



GREATER CHEYENNE MSA

PRIORITY CLIMATE ACTION PLAN

MARCH 2024

Priority Climate Action Plan

For the Cheyenne Metropolitan Statistical Area (MSA),
on behalf of all cities within Laramie County, Wyoming

March 2024

PREPARED FOR:

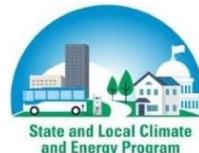
State and Local Climate and Energy Program

U.S. Environmental Protection Agency

PREPARED BY:

City of Cheyenne

2101 O'Neil Avenue, Cheyenne WY 82001



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1 Introduction

The City of Cheyenne has begun collaborative work across diverse public and private sectors in the Cheyenne Metropolitan Statistical Area (MSA) to produce this Priority Climate Action Plan (PCAP). This PCAP is designed to support investment in policies, practices, and technologies that reduce greenhouse gas (GHG) and other pollution emissions, create high-quality jobs, spur economic growth, and enhance the quality of life for all communities and residents of Laramie County. This project has been funded wholly or in part by the United States Environmental Protection Agency (EPA) under assistance agreement #5D - 0010301-0. The contents of this document do not necessarily reflect the views and policies of the EPA, nor does the EPA endorse trade names or recommend the use of commercial products mentioned in this document.

The priority GHG measures contained within this PCAP should be construed as broadly available to any entity in the MSA eligible for receiving funding under the EPA's Climate Pollution Reduction Grants (CPRG) program and other funding streams, as applicable.

This PCAP is organized into ten sections:

1. Introduction
2. GHG Emissions Inventory
3. GHG Emissions Projections and Reduction Targets
4. Quantified Priority GHG Reduction Measures
5. Benefits Analysis
6. Low-Income and Disadvantaged Community Benefits Analysis
7. Review of Authority to Implement
8. Workforce Planning Analysis
9. Stakeholder Engagement Activities
10. Next Steps, Future Budget & Staffing Needs

1.1 CPRG overview

The Climate Pollution Reduction Grants (CPRG) program provides \$5 billion in grants to states, local governments, tribes, and territories to develop and implement ambitious plans for reducing greenhouse gas emissions and other harmful air pollution. Authorized under Section 60114 of the Inflation Reduction Act, this two-phase program provides \$250 million for noncompetitive planning grants, and approximately \$4.6 billion for competitive implementation grants.

Phase 1 of the CPRG program provides flexible support to states, local governments, tribes, and territories regardless of where they are in their climate planning and implementation process. Planning grant recipients

are using the funding to design climate action plans that incorporate a variety of measures to reduce GHG emissions from across their economies in six key sectors, including electricity generation, industry, transportation, buildings, agriculture/natural and working lands, and waste management.

Participation in the CPRG program will allow the Cheyenne Metropolitan Service Area to assess, develop, and implement plans for reducing greenhouse gas emissions and other harmful air pollution through policy, collaboration, and innovation in an equitable, just, and sustainable way.

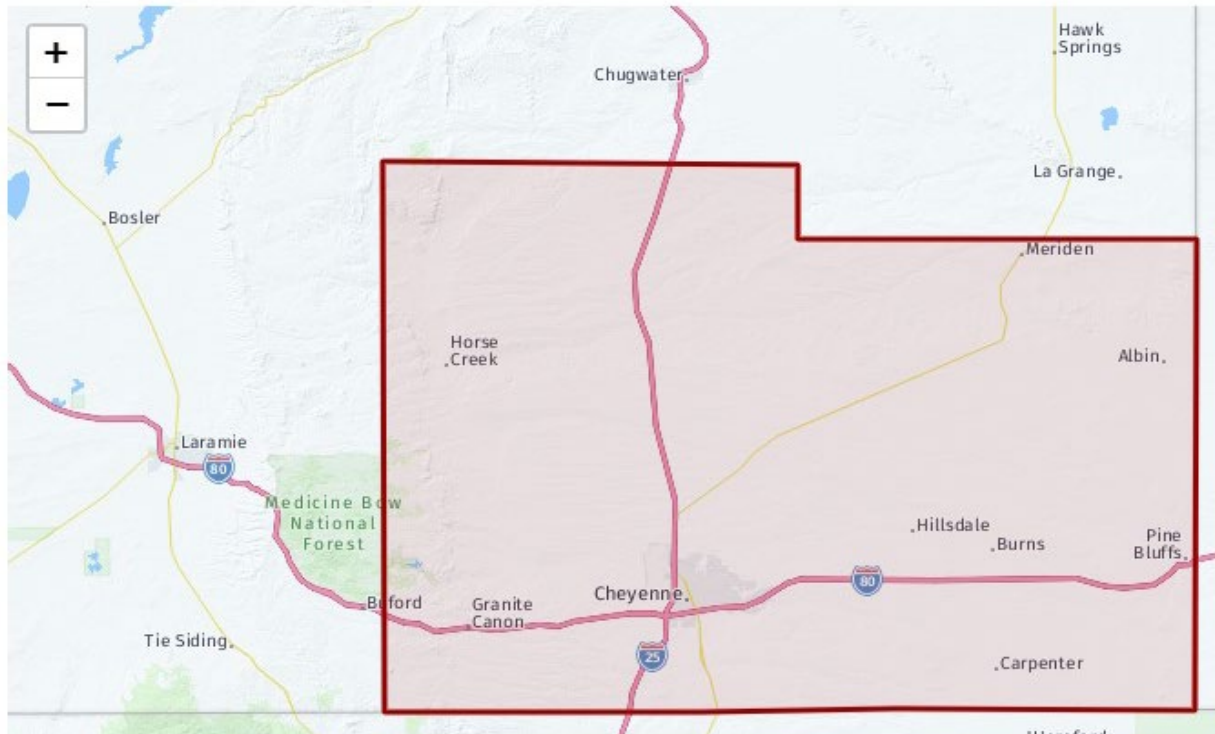


Figure 1: Cheyenne, WY Metropolitan Statistical Area Boundary Map

1.2 PCAP Overview and Definitions

- **Greenhouse gas (GHG) inventory:** The information used was based on version 1.2 of the U.S. Community Protocol for Accounting and Reporting GHG Emissions and additional activities/sources are considered in accordance with the Global Protocol for Community-Scale GHG Emissions Inventories. The GHG inventory includes a list of emission sources and sinks, and the associated emissions quantified using standard methods. The PCAP includes a “simplified” inventory. The CCAP will include a comprehensive inventory of emissions and sinks for the following sectors: industry, electricity generation/use, transportation, commercial and residential buildings, agriculture, natural and working lands, and waste and materials management.
- **GHG emission projections:** This PCAP uses a Business-as-Usual projection from 2021 (baseline year) to 2030 and 2050. This projection was carried out for every activity and source based on various activity growth rates and carbon intensity growth rates and is based on national data due to minimal current data for the Cheyenne MSA.

- **GHG reduction measures:** There are eleven GHG Reduction Measures in this PCAP. They are Residential Efficiency (Electricity/Natural Gas), Residential Building Electrification, Commercial Efficiency (Electricity/Natural Gas), Commercial Building Electrification, Residential Rooftop Solar, Commercial Rooftop Solar, a 10% Gasoline VMT Reduction, EV Adoption for Gasoline-powered vehicles, EV Adoption for Diesel-powered vehicles, a Landfill Solar project, and a Ranch Solar project.
- **Low Income / Disadvantaged Communities (LIDAC) benefits analysis for the PCAP and the measures within it:** The LIDAC benefits analysis focuses primarily on how energy efficiency and renewable energy sources will provide cost savings for residential energy bills. Another benefit will be improved air quality in LIDAC areas from reduced car exhaust, as well as improved multi-modal transportation opportunities, increasing walking, biking, and other healthy activities. LIDACs are communities with residents that have low incomes, limited access to resources, and disproportionate exposure to environmental or climate burdens. Although the Inflation Reduction Act does not formally define LIDACs, EPA strongly recommends grantees use the Climate and Economic Justice Screening Tool and the Environmental Justice Screening and Mapping Tool to identify LIDACs in their communities. These tools identify LIDACs by assessing indicators for categories of burden: air quality, climate change, energy, environmental hazards, health, housing, legacy pollution, transportation, water and wastewater, and workforce development.
- **Review of authority to implement for each measure:** As stated in Section 3.4.2., the City of Cheyenne has the authority to implement these reduction measures in partnership with executing organizations. These executing organizations will be further identified in the development of the CCAP.
- **Intersection with Other Funding Availability:** This PCAP anticipates leveraging other sources of funding from federal, state, and private sectors. See funding measures listed in the GHG Reduction Strategies table in Section 3.4.
- **Next steps:** This PCAP provides a foundation for more detailed analysis in the CCAP, including projected energy and emissions across the region and within specific geographies. It highlights how specific actions can benefit LIDAC neighborhoods both directly and indirectly. The CCAP will construct a model of the Cheyenne MSA and systematically evaluate actions and policies and their GHG impacts, financial impacts, and implementation mechanisms, supported by an extensive engagement process.
- **Priority Climate Action Plan (PCAP):** a narrative report that includes a focused list of near-term, high-priority, and implementation-ready measures to reduce GHG pollution and an analysis of GHG emissions reductions.
- **Comprehensive Climate Action Plan (CCAP):** a narrative report that provides an overview of the grantees' significant GHG sources/sinks and sectors, establishes near-term and long-term GHG emission reduction goals, and provides strategies and identifies measures that address the highest priority sectors to help the grantees meet those goals.

- **MSA:** metropolitan statistical areas as defined by the U.S. Census 2020 MSA population. A list of eligible MSAs can be found in Appendix 15.2 in EPA’s [CPRG: Formula Grants for Planning, Program Guidance for States, Municipalities, and Air Control Agencies](#).
- **State:** all 50 U.S. states and the District of Columbia and Puerto Rico. All other Tribes or U.S. territories (the Virgin Islands, Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands) should follow CRPG guidance for [Tribes and Territories](#).

1.3 Scope of the PCAP

The PCAP provides a focused list of near-term, high-priority measures to reduce climate pollution from GHG emissions. Additionally, the plan aims to provide 40% of the benefits of these measures to low-income and disadvantaged communities (LIDACs) under the Justice40 initiative. As required by the Environmental Protection Agency, this PCAP contains:

- A GHG Inventory
- Quantified GHG reduction measures
- Low-income and disadvantaged communities (LIDAC) benefits analysis
- A review of authority to implement

1.4 Approach to Developing the PCAP

A review of the City of Cheyenne’s existing plans, commitments, regulations, and/or policies did not identify any connections to reducing climate pollution, with the exception of Principle 5.4 in the *Community Master Plan* that briefly mentions resource and energy efficiency. These statements are generally vague and provide little insight for implementing, monitoring, or achieving these goals. The PCAP has substantially expanded on the existing principle in the *Community Master Plan* and has provided insight for implementing, monitoring, and achieving the goal of reducing climate pollution.



Figure 2: Active Landfill Area (looking East)

The Belvoir Ranch (“the ranch”) is a large property that was purchased by the City of Cheyenne in 2003 for various purposes, such as land use, water development, and recreation. In 2008, a master plan was created to guide the development of the ranch, which included a variety of uses from recreational trails to a site for a new landfill. Within the plan, renewable resources are mentioned a handful of times, primarily referencing wind energy opportunities, as the National Renewable Energy Lab classified the area as a four to six out of seven. Solar was mentioned in the master plan but needed

additional evaluation to better understand its potential. Work to amend this master plan is currently underway.

On November 30, 2023, Governor Mark Gordon formally withdrew Wyoming's EPA CPRG application, presenting an opportunity for the City of Cheyenne to submit a Letter of Interest. The City applied for CPRG planning grant funds on December 11, 2023, and on February 12, 2024, the City's Grant Agreement was finalized. We have worked diligently in an immensely compressed schedule to complete this Priority Climate Action Plan and intend for the CCAP will provide any missing context. This document was completed with the assistance of ICLEI USA, Climate Mitigation Strategies LLC, Wyoming Outdoor Council, and Rocky Mountain Institute.

ICLEI USA assisted with the creation of the GHG emission inventory as this information is not readily available for the MSA. The information used was based on version 1.2 of the U.S. Community Protocol for Accounting and Reporting GHG Emissions, and additional activities/sources are considered in accordance with the Global Protocol for Community-scale GHG Emissions Inventories.

The City of Cheyenne created a survey in partnership with Wyoming Outdoor Council and met with stakeholder representatives from community organizations and municipal departments. Through the survey we gained a high level understanding of the level of awareness and concern for GHG emissions-related issues within the Cheyenne MSA. The next step is to develop these stakeholder relationships to create an Environmental Equity Steering Committee (EESC) to create a more robust, in-depth community outreach strategy for the CCAP phase. The tools used to identify the LIDACs in the MSA were the EPA's *Environmental Justice Screening and Mapping Tool* and the U.S. Executive Office Council on Environmental Quality's *Climate and Economic Justice Screening Tool*.

The City of Cheyenne has the authority to implement these reduction measures in partnership with executing organizations, as stated in Section 3.4.2. These executing organizations will be further identified in the development of the CCAP.

2 State/MSA Context

State Policy Landscape

Wyoming's energy strategy focuses on the full value of its resources, from extraction of commodities to transportation and transformation of raw products, to commercialization of energy services. The state intends to continue appropriate development of its legacy products while expanding investment in renewables, hydrogen, nuclear, geothermal, and rare earth elements. The state's Governor, Mark Gordon, is promoting this policy with the aim of achieving net-negative emissions.¹ The state's policy is focused on leveraging its abundant natural resources and deep energy expertise to lead the way in the next-generation energy economy, committing to a more diverse and sustainable energy future.

Wyoming is a significant energy producer, with large reserves of coal, uranium, oil, and natural gas, and it exports 83% of its energy.² The state also has significant potential for wind energy. The National Renewable Energy Laboratory identifies Wyoming as the state with the eighth highest wind energy potential in the

¹Statement of Governor Mark Gordon of Wyoming Before the Senate Energy and Natural Resources Committee Tuesday, April 27, 2021 <https://www.energy.senate.gov/services/files/BAEB9A1D-6D39-48E4-8099-2310FCDE2301>

² Wyoming Gov. Mark Gordon pursues green, carbon-negative agenda in one of the nation's reddest states. CBS News. December 10, 2023. <https://www.cbsnews.com/news/wyoming-mark-gordon-energy-agenda-60-minutes-transcript/>

nation.³ In addition to harnessing its natural resources, Wyoming is also exploring technological solutions to reduce its carbon footprint. One of these is carbon capture, a technology that aims to remove more carbon from the atmosphere than it emits.⁴ However, this technology is still under development and needs more research around its effectiveness and cost.

The Wyoming Energy Authority (WEA)—a state affiliated group— funnels federal resources to Wyoming communities through their energy audit and building retrofit grants for local governments, public schools, and small businesses.⁵ The WEA will also be facilitating the passthrough of tax credits from the Inflation Reduction Act. As shown in *Figure 2* below, the entire state of Wyoming meets the Fossil Fuel Employment threshold and half of the state also meets the unemployment rate requirement to receive the Energy Community Tax Credit Bonus—an important investment in the state’s economy.

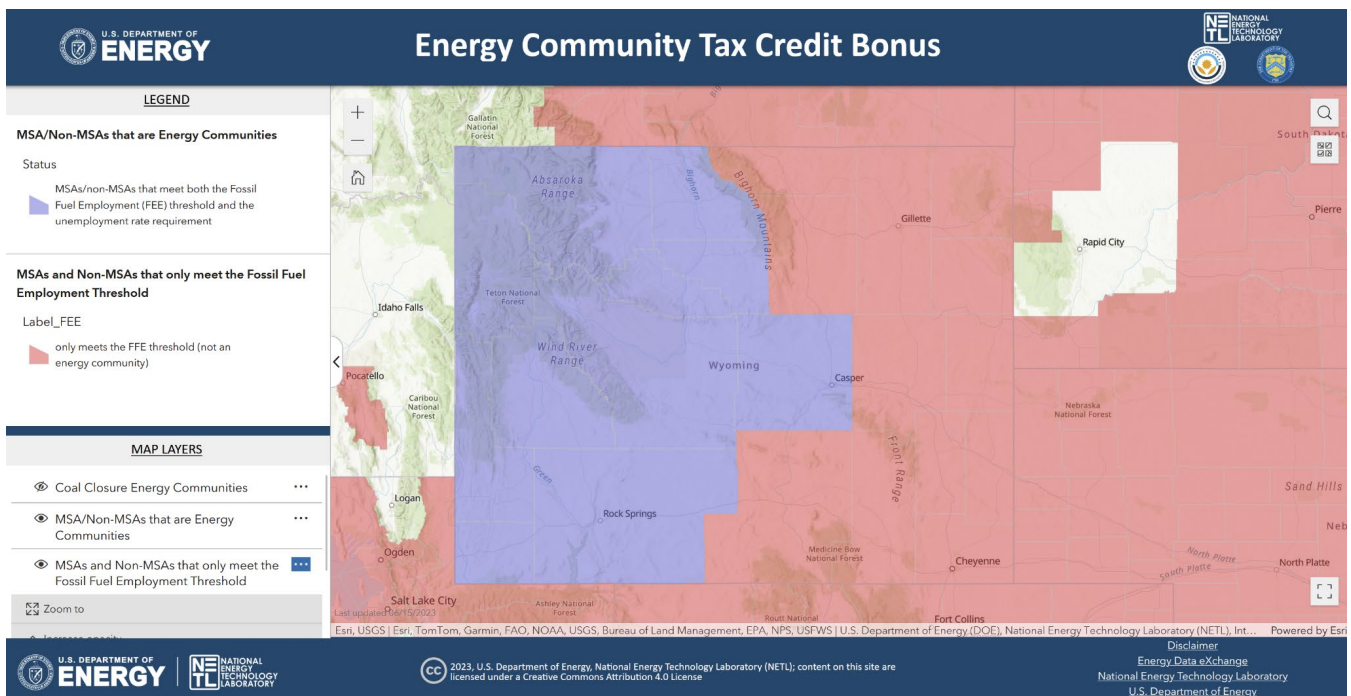


Figure 3: The U.S. Department of Energy’s GIS map depicting Wyoming’s energy communities and communities that meet the Fossil Fuel Employment Threshold.

Source: <https://arcgis.netl.doe.gov/portal/apps/experiencebuilder/experience/?id=a2ce47d4721a477a8701bd0e08495e1d>

Regional Policy Landscape

Cheyenne is the capital and most populous city in the state of Wyoming, as well as the county seat of Laramie County. As of 2021, Cheyenne had a population of approximately 64,610, with a median age ranging from 37.6 to 38 years. The city is predominantly inhabited by White (Non-Hispanic) and White (Hispanic) ethnic groups. The average commute time was around 15.7 to 17 minutes, and the average car ownership was 2 cars per household. The homeownership rate was between 69.1% and 72.2%. The median household income

³ Wyoming Renewables. University of Wyoming. <https://wyomingrenewables.org/renewable-technologies/wind/>

⁴ Wyoming Carbon Safe Project. University of Wyoming. <https://www.uwyo.edu/cegr/research-projects/wyoming-carbonsafe.html>

⁵ Financing. Wyoming Energy Authority. <https://wyoenergy.org/financing/>

was between \$70,705 and \$71,550.⁶ The city's economy is diverse, with industries such as tech, entertainment, education, and traditional sectors like mineral extraction, wind power generation, oil, and gas. *Figure 4* below from the Bureau of Labor Statistics compares occupational employment and wages by major occupational groups for the United States and the Cheyenne MSA during May 2021.

