbon-positive city by 2040 means that the city aims to absorb more GHGs than it emits.

Demand Side Management (DSM): Modification of consumer demand for energy through various methods, including technology, education and financial incentives. DSM aims to encourage consumers to decrease or shift energy consumption, especially during hours of high emissions and peak hours.

Electrification: The process of replacing technologies that use gasoline and diesel for transportation or natural gas or propone for heating with technologies that use electricity as a source of energy.

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

Energy Efficiency: The use of less energy to perform the same task or produce the same result. Energy-efficient buildings use less energy to heat, cool, and run appliances and electronics.

Energy Reduction: The result of behavior changes that cause less energy to be used. For example, setting the thermostat to a lower temperature *reduces* the energy used in your home during the winter. Since energy reductions can be easily reversed, they are not accounted for when calculating changes in energy usage.

Energy Savings: Comes from a permanent change that results in using less energy to achieve the same results. A new furnace uses X percent less energy to keep your home at the same temperature (all things being equal), resulting in energy *savings* of X percent. For accounting purposes, energy savings are only counted in the year the new equipment is installed.

Fugitive Emissions: Emissions resulting from the direct release of greenhouse gases to the atmosphere from equipment or processes that are not accounted for in energy consumption. For example, emissions associated with system leakages or losses.

Greenhouse Gases (GHG): Gases in the atmosphere that absorb and emit radiation and significantly contribute to climate change. The primary greenhouse gases in the earth's atmosphere are water vapor, carbon dioxide, methane, nitrous oxide, and ozone.

Grid Decarbonization: The reduction in the carbon intensity of electricity provided by electric utilities through the addition of low- or no-carbon energy sources to the electricity grid.

Kilowatt-hour (kWh): A unit of electricity consumption. 1,000 kilowatt-hours equals one megawatt-hour (see "Megawatt" definition).

Million British Thermal Units (MMBtu): A unit of energy consumption that allows electricity and natural gas consumption to be combined.

Metric Tons of Carbon Dioxide Equivalent ($MTCO_2e$): A unit of measure for greenhouse gas emissions. The unit "CO2e" represents an amount of a greenhouse gas whose atmospheric impact has been standardized to that of one unit mass of carbon dioxide (CO2), based on the global warming potential (GWP) of the gas.

Megawatt (MW): A unit of electric power equal to 1,000 kilowatts. One megwatt (or 1,000 kilowatts) used for one hour equals one megawatt-hour (or 1,000 kilowatt-hours) million watts.

Net-Metering: An Xcel Energy tariff that allows customers to offset electric consumption by using a bi-directional meter and selling excess electricity generated from an onsite solar system. Visit Xcel Energy's website for more information.

Net-Zero Emissions: Reducing emissions as close to zero as possible while balancing out any remaining emissions with an equivalent amount of carbon removal.

Premise: A unique combination of service address and meter. For residential customers, this is the equivalent of an individual house or dwelling unit in a multi-tenant building. For business customers, it is an individual business, or for a larger business, a separately-metered portion of the business's load at that address.

Public Utilities Commission (PUC) : A commission appointed by the Governor of Colorado regulatory authority over publicly held utilities such as Xcel Energy.

Renewable Energy: See "Carbon-Free Energy" definition.

Renewable Energy Certificate (REC): For every megawatt-hour of clean, renewable electricity generation, a renewable energy certificate (REC) is created. A REC embodies all the environmental attributes of the generation and can be tracked and traded separately from the underlying electricity. Also known as a Renewable Energy Credit.

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.

Solar Photovoltaic (PV): Solar cells/panels that convert sunlight into electricity (convert light, or photons, into electricity, or voltage).

Solar*Rewards®: An Xcel Energy program that provides monthly incentive payments to participating customer in exchange for the RECs generated by the energy produced by the solar system. Visit Xcel Energy's website for more details and Solar*Rewards® program eligibility.

Solar*Rewards Community®: Xcel Energy program allowing third party solar garden subscription with a bill credit for solar energy produced. Xcel Energy retains the RECs. Visit Xcel Energy's website for more details on Solar*Rewards Community®.

Split Incentive: A barrier to energy improvements for residential and business customers that rent homes and places of business,

Zero Emissions Electricity: Achieving 100% renewable electricity means that Boulder's electricity consumption will have no emissions. The zero emissions electricity goal means that every kilowatt-hour of electricity consumption is met with carbon-free electricity sources, every hour, every day.