CITY OF SPOKANE

2022 Community and Local Government Operations Greenhouse Gas Emissions

INVENTORY REPORT

Land Acknowledgement

We acknowledge that we are on the unceded land of the Spokane people. And that these lands were once the major trading center for the Spokanes as they shared this place and welcomed other area tribes through their relations, history, trade, and ceremony. We also want to acknowledge that the land holds the spirit of the place, through its knowledge, culture, and all the original peoples Since Time Immemorial.

As we take a moment to consider the impacts of colonization may we also acknowledge the strengths and resiliency of the Spokanes and their relatives. As we work together making decisions that benefit all, may we do so as one heart, one mind, and one spirit.

We are grateful to be on the shared lands of the Spokane people and ask for the support of their ancestors and all relations. We ask that you recognize these injustices that forever changed the lives of the Spokane people and all their relatives.

We agree to work together to stop all acts of continued injustices towards Native Americans and all our relatives. It is time for reconciliation. We must act upon the truths and take actions that will create restorative justice for all people.

Adopted by Spokane City Council on the 22nd day of March 2021
via Resolution 2021-0019

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Acknowledgements

This Greenhouse Gas Inventory update was conducted by the following individuals on the City and Consultant team.

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Data Partners

The City would like to offer a special thank you to the internal staff that provided data, as well as those at external organizations who participated in providing data for this inventory update. For more information on data collection for this effort, please see *Appendix B: Data Providers and Contact Information*.

Glossary

Biomass	Non-fossilized organic material from plants, animals, and other organisms
BNSF	Burlington Northern Santa Fe railroad
CH_4 Fossil	Methane (GWP = 29.8)
CH_4 non-Fossil	Methane (GWP = 27.0)
CNG	Compressed natural gas
CO_2	Carbon dioxide (GHG)
Cooling Degree Days	A measure of how much and how long the outdoor temperature exceeds a certain threshold, typically 65°F (18°C), indicating the need for air conditioning to cool indoor spaces. The higher the CDD, the hotter the climate.
Denitrification	Process through which nitrogen is released back into the atmosphere by converting nitrate into gaseous nitrogen during wastewater treatment process
EPA	Environmental Protection Agency
Fugitive emissions	Emissions from the direct release to the atmosphere of GHG compounds from various types of equipment and processes (e.g., refrigeration and air conditioning systems, fire suppression systems)
GHG	Greenhouse gas
GCOM	Global Covenant of Mayors for Climate and Energy – a global alliance for city climate leadership across the globe.
GWP	Global warming potential - measure of how much energy the emissions of one ton of a GHG will absorb over a given period of time, relative to the emissions of one ton of CO_2
Heating Degree Days	A measure of how much and how long the outdoor temperature is below a certain threshold, typically 65°F (18°C), indicating the need for heating to maintain a comfortable indoor temperature. The higher the HDD, the colder the climate.
HFCs	Fugitive hydrofluorocarbons (GWP varies by specific gas)
HPMS	Highway Performance Monitoring System
LPG	Liquefied petroleum gas
MMBtu	One million British Thermal Units (unit of energy measurement)
MOVES	Motor Vehicle Emission Simulator (EPA model)
$MTCO_2e$	Metric tons of carbon dioxide equivalent

N_2O	Nitrous oxide (GWP = 273)
Nitrification	Process through which nitrogen compounds are turned into nitrates during wastewater treatment process
NSLF	Northside Landfill
Off-road vehicles	Vehicles and equipment typically used onsite for activities related to agriculture, construction, lawn and garden, etc.
Paratransit vehicles	Accessible transit service with individualized rides operating alongside conventional fixed-route services
PFCs	Perfluorinated compounds (GWP varies by specific gas)
Refrigerants	Refrigeration systems, fire suppression equipment, and vehicle air conditioning
RPWRF	Riverside Park Water Reclamation Facility
SF_6	Sulfur hexafluoride (GWP =24,300)
SRTC	Spokane Regional Transportation Council
SSLF	Southside Landfill
T&D	Transmission and distribution
UP	Union Pacific Railroad
VMT	Vehicle miles traveled
WTE	Waste to Energy – combustion of municipal solid waste to generate energy as heat or electricity

CITY OF SPOKANE, WASHINGTON

Greenhouse Gas Inventory Results

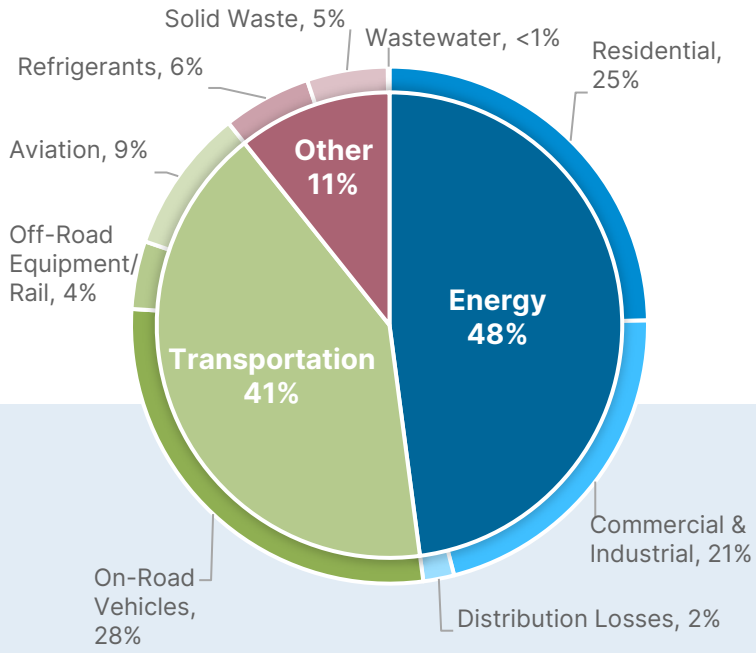
The City of Spokane has committed to reducing greenhouse gas (GHG) emissions within its community and governmental operations.

As an important step in its climate action planning process, the City has completed GHG inventories for each year from 2016-2022.

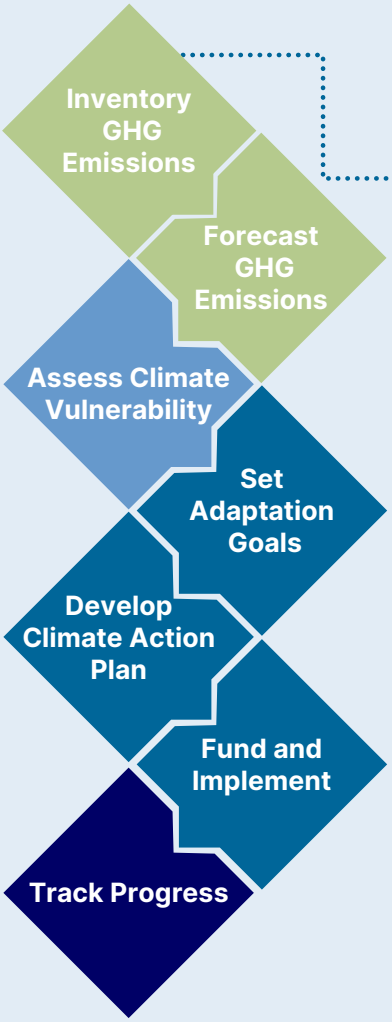
These inventories help the City set targets and goals, measure progress over time, and inform which actions will have the greatest GHG emissions reduction benefits.

2022 Community Emissions At A Glance

2,283,457 Estimated Metric Tons of Carbon Dioxide Equivalent ($MTCO_2e$)



Where We Are & Where We're Going



Greenhouse Gas Overview:

Greenhouse gas emissions are a type of **climate pollution** that represent the release of heat-trapping gases.

Greenhouse gas inventories focus on **tracking activity** that leads to greenhouse gas emissions. Most greenhouse gas emissions come from **fossil fuels.**

Emissions reductions can provide **local benefits** like improved local air quality, health benefits, and lower household costs.

Did You Know?

The City of Spokane has set greenhouse gas reduction goals for the next twenty-five years for community emissions:

-45% by 2030

-70% by 2040

Net Zero by 2050

** relative to a 2016 baseline*

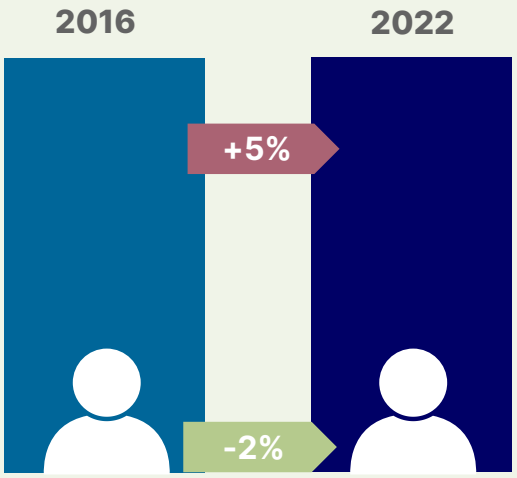
Community GHG Emissions Trend

2016 and 2022

	2016 Emissions ($MTCO_2e$)	2022 Emissions ($MTCO_2e$)	% Change
Energy	1,017,275	1,094,000	+8%
Transportation	923,084	945,012	+2%
Refrigerants	111,973	126,649	+13%
Solid Waste	117,502	115,455	-2%
Wastewater	3,074	2,341	-24%
Total	2,172,907	2,283,457	**+5%**
Per-Capita	10.10	9.89	**-2%**

Overall emissions were **up 5%** from 2016 to 2022.

Emissions **decreased 2%** on a **per-capita** basis.

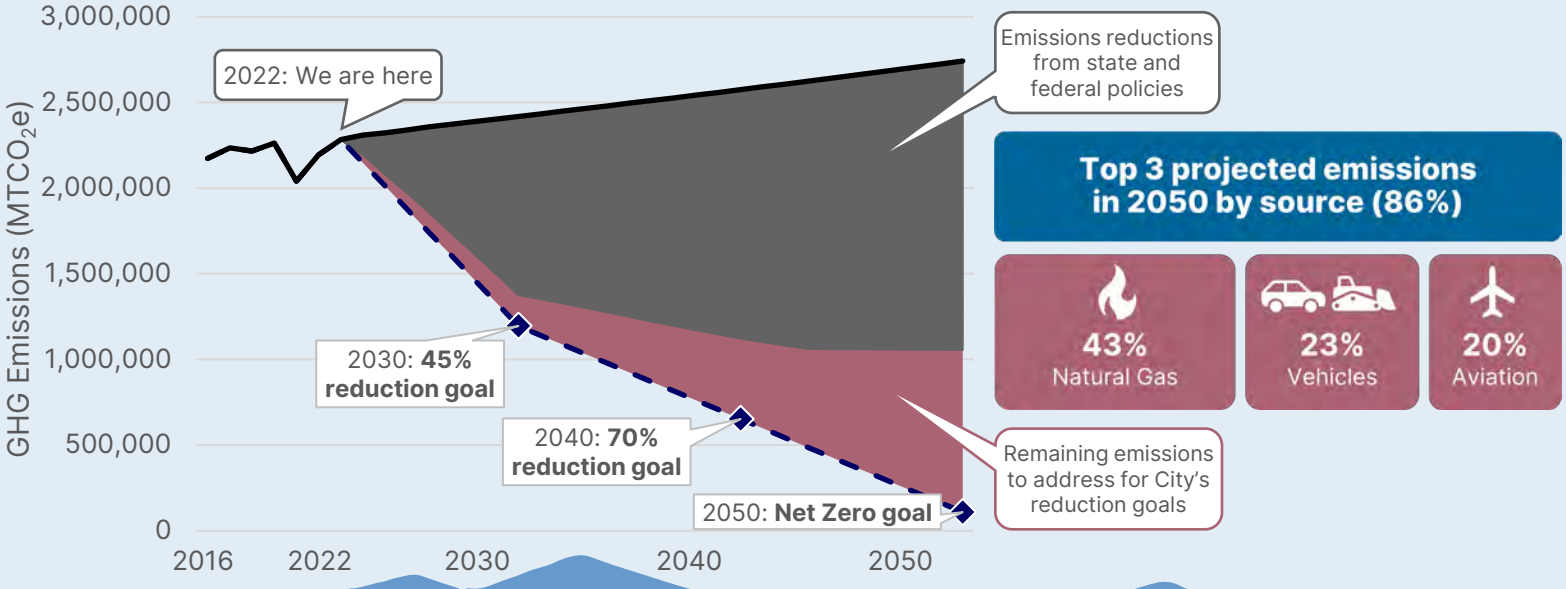


Communitywide Emissions Forecast Through 2050

The City's **"no action future"** is shown below, represented by the black line.

The gray area represents emission reductions from adopted state or federal policies, or the **"adjusted business as usual"** scenario. When accounting for the impact of **state and federal policy**, compared to the 2016 baseline, emissions are expected to **decrease by 51%**.

The red area shows the remaining emissions needed to be reduced to meet the City's emissions goals.



Visit greenspokane.org for more information about the greenhouse gas inventory and climate action planning process. Follow us on social media to stay up to date with all the efforts across the City.

City of Spokane
2022 Environmental Highlights

Water Department

ELECTRICITY GENERATED: Upriver Dam is owned and operated by the City and generates enough electricity to power 6,000 homes annually.