Major occupational group	Percent of total employment		Mean hourly wage		
	United States	Cheyenne	United States	Cheyenne	Percent difference (1)
Total, all occupations	100.0	100.0	\$28.01	\$24.66*	-12
Management	6.3	5.2*	59.31	46.20*	-22
Business and financial operations	6.4	6.3*	39.72	32.70*	-18
Computer and mathematical	3.3	2.1*	48.01	32.25*	-33
Architecture and engineering	1.7	1.6	44.10	35.86*	-19
Life, physical, and social science	0.9	1.4*	38.81	33.87*	-13
Community and social service	1.6	1.5	25.94	27.63*	7
Legal	0.8	1.2*	54.38	35.77*	-34
Educational instruction and library	5.8	6.4*	29.88	24.45*	-18
Arts, design, entertainment, sports, and media	1.3	0.9*	31.78	26.12*	-18
Healthcare practitioners and technical	6.2	6.6*	43.80	46.20*	5
Healthcare support	4.7	3.8*	16.02	16.31	2
Protective service	2.4	2.0*	25.68	24.70*	-4
Food preparation and serving related	8.0	8.7*	14.16	12.93*	-9
Building and grounds cleaning and maintenance	2.9	3.5*	16.23	15.43*	-5
Personal care and service	1.8	1.8	16.17	13.70*	-15
Sales and related	9.4	8.9*	22.15	17.79*	-20
Office and administrative support	13.0	12.6*	20.88	19.20*	-8
Farming, fishing, and forestry	0.3	0.1*	16.70	16.49	-1
Construction and extraction	4.2	6.0*	26.87	23.91*	-11
Installation, maintenance, and repair	4.0	5.1*	25.66	26.50*	3
Production	6.0	3.0*	20.71	22.20*	7
Transportation and material moving	9.0	11.2*	19.88	19.89	0

(1) A positive percent difference measures how much the mean wage in the Cheyenne, WY Metropolitan Statistical Area is above the national mean wage, while a negative difference reflects a lower wage.
* The mean hourly wage or percent share of employment is significantly different from the national average of all areas at the 90-percent confidence level.

Figure 4: Bureau of Labor Statistics May 2021 Cheyenne labor statistics.

Source: https://www.bls.gov/regions/mountain-plains/news-release/occupationalemploymentandwages_cheyenne.htm

Based on Census data, Laramie County is projected to add 2,215 households between 2023 and 2028. The total population is projected to increase by 5,025 during the same period.⁷ In addition to those trends, Laramie County and the surrounding areas will be impacted by the Sentinel Project. This is a major missile replacement program that involves construction on and off F.E. Warren Air Force Base, as well as additional operations positions located on base during the entirety of the project. All labor and population estimations related to the Sentinel Projects were estimated with *Economic Impact Analysis for Planning* (IMPLAN) and come directly from the official environmental impact report for the project.

⁶ Data USA. <https://datausa.io/profile/geo/cheyenne-wy>

⁷ Source: Greater Cheyenne Chamber of Commerce 2023 Housing Study
https://www.cheyennechamber.org/files/ugd/bc6a36_67678ce8ad4544c5843e443d809e59f2.pdf

According to a Harvard Growth Lab Study, “Wyoming today is a rural, remote, mineral-based economy that is surrounded by states with larger population agglomerations and more diverse industrial activities. Achieving future growth will require breaking this cycle of low population growth, at least to some degree and in some places. Given changes in technology that have made harsh environments more livable, this is possible, but policies to facilitate population growth may need to overcome historic barriers to this growth.”⁸ While most Wyoming counties have experienced slow population growth over the past few decades, Laramie County continues to outpace all others (see *Figure 5* below).

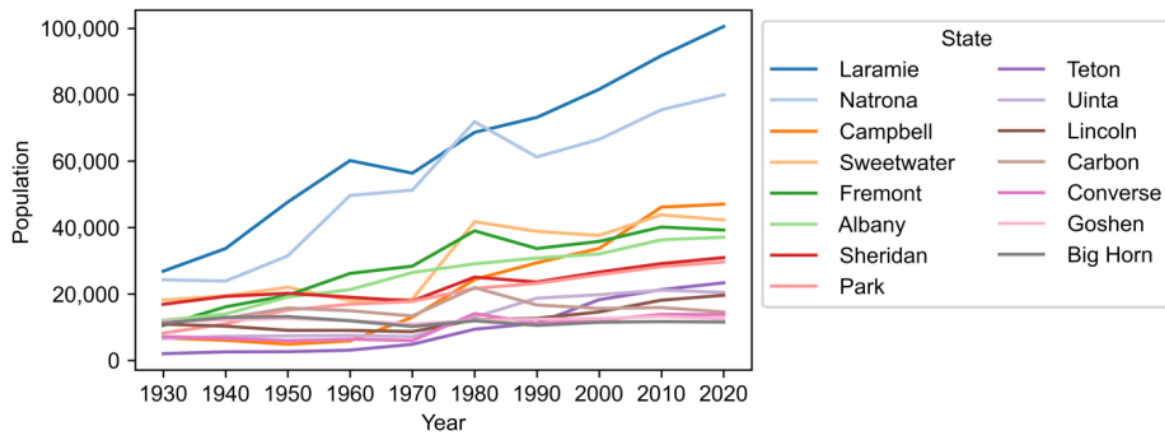


Figure 5: Population over time in 15 Most Populous Counties Today (1930-2020).
Source: U.S. Census Bureau

Climate change and clean energy are topics that cross a variety of regional planning issues. Several clean energy projects are being pursued in Cheyenne, reflecting a growing interest in renewable and low-carbon energy. The Wyoming Energy Authority has awarded funds to various projects across the state, including industrial carbon capture, coal refinery, hydrogen production, biomass, biochar, hydropower, lithium processing, battery storage, and renewable energy sources like wind and solar power. Additionally, the state has recommended investing \$37.5 million in six energy projects, such as carbon capture and storage initiatives and the conversion of coal to hydrogen.⁹ Furthermore, Southern Power has acquired the South Cheyenne Solar Facility, indicating a significant investment in solar energy in the region.¹⁰ These developments demonstrate a concerted effort to promote and invest in clean energy initiatives in Cheyenne, Wyoming.

The benefits of clean energy for industries include environmental sustainability, cost savings, and the potential for economic growth. Several companies in Cheyenne, such as Green House Data, are powered by 100% renewable wind energy, demonstrating a commitment to environmental responsibility.¹¹ Furthermore, the use of renewable energy sources can contribute to a reduction in carbon emissions and support the

⁸ A Growth Perspective on Wyoming. March 2023. Center for International Development at Harvard University.
<https://growthlab.hks.harvard.edu/sites/projects.iq.harvard.edu/files/growthlab/files/2023-03-cid-wp-432-wyoming-growth-perspective.pdf>

⁹ Six Projects Awarded with Energy Matching Funds. Wyoming Energy Authority. January 16, 2024.
<https://wyoenergy.org/six-projects-awarded-with-energy-matching-funds/>

¹⁰ Southern Power Acquires South Cheyenne Solar Facility. PR Newswire. September 25, 2023.
<https://www.prnewswire.com/news-releases/southern-power-acquires-south-cheyenne-solar-facility-301936816.html>

¹¹ Green House Data Doubles Its Renewable Energy Purchases. LUNAVI. December 16, 2011.
<https://www.lunavi.com/press-release/green-house-data-doubles-its-renewable-energy-purchases-for-data-center>

region's efforts to fight climate change. Embracing clean energy can also lead to long-term energy security and resilience for industries in Cheyenne, making them less dependent on traditional fossil fuels. Overall, the adoption of clean energy in Cheyenne offers a range of benefits, including environmental stewardship, potential cost savings, and support for sustainable economic development.

Adjacent to the Cheyenne MSA is Albany County, home to the City of Laramie and the University of Wyoming ("UW"). Collaboration between the City of Laramie and the UW Haub School of Environment and Natural Resources ("Haub School") has recently propelled the community's climate action forward. In 2019, the two entities worked together with a regional non-profit to produce a community-wide GHG inventory.¹² With this knowledge in hand, the Laramie City Council signed a proclamation in 2020 committing the city to achieve carbon neutrality community-wide by 2050. Haub School students continue to be a vital resource for the City of Laramie by producing planning guidance documents and GHG inventory updates for the city. Since the passing of the carbon neutrality goal in 2020, the City of Laramie has installed four 25-kilowatt solar arrays on its municipal buildings, including one with a public EV charger, and is starting to transition some of their city fleet to electric hybrid technology.¹³

Lander, Wyoming, located in the central part of the state, is another community that has started to address their greenhouse gas emissions. In 2022, a citizen-led city advisory committee, called the Energy & Environment Task Force ("E&E"), published a municipal GHG inventory. The following year, E&E presented to the Lander City Council on the strategic importance of GHG reduction goals and the co-benefits of GHG reduction projects, such as cost savings, resilient infrastructure, improved environmental quality, increased public safety, and increased quality of life. On December 12th, 2023, Lander City Council voted to adopt municipal GHG reduction targets of 20% by 2030, 50% by 2050, and 80% by 2050.¹⁴ The City of Lander and E&E are now working to chart a path toward achieving their 2030 reduction goal. Efforts from these two communities serve as an important example for the Cheyenne MSA and could lead to regional partnerships.

Tribal Partnerships

Tribal partnerships are evident through various initiatives and grant programs in Wyoming. The **Adapting to Climate Change in Wyoming** grant program, in collaboration with the University of Wyoming and partner organizations, is funding projects to help localities build resilience to climate-related risks, particularly in rural, underserved, and tribal communities. This program supports grassroots efforts and shares resources with community leaders. The initiative is open to community groups, local, state, and tribal governments, nonprofit organizations, and private entities working across the state in these underserved areas. The program seeks to address increasing climate-related risks, such as wildfire, drought, flooding, and heat waves compounded by existing economic, social, and environmental stressors.¹⁵

Additionally, the Western Water Assessment is leveraging federal resources through NOAA to support tribal governance and climate action, particularly focusing on the Wind River Reservation. Furthermore, the U.S.

¹² Laramie Greenhouse Gas Inventory. City of Laramie. August 27, 2019.

<https://cityoflaramie.org/AgendaCenter/ViewFile/Item/6707?fileID=8322>

¹³ Climate and Energy. City of Laramie. <https://www.cityoflaramie.org/1234/Climate-and-Energy>

¹⁴ Energy and Environment Task Force. City of Lander. <https://www.landerwyoming.org/lander-energy-and-environment-task-force>

¹⁵ UW and Partner Offer Grants for Wyoming Communities to Adapt to Climate Change. February 22, 2023. <https://www.uwyo.edu/news/2023/02/uw-and-partner-offer-grants-for-wyoming-communities-to-adapt-to-climate-change.html>

Department of Agriculture's Regional Conservation Partnership Program (RCPP) is streamlining efforts to promote conservation and climate-smart agriculture in Wyoming, which can also benefit tribal lands and communities. These efforts demonstrate an opportunity for tribal partnerships in addressing climate change and building resilience in Wyoming.¹⁶

The City of Cheyenne is open to working with the tribes in the region but acknowledges that the geographical limitations and distance to the nearest tribal community present challenges to developing relationships that provide meaningful benefits to all parties involved.

Local Climate Action Plans and Comprehensive Plans

In Wyoming, the cities of Lander and Laramie have completed GHG inventories, adopted GHG reduction resolutions, and are in the process of finalizing CAPs. The Cheyenne MSA, however, currently does not have such documents. The CPRG Planning Grant funds will be used to conduct a thorough greenhouse gas inventory and Comprehensive Climate Action Plan.

The Cheyenne MSA is starting to incorporate climate-friendly policies and municipal code regulations including mixed-use development, complete streets, urban canopy development, and other climate actions. Cheyenne will advance clean energy and emissions reduction through priority projects including renewable energy, landfill solar, community solar, and methane emissions reduction strategies and implementation.

Generally, cities and counties with CAPs divide goals and strategies into four major categories: Buildings and Energy, Transportation, Green Space, and Waste and Operations. Broad, region-wide alignment exists on several CAP strategies to address climate change, particularly those that both mitigate climate change and increase quality of life. Aligned strategies may include:

1. Mixed-use and transit-oriented development projects that encourage transit ridership, foster walkability, and operate efficiently.
2. Complete streets goals focused on encouraging sustainable transportation.
3. Carbon sequestration through urban forestry to reduce heat islands and improve mental health.
4. Increase energy efficiency and renewable energy development.
5. Support for electric vehicle (EV) charging infrastructure.
6. Reduce waste in government operations and divert appropriate waste to recycling and composting streams.

Identifying Overburdened Communities

An overburdened community might be defined by factors such as high levels of pollution, limited access to essential services, economic distress, or other social determinants of health. These criteria can vary depending on the specific policies or programs in place at the state or local level. The Comprehensive Climate Action Plan will further investigate the specific state policies, regulations, and programs that define the criteria for a community in Wyoming, and the Cheyenne MSA specifically, to be considered overburdened. Other considerations will include environmental exposure and environmental affects that represent threat indicators in a community, as well as additional sensitive population indicators and socioeconomic factors that represent the vulnerability of a community.

¹⁶ Adapting to Climate Change in Wyoming. Western Water Assessment.
<https://www.colorado.edu/research/projects/adapting-climate-change-wyoming>

For the purposes of CPRG, EPA defines a Low-Income and Disadvantaged Community (LIDAC) as a community that is identified as disadvantaged by the [Climate and Economic Justice Screening Tool](#) (CEJST) or any census block group that is at or above the 90th percentile for any of the [Environmental Justice Screening and Mapping Tool](#)'s (EJScreen) Supplemental Indexes when compared to the nation or state.¹⁷ Figure 6 below illustrates the Cheyenne MSA LIDACs (in blue) as defined by the CEJST mapping tool. A deeper analysis of LIDAC areas is covered in section 3.5 Low Income and Disadvantaged Communities Benefit Analysis.



Figure 6: Climate and Economic Justice Screening Tool for the Cheyenne MSA
Source: <https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5>

Equity Plans and Approaches across Cheyenne MSA

The most notable equity plan existing in the Cheyenne MSA is the Laramie County Community Health Improvement Plan (CHIP).¹⁸ Created by the Laramie County Community Partnership to guide public health initiatives in Laramie County, the CHIP uses a broad range of data to identify priority health needs in the community. Their most recent version, published in 2022, prioritized three areas of focus: Neighborhood and Physical Environment, Access to Healthcare, and Economic Stability. These were further broken down into six goals, or community measures, that “encompass the collaborative work of multiple initiatives and organizations.”

Focus 1: Neighborhood and Physical Environment

¹⁷ Climate Pollution Reduction Grants Program: Technical Reference Document for States, Municipalities and Air Pollution Control Agencies. Benefits Analyses: Low-Income and Disadvantaged Communities. United States Environmental Protection Agency Office of Air and Radiation. April 27, 2023.

https://www.epa.gov/system/files/documents/2023-05/LIDAC%20Technical%20Guidance%20-%20Final_2.pdf

¹⁸ 2022 Laramie County Community Health Improvement Plan. Laramie County Community Partnership. May 2022. https://www.laramiecountyhealthmatters.org/content/sites/laramie/CHIP_-_Final.pdf

1. Increase housing stability in Laramie County: Build capacity and partnership to sustain and improve emergency shelter and transitional housing; support and expand programs that connect individuals to resources and services for their wellbeing.
2. Increase community safety throughout Laramie County: Promote policies that increase housing affordability; create a safer transportation environment (especially for pedestrians and bicyclists).

Focus 2: Access to Healthcare

3. Increase access to comprehensive healthcare coverage: Improve knowledge, skills, and ability to enroll in and use health insurance, promote policies that increase access to healthcare coverage.
4. Increase access to providers through innovative community partnerships: Improve the accessibility of behavioral health services; improve the accessibility of primary healthcare services.

Focus 3: Economic Stability

5. Cultivate an environment that increases workplace participation: Improve workplace policies to facilitate an environment that promotes inclusion and economic stability.
6. Build and sustain partnerships and resources that support economic stability for residents, especially youth and families: Improve workplace policies to facilitate an environment that promotes inclusion and economic stability.

This CHIP is the only known Equity Plan for the Cheyenne MSA in existence. However, the City of Cheyenne has been working with the Housing Solutions Lab/Peer Cities and Hester Street to develop a community engagement plan that will improve the effectiveness of our outreach efforts and will further inform future equity plans for the area, including the CCAP.^{19 20} The City has identified that the largest gaps in outreach and engagement have historically been with communities in the Cheyenne neighborhoods south of I-80 and in the South Greeley area, as well as with the smaller towns within Laramie County, such as Pine Bluffs, Burns, Albin, and Ranchettes—a census-designated area north of Cheyenne within the MSA. These areas tend to have lower-income populations, less access to infrastructure such as high-speed internet, and tend to suffer more risks related to environmental changes, such as increased wildfire risk, agricultural loss, flooding, etc. Several steps have been made to help the City better understand the culture of these underrepresented areas and groups within the Cheyenne MSA, including the creation of an internal Community Outreach Task Force, creating relationships within the Laramie County Community Partnership, and reaching out to influential stakeholders making measurable differences throughout Laramie County. The City was also selected to participate in the EPA’s Building Blocks for Sustainable Communities program, which will assist in developing an equitable community and infrastructure development plan in under-resourced areas through sustainable, smart-growth strategies.²¹ By forming these relationships, we are planning our next step of creating a consistent and robust outreach strategy to maintain connections with our underrepresented community members.

A comprehensive communications and outreach strategy will be built in partnership with stakeholders and the EPA’s Planning for Equitable Development tool, and executed through City attendance of community

¹⁹ Cheyenne Joins National Effort to Confront Local Housing Challenges. City of Cheyenne. June 1, 2023.

<https://www.cheyennecity.org/News-articles/Cheyenne-Joins-National-Effort-to-Confront-Local-Housing-Challenges>

²⁰ Community Engagement Guidebook. 2023 Peer Cities Network Learning Module. Housing Solutions Lab. Hester St.

<https://hesterstreet.org/wp-content/uploads/2023/12/Peer-Cities-Final-Report-Draft-v7-Cheyenne.pdf>

²¹ Building Blocks for Sustainable Communities. EPA. <https://www.epa.gov/smartgrowth/building-blocks-sustainable-communities>

events, City-led initiatives that utilize multiple channels of communication and ensuring that City-organized events are inclusive and equitable, with appropriate digital and accessibility options. Through these tactics, we will develop a data-driven and people-focused outreach and equity program, guided by smart growth principles with substantive steps towards implementation of sustainable environmental, social, and economic equity.

Utility Considerations

Wyoming has adopted an all the above energy strategy due to its abundant natural resources and deep energy expertise. Evolving market conditions and increasing demands for low-emission energy products have encouraged the state to invest in energy research and technology commercialization.

Black Hills Energy, the natural gas and electricity service provider to the Cheyenne MSA, is pursuing climate targets across their corporation with goals to reduce electric utility emission intensity 40% by 2030 (0.59 MT CO₂e/MWh) and 70% by 2040 (0.29 MT CO₂e/MWh) as compared to 2005 (0.99 MT CO₂e/MWh). This includes Scope 1 owned generation and Scope 3 purchased power.²² The utility provides residential and commercial rebates to their customers in Laramie County for lighting, air conditioning, and electric vehicle charging stations.^{23,24} Cheyenne MSA can leverage these existing incentive programs in future community outreach campaigns to help residents, businesses, and the City itself reduce utility costs and lower their carbon footprint.

The state legislature has established a net metering limit of 25 kilowatts for all residential and commercial customers.²⁵ This will limit the size of solar arrays that commercial customers can install on their facilities; however, other mechanisms can be employed to supply renewable energy credits to customers.

Fully electrifying rural communities in Laramie County and across Wyoming is impractical due to various economic, geographical, and infrastructure challenges, including high capital and operating costs for utility companies due to low population densities, difficulties in securing rights of way for construction and maintenance in local communities, remote terrain and the lack of existing infrastructure that make it costly and unfeasible to extend traditional electrical grids to rural areas. Sustainable microgrids could be considered in the CCAP as a reliable, affordable, and clean energy solution tailored to the specific needs of underserved and remote communities.

A transition to electric energy will require thoughtful planning and implementation, taking into account energy challenges that largely fall to electric utilities to address. It is necessary that utilities be central to electrification planning to ensure that electricity in the region remains safe, reliable, and affordable. Common challenges that utilities face as the region moves to an electrified future and confronts climate change include:

1. Comprehensive transportation and building electrification will significantly increase electric demand.

²² Our Commitment to Sustainability. Black Hills Energy. <https://www.blackhillsenergy.com/our-company/commitment-sustainability>

²³ Cheyenne Electric–Laramie County Residential Rebates. <https://www.blackhillsenergy.com/efficiency-and-savings/residential-rebates/cheyenne-electric-laramie-county-residential-rebates>

²⁴ Cheyenne Electric–Laramie County Commercial Rebates. <https://www.blackhillsenergy.com/efficiency-and-savings/commercial-rebates/cheyenne-electric-laramie-county-commercial-rebates>

²⁵ Net Metering. DSIRE. February 21, 2023. <https://programs.dsireusa.org/system/program/detail/553>

2. Power supply forecasting is increasingly difficult due to: increased demand for carbon-free and renewable energy to meet clean energy mandates and increased energy demand; increasing extreme weather events; anticipated climate change impacts to the region's hydroelectric resource; and variable energy resources (e.g., wind and solar) replacing predictable and on- demand resources (e.g., natural gas and coal generation).
3. Grid maintenance and operational costs will increase as electric loads increase and infrastructure ages. There is also a significant cost burden for the necessary network upgrades for new clean energy construction projects.
4. The lag in transmission development and infrastructure restricts access from rural renewable energy production to urban centers.

