

2024

City of Laramie Municipal Emissions Reduction Plan



HAUB SCHOOL OF ENVIRONMENT
AND NATURAL RESOURCES



Acknowledgements

We extend our sincere appreciation to all individuals who have contributed to the conception and evolution of this plan. This endeavor stands as a testament to the enduring commitment to sustainability demonstrated by city and community representatives over the course of several years, encompassing a diverse array of contributions and efforts. These representatives include but are not limited to:

- ▶ Laramie City Council
- ▶ City of Laramie Staff
- ▶ Environmental Advisory Committee (EAC)
- ▶ Alliance for Renewable Energy (ARE)
- ▶ University of Wyoming Haub School of Environment and Natural Resources Representatives
- ▶ Laramie Climate Action Planning Coalition (LCAPP)



Executive Summary

In 2020, the City of Laramie adopted resolution 2020-14: *Establishing the Intent of the Governing Body to Immediately Reduce Carbon Emissions from Municipal Government Operations and Pursue a Net Zero, Carbon Neutral Future for the City of Laramie, Wyoming*. This resolution established the goal to incrementally reduce emissions from municipal operations striving toward net zero emissions by the year 2050. Recommendations from the Environmental Advisory Committee (EAC) to Laramie City Council influenced the adoption of this goal and established the following benchmarks:

- ▶ 50% reduction by 2030
- ▶ 90% reduction by 2040
- ▶ Net Zero by 2050

The recommendations define the goal of “net zero” to mean that the city will work to reduce greenhouse gas emissions as much as reasonably possible, while working to implement measures and changes to offset the remaining emissions that cannot be completely eliminated. Specifically, they suggested the city “work to make *net* greenhouse gas emissions—including efforts from reduction, capture, and offset—as close to zero as is possible and feasible.”

This plan provides a roadmap to guide the City of Laramie in its implementation of these recommendations to achieve its benchmarks. Regular emissions inventories of municipal operations have informed the development of this plan by identifying specific opportunities for reduction. Categories of emissions inventoried provide the framework for this document, which includes the following sections:

- ▶ Buildings and Facilities
- ▶ Vehicle Fleet (including city vehicle fleet and employee commute)
- ▶ Waste Facilities (including landfill and waste and wastewater treatment)

In accordance with the EAC recommendations, this document outlines phased benchmarks for success at 10-, 20-, and 30-years with corresponding implementation recommendations (see Table 1). Table 1 outlines strategies for emissions reduction which will be detailed more extensively within the plan itself. The order of reduction strategies presented is in accordance with the 10-, 20-, and 30-year benchmarks, however these various actions should be implemented both incrementally and, as supportive opportunities arise over time, simultaneously to each other.

The scope of this plan is limited to emissions inventory arising solely from municipal operations within the City of Laramie. It does not encompass recommendations for reducing emissions associated with broader community-level sources, including private residents. References to buildings, facilities, or the vehicle fleet, for example, refer to city-owned buildings and vehicles. The term “City of Laramie,” as used in this document, specifically pertains to the municipal government of Laramie. Nevertheless, as actions progress, the recommendations and information provided in this document can be utilized to identify opportunities for broader-level community emissions reduction projects, subject to determination through consultation with city stakeholders.

Table 1: Summary of recommendations for emissions reduction by sector. Strategies are organized by sector (Buildings and Facilities (BF), Vehicle Fleet (VF), Waste Facilities (WF), and Sequestration and Offsets (SO)), and by implementation phase (1,2, and 3).

Sector	Phase 1 (2020-2030)	Phase 2 (2030-2040)	Phase 3 (2040-2050)
Buildings and Facilities (BF)	BF.1a: Take initial steps to retrofit municipal buildings to increase energy efficiency. Use the energy conservation measures from the Honeywell audit report to guide this process.	BF.2a: Continue retrofits to municipal buildings as old equipment ages out to maximize energy efficiency.	BF.3a: Complete energy conservation measures (ECMs) identified in the Honeywell audit to the greatest extent financially prudent to maximize energy efficiency in municipal buildings.
	BF.1b: Continue installing solar PV systems for remaining and eligible municipal facilities.	BF.2b: Pursue additional renewable energy opportunities through utility and partner opportunities including power purchase agreements (PPAs), leasing, utility partnerships, and renewable energy credits (RECs).	BF.3b: Through a combination of on-site energy generation and off-site procurement, municipal facilities should be powered to the greatest extent feasible through renewable and low carbon energy sources.
		BF.2c: Stay informed of state-level policy changes and opportunities for renewable energy expansion.	
Vehicle Fleet (VF)	VF.1a: Continue green purchasing policy for vehicles, pursuing high efficiency, hybrid, and electric vehicle upgrades, starting with passenger cars and light vehicles. Continuously assess factors such as maintenance costs, resale values, and range limitations to inform this process.	VF.2a: Continue transitioning of vehicle fleet. Begin investigating feasibility of transitioning medium/heavy duty vehicles to hybrid or electric. Continuously assess factors such as maintenance costs, resale values, and range limitations to inform this process.	VF.3: Complete upgrade of city vehicle fleet to a combination of high efficiency, hybrid, and electric vehicles as is feasible. Continuously assess factors such as maintenance costs, resale values, and range limitations to inform this process.
	VF.1b: Identify and pursue additional opportunities for installation of EV charging infrastructure.		
	VF.1c: Optimize driving routes of municipal vehicles to reduce vehicle miles traveled.		
	VF.1d: Ensure walkability and bikeability of city sidewalks and bike lanes. Plow bike lanes during winter months.		
Waste Facilities (WF)	WF.1a: Ensure that recycling bins are available in all municipal buildings.	WF.2a: Implement strategies of waste reduction strategy or plan.	WF.3a: Prioritize waste reduction and diversion strategies.
	WF.1b: Collect waste characterization data to identify opportunities for waste diversion and to refine landfill emissions estimates.	WF.2b: Upon addition of new cell to the landfill and at least 1 million tons of waste in place, investigate partnership with the Environmental Protection Agency's Landfill Methane Outreach Program. Re-assess feasibility of landfill gas capture system, including metrics of direct yearly emissions from the Laramie Landfill.	WF.3b: Continually investigate cost and opportunity for gas capture technology at the landfill, including pilot projects targeted to small landfills.
	WF.1c: Develop a waste reduction strategy or plan with established waste diversion goals in accordance with the Environmental Advisory Committee's emissions reduction benchmarks.	WF.2c: Explore opportunities to expand composting facilities.	
Sequestration and Offsets (SO)	SO.1: Include calculated estimate of emissions sequestered from greenspace into yearly emissions inventories.	SO.2: Identify opportunities for greenspace expansion and carbon sequestration in city limits.	SO.3: For any remaining emissions after all prior recommendations have been implemented, investigate, and implement sequestration and offsets as needed to reach emissions reduction goals.



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CONTEXT AND BACKGROUND



Timeline Toward Carbon Neutrality in Laramie


In February 2020, the Laramie City Council voted unanimously to adopt resolution 2020-14: *Establishing the Intent of the Governing Body to Immediately Reduce Carbon Emissions from Municipal Government Operations and Pursue a Net Zero, Carbon Neutral Future for the City of Laramie, Wyoming.*¹ The document commits the City of Laramie to “direct the establishment of modifications of municipal government operations and facilities designed to contribute immediately and incrementally toward a 2050 net-zero emissions goal” and:

“To direct planning for a 2050 carbon neutral goal to include the collection of quantitative data, analysis, and a community-wide emissions inventory and reduction strategy; establishment of community-wide reduction goals as a matter of public policy; implementation of community outreach, education, and training program; and securing financial resources for expansion into community-wide net zero efforts for review, approval, and allocation of funds by the governing body.”²

The scope of this plan is exclusively focused on the municipal operations of the City of Laramie. Nonetheless, as delineated in the aforementioned resolution, the strategies, information, and recommendations presented therein can serve to guide broader-level initiatives aimed at involving community stakeholders in efforts to reduce emissions beyond the purview of local government operations.

The road to the resolution itself was paved by a broader community effort in Laramie. Specifically, the community organization, Alliance for Renewable Energy (ARE), was instrumental in encouraging the city’s emissions reduction goals. In 2018, they began exploring options to reduce community emissions in Laramie and sought support from various stakeholders, including the University of Wyoming Haub School of Environment and Natural Resources (ENR).³ Through this partnership, students in the spring 2019 Haub School of ENR Campus Sustainability course worked with a City of Laramie staff mentor to conduct Laramie’s first municipal operations greenhouse gas (GHG) emissions inventory for fiscal year (FY) 2018/2019. Following the GHG inventory, ARE urged city-wide emissions reduction goals in Fall 2019, and through their continued public engagement, encouraged the City of Laramie’s commitment to carbon neutrality.

This encouragement led to specific emissions reduction recommendations, created by the Environmental Advisory Committee (EAC), which is jointly appointed by the Laramie City Council and the Albany County Board of Commissioners to advise on environmental issues. The EAC formed the Subcommittee on Emissions Reduction and Carbon Neutrality for the City of Laramie and proposed recommendations on these topics in February 2020. These recommendations ultimately informed the city’s resolution. In their recommendations, EAC proposed that Laramie establish goals (including 10-, 20-, and 30-year emissions reduction benchmarks), draft a comprehensive plan, perform regular emissions assessments, implement outreach, provide training, and explore financing.⁴ Regarding a comprehensive plan, they recommended “developing a municipal operations emissions reduction plan, followed by a separate community plan” which should include “scope, objectives, specific goals, baselines, timelines and metrics, strategies and solutions.”⁵ They also provided targeted recommendations for actions that the City of Laramie could take to reach its net-zero goal, including streamlining procedures, upgrading/replacing current fleet vehicles, replacing maintenance equipment, continuing energy efficiency improvements, installing rooftop solar on municipal facilities, facilitating a rooftop solar bulk buy program, and reducing emissions from solid waste management.⁶



In 2020, students in the Haub School of ENR Campus Sustainability course took the first steps to outlining the municipal emissions reduction plan itself, again under the mentorship of City of Laramie staff. They gathered information from several example climate action plans from cities similar or near to Laramie, including Missoula, MT; Reno, NV; and Fort Collins, CO. Recommended sections in the outline include electrification of vehicle fleet, development of performance indicators and regular emissions inventories, and adaptive management.⁷ Further development of the outline was paused due to complications arising from the COVID-19 pandemic.

These efforts ultimately culminated in the development of a City of Laramie Climate Action and Sustainability Graduate Assistant position, tasked with the development of the municipal emissions reduction plan, and mentored by City of Laramie staff. This position builds from the multi-year partnership between the City of Laramie and the Haub School of ENR, including shared funding resources. This plan aims to fulfill the EAC's recommendations and efforts already initiated by students in the Campus Sustainability course. In sum, the development of a municipal emissions reduction plan for the City of Laramie is the product of years of collaboration between the City of Laramie, the broader community, and University of Wyoming Haub School of ENR sustainability students. (See Table 2 for a full timeline of emissions reduction efforts in Laramie.)

¹ City of Laramie, *Resolution 2020-14: Establishing the Intent of the Governing Body to Immediately Reduce Carbon Emissions from Municipal Government Operations and Pursue a Net Zero, Carbon Neutral Future for the City of Laramie, Wyoming*, (2020), <https://www.cityoflaramie.org/DocumentCenter/View/18738/Reso-2020-14-Reduce-Carbon-Emissions-3-3-2020?bidId=>.

² City of Laramie, "Resolution 2020-14," p.1

³ Rachael Budowle, Eric Krszjzaniek, and Chelsea Taylor, "Students as Change Agents for Community–University Sustainability Transition Partnerships," *Sustainability* 13, no. 11 (2021): doi:10.3390/su13116036.

⁴ Environmental Advisory Committee, *Environmental Advisory Committee Subcommittee Recommendations*, (2020), <https://cityoflaramie.org/AgendaCenter/ViewFile/Item/7598?fileID=9598>.

⁵ Environmental Advisory Committee, "Subcommittee Recommendations," p. 2

⁶ Environmental Advisory Committee, "Subcommittee Recommendations."

⁷ N. Camille et al., *The City of Laramie Emissions Reduction Management Outline*, (2020), <https://cityoflaramie.org/AgendaCenter/ViewFile/Item/8586?fileID=11254>.

Table 2: Timeline of City of Laramie Emissions Reduction.

Timeline	
Year	
2018/2019	First Emissions Inventory: Students in the spring 2019 Haub School of ENR Campus Sustainability course conduct Laramie’s first municipal operations GHG inventory for FY 2018/2019.
	Honeywell Investment Grade Audit: Efficiency audit of city-owned buildings provides recommendations to implement energy savings and efficiency projects.
2019/2020	Official Baseline Inventory: Laramie becomes an ICLEI member with access to the ClearPath Inventory tool. The first inventory produced with this tool provides the official baseline inventory for municipal emissions.
2020	EAC Recommendations: The Subcommittee on Emissions Reduction and Carbon Neutrality for the City of Laramie proposes recommendations for emissions reduction to the Laramie City Council.
	Laramie City Council Resolution: Laramie City Council votes unanimously to adopt resolution 2020-14: <i>Establishing the Governing Body to Immediately Reduce Carbon Emissions from Municipal Government Operations and Pursue a Net Zero, Carbon Neutral Future for the City of Laramie, Wyoming.</i>
	Emissions Reduction Outline: Students from the Haub School of ENR Campus Sustainability course take the first steps to outlining the emissions reduction plan. Further development of the outline is paused due to complications from the COVID 19 pandemic.
2021	Ice and Event Center Solar: City of Laramie announces that the 25kW solar projects at the Laramie Community Recreation Center and Laramie Ice & Event Center have been completed with the installation of three public kiosks. The kiosk monitors provide daily and weekly real-time solar energy production, lifetime totals, and comparisons to saved carbon emissions and trees planted. Funding for the project was provided through the Rocky Mountain Power Blue Sky Renewable Energy Program.
	Hybrid and Electric Vehicle Bidding: The City of Laramie begins bidding all cars and pickups with hybrid, electric, and idle reduction technology alternatives.
	Bulldozer: The City of Laramie replaces the bulldozer at the landfill with a D6XE, which utilizes an electric drive system to reduce fuel usage by up to 35%.
2022	Fire Station 3 EV Charging Station and Solar Array: Laramie receives funding to support the installation of a 25kW solar array and an electric vehicle charging station in West Laramie through the Rocky Mountain Power Blue Sky Renewable Energy Program.
	Begin Drafting of Emissions Reduction Plan: The City of Laramie Climate Action and Sustainability Graduate Research Assistant position is created and hired to begin drafting the City of Laramie’s Municipal Emissions Reduction Plan.
	Municipal Operations Center Solar: The 25kw solar array at the Municipal Operations Center is completed.
2023	Solar Streetlights: Four solar streetlights are installed.

Climate Trends and Risks

According to the latest report from the Intergovernmental Panel on Climate Change (IPCC), human activities, largely through the emissions of carbon dioxide (CO₂) and other GHGs have unequivocally resulted in global atmospheric change. Most notably, in 2011-2020, global surface temperature has increased by 1.1°C above 1850-1900 temperatures, resulting in widespread changes in weather and climate extremes, which have had adverse impacts to nature and people.⁸ Projected CO₂ emissions from existing fossil fuel infrastructure without additional abatement will exceed the remaining carbon budget to limit warming to 1.5°C. To secure a livable and sustainable future across the globe and limit warming to 1.5 or 2°C, rapid and immediate reduction of GHG emissions is needed.⁹

While climate change is a global problem, its impacts will manifest locally. The state of Wyoming is projected to experience increased risks to public health as a result of severe weather, including a greater frequency of extremely hot and cold days.¹⁰ Specifically, by 2050, Wyoming is likely to have twice as many days above 100°F as it has today.¹¹ The City of Laramie, in particular, is considered to be at “high” heat risk, and is projected to experience 36 hot days per year (i.e., days above 86°F) by 2050, as opposed to 7 hot days per year that it traditionally experiences.¹² Depending on future emissions scenarios, annual average daily temperatures in Albany County are projected to increase between 5.8° F and 10.7°F by the end of the century.

Laramie is at “extreme” risk of drought, with a drought risk 81% higher than the Wyoming average.¹³ Different regions of Wyoming will be affected disparately by changes in precipitation. Southeastern Wyoming, in particular, is likely to experience longer periods without rain and drier soils, even under scenarios of increased precipitation.¹⁴ Declining snowpack resulting from decreasing precipitation and increased snow melt during the winter could further impact drought conditions, while also shortening seasons for winter recreation and tourism, and potentially threatening various species.¹⁵

Both drought and increasing temperatures are also projected to increase the likelihood and severity of wildfires in Wyoming, which have the potential to damage property, livelihoods, and human health. Under a higher emissions scenario, Albany County could experience a higher number of days per year without precipitation by the end of the century, thereby increasing wildfire risk.¹⁶ Wildfire smoke threatens community health through increased risk of cardiovascular and pulmonary complications among residents.¹⁷ Wildfires also have the potential to impact agriculture and ranching and have heavy economic costs in terms of fighting and managing fires.¹⁸

⁸ Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2023 Synthesis Report: Summary for Policy Makers*, (2023), https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.

⁹ Intergovernmental Panel on Climate Change (IPCC), "Synthesis Report."