WATER WISE: 44M Gallons saved by replacing outdated irrigation equipment, turf and installing recirculating ponds throughout the City as part of the Spokane Water Wise program.

WATER WISE: City of Spokane begins education for Drought Response Measures Ordinance to prevent over-watering between June and Oct.

Renewable Energy

ELECTRICITY GENERATED: As part of Avista's Solar Select Program, City Hall acquires enough solar power to charge an electric vehicle 16,000 times.
.

ELECTRICITY GENERATED: The volume of City garbage is reduced by 90% when it goes through the Waste to Energy facility and provides enough electricity to power 13,000 homes annually instead of going to landfills.

Planning & Redevelopment

EPA AWARD: Riverfront Park was recognized with the Phoenix Award for excellence for redeveloping a polluted Brownfield site into a regional outdoor asset.

ALTERNATIVES: The City added 7 miles of bikeways, greenways, and shared use trails, giving us over 108 miles.

Parks

WATER WISE: City Parks saved 73M Gallons of water with improved irrigation systems. That's enough to fill the Shadle Water Tower over 15 times.

Urban Forestry

SPOCANOPY: Planted 1,408 trees towards the goal of having 30% coverage in neighborhoods by 2030.

Stormwater & Wastewater

CLEANER RIVER: Riverside Park Water Reclamation Facility and the City's Combined Sewer Overflow tank system cleaned 99.6% of water before it goes back into the Spokane River.

Infrastructure

ELECTRIC ACCESS: 20 electric vehicle chargers were installed city-wide, bringing the total to 33.

ALTERNATIVES: In partnership with Lime, car trips were reduced by 428,000.

Solid Waste

REDUCED EMISSIONS: Changes made to City garbage trucks eliminated CO2 emissions equal to 300 gasoline-powered passenger cars.

MOVING FORWARD: Reached 53% of garbage trucks being converted to compressed natural gas. The goal is 100% by 2027.

Greenhouse Gas Inventory Introduction

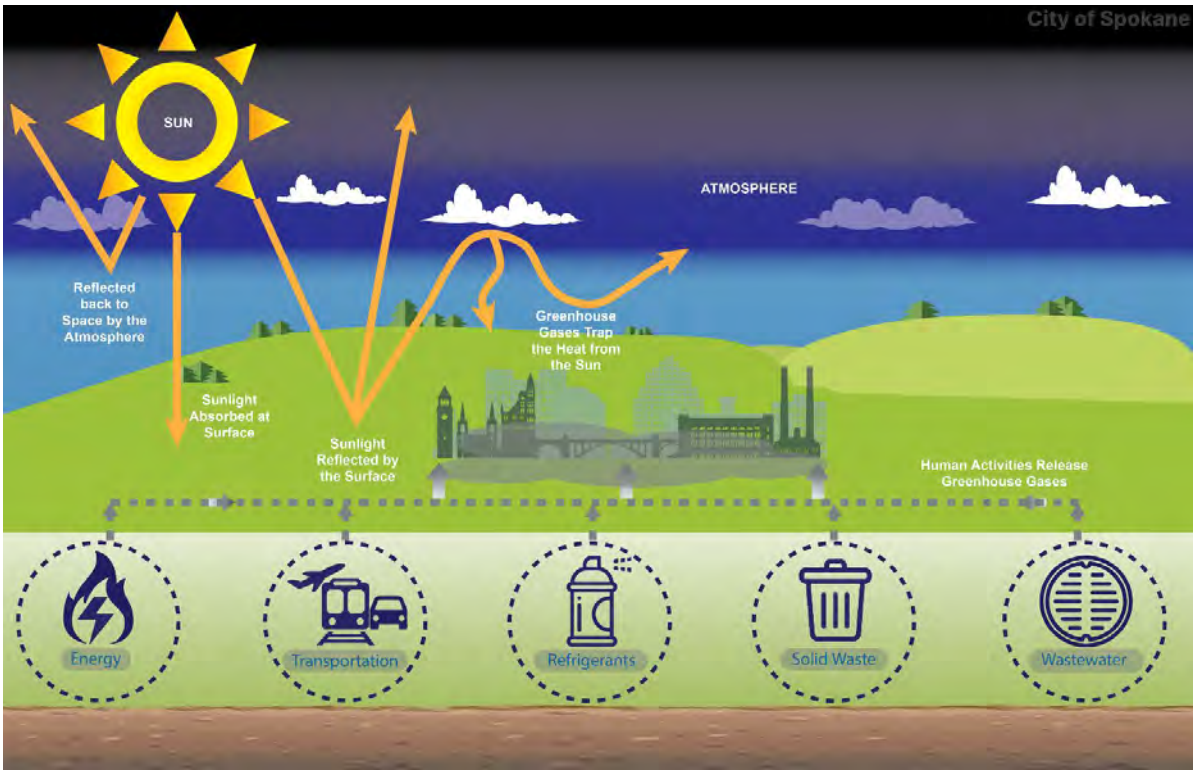
The following report summarizes findings from the **2022 greenhouse gas (GHG) inventories** completed for City of Spokane's **community and government operations**. It also provides comparisons to 2020 and 2021 inventory results.

What is a Greenhouse Gas Inventory?

Greenhouse gas (GHG) inventories calculate, quantify, and assess community associated emissions and their sources.[1]

Greenhouse gas emissions are a type of climate pollution that represent the release of heat-trapping gases, such as carbon dioxide and methane, into the atmosphere that contribute to the greenhouse effect. Human activities like transportation, electricity production, and industrial operations are the largest contributors of greenhouse gases in the United States.[2,3]

Figure 1. Greenhouse Gas Effect and Emissions Sectors

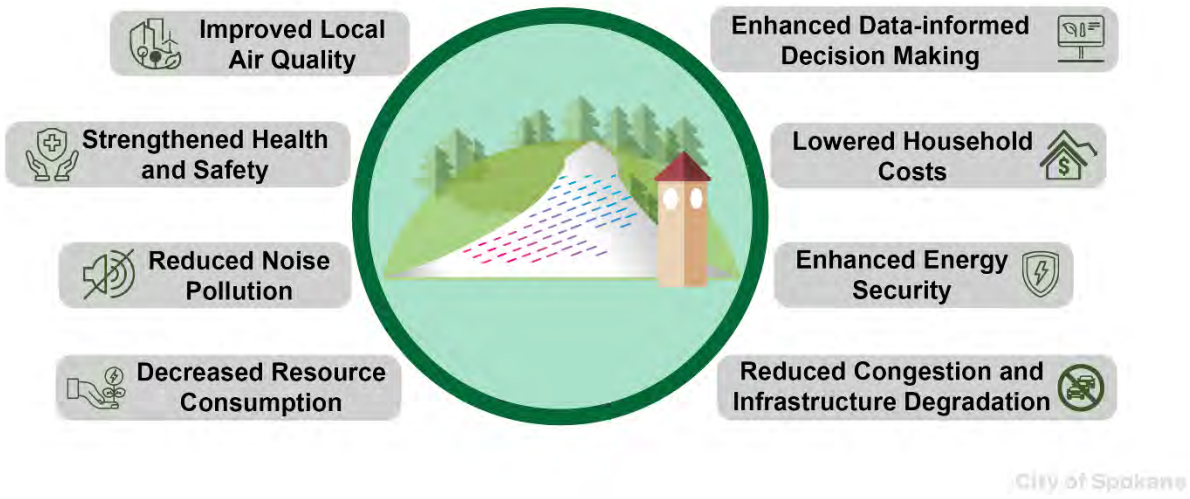


[1] https://icleiusa.org/what-is-a-greenhouse-gas-inventory-and-why-is-it-important/
[2] https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions#t1fn1
[3] https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf

Greenhouse gas reporting focuses on tracking emissions metrics that impact the warming of the atmosphere on a global scale, but it also provides a basis for understanding other air pollution-related issues at the community level. Since most greenhouse gas emissions originate from a reliance on fossil fuels, co-benefits to emissions reduction efforts can be achieved locally as well[4]. Community benefits that can arise from reducing emissions and vehicle miles traveled through tracking and mitigation efforts include:

- Improved local air quality
- Strengthened health and safety
- Reduced noise pollution
- Decreased resource consumption
- Enhanced data-informed decision making
- Lowered household costs
- Enhanced energy security
- Reduced congestion
- Reduced infrastructure degradation

Figure 2. Benefits of Reducing GHG Emissions and VMT



Climate Planning Overview

The City has tracked and reported greenhouse gas emissions in various forms since 2009. In 2023, new Washington state regulations were passed to ensure

[4] https://www.eia.gov/energyexplained/energy-and-the-environment/where-greenhouse-gases-come-from.php

these technical reports are used to inform policy to reduce and mitigate emissions when a city is updating their comprehensive plans.

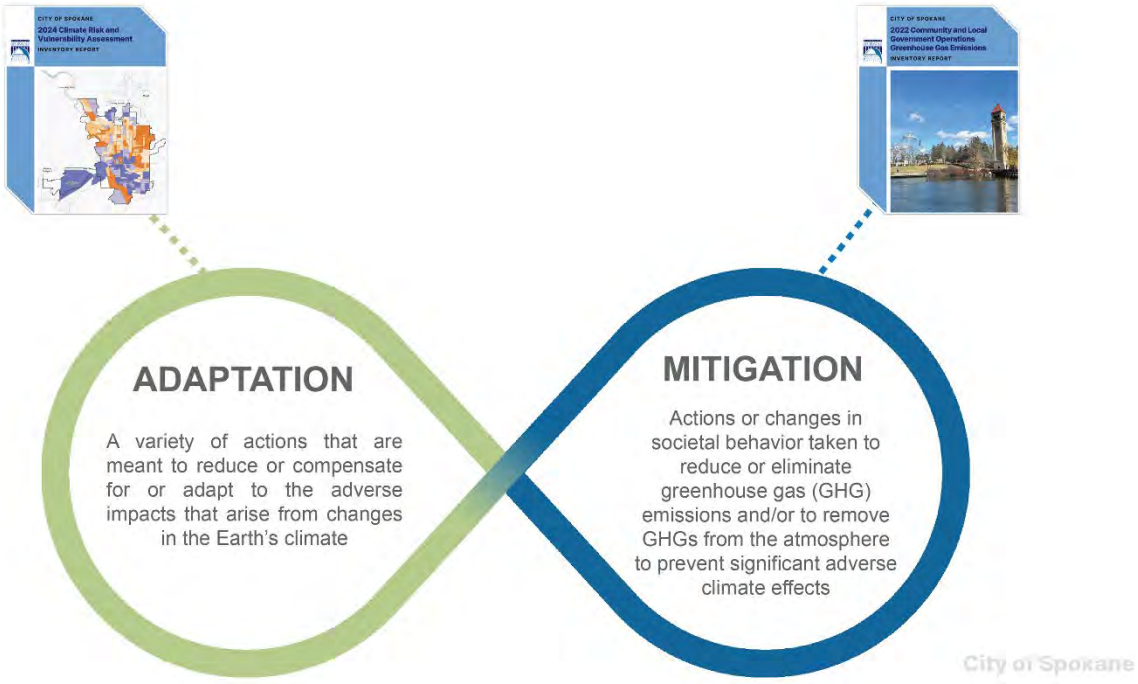
A comprehensive plan is a long-term planning document that establishes the vision, goals, and policies that guide all aspects of Spokane's growth and development over the next twenty years. The plan guides the City's actions related to land use and growth, housing, economic development, natural environment protection, infrastructure, parks, emergency response, wastewater and stormwater, and more.

The City of Spokane is currently working on a periodic update to the City's Comprehensive Plan as required by the Growth Management Act (GMA)[5]. A "periodic update" is the state's term for a full review of a Comprehensive Plan to make sure it's in conformance with any legislative changes to state law. The last periodic update was completed in 2017. Since the last periodic update, Washington passed several new requirements that has added additional considerations, specifically around Climate Planning[6] and Planning for Housing for all income levels, to be added to the City's Comprehensive Plan[7].

Due in June 2026, the periodic update will identify policies, strategies, and goals to guide the next 20 years of Spokane's growth. The inclusion of Climate Planning requirement from HB 1181 requires the communities to set these goals from a data-informed perspective. This City ensures the future goals and policies outlined in the Comprehensive Plan are supported by data by carrying out two technical assessments: 1) a greenhouse gas (GHG) inventory and 2) a climate risk and vulnerability assessment (CRVA). By doing so, the greenhouse gas inventory supports mitigation goals and the CRVA supports the adaptation goals for the community.

[5] https://www.commerce.wa.gov/serving-communities/growth-management/
[6] https://my.spokanecity.org/planspokane/climate-planning/
[7] https://my.spokanecity.org/shapingspokane/comprehensive-plan/

Figure 3. Technical Reports Support Mitigation and Adaptation Climate Planning



When setting those goals and policies as a community, there are three greenhouse gas sub-elements that Washington's Department of Commerce requires[8]:

- **Requirement 1**: Result in **reductions** in overall **greenhouse gas emissions** generated by transportation and land use within the jurisdiction without increasing emissions elsewhere in Washington;
- **Requirement 2**: Result in **reductions** in per capita **vehicle miles traveled** within the jurisdiction without increasing greenhouse gas emissions elsewhere in Washington; and,
- **Requirement 3**: Prioritize reductions that **benefit overburdened communities** to maximize the co-benefits of reduced air pollution and environmental justice.