The projected need for clean energy has created an opportunity for utilities to partner with customers and communities to collaborate on energy and environmental goals that will have far-reaching benefits beyond energy conservation (i.e., improved health, comfort, safety, and financial outcomes). Opportunities to continue to partner with customers and communities to achieve smart and beneficial electrification goals include:

1. Increased emphasis on energy efficiency and conservation, particularly as consumers purchase and install electrified equipment in homes and businesses.
2. Transportation electrification planning that results in managed and bi-directional EV charging strategies.
3. Expanded implementation of demand-response programs, including rate design, that encourages energy consumption at times of low demand.
4. Expansion of local distributed energy resources, including solar installations paired with battery energy storage.
5. Development of public-private partnerships to implement innovative load management projects in concert with electrification to optimize grid operations.
6. Broad stakeholder engagement to ensure electrification opportunities are accessible across all demographics and to avoid system-wide cost-shifts to overburdened households and communities.
7. Broad access to funding, technical resources, grant administrative assistance, and installer networks to lower barriers to implementing the above.

Financial Challenges Associated with Grid Decarbonization

Some of the financial challenges for grid decarbonization in Wyoming include the access to low-carbon energy, the cost of deploying new technologies, and the economic impact on the existing workforce. Wyoming faces hurdles in scaling Direct Air Capture (DAC) due to the need for additional clean electricity and heat for large DAC projects, despite already meeting over 20% of its electricity needs with wind power.²⁶ The state has mandated that utilities implement carbon capture technology to keep the coal industry alive but

²⁶ DAC Captures Wyoming's Imagination. Center for Climate and Energy Solutions. <https://www.c2es.org/2023/06/dac-captures-wyomings-imagination/>

this technology is still expensive and ratepayers are paying the increased costs.²⁷ The state's heavy reliance on fossil fuel extraction and its workforce in the coal industry also present challenges in transitioning to a decarbonized grid, as rapid decarbonization could lead to job losses in the mining sector.²⁸

3 PCAP elements

3.1 Greenhouse Gas (GHG) Inventory

3.1.1 GHG Inventory Scope

This GHG inventory represents the Cheyenne MSA, wherein Laramie County is the only county represented in this region. This Metropolitan Statistical Area represents an estimated population of 100,863.

The base year for this PCAP and GHG inventory is 2021. The grantees have chosen this year because of federal, state, and local data availability. This year is also representative of general emissions patterns.

This inventory represents emission estimates for primary GHGs (i.e., CO₂, CH₄, N₂O, HFCs, PFCs, SF₆, and NF₃) for the Cheyenne, WY Metro Area.²⁹

This inventory is based on version 1.2 of the U.S. Community Protocol for Accounting and Reporting GHG Emissions and additional activities/sources are considered in accordance with the Global Protocol for Community-Scale GHG Emissions Inventories.³⁰ The scope covers both “sources” and “activities” since they are the two central categorizations of emissions.³¹

3.1.2 Methodology & Data Overview

GHG emissions are quantified in two ways:

1. Measurement-based methodologies refer to the direct measurement of GHG emissions (from a monitoring system) emitted from a flue of a power plant, wastewater treatment plant, landfill, or industrial facility.
2. Calculation-based methodologies calculate emissions using activity data and emission factors. To calculate emissions accordingly, the basic equation below is used:

$$\text{Activity Data} \times \text{Emission Factor} = \text{Emissions}$$

Most emissions sources in this inventory are quantified using calculation-based methodologies. Activity data refers to the relevant measurement of energy use or other GHG-generating processes such as fuel consumption by fuel type, metered annual electricity consumption, and annual vehicle miles traveled.

Known emission factors are used to convert energy usage or other activity data into associated quantities of emissions. Emissions factors are usually expressed in terms of emissions per unit of activity data (e.g. MT

²⁷ Wyoming’s coal mandate continues to cost electric customers. Wyofile. January 24, 2024.

<https://wyofile.com/wyomings-coal-mandate-continues-to-cost-electric-customers/>

²⁸ Distributional labor challenges and opportunities for decarbonizing the US power system. Nature Climate Change. November 2, 2023. <https://www.nature.com/articles/s41558-023-01802-5>

²⁹ GHGs aside from CO₂, CH₄, N₂O are estimated from Industrial Processes and entered as CO₂ equivalent (CO₂e)

³⁰ ICLEI. 2019. US Community Protocol for Accounting and Reporting Greenhouse Gas Emissions. Retrieved from <http://www.icleiusa.org/tools/ghg-protocol/community-protocol>

³¹ 1) GHG emissions that are produced by “sources” located within the community boundary, and 2) GHG emissions produced as a consequence of community “activities.”

CO₂/kWh of electricity). For this inventory, calculations were made using ICLEI's ClearPath Climate Planner tool.³²

³² <https://icleiusa.org/clearpath/>

The following tables provide an overview of data sources, methodologies, and data gaps/assumptions:

Transportation & Mobile Sources			
Activity/Source	Data Source	Methodology	Data Gaps/Assumptions
On-Road	Google Environmental Insights Explorer	Extracted GPC compliant Boundary, Inbound, and Outbound county VMT and applied national average MPGs and vehicle/fuel types.	Since local VMT data was not available, national defaults were used. Therefore, VMT data was only separated into Gasoline and Diesel.
Rail	EPA's 2020 National Emissions Inventory	Extracted county data by GHG type, estimated MMBtu using MT CO2/MMBTU emissions factor	Because NEI does not provide activity data, we estimated MMBtu using the MT CO2/MMBTU emissions factor
Aviation	Not included in PCAP		
Waterborne	EPA's 2020 National Emissions Inventory	Extracted county data by GHG type, estimated MMBtu using MT CO2/MMBTU emissions factor	Because NEI does not provide activity data, we estimated MMBtu using the MT CO2/MMBTU emissions factor
Off-Road/Mobile	EPA's 2020 National Emissions Inventory	Extracted county data by GHG type, estimated MMBtu using MT CO2/MMBTU emissions factor	Because NEI does not provide activity data, we estimated MMBtu using the MT CO2/MMBTU emissions factor
Emissions factors	EIA's Annual Energy Review, Bureau of Transportation Statistics Average Fuel Efficiencies, and EPA's Emission Factors for Greenhouse Gas Inventories	n/a	n/a

Grid Electricity			
Activity/Source	Data Source	Methodology	Data Gaps/Assumptions
Residential Electricity	Energy Information Association State Energy Summaries	Extracted state electricity consumption data and downscaled using a ratio of county households out of state households	Since utility data was unavailable, this alternative was considered most applicable. This approach assumes every house uses grid electricity.
Commercial Electricity	Energy Information Administration State Energy Summaries	Extracted state electricity consumption data and downscaled using a ratio of county commercial jobs out of state commercial jobs	Since utility and state commercial square footage data was unavailable, this alternative was considered most applicable.
Industrial Electricity	Energy Information Administration State Energy Summaries	Extracted state electricity consumption data and downscaled using a ratio of county industrial jobs out of state industrial jobs	Since utility and state industrial square footage data was unavailable, this alternative was considered most applicable.
Electricity Generation	EPA FLIGHT	Extracted site-specific data per county and directly entered raw metric tons (per GHG)	This data is recorded but emissions are not considered in the GHG inventory total because the majority of electricity generation emissions are assumed to be captured in the residential, commercial, and industrial electricity emissions.
Emissions factors	EPA's eGRID2021	n/a	n/a

Solid Waste			
Activity/Source	Data Source	Methodology	Data Gaps/Assumptions
Landfilled Waste	City of Cheyenne	Enter waste generation tonnage	Assumed that Landfill Methane Collection Scenario is "worst case," used national average Mix MSW composition, and assumed all waste is generated in boundary. (all confirmed by Cheyenne staff)
Emissions factors	TBD	TBD	TBD

Other Sources			
Activity/Source	Data Source	Methodology	Data Gaps/Assumptions
Residential Stationary Fuel	Energy Information Administration State Energy Summaries	Extracted state stationary fuel consumption data and downscaled using a ratio of county households out of state households	Since utility data was unavailable, this alternative was considered most applicable.
Commercial Stationary Fuel	Energy Information Administration State Energy Summaries	Extracted state stationary fuel consumption data and downscaled using a ratio based on county commercial jobs out of state commercial jobs	Since utility and state commercial square footage data was unavailable, this alternative was considered most applicable.
Industrial Stationary Fuel	EPA FLIGHT	Extracted site-specific data per county and directly entered raw metric tons (per GHG)	Assumed the majority of industrial stationary fuel consumption is captured in EPA FLIGHT.
Fugitive emissions from natural gas distribution	Energy Information Administration State Energy Summaries & FLIGHT	Enter natural gas consumption (MMBtu) per county	Used defaults from ClearPath Fugitive Emissions from Natural Gas Distribution Calculator
Fugitive emissions from oil and natural gas systems	EPA FLIGHT	Extracted site-specific data per county and directly entered raw metric tons (per GHG)	Assumed any emissions from natural gas distribution is captured in "Fugitive emissions from natural gas distribution"
Industrial Process & Product use	EPA FLIGHT	Extracted site-specific data per county and directly entered raw metric tons (per GHG)	GHGs are captured internally and entered as CO2 equivalent (CO2e)
Water Treatment Energy	n/a	n/a	Assumed to be captured in the commercial and/or industrial electricity and stationary fuel consumption estimates.
Wastewater Treatment Energy	n/a	n/a	Assumed to be captured in the commercial and/or industrial electricity and stationary fuel consumption estimates.
Wastewater Treatment	US Census Bureau	Used ClearPath's population-based calculations	Due to the unavailability of site-specific wastewater treatment operations data, we assumed the following: Yes Nitrification/Denitrification, an Industrial Commercial Discharge Multiplier of 1.25, WW generated and treated in boundary, systems are predominantly Anaerobic, Effluent discharge goes into stream/river
Agriculture: Livestock	U.S. Department of Agriculture's (USDA) 2017 Census of Agriculture, County Data	Extracted livestock headcounts and crop counts and utilized the EPA's State Inventory Tool, Agriculture Module to estimate emissions	Due to the differing categorizations of the EPA's SIT Agriculture Modules and the USDA's 2017 Census of Agriculture county data, the following categories were grouped together/assumptions were made: Milks Cows = Dairy Cows, Cows and heifers that calved = Feedlot Heifers, Cattle/calves = Calves, Beef cows = Beef Cows, Other cattle = Heifer Stockers, Hogs are all assigned to the "Market 120-179 lbs" category, Layers = Layers, Pullets for laying flock replacement = Pullets/ Chickens, Broilers, and other meat-type chickens = Broilers, all sheep = Sheep on Feed

Other Sources (cont'd)			
Activity/Source	Data Source	Methodology	Data Gaps/Assumptions
Forestry and Land Use	Land Emissions and Removals Navigator (LEARN) Tool	Extracted county-level emissions and removals for forests, changes in forestry, urban trees, etc.	This data is recorded but emissions are not considered in the GHG inventory total per ICLEI's US Community Protocol (emissions and removals from forestry and land use should not count towards gross emissions) Used Albuquerque, NM as the "representative urban area" for emissions factors
Stationary Fuel Emissions Factors	EPA's GHG Emission Factors Hub	n/a	n/a
Fugitive emissions from natural gas distribution	Environmental Defense Fund's (EDF) User Guide for Natural Gas Leakage Rate Modeling Tool.	n/a	n/a
Wastewater Treatment Emissions Factors	IPCC Methods for Greenhouse Gas Inventories	n/a	n/a
Agriculture Emissions factors	EPA's State Inventory Tool Agriculture Module	n/a	n/a
Forestry and Land Use	U.S. Forest Service's Forest Inventory and Analysis (FIA) database	n/a	n/a

3.1.3 GHG Emission Results

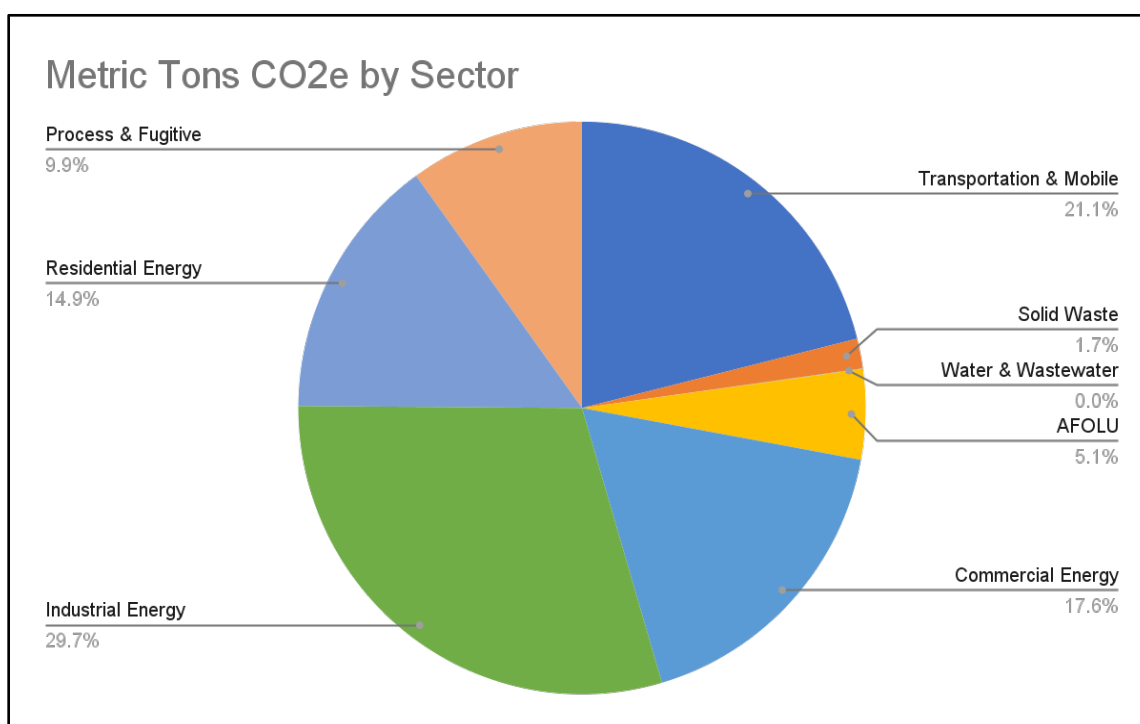
Sector/Activity	Fuel or Source	2021 Usage/Activity	Units	2021 Emissions (MT CO ₂ e)
Residential Energy	Electricity	513,630,696	kWh	271,708
	Wood	264,462	MMBtu	2,576
	Distillate Fuel Oil No. 2	6,434	MMBtu	479
	Propane	398,176	MMBtu	24,710
	Natural Gas	2,792,133	MMBtu	148,495
	Residential Energy Total			447,968
Commercial Energy	Electricity	667,401,180	kWh	353,052
	Distillate Fuel Oil No. 2	311,497	MMBtu	23,192
	Propane	194,685	MMBtu	12,082
	Natural Gas	2,530,909	MMBtu	134,602
	Other Commercial Fuels	-		3,198
	Commercial Energy Total			526,126

Sector/Activity	Fuel or Source	2021 Usage/Activity	Units	2021 Emissions (MT CO ₂ e)
Industrial Energy	Electricity	1,333,972,875	kWh	705,665
	Natural Gas	3,154,893	MMBtu	178,468
	Distillate Fuel Oil No. 2	932	MMBtu	69
	Other Industrial Fuels	-		4,652
	Industrial Energy Total			888,854
On Road Transportation	Gasoline	844,588,503	Vehicle Miles Traveled (VMT)	340,558
	Diesel	100,919,760	Vehicle Miles Traveled (VMT)	145,346
Rail Transportation	Diesel	1,324,829	MMBTU	98,845
Waterborne Transportation	Gasoline	846	MMBTU	61
	Diesel	207	MMBTU	15
Off Road Transportation & Mobile Sources	Gasoline	147,202	MMBTU	10,576
	Diesel	474,614	MMBTU	35,120
	CNG	4,361	MMBTU	277
	LPG	28,565	MMBTU	1,759
	Transportation & Mobile Sources Total			632,557

Sector/Activity	Fuel or Source	2021 Usage/Activity	Units	2021 Emissions (MT CO2e)
Solid Waste	Waste Landfilled	81,556	Tons	50,456
	Solid Waste Total			50,456
Water and Wastewater	Wastewater Treatment	-	-	997
	Water and Wastewater Total			997
Process & Fugitive Emissions	Fugitive Emissions from Natural Gas Distribution	8,565,576	MMBTU	15,816
	Industrial Process & Product Use	-	-	282,282
	Process & Fugitive Emissions Total			298,098
Agriculture, Forestry, and other Land Uses (AFOLU)	Livestock	-	-	152,153
	Land/Forestry	-	-	-107
	AFOLU Total (does not include Land/Forestry)			152,153
Total 2021 Regional Emissions				2,997,209

3.1.4 Inventory by Sector

Sector	Metric Tons CO ₂ e
Transportation & Mobile Sources	632,557
Solid Waste	50,456
Water & Wastewater	997
AFOLU	152,153
Commercial Energy	526,125
Industrial Energy	888,853
Residential Energy	447,968
Process & Fugitive Emissions	298,097



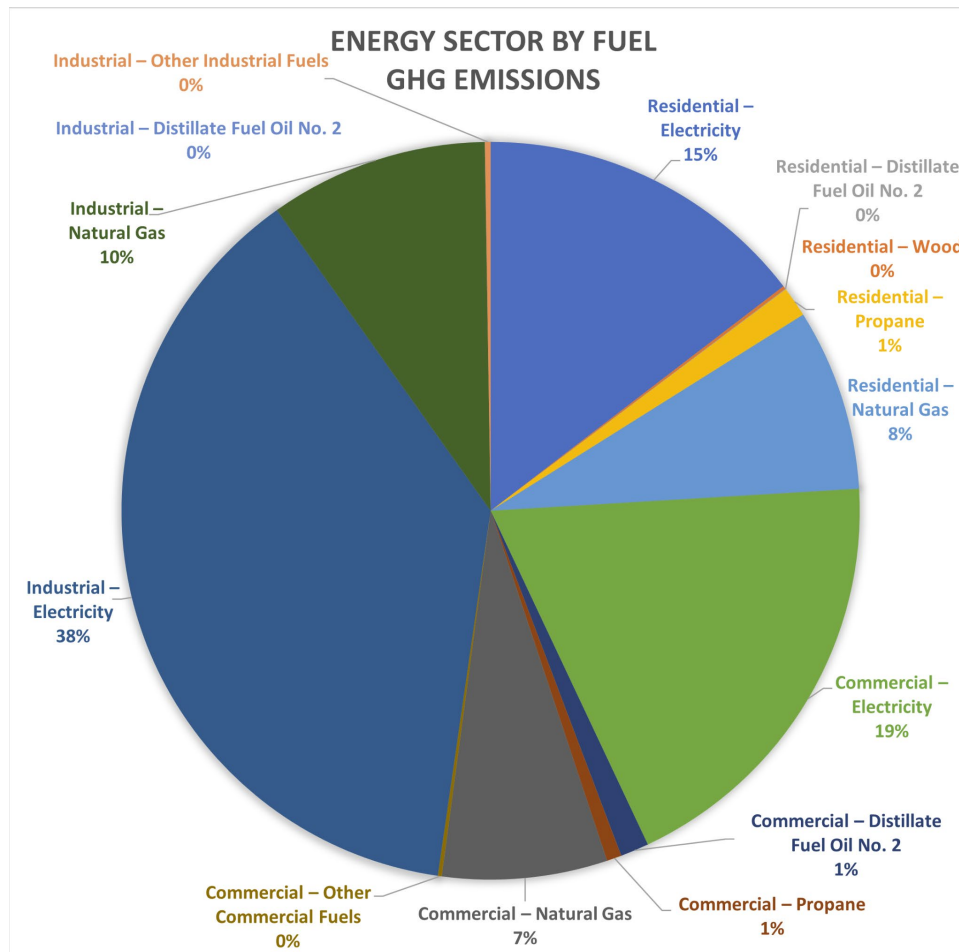
Built Environment and Energy Consumption