¹⁰ ClimateCheck, "Climate Risk Report - Flood, Fire, Storm, Heat and Drought," Climate Risk Report for Homes and Real Estate - Fire, Flood, Storm, Heat / ClimateCheck, last modified November 22, 2022, <https://climatecheck.com/report?address=Laramie%2C%20Wyoming%2C%20United%20States>.

¹¹ EPA, *What Climate Change Means for Wyoming*, (2016), <https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-wy.pdf>.

¹² ClimateCheck, "Risk Report."

¹³ ClimateCheck, "Risk Report."

¹⁴ EPA, "What Climate Change Means for Wyoming."

¹⁵ Ibid.

¹⁶ US Global Change Research Program, "CMRA - Climate Mapping For Resilience and Adaptation," Redirect, accessed June 1, 2023, <https://livingatlas.arcgis.com/assessment-tool/search>.

¹⁷ EPA, "Wildland Fire Research: Health Effects Research," US EPA, last modified April 14, 2022, <https://www.epa.gov/air-research/wildland-fire-research-health-effects-research>.

¹⁸ C. Peterson, "As Wyoming's wildfire seasons worsen, so will fires across the prairie," *Casper Star Tribune*, June 28, 2020, xx, https://trib.com/news/state-and-regional/as-wyoming-s-wildfire-seasons-worsen-so-will-fires-across-the-prairie/article_a3ee832e-0c50-569d-853f-7ce720a3d189.html.

Wyoming State Energy Policy Context

Mining and crude oil and natural gas extraction are major contributors to Wyoming's gross domestic product (GDP) and tax revenue.^{19,20} Coal production, specifically, generates around 23,000 statewide jobs annually, contributing 14% of the state's GDP.²¹ Wyoming is the second largest net supplier of energy among the states and has been the leading coal-producing state since 1986.²² Specifically, Wyoming produces about 12 times more energy than it consumes²³, meaning that it exports a vast majority of its energy products to out of state markets. Given limitations of Wyoming local governments to raise revenue through taxes, as well as the large amount of state revenue derived from extractive industries, local governments in Wyoming are often heavily dependent on direct distribution payments from the state for their finances.

However, amid a shifting energy economy, changing consumer sentiment, and increased demand for low-emissions energy products, the Wyoming Energy Authority (WEA) has adopted a statewide energy strategy to promote an "all of the above" energy mix.²⁴ This approach includes harnessing emerging renewable and other clean energy opportunities in conjunction with legacy industries.²⁵ In their energy strategy, the WEA has promoted active initiatives in carbon sequestration as a service, including preventing CO₂ emissions through carbon capture utilization and storage (CCUS), as well as direct air capture technology to remove CO₂ directly from the atmosphere. Additionally, the state has published a roadmap and established intention to lead the region in the development of a low-carbon hydrogen economy.²⁶ In 2022, renewable energy sources generated roughly 24% of Wyoming's electricity, about nine tenths of which was generated from wind power.²⁷

¹⁹ U.S. Bureau of Economic Analysis, Interactive Data, Regional Data, GDP and Personal Income, Annual Gross Domestic Product (GDP) by State, GDP in current dollars, NAICS, Wyoming, All statistics in table, 2021.

²⁰ Petroleum Association of Wyoming, Oil and Gas Facts & Figures 2021, Gross Domestic Production (GDP) by Industry (in millions).

²¹ Robert Godby, R. C., Taylor, D. (., & Considine, T. (n.d.). Wyoming Coal Impacts Study. University of Wyoming .

²² US Energy Information Administration (EIA), "U.S. Energy Information Administration - EIA - Independent Statistics and Analysis," U.S. Energy Information Administration (EIA), accessed June 1, 2023, <https://www.eia.gov/state/?sid=WY>.

²³ Ibid.

²⁴ Wyoming Energy Authority, "Wyoming Energy Strategy," Wyoming Energy Authority, last modified February 22, 2023, <https://wyoenergy.org/energy-strategy-energy-generation/>.

²⁵ Wyoming Energy Strategy, "Strategy."

²⁶ Wyoming Energy Authority, "Roadmap to Build a Hydrogen Economy," last modified 2022, https://wyoenergy.org/wp-content/uploads/2022/11/WEA_WyomingHydrogenRoadMap-FINAL-1.pdf.

²⁷ U.S. EIA, Electricity Data Browser, Net generation for all sectors (thousand megawatthours), Wyoming, Annual, 2019-22.

Importance of Municipal Action

Localities across the United States, including a few in Wyoming, are already taking steps to reduce their emissions through energy and transportation policies focused on both government and community-wide operations.^{28,29} For example, more than 750 U.S. mayors have committed to emissions reduction through significant climate action and policy, and over 100 have pledged to accelerate net zero emissions.³⁰ National and international networks of municipalities committed to climate action are working to share information and best practices from this work, including but not limited to the International Council for Local Environmental Initiatives (ICLEI), 100 Resilient Cities, C40 Cities, and the Mountain Towns 2030 (MT 2030) Solutions Project. Laramie is currently participating in ICLEI and MT 2030 to advance its own climate goals.

In these ways, cities and counties across the country have become important leaders in the national and international climate change conversation, as they serve as centers of innovation and are implementers of context-based climate solutions.³¹ While localities such as Laramie have relatively small contributions to global greenhouse gas emissions, they have the opportunity to lead the way in the development of equitable, climate-resilient, and sustainable communities. Municipalities have control over building design, land development, transportation, waste management, and more within their jurisdictions, all of which contribute to local energy use and emissions. Local governments, relative to their federal and state counterparts, are highly connected to their constituents on a microscale. Often, this allows local governments to be responsive to community-specific opportunities and constraints, including those relevant to climate change.^{32,33}

The benefits of engaging in local climate action planning are not limited to emissions reduction. In Wyoming, cutting energy cost through increased operational efficiency is one of the major motivators for communities engaging in local climate efforts.³⁴ Energy consumption is a major expenditure for local government operations. Amid declining state and local budgets, as well as statewide limitations on how towns and counties can generate local revenue through taxes,³⁵ finding ways to increase efficiencies and savings is of essential importance to localities in Wyoming. In addition to cost savings, cities engaging in climate action have identified numerous economic opportunities arising from their efforts, including development of new business industries, increased attention to other environmental concerns, increased infrastructure investment, improved efficiency of operations, additional funding options, and increased energy security.³⁶ Additional funding options are of particular importance at the time of writing this document, given a recent influx of federal funding opportunities through legislation such as the Inflation Reduction Act (IRA) and Infrastructure Investment and Jobs Act (IIJA). Having an approved climate action or emissions reduction plan

²⁸ ICLEI, "About Us," ICLEI – Local Governments for Sustainability, accessed June 1, 2023, https://iclei.org/about_iclei_2/.

²⁹ Center for Climate and Energy Solutions, "City Climate Policy," Center for Climate and Energy Solutions, last modified June 7, 2019, <https://www.c2es.org/content/city-climate-policy/>.

³⁰ C40 Cities, "More Than 100 American Cities Make Historic Pledge to Accelerate Net-Zero Emissions, Deliver Action Needed to Meet National Climate Goals," C40 Cities, last modified December 10, 2021, <https://www.c40.org/news/american-cities-net-zero-climate-goals/#:~:text=to%20News%20%26%20Insights-.More%20than%20100%20American%20Cities%20Make%20Historic%20Pledge%20to%20Accelerate,to%20Meet%20National%20Climate%20Goals>

³¹ Center for Climate and Energy Solutions, "City Climate Policy."

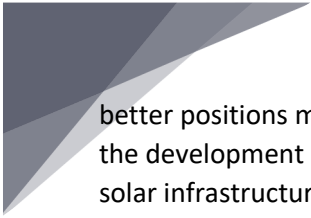
³² Ibid.

³³ B. Barber, "Benjamin Barber: Does The Road To Changing The World Go Through City Hall?," NPR, last modified January 8, 2016, <https://www.npr.org/2016/01/08/462270486/does-the-road-to-changing-the-world-go-through-city-hall>.

³⁴ D. Bleizeffer, "Local climate efforts cut costs and carbon in Wyoming," *High Country News*, December 11, 2020, <https://www.hcn.org/articles/climate-local-climate-efforts-cut-costs-and-carbon-in-wyoming>.

³⁵ A. M. Thuermer, "As Legislature hems and haws, 19 counties to vote on taxes," *WyoFile*, October 27, 2020, <https://wyofile.com/as-legislature-hems-and-haws-19-counties-to-vote-on-taxes/>.

³⁶ CDP, *It Takes a City: The Case for Collaborative Climate Action*, (CDP, 2016), https://cdn.cdp.net/cdp-production/cms/reports/documents/000/001/172/original/CDP_Thematic-Report_2016.pdf?1475744852.



better positions municipalities to apply for funding for several different priorities including but not limited to the development of EV charging infrastructure, improving energy efficiency and electrification of buildings, solar infrastructure expansion, and workforce development.^{37,38}

Finally, Laramie is uniquely equipped to succeed in its emissions reduction goals. Achieving emissions reduction goals at the municipal level is a challenging process, one that will require continued dedication and support from both city and community representatives. However, the City of Laramie benefits from a history of and continued commitment and engagement from strong community groups, opportunities for partnership with Albany County, and involvement and support from various representatives at the University of Wyoming.

³⁷ Climate Action Tracker, "Overview," Home | Climate Action Tracker, accessed July 24, 2023, <https://climateactiontracker.org/countries/usa/>.

³⁸ C40 Cities, *Climate Action and the Inflation Reduction Act*, (Climate Mayors, C40 Cities, 2022), https://www.c40knowledgehub.org/s/article/Climate-action-and-the-Inflation-Reduction-Act-A-guide-for-local-government-leaders?language=en_US.

FY'22 EMISSIONS INVENTORY



Background

The first step in identifying strategies for emissions reduction is to understand emissions sources and quantities within municipal operations. Emissions inventories are tools used to calculate emissions based on usage data and organizes them by scope and sector. There are a variety of tools available to develop an emissions inventory, however as a member of ICLEI, the City of Laramie has opted to use the ICLEI ClearPath calculator for the development of its annual GHG emissions inventory. Beginning in FY'18, the city has collected and compiled data into the calculator to establish a baseline for municipal operations. Regularly conducting inventories enables tracking changes in municipal emissions over time. The following section outlines emissions from the most recent inventory at the time of writing this document, for FY'22. This inventory provides a starting point from which to strategize a path toward the City of Laramie's carbon neutrality by 2050 goal.

According to the Greenhouse Gas Protocol, the world's most widely used GHG accounting standard, there are three categories to define different kinds of emissions, known as "scopes." Scope 1 refers to direct GHG emissions, or emissions that occur from sources that are owned by the entity conducting a GHG inventory. Scope 2 emissions refer to indirect electricity emissions that result from the generation of purchased electricity. Finally, Scope 3 emissions refer to those not covered by Scopes 1 and 2, and are typically associated with emissions produced through the value chain of purchased products, such as extraction and production of purchased materials.³⁹ Emissions covered in the following inventory are categorized under Scopes 1 and 2. While the City of Laramie acknowledges Scope 3 emissions associated with production and manufacturing of materials utilized in city operations, strategies and recommendations for emissions reduction are limited to those accounted for within the inventory at this time.

The ClearPath tool organizes municipal emissions into various categories. For the City of Laramie, these categories are Buildings and Facilities, Vehicle Fleet, Employee Commute, Solid Waste Facilities, and Waste and Wastewater Treatment Facilities. Each chapter of the plan focuses on these categories with specific corresponding reduction strategies. Immediately below, however, is an outline of baseline emissions for each category.

Buildings and Facilities

This section uses data from all municipal utility bills (from Rocky Mountain Power (RMP); Black Hills Energy (BHE); and Carbon Power Light (CPL)) for each month over the course of a fiscal year and organized by department. Inputs included emissions from grid electricity and stationary fuel combustion. The EPA eGrid Summary Tables⁴⁰ provided information about grid electricity. As City of Laramie operations shift to photovoltaics (PV) or other renewable sources, kWh usage will be shifted to zero and removed from entry into the ClearPath tool, as the emissions are considered to be net-zero, even if production does not occur in city limits. In FY '22, total carbon dioxide equivalent (CO₂e) for buildings and facilities totaled 7,322 metric tons

³⁹ World Business Council for Sustainable Development and World Resources Institute, *The Greenhouse Gas Protocol*, (2004), <https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf>.

⁴⁰ EPA, "Summary Data," US EPA, last modified January 31, 2023, <https://www.epa.gov/egrid/summary-data>.

(MT). After the Laramie Landfill, this category accounts for the second largest source of emissions for municipal operations. Figure 1 shows these emissions by department.

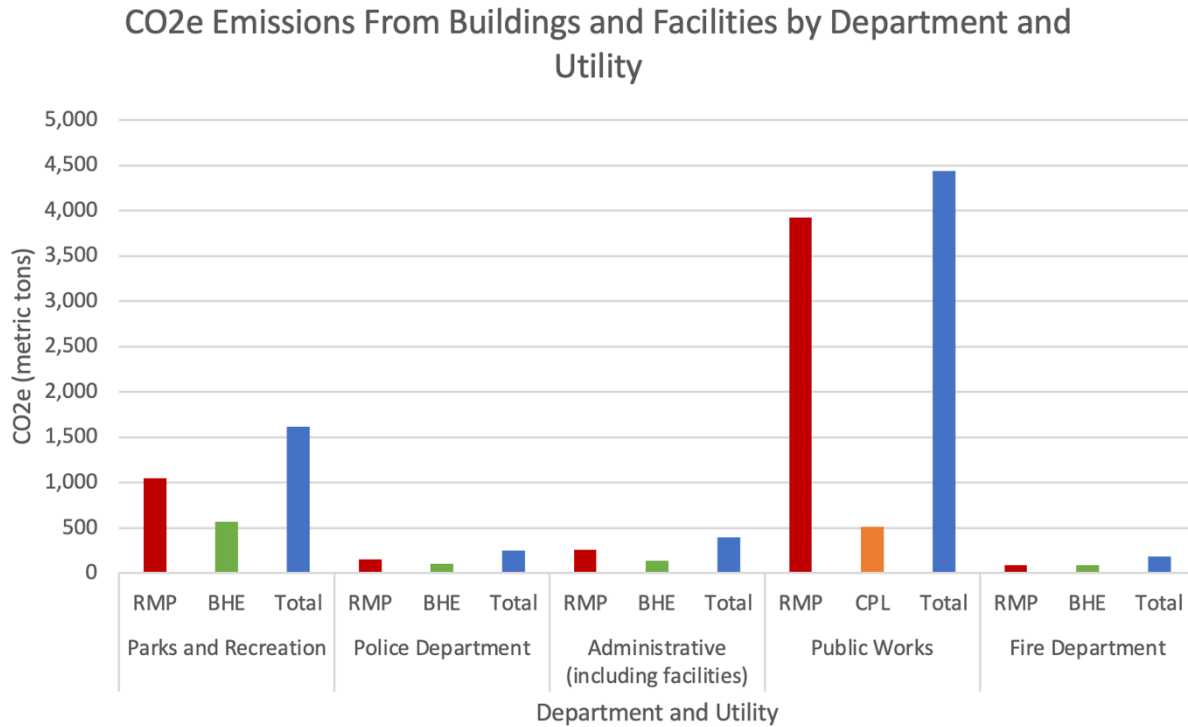


Figure 1: CO₂e emissions for City of Laramie buildings and facilities by department and utility (including Rocky Mountain Power (RMP), Black Hills Energy (BHE), and Carbon Power Light (CPL)).

Vehicle Fleet

Data entries for this category included total fuel consumed in gallons and total vehicle miles traveled (VMT) for passenger cars, light trucks, and heavy trucks for each fuel type, both gasoline and diesel. Data are not further organized by department for this category, however, see Appendix 3 for a full list of vehicles included in the city fleet. Fleet accounts for a total of 1,015 MTCO₂e of City of Laramie emissions. Figure 2 shows these emissions by fuel type.

An important note for this section of the inventory is the ICLEI calculator does not currently include an option to incorporate emissions from other types of heavy machinery used by the city outside of vehicles, but these are still important in the greater emissions picture.

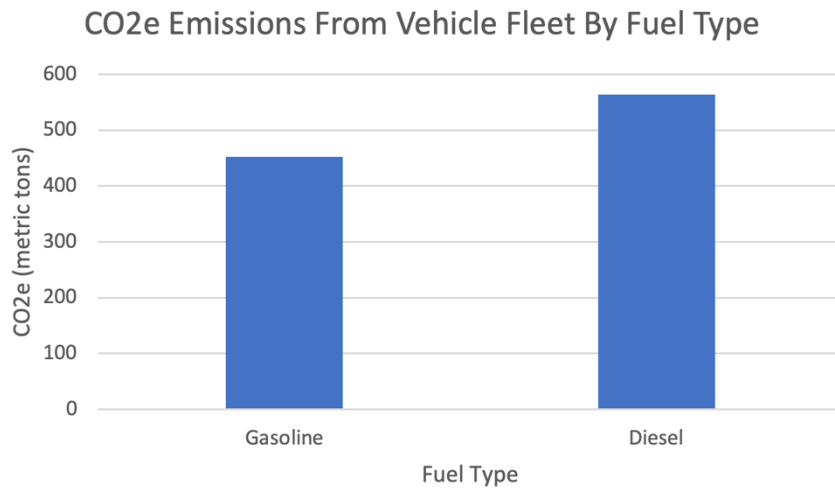


Figure 2: CO₂e from vehicle fleet by fuel type.