This greenhouse gas inventory provides the necessary information required to make informed decisions during the climate planning process.

Not only is greenhouse gas reporting required for Comprehensive Plan updates, but it is also part of global best practices in environmental reporting. A baseline

[8] https://deptofcommerce.box.com/s/fpg3h0lbwln2ctqjg7jg802h54ie19jx

understanding of community emissions paired with routine tracking and forecasting of emission scenarios via the greenhouse gas inventory enables the City to prioritize data-driven goals, enact policies with measurable success, and attain grants and other funding with the support of data. Additionally, the City's regular greenhouse gas reporting allows for continual evaluation of these policies and actions over time. Since tracking progress of the implementation of goals and policies is a requirement of HB 1181, the greenhouse gas inventory also ensures compliance with State law.

Greenhouse Gas Methodology Overview

Background

A greenhouse gas inventory is a report that combines the carbon emissions of various activities initiated within a community. It can also be done at an organizational level as is done for City of Spokane municipal operations in this report. Community emissions come from daily activities like transportation and heating homes, while governmental emissions result from services the City provides like water distribution, wastewater treatment, and solid waste management.

Greenhouse gas accounting is a set of **methods for quantifying/estimating GHG emissions** produced by a community or other entity. While some inputs used in inventory calculations are obtained from measured activity data (e.g., electricity and natural gas consumption), others are modeled based on robust assumptions (e.g., transportation mileage). GHG inventories provide insights into the **primary sources of GHG emissions and inform climate action planning**.

Note that the COVID-19 pandemic, which began in 2020, significantly altered human activities and, consequently, GHG emissions. Recent sector trends observed during the pandemic, such as reduced energy consumption in commercial buildings, may not accurately reflect long-term patterns and should be interpreted with this context in mind.

Greenhouse Gases

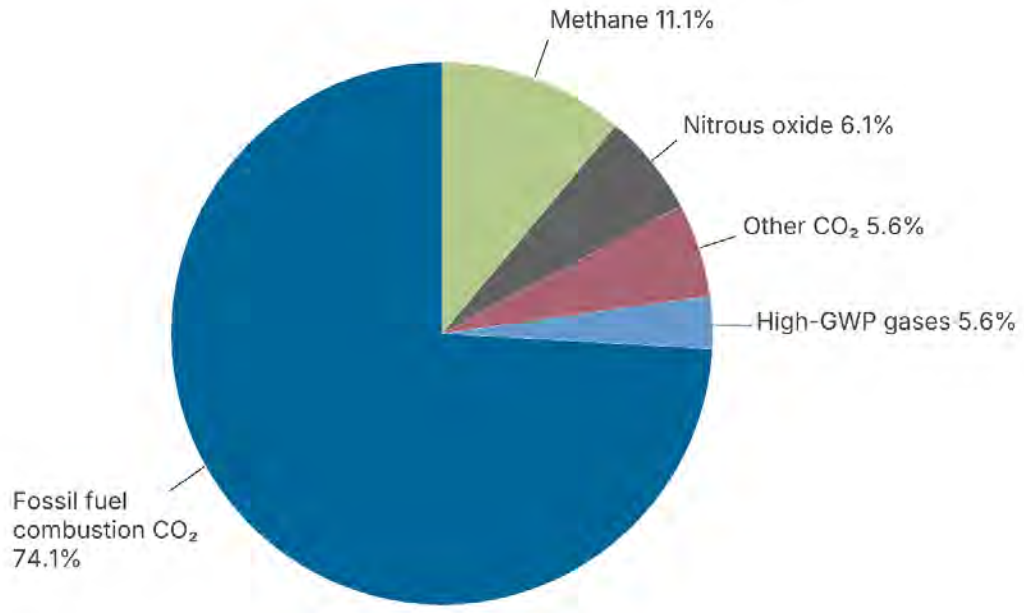
Greenhouse gases cause climate change by absorbing radiation and trapping heat that would otherwise escape from the atmosphere. Human activities like

transportation, electricity production, and industrial operations are the largest contributors of greenhouse gases in the U.S.[9]

GHG inventories typically focus on the following gases:[10]

- **Carbon dioxide (CO_2)** – emitted through burning fossil fuels, solid waste, biomass, and certain chemical reactions
- **Methane (CH_4)** – emitted during the production and transport of coal, natural gas, and oil, livestock and agricultural practices, land use, and decay of organic waste in landfills
- **Nitrous Oxide (N_2O)** – emitted during agricultural, land use, and industrial activities, combustion of fossil fuels and solid waste, and wastewater treatment
- **Fluorinated gases** – High global warming potential (GWP) gases like hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6) are emitted from a variety of household, commercial, and industrial applications and processes.

Figure 4. GHG Emissions by Gas for the United States



Data Source: U.S. Environmental Protection Agency (EPA), Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2022, April 2024.
Note: Data are CO_2e based on 100-year global warming potential.

[9] https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions#t1fn1

[10] https://www.epa.gov/ghgemissions/overview-greenhouse-gases

Each gas differs in terms of the amount of energy absorbed per unit of mass and as such, each gas contributes to global warming at different magnitudes. Methane, for example, is 27-30 times more absorbent to radiation than carbon dioxide, while nitrous oxide is 273 times more absorbent to radiation[11]. To compare and combine the global warming potential of these different gases, a common unit of measure is used. Referred to as the global warming potential (GWP), greenhouse gas inventories utilize the standardized unit of **metric tons of carbon dioxide equivalent ($MTCO_2e$) as the key metric to sum, compare, and track total greenhouse gas emissions across sectors and over time**. Most of these emissions come from fossil fuel combustion[12].

Additionally, **vehicle miles traveled (VMT) is a metric used to quantify the amount of vehicular transportation in a geographic region on an annual basis**[13]. While VMT has always been a part of calculating transportation emissions, new HB 1181 requirements state that VMT is a key metric that should be tracked continuously in addition to $MTCO_2e$.

Inventory Scopes and Scales

Determining which activities to include or not include in an inventory is an important part of the process. Ensuring that the right information is available to the community and City staff and leadership is critical to supporting those groups' mitigation and adaptation goals and actions.

The City of Spokane follows global best practices[14] and those outlined by the Washington State Department of Commerce in focusing on sector-based emissions for community emissions that are initiated within the city limits. These inventories are considered "geographic" or "**community-scale**" inventories.

In addition to reporting community-scale emissions, the City of Spokane also reports local government operations (LGO) emissions as well. These inventories are considered "operational" or "**LGO-scale**" inventories. While the City's operational emissions typically only account for approximately 6.5% of the total community emissions, the City includes these emissions when reporting because they are important in helping to identify areas of action directly within the City's

[11] https://www.epa.gov/ghgemissions/understanding-global-warming-potentials
[12] https://www.eia.gov/energyexplained/energy-and-the-environment/where-greenhouse-gases-come-from.php
[13] https://static.tti.tamu.edu/tti.tamu.edu/documents/PRC-15-40-F.pdf
[14] https://icleiusa.org/what-is-a-greenhouse-gas-inventory-and-why-is-it-important/

operational control. In this report these two GHG inventories were prepared for each inventory year from 2020 – 2022.

Types of Greenhouse Gas Inventories

Communitywide

Emissions that initiated within City of Spokane's geo-political boundaries across the residential, commercial, municipal, and industrial sectors. Spokane's city boundary covers approximately 69.5 square miles (Figure 1).

Local Government Operations

Emissions that resulted from the City's governmental operations. Includes sources under the City's operational control (City has full authority to introduce and implement operating policies at facility), regardless of geographic location.

Both community-scale greenhouse gas emissions and LGO-scale greenhouse gas emissions are categorized into three "scopes" described below and visualized in Figure 5:

- **Scope 1 emissions**: Direct emissions from owned/controlled sources or sources occurring within the community's geographic boundary shown in Figure 6.
- **Scope 2 emissions**: Indirect emissions from purchased energy consumed by the community or government.
- **Scope 3 emissions**: All other indirect emissions related to the consumption of goods and services by a community or government.

Figure 5. Scope 1, 2, and 3 Emissions Sources.[15]

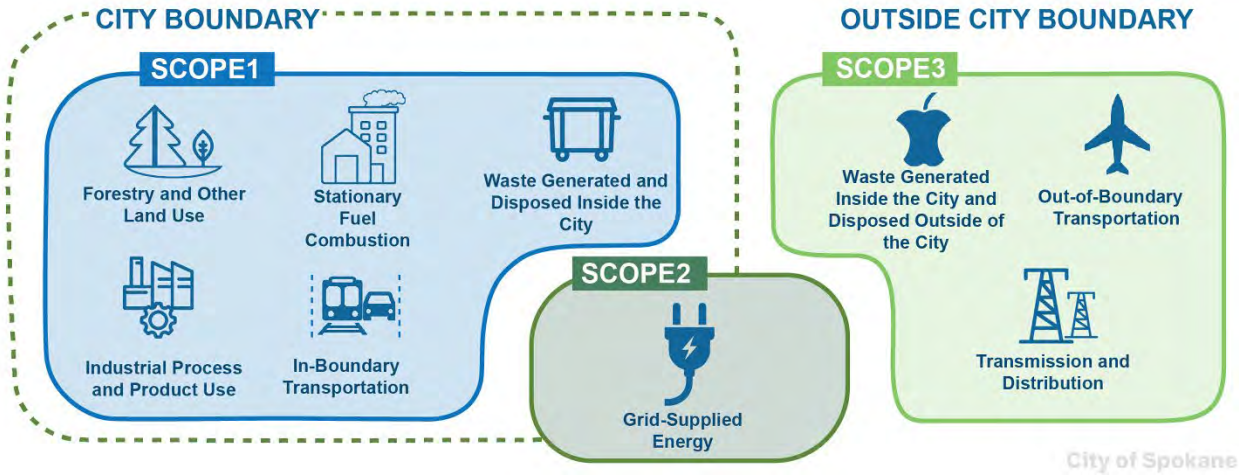
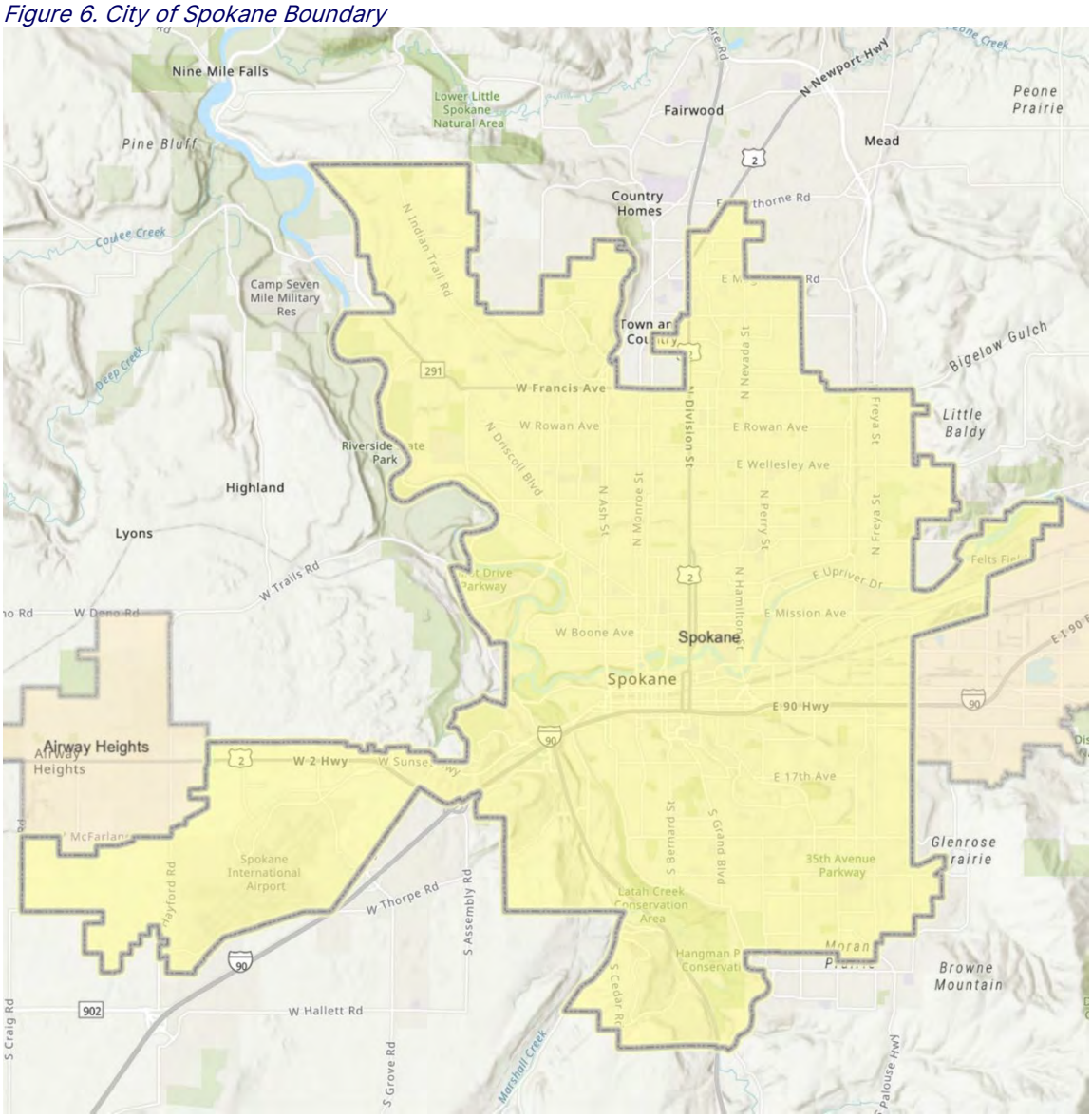


Figure 6. City of Spokane Boundary



The City's community-scale inventory does not include most Scope 3 upstream and downstream emissions associated with consumed goods and services. However, they do include some Scope 3 emissions that initiate within the City boundaries but leave the City boundaries like composting, air travel, and transmission and distribution losses.