As can be seen in the energy sector pie chart below, emissions from residential, commercial, and industrial electricity use are the largest GHG polluters. According to the Wyoming GHG Inventory and Reference Case Projection, electricity use, the fossil fuel industry, and transportation are the state's primary emissions with electricity use projected to be the largest contributor to future emissions growth, followed by emissions associated with transportation.³³ The Wyoming Department of

³³ Wyoming Greenhouse Gas Inventory and Reference Case Projections 1990-2020. Center for Climate Strategies Spring 2007.
https://eplanning.blm.gov/public_projects/nepa/66551/143342/176067/B11_Wyoming_GHG_Inventory_and_Reference_Case_Projections_1990-2020.pdf

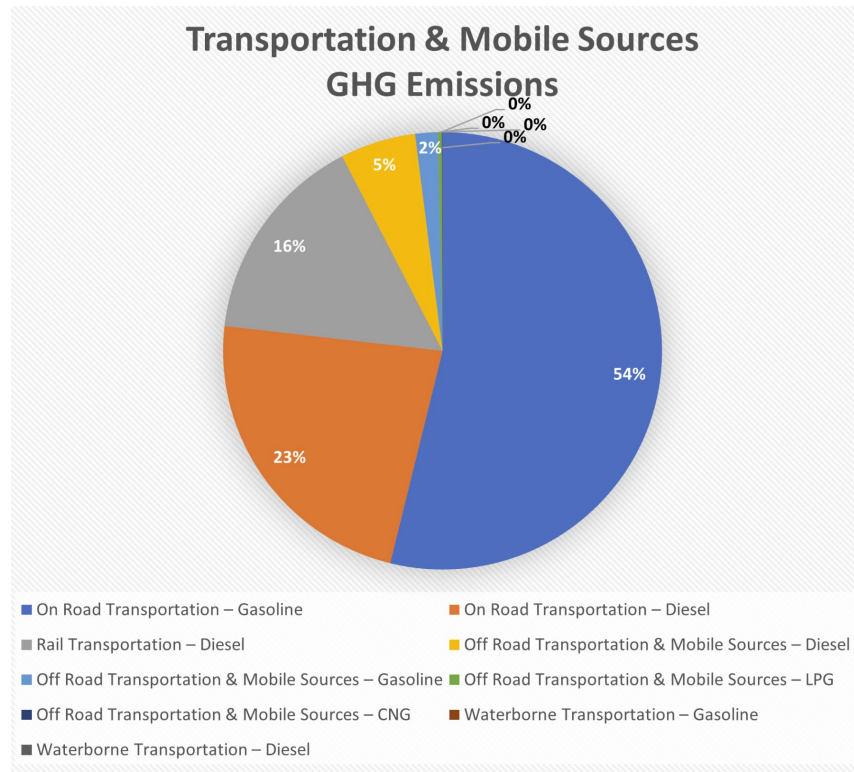
Environmental Quality monitors and collects actual emissions data in accordance with federal regulations.

The City of Cheyenne is interested in exploring options to reduce GHG emissions from its electricity use through the installation of renewable energy. The City has been collaborating with RMI to identify opportunities on municipally owned land, which include solar at the landfill and landfill buffer areas, Belvoir Ranch, and energy-intensive municipal facilities.



Transportation and Land Use

Transportation and other mobile sources can be divided into several sub-sectors—on-road vehicles, rail transportation, off-road transportation, waterborne transportation, and aviation. As seen in the Transportation & Mobile Sources pie chart below, on-road vehicles are dominated by light-duty (gasoline) passenger vehicles and heavy-duty (diesel) vehicles. The heavy-duty on-road sector is primarily freight and service vehicles, although there is a contribution from public transit vehicles which are inventoried separately because of their differing roles and controls. The off-road transportation and mobile sources sub-category includes a range of construction equipment, generators, off-road vehicles, farm equipment, and miscellaneous equipment. Emissions from waterborne vehicles are negligible. Aviation is primarily military and commercial passenger (jet) aircraft with some commercial freight. There is not a clear technical consensus on the scope of the aviation emissions and may be further quantified in the CCAP.



Materials and Waste

In a geographic-based emissions analysis, materials and waste management includes the handling of solid and liquid waste. Solid waste emissions come from the transport of waste to landfill facilities, and any CH₄ and CO₂ that is released as a result of natural breakdown of waste materials. There are two landfills within the MSA boundary—the City of Cheyenne-owned Happy Jack Landfill west of Cheyenne and the privately-owned Eastern Laramie County Landfill northeast of Burns—with transfer stations in the surrounding communities. The City of Cheyenne provides curbside recycling services to residents within city limits.

Liquid waste (wastewater) includes both sewer and septic systems and is primarily due to the biological processing of organic material in the water. Sewage waste from around Laramie County is processed at two facilities in Cheyenne – Crow Creek and Dry Creek. At Crow Creek, waste is initially treated and then rerouted to the Dry Creek facility to undergo anaerobic digestion. At Dry Creek, sludge goes through gas compressed primary and secondary digesters and eventually is turned into biogas. The biogas is then either cycled back to be used to power the digesters or is flared off into the environment. Flaring the gas reduces the greenhouse warming potential of the methane by releasing carbon dioxide instead. The utility and the City are interested in investigating an expansion of this biogas capture and potentially using it for end product purposes, such as fuel or electricity production.

Natural Resources

Natural resources refer primarily to emissions due to tree cover loss. When a tree is cut down or dies, the soil and roots under the tree release carbon into the air resulting in GHG emissions. The loss of trees can result from a range of actions including harvesting/clearing, fire, disease, and storm damage. The Cheyenne MSA is located in a prairie environment, but the urban areas are populated with trees. The City of Cheyenne requires trees to be planted for commercial developments and there are two tree initiatives in the broader MSA—the



Figure 7: Landfill Site Area (looking Northwest)

High Plains Arboretum and Rooted in Cheyenne. As in many Wyoming towns, there are 100+ year old cottonwood trees that are infected or aging out. These large trees that provide shade for people and other ecological services will need to be removed.

The U.S. Forest Service is working with the City of Cheyenne to identify target areas to perform tree thinning to decrease fuel loading and wildfire risk. Those target areas include forested stands adjacent to 1) City of Cheyenne water sources, 2) critical power and transportation infrastructure within our unit's boundaries, 3) private parcels to promote human safety by improving ingress/egress and increasing efficacy in wildfire suppression efforts, and 4) within prioritized coniferous stands to enhance ecosystem and watershed resilience to future wildfires. Retooling heating equipment to accept biomass at facilities like the University of Wyoming might be an end market for the thinned wood.

Additionally, federally managed lands around Rob Roy Reservoir contain important municipal water infrastructure for the City of Cheyenne, including water intakes, pipelines, and the reservoir itself. The City of Cheyenne, Cheyenne Board of Public Utilities, Wyoming State Forestry Division, and Medicine Bow National Forest have collaborated on fuel treatments in the past as well as the Rob Roy GNA project, which is currently nearing completion. Despite past success, there is a clear need for additional vegetation management in this area to further reduce the risk of wildfire to City infrastructure and the municipal watershed. The Forest Service is currently exploring additional fuel treatments in the area, with implementation expected to start in 2026. In the interim, they are exploring options for funding final planning (treatment identification and resource surveys), as well as implementation itself. The City of Cheyenne and Wyoming State Forestry Division will be key partners in this future work.

Other Sectors

The last two important sectors are agriculture and refrigerants. Agriculture emissions are primarily CH₄ and N₂O from livestock digestion and manure management. Much of the non-urbanized land in the Cheyenne MSA is agricultural with grazing and crop production.

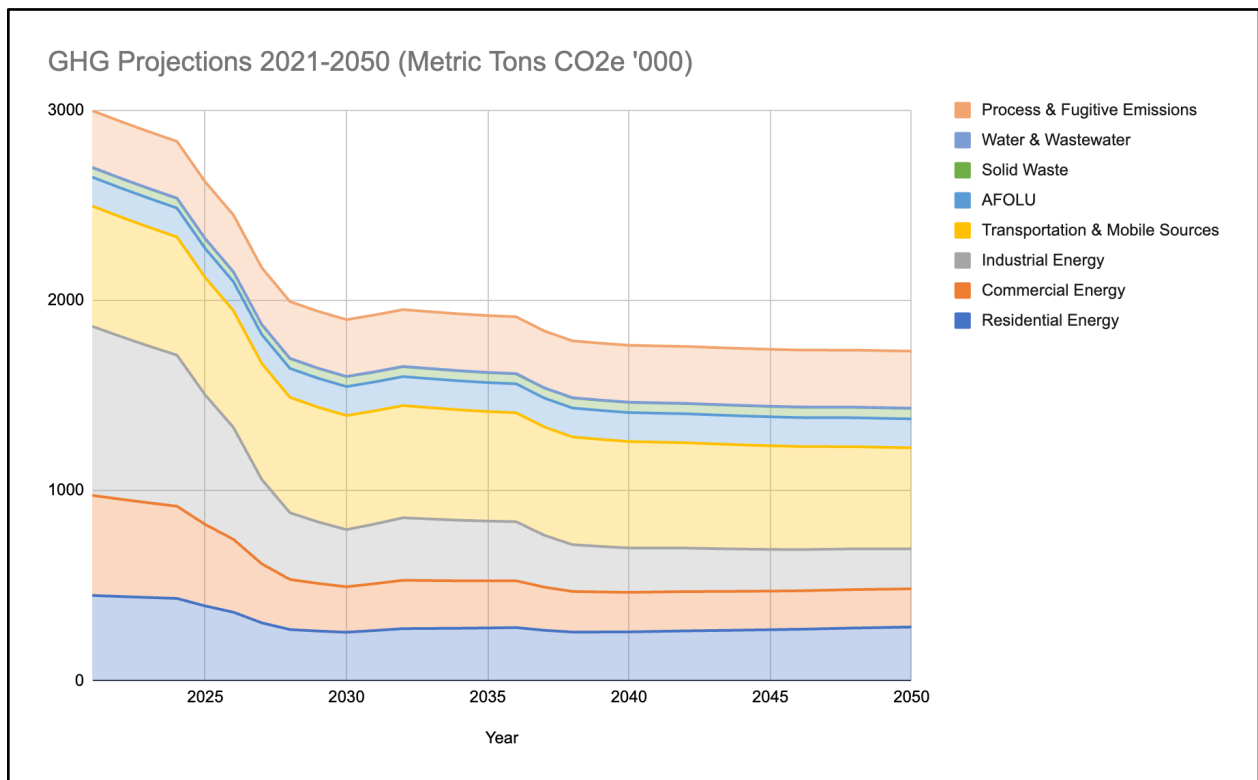
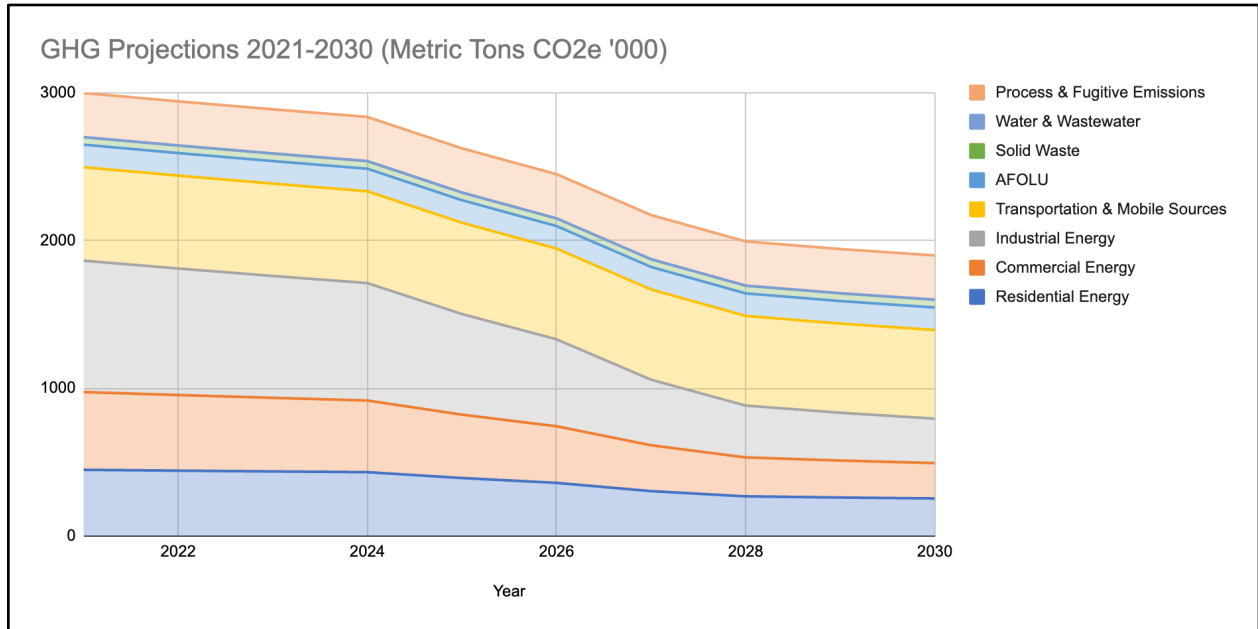
Refrigerant emissions are primarily due to leakage of chemical refrigerants, primarily hydrofluorocarbons (HFCs), from air conditioners, heat pumps, and refrigeration equipment.

3.2 GHG Emissions Projections

3.2.1 GHG Emissions Projections Overview

This PCAP uses a Business-as-Usual projection from 2021 (baseline year) to 2030 and 2050. This projection was carried out for every activity and source based on various activity growth rates and carbon intensity growth rates. These growth rates are listed below:

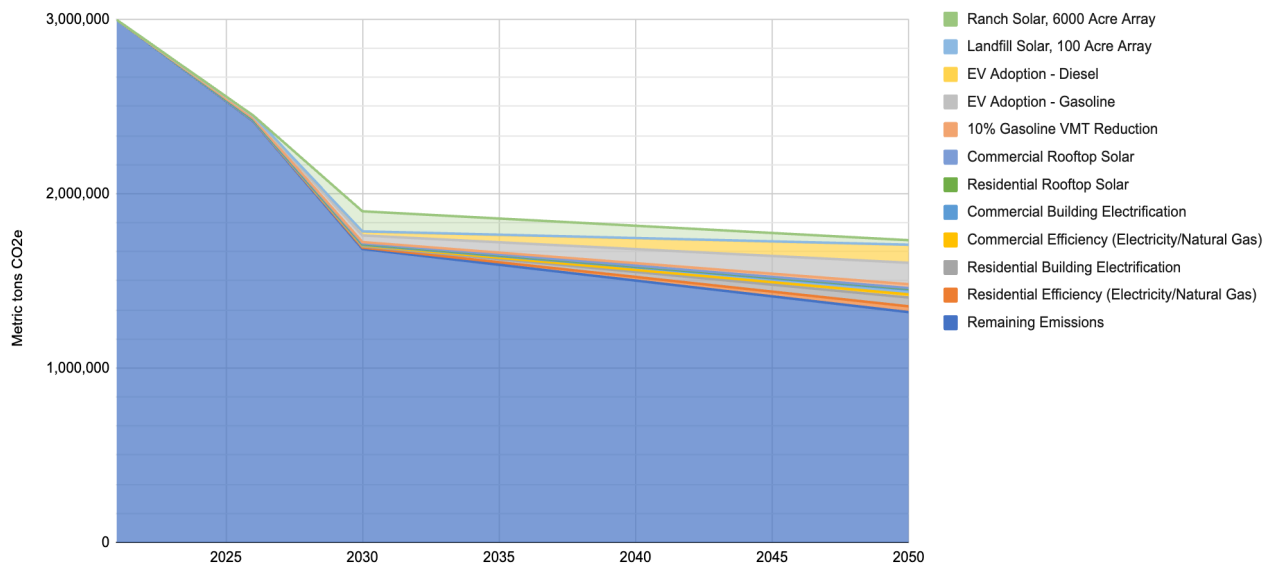
Projection Growth Rates				
Activity/Source	Type	Data Source	Methodology	Data Gaps/Assumptions
Wyoming State Grid Projections to 2050	Electricity Carbon Intensity Rate	2021 baseline data from eGRID2021 and projection data from National Renewable Energy Laboratory's (NREL) Cambium Scenario Viewer	n/a	n/a
Laramie County Population Projections	Residential Growth Projection	Wyoming Center for Business and Economic Analysis	Imputed provided data in 5-year increments	Based on growth to 2028
Laramie County Household Projections	Growth Projection (For various sectors)	Wyoming Center for Business and Economic Analysis	Imputed provided data in 5-year increments	Based on growth to 2028
CAFE Standards Default on Road Carbon Intensity Factors	On Road (passenger/light duty) Carbon Intensity Rate	Center for Climate and Energy Solutions (C2ES)	Miles per Gallon fleet averages were converted to Gallons per Mile. Values were then utilized to calculate a Compound Annual Growth Rate from 2010 to 2040. Values were carried forward to 2050.	Although CAFE standards apply to medium/heavy-duty trucks, the provided Carbon Intensity Factors are based on passenger cars and light-duty trucks because limited analysis of the fleetwide impact has been performed. The test procedure for CAFE standards is different than that used for MPG of vehicles in actual driving conditions.
No Growth	n/a	n/a	n/a	n/a



3.3 GHG Reduction Measures & Strategies (Annual Net MT CO₂e)

Measure	2026	2030	2050
Residential Efficiency (Electricity/Natural Gas)	2,564	8,155	33,408
Residential Building Electrification	752	7,121	50,577
Commercial Efficiency (Electricity/Natural Gas)	1,634	4,683	17,910
Commercial Building Electrification	347	3,289	27,652
Residential Rooftop Solar	5,685	4,939	4,823
Commercial Rooftop Solar	4,429	3,848	3,758
10% Gasoline VMT Reduction	2,627	7,329	22,085
EV Adoption - Gasoline	10,564	38,135	122,893
EV Adoption - Diesel	4,780	21,532	103,148
Landfill Solar, 100 Acre Array	0	1,884	424
Ranch Solar, 6000 Acre Array	0	115,077	25,934

GHG Reductions by Strategy (MT CO₂e)



GHG Reduction Strategies					
Measure	Data Used	Data Gaps/Assumptions	Data Source	Co-Benefits	Existing Financial Incentives
Residential Efficiency (Electricity/Natural Gas)	<p>-2% of existing housing units receiving efficiency retrofits per year.</p> <p>-20% Savings from efficiency retrofit of existing buildings.</p> <p>-25% Energy savings in new buildings</p>	<p>-Default value of existing housing units receiving efficiency retrofit per year was 5%, 5% of building stock per year: Typical heating/cooling equipment life is around 15-20 years, and 20 years translates to 1/20, or 5%, each year. It can make sense to do an efficiency upgrade at the same time as equipment replacement - the efficiency may allow for a smaller, less expensive AC unit or furnace.</p> <p>-ACEE reported 10% typical energy savings for a 'light' retrofit and 29% for a 'medium' retrofit - so 20% falls in the middle between those.</p> <p>-Default Energy savings in new buildings was 37%, 37% improvement for new buildings comes from comparing estimated EUI (energy use intensity) for 2018 commercial model energy code with average EUI of existing commercial buildings from 2012 commercial buildings energy consumption survey.</p>	Pacific Northwest National Laboratory (PNNL), U.S. Energy Information Administration	Lower utility bills for residential customers.	
Residential Building Electrification	<p>.5% (2026-2035) and 1% (2036-2050) of existing housing units with natural gas electrified per year.</p> <p>-50% of new construction electrified.</p> <p>-2.4 Heat Pump Coefficient of Performance (COP)</p> <p>-80% Furnace Efficiency</p>	<p>-Default value of existing housing units with natural gas electrified per year is 5%, 5% of building stock per year: Typical heating/cooling equipment life is around 15-20 years, and 20 years translates to 1/20, or 5%, each year.</p>	EnergyStar, Schroders (Peiser, R., & Wiegelmann, T. "Real Estate and Sustainability: The Moral Imperative." Property Chronicle.)	Improved indoor air quality	<p>Black Hills Energy residential <u>rebate program</u></p> <p>WY Energy Authority passthrough Home Electrification and Appliance Rebates Program ((if the DOE grants this money)).</p>