Employee Commute

Employee commute is a useful statistic that, while minimal in its contribution to City of Laramie emissions, can bring mindfulness to individual commuting. Data collection for this category involved distributing a survey to employees with the following questions:

- 1) Do you drive to work?
- 2) If yes, please respond to the following questions:
 - a) Make and model of vehicle:
 - b) Gasoline, diesel, or other:
 - c) Please estimate your round-trip miles to work:
 - d) Giving a rough estimate, approximately how many days do you drive to work each year (there are approximately 261 business days in a year):

Annual vehicle miles traveled (AMT) was calculated for each fuel type (gasoline, diesel, electric) and broken down in percentages of vehicle type (passenger car, light truck, heavy truck) (not shown here). CO₂e from employee commute totaled 158 MT.

Solid Waste Facilities

Data entries for this section include total tons of waste landfilled, total tons of green waste composted, and total tons of biowaste composted. Landfill waste is the largest source of emissions for Laramie municipal operations, largely due to the fact that the landfill is municipally owned, and emissions from all waste sent to the landfill are included in the inventory, regardless of whether or not it is generated in city limits. However, green waste and biowaste composting help to reduce this impact. Accounting for these

reductions in emissions through composting, the Laramie Landfill accounted for roughly 46,343 MTCO₂e in FY '22, which is approximately 84% of total City of Laramie emissions. Due to the significant portion of total emissions resulting from solid waste, its independent function compared to other operations, and the fact that it processes waste generated in other localities, actions taken to reduce emissions from the landfill may extend beyond the scope of a municipal operations plan.

Waste and Wastewater Treatment Facilities

Waste and Wastewater Treatment is a relatively small-scale emissions source for the City of Laramie. All electricity emissions related to water treatment are included in the Buildings and Facilities category of the inventory. This section specifically focuses on two types of wastewater treatment emissions: process nitrous oxide (N₂O) from wastewater treatment and process N₂O from effluent discharge to rivers and estuaries. These emissions are categorized as emissions from wastewater treatment and wastewater treatments discharge, respectively. (See Figure 3.) N₂O emissions are converted to CO₂e for consistency in the inventory.

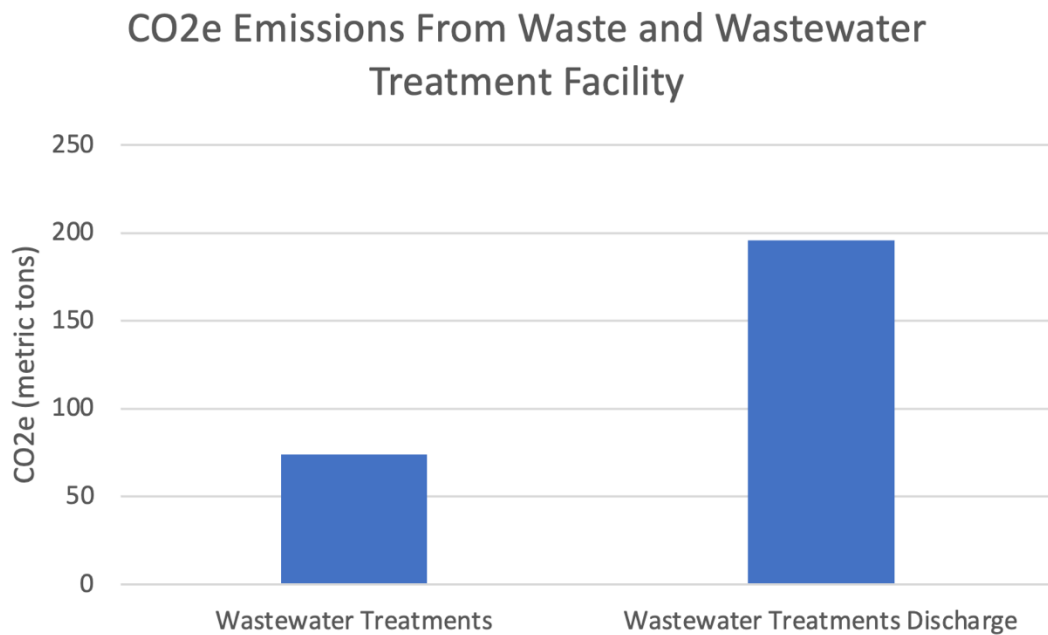


Figure 3: CO₂e from Waste and Wastewater Treatment Facilities.

Summary

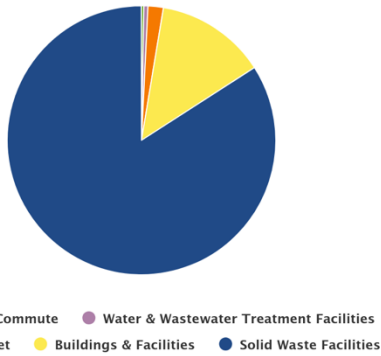
The 2022 baseline inventory shows that most of Laramie's municipal emissions come from processing solid waste. Over 84% (46,343 of 54,951 MTCO₂e) of emissions come from solid waste, followed by buildings and facilities, and then vehicle fleet. See Table 3 and Figure 4 below, for total City of Laramie emissions by category, both with and without emissions from the landfill. Each emissions sector will be broken down individually, with strategies for emissions reduction, in later sections of the plan. For a more comprehensive

breakdown of the methodology and inputs used in the ICLEI ClearPath calculator, see the City of Laramie’s Government Operations Greenhouse Gas Inventory Manual.⁴¹

Table 3: CO₂e by sector for the selected inventory year.

Sector	MTCO ₂ e
Buildings and Facilities	7,322
Vehicle Fleet	1,015
Employee Commute	158
Solid Waste Facilities	46,343
Water and Wastewater Treatment Facilities	270

CO₂e By Category



CO₂e By Category

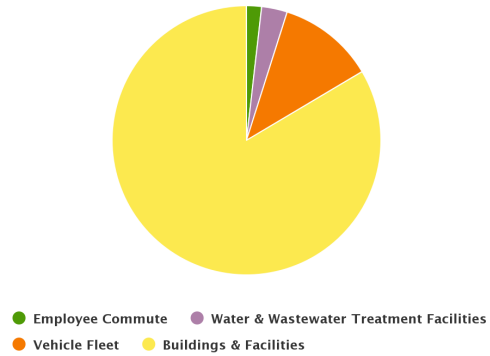


Figure 4: Breakdown of FY ‘22 Emissions Inventory with and without the Landfill.

⁴¹ M. G. Bedwell, *Government Operations Greenhouse Gas Inventory Manual*, (City of Laramie, 2020).



METHODS



Stakeholder Interviews and Consultation

Tours of City of Laramie facilities informed the development of this plan to understand current operations and sustainability initiatives, as well as to identify opportunities for emissions reduction. Tours included the water and wastewater treatment plant, the landfill, the community recreation and ice and events centers, administrative buildings, and parks facilities.

In addition to the key information provided by the baseline greenhouse gas emissions inventory, the City of Laramie Climate Action and Sustainability Graduate Research Assistant conducted interviews with key stakeholders to generally identify priorities and best practices existing in other Wyoming communities. Interview questions focused on topics related to effective community-based approaches to climate action planning in Wyoming, including perceived motivations, barriers, and key strategies. Laramie stakeholders additionally provided information regarding desired strategies for the emissions reduction plan itself. Participants included stakeholders from City of Laramie, Albany County, and Wyoming state government staff and elected officials; the private sector; University of Wyoming; and community organization representatives across the state of Wyoming.

CO₂e Emissions Calculations

As mentioned above, the based GHG used the ICLEI ClearPath calculator. Tools and information provided by ICLEI also informed reduction strategies and estimations of emissions reduction as outlined below. Specifically, the “forecasting” tool estimated baseline emissions scenarios and the “planning” tool was used to identify potential emissions reduction strategies, as well as their associated reductions in emissions.

The background image shows the facade of a brick building, likely a city hall or government building. The top part of the building features a decorative archway with the words "CITY OF LARAMIE" carved into it. Below the archway is a large glass entrance door. To the right of the door, there is a small sign with a wheelchair icon, indicating accessibility. The building is set against a clear blue sky. Two horizontal white lines are positioned above and below the main text.

BUILDINGS AND FACILITIES

Introduction

This section outlines strategies to reduce emissions from buildings and facilities owned by the City of Laramie, including by both increasing energy efficiency, increasing onsite capacity for renewable energy generation, and off-site energy procurement. While this is not an exhaustive list of strategies that could support emissions reduction goals, this section provides an overview of strategies that best complement and expand on existing emissions reduction efforts undertaken by the City of Laramie.

In FY'22, emissions from buildings and facilities totaled roughly 7,322 MTCO₂e. This was a significant jump from prior years, with FY'20 and FY'21 emissions from this category totaling 4,259 and 4,793 MTCO₂e, respectively. In FY'22, the City of Laramie completed construction of a new municipal operations building. However, in transferring from the old to new building, it is likely that electrical usage from both facilities factored into a higher electrical usage in FY'22. Upon completion of future inventories, it is likely that emissions from buildings and facilities will decrease as a result of decommissioning of the old building space. However, it remains undetermined to what extent that will be.

Strategies throughout the plan are roughly organized via chronological order of implementation (as organized by 10-, 20-, and 30- year phases of implementation). However, many strategies can be implemented both incrementally and simultaneously to each other.

Energy Efficiency Upgrades

Background and City Progress

Typically, most of the energy used in buildings comes from heating, cooling, and ventilation systems.⁴² Upgrading the operational performance of these systems in existing buildings, known as retro-commissioning,⁴³ can both reduce emissions and result in saved energy costs over time. Retro-commissioning can identify inefficiencies that exist in current building operations and implement improvements to ventilation, heating, cooling, lighting systems, and controls. In addition to cutting energy usage, this process can result in improved indoor air quality, better temperature comfort, greater productivity and safety, extended equipment life, and reduced need for warranty claims or repairs.⁴⁴

Lighting can be a significant source of electricity use, especially in larger buildings. Lighting occupancy sensors prevent wasted electricity usage by turning lights off in the absence of detected motion. Sensors have the potential to reduce energy use from lights by an average of 35% and typically have a payback period of less than two years.⁴⁵ Installing lighting sensors in all municipal buildings would result in an estimated reduction of 792,412 kWh usage or 416.8 MTCO₂e.

In their recommendations to City Council, the Environmental Advisory Committee Subcommittee on Emissions Reduction and Carbon Neutrality for the City of Laramie provided the following guidance:

⁴² ICLEI, "ClearPath Calculator," ICLEI USA | Local Governments for Sustainability, last modified December 11, 2020, <https://icleiusa.org/clearpath/>.

⁴³ EPA, *EPA Building Commissioning Guidelines*, (Environmental Protection Agency, n.d), https://www.epa.gov/sites/default/files/2015-09/documents/ae-guidelines_appendixb.pdf.

⁴⁴ Sitelogiq, "Benefits of Retro-Commissioning Your Buildings," Sitelogiq, last modified May 19, 2023, <https://www.sitelogiq.com/blog/benefits-retro-commissioning/>.

⁴⁵ ICLEI, "Clearpath Calculator."

“CONTINUE IMPROVING FACILITY ENERGY EFFICIENCY: We recommend that the City of Laramie continue to seek opportunities for energy efficiency upgrades. Existing audits, power usage information from invoices, and additional monitoring devices could be used to identify areas where efforts should be targeted and inform efficiency decisions. Where possible, consider cost and energy savings by shifting usage of high energy demand equipment and machinery to times of the day when rates are lower.”⁴⁶

In 2020, Honeywell completed an investment grade audit report of the City of Laramie municipal operations. It outlines city-staff-elected energy conservation measures with cost estimates and implementation recommendations. Implementation of all projects outlined in the report are estimated to reduce baseline emissions by 28%.⁴⁷ Measures prioritized in the report include upgrades to building automation, boilers, chiller plants, remote terminal units (RTU), air handling units (AHU), light-emitting diode (LED) lighting, building envelopes, domestic water, backup generators, aeration, and clean buildings. See Table 4 for more detailed information on the scope of each measure. For cost estimates and financials, see the full Honeywell Audit Report.

Table 4: Energy Conservation Measures (“ECMs”) in the final City-staff elected scope (as included in the Honeywell audit report).

ECM	Scope
Boiler Upgrades	<ul style="list-style-type: none"> • City Annex: Flow test and piping changes to correct low flow and stagnation problems and optimize heating water flow. • Recreation Center: Replace old/inefficient boilers. Install new high-efficient condensing boilers: Lap Pool Boiler, Outdoor Pool Boiler and Spa Boiler.
Chiller Plant Upgrades	<ul style="list-style-type: none"> • City Annex: Upgrade chiller compressor with high-efficient digital compressor, convert AHU to 2-way energy valves, convert primary-secondary chilled water loop to variable primary flow. Optimize control sequences and connect to building automation system (BAS) and new controls front end. • Ice and Event Center: Replace old/inefficient, oversized chiller. Calculate chiller load and select chiller correctly sized for the load. Improve piping and pumping chilled water loop. Advanced sequences and connect to BAS.
Building Automation	<ul style="list-style-type: none"> • City Hall and Fire Station 1: Re-commission existing BAS, document deficiencies. Integrate existing BAS equipment schedule to remain. Tie in new controls on new equipment into BAS. • City Annex: Same system as City Hall. • Recreation Center: Install updated Tridium Niagara this is where the global BAS for the city will be located. Tie new equipment controls into Niagara. Integrate existing equipment controls into update Niagara. • Ice and Event Center: Install new controllers on air side equipment and integrate into upgraded Niagara. • Police: Convert existing pneumatic controls to direct digital control (DDC), integrate boiler, AHU and flexible connection (FC) unit controls into building controls. Integrate into upgraded Niagara. • Animal Shelter: Install new controllers for HVAC equipment and integrate into upgraded Niagara. • Fire Station 3: Tie existing Trane building management system (BMS) into upgraded.

⁴⁶ EAC, “Subcommittee Recommendations,” pp. 5

⁴⁷ Honeywell, *City of Laramie, WY Investment Grade Audit Report*, (Honeywell, 2020).

RTU Upgrades	<ul style="list-style-type: none"> • City Hall Fire Station 1: Repair economizer control, replace Make-up air unit including heat recovery. • Recreation Center: Replace (9) RTU with high efficiency units, Replace (2) Pool Heat Recovery units with high efficiency units with heat recovery.
AHU Upgrades	<ul style="list-style-type: none"> • Dewatering Building: Replace (2) old/non-functioning Make-up air units. Install one smaller Make-up air unit. Right sized and locate outside. Duct into the space. • City Annex: Rebuild existing AHU to include new heating and cooling water coils (see chiller optimization), variable frequency drive (VFDs), rebalance, update sequences. • Ice and Event Center: Install direct expansion (DX) cooling section to existing Make-up Air unit. • Police Station: Rebuild (2) AHU with updated controls, valves, motors and VFDs. Replace fan coil units (FCUs) with variable air volume (VAV) boxes in certain areas, convert air distribution system to DDC. • Animal Shelter: Install dedicated exhaust fan and ducting to animal isolation room. Prove heat recover on new exhaust system. • Mosquito Shop: Replace furnace with new heating, cooling, ventilation unit. Redo ductwork. Install new roof or side wall mounted exhaust fans with carbon monoxide level control.
LED Upgrades	<ul style="list-style-type: none"> • City Hall, Fire Station1, City Annex, Recreation Center, Ice and Event Center, Police Station, Fire Station3, Parks Shop and Mosquito Shop: Upgrade interior, exterior and parking lot lights to LED
Building Envelope	<ul style="list-style-type: none"> • Recreation Center, Ice and Event Center, City Hall, City Annex, Fire Station 1, Police Station, Animal Shelter, Park Shop, Mosquito Shop, Fire Station 3: Replace door weather stripping, replace window gaskets, seal vents, seal wall joints, install insulating pink board, seal holes.
Domestic Water Upgrades	<ul style="list-style-type: none"> • Recreation Center: Replace with new, thermostatic mixing valve for serving locker rooms
Backup Generator	<ul style="list-style-type: none"> • Wastewater Treatment Plant: Install new 1000 kW emergency back-up generator to provide backup power to all WWTP operations. • WWTP Lab Bldg.: Install new 80 kW emergency back-up generator to provide backup power to lab building.
Aeration Upgrades	<ul style="list-style-type: none"> • New Aerated Sludge Holding Tank Blower Building. • New (3) 250 horsepower (hp) high speed turbo (HST) Oxidation ditch blowers and. • New (2) 120 hp HST Jockey blowers. • New dissolved oxygen (DO) probes. • Oxidation ditch DO set point and off/on aeration control.
Clean Building Upgrades	<ul style="list-style-type: none"> • Incorporate negative ionization, UV-light, filtration, demand control ventilation and other advanced technologies and controls to improve the breathable air within a building. This measure is in addition to the recommend upgrades for AHU and RTU measures at: <ul style="list-style-type: none"> • City Hall and Fire Station 1. • City Annex. • Ice and Event Center. • Recreation Center. • Animal Shelter • Mosquito Shop.