The focus of this GHG inventory is **anthropogenic GHG emissions** – emissions that are a direct result of human activities or result from natural processes that have been affected by human activities. In accordance with inventory protocols and best practices, **biogenic emissions are excluded from totals** in this report. Carbon emissions removed by forests only represent around 1% of community emissions. Refer to *Appendix D: Biogenic Emissions Summary* for more information on biogenic emissions.

Greenhouse Gas Emissions Reduction Targets

The City of Spokane has completed and published GHG inventories since 2009 and is committed to continuing to update these inventories at least every three years (SMC 15.05.060). Reports prior to 2016 used different methodologies, calculations, and lower quality data so the City chose to set 2016 as the baseline year.

Using 2016 as its baseline year, the City has adopted the following **emissions reduction targets** to align with Washington State's goals:

- 45% below 2016 levels by 2030
- 70% below 2016 levels by 2040
- Net zero emissions by 2050

Carbon Accounting Standards

Like financial accounting, there are a variety of standards, rules, and frameworks that can be used to ensure consistency and accuracy in the data collection and analysis processes. The City of Spokane inventories are prepared in accordance with three protocols:

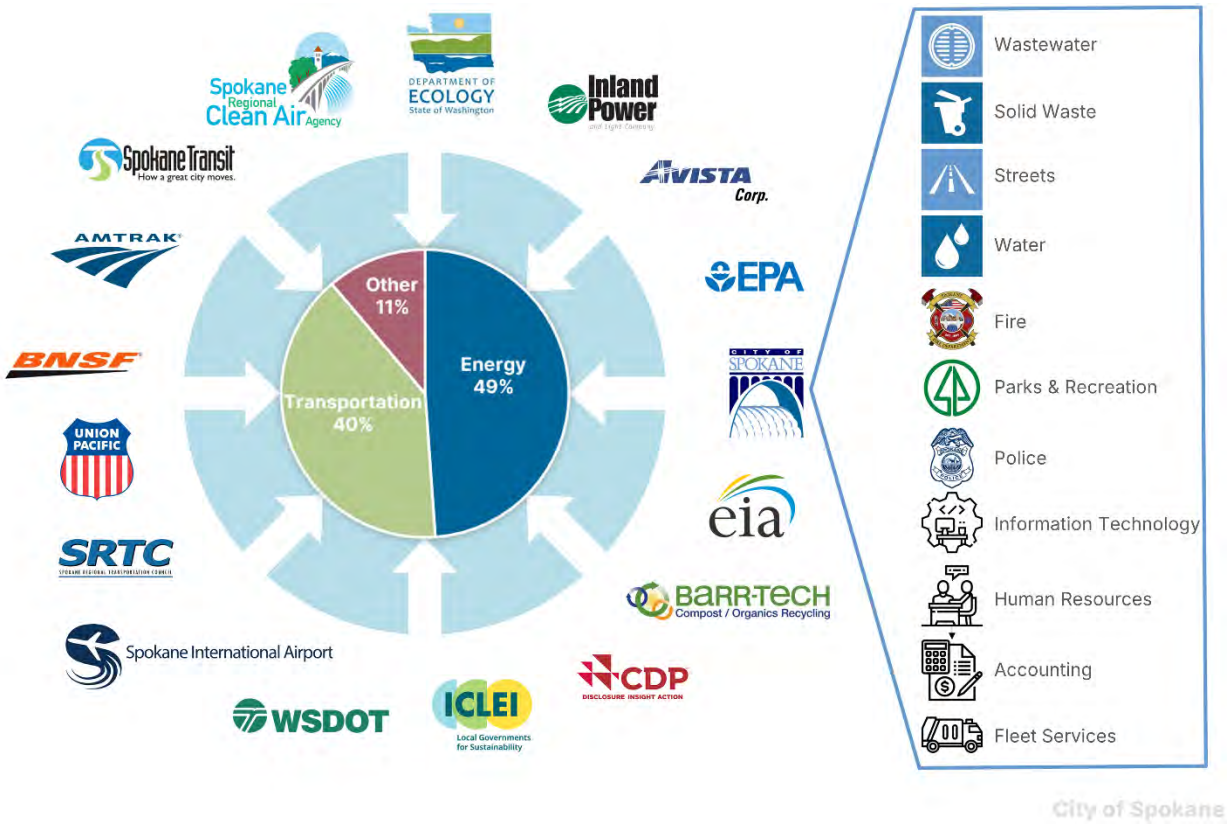
[15] https://www.c40knowledgehub.org/s/article/Consumption-based-GHG-emissions-of-C40-cities?language=en_US

- **Global Protocol for Community-scale GHG Emissions (GPC)**: Developed by the World Resources Institute, C40 Cities Climate Leadership Group, and ICLEI (Local Governments for Sustainability), the GPC provides standards for disclosure and reporting requirements for community-scale inventories that align with global standards (IPCC Guidelines for National Greenhouse Gas Inventories).
- **U.S. Community Protocol (USCP) for Accounting and Reporting of Greenhouse Gas Emissions**: Developed by ICLEI (Local Governments for Sustainability) and a Steering Committee of U.S. local government members and technical subject matter experts. The USCP provides detailed guidance on how to perform communitywide GHG inventory calculations for U.S. cities.
- **Local Government Operations Protocol (LGOP)**: Developed by the California Air Resources Board (CARB), California Climate Action Registry (CCAR), ICLEI (Local Governments for Sustainability), and The Climate Registry, the LGOP provides detailed guidance on best practices for completing a government operations GHG emissions inventory for U.S. jurisdictions.

Data Management

To calculate the key metrics used in this report, a large amount of data needs to be collected. For the community-scale inventory, various external data partners provide community-wide data relating to transportation, power generation, electricity consumption, and more. For the LGO-scale inventory, various departments within the City of Spokane's municipal government provide operational data relating to fleet operations, waste management, electricity and fuel consumption, and more. Figure 7 highlights these data partnerships.

Figure 7. Network of Internal and External Data Partnerships Critical for GHG Inventories



Project Management

Due to the large volume and diversity of data that is collected, data management is a critical element to ensuring accuracy and consistency. Similarly, the acquisition and processing of the data requires a variety of technical and project management tools as well.

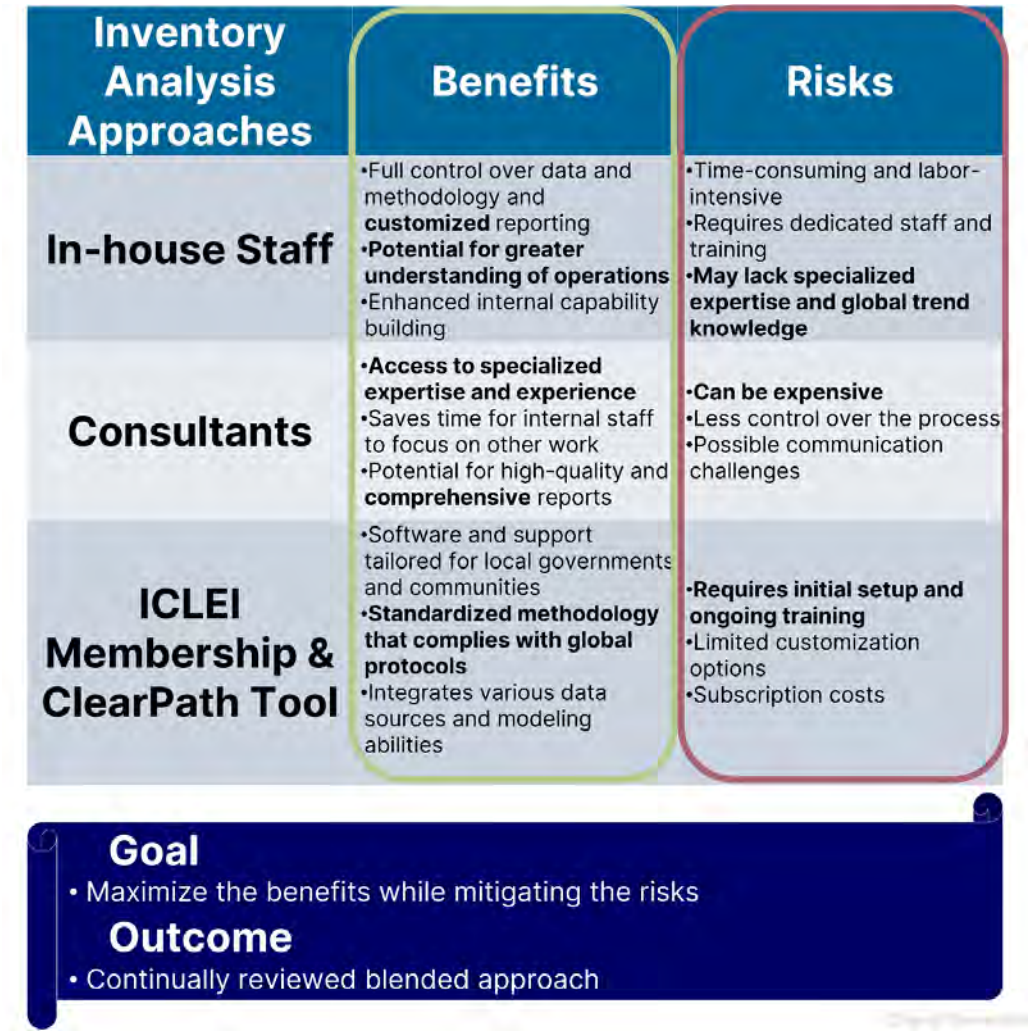
Not all data is available as soon as a year is completed. Each dataset has its own timeline of when it is available. Due to this lag in data availability, an inventory typically reports on data from 2-3 years prior. On top of that, the process of producing the new inventory typically takes 6-12 months. Together, these timelines result in the most recently available data from 2022 being reported on and released in 2025. The City of Spokane has been working to optimize data and project management schedules to reduce the data lag and reporting gap to the shortest timeframe possible while maintaining consistency and accuracy.

Data Analysis

Data analysis for a greenhouse gas inventory can be carried out multiple ways. Analysis can be completed by in-house staff, consultants, or via ICLEI's ClearPath tool[16].

Each method of analysis has benefits and risks. The City of Spokane's reporting goal is to maximize the benefits while mitigating the risks. This leads to a blended approach where dedicated in-house staff manage specific portions of the process and then use expert consultants and ICLEI's ClearPath tool to ensure the highest quality reporting while keeping time-spent and costs down.

Figure 8. Different Approaches to Completing a GHG Inventory



[16] https://icleiusa.org/clearpath/

Data Quality

In conjunction with data management and analysis, monitoring the quality of data that goes into the inventory ensures continuous improvement. Not all data required for an inventory is available in granular or directly measured ways. As a result, modeled analyses based on assumptions are, at times, necessary. All assumptions are recorded and summarized for purposes of documentation and transparency. Based on the level of modelling, reliance upon assumptions, and robustness of assumptions, each metric's data quality is categorized as low, medium, or high as shown below in Figure 9. These designations are entered into ClearPath along with the activity data and emissions factors. This information is used to identify areas of opportunity for improvement in future analyses.