GHG Reduction Strategies					
Measure	Data Used	Data Gaps/Assumptions	Data Source	Co-Benefits	Existing Financial Incentives
Commercial Efficiency (Electricity/Natural Gas)	<p>-2% of existing commercial building units receiving efficiency retrofit per year.</p> <p>-20% Savings from efficiency retrofit of existing buildings.</p> <p>-25% Energy savings in new buildings</p>	<p>-Default value of existing housing units receiving efficiency retrofit per year was 5%, 5% of building stock per year: Typical heating/cooling equipment life is around 15-20 years, and 20 years translates to 1/20, or 5%, each year. It can make sense to do an efficiency upgrade at the same time as equipment replacement - the efficiency may allow for a smaller, less expensive AC unit or furnace.</p> <p>-ACEE reported 10% typical energy savings for a 'light' retrofit and 29% for a 'medium' retrofit - so 20% falls in the middle between those.</p> <p>-Default Energy savings in new buildings was 37%, 37% improvement for new buildings comes from comparing estimated EUI (energy use intensity) for 2018 commercial model energy code with average EUI of existing commercial buildings from 2012 commercial buildings energy consumption survey.</p>	Pacific Northwest National Laboratory (PNNL), U.S. Energy Information Administration	Lower utility bills for commercial customers.	<p>Black Hills Energy commercial <u>rebate program</u>.</p> <p>WY Energy Authority WYLite Energy Audits, Local Government Retrofit grant,</p> <p>K-12 Retrofit grant WY Energy Authority Small Business Energy Audit & Retrofit grant</p>
Commercial Building Electrification	<p>.5% (2026-2035) and 1% (2036-2050) of existing units with natural gas electrified per year</p> <p>-50% of new construction electrified</p> <p>-2.4 Heat Pump Coefficient of Performance (COP)</p> <p>-80% Furnace Efficiency</p>	<p>-Default value of existing commercial units with natural gas electrified per year is 5%, 5% of building stock per year: Typical heating/cooling equipment life is around 15-20 years, and 20 years translates to 1/20, or 5%, each year.</p>	EnergyStar, Schroders (Peiser, R., & Wiegelmann, T. "Real Estate and Sustainability: The Moral Imperative." Property Chronicle.)		<p>Black Hills Energy commercial <u>rebate program</u>.</p>

HG Reduction Strategies					
Measure	Data Used	Data Gaps/Assumptions	Data Source	Co-Benefits	Existing Financial Incentives
Residential Solar	-1,388.68 kWh/kW- Generation Potential -6745.72 kW installed capacity/year	<p>-Solar data-based Satellite imagery, 3D modeling, and shade calculations from Google. Baseline year for this data varies from analysis base year</p> <p>-Because Google estimates total rooftop solar capacity without consideration of technical/financial constraints, we assume 15% of estimated capacity is achievable by 2030, and another 50% is achievable by 2050</p> <p>-Because google outputs rooftop solar potential by roof orientation, we assume all directional orientations are residential</p>	Google Project Sunroof/EIE	Lower electricity bills for residents	30% federal tax credit (until 2035)
Commercial Solar	-1,388.68 kWh/kW- Generation Potential -5255.25 kW installed capacity/year	<p>-Solar data-based Satellite imagery, 3D modeling, and shade calculations from Google. Baseline year for this data varies from analysis base year.</p> <p>-Because Google estimates total rooftop solar capacity without consideration of technical/financial constraints, we assume 15% of estimated capacity is achievable by 2030, and another 50% is achievable by 2050</p> <p>-Because google outputs rooftop solar potential by roof orientation, we assume all flat roof orientations are non-residential</p> <p>- Does not account for Wyoming's 25kW net metering cap</p>	Google Project Sunroof/EIE	Lower electricity bills for commercial owners.	30% federal tax credit (until 2035)

GHG Reduction Strategies					
Measure	Data Used	Data Gaps/Assumptions	Data Source	Co-Benefits	Existing Financial Incentives
10% Gasoline VMT Reduction	10% Gasoline VMT Reduction by 2050	General benchmark	n/a	Improved air quality More people using alternative modes of transportation	n/a
EV Adoption - Gasoline	63.75% of Gasoline VMT will switch to EVs by 2050	-Follows National LDV Average -We assume 80% of new charging occurs in the residential sector, and 20% occurs in the commercial sector -We assume MSA EV turnover rate will be approximately 2/3 of national average	DOE Alternative Fuels Data Center, Statista, Rocky Mountain Institute (RMI)	Improved air quality	Up to \$2,000-3,000/port rebate from BHE for commercial Level 2 chargers and up to \$500 for residential Level 1 chargers. \$2,500-7,500 federal tax credit for EVs.
EV Adoption - Diesel	66.42% of Diesel VMT will switch to EVs by 2050	-Follows National HDV Average -We assume all new charging occurs in the commercial sector -We assume MSA EV turnover rate will be approximately 2/3 of national average	DOE Alternative Fuels Data Center, Statista, Rocky Mountain Institute (RMI)	Improved air quality	Black Hills Energy residential <u>rebate program</u> WY Energy Authority passthrough Home Electrification and Appliance Rebates Program ((if the DOE grants this money)).
Solar Development on Municipally Owned Land <u>Potential Projects Include:</u> -Landfill Grounds -Ranch Grounds -Other	<u>Landfill:</u> -1,507 kWh/kW- Generation Potential -14,230 kW Total Installed capacity -7,115 kW Installed capacity/year. <u>Ranch Grounds:</u> -1,559 kWh/kW- Generation Potential -840,000 kW Total Installed capacity -420,000 kW Installed capacity/year	-Estimated generation potential (kWh/kW) by dividing the provided capacity of the estimate total generation potential (kWh) -Assumed two active years of implementation/installment	Rocky Mountain Institute	Income from land leasing and reduced energy costs	

3.4 Low-Income Disadvantaged Communities Benefits Analysis

Cheyenne lost their designated Qualified Census Tracts based on the most recent 2020 Census, citing insufficient data to determine whether they met statutory QCT income or poverty rate eligibility criteria. This will have a significant impact on future development of low-income areas, which will further disenfranchise these low-income communities. The CCAP will provide a more thorough, detailed analysis through robust community engagement. Qualitative and quantitative data collection will provide a stronger picture of climate impacts and associated risks in the Cheyenne MSA region.

3.4.1 Identifying LIDACs and Climate Impacts and Risks

The *Climate and Economic Justice Screening Tool*, the *Environmental Justice and Screening Mapping Tool*, and responses from the Stakeholder and Community Outreach survey were used to identify several key LIDACs within the Cheyenne MSA.

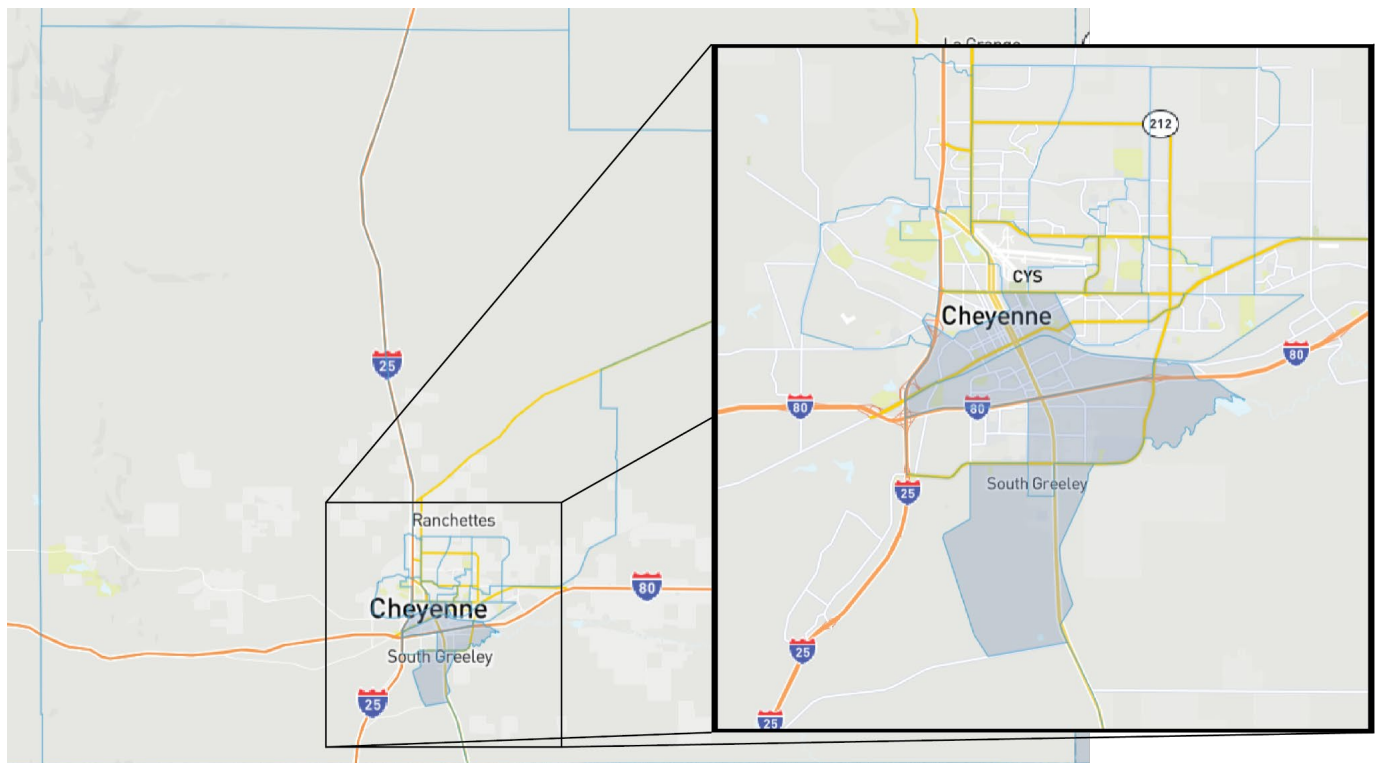


Figure 8: LIDACs within the Cheyenne MSA
Source: *Climate and Economic Justice Screening Tool*

According to the *Climate and Economic Justice Screening Tool*, there are four LIDAC census tracts in Cheyenne, Wyoming. Each of the four tracts are detailed in the descriptions below. LIDAC data is unavailable for more rural areas of the MSA. This information will be captured for the CCAP.

1. Tract 56021000401 (South Greeley Area)

This LIDAC area has a population of 5,271, a majority of which is White (75%), followed by 5% Other Races, 3% Two or More Races, and 2% Black or African American. 20% of the population within this tract identifies as Hispanic or Latino. The bulk of the population is between the ages of 10 and 64 (75%), with 12% under the age of 10 and 12% over 65 years old. This tract rates high in the Climate Change Burden Threshold for Projected Wildfire Risk (scoring in the 98th percentile) and has an Associated Socioeconomic Threshold of Low Income (scoring in the 68th percentile) and 10% of the population has a high school education less than a high school diploma. These three factors indicate that Tract 56021000401 is a targeted LIDAC area within the Cheyenne MSA. See the table below for a list of secondary identifiers that also rank highly.³⁴

Climate and Economic Justice Screening Tool Identifiers—Tract 56021000401	
Primary Disadvantaged Identifiers (percentile)	Secondary Disadvantaged Identifiers (percentile)
Projected Wildfire Risk (98th)	Expected Population Loss due to fatalities and injuries from natural hazards (89th)
Low Income (68th)	Asthma rates (73rd)
High School Education or Less (10% of pop.)	Proximity to Superfund sites (70th)



Figure 9: Tract 56021000401
Source: Climate and Economic Justice Screening Tool

³⁴ <https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5>

2. Tract 56021000402 (Fox Farm Area - Laramie County)

This LIDAC area has a population of 6,626, a majority of which is White (57%), followed by 7% Other Races, 6% American Indian and Alaskan Native, and 3% Two or More Races. 33% of the population within this tract identifies as Hispanic or Latino. The bulk of the population is between the ages of 10 and 64 (73%), with 17% under the age of 10 and 9% over 65 years old. This tract rates high in the Climate Change Burden Threshold for Projected Wildfire Risk (scoring in the 94th percentile) and has an Associated Socioeconomic Threshold of Low Income (scoring in the 71st percentile) and 21% of the population has a high school education less than a high school diploma. These three factors indicate that Tract 56021000402 is a targeted LIDAC area within the Cheyenne MSA. See the table below for a list of secondary identifiers that also rank highly.³⁵

Climate and Economic Justice Screening Tool Identifiers—Tract 56021000402	
Primary Disadvantaged Identifiers (percentile)	Secondary Disadvantaged Identifiers (percentile)
Projected Wildfire Risk (94th)	Expected Population Loss due to fatalities and injuries from natural hazards (89th)
Low Income (71st)	Asthma rates (86th)
High School Education or Less (21% of pop.)	Proximity to Superfund sites (75th)
	Proximity to Risk Management Plan Facilities (70th percentile)
	Expected Agricultural Loss Rate (78th percentile)
	Projected Flood Risk (82nd percentile)
	Wastewater Discharge (83rd percentile)
	Underground Storage Tanks and Releases (84th percentile)
	Housing Costs (87th percentile)



Figure 10: Tract 56021000402

Source: Climate and Economic Justice Screening Tool

³⁵ <https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5>

3. Tract 56021000200 (Southside East and Southside West Cheyenne)

This LIDAC area has a population of 4,791, a majority of which is White (60%), followed by 3% Black or African American, 3% Other Races, 2% American Indian and Alaskan Native, and 1% Two or More Races. 34% of the population within this tract identifies as Hispanic or Latino. The bulk of the population is between the ages of 10 and 64 (75%), with 14% under the age of 10 and 10% over 65 years old. This tract rates high in the Climate Change Burden Threshold for Projected Wildfire Risk (scoring in the 95th percentile) and Expected Population Loss due to fatalities and injuries from natural hazards (93rd percentile). It also has an Associated Socioeconomic Threshold of Low Income (scoring in the 83rd percentile) and 16% of the population has a high school education less than a high school diploma. These factors indicate that Tract 56021000200 is a targeted LIDAC area within the Cheyenne MSA. See the table below for a list of secondary identifiers that also rank highly.³⁶

Climate and Economic Justice Screening Tool Identifiers—Tract 56021000200	
Primary Disadvantaged Identifiers (percentile)	Secondary Disadvantaged Identifiers (percentile)
Projected Wildfire Risk (95th)	Unemployment (89th)
Expected Population Loss Rate (93rd)	Expected Population Loss due to fatalities and injuries from natural hazards (89th)
Low Income (83rd)	Wastewater Discharge (88th)
	Underground Storage Tanks and Releases (86th)
	Proximity to Superfund sites (83rd)
	Asthma rates (80th)
	Poverty (80th)
	Expected Agricultural Loss Rate (78th)
	Lead Paint (76th)
	Traffic Proximity and Volume (74th)
	Proximity to Risk Management Plan Facilities (68th)
	Projected Flood Risk (67th)



Figure 11: Tract 56021000401
Source: Climate and Economic Justice Screening Tool

³⁶ <https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5>

4. Tract 56021000700 (Old City Cheyenne Area)

This LIDAC area has a population of 3,954, a majority of which is White (80%), followed by 2% Two or More Races, 1% Black or African American, and 1% Other Races. 15% of the population within this tract identifies as Hispanic or Latino. The bulk of the population is between the ages of 10 and 64 (77%), with 8% under the age of 10 and 13% over 65 years old. This tract rates high in the Climate Change Burden Threshold for Expected Population Loss due to fatalities and injuries from natural hazards (93rd percentile). It also rates high in Housing Burden for Lack of Indoor Plumbing (90th percentile) and Lead Paint (98th percentile), as well as Waste and Wastewater Burden for Underground Storage Tanks and Releases (91st percentile). This tract has an Associated Socioeconomic Threshold of Low Income (scoring in the 77th percentile), with 14% of the population having a high school education less than a high school diploma and a low-income median burden in the 93rd percentile. These three factors indicate that Tract 56021000700 is a targeted LIDAC area within the Cheyenne MSA. See the table below for a list of secondary identifiers that also rank highly.³⁷

Climate and Economic Justice Screening Tool Identifiers—Tract 56021000200	
Primary Disadvantaged Identifiers (percentile)	Secondary Disadvantaged Identifiers (percentile)
Expected Population Loss Rate (93rd)	Proximity to Superfund Sites (87th)
Lack of Indoor Plumbing (90th)	Traffic Proximity and Volume (86th)
Lead Paint (98th)	Housing Costs (83rd)
Underground Storage Tanks and Releases (91st)	Projected Wildfire Risk (81st)
Low Income (77th)	Lack of Green Space (80th)
Low Median Income (93rd)	Wastewater Discharge (80th)
High School Diploma (14% of population)	Unemployment (80th)
	Poverty (78th)
	Asthma (73rd)

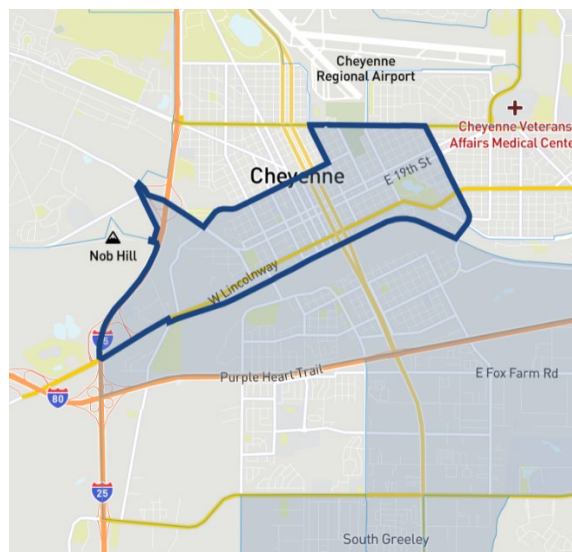


Figure 12: Tract 56021000200

Source: Climate and Economic Justice Screening Tool

³⁷ <https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5>

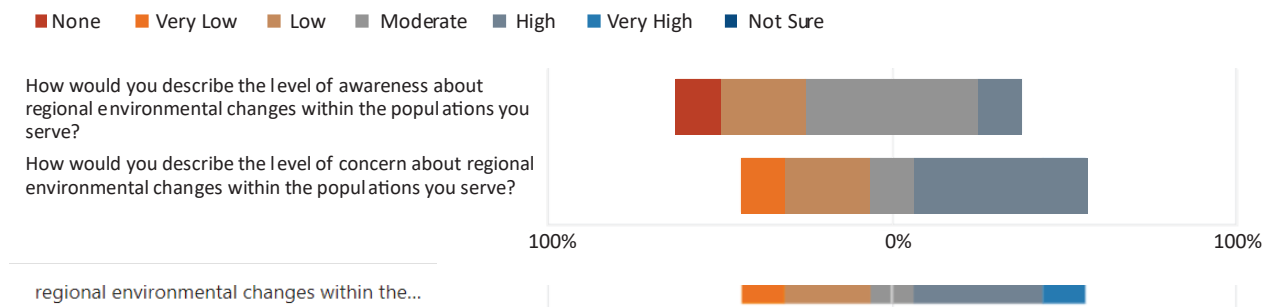
The *Environmental Justice Screening and Mapping Tool* identified similar environmental justice, socioeconomic, and pollution impacts within the Cheyenne MSA. (Comparisons to state and national levels are provided in Appendix A: LIDAC Indexes via EJ Screening Tool).

After identifying the Cheyenne MSA LIDACs above, our next goal was to understand the level of awareness and concern for GHG emission related issues within the communities, inventory the initiatives and projects currently underway, and analyze the benefits and disbenefits of potential GHG reduction measures. Wyoming in general, aside from the Cheyenne MSA, appears more conservative on issues related to climate change, and we wanted to ensure that our messaging would not deter constructive feedback from more conservative viewpoints, ideally resonating with the overall population. Due to the limited timeline, we focused on engaging with key stakeholders who work with various communities throughout the MSA, gaining data and high-level information to create a more robust community outreach strategy for the CCAP phase.