Implementation Considerations

Energy conservation measures should be implemented gradually over time, taking into consideration upfront costs. Upgrades should be phased in as old equipment ages out and as opportunities arise. This phased approach ensures a gradual transition to more energy-efficient systems while ideally minimizing financial strain. Additionally, it allows for strategic planning and prioritization of upgrades based on factors such as equipment lifespan and available resources. By carefully coordinating the timing of implementation with the natural replacement cycle of equipment and seizing opportunities as they arise, the City of Laramie can effectively optimize the energy efficiency of buildings without overwhelming financial burdens.

See Table 5 for estimated emissions reduction associated with a full completion of energy conservation measures as outlined above and Table 6 for a summary of the energy efficiency strategy. Note that emissions reduction estimates assume a full completion of items outlined in the Honeywell report, however, discretion to prioritize and choose projects feasible to implement within city budgets is retained by city council and staff.

Table 5: Energy Conservation Measure Emissions Reduction Estimates.

ECM No. & Description	Electric Savings (kWh)	Natural Gas Savings (therms)	Total MTCO ₂ e Reduction (metric tons)
Totals	2,539,754	41,588	1,555
Pre-Retrofit Baseline	8,546,121	189,193	5,495
Percent Reduction	30%	22%	28%

Table 6: Summary Table for Energy Efficiency Strategy.

Strategy	Benefits	Considerations for Implementation	Potential Emissions Impact
Energy Efficiency	<ul style="list-style-type: none"> -Improved efficiency of building operations -Saved energy costs overtime -Improved air quality -Better temperature comfort -Greater productivity and safety -Extended equipment life -Reduced need to warranty claims or repairs 	-Given upfront costs, upgrades should be implemented over time and as opportunities arise and as old equipment ages out	Up to 1,555 MTCO ₂ e

Solar Installation and Renewable/Low-Carbon Energy Purchasing

Background and City Progress

In their recommendations to the Laramie City Council, the EAC Subcommittee on Emission Reduction and Carbon Neutrality for the City of Laramie included specific recommendations to:

- **“STREAMLINE PROCEDURES:** To better enable community members’ efforts to reduce their carbon footprint, we recommend reviewing and adjusting all relevant ordinances, policies, and permitting procedures so as to streamline renewable energy and energy efficiency projects for individuals and businesses. Such actions may include, but are not to be limited to:
 - Waiving or reducing permitting fees for solar installations as an incentive for participation.
 - Offering templates of photovoltaic system configurations to streamline the permitting process.
- **INSTALL ROOFTOP SOLAR ON MUNICIPAL FACILITIES:** We recommend that the city invest in photovoltaic arrays installed on all eligible and feasible municipal building rooftops. Installation of photovoltaic systems can make a considerable difference in overall carbon emissions by the city, as well as work to offset at least part of the city’s considerable energy costs. Given that solar panels are warranted for at least 25 years, and that solar panels continue to produce energy well past their warranted lifetimes, the city has the ability to reduce and control its energy costs for decades to come by installing photovoltaic systems wherever possible. Upfront costs for this investment can appear prohibitive, therefore we recommend looking into supplemental external funding options.”⁴⁸

As of the writing of this document, the City of Laramie has already successfully implemented various solar projects through the Rocky Mountain Power (RMP) Blue Sky Program. Successfully implemented projects thus far include 25 kW individual solar arrays at Fire Station 3, Laramie Community Recreation Center, the Ice and Event Center, and the Municipal Operations Center.⁴⁹ Additionally, in 2022, the City of Laramie received a silver designation from SolSmart,⁵⁰ a national program led by the International City/County Management Association and the Interstate Renewable Energy Council (IREC), which provides technical assistance to improve municipalities’ solar-friendly practices. This designation recognizes the City of Laramie’s efforts to expand their solar capacity through these projects. Additionally, in September 2021, the Laramie City Council passed Resolution No: 2021-62: Recognizing the City of Laramie’s Commitment to Solar Initiatives Through the Participation in the US Department of Energy’s SolSmart Program.⁵¹ This resolution affirmed the City of Laramie’s commitment to participate in the SolSmart program to facilitate the creation and use of solar energy throughout city processes.

⁴⁸ Environmental Advisory Committee, "Subcommittee Recommendations," pp.4

⁴⁹ City of Laramie, "Solar Laramie | Laramie, WY," Laramie, WY - Official Website | Official Website, accessed June 13, 2023, <https://www.cityoflaramie.org/1205/Solar-Laramie>.

⁵⁰ SolSmart, "Laramie," SolSmart, last modified 2022, <https://solsmart.org/designee/laramie>.

⁵¹ City of Laramie, *Resolution No: 2021-62: Recognizing the City of Laramie’s Commitment to Solar Initiatives Through Participation in the US Department of Energy’s SolSmart Program*, (City of Laramie, 2021), <https://www.cityoflaramie.org/DocumentCenter/View/21468/Reso-2021-62-SolSmart-Solar-Initiatives-9-21-21?bidId=>.

Installation of rooftop solar on city buildings has several benefits, including increasing the visibility of solar energy production in the community and the generation of clean, renewable energy for municipal use.

However, of the various strategies presented here, installation of solar projects tends to have a relatively high upfront cost. Strategies for external funding include but are not limited to:

1. **Grant Funding Opportunities:** Recently, an influx of federal funding opportunities, such as those from the Inflation Reduction Act (IRA) and Infrastructure Investment and Jobs Act (IIJA), are available to support local installation of solar infrastructure.⁵² Specifically, local governments are eligible through 2032 for a cash payment under the IRA equivalent to a 30% investment tax credit (ITC), for which they were previously ineligible as non-taxable entities.
2. **Bond Funding:** Local governments can borrow money at low interest rates through bond issues, which makes solar more economical than for individuals or businesses.⁵³
3. **Power Purchase Agreements (PPAs):** PPAs allow solar customers to overcome financial barriers of installing and maintaining solar systems. In a PPA, a property owner provides space for the solar system installation and subsequently agrees to buy the electricity produced at a predetermined rate.⁵⁴

Table 7 provides additional information regarding current and future emissions reduction and cost savings from solar installation. Estimate averages are calculated from numbers provided in proposals for the solar arrays at both the Laramie Recreation Center and Ice and Event Center. The yearly kWh savings received from the 25 kWh systems currently installed in Laramie averages to roughly 39,500 kWh per system, per year,⁵⁵ which is close to averages of other systems of that size across the country.⁵⁶ Across the 4 systems installed, kWh savings amount to roughly 158,000 kWh, or 83.12 MTCO₂e saved each year.

Table 7: Current savings estimates per 25 kW system.

Average Asset Life (years)	Asset Life Net Present Value (\$)	Utility Rate Inflation	First Year Effective Cost of Electricity (\$/kWh)	Monthly Utility Savings (\$)	Average Lifetime Utility Savings (\$)	Average Estimated Yearly Solar Production	Average Reduction in Emissions (MTCO ₂ e)
30	22284	4%	0.04	129.50	74,280	39,500	20.77

Assuming similar estimations for future expansion of solar arrays in Laramie, doubling solar kW capacity across municipal operations by the 2050 goal would reduce emissions by roughly an additional 83.12 MTCO₂e.

However, the majority of local governments, including Laramie, lack sufficient roof space to implement adequate on-site solar installations capable of powering all municipal operations. This gap can be

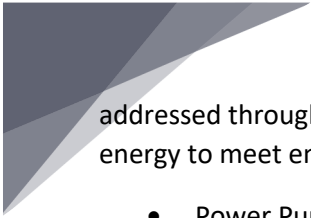
⁵² Climate Action Tracker, "Overview."

⁵³ ICLEI, "Clearpath Tool"

⁵⁴ EPA, "Customer Power Purchase Agreements," US EPA, last modified April 26, 2023, <https://www.epa.gov/statelocalenergy/customer-power-purchase-agreements#:~:text=In%20a%20Power%20Purchase%20Agreement,from%20a%20third%2Dparty%20investor>

⁵⁵ Creative Energies, *Solar Energy Proposal*, (Creative Energies, 2020).

⁵⁶ Sunwatts, "25 KW Solar Kits," SunWatts - Solar Kits, Solar Panels, Home Storage Batteries, accessed June 14, 2023, <https://sunwatts.com/25-kw-solar-kits/#:~:text=A%2025kW%20solar%20kit%20requires,the%20solar%20array%20facing%20South>



addressed through leasing of local land and/or off-site purchasing of renewable or low-carbon sources of energy to meet emissions reduction goals. These methods include:

- **Power Purchase Agreements (PPAs)/Renewable Energy Credits (RECs):** As mentioned above, PPAs allow municipalities to partner with third-party solar developers who install, finance, and maintain solar systems on municipal property. The municipality is then able to purchase the electricity generated by the solar panels at a predetermined rate. RECs are issued when one megawatt-hour (MWh) of electricity is generated and delivered to the electricity grid, which can be purchased to offset traditional energy usage.
- **Leasing:** Municipalities can lease land to solar developers who then install and operate solar systems on the leased space.
- **Regional Energy Projects:** Municipalities can collaborate with partners such as local utilities, neighboring municipalities, county, or private partners to develop and invest in renewable energy projects. This allows for distribution of cost and enhancement of renewable energy impact.

Additionally, the manufacturing and disposal of solar panels entail environmental considerations. Solar panels contain hazardous materials necessitating careful handling during disposal, and adherence to regulation under the Resource Conservation and Recovery Act must be followed to ensure that panels are safely disposed.⁵⁷ With an average lifespan of around 30 years, the City of Laramie should prepare and plan for proper disposal of solar panel materials over the course of the emissions reduction planning process.

Lastly, the expansion of solar systems in Wyoming is currently limited by a statewide 25 kW net metering cap. While 25 kW is sufficient for smaller projects, such as individual residences, it is insufficient for larger operations or facilities at a municipal or commercial scale. In their 20-Year Economic Diversification Strategy, the Economically Needed Diversity Options for Wyoming (ENDOW) initiative identified such net metering regulations as “barriers to growth for solar development” and recommended that the state of Wyoming “promote less restrictive net metering regulation.”⁵⁸ Therefore, while expansion of solar energy development in Laramie is currently limited by the net-metering cap, future changes to the regulatory landscape would potentially open up opportunities for expansion between now and 2050. Upon this type of change, Laramie would have opportunity to further reduce their municipal emissions through solar expansion, beyond what is outlined in this plan. See Table 8 for a summary of the solar installation and purchasing strategy.

⁵⁷ EPA, "End-of-Life Solar Panels: Regulations and Management," US EPA, last modified October 23, 2023, <https://www.epa.gov/hw/end-life-solar-panels-regulations-and-management>.

⁵⁸ ENDOW, *Transforming Wyoming: 20 Year Economic Diversification Strategy*, (Economically Needed Diversity Options for Wyoming (ENDOW), 2018), https://3706579a-b62e-451c-b576-31a8ca50ae57.filesusr.com/ugd/e4e133_2c1746a901754418be4d6fbd50b19f32.pdf, pp. 67,68

Table 8: Summary Table for Solar Installation and Purchasing Strategy.

Strategy	Benefits	Considerations for Implementation	Potential Emissions Impact
Solar Installation and Renewable/Low-Carbon Energy Purchasing	<ul style="list-style-type: none"> -Increased energy independence -Cost savings overtime -Less volatile energy market -Enhanced public image 	<ul style="list-style-type: none"> -Potentially high upfront costs -Intermittency of renewable energy generation/advances needed in storage for on-site generation -Environmental impact of production and recycling materials 	<ul style="list-style-type: none"> -Variable- up to ~7,322 MTCO₂e -Each 25 kw solar PV installation results in a reduction of ~20.77 MTCO₂e per year

Conclusions/Key Recommendations

See Table 9 below for a summary of key recommendations to reduce emissions from municipal buildings and facilities.

Table 9: Summary of recommendations to reduce emissions from buildings and facilities.

Phase 1 (2020-2030)	Phase 2 (2030-2040)	Phase 3 (2040-2050)
BF.1a: Take initial steps to retrofit municipal buildings to increase energy efficiency. Use the energy conservation measures from the Honeywell audit report to guide this process.	BF.2a: Continue retrofits to municipal buildings as old equipment ages out to maximize energy efficiency.	BF.3a: Complete energy conservation measures (ECMs) identified in the Honeywell audit to the greatest extent financially prudent to maximize energy efficiency in municipal buildings.
BF.1b: Continue installing solar PV systems for remaining and eligible municipal facilities.	BF.2b: Pursue additional renewable energy opportunities through utility and partner opportunities including power purchase agreements (PPAs), leasing, utility partnerships, and renewable energy credits (RECs).	BF.3b: Through a combination of on-site energy generation and off-site procurement, municipal facilities should be powered to the greatest extent feasible through renewable and low carbon energy sources.
	BF.2c: Stay informed of state-level policy changes and opportunities for renewable energy expansion.	



VEHICLE FLEET

Introduction

This section outlines strategies to reduce emissions from the City of Laramie's vehicle fleet and employee commute, including increasing efficiencies within the current vehicle fleet, upgrading to high efficiency, hybrid and electric vehicles (EVs) where possible, expanding EV infrastructure, and encouraging walking and biking in the City of Laramie to the greatest extent feasible. Again, this is not an exhaustive list of strategies; rather, these strategies best align with efforts already undertaken by the City of Laramie.

Emissions from the municipal vehicle fleet and employee commute account for the third and fifth highest emissions sectors for municipal operations, respectively. Emissions from the city vehicle fleet totaled 1015 MTCO₂e and employee commute produced an estimated 158 MTCO₂e in FY'22.

Upgrade/Replace Vehicle Fleet

Background and City Progress

Upgrading/replacing the current fleet vehicles is one of the targeted recommendations provided in the EAC recommendations to Laramie City Council. Specifically, the EAC recommendations to upgrade and replace the vehicle fleet were as follows:

"We recommend that the City of Laramie develop and implement a 'Green Fleet' purchasing policy wherein purchases of new fleet vehicles are mandated to be the lowest emission vehicle possible, with special effort made to purchase electric vehicles. The overall purpose of this policy is to reduce or eliminate (where possible) the dependence on gasoline and diesel engines in fleet vehicles. Such a policy has the benefit of providing more immediate return on investment. We recommend that the City of Laramie:

- *Prioritize upgrades for police vehicles* to more efficient technology, including hybrid engines, to reduce emissions while idling. Department of Energy (DOE) reports that fuel consumption by parked police cruisers was 21% of the total fuel consumed in one study.⁵⁹ Given the reduced costs of idling a hybrid engine compared to a gas engine, Ford motors claims that the savings from converting police vehicles with gas engines to hybrid vehicles will save \$3,500 per vehicle per year.⁶⁰
- *Consider purchasing Accessory Power Units* for all emergency vehicles to power equipment while stationary.⁶¹ Payback periods for accessory power packs are very short, with returns on investment being reached within just months to a few years because of fuel savings, according to DOE.⁶²

⁵⁹ Eric Rask, et al., Argonne National Laboratory, Final Report: Police Cruiser Fuel Consumption Characterization, for the Illinois State Toll Highway Authority (February 2013)

⁶⁰ <https://www.ford.com/police-vehicles/police-interceptor/hybrid-utility/calculator/>

⁶¹ For example, Moab, Utah has successfully implemented Stealth Modules in their police fleet. See <https://www.stealthmodules.com/> for more information.

⁶² Department of Energy, "Idling Reduction for Emergency and Other Service Vehicles," last modified May 2015, https://afdc.energy.gov/files/u/publication/idling_emergency-service_vehicles.pdf.

- Consider purchasing other fleet vehicles (e.g., cars and light-duty trucks, heavy-duty trucks such as garbage-collection trucks, buses, etc.) that are in line with this Green Fleet purchasing policy.^{63,64}

There are a variety of steps that can be taken to reduce emissions from the vehicle fleet. Reducing vehicle usage and optimizing driving routes can provide a viable alternative to upgrading existing vehicles where it is cost prohibitive. Additionally, maintaining the vehicle fleet through actions such as keeping tires inflated, changing oil, and replacing air filters, can make a small but meaningful difference in the efficiency of vehicle operation and subsequently reduce carbon emissions. Additionally, as noted in the EAC recommendations, accessory power units provide short payback periods while increasing energy efficiency.

Conversion to high efficiency, hybrid, and electric vehicles is perhaps the most impactful way to reduce municipal vehicle emissions. As of the writing of this document, the City of Laramie has begun bidding all cars and pickups with hybrid, electric, and idle reduction technology alternatives. 4 hybrid cruisers are currently in the fleet, with 8 on order. Additionally, there are currently two publicly available charging locations in the city, at both Fire Station 3 and the Bison Lot.

Implementation Considerations

EV and hybrid technology and markets will likely evolve significantly over the course of the next 30 years. EVs are available for purchase by most car manufacturers,⁶⁵ and municipalities are increasingly incorporating EVs into their fleets.⁶⁶ Previous recommendations for Laramie’s emissions reduction process from campus sustainability students suggested that the City of Laramie should first prioritize transitioning passenger cars and light trucks to EVs, given that these vehicles are currently a central focus of the market.^{67,68} As EV technology and markets advance for medium and heavy duty vehicles, the City of Laramie can investigate upgrading these types of vehicles in the future. See Table 10 for estimates of emissions reduction overtime resulting from converting the city vehicle fleet to electric vehicles. However, while this represents the maximum emissions reduction associated with conversion of the vehicle fleet, this plan recommends that the city gradually pursue upgrades to a combination of high efficiency, hybrid, and electric vehicles overtime, as old vehicles age out, alongside efficiency upgrades to existing vehicles, as is deemed to be financially accessible by City Council and city staff (see Table 11).