Figure 9. Data Quality is Tracked for Activity Data and Emission Factors

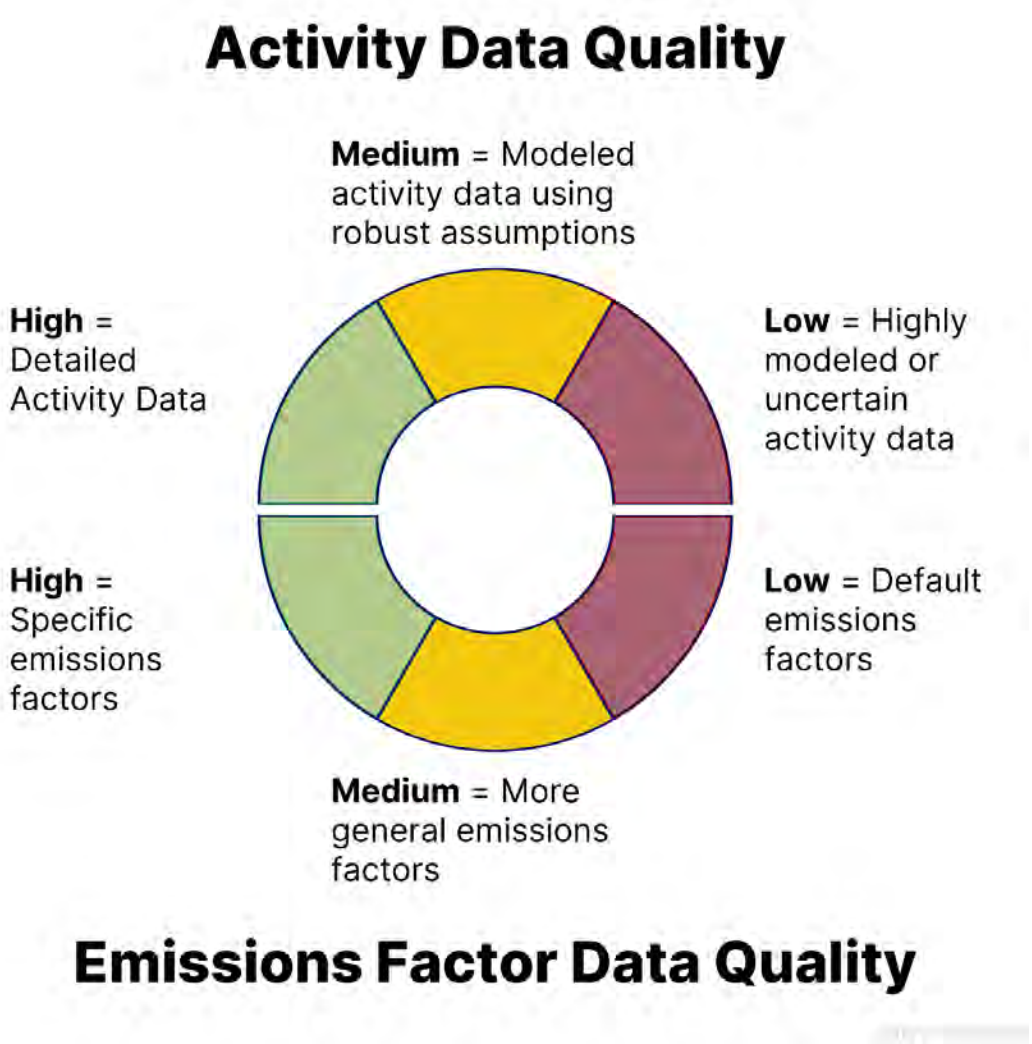


Table 1 and Table 2 summarize the quality of data used for each emission source in the communitywide GHG inventory and the government operations GHG inventory, respectively. Quality is determined based on whether emissions are calculated from local, regional/state, or national data sets.

Table 1. Communitywide GHG Inventory Summary of Data Quality

Sector	Values based on local data	Values are based on local data, with some exceptions	Values are based on scaled regional/state data	Values are based on scaled national data
Built Environment				
Electricity		✓		
Natural gas		✓		
Fuel oil		✓		
Propane		✓		
Industrial processes		✓		
Transportation				
On-road vehicles			✓	
Off-road equipment	✓			
Rail		✓		
Aviation		✓		
Solid Waste and Wastewater				
Solid waste generation & disposal		✓		
Wastewater treatment processes	✓			
Process & Fugitive				
Refrigerants				✓
Land Use				
Tree loss	✓			

Table 2. Municipal Operations GHG Inventory Summary of Data Quality

Higher Quality → Medium Quality → Lower

Sector	Values based on local data	Values are based on local data, with some exceptions	Values are based on scaled regional/state data	Values are based on scaled national data
Solid Waste Operations				
Waste to Energy	✓			
Grid Electricity	✓			
Natural Gas	✓			
Landfills	✓			
Vehicle Fleet				
On-road vehicles	✓			
Off-road vehicles & equipment		✓		
Wastewater Operations				
Grid Electricity	✓			
Natural Gas	✓			
Wastewater Treatment	✓			
Water Systems				
Grid Electricity	✓			
Natural Gas	✓			
Streetlights & Traffic Signals				
Grid Electricity	✓			
Other				
Building & Facilities	✓			
Employee Commute		✓		
Refrigerants	✓			

When new datasets are available, or data changes, this tracking allows for identification of those changes and recording how data availability has changed over time. As part of the inventory process, the City of Spokane always includes a **Recommendations for Future Improvements** section to identify the highest priority items to focus on for the next inventory.

Throughout the entire process there are several quality assurance and quality control steps. The City of Spokane's Environmental Analytics staff follow several quality assurance processes while collecting and processing the data. The consultants on the project not only validate that information, but they also perform various checks of their own throughout the process. One critical checkpoint is to analyze the data from workbooks and what is entered into ClearPath. City staff then validate that work, ensuring there are multiple sets of review steps for each part of the process. All quality assurance steps are outlined in a detailed standard operating procedure that guides the work.

Data Reporting

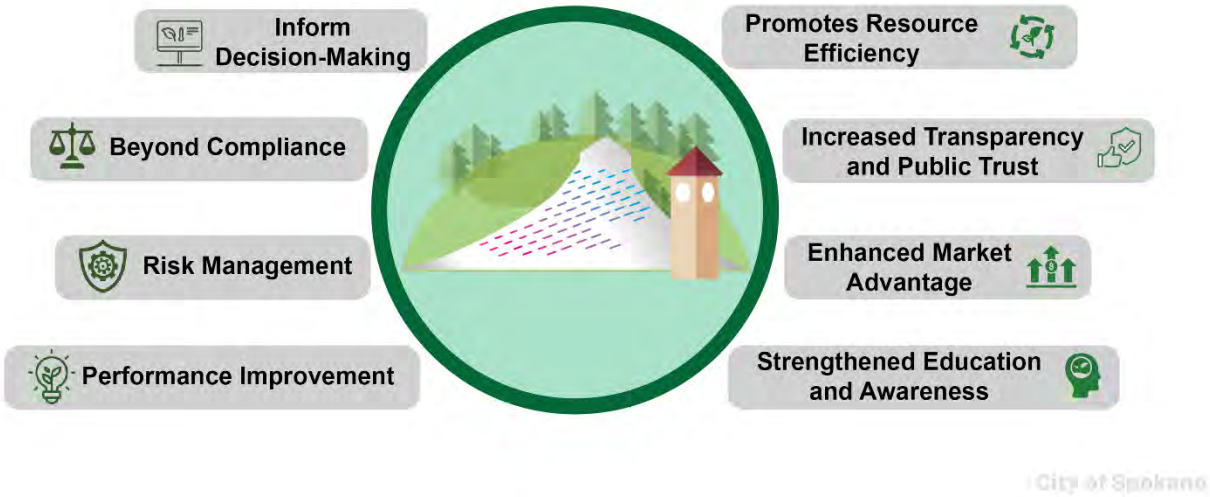
Goals

Once the data analysis and quality assurance processes have been completed, reporting the data in effective and compelling ways is the primary focus. There are several goals and benefits of clear and consistent reporting.

- **Inform Decision-Making**: Supplies leaders and the community with the necessary data to make informed decisions and prioritization regarding policies, investments, and strategies
- **Beyond Compliance**: Ensures adherence to environmental laws, regulations, and standards but also includes global best practices
- **Risk Management**: Identifies environmental risks that could impact government and business operations
- **Performance Improvement**: Tracks progress and identifies areas for improvement in environmental performance
- **Promotes Resource Efficiency**: Promotes the efficient use of resources and minimizes waste
- **Increased Transparency and Public Trust**: Builds trust and credibility with the public by demonstrating a commitment to environmental responsibility

- **Enhanced Market Advantage**: Differentiates the city in grant applications as leaders in sustainability and can provide a competitive edge
- **Strengthened Education and Awareness**: Increases awareness and understanding of environmental issues and the importance of sustainability

Figure 10. Goals and Benefits of Clear and Consistent Reporting



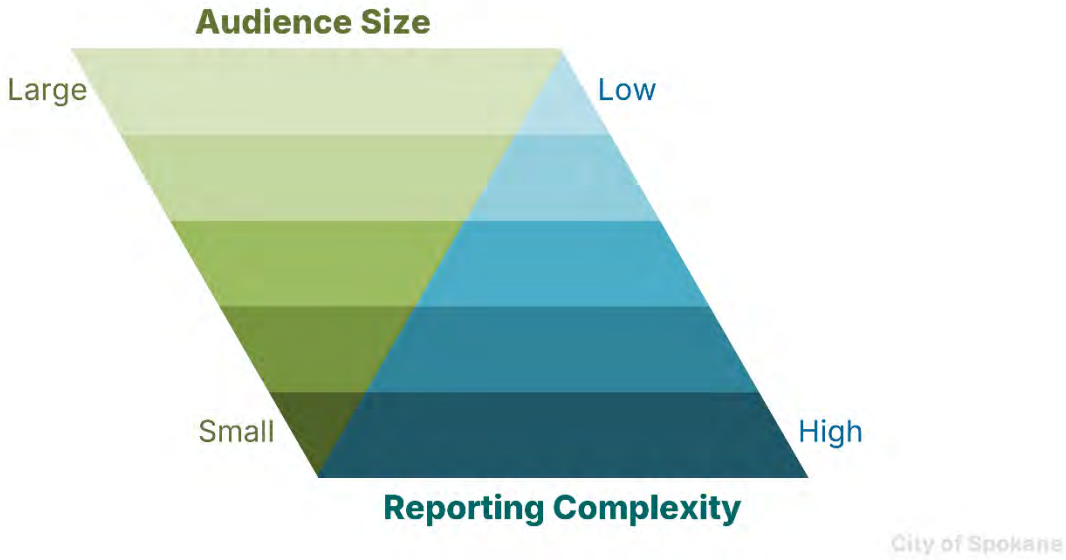
Audience

In order to meet data reporting goals, understanding the different audiences that the reporting needs to be communicated to is critical. Developing multiple deliverables that target distinct audiences through customized communication methods ensure the reporting goals are being met.

The City of Spokane also submits the inventory results, along with other environmental reporting efforts, to Carbon Disclosure Project (CDP)[17], the Global Covenant of Mayors (GCoM)[18], and the World Wide Fund for Nature (WWF)[19]. This not only provides transparency and alignment with global efforts, but it also provides feedback that improves the process and incorporates best practices from across the world.

[17] https://cdp.net/
[18] https://www.globalcovenantofmayors.org/
[19] https://wwf.panda.org/

Figure 11. Customized Reporting To Serve Various Audiences

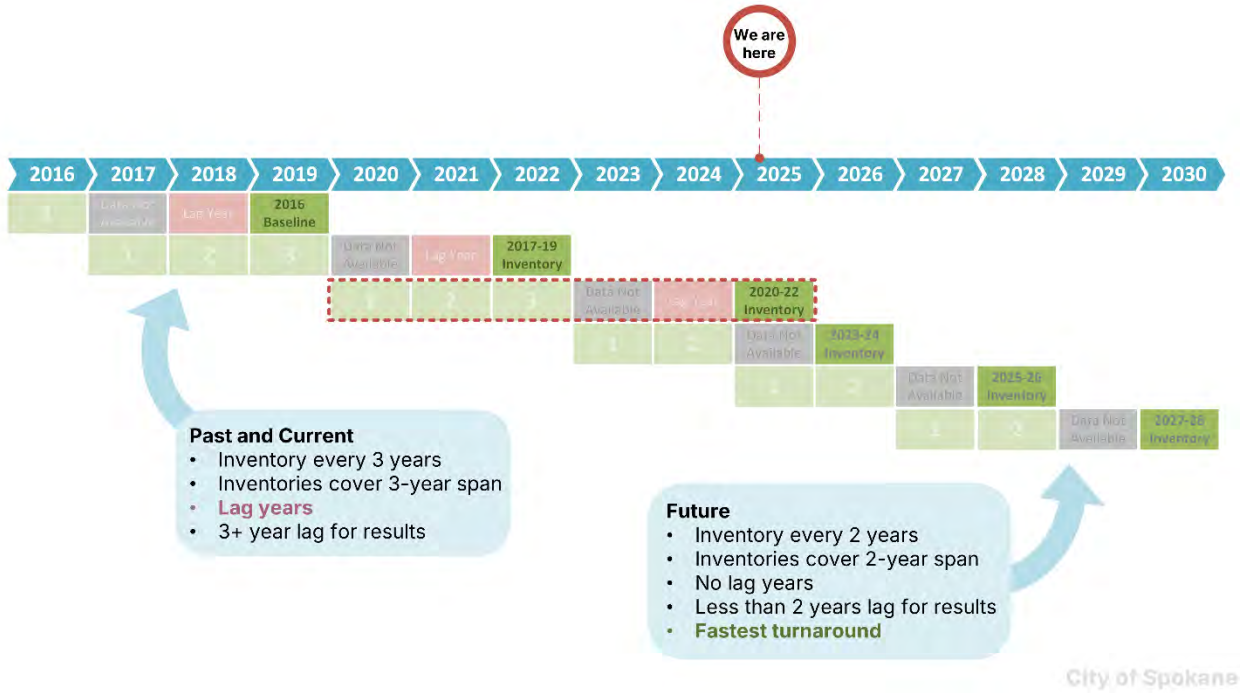


Update Intervals

In 2017 Spokane Municipal Code (SMC) Ordinance 15.05.060[20] set the City's greenhouse gas inventory reporting schedule to every three years. As mentioned previously, the lag time in data availability has spurred the City to shift that reporting frequency to a biennial basis. Releasing a report annually was not considered due to efficiency; that is the higher frequency reporting would lead to increased costs and staff time while not necessarily leading to an increase in information. Biennial reporting allows for more timely feedback for decision-makers to monitor progress while maintaining cost- and time-efficiency. Additionally, all years since the last inventory are reported to ensure annual variation is captured in detail. The current goal is to report by the end of every even year the community and local government operation emissions through the preceding even year. For example, the inventory that includes 2023 and 2024 should be published by the end of 2026.