Working in partnership with the Wyoming Outdoor Council, as well as with community members with more conservative perspectives, we created an initial outreach plan consisting of a high-level survey and direct meetings with stakeholder groups. These groups included stakeholders from city and departments, utilities, religious institutions, and community action organizations (see Appendix B: Stakeholder Outreach and Partnership List).

The survey asked several questions related to the type of organization each stakeholder represented, the level of engagement their organization has with LIDAC populations, the levels of awareness and concern for environmental changes of the communities they work with, and local environmental initiatives the stakeholders were aware of. The survey proved helpful in gaining a general perspective and direction for further outreach but was limited in participation and gave less robust responses. However, several notable outcomes were revealed:

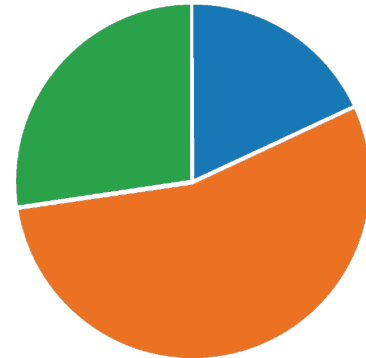
1. There seems to be an overall moderate level of awareness of GHG emissions and impacts within the Cheyenne MSA, but notably more concern over the effects of these environmental changes.



2. The level of involvement that many Cheyenne MSA stakeholder organizations have in addressing environmental concerns is fairly moderates and has room for increased environmental-related activities.

Stakeholder Involvement in Addressing Environmental Concerns

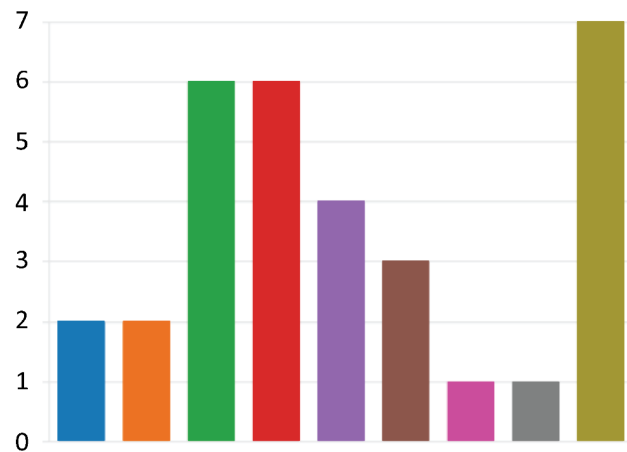
Very involved	2
Somewhat involved	6
Not very involved	3
Not involved at all	0
Very involved	0



- The majority of environmental impacts observed on the populations the stakeholders work with are related to Economic Impacts (costs of adapting to or recovering from environmental or weather-related damages) and Energy Strain (increased demand for energy due to climate control use).

Environmental Impacts on Populations Served in Cheyenne MSA

Agricultural Impacts: Changes in crop yields (due to altered weather patterns, increased pests, and water scarcity) affecting food security and jobs.	2
Biodiversity Loss: Species migration and extinction or biodiversity and ecological imbalance due to altered habitats and ecosystems.	2
Economic Impacts: Economic strain from the costs of adapting to or recovering from environmental or weather-related damages.	6
Energy Strain: Increased demand for energy, especially cooling, and the need for significant investment in infrastructure to withstand increased populations, commercial use, or extreme weather events.	6
Health Issues: Increase in diagnoses of environmental diseases and conditions, including vector-borne diseases like West Nile virus and Lyme disease, certain types of cancer, and respiratory illnesses due to poor air quality.	4
Extreme Weather and Infrastructure: Increased frequency and intensity of storms, floods, heat, and droughts, causing significant damage to infrastructure, private property and/or habitats.	3
Extreme Weather and Health: More frequent and severe heatwaves or freezes leading to health risks such as heatstroke and exacerbating conditions like heart disease.	1
Not Sure	1
Other	7



The Stakeholder Engagement process also involved attending committee meetings and having one-on-one interviews. This provided further information about current and potential initiatives within the community, as well as resources for developing the community outreach plan for the CCAP. Presentations about the CPRG and PCAP were made at the Metropolitan Planning Organization Technical Committee and the LCCP subcommittees Better Together and Housing and Income Action Teams. One-on-one interviews were conducted with stakeholder leaders, most notably LCCP, Cheyenne LEADS, and Black Hills Energy. During these interviews, there were several insights:

- Black Hills Energy: City staff, RMI, and Black Hills Energy met to discuss the potential options and technical questions of putting solar on the landfill and the Belvoir Ranch as an electricity-sector GHG reduction strategy. This discussion was a high-level overview of what it would take to

interconnect the systems. During this meeting methane capture was briefly discussed as another potential GHG emission reduction.

- Cheyenne LEADS: City staff and RMI met with Cheyenne LEADS (economic development non-profit) to discuss their work with large private entities and green development strategies. Cheyenne LEADS noted a high appetite for green energy and zero carbon campuses among many of the new data centers being developed, as well as investments being made in wind energy, resource conservation and management, and potentially solar infrastructure. Another notable insight from this meeting was the discussion of the Colorado—Wyoming Climate Resilience Engine (CO-WY Engine) recent award from the National Science Foundation Engines grant. This grant will provide up to \$160M over the next 10 years to transform the region into a national leader in developing climate-resilient and sustainable technologies.
- LCCP and Action Teams: City staff met with LCCP, a network of community organizations dedicated to improving the lives of citizens in Laramie County. LCCP provided insights into the LIDACs within the Cheyenne MSA, as well as data on health and community metric and the LCCP 2022 Community Health Improvement Plan.
- City Council and Finance Committee: On February 26th and February 20th (respectively), the CPRG was an agenda item open for public comment.

Overall, there were several major takeaways from initial stakeholder engagement that will be applied during the CCAP. First, more education and awareness are needed for community members to make informed decisions and suggestions regarding climate change efforts in the Cheyenne MSA. There also needs to be more discussion and alignment opportunities for stakeholders from diverse sectors and backgrounds to ensure equitable and comprehensive GHG pollution reduction initiatives now and in the future. Finally, our ability to collect and analyze community level data regarding GHG emissions and environmental changes needs to expand, so we can gain a clearer picture of our role in reducing GHG emissions in the world.

In the CCAP phase, we plan to implement these takeaways in the following steps:

- Create an Environmental Equity Steering Committee (EESC) for this grant and long-term environmental equity work: This committee will be composed of stakeholders from diverse sectors and backgrounds, ensuring strong advocacy from LIDACs and underrepresented areas in the MSA, leaders from the private sector, and bipartisan representation. This will establish support systems for steering committee members to promote participation. We will include representation from higher education institutions, Laramie County Community College and University of Wyoming, particularly for workforce development insights. Although the City of Cheyenne reached out to these institutions and they expressed support, their involvement will be more effective during the CCAP development.
- Create a Comprehensive Community Outreach Plan with the EESC: Built in partnership with stakeholders and the EPA's Planning for Equitable Development tool, this Plan will assign tasks to ensure outreach work is completed effectively and timely, and will focus on outreach materials that inform and educate stakeholders and the general public, attendance of community events, organization of town halls, and of course, continued gathering of key measures and data regarding direct and indirect emissions reductions.

Through these tactics, we will develop a data-driven and equity-focused outreach program, guided by smart growth principles with substantive steps towards implementation of sustainable environmental, social, and economic equity.

3.4.2 LIDAC Benefit Analysis

Reduction Measure: Residential Efficiency

- The amount of wasted energy, and therefore GHG emissions, will be reduced by increasing energy efficiency in homes. It is important to conduct this step before attempting to electrify or install solar so that systems are sized correctly.
- Conducting energy efficiency will save residents money over the long term and, with the use of program implementation funds, the payback time period could be reduced substantially.
- In the case where residential units are rentals, incentive programs will need to be established for landlords to facilitate the implementation of energy improvements. Per the 2020 Decennial Census, Cheyenne had 10,369 renter-occupied housing units, approximately 37% of occupied housing units in Cheyenne.³⁸
- Any residents that rely on inefficient heating systems will realize substantial savings in their electricity bills.
- Black Hills Energy and other power utilities have raised electricity fee rates which acutely impacts LIDACs. Energy efficiency measures will help alleviate this added burden by reducing billable kWh usage.³⁹
- Habitat for Humanity of Laramie County would be a great partner in this effort with their Habitat Repairs program. The goal of this program is to “coordinate repairs needed to make a home safe, secure, and healthy for low-income homeowners, often elderly and/or disabled.”⁴⁰
- Habitat for Humanity, Laramie County Community Partnership, and the Cheyenne Housing Authority would be good resources in identifying needs on-the-ground to get energy efficiency projects started quickly. They would also be able to provide trusted names of contractors.
- The City of Cheyenne has authority to implement this project.

Reduction Measure: Residential Building Electrification

- Laramie County Community College (LCCC), based in Cheyenne, has an Electrical Technology Program which could benefit from hands-on training for students helping to electrify residents’ homes. This would be a pre-apprentice level application. With the majority of students that attend LCCC being from Laramie County (see the Laramie County Community College 2018-2019 Student Place of Residence graph below), these students would be able to help residents in their own communities.
- Residential natural gas use makes up eight percent of the energy sector, according to the GHG inventory conducted above. Due to cold winter temperatures in the region, natural gas furnaces

³⁸ US Census Bureau 2020 Decennial Census: Table DP1 Profile of General Populations and Housing Characteristics. [https://data.census.gov/table?t=Owner/Renter%20\(Householder\)%20Characteristics&g=160XX00US5613900&y=2020&d=DEC%20Demographic%20Profile](https://data.census.gov/table?t=Owner/Renter%20(Householder)%20Characteristics&g=160XX00US5613900&y=2020&d=DEC%20Demographic%20Profile)

³⁹ New electric rates approved to support system resiliency and growing energy demand in Greater Cheyenne Community | Wyoming. Black Hills Energy. January 30, 2023. <https://www.blackhillsenergy.com/news/new-electric-rates-approved-greater-cheyenne-wyoming>

⁴⁰ Habitat Repairs. Habitat for Humanity. <https://www.cheyennehabitat.org/habitat-repairs-1>

would likely not be replaced but could be supplemented with highly efficient electric air-source heat pumps. Any residential units that do not have air conditioning with their HVAC system would benefit from the heat pump installment as well.

- Cost savings from electrifying are difficult to quantify since the price of natural gas highly fluctuates.
- There is no data on the indoor air quality or quantity of natural gas stove tops in use within Cheyenne's LIDACs, but some studies seem to link the two and offer electric stoves as a safer alternative.⁴¹
- As the electricity grid becomes less carbon intensive, switching to all electric heating and appliances will reduce GHG emissions when compared to natural gas. However, with the current coal-heavy RMPA eGRID fuel mix, the GHG emissions will likely be higher than natural gas.⁴² On-site clean energy or renewable energy credits will result in minimal GHG emissions.
- The City of Cheyenne has authority to implement this project.

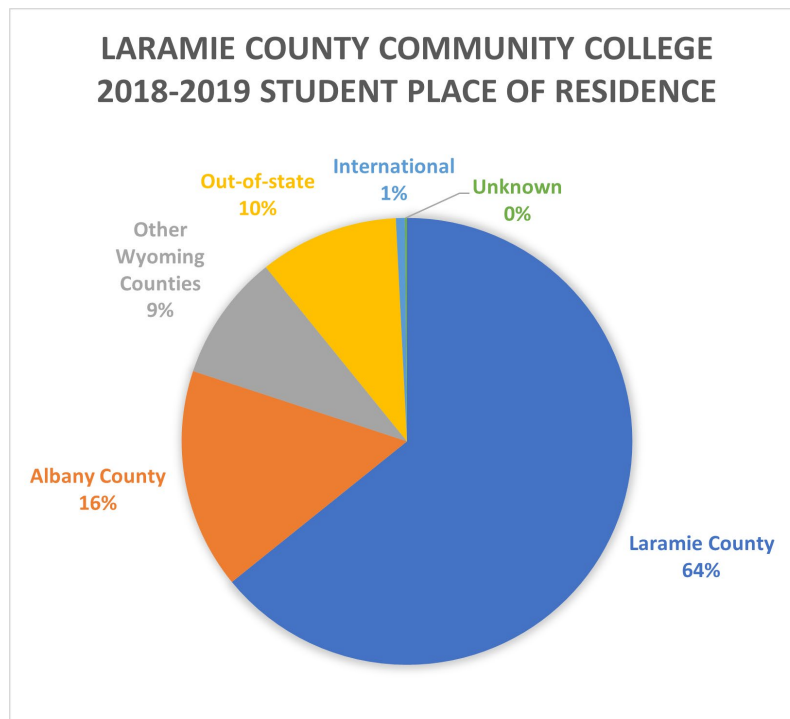


Figure 13: Laramie County Community College 2018-2019 Student Place of Residence

Source: Laramie County Community College 2018-2019 Annual Report.

<https://www.lccc.wy.edu/about/marketingCommunications/talon-magazine/2020-summer-vol-28/annual-report-2019.aspx>

⁴¹ Have a gas stove? How to reduce pollution that may harm health. Harvard Health Publishing. Harvard Medical School. September 7, 2022.

<https://www.health.harvard.edu/blog/have-a-gas-stove-how-to-reduce-pollution-that-may-harm-health-202209072811>

⁴² Power Profiler. EPA. <https://www.epa.gov/egrid/power-profiler#/RMPA>

Reduction Measure: Commercial Efficiency

- The amount of wasted energy, and therefore GHG emissions, will be reduced by increasing energy efficiency in homes. It is important to conduct this step before attempting to electrify or install solar so that systems are sized correctly.
- Conducting energy efficiency will save business owners in LIDACs money over the long term and, with the use of program implementation funds, the payback time period could be reduced substantially.
- In the case where commercial units are leased, incentive programs will need to be established for landlords to facilitate the implementation of energy improvements.
- Any commercial properties that rely on inefficient heating systems will realize substantial savings in their electricity bills.
- Black Hills Energy and other power utilities have raised electricity fee rates which acutely impacts LIDACs. Energy efficiency measures will help alleviate this added burden by reducing billable kWh usage.⁴³
- The City of Cheyenne has authority to implement this project.

Reduction Measure: Commercial Building Electrification

- Commercial activities take place in all of Cheyenne's LIDACs. Reducing worker exposure to fuels that are combusted indoors might improve air quality.
- Depending on the commercial activity, the electricity utility's billing structure, and the cost of energy commodities, commercial operators might see a decrease in energy costs.
- As the electricity grid becomes less carbon intensive, switching to all electric heating and appliances will reduce GHG emissions when compared to natural gas or other fossil fuels. However, with the current coal-heavy RMPA eGRID fuel mix, the GHG emissions will likely be higher than natural gas.⁴⁴ On-site clean energy or renewable energy credits will result in minimal GHG emissions.
- LCCC's Electrical Technology program (see *Reduction Measure: Residential Building Electrification* for more details) students might be able to learn the applicability of electrifying commercial buildings. Any training would be at pre-apprentice level.
- Commercial natural gas use makes up seven percent of the energy sector, according to the GHG inventory conducted above. Due to cold winter temperatures in the region, natural gas furnaces would likely not be replaced but could be supplemented with highly efficient electric air-source or geothermal heat pumps. Any commercial buildings that did not have air conditioning with their HVAC system would benefit from the heat pump installment as well.
- The City of Cheyenne has authority to implement this project.

Reduction Measure: Residential Rooftop Solar

- Reduced electricity bills for LIDAC residents.

⁴³ New electric rates approved to support system resiliency and growing energy demand in Greater Cheyenne Community | Wyoming. Black Hills Energy. January 30, 2023. <https://www.blackhillsenergy.com/news/new-electric-rates-approved-greater-cheyenne-wyoming>

⁴⁴ Power Profiler. EPA. <https://www.epa.gov/egrid/power-profiler#/RMPA>

- Immediate GHG reduction from replacing fossil fuel energy while the electric grid transitions to clean energy.
- There are several solar installers in and around the southeast corner of Wyoming that will be notified of the RFP for this work, thereby attempting to boost the local economy and support job creation.
- Community engagement in LIDACs to present the financial and environmental benefits of residential solar.
- The LCCC Electrical Technology program could be introduced to the field of solar energy through class material and in-person demonstrations.
- The City of Cheyenne has the authority to implement this project.

Reduction Measure: Commercial Rooftop Solar

- Reduced electricity bills for LIDAC business owners.
- Immediate GHG reduction from replacing fossil fuel energy while the electricity grid transitions to clean energy.
- There are several solar installers in and around the southeast corner of Wyoming that will be notified of the RFP for this work, thereby attempting to boost the local economy and support job creation.
- Community engagement to LIDAC businesses to present the financial and environmental benefits of solar.
- The LCCC Electrical Technology program could be introduced to the field of solar energy through class material and in-person demonstrations.
- The City of Cheyenne has the authority to implement this project.

Reduction Measure: 10% Gas VMT Reduction

- Goals could include: increasing pedestrian and non-motorized transportation, increase use of public transportation, incentivize carpooling.
- Could have broader impacts such as making more green spaces and modifying development standards to incentivize more pedestrian traffic.
- Reductions in gas and diesel fuel consumption and GHG emissions from fewer miles driven.
- Reduction in fuel costs for drivers.
- The City of Cheyenne has the authority to implement this project.

Reduction Measure: EV Adoption - Gas & Diesel

- Improved public health from no car exhaust.
- Reduction in GHG emissions will depend on the charging fuel source. If the car batteries are charged using the current coal-heavy RMPA eGRID fuel mix, the emissions will be higher than if charged using clean energy. Either way though, GHG emissions will be reduced when compared to gasoline.⁴⁵
- Studies need to be performed to assess the likelihood of residents and business owners' willingness to adopt EVs in LIDACs, provided sufficient charging infrastructure. The City of

⁴⁵ Alternative Fuels Data Center. U.S. Department of Energy: Energy Efficiency & Renewable Energy.
https://afdc.energy.gov/vehicles/electric_emissions.html

Cheyenne has control over its own vehicle fleet and could research the feasibility of integrating EVs into their fleet, especially vehicles that travel in LIDACs such as public transportation.

- The LCCC Electrical Technology program could be introduced to the field of electric vehicles and electric vehicle charging stations through class material and in-person demonstrations.
- The City of Cheyenne has the authority to implement this project.

Reduction Measure: Solar on Municipally-Owned Land (examples include Cheyenne Landfill and Belvoir Ranch) and Energy-Intensive Municipal Facilities (examples include Cheyenne’s Wastewater Treatment Plants)

- This would increase clean energy in the Black Hills Energy grid, reduce energy consumption from specific facilities if connected behind the meter to reduce on-site municipal electricity consumption and emissions from purchased electricity, and would offer another source of revenue for the city and/or a way to reduce energy costs—both of which benefit city taxpayers.
- Depending on the ownership of renewable energy credits, these projects have the potential to decrease the city’s GHG footprint.
- The LCCC Electrical Technology program could be introduced to the field of solar energy through class material and in-person demonstrations.
- By using already disturbed land to construct clean energy projects, such as the landfill, the city will be less likely to disturb sensitive habitats and greenfield land.
- The City of Cheyenne has the authority to implement this project and owns the land/facilities involved.

3.5 Review of Authority to Implement

As stated in Section 3.4.2., the City of Cheyenne has the authority to implement these reduction measures in partnership with executing organizations. These executing organizations will be further identified in the development of the CCAP.

3.6 Intersection with Other Funding Availability

MSA’s are encouraged to leverage other sources of funding from federal, state, and private sectors. Federal agencies such as the Environmental Protection Agency, Department of Energy, and Department of Transportation offer renewable energy, electric vehicle, infrastructure, and climate focused grants that align with the identified goals of the PCAP. State funding is also available through the Wyoming Energy Authority and Governor’s Matching Fund Grant. Other funding measures are listed in the GHG Reduction Strategies table in section 3.4. Funding gaps, project development and costs will be presented in more detail in the CCAP.