Table 10: Fuel and Emissions Reduction From 100% Conversion to EV Per Year.

Reduction in Gasoline Usage (gallons/year)	Reduction in Diesel Usage (gallons/year)	Reduction in Yearly Emissions (MTCO ₂ e)
51,245	55,199	1,015

There are several important considerations for the incorporation of electric and hybrid vehicles into the city fleet. These include but are not limited to:

⁶³ Electric and hybrid models of light- and heavy-duty trucks and buses are already available, with additional models nearing production. For commercial trucks, see <https://en.byd.com/truck/>. Ford will soon offer an electric F-150, <https://www.caranddriver.com/news/a28947992/electric-ford-f-150-2021-planned/>.

⁶⁴ EAC, “Subcommittee Recommendations,” pp. 4

⁶⁵ Ibid.

⁶⁶ Climate Mayors, "EV Purchasing Collaborative," Climate Mayors, last modified January 5, 2021, <https://climatemayors.org/ev-purchasing-collaborative/>.

⁶⁷ University of Wyoming Campus Sustainability Committee and University of Wyoming Haub School of Environment and Natural Resources, *Emissions Reduction Management Plan Outline*, (n.d), <https://www.cityoflaramie.org/AgendaCenter/ViewFile/Item/9283?fileID=12160>.

⁶⁸ Climate Mayors, "EV Purchasing Collaborative."

- Fuel usage: Through the use of electric drive technologies, hybrid electric vehicles typically use less fuel than conventional vehicles. Plug-in hybrid vehicles and all electric vehicles are both capable of running entirely on electricity, saving money on fuel costs.
- Costs: Purchase prices for hybrid or electric vehicles can be significantly higher than conventional vehicles. However, this is subject to change upon increases in production volumes and advancement of battery technology.
- Batteries: Electric vehicle batteries are estimated to last between 8 to 15 years, depending on factors such as climate, driving and charging patterns, battery cell chemistry and design, and the vehicle battery environmental thermal system.⁶⁹ Replacement of batteries outside of a warranty can present a significant expense. Furthermore, the recycling of electric vehicle (EV) batteries presents significant challenges, potentially contributing hazardous waste to the waste stream.⁷⁰ Implementation strategies must encompass comprehensive recycling protocols that address the unique composition and complex materials of EV batteries, incorporating specialized processes to mitigate environmental risks and ensure efficient resource recovery.

Primary concerns of EV and hybrid vehicle adoption into the fleet expressed by city stakeholders included uncertain resale values, maintenance costs, and range and performance limitations in severely cold weather conditions. Fleet upgrades should therefore be a gradual process implemented overtime, conducted upon periodic assessment of these factors.

Additionally, if the City of Laramie chooses to pursue upgrades of their vehicle fleet, this action should be accompanied by the development and expansion of EV charging infrastructure in Laramie. In 2022, an EV charging station was installed at Fire Station 3, marking the first EV station installed in Laramie and starting the process of expanding this infrastructure. There are various types of charging stations, all associated with different charging capacities for vehicles.⁷¹ A combination of various types will likely need to support the municipal fleet. Lastly, campus sustainability students have also recommended that Laramie should investigate becoming a member of the Climate Mayors EV Purchasing Collaborative, which is a coalition of municipalities to leverage their buying power and accelerate conversions of municipal fleets to electric vehicles.^{72,73}

Finally, as with any emissions reduction measure focused on electrification, attention to the carbon output of electrical use as opposed to gasoline or diesel is key. The state of Wyoming currently has the country's highest carbon intensity of 1,970.8 pounds of CO₂ per megawatt hour (MWh).⁷⁴ While subject to change overtime, any strategy that involves the conversion to electricity use should be approached with caution, as emissions from electricity use will then need to be accounted for through future inventories. However, according to the EPA, even accounting for emissions from electricity, research shows that an EV vehicle typically produces lower levels of GHGs than an average new gasoline car.⁷⁵ This difference could be even greater depending upon the proportion of renewable energy that supplies the electric grid, which again, is subject to

⁶⁹ Smith et al, "Predictive Models of Li-ion Battery Lifetime," National Renewable Energy Laboratory (NREL) NREL, last modified 2014, <https://www.nrel.gov/docs/fy14osti/62813.pdf>.

⁷⁰ Department of Energy. "Alternative Fuels Data Center: Batteries for Electric Vehicles." EERE: Alternative Fuels Data Center. Accessed January 31, 2024. https://afdc.energy.gov/vehicles/electric_batteries.html.

⁷¹ Climate Mayors, "EV Purchasing Collaborative."

⁷² City of Laramie, "Renewable Energy Projects | Laramie, WY," Laramie, WY - Official Website | Official Website, accessed May 15, 2023, <https://www.cityoflaramie.org/1175/Renewable-Energy-Projects>.

⁷³ Climate Mayors, "EV Purchasing Collaborative."

⁷⁴ U.S. Energy Information Administration. "Carbon intensity of U.S. power generation continues to fall but varies widely by state." Last modified 2022. <https://www.eia.gov/todayinenergy/detail.php?id=53819#:~:text=Wyoming%2C%20the%20state%20with%20the,intensity%20of%20their%20power%20g eneration.>

⁷⁵ EPA, "Electric Vehicle Myths," US EPA, last modified October 18, 2022, <https://www.epa.gov/greenvehicles/electric-vehicle-myths#Myth1>.

change as time goes on. This further emphasizes the need for adaptive management in the implementation of these strategies. These factors, among others, should be assessed on a yearly basis. Additionally, as future technologies evolve, such as hydrogen fuel cells, for example, it is possible that additional strategies will be available to reduce emissions from vehicles. See Table 11 for a summary of the strategy to upgrade the vehicle fleet overtime.

Table 11: Summary of Upgrade/Replace Vehicle Fleet Strategy.

Strategy	Benefits	Considerations for Implementation	Potential Emissions Impact
Integrate High Efficiency, Hybrid, and/or Vehicles to City Fleet	<ul style="list-style-type: none"> -Cost savings from lower fuel price overtime -Improved air quality -Increased energy independence 	<ul style="list-style-type: none"> -Higher upfront cost compared to gasoline/diesel vehicles -Investment in charging infrastructure -Uncertain resale values -Environmental impacts of EV batteries (production and recycling) -Potential range and performance limitations in severely cold weather conditions -Conversion of the fleet should happen gradually over time, as old vehicles age out, and upon periodic assessment of vehicle miles traveled, functionality, and upfront costs. 	<ul style="list-style-type: none"> -Up to ~ 1,015 MTCO_{2e}

Employee Commute


Employee commute accounts for the smallest percentage of municipal operations out of any category, totaling 158 MTCO_{2e}. While reducing emissions from this category to zero is highly unlikely, encouraging a reduction in employee vehicle miles traveled (VMT) to the greatest extent feasible would help to reduce these emissions. Encouraging walking and biking throughout the City of Laramie through measures such as maintaining sidewalks, plowing bike lanes in the winter, and more will support a reduction in VMT, especially on days with nicer weather where employees may prefer to walk or bike to their offices. The City of Laramie already employs several wellness initiatives to encourage walking and biking among staff, which should continue to receive support. Supporting biking and walking infrastructure has the added benefit of supporting community-wide, non-employee emissions reduction, as well.

Conclusions/Key Recommendations

See Table 12 for a summary of key recommendations to reduce emissions from both the municipal vehicle fleet and employee commute.

Table 12: Summary of recommendations to reduce emissions from municipal vehicle fleet.

Phase 1 (10 years)	Phase 2 (20 years)	Phase 3 (30 years)
VF.1a: Continue green purchasing policy for vehicles, pursuing high efficiency, hybrid, and electric vehicle upgrades, starting with passenger cars and light vehicles. Continuously assess factors such as maintenance costs, resale values, and range limitations to inform this process.	VF.2a: Continue transitioning of vehicle fleet. Begin investigating feasibility of transitioning medium/heavy duty vehicles to hybrid or electric. Continuously assess factors such as maintenance costs, resale values, and range limitations to inform this process.	VF.3: Complete upgrade of city vehicle fleet to a combination of high efficiency, hybrid, and electric vehicles as is feasible. Continuously assess factors such as maintenance costs, resale values, and range limitations to inform this process.
VF.1b: Identify and pursue additional opportunities for installation of EV charging infrastructure.		
VF.1c: Optimize driving routes of municipal vehicles to reduce vehicle miles traveled.		
VF. 1d: Ensure walkability and bikeability of city sidewalks and bike lanes. Plow bike lanes during winter months.		



WASTE FACILITIES



Introduction

This section outlines various potential strategies to reduce emissions from waste facilities in Laramie, including both the Laramie Landfill and the waste and wastewater treatment facility. The Laramie Landfill is the biggest source of emissions for the City of Laramie, accounting for roughly 84% of total emissions. In FY'22, 46,343 MTCO₂e were attributed to the landfill. There is an important distinction to make in how the ICLEI ClearPath calculator reports emissions for this sector. The tool estimates all future methane emissions from the mass of waste sent to the landfill in a fiscal year, attributing them all to that year. However, the emissions from that waste are not all emitted in the same year that they are landfilled; rather, they are spread out over the course of the waste's "lifetime" in the landfill. Therefore, saying that x amount of emissions are *attributed to* FY'22 in the inventory is not the same thing as saying that x number of emissions were *directly emitted* from the landfill that year. The latter is a number not yet measured by the City of Laramie, given that the landfill does not meet state or federal reporting requirements. However, this would be a useful number to obtain in the future, as it would enable City of Laramie staff to make determinations as to whether installation of landfill gas capture technology would be technically and economically feasible.

Especially for a municipality the size of Laramie, reducing emissions in this sector through either offsets or gas capture technology presents significant economic challenges. Additionally, the landfill itself contains waste from residents not only in Laramie but neighboring communities. In fact, approximately 48% of waste landfilled each year is generated within City of Laramie limits. This plan recommends that the scope and responsibility of waste emissions from the landfill should extend beyond the City of Laramie itself to a broader community-level effort in coordination with other waste contributors, such as Albany County and the University of Wyoming.

Given these current data and collaboration limitations, this section briefly explores preliminary scenarios for waste reduction measures and gas recovery technology at the landfill. This information provides an initial assessment of potential cost and emissions reduction, the feasibility of which should be more deeply assessed and investigated in future years.

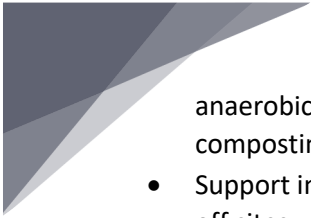
Waste Reduction and Diversion

Background/City Progress

While implementing technology to capture emissions at the landfill may be expensive, an early step is to actively work to reduce the amount of waste that is sent to the landfill in the first place. Specifically, diverting waste through expansion of recycling and composting programs throughout Laramie could help to make an important impact on emissions. In their recommendations to City Council, the Environmental Advisory Committee including the following regarding waste reduction and diversion:

“REDUCE EMISSIONS FROM SOLID WASTE MANAGEMENT: A large amount of the city's emissions are derived from solid waste management. We suggest the following as actions to reduce these overall associated emissions:

- Continue the current green waste program and expand it to include community composting solutions. Methane emissions could be lowered by reducing the quantity of organic matter that is decomposing in



anaerobic conditions when buried in the landfill.⁷⁶ A secondary benefit of diverting organic matter to composting is conserving landfill space.

- Support increasing recycling opportunities as a way to reduce landfill usage. Explore possibility of drop-off sites where citizens can sort their own recycling, providing increased marketability to recycling companies and increased accessibility to apartment dwellers.”⁷⁷

In FY’22, the City of Laramie reported recycling 4.04 tons of batteries, 23.52 tons of e-waste, 147.36 tons of metal, and 35.39 tons of glass. Additionally, roughly 1,359.61 tons of single stream recycling was shipped to a materials recovery facility in Denver. Regarding composting efforts, 4,728.14 tons of green waste was diverted for use in the compost program or given away as mulch, and 1,971.93 tons of compost was sold or given away to the public, businesses, or organizations in the community.

Implementation Considerations

If Laramie chooses to pursue a community-wide mitigation plan, given the community-wide nature of waste generation to the landfill, further strategies to reduce waste should be explored as part of a broader, community-wide effort to achieve community emissions reduction and climate action. A potential future step would be to develop a supplemental waste reduction strategy or plan, one that would supplement and build upon the goals outlined in this plan. Two examples of action from nearby communities include Fort Collins, CO and Teton County, WY.

Fort Collins, CO

The City of Fort Collins, CO was an early trailblazer in municipal waste reduction and diversion practices, adopting a goal to divert 50% of its waste from landfills in 1999. After reaching this goal, the city instituted its *Road to Zero Waste Plan*, which outlines their plan to reach zero waste by 2030. The waste reduction goals specifically adopted by the Fort Collins City Council in 2013 are 75% diversion by 2020 with 3.5 pounds per day per capita of waste generation, 90% diversion by 2025 with 2.8 pounds per day per capita of waste generation, and zero waste by 2030. Their zero waste programs are based on the premise that “waste generation represents an economic inefficiency that can be eliminated.”⁷⁸ The plan argues that there are many benefits that will result from Fort Collins pursuing zero waste. These include reducing greenhouse gasses that will address the urgency of climate change; providing local jobs, income, and wealth creation from conserving and using resources locally rather than landfilling them; helping businesses and residents be more sustainable and efficient; promoting local food cultivation and consumption by putting valuable nutrients back into the soil; saving energy and producing local clean energy; providing a “green” marketing edge for local businesses; protecting the health of residents; decreasing irrigation water use by applying compost to soils; reducing use of toxic products; and protecting biodiversity and open space through increased use of compost products and reducing the need for mining. Finally, key strategies included in the plan to reach net zero include culture change; reinvesting resources in the local economy; universal recycling; prohibiting materials from landfilling including construction and demolition materials, yard trimmings, and food scraps; composting organic materials; reduce and reuse; product stewardship; waste to clean energy; funding through recycling investment fees on waste hauling services or waste shipped for landfilling to generate revenue needed to fund new city initiatives; and regional

⁷⁶ EPA, “Basic Information About Landfill Gas,” last modified February 12, 2024, <https://www.epa.gov/lmop/basic-information-about-landfill-gas>.

⁷⁷ EAC, “Subcommittee Recommendations”, pp. 5

⁷⁸ City of Fort Collins, “Zero Waste || Zero Waste,” Official Web Site of the City of Fort Collins, accessed January, 2024, <https://www.fcgov.com/zerowaste>.

cooperation.⁷⁹ Since the passing of the 2013 plan, Fort Collins has built a commercial composting facility, a recycling plant to accommodate construction and demolition materials, and a warehouse for the sale of reusable products.⁸⁰

Table 13: Example Strategies from the Fort Collins Road to Zero Waste Plan.

Road to Zero Waste Plan, City of Fort Collins, CO ⁸¹
Provide leadership by placing recycling bins in tandem with all city-serviced public trash bins and ensure that comprehensive signage is posted about what to recycle.
Once “all compostable” organics recycling services are readily available, add composting bins in public areas where food is sold.
Expand and strengthen programs to educate residents, businesses and visitors about how and where to reduce, reuse and recycle in the city.
Implement a comprehensive, community-based social marketing program.
In the hierarchy of waste diversion actions, promote “reduce and reuse” as first-line actions, followed by “recycle, compost or redesign the rest”.
Adopt recycling investment fees on waste hauling services or waste shipped for landfilling to generate revenue needed to fund new city initiatives.

Teton County, WY

In 2014, Teton County Commissioners unanimously adopted a zero-waste resolution, in which zero waste is defined as “a whole systems approach that aims to change the way materials flow through society, resulting in no waste” and as “a conceptual ideal rather than a hard target, accepted as a waste diversion goal of 90% or better.”⁸² Guiding principles in the resolution are managing resources instead of waste, conserving natural resources through waste prevention and recycling, turning discarded resources into jobs and new products instead of trash, promoting products and materials that are durable and recyclable, discouraging products and materials that can only become trash after their use, and using education as a tool to maximize community engagement. In Teton County, all recycling materials are brought to a community recycling center, where recycling crew members remove trash and other contaminants by hand, leading to a contamination rate of less than 1%.⁸³ The Integrated Solid Waste and Recycling (ISWR) division in the county also offers municipal yard waste composting services at the transfer station in Jackson. To promote community partnerships and engagement, ISWR offers community partnership awards on an annual basis, which include funding to programs that offer education and outreach programming, events, and projects related to minimizing waste and conserving resources. Currently, Teton County diverts 34% of their waste, however they are striving for an interim goal of 60% diversion by the year 2030.⁸⁴ Strategies to reach this goal as identified in the Teton County Zero Waste Annual report include pay as you throw fees, expanding food waste composting, diverting construction and demolition materials, green purchasing initiatives, a beverage container recycling ordinance,

⁷⁹ Zero Waste Associates, *Road to Zero Waste Plan*, (City of Fort Collins, 2013), https://www.fcgov.com/recycling/pdf/RoadtoZeroWasteReport_FINAL.pdf

⁸⁰ Lesley Lammers, "Will These 10 U.S. Cities Achieve Zero Waste?," Earth911, last modified January 14, 2016, <https://earth911.com/business-policy/will-these-10-u-s-cities-achieve-zero-waste/>.