[20] https://my.spokanecity.org/smc/?Section=15.05.060

Figure 12. Greenhouse Gas Reporting Timeline, Frequency, and Turnaround



Baseline for Tracking Progress

When reporting greenhouse gas changes, a baseline is required to be able calculate those differences. In 2010, under City of Spokane Resolution 2010-038, the City set its first greenhouse gas reduction goals. Additionally, in 2021, the City's emission reduction goals in SMC Ordinance 15.05.020[21] were updated to align with Washington State's more stringent reduction goals (RCW 70A.45.020[22]), aiming to achieve net zero emissions by the year 2050. This ordinance also established **baseline emissions to be from the year 2016**. While the City had created inventories since 2009, due to various changes of data availability, emissions protocols, and government operations, the older inventories are not comparable with the latest industry best practices. As a result, inventory data prior to 2016 is no longer included in current inventories.

Process Summary

While the methodology and data management plans have been listed out in this section, it is important to note that the City also has detailed standard operating procedures in place for City staff to manage the entire greenhouse gas inventory

[21] https://my.spokanecity.org/smc/?Section=15.05.020
[22] https://app.leg.wa.gov/RCW/default.aspx?cite=70A.45.020

process from start to finish. This ensures that the process is efficient, repeatable, and effective. While there are primary owners of certain steps in the process, these roles overlap and blend together with several quality assurance checks at each hand-off. The end-product from the process enables better target setting, planning, policy development, and project implementation.

Figure 13. Greenhouse Gas Inventory Process

Inventory Report Overview

The sections of this report are as follows:

- **Communitywide GHG Inventory**
  - Overview
  - Energy
  - Transportation
  - Refrigerants
  - Solid Waste
  - Wastewater
- **Government Operations Inventory**
  - Overview
  - Solid Waste Operations
  - Vehicles & Equipment Fleet
  - Wastewater Operations
  - Water Systems
  - Streetlights & Traffic Signals
  - Other Emissions Sources
- **Energy Access & Poverty Assessment**
- **Emissions Forecast & Target Recommendations**
- **Recommendations for Future Inventories**

- **Appendices:**
  - A: Emissions Summary Tables
  - B: Data Providers and Contact Information
  - C: Factor Sets
  - D: Biogenic Emissions Summary
  - E: Emissions Forecast Assumptions

Communitywide Greenhouse Gas Inventory

Overview

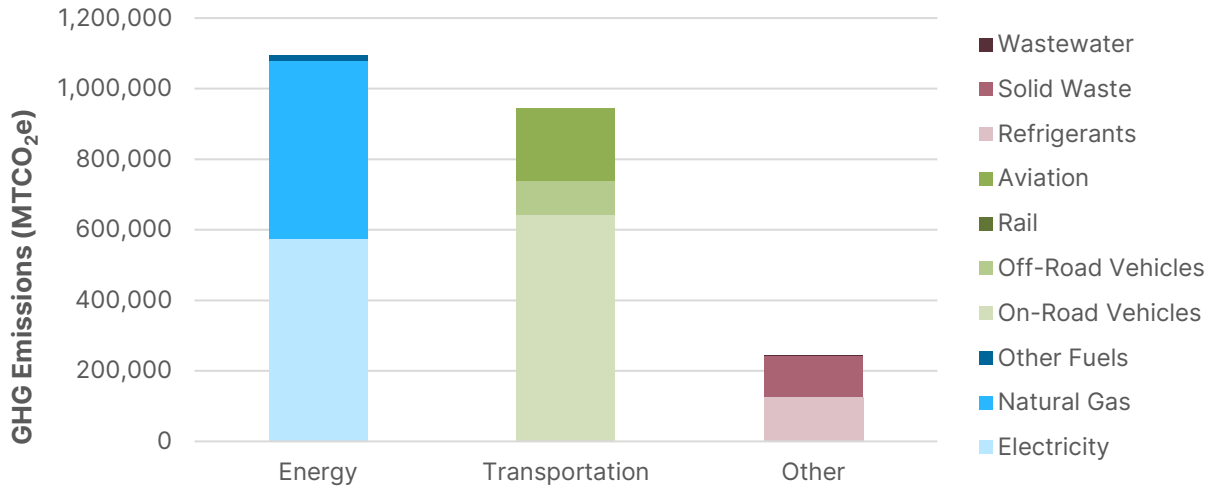
Every action matters when reducing community emissions. In addition to the sector results, additional details are provided on larger actions being taken, as well as resources if you want to take individual action. Refer to the *Get Involved!* section of this report to find out ways to get involved in the climate planning efforts currently underway to help make larger changes!

The City of Spokane's community produced 2,283,457 metric tons of carbon dioxide equivalent ($MTCO_2e$) in 2022. The total per-capita emissions for the City of Spokane in 2022 were 9.89 $MTCO_2e$.

Greenhouse gas (GHG) emissions sources included in this inventory are from:

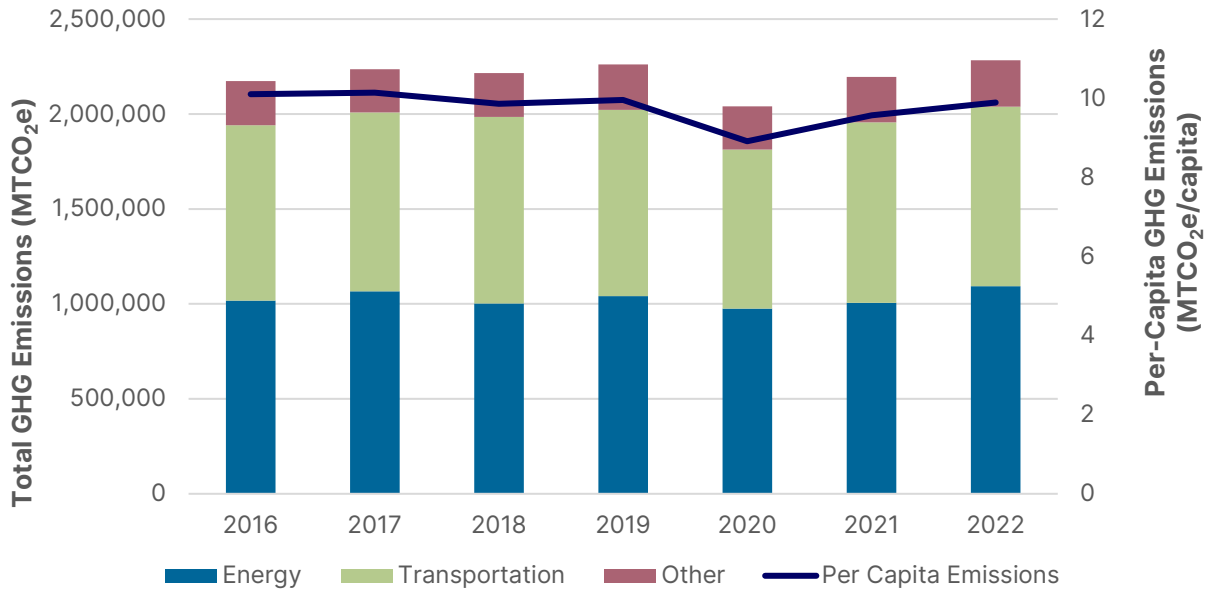
- **Energy**: *48% of communitywide emissions*
  Residential, commercial, and industrial grid electricity, natural gas, and other fossil fuel consumption. These emissions sources also include transmission and distribution (T&D) losses from the electricity grid and fugitive emissions from natural gas distribution.
- **Transportation**: *41% of communitywide emissions*
  On- and off-road vehicles, transit vehicles, and rail transportation.
- **Refrigerants**: *6% of communitywide emissions*
  Fugitive hydrofluorocarbons (HFCs) are commonly used in refrigeration or air conditioning.
- **Solid Waste**: *5% of communitywide emissions*
  City of Spokane's Waste to Energy (WTE) facility, the Northside Landfill, and compost generation.
- **Wastewater**: *less than 1% of communitywide emissions*
  Process emissions from wastewater treatment.

Figure 14. Total Communitywide GHG Emissions, by Source (2022)



Total **emissions increased 5%** from 2016 to 2022 while the total population increased 7%. On a **per capita basis, overall emissions decreased by 2%**. The increase in emissions results from higher consumption of aviation fuel, natural gas, and refrigerants. Since 2016, natural gas consumption in the city has risen by 30%, with residential consumption increasing by 30% and commercial consumption growing by 27%.

Figure 15. Total and Per Capita Annual GHG Emissions



Each emissions source is discussed in further detail in the report sections that follow.

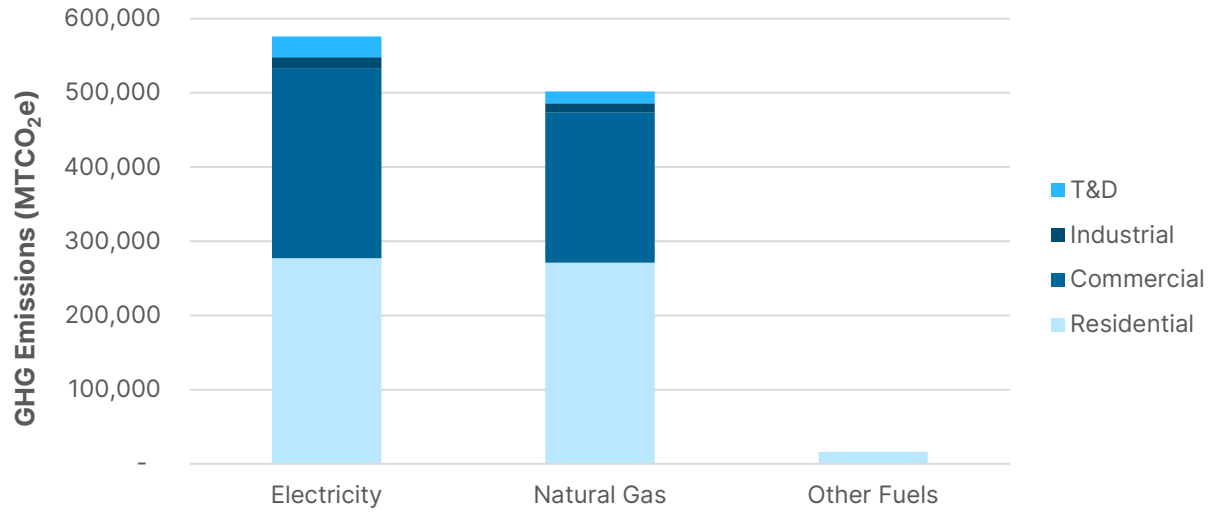
Energy

Overview

Energy consumption produced 1,094,000 $MTCO_2e$ and 4.74 $MTCO_2e$ per capita in 2022 (48% of total communitywide emissions) (Table 4). These emissions result from:

- **Electricity:** *53% of total communitywide energy emissions and 2.49 $MTCO_2e$ per capita in 2022.*
  Electricity consumption in residential, commercial, and industrial sectors and associated transmission and distribution (T&D) losses.
- **Natural gas:** *46% of total communitywide energy emissions and 2.17 $MTCO_2e$ per capita in 2022.*
  Natural gas consumption in residential, commercial, and industrial sectors and associated fugitive emissions from distribution.
- **Fuel oil and propane:** *1% of total communitywide energy emissions and 0.07 $MTCO_2e$ per capita in 2022.*
  Consumption of fuel oil and propane by residential sector only due to lack of available data for industrial and commercial sectors.