4 Next Steps

The PCAP provides a foundation for more detailed analysis in the CCAP, including projected energy and emissions across the region and within specific geographies. It highlights how specific actions can benefit LIDAC neighborhoods both directly and indirectly.

While the PCAP evaluated the impact of specific measures, the CCAP will construct a model of the Cheyenne MSA and systematically evaluate actions and policies and their GHG impacts, financial impacts and implementation mechanisms, supported by an extensive engagement process.

Based on the technical analysis in the PCAP, recommendations for the CCAP include the following:

1. Evaluate the compounding and integrated impact of electrification combined with clean energy on GHG reductions for key measures;
2. Identify mechanisms to specifically target LIDAC neighborhoods through policies, incentives and investments;
3. Directly involve LIDAC representatives in designing policies and mechanisms;
4. Identify transportation options for rural areas, given the relatively heavy reliance on vehicles;
5. Evaluate mechanisms for community solar and/or to scale building weatherization or retrofits across the region.

The following recommendations are suggested as a result of the pre-engagement process for the community engagement plans and activities for the CCAP. These recommendations can be used in conjunction with other communication plans and protocols to assist with project development, increase awareness, and ensure successful implementation. Recommendations include the following:

1. Stakeholder Engagement and Goal Alignment
2. Overcoming Financial and Resource Barriers
3. Prioritize Marginalized Communities
4. Conduct Targeted Outreach and Community Engagement
5. Develop Educational and Communication Initiatives
6. Leverage Technology and Media for Engagement

5 Appendix List

Appendix A: LIDAC Indexes via EJ Screening Tool



Figure 14: Census Tract 56021000401 (South Greeley area) — Environmental Justice Indexes. Source: EJ Screening Tool

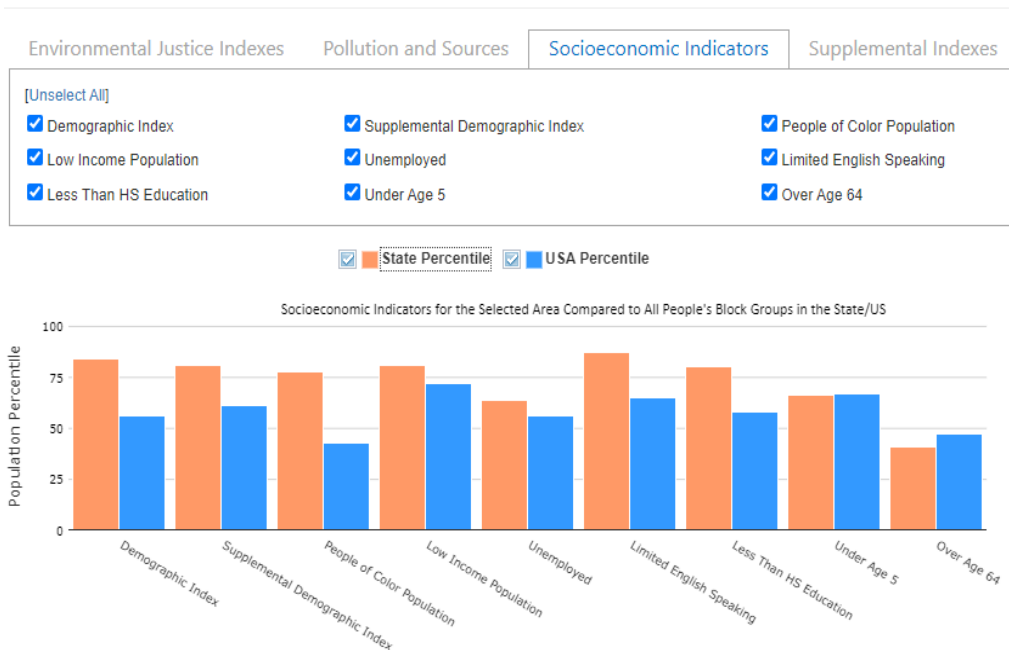


Figure 15: Census Tract 56021000401 (South Greeley area) — Socioeconomic Indicators. Source: EJ Screening Tool.

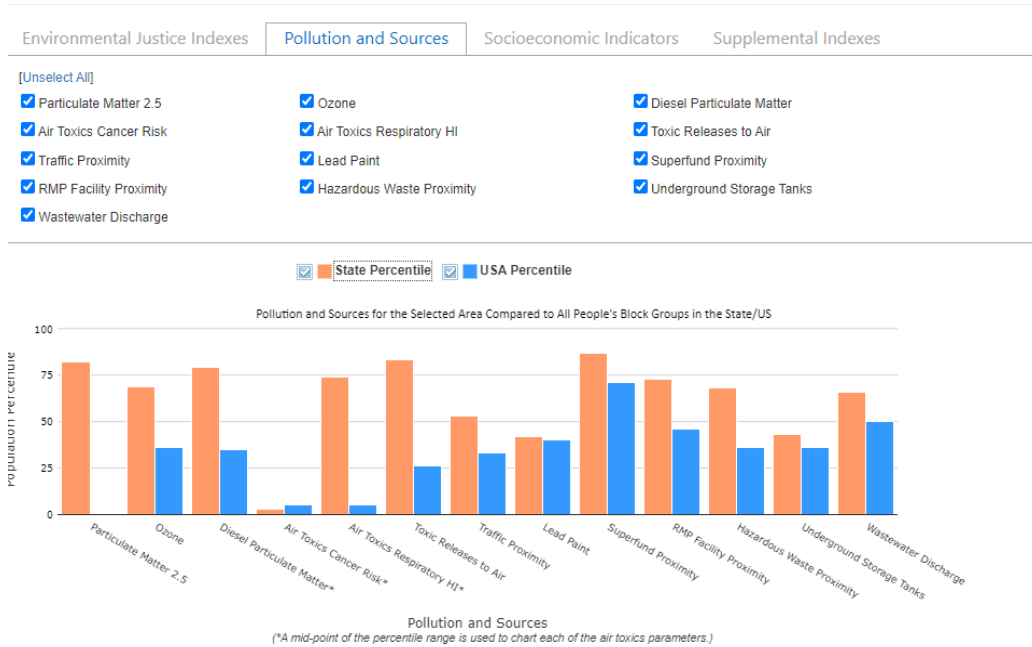


Figure 16: Census Tract 56021000401 (South Greeley area) —Pollution and Sources. Source: EJ Screening Tool.

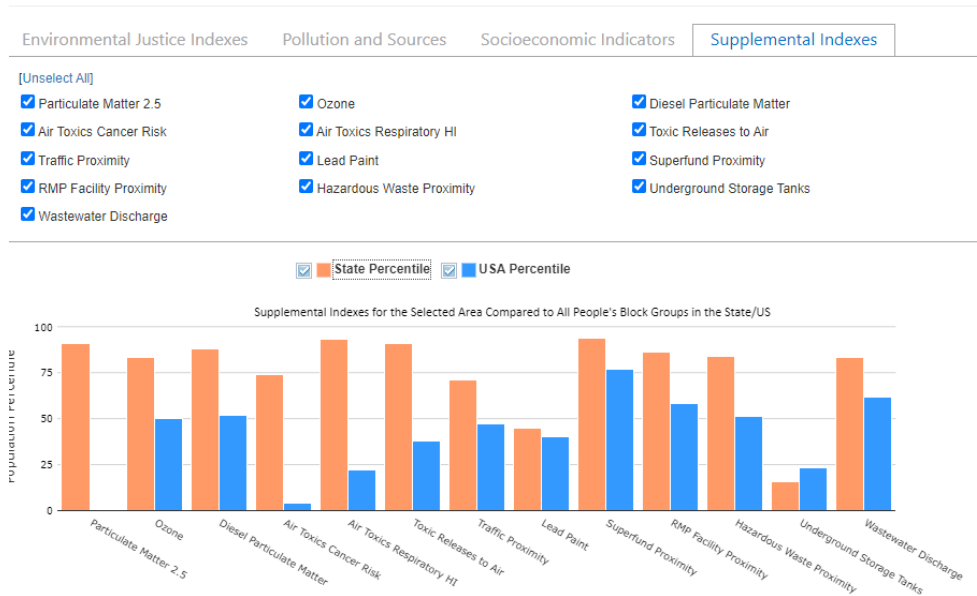


Figure 17: Census Tract 56021000401 (South Greeley area) —Supplemental Indexes. Source: EJ Screening Tool.

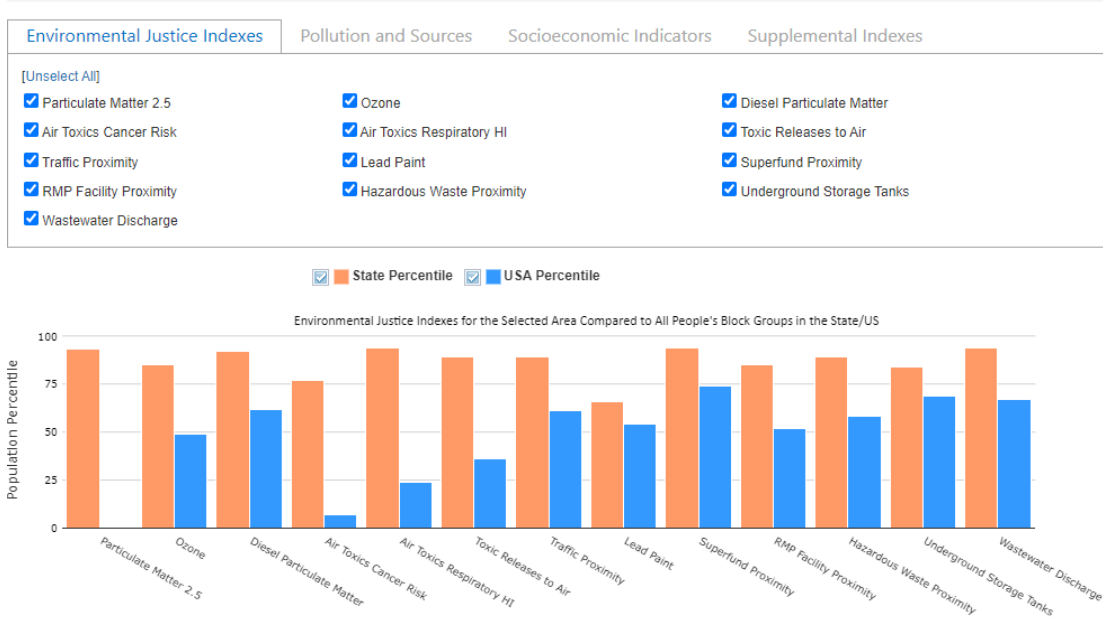


Figure 18: Census Tract 56021000402 (Fox Farm Area - Laramie County) —Environmental Justice Indexes. Source: EJ Screening Tool.

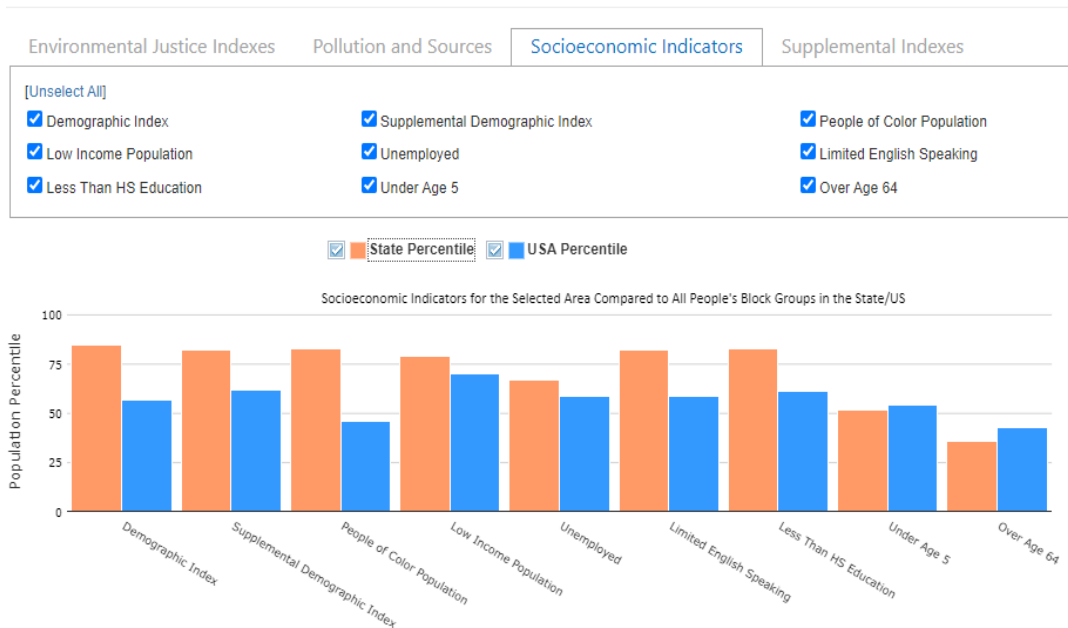


Figure 19: Census Tract 56021000402 (Fox Farm Area - Laramie County) —Socioeconomic Indicators. Source: EJ Screening Tool.

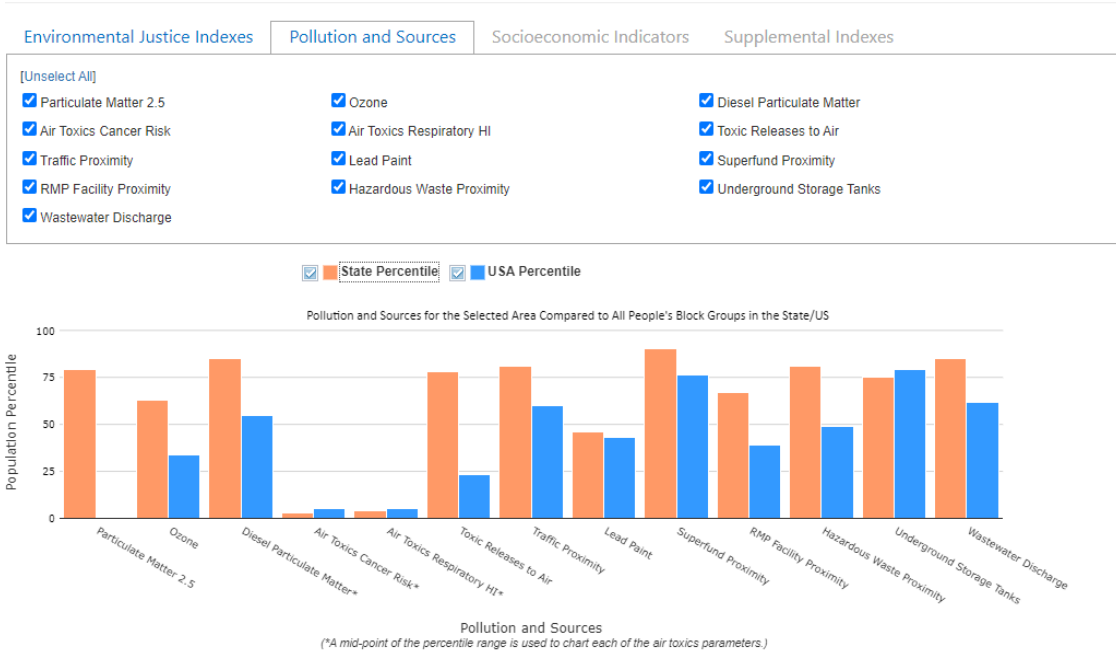


Figure 20: Census Tract 56021000402 (Fox Farm Area - Laramie County) —Pollution and Sources. Source: EJ Screening Tool.

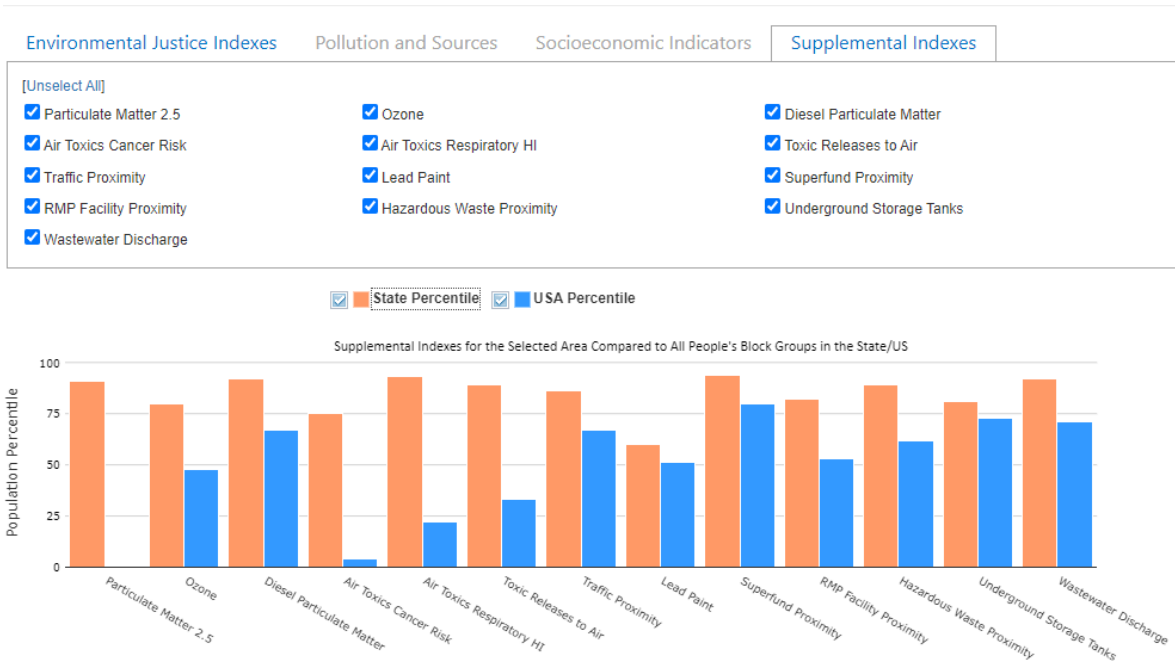


Figure 21: Census Tract 56021000402 (Fox Farm Area - Laramie County) —Supplemental Indexes. Source: EJ Screening Tool.

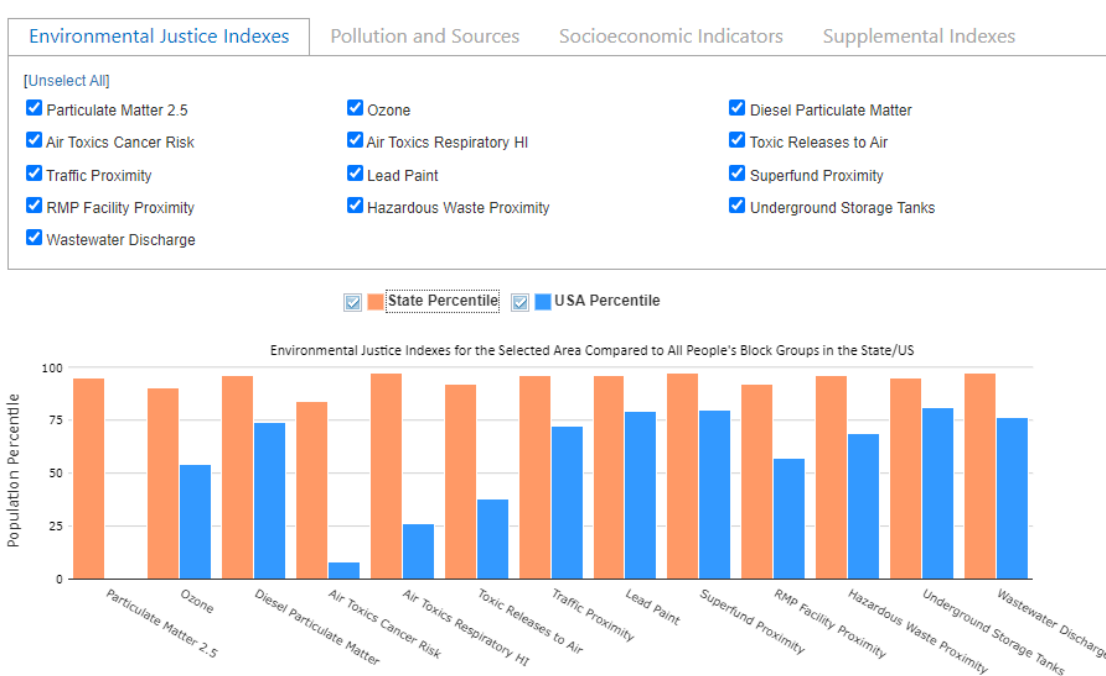


Figure 22: Census Tract 56021000200 (Southside East and Southside West Cheyenne) —Environmental Justice Indexes. Source: EJ Screening Tool.

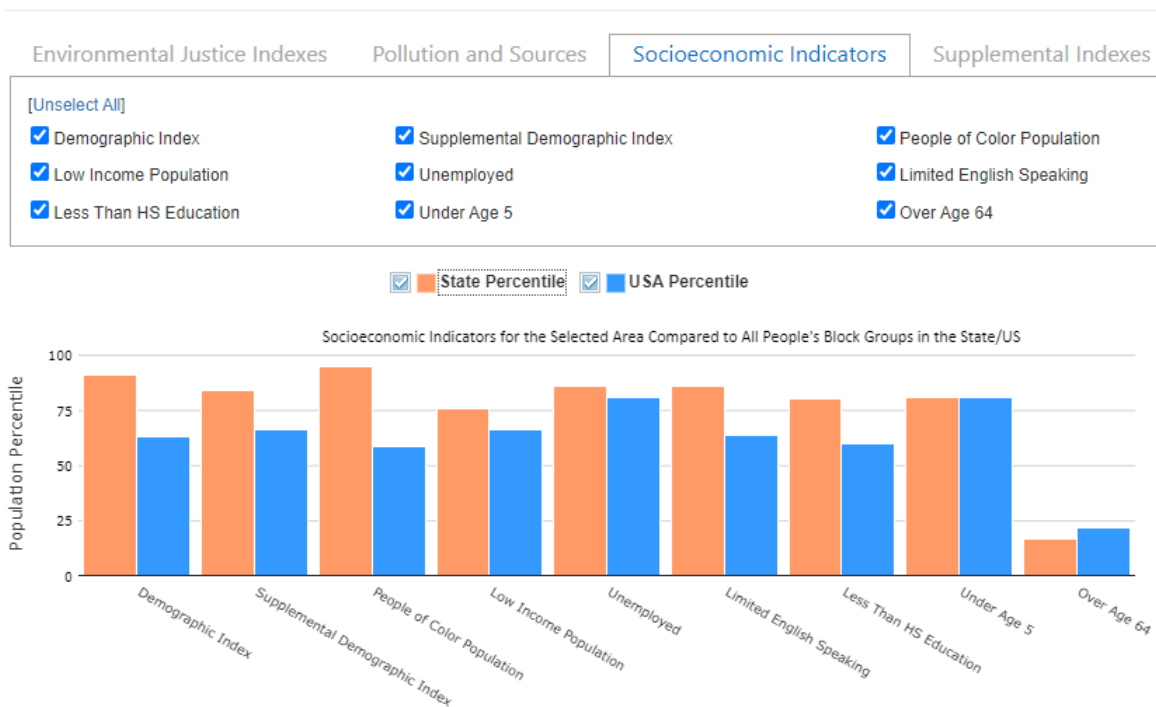


Figure 23: Census Tract 56021000200 (Southside East and Southside West Cheyenne) —Socioeconomic Indicators. Source: EJ Screening Tool.

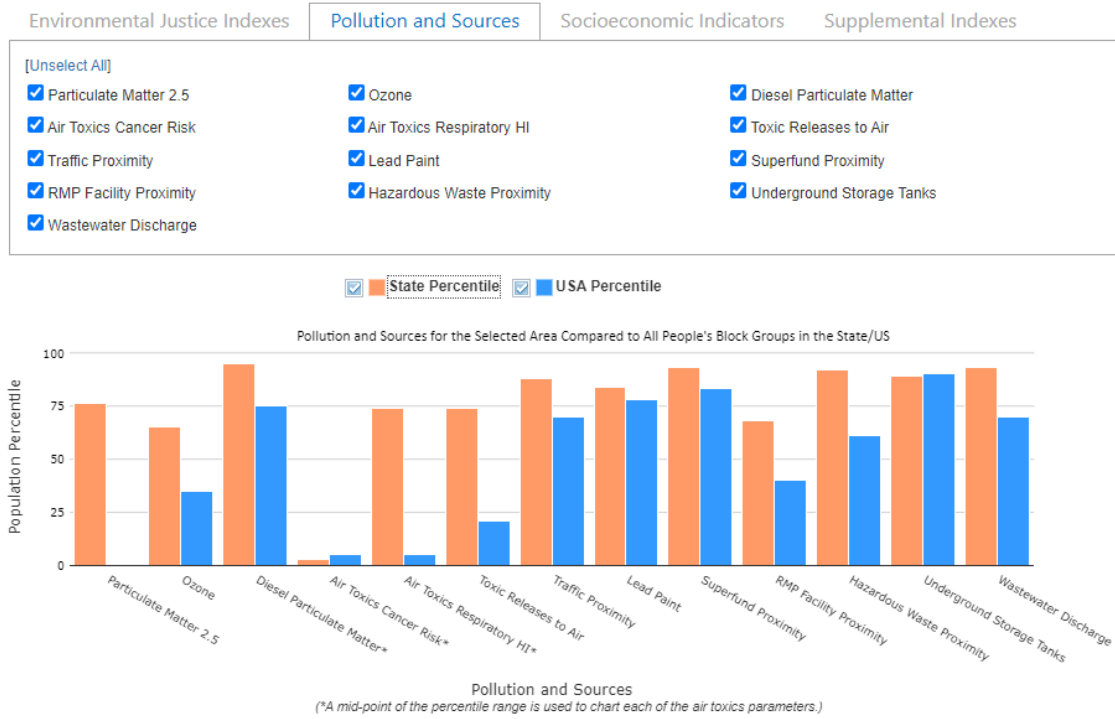


Figure 24: Census Tract 56021000200 (Southside East and Southside West Cheyenne) —Pollution and Sources. Source: EJ Screening Tool.

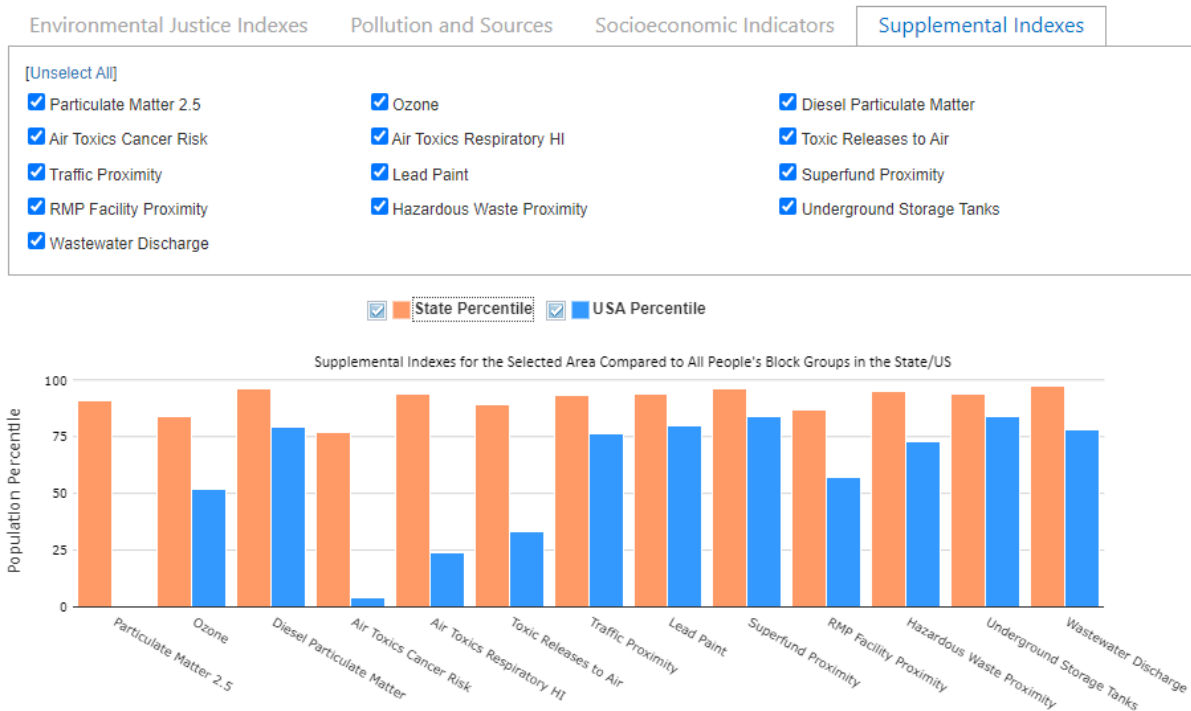


Figure 25: Census Tract 56021000200 (Southside East and Southside West Cheyenne) —Supplemental Indexes. Source: EJ Screening Tool.

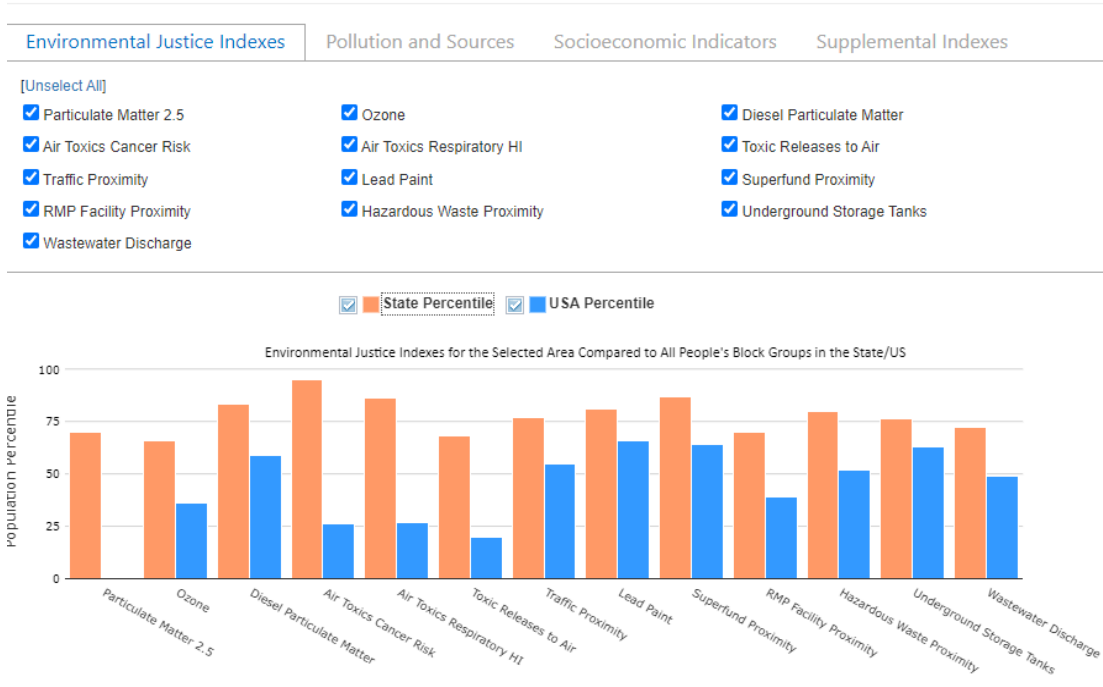


Figure 26: Census Tract 56021000700 (Old City Cheyenne Area) —Environmental Justice Indexes. Source: EJ Screening Tool.

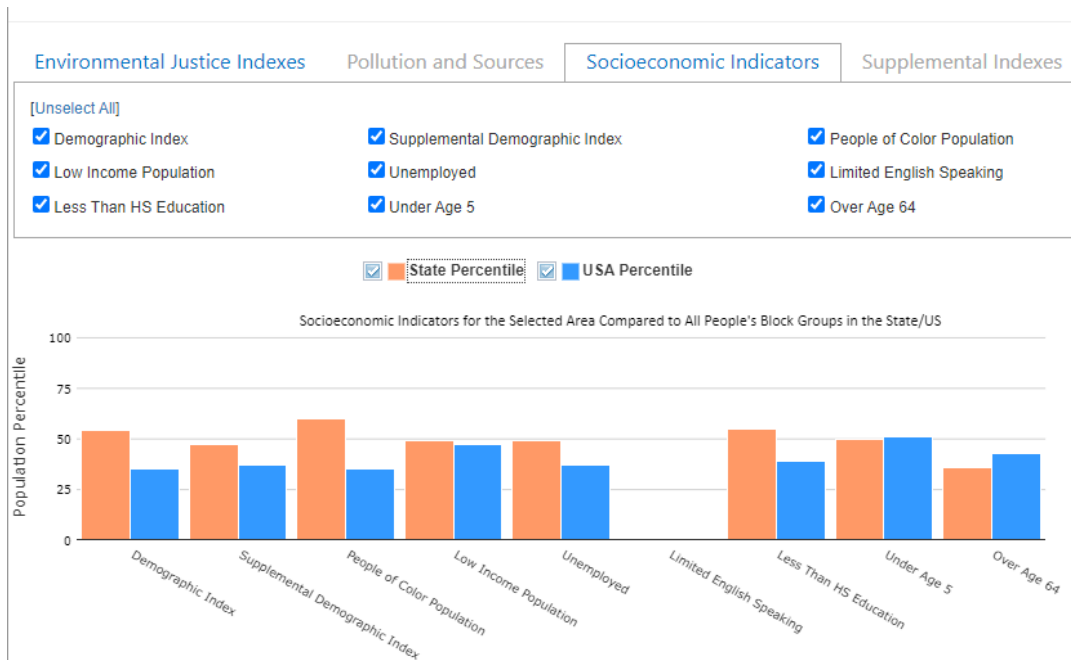


Figure 27: Census Tract 56021000700 (Old City Cheyenne Area) —Socioeconomic Indicators. Source: EJ Screening Tool.

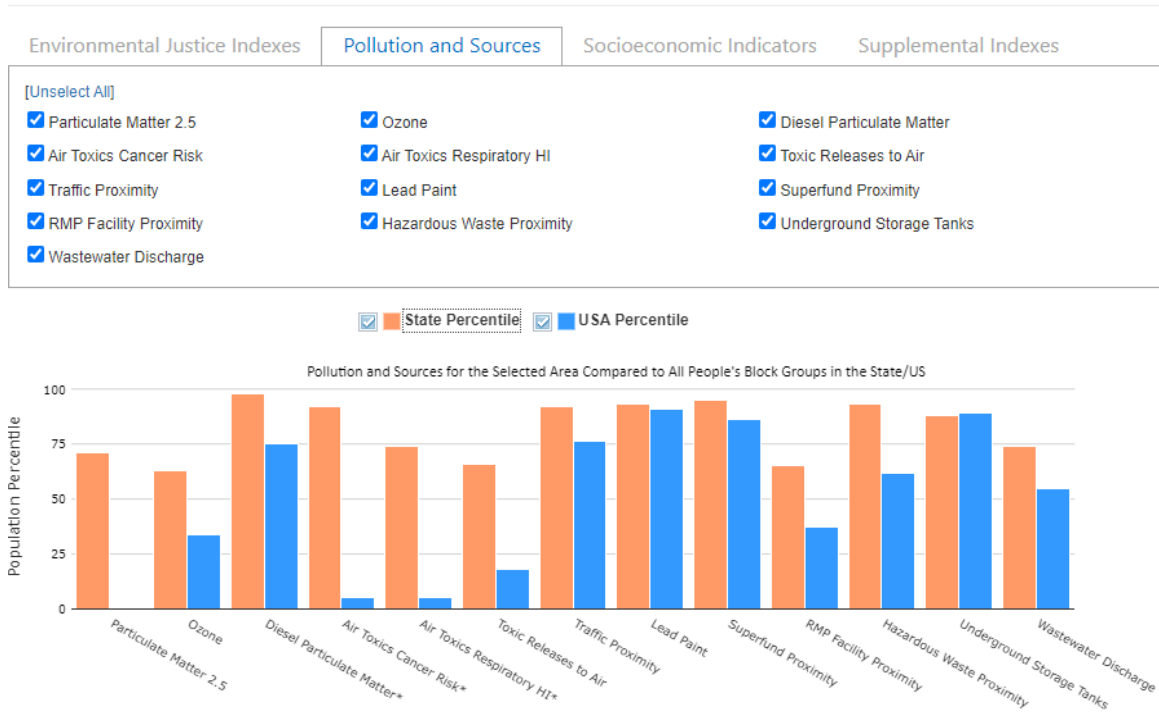


Figure 28: Census Tract 56021000700 (Old City Cheyenne Area)—Pollution and Sources. Source: EJ Screening Tool.

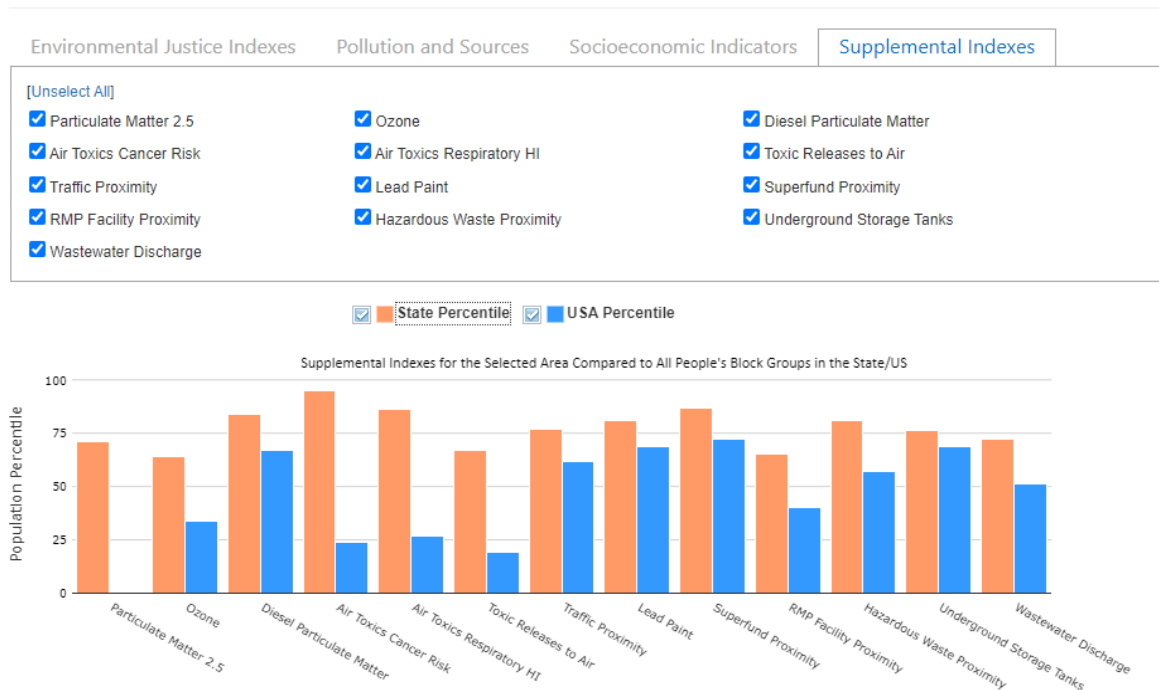


Figure 29: Census Tract 56021000700 (Old City Cheyenne Area)—Supplemental Indexes. Source: EJ Screening Tool.

Appendix B: Stakeholder Outreach and Partnership List

Key stakeholder groups included:

- Laramie County Community Partnership (LCCP) and various sub-committees
 - Better Together Action Team
 - Housing and Income Action Team
- Grace United Methodist Church (Cheyenne Chapter)
- Cheyenne LEADS: A local economic development non-profit
- My Front Door
- We Got Your Back

We also consulted with several municipal entities (both internal and external). These included:

- City of Cheyenne Engineering
- City of Cheyenne Planning & Development
- City of Cheyenne Public Works
- City of Cheyenne Board of Public Utilities—Cheyenne Water & Sewer Departments
- Cheyenne Metropolitan Planning Organization
- Cheyenne Downtown Development Authority
- Laramie County Planning & Development
- Sexual Assault Prevention and Response (SAPR) at Veterans Affairs
- 90th Missile Wing—F.E. Warren Air Force Base
- Utilities: Black Hills Energy

Potential Partnerships

- Wyoming Outdoor Council
- Laramie County Community College (LCCC)
- University of Wyoming