⁸¹ Zero Waste Associates, “*Road to Zero Waste Plan*”

⁸² Teton County Board of Commissioners, *Resolution Adopting Zero Waste as a Guiding Principle and Supporting the Creation of a Zero Waste Plan*, (2014), <https://www.tetoncountywy.gov/DocumentCenter/View/977/Signed-Zero-Waste-Resolution---September-16-2014-PDF>.

⁸³ Teton County Recycling, "Road to Zero Waste," How Do You RRR, last modified September 22, 2015, <https://www.roadtozerowastejh.org/road-to-zero-waste/>.

⁸⁴ Ibid.

required separation of corrugated cardboard for recycling, an annual road to zero waste report card, and recognition programs for waste diversion efforts.⁸⁵

Laramie Next Steps

As a first step, it is important for the City of Laramie to lead by example.⁸⁶ This could be done through equipping all municipal offices and facilities, including parks, with consistent signage and recycling bins. Additionally, collection and analysis of waste characterization data from the landfill would provide a baseline to identify opportunities for waste reduction and diversion and could serve as a framework for future waste reduction and diversion strategies. In FY’22, for example, 1,359.61 tons of single stream recycling were shipped to Denver, however other actors in the community, including the University of Wyoming, have their own recycling programs. Further data collection and analysis is needed to determine a waste diversion rate, which would provide a baseline to set waste diversion targets. Setting targets to increase this diversion rate, through recycling and expanded organic waste composting beyond green waste and biowaste, would be an important first step toward reducing the amount of waste landfilled each year. See Table 14 for a summary of the waste diversion and reduction strategy.

Table 14: Summary Table for Waste Reduction and Diversion Strategy.

Strategy	Benefits	Considerations for Implementation	Potential Emissions Impact
Waste Reduction and Diversion	<ul style="list-style-type: none"> -Increased efficiency/reduced waste -Extended lifespan of landfill -Saves economic value of materials otherwise sent to landfill 	<ul style="list-style-type: none"> -Lack of local sorting or processing facilities -Single stream recycling currently shipped to Denver -Limited scope of authority over all waste generation sources 	<p>Variable depending on scope</p> <p>Up to 48% of MTCO₂e from the landfill can be traced to waste generated in Laramie city limits. Waste generated from municipal operations exclusively is likely significantly less</p>

⁸⁵ Teton County Integrated Solid Waste and Recycling, *Strategies on the Road to Zero Waste: Annual Report*, (2021), <https://www.tetoncountywy.gov/DocumentCenter/View/21100/Road-to-Zero-Waste-Annual-Report-2021?bidId=>

⁸⁶ EPA, "Examples and Resources for Transforming Waste Streams in Communities (#1—50)," US EPA, last modified June 26, 2023, <https://www.epa.gov/transforming-waste-tool/examples-and-resources-transforming-waste-streams-communities-1-50>.

Landfill Gas Collection and Energy Recovery

Background/City Progress

Landfill emissions, predominantly methane resulting from organic waste decomposition, contribute significantly to the City of Laramie's inventory due to municipal ownership, which entails the inclusion of all landfill emissions in the city's inventory. Landfill methane, however, can be a valuable energy source by drilling wells to capture and collect it at a central point. At some landfills, the gas is simply burned in a flare, but it is also possible to use it to generate electricity, industrial process heat, and/or to purify and sell it to the natural gas pipeline network. Using landfill methane can improve the economics of a landfill and displace fossil fuels that would have had to be burned to provide that energy. Because methane is a potent GHG, capturing it additionally has the potential for substantial emissions reductions. The Laramie Landfill currently does not utilize a system for methane capture.

Implementation Considerations

Landfill gas capture system configuration can vary widely depending on chosen technology, with various levels of efficiency associated with generator type. All inputs for estimates below are obtained from the ICLEI ClearPath calculator.

Approximate costs for capture system types include costs for the electricity generation equipment, typical gas compression and treatment systems appropriate to the technology, and interconnection equipment. Collection system costs are based on a typical 40-acre system; however, costs can range significantly depending on specific configuration and site conditions. The default values for capital and operation and maintenance (O&M) costs were derived from the EPA Landfill Methane Outreach Program Project Development Handbook, Chapter 4.⁸⁷

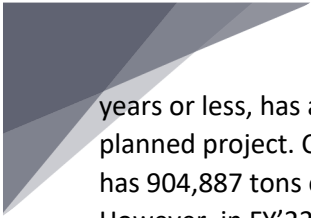
Table 15 provides estimated characteristics, outputs, and outcomes of a gas collection system at the Laramie Landfill, generated using the inputs above, as well as the fact that the landfill emitted roughly 2,524.5 metric tons of methane (CH₄) in FY'22.

Table 15: Estimations of emissions reduction and costs associated with installation of gas capture technology.

Name	Value for Gas Collection System
CH ₄ Captured per Year (MT)	1,229.6
Landfill Emissions Reduced (MTCO ₂ e/year)	34,430
Volume of Methane Captured (standard cubic foot (SCF)/Year)	6.5634 x 10 ⁷
Gas Capture Rate (SCF/Minute)	124.87
System Size (kW)	37.623
Total Capital Cost (\$)	206,043
Annual O&M Costs (\$/year)	34,340

The federal EPA Landfill Methane Outreach Program (LMOP) identifies candidates for landfill gas (LFG) energy projects, with candidate landfills defined as those “currently accepting waste or have been closed for 5

⁸⁷ EPA, *Landfill Methane Outreach Program Project Development Handbook*, (Environmental Protection Agency, 2021), <http://www.epa.gov/lmop/publications-tools/handbook.html>.



years or less, has at least 1 million tons of waste, and does not have an operational, under-construction, or planned project. Can also be designated based on actual interest by the site.”⁸⁸ The Laramie Landfill currently has 904,887 tons of waste in place, meaning that it is below the threshold to be considered as a candidate. However, in FY’22, 43,287.18 tons of waste were generated, meaning that over the course of the emissions reduction planning process through 2050, the landfill will exceed the 1 million tons of waste threshold. In determining the potential of a future LFG project in Laramie, a feasible next step would be to connect with the EPA LMOP to obtain necessary data and determine whether Laramie would meet the technical criteria for such a project, as well as to receive more specific cost estimates. Partnership with this program will include additional reporting and administrative requirements for the City of Laramie, meaning that this strategy should only be pursued once the landfill has more waste in place and is therefore more likely to be a candidate for an LFG system.

Additionally, there are a number of emergent pilot projects demonstrating gas collection systems for small landfills.⁸⁹ While this technology is still in its early stages, pilot projects in this realm could provide a viable alternative to traditional gas capture systems if the City of Laramie deems them to be too cost prohibitive. Ultimately, methane collection technology feasibility will need continual reassessment over the course of the course of the emissions reduction planning process.

Consideration of emissions reduction strategies for waste facilities in relation to municipal goals is complicated by the community-wide (and beyond) nature of waste generation. While the City of Laramie owns the landfill, a small percentage of waste landfilled is generated from municipal operations. Additionally, technical expertise is required to assess and collect waste characterization data, as well as strategies to expand recycling and composting services by the City of Laramie. Therefore, the completion of a waste reduction strategy or plan to supplement this document would be most effective in helping the City of Laramie to meet its emissions reduction goals.

Additionally, for a variety of reasons, prioritization of emissions reduction strategies should first emphasize waste reduction and diversion over gas capture technology. First, the Laramie Landfill is currently too small for a gas capture system to be technically feasible, though as noted in the recommendations below, this is subject to change as waste in place increases overtime, thus producing more gas. Second, the financials of a gas capture system would present a large cost for municipal operations, especially for a municipality the size of Laramie. However, again, this is subject to change as technology advances, funding opportunities become available, and/or pilot projects targeting small landfills become more viable. Last, the City of Laramie should avoid inadvertently incentivizing the production of more waste through the installation of a gas capture and utilization system. While captured LFG has economic value, reducing waste landfilled to the greatest extent possible before implementing such a system is the most environmentally sustainable option in line with the recommendations from EAC and other recommendations outlined within this plan. See Table 16 for a summary of the landfill as capture strategy.

⁸⁸ EPA, "LMOP Landfill and Project Database," US EPA, last modified August 3, 2023, <https://www.epa.gov/lmop/lmop-landfill-and-project-database>.

⁸⁹ WasteDive, "Qnergy Pilot to Demonstrate Gas Collection System for Small Landfills," Waste Dive, last modified August 30, 2023, <https://www.wastedive.com/news/qnergy-small-landfill-methane-gas-electricity-weber-county-utah/692406/#:~:text=Federal%20requirements%20updated%20in%202021,gas%20collection%20and%20control%20system>

Table 16: Summary Table for Landfill Gas Capture Strategy.

Strategy	Benefits	Considerations for Implementation	Potential Emissions Impact
Landfill Gas (LFG) Capture	<ul style="list-style-type: none"> -High impact on emissions locally -Economic value created through captured LFG 	<ul style="list-style-type: none"> -The Laramie landfill is currently too small to be considered a candidate for an LFG system with current technology -High upfront and maintenance costs -While currently not technically feasible, installation of an LFG system should be readdressed upon increased waste in place (at least meeting LMOP minimum of 1,00,000 tons) 	<ul style="list-style-type: none"> Variable depending on type of project LFG systems are estimated to reduce emissions from landfills anywhere between 60-90% of MTCO₂e

Wastewater and Water Treatment Facilities

The water and wastewater treatment facility in Laramie is responsible for a relatively small proportion of total municipal emissions, equaling 270 MTCO₂e. All emissions produced from electricity usage at the facility is accounted for under the Buildings and Facilities category. The wastewater treatment plant should be assessed for potential installation of a solar system, much like those already installed at the municipal operations center, community recreation center, ice and events center, and fire station 3. This project would help to reduce emissions generated at the plant through electricity usage.

Therefore, emissions accounted for in this category specifically are a result of water treatment and discharge. Specifically, process nitrous oxide (N₂O) from treatment, and process N₂O from effluent discharge to rivers and estuaries. While small, these emissions will need to be considered in meeting municipal emissions reduction goals.

Conclusions/Key Recommendations

See Table 17 for a summary of key recommendations to reduce emissions from municipal solid waste.

Table 17: Summary of recommendations to reduce emissions from municipal solid waste facilities.

Phase 1 (10 years)	Phase 2 (20 years)	Phase 3 (30 years)
WF.1a: Ensure that recycling bins are available in all municipal buildings.	WF.2a: Implement strategies of waste reduction strategy or plan.	WF.3a: Prioritize waste reduction and diversion strategies.
WF.1b: Collect waste characterization data to identify opportunities for waste diversion and to refine landfill emissions estimates.	WF.2b: Upon addition of new cell to the landfill and at least 1 million tons of waste in place, investigate partnership with the Environmental Protection Agency’s Landfill Methane Outreach Program. Re-assess feasibility of landfill gas capture system, including metrics of direct yearly emissions from the Laramie Landfill.	WF.3b: Continually investigate cost and opportunity for gas capture technology at the landfill, including pilot projects targeted to small landfills.
WF.1c: Develop a waste reduction strategy or plan with established waste diversion goals in accordance with the Environmental Advisory Committee’s emissions reduction benchmarks.	WF.2c: Explore opportunities to expand composting facilities.	

CARBON SEQUESTRATION AND OFFSETS

Introduction

The previous sections of this plan have provided direct suggestions for emissions reduction in each of the major emissions categories. Inevitably, over the course of implementing projects to meet emissions reduction goals, there will likely be remaining municipal emissions at the end of the process that cannot be removed. See each of the above sections for places in which emissions may persist after implementing recommended reduction measures, including in the buildings and facilities and employee commute sectors. As such, sequestration of carbon from the atmosphere by greenspace in the City of Laramie, as well as other offset options, can serve as supplementary strategies to those previously outlined.

Sequestration

Background/City Progress

Carbon sequestration is “the incorporation of atmospheric carbon into plants, soils, and water.”⁹⁰ However, calculation of carbon sequestration can be a comprehensive and difficult process due in part to data collection requirements, such as location and size of forested properties, species composition, estimates of forest cover as well as complex methodologies of estimation.⁹¹

However, general estimates of sequestered carbon from greenspace include:

- Roughly 0.060 metric tons of carbon is sequestered per urban tree planted.⁹²
- Wetlands can store anywhere from 81 to 216 metric tons of carbon per acre, depending on type and location.⁹³
- 1 metric ton of biochar is estimated to offset roughly 2.93 metric tons of CO₂ when applied to soils.⁹⁴

The City of Laramie has already made progress toward expanding and preserving greenspace, including implementing standards for sustainable landscaping. Additionally, EAC recommended the following strategies to Laramie City Council:

- When landscaping and reclaiming disturbed areas, we recommend choosing plant species strategically for carbon storage capacity. Consider native species with deep root systems, including perennial grasses, which pump CO₂ from the atmosphere and store biomass underground in their roots systems.
- Continue and expand opportunities for community gardens.

⁹⁰ A. Ravin and T. Raine, *Best Practices for Including Carbon Sinks in Greenhouse Gas Inventories*, (EPA, n.d), <https://www3.epa.gov/ttnchie1/conference/ei16/session3/ravin.pdf>

⁹¹ Ibid.

⁹² EPA, "Greenhouse Gases Equivalencies Calculator - Calculations and References | US EPA," US EPA, last modified May 30, 2023, <https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references>.

⁹³ Texas A&M AgriLife Extension, "Carbon Storage and Credits | Wetland Economic Benefits for Landowners," last modified July 1, 2015, <https://valuwetlands.tamu.edu/land-use-goals-and-resources/carbon-storage-and-credits/>.

⁹⁴ Kelli G. Roberts et al., "Life Cycle Assessment of Biochar Systems: Estimating the Energetic, Economic, and Climate Change Potential," *Environmental Science & Technology* 44, no. 2 (2009), doi:10.1021/es902266r.

These actions would contribute to sequestration of carbon in the atmosphere. Estimations of sequestered carbon should be considered in future emissions inventories, since, as detailed above, calculations will require additional data collection. See Table 18 for a summary of the sequestration strategy.

Table 18: Summary Table for Sequestration Strategy.

Strategy	Benefits	Considerations for Implementation	Potential Emissions Impact
Carbon Sequestration (Greenspace)	-Aesthetic value -Mental health benefits to residents -Locally-based solution	-Acreage limitations of land under municipal authority -Additional data collection necessary to accurately calculate emissions offset	-Exact estimates depend on specific vegetation type and land cover

Lastly, a distinction should be noted between carbon sequestration via uptake from greenspace and carbon capture, utilization, and storage (CCUS) technology. Increasingly at the state policy level in Wyoming, carbon sequestration can refer to the utilization of CCUS technology, which is defined as the “process in which carbon is captured from industrial processes and is either utilized by turning the carbon into a new product or stored by injecting the carbon into a storage site, usually underground in a geological formation.”⁹⁵ Given that this is still an emerging industry and technology, with proposed projects generally occurring on a larger, industrial scale, this plan does not include a specific recommendation regarding CCUS technology at this time. However, nothing in this plan would preclude the City of Laramie from integrating such technology into consideration of their greenhouse gas (GHG) inventory and associated emissions reduction strategies were it to become viable in the future.

Offsets

A carbon offset is defined by the International Carbon Offset and Reduction Alliance as “a mechanism used to compensate for corporate or individual carbon footprints through the purchase of carbon credits issued by accreditation standards to projects that remove greenhouse gas emissions from the atmosphere or avoid generating the emissions in the first place. Each credit is equal to one ton of CO₂e that has not been emitted. Once purchased, the credit is then retired through an internationally recognized and publicly viewable registry.”

⁹⁶

Carbon offsetting is not a perfect process, and has oftentimes been mired in controversy.⁹⁷ Problems associated with carbon offsets include double counting (meaning more than one party claims the same carbon credit), non-additionality (the project would have happened anyway), impermanence (such as trees dying after a number of years), and leakage (projects superficially reduce carbon but ultimately result in higher emissions

⁹⁵ Wyoming Energy Authority, "Next Generation Energy," Wyoming Energy Authority, last modified August 1, 2023, <https://wyoenergy.org/portfolio/next-generation-energy/>.

⁹⁶ ICROA, "Accrediting Best Practice in Carbon Offsetting," ICROA, last modified May 19, 2023, <https://icroa.org/>.

⁹⁷ The Guardian, "Revealed: More Than 90% of Rainforest Carbon Offsets by Biggest Certifier Are Worthless, Analysis Shows," The Guardian, last modified January 18, 2023, <https://www.theguardian.com/environment/2023/jan/18/revealed-forest-carbon-offsets-biggest-provider-worthless-verra-aoe>.

elsewhere).⁹⁸ These issues combine to mean that voluntary carbon offsetting has lost accountability in recent years. Therefore, in taking steps toward emissions reduction goals, the City of Laramie should prioritize reduced energy use and avoided carbon emissions, as well as local sequestration through greenspace initiatives. As a result, this plan does not recommend purchasing of offset credits at this time, at the very least not in the near term. In the case of pursuing a carbon offset project in the future, projects must be real, verified, permanent, and additional in nature.

See Table 19 for a summary of the offset strategy.

Table 19: Summary Table for Offset Strategy.

Strategy	Benefits	Considerations for Implementation	Potential Emissions Impact
Offsets	-Offsets emissions unable to be eliminated or sequestered locally	-Emissions reduction is often outsourced and not local -Credibility/verifiability concerns of offset purchasing programs -Generally meant for larger entities -City of Laramie should first prioritize reduced energy use and avoided carbon emissions	Variable

⁹⁸ Sharpe Pritchard, "The Role of Offsetting in Local Government Climate Change Plans," Sharpe Pritchard, last modified January 24, 2023, <https://www.sharpepritchard.co.uk/latest-news/the-role-of-offsetting-in-local-government-climate-change-plans/>.



Key Conclusions/Recommendations

See Table 20 below for a summary of recommendations regarding the sequestration and offsetting of remaining municipal emissions.

Table 20 Summary of recommendations for sequestration or offsetting of municipal emissions.

Phase 1 (10 years)	Phase 2 (20 years)	Phase 3 (30 years)
SO.1: Include calculated estimate of emissions sequestered from greenspace into yearly emissions inventories.	SO.2: Identify opportunities for greenspace expansion and carbon sequestration in city limits.	SO.3: For any remaining emissions after all prior recommendations have been implemented, investigate, and implement sequestration and offsets as needed to reach emissions reduction goals.

An aerial photograph of a large industrial building with a complex, multi-gabled roof made of corrugated metal. Several large rectangular solar panels are mounted on the roof. The building is surrounded by a parking lot with a few vehicles, including a white van and a white truck. The overall scene is in a semi-arid or desert environment.

IMPLEMENTATION



Introduction

This section provides recommendations for the implementation of the strategies outlined in previous sections of the plan and pertain to overarching coordination, partnership, and tracking of projects and metrics relevant to achieving the municipal emissions reduction goals.

Recommendation 1: Hire a Full-Time Sustainability Coordinator Position at the City

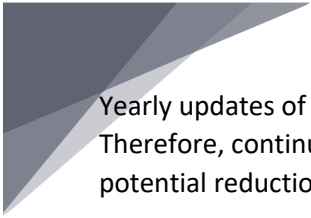
Coordination and implementation of all activities associated with reaching emissions reduction goals requires the attention of a full-time City of Laramie employee. Upon approval of this plan, a sustainability coordinator should be hired to take the first steps necessary to achieve city goals. Specifically, this position should be responsible for coordinating sustainability projects at the city, including but not limited to, municipal building retrofits, development of solar systems and investigation of other renewable energy opportunities, installation of EV charging stations, upgrading municipal vehicles, landfill waste reduction and diversion projects, and annual GHG inventories. The position should work to expand existing and develop new partnerships for the City of Laramie regarding sustainability projects, including engagement with Albany County, private entities, University of Wyoming, and other community stakeholders. Lastly, the sustainability coordinator should provide regular updates to City of Laramie committees and elected officials regarding progress toward emissions reduction goals.

Recommendation 2: Regularly Report and Track Progress Toward Emissions Reduction Goals

To reliably track progress toward emissions reduction goals, the City of Laramie must develop a consistent and easily accessible platform through which to assess and track progress of emissions reduction strategies. At minimum, this should include an annual report to City Council on emissions reduction progress and metrics (specifically, those included in the GHG inventory). A dashboard-style website dedicated to reporting emissions-related data and progress could support this as a mechanism to provide transparent information to interested members of the public. Data metrics to be tracked include electricity usage from municipal buildings (collected from utility bills), solar kWh generated, annual fuel use of the vehicle fleet, recycling metrics and diversion rates from the landfill, specific waste characterization data, and emissions reduction progress relative to baseline inventories.

Recommendation 3: Continue Peer Networking Through Engagement with ICLEI and the MT 2030 Mountain Towns Solutions Project

Peer networks provide essential information-sharing opportunities to investigate barriers and opportunities associated with local climate action. Membership with ICLEI has provided the City of Laramie with essential tools to develop GHG emissions inventories and take steps necessary to reducing these emissions.



Yearly updates of the GHG inventory will be essential to tracking progress towards the emissions reduction goal. Therefore, continued engagement with ICLEI is important to continuing to track these data and forecast for potential reduction strategies.

Additionally, MT 2030 provides essential information to Laramie specific to mountain communities. Many communities across Colorado, Utah, Montana, etc. have made carbon neutrality declarations that are either similar to or more aggressive than the City of Laramie's declaration to achieve carbon neutrality by 2050. These groups are workshopping various strategies and sharing essential information on their lessons learned through the MT 2030 Solutions Project. Continued engagement with this group will not only allow learning from others who have engaged in similar emissions reduction planning, but also to share opportunities and best practices learned through its own work to other communities across the Intermountain West, including in Wyoming.

If hired, the sustainability coordinator position should serve as the city-appointed liaison to these groups.


Recommendation 4: Continue to Engage with Students at the University of Wyoming

Students have thus far been an essential resource and driver to the City of Laramie's sustainability efforts, including conducting the City of Laramie's first municipal emissions inventory and creating initial outlines and recommendations for the emissions reduction plan. In pursuing carbon neutrality, there are many opportunities to continue engagement with students and allow opportunities to bolster city capacity through university resources. Potential projects emerging from this plan include investigation of opportunities to reduce waste sent to the Laramie Landfill and estimating carbon sequestrations from City of Laramie greenspace.

Recommendation 5: Adaptive Management

Nothing in this plan is set in stone; goals and emissions strategies are subject to many factors, including economic up and down-turns, changes in population, technology breakthroughs, natural disasters, and policy changes. Therefore, flexibility is an integral part of this process. The City of Laramie should plan for yearly updates to Laramie City Council outlining progress toward emissions reduction goals and adjustments to targets, proposed strategies, and project timelines.

The implementation of this plan should be a dynamic and iterative process that allows the City of Laramie to continually assess and adjust strategies based on new information and changing conditions. As mentioned above, regular monitoring and data collection on key emission sources, such as energy consumption, vehicle fuel usage, waste management, and sequestration will provide essential insights into progress and areas needing attention. Additionally, conducting periodic reviews and evaluations of implemented measures will help identify successes, challenges, and opportunities for improvement. Based on these assessments, adjustments and refinements to strategies can be made to optimize effectiveness and ensure the plan remains relevant and impactful. Furthermore, fostering stakeholder engagement and collaboration throughout the process is vital for garnering support, gathering diverse perspectives, and fostering innovation. By embracing adaptive



management principles, the City of Laramie can navigate the complexities of emissions reduction with agility, resilience, and a commitment to continuous improvement.

Recommendation 6: Community and Partner Engagement

Implementation priorities and actions should be informed not only by the City of Laramie, but also by other stakeholders throughout the Laramie community. Essential partners to this process include the Alliance for Renewable Energy (ARE), the Environmental Advisory Council (EAC), the Laramie Climate Action Planning Coalition (LCAPP), Albany County, and the University of Wyoming. Members from all groups should be updated and invited to engage wherever possible continuously throughout the implementation process of this plan. Additionally, outreach needs to extend to the general public and Laramie taxpayer and facilitate public comment and feedback on projects identified for implementation of this plan. Potential options for public outreach include focus groups, workshops, social media outreach, community surveys, and/or regular updates to the emissions landing page on the municipal website.

Previous recommendations provided to City Council by the Environmental Advisory Committee Subcommittee on Emissions Reduction to implement outreach in the community included the following:

“IMPLEMENT OUTREACH: We recommend that the City of Laramie initiate and support an “Emissions Reduction Community Network” to provide inspiration, guidance, and resources for emission reduction efforts by citizens and businesses. Specifically, we recommend that Laramie:

- *Create a landing page* on the municipal website where community members can access resources regarding the status of emissions in Laramie, steps they can take to reduce their emissions, and steps the city has taken to reduce emissions.
- *Facilitate group photovoltaic buys.* We recommend that Laramie help interested community members find one another and invite bids from solar installers. The equipment and installation for solar energy can be cost-prohibitive to some, but group solar purchases where equipment and labor are contracted in bulk can reduce the overall cost of photovoltaic systems.
- *Create a marketing campaign to engage community members.* We recommend establishing a marketing campaign to reach the general public to educate the community and increase citizen buy-in regarding efforts for emissions reduction. Campaigns may include information on food waste reduction, effective composting, recycling, and energy efficiency. By partnering with the University of Wyoming, we can leverage relevant courses in marketing and student groups to facilitate development of a campaign as part of course content to minimize cost and maximize community benefit.”⁹⁹

⁹⁹ EAC, “Subcommittee Recommendations” pp. 3



CONCLUSION



Conclusion

Below is a summary of recommendations included in the plan, divided into phases of implementation. Phase 1 recommendations are intended to be implemented in the first ten years of the net zero goal (2020-2030) and include actions that represent “low-hanging fruit” for emissions reduction, such as energy efficiency measures, as well as needed research and data collection, such as the development of a waste reduction and diversion strategy. Phase 2 and 3 recommendations, representing 2030-2040 and 2040-2050, respectively, require longer timeframes for implementation due to factors such as needed technological innovation or logistical and cost barriers. Additionally, some recommendations are designed to be prioritized first chronologically over others, such as waste reduction over gas capture technology, or local emissions reduction and sequestration projects over offset measures. Recommendations were selected based on compatibility with existing City of Laramie initiatives and resolutions, as well as prior recommendations made by the Environmental Advisory Committee and campus sustainability students from the University of Wyoming.

Achieving municipal emissions reduction goals for City of Laramie municipal operations will be challenging. However, with continued dedication and support from city staff and the broader Laramie community, innovative and proactive strategies can develop a more sustainable and climate-friendly community. The City of Laramie can both be a leader in emissions reduction, as well as learn from existing efforts from surrounding communities. The strategies outlined in this plan provide opportunities not only to reduce emissions, but also to enhance cost savings, prepare for incoming funding opportunities, and enhance community resilience in the face of transitioning energy economies and climate change impacts. By engaging with and committing to emissions reduction goals, the City of Laramie is positioning itself as a sustainability leader, while simultaneously honoring the commitment and advocacy work already completed by members in our community.

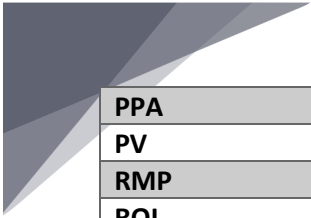
Table 21: Summary of recommendations for emissions reduction by sector.

Sector	Phase 1 (2020-2030)	Phase 2 (2030-2040)	Phase 3 (2040-2050)
Buildings and Facilities (BF)	BF.1a: Take initial steps to retrofit municipal buildings to increase energy efficiency. Use the energy conservation measures from the Honeywell audit report to guide this process.	BF.2a: Continue retrofits to municipal buildings as old equipment ages out to maximize energy efficiency.	BF.3a: Complete energy conservation measures (ECMs) identified in the Honeywell audit to the greatest extent financially prudent to maximize energy efficiency in municipal buildings.
	BF.1b: Continue installing solar PV systems for remaining and eligible municipal facilities.	BF.2b: Pursue additional renewable energy opportunities through utility and partner opportunities including power purchase agreements (PPAs), leasing, utility partnerships, and renewable energy credits (RECs).	BF.3b: Through a combination of on-site energy generation and off-site procurement, municipal facilities should be powered to the greatest extent feasible through renewable and low carbon energy sources.
		BF.2c: Stay informed of state-level policy changes and opportunities for renewable energy expansion.	
Vehicle Fleet (VF)	VF.1a: Continue green purchasing policy for vehicles, pursuing high efficiency, hybrid, and electric vehicle upgrades, starting with passenger cars and light vehicles. Continuously assess factors such as maintenance costs, resale values, and range limitations to inform this process.	VF.2a: Continue transitioning of vehicle fleet. Begin investigating feasibility of transitioning medium/heavy duty vehicles to hybrid or electric. Continuously assess factors such as maintenance costs, resale values, and range limitations to inform this process.	VF.3: Complete upgrade of city vehicle fleet to a combination of high efficiency, hybrid, and electric vehicles as is feasible. Continuously assess factors such as maintenance costs, resale values, and range limitations to inform this process.
	VF.1b: Identify and pursue additional opportunities for installation of EV charging infrastructure.		
	VF.1c: Optimize driving routes of municipal vehicles to reduce vehicle miles traveled.		
	VF.1d: Ensure walkability and bikeability of city sidewalks and bike lanes. Plow bike lanes during winter months.		
Waste Facilities (WF)	WF.1a: Ensure that recycling bins are available in all municipal buildings.	WF.2a: Implement strategies of waste reduction strategy or plan.	WF.3a: Prioritize waste reduction and diversion strategies.
	WF.1b: Collect waste characterization data to identify opportunities for waste diversion and to refine landfill emissions estimates.	WF.2b: Upon addition of new cell to the landfill and at least 1 million tons of waste in place, investigate partnership with the Environmental Protection Agency's Landfill Methane Outreach Program. Re-assess feasibility of landfill gas capture system, including metrics of direct yearly emissions from the Laramie Landfill.	WF.3b: Continually investigate cost and opportunity for gas capture technology at the landfill, including pilot projects targeted to small landfills.
	WF.1c: Develop a waste reduction strategy or plan with established waste diversion goals in accordance with the Environmental Advisory Committee's emissions reduction benchmarks.	WF.2c: Explore opportunities to expand composting facilities.	
Sequestration and Offsets (SO)	SO.1: Include calculated estimate of emissions sequestered from greenspace into yearly emissions inventories.	SO.2: Identify opportunities for greenspace expansion and carbon sequestration in city limits.	SO.3: For any remaining emissions after all prior recommendations have been implemented, investigate, and implement sequestration and offsets as needed to reach emissions reduction goals.

Appendix 1: Acronym Reference Table

Table 22: Acronym reference table.

Acronym	Definition
AHU	Air Handling Unit
AMT	Annual Miles Traveled
ARE	Alliance for Renewable Energy
BAS	Building Automation System
BAU	Business As Usual
BHE	Black Hills Energy
BMS	Building Management System
CAFE	Corporate Average Fuel Economy
CO ₂ e	Carbon Dioxide Equivalent
CPL	Carbon Power Light
DDC	Direct Digital Control
DO	Dissolved Oxygen
DOE	Department of Energy
DX	Direct Expansion
EAC	Environmental Advisory Committee
ECM	Energy Conservation Measure
ENDOW	Economically Needed Diversity Options for Wyoming
ENR	Environment and Natural Resources
EPA	Environmental Protection Agency
EV	Electric Vehicle
FC	Flexible Connection
FCU	Fan Coil Unit
FY	Fiscal Year
GDP	Gross Domestic Product
GHG	Greenhouse Gas
hp	Horsepower
HST	High Speed Turbo
HVAC	Heating, Ventilation, and Air Conditioning
ICLEI	International Council for Local Environmental Initiatives
IIJA	Infrastructure Investment and Jobs Act
IRA	Inflation Reduction Act
IREC	Interstate Renewable Energy Council
ITC	Investment Tax Credit
kW(h)	Kilowatt (hour)
LED	Light Emitting Diode
LFG	Landfill Gas
LMOP	Landfill Methane Outreach Program
MT	Metric Tons
MT 2030	Mountain Towns 2030
MW(h)	Megawatt (hour)
N ₂ O	Nitrous Oxide
O&M	Operation and Maintenance



PPA	Power Purchase Agreement
PV	Photovoltaic
RMP	Rocky Mountain Power
ROI	Return on Investment
RTU	Remote Terminal Unit
UV	Ultraviolet
VAV	Variable Air Volume
VFD	Variable Frequency Drive
VMT	Vehicle Miles Traveled
WEA	Wyoming Energy Authority
WWTP	Wastewater Treatment Plant

Appendix 2: Additional Resources

Context and Background

Climate Risks and Trends

[The Climate Explorer](#): Climate projections by county.

[Climate Check](#): Climate risk report.

[Climate Mapping for Resilience and Adaptation](#): Current and future climate hazard information.

Wyoming State Energy Policy Context

[US Energy Information Administration \(EIA\)](#): State profiles and energy estimates.

[State Policy Opportunity Tracker \(SPOT\)](#): Existing and future opportunity for state-level clean energy policies.

Importance of Municipal Action

[ICLEI](#): Local governments for sustainability.

[MT 2030](#): Mountain Towns 2030 Peer Networking Group.

Buildings and Facilities

Energy Conservation Measures

[DOE Building Technologies Program](#): Information, support, and access to DOE's online certification tools, eeCompass, the Compliance Certification Management System (CCMS) and the Compliance Certification Database.

[Energy Star Building Upgrade Manual Cpt. 5](#): Retro commissioning framework for project planning and execution.

[Honeywell Infrastructure Renewal Project](#): Summary of financials and other project details from the Honeywell Audit Report.

Solar Photovoltaic (PV) Installation

[SolSmart](#): Guide to implementing solar PV for local governments.

[City of Laramie Resolution No: 2021-62](#): Resolution to participate in U.S. Department of Energy's SolSmart Program.

[Database for State and Federal Renewable Energy Incentives](#)

[National Renewable Energy Center PVWATTS Calculator](#) : Estimates for the performance of PV energy

systems.

[Sheridan Renewable Energy Assessment](#): Example renewable energy assessment conducted by the City of Sheridan, WY.

Vehicle Fleet

Upgrade/Replace Vehicle Fleet

[Climate Mayors EV Purchasing Collaborative](#): Collaborative of local governments to leverage buying power and accelerate conversion of municipal fleets to electric vehicles.

[Fueleconomy.gov](#): Fuel economy estimates.

Waste Facilities

Waste Reduction and Diversion

[Fort Collins Road to Zero Waste Plan](#): Example zero waste plan and implementation strategies from Fort Collins, CO.

[Road to Zero Waste in Jackson Hole](#): Example zero waste initiatives from Teton County and the City of Jackson, WY.

Landfill Gas Collection and Energy Recovery

[Landfill Methane Outreach Program \(LMOP\)](#): Resources from the EPA's LMOP program including a project development handbook and project database.

Appendix 3: Vehicle Fleet List

Code
Engineering
IT
Facilities Maintenance
Fire
Mosquito
Police
Parks
Streets
Solid Waste
Utilities

Figure 6: Color explanation for Table 23.

Table 23: List of vehicles included in the FY'22 inventory by vehicle and fuel type.

Unit #	Description	Type	Fuel Type	Miles for FY 2022	Hours For FY 22	Unleaded Gallons Used	Diesel Gallons Used
Engine 3	2009 Pierce Dash	Heavy Truck	Diesel	4,282			1,019.31
Engine 4	2000 American LaFrance	Heavy Truck	Diesel	2,851			811.73
Engine 6	2008 Ford F-550	Heavy Truck	Diesel	127			25.08
Engine 7	2012 Spartan	Heavy Truck	Diesel	5,994			964.94
Engine 8	2008 Ford F-550	Heavy Truck	Diesel	558			34.94
Ladder 5	2016 Rosenbauer	Heavy Truck	Diesel	4,782			1,419.12
RR3	2004 GMC Topkick	Heavy Truck	Diesel	514			57.67
Truck 2	2003 Pierce Ladder	Heavy Truck	Diesel	553			168.54
160	2004 Lenco	Heavy Truck	Diesel	103			29.79
211	2016 Schwarze Sweeper	Heavy Truck	Diesel				
213	2010 International	Heavy Truck	Diesel		152		455.15
214	2008 Ford F-750	Heavy Truck	Diesel		285		261.55
215	2005 International	Heavy Truck	Diesel		270		290.57
216	2009 Freightliner	Heavy Truck	Diesel		67		205.75
219	2012 Ford F-550	Heavy Truck	Diesel		N/A		340.32
223	2012 Freightliner	Heavy Truck	Diesel		450		1,212.05
226	2012 Freightliner	Heavy Truck	Diesel		407		1,148.39

228	2009 Volvo	Heavy Truck	Diesel		376		835.28
230	2015 Tymco Sweeper	Heavy Truck	Diesel		585		1,669.49
240	2009 Volvo	Heavy Truck	Diesel		268		870.33
244	2015 Tymco Sweeper	Heavy Truck	Diesel		434		1,202.76
278	2006 International	Heavy Truck	Diesel		86		325.98
280	2009 F-550 Bucket Truck	Heavy Truck	Unleaded	7,785		1,265.30	
303	2022 Ford E450 Van	Camera Van	Unleaded				
328	2016 Freightliner	Heavy Truck	Diesel		2,206		1,813.34
329	2012 Freightliner	Heavy Truck	Diesel		4,337		1,612.68
352	2016 Mack Dump Truck	Heavy Truck	Diesel		387		634.21
353	2013 Freightliner	Heavy Truck	Diesel				622.38
357	2005 International	Heavy Truck	Diesel		292		499.42
359	2000 Ford F-450	Heavy Truck	Diesel	1,459			17.68
362	2014 Freightliner	Heavy Truck	Diesel		501		454.58
604	2000 Sterling Roll Off	Heavy Truck	Diesel				
606	2014 Mack Roll off Truck	Heavy Truck	Diesel	599			833.64
660	2019 Ford F-550	Heavy Truck	Diesel		463		541.61
662	2009 Ford F-550	Heavy Truck	Unleaded	1,321			292.93
666	2016 Freightliner	Heavy Truck	Diesel	1,479			217.08
669	2019 Collection Truck	Heavy Truck	Diesel		268		499.91
671	2012 Collection Truck	Heavy Truck	Diesel		20		50.56
672	2019 Collection Truck	Heavy Truck	Diesel		1,987		4208.47
675	2019 Collection Truck	Heavy Truck	Diesel		1,904		4695.59
676	2022 Collection Truck	Heavy Truck	Diesel		610		948.72
677	2020 Collection Truck	Heavy Truck	Diesel		1,949		4333.81
678	2014 Collection Truck	Heavy Truck	Diesel		524		1433.95
679	2016 Collection Truck	Heavy Truck	Diesel		2,244		4450.18
	Heavy Truck Totals			32,407	21,072	1,265.30	20,888.29
MS136	2021 Chevrolet	Light Truck	Diesel				
MS142	2016 Chevrolet	Light Truck	Diesel	21,103			5,963.40

MS143	2019 Chevrolet	Light Truck	Diesel	14,689			2,068.98
MS144	2019 Chevrolet	Light Truck	Diesel	20,975			2,149.08
MS145	2012 GMC	Light Truck	Diesel	18,835			1,452.16
MS149	2021 Dodge	Light Truck	Diesel	20,292			1,980.95
42	2009 Chevrolet 1500	Light Truck	Unleaded	5,233			328.99
43	2021 Ford F-150	Light Truck	Unleaded				
118	2018 Ford F-250	Light Truck	Unleaded	273		36.31	
146	2019 Ford F-150	Light Truck	Unleaded	1,699		742.65	
147	2019 Ford F-150	Light Truck	Unleaded	1,507		527.41	
170	1999 Chevrolet Box Van	Light Truck	Unleaded				
173	2004 Chevrolet	Light Truck	Diesel	395		39.03	
190	2015 Nissan Frontier	Light Truck	Unleaded	3,496		242.63	
191	2015 Nissan Frontier	Light Truck	Unleaded	496		125.01	
192	2014 F 150	Light Truck	Unleaded	409		29.25	
194	2008 Chevrolet Colorado	Light Truck	Unleaded	3,184		219.94	
209	2000 GMC 3500	Light Truck	Unleaded	564		198.94	
212	2006 Chevrolet 1500	Light Truck	Unleaded	3,107		259.70	
217	2010 Ford F-350	Light Truck	Unleaded	2,077		276.17	
220	2012 Chevrolet 2500	Light Truck	Unleaded	3,174		346.50	
221	2008 Ford F-250	Light Truck	Unleaded	2,031		257.26	
224	2006 Chevrolet 1500	Light Truck	Unleaded	3,161		205.40	
225	2006 Chevrolet 1500	Light Truck	Unleaded	3,580		304.20	
250	2018 Chevrolet 1500	Light Truck	Unleaded	2,323		155.51	
251	2012 Ford F-150	Light Truck	Unleaded	1,456		118.69	
281	2015 Ford F-350	Light Truck	Unleaded	1,155		157.13	
312	2019 Ford F-150	Light Truck	Unleaded	2,915		206.36	
327	2021 Ford F-150	Light Truck	Unleaded	669		59.82	
330	2017 Ford F-350	Light Truck	Unleaded	6,842		863.66	
331	2015 Ford F-250	Light Truck	Unleaded	5,511		723.85	
333	2011 Ford F-250	Light Truck	Unleaded	7,325		608.46	

334	2020 Ford F-350	Light Truck	Unleaded	2,825		847.95	
335	2015 Ford F-250	Light Truck	Unleaded	6,454		944.19	
336	2021 Ford F-350	Light Truck	Unleaded	1,302		234.45	
338	2016 Ford F-250	Light Truck	Unleaded	4,179		430.11	
340	2016 Ford F-150	Light Truck	Unleaded	7,743		497.09	
341	2021 Ford Ranger	Light Truck	Unleaded	7,252		413.73	
342	2013 Ford F-150	Light Truck	Unleaded	8,010		529.55	
344	2019 Ford F-350	Light Truck	Unleaded	8,705		1,068.23	
345	2009 Ford F-150	Light Truck	Unleaded	7,450		617.77	
346	2019 Ford F-350	Light Truck	Unleaded	10,953		860.23	
348	2020 Chevrolet 1500	Light Truck	Unleaded	3,244		268.54	
350	2022 Ford F-150	Light Truck	Unleaded	2,100		123.20	
351	2013 Ford F-150	Light Truck	Unleaded	5,896		405.80	
354	2013 Ford F-150	Light Truck	Unleaded	3,914		269.98	
355	2016 Ford F-150	Light Truck	Unleaded	2,813		230.97	
358	2003 GMC Sonoma	Light Truck	Unleaded	2,057		121.94	
360	2015 Ford F-250	Light Truck	Unleaded	5,510		872.76	
361	2015 Ford F-250	Light Truck	Unleaded	3,897		695.18	
663	2020 Ford F-150	Light Truck	Unleaded	4,618		462.61	
664	2012 Dodge 1500	Light Truck	Unleaded	4,302		493.68	
665	2019 Ford F-150	Light Truck	Unleaded	1,397		74.23	
668	2014 Ford F-150	Light Truck	Unleaded	3,901		295.18	
760	2007 Chevrolet Colorado	Light Truck	Unleaded	620		59.04	
762	2012 Chevrolet 1500	Light Truck	Unleaded	3,968		338.39	
763	2010 Ford F-150	Light Truck	Unleaded	3,861		328.51	
764	2006 Chevrolet 2500	Light Truck	Unleaded	1,218		161.11	
765	2008 Ford F-250	Light Truck	Unleaded	1,627		213.03	
766	2020 Chevrolet 1500	Light Truck	Unleaded	6,720		563.93	
767	2011 Chevrolet 1500	Light Truck	Unleaded	3,851		366.99	
769	2012 Ford F-250	Light Truck	Unleaded	3,554		423.71	

880	2001 Ford Ranger	Light Truck	Unleaded	3,912		289.52	
882	2015 Nissan Frontier	Light Truck	Unleaded	1,222		233.02	
883	2015 Nissan Frontier	Light Truck	Unleaded	2,628		154.36	
885	2007 Ford Ranger	Light Truck	Unleaded	2,480		154.71	
887	2002 GMC Sonoma	Light Truck	Unleaded	932		59.80	
889	2015 Ford F-150	Light Truck	Unleaded	1,822		100.42	
910	2012 Ford F-150	Light Truck	Unleaded	5,267		436.87	
915	2006 Ford F-350	Light Truck	Unleaded	783		150.62	
916	2008 Ford F-350	Light Truck	Unleaded	596		70.52	
920	2008 Chevrolet 2500	Light Truck	Unleaded	3,346		547.56	
930	2006 GMC Canyon	Light Truck	Unleaded	2,142		160.34	
932	2007 Chevrolet 2500	Light Truck	Unleaded	2,908		349.42	
940	2008 Ford F-150	Light Truck	Unleaded	2,414		208.13	
942	2004 Ford F-350	Light Truck	Unleaded	534		76.50	
943	2007 Ford F-150	Light Truck	Unleaded	2,380		254.90	
951	2012 Ford F-350	Light Truck	Unleaded	1,635		237.14	
952	2010 Dodge Dakota	Light Truck	Unleaded	4,948		447.50	
960	2006 GMC 1500	Light Truck	Unleaded	4,169		341.05	
963	2007 Chevrolet Colorado	Light Truck	Unleaded	2,992		191.12	
	Light Truck Totals			339,527	0	24,379.46	13,943.56
8	2009 Ford Expedition	Passenger Car	Unleaded	893		64.76	
40	2011 Chevrolet Equinox	Passenger Car	Unleaded	1,736		92.70	
45	2010 Chevrolet Equinox	Passenger Car	Unleaded	4,270		251.11	
46	2007 Chevrolet Suburban	Passenger Car	Unleaded	3,791		355.91	
47	2011 Ford Expedition	Passenger Car	Unleaded	4,002		298.65	
99	2007 Chevrolet Trailblazer	Passenger Car	Unleaded	1,707		133.59	
100	2016 Nissan Rogue	Passenger Car	Unleaded	3,739		168.63	
101	2011 Ford Crown Victoria	Passenger Car	Unleaded	1,076		94.39	
102	2015 Ford Explorer	Passenger Car	Unleaded	6,048		519.11	
103	2014 Ford Taurus	Passenger Car	Unleaded	7,645		585.80	

104	2014 Ford Taurus	Passenger Car	Unleaded	8,788	632.28
105	2016 Dodge Charger	Passenger Car	Unleaded	6,396	594.42
106	2021 Ford Explorer Hybrid	Passenger Car	Unleaded	3,677	483.85
107	2020 Dodge Charger	Passenger Car	Unleaded	6,807	575.72
108	2013 Ford Taurus	Passenger Car	Unleaded	10,564	786.05
109	2021 Ford Explorer Hybrid	Passenger Car	Unleaded	924	70.18
110	2013 Ford Taurus	Passenger Car	Unleaded	7,526	876.49
111	2011 Ford Crown Victoria	Passenger Car	Unleaded	2,182	270.59
112	2018 Ford Explorer	Passenger Car	Unleaded	6,123	573.08
113	2011 Ford Crown Victoria	Passenger Car	Unleaded	448	32.20
114	2013 Ford Taurus	Passenger Car	Unleaded	7,332	498.91
115	2015 Ford Explorer	Passenger Car	Unleaded	8,962	656.36
116	2012 Dodge Charger	Passenger Car	Unleaded	9,214	861.15
117	2012 Dodge Charger	Passenger Car	Unleaded	6,068	362.17
119	2020 Ford Explorer	Passenger Car	Unleaded	10,029	647.28
120	2012 Dodge Charger	Passenger Car	Unleaded	2,370	175.52
121	2013 Ford Taurus	Passenger Car	Unleaded	9,994	572.08
122	2013 Ford Taurus	Passenger Car	Unleaded	12,157	804.03
123	2019 Dodge Charger	Passenger Car	Unleaded	4,245	766.8
124	2015 Ford Explorer	Passenger Car	Unleaded	9,699	745.67
125	2012 Dodge Charger	Passenger Car	Unleaded	12,111	767.69
126	2009 Chevrolet Impala	Passenger Car	Unleaded	3,873	233.58
127	2012 Dodge Charger	Passenger Car	Unleaded	5,914	510.26
128	2013 Ford Taurus	Passenger Car	Unleaded	6,084	625.99
129	2022 Ford Explorer Hybrid	Passenger Car	Unleaded	878	62.86
130	2012 Dodge Charger	Passenger Car	Unleaded	10,172	518.45
131	2014 Ford Taurus	Passenger Car	Unleaded		
132	2013 Ford Taurus	Passenger Car	Unleaded	9,957	827.03
133	2019 Dodge Charger	Passenger Car	Unleaded	11,364	926.33
134	2019 Dodge Charger	Passenger Car	Unleaded	7,177	942.66

135	2022 Ford Explorer Hybrid	Passenger Car	Unleaded	833		84.94	
136	2011 Ford Crown Victoria	Passenger Car	Unleaded	3,348		227.41	
137	2016 Dodge Charger	Passenger Car	Unleaded	6,846		710.29	
138	2011 Ford Crown Victoria	Passenger Car	Unleaded	1,073		95.21	
139	2021 Ford Explorer Hybrid	Passenger Car	Unleaded	11,162		627.17	
140	2010 Chevrolet Equinox	Passenger Car	Unleaded	9,217		470.97	
141	2012 Dodge Journey	Passenger Car	Unleaded	1,024		231.65	
142	2010 Chevrolet Equinox	Passenger Car	Unleaded	3,665		186.36	
143	2016 Nissan Rogue	Passenger Car	Unleaded	7,160		308.8	
148	2012 Dodge Charger	Passenger Car	Unleaded	7,648		540.56	
171	2013 Ford Taurus	Passenger Car	Unleaded	11,550		700.68	
172	2022 Ford Explorer Hybrid	Passenger Car	Unleaded	225		32.58	
174	2011 Chevrolet Malibu	Passenger Car	Unleaded	2,380		239.73	
175	2016 Nissan Rogue	Passenger Car	Unleaded	5,356		170.46	
299	2015 Dodge Journey	Passenger Car	Unleaded		329	55.27	
339	2018 Ford Escape	Passenger Car	Unleaded	2,478		105.32	
347	2019 Ford Escape	Passenger Car	Unleaded	8,597		378.29	
881	2008 Ford Focus	Passenger Car	Unleaded	1,272		57.19	
884	2020 Ford E-250 Transit	Passenger Car	Unleaded	5,880		516.83	
886	2013 Ford E-150	Passenger Car	Unleaded	660		55.71	
888	2009 Chevrolet Equinox	Passenger Car	Unleaded	2,015		90.51	
905	2015 Ford Transit Connect	Passenger Car	Unleaded	1,042		166.76	
	Passenger Car Totals			329,373	329	12,086.78	0.00