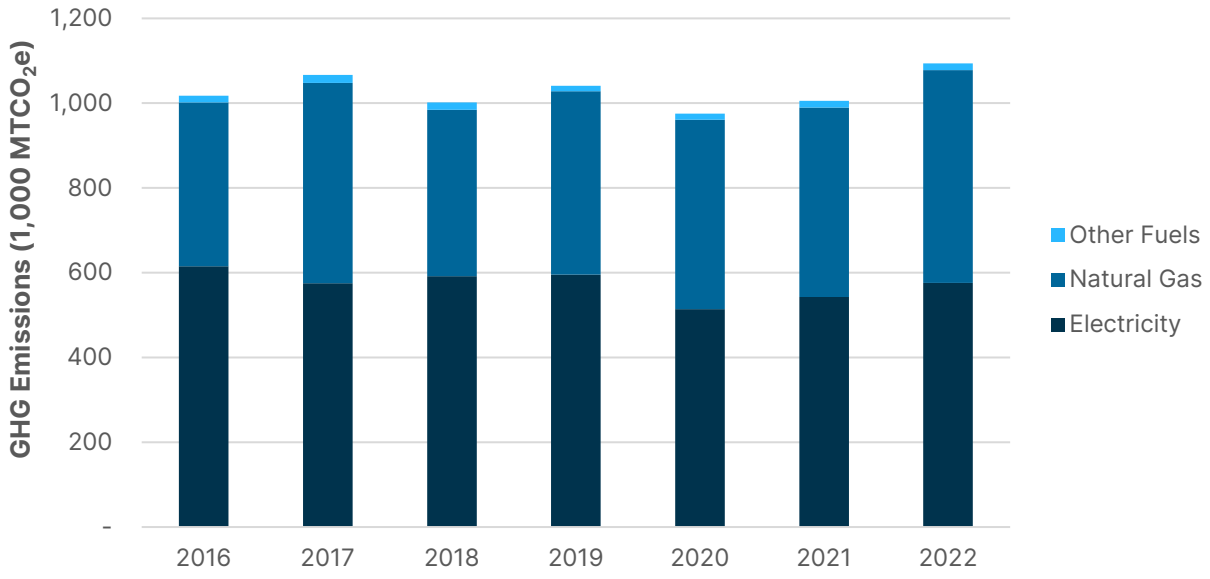
Figure 16. Energy Emissions by Sector and Source in 2022



Energy emissions **increased 8%** from 2016 to 2022. Emissions from electricity **decreased 6%** over this time while emissions from natural gas **increased 30%**. Hotter and colder temperatures play a significant role in energy consumption. Both hotter and cooler temperatures impact emissions and increase energy

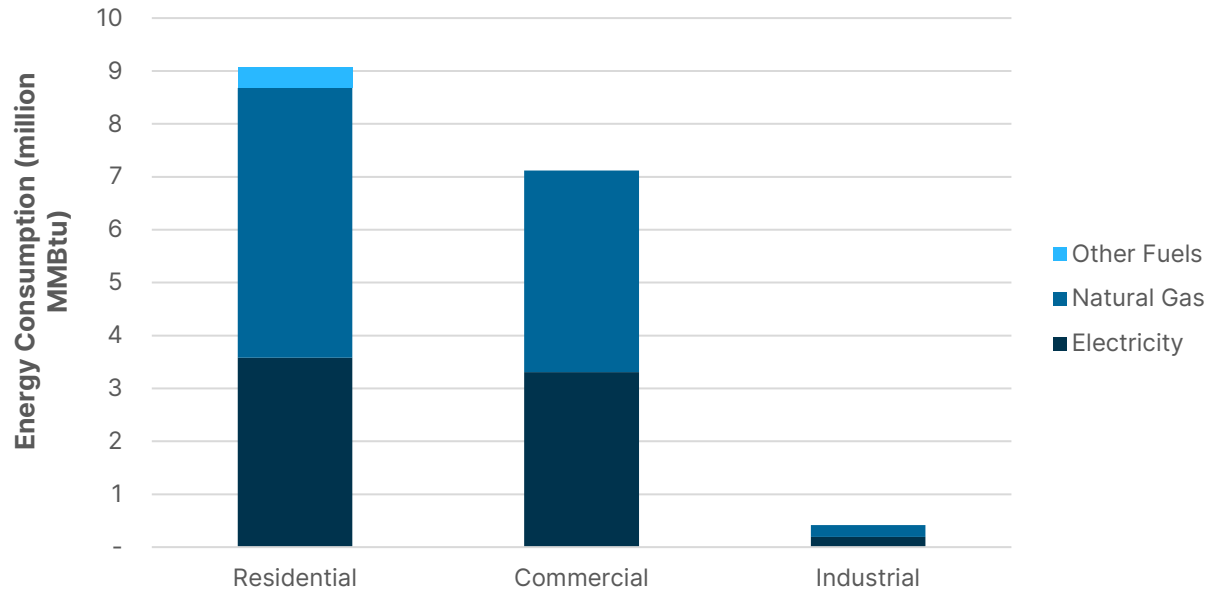
consumption. In 2022, the City of Spokane experienced a 16% increase in heating degree days for a total of 6,821 heating degree days, up from 5,870 in 2016. Similarly, the City recorded an increase in 50% cooling degree days 764 cooling degree days in 2022, compared to 510 in 2016. The increase in heating and cooling degree days drives higher energy consumption and an increase in energy emissions 2022 compared to 2016.

Figure 17. Annual Energy Emissions, by Fuel Source



Comparing total energy consumption by fuel source (in MMBtu) shows that the **largest source of energy consumption is natural gas in the residential sector**. The largest source of energy consumption in the commercial and industrial sectors was natural gas (Figure 18).

Figure 18. Total Energy Consumption, by Sector and Fuel Source in 2022

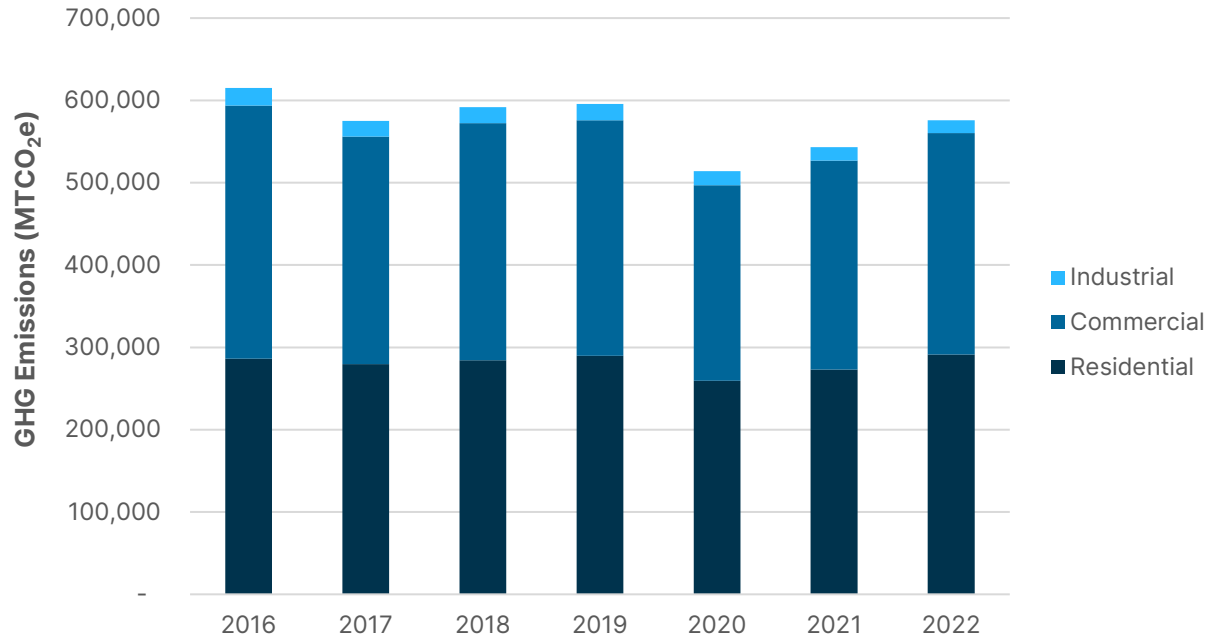


Electricity | Scope 2

Communitywide electricity consumption produced 575,957 $MTCO_2e$ in 2022 (27% of Spokane's total communitywide GHG emissions and 53% of total energy emissions). Over 99% of Spokane's 2022 consumed electricity was provided by Avista and the remaining electricity was provided by Inland Power and Light (IPL).

Most of 2022's electricity emissions are from the residential and commercial sectors, 51% and 47% respectively. The industrial sector contributed only 3% of 2022 electricity emissions.

Figure 19. Annual Electricity GHG Emissions, by Sector

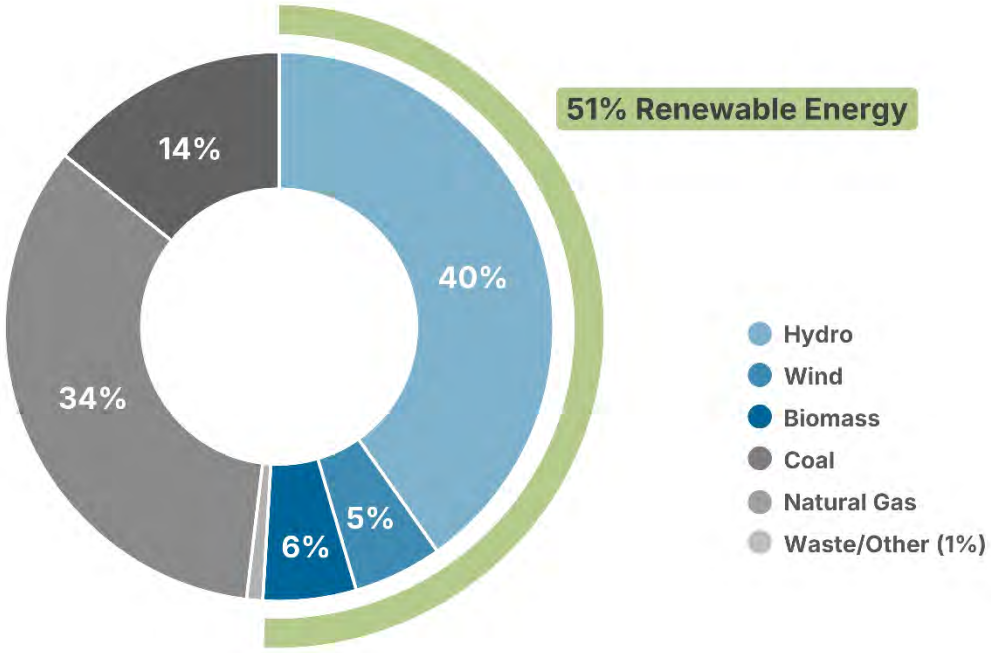


Based on Avista's published generation resource mix (2022), approximately **51% of the community's electricity is currently coming from renewable energy**, produced through a combination of hydro, wind, and biomass (Figure 20).[23] In 2019, Avista announced their goals to provide 100 percent clean electricity by 2045 in alignment with the Clean Energy Transformation Act, so the proportion of electricity coming from renewable electricity is expected to continue to increase moving forward.[24]

[23] https://deptofcommerce.app.box.com/s/l9sqx4bcfnko3omrpk4tv8n0vbzcvsdz/file/1673766736695

[24] https://www.myavista.com/about-us/our-commitment

Figure 20. Avista Renewable Energy Fuel Mix

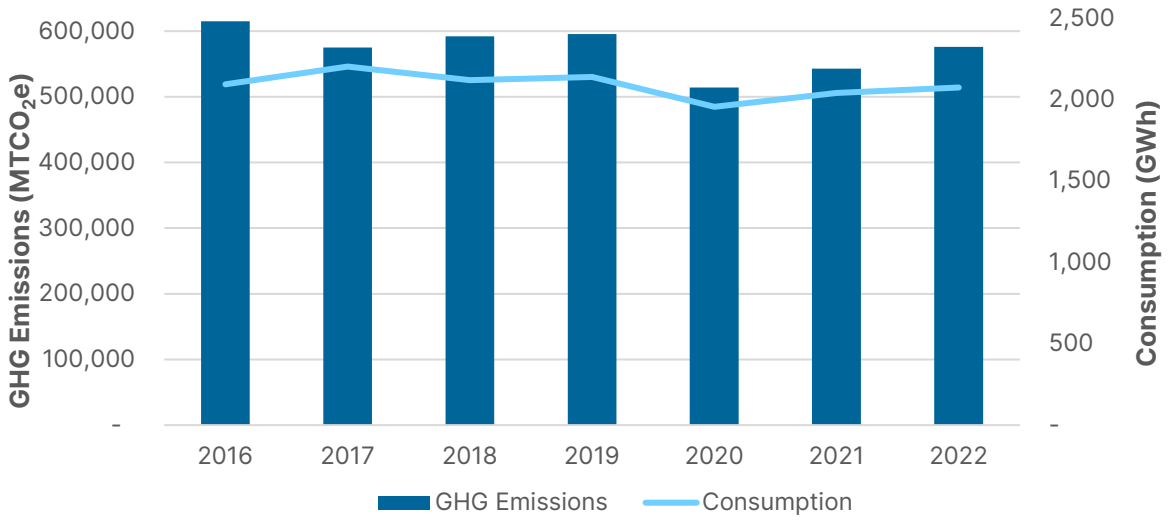


Data Source: Washington State Department of Commerce, Washington Electric Utility 2023 Fuel Mix Disclosure Report, For calendar year 2022, published June 3, 2024

City of Spokane

As shown in Figure 21, **electricity emissions have decreased 6%** since 2016 while consumption has increased 3%. This overall decrease in emissions is attributed to an increase in renewable energy sources, as the reported carbon intensity of both Avista and Inland Power & Light's electricity provided to the city of Spokane **decreased by approximately 7%** from 2016 to 2022.

Figure 21. Annual Electricity Emissions and Consumption



On a **per capita basis, electricity consumption has decreased by 4%** while population has grown 7% since 2016.

Electricity Consumption	Residential	Commercial	Industrial
GHG emissions ($MTCO_2e$)	291,242	269,057	15,658
Activity data (kWh)	1,048,568,444	968,855,347	56,206,880
Emissions Factors	• Avista Emissions Factor 2022 (Appendix C) • Inland Power & Light Emissions Factor 2022 (Appendix C)		
Activity Data Sources	• Avista Utilities • Inland Power & Light		
GPC Reference	I.1.2	I.2.2	I.3.2

Transmission & Distribution Losses	Residential	Commercial	Industrial
GHG emissions ($MTCO_2e$)	14,133	13,056	760
Activity data (kWh)	1,048,568,444	968,855,347	56,206,880
Emissions Factors	• Avista Emissions Factor 2022 (Appendix C) • Inland Power & Light Emissions Factor 2022 (Appendix C)		
Activity Data Sources	• Avista Utilities • Inland Power & Light • U.S. EPA Emissions & Generation Resource Integrated Database (eGRID)		
GPC Reference	I.1.3	I.2.3	I.3.3

Natural Gas | Scope 1

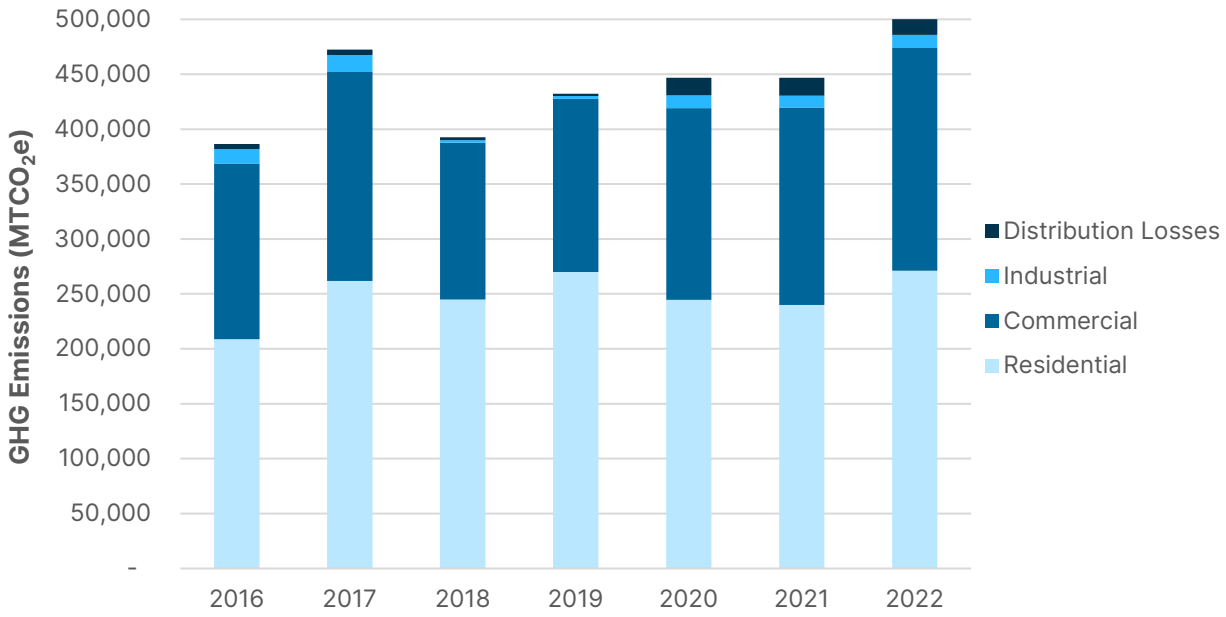
Natural gas produced 501,999 $MTCO_2e$ in 2022 (23% of Spokane's total communitywide GHG emissions and 46% of total energy emissions).

Avista is the City's natural gas provider. In 2021, Avista announced their aspirational goals to be carbon neutral in natural gas operations by 2045, so these emissions are expected to decrease over time.[25]

Most of 2022's natural gas emissions are from the residential sector (54%), followed by the commercial sector (40%). About 2% of natural gas emissions are from the industrial sector and 3% are from distribution losses.

Natural gas emissions have **increased 30%** since 2016, largely due to an increase in residential (30%) and commercial consumption (27%). Industrial natural gas consumption has decreased 8% since 2016. These increases are likely to be primarily due to the colder temperatures that led to a significant increase in heating degree days.

Figure 22. Annual Emissions from Natural Gas Consumption, by Sector



Natural Gas Consumption	Residential	Commercial	Industrial
GHG emissions ($MTCO_2e$)	271,206	202,645	11,935
Activity data (therm)	50,994,603	38,103,152	2,248,663
Emissions Factor ($MTCO_2e$/therm) *ClearPath Default*	0.005318	0.005318	0.005307
Activity Data Sources	Avista Utilities		
GPC Reference	I.1.1	I.2.1	I.3.1

[25] https://www.myavista.com/about-us/our-commitment

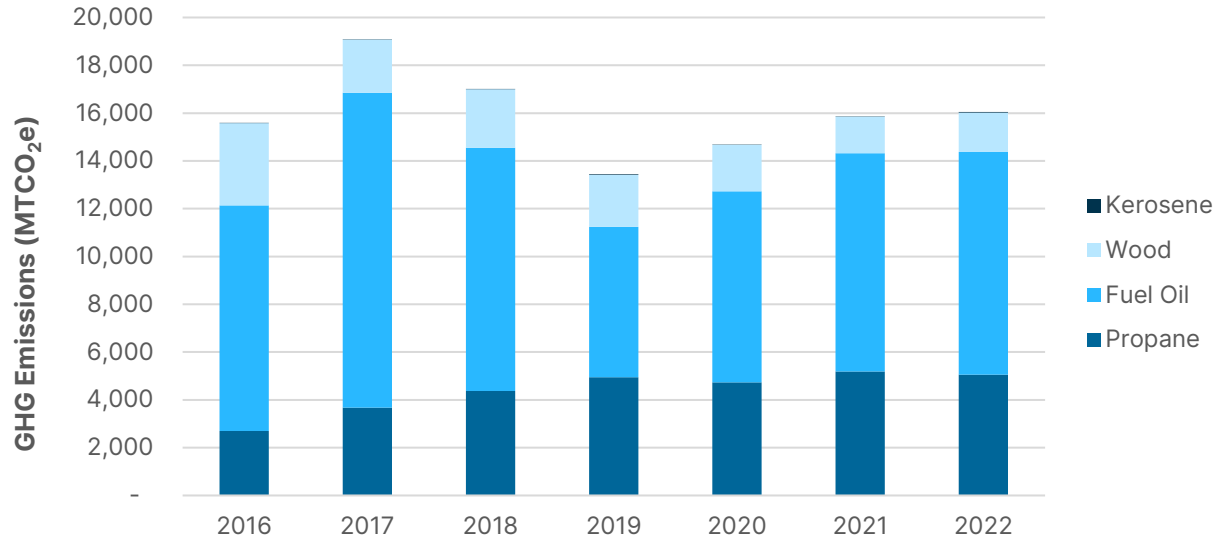
Natural Gas Distribution Losses	2022
GHG emissions	16,213 $MTCO_2e$
Activity data	91,346,418 therms
Emissions Factor *ClearPath Default*	0.000177 $MTCO_2e$/therm
Activity Data Sources	Avista Utilities
GPC Reference	I.8.1

Other Fuels | Scope 1

Data on other fuel consumption is currently only available for the residential sector. These emissions are calculated using data on residential fuel consumption in the state of Washington with census data on Spokane's household fuel use.

Propane, fuel oil, wood, and kerosene consumption produced 16,044 $MTCO_2e$ in 2022 (1% of energy emissions, less than 1% of total communitywide emissions). These emissions have fluctuated between 2016 and 2022 due to changes in consumption at the state level (Figure 23).

Figure 23. Annual Residential "Other" Fuel Emissions



Kerosene Consumption	2022
GHG emissions	17 $MTCO_2e$
Activity data	1,688 gallons
Emissions Factor *ClearPath Default*	0.01022 $MTCO_2e$/gallon
Activity Data Sources	• U.S. Energy Information Administration • U.S. Census Data
GPC Reference	I.1.1

Wood Consumption	2022
GHG emissions	1,656 $MTCO_2e$
Activity data	170,012 MMBtu
Emissions Factor *ClearPath Default*	0.009742 $MTCO_2e$/MMBtu
Activity Data Sources	• U.S. Energy Information Administration • U.S. Census Data
GPC Reference	I.1.1

Fuel Oil Consumption	2022
GHG emissions	9,321 $MTCO_2e$
Activity data	125,987 MMBtu
Emissions Factor *ClearPath Default*	0.073985 $MTCO_2e$/MMBtu
Activity Data Sources	• U.S. Energy Information Administration • U.S. Census Data
GPC Reference	I.1.1

Propane Consumption	2022
GHG emissions	5,049 $MTCO_2e$
Activity data	894,037 gallons
Emissions Factor *ClearPath Default*	0.00565 $MTCO_2e$/gallon
Activity Data Sources	• U.S. Energy Information Administration • U.S. Census Data
GPC Reference	I.1.1

Emission Reduction Actions

Below are some resources for further information or actions that you can take to help reduce emissions that come from the energy sector.

- Use energy efficient appliances and devices.
  - Appliances and Electronics | US Department of Energy
  - Energy Efficient Products | ENERGY STAR
- Improve energy efficiency with home upgrades.
  - Energy-Saving Home Upgrades Program | Avista
- Find out where energy is being used in your home.
  - Home Energy Audit | Avista
  - Always On Energy Saving Tips | Avista
- Follow energy-saving tips.
  - Energy Saving Advice for Your Home | Avista
- Sign your business up for energy-saving programs, services, and rebates.
  - Energy Saving Programs and Services for Your Business | Avista
  - Energy Saving Advice for Your Business | Avista
- Participate in residential rebate programs.
  - Energy Rebate Overview | Avista

Transportation

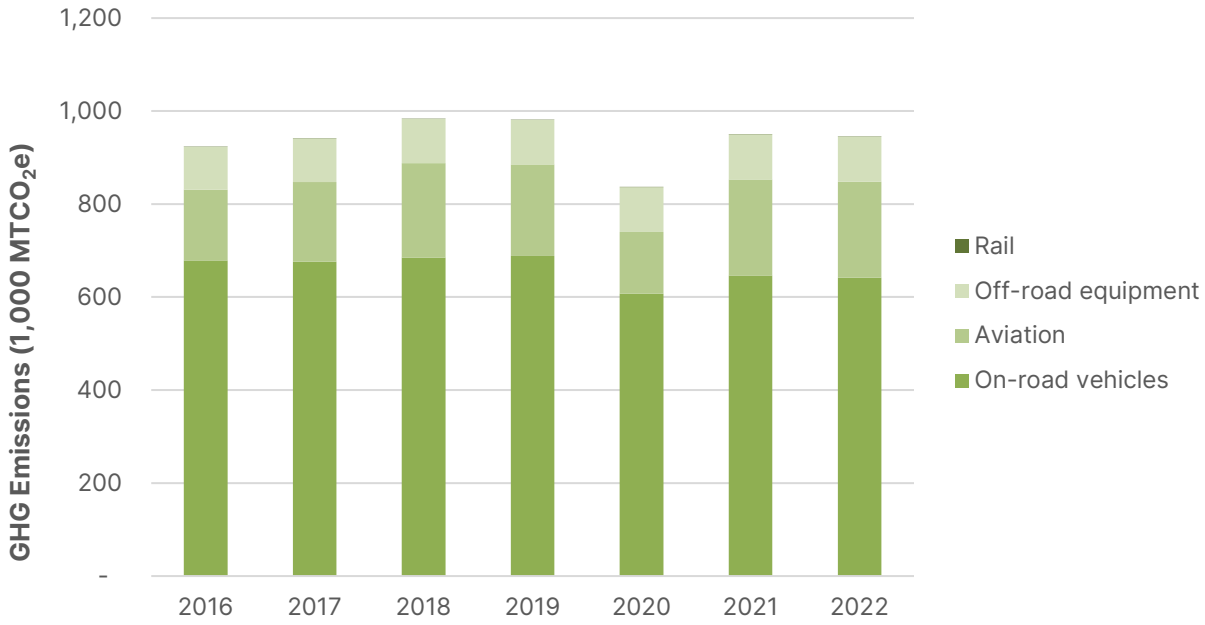
Overview

Transportation produced 945,012 $MTCO_2e$ in 2022 (41% of total emissions). The total per-capita VMT was 5,519 VMT/capita.

Emissions sources in this sector include:

- **On-road vehicles:** *68% of total transportation emissions and 2.78 $MTCO_2e$ per capita in 2022.*
  Fuel combustion (gasoline, diesel, LPG) in passenger, light-duty, and heavy-duty vehicles as well as transit and paratransit vehicles.
- **Off-road vehicles and equipment:** *10% of total transportation emissions and 0.42 $MTCO_2e$ per capita in 2022.*
  Fuel combustion (gasoline, diesel, CNG, LPG) in off-road vehicles and equipment.
- **Aviation:** *22% of total transportation emissions and 0.89 $MTCO_2e$ per capita in 2022.*
  Fuel combustion (jet kerosene and aviation gasoline) in Spokane International Airport and Spokane Felts Fields.
- **Rail:** *less than 1% of total transportation emissions and less than .01 $MTCO_2e$ per capita in 2022.* Fuel combustion in Amtrak and Union Pacific railways.

Figure 24. Annual Transportation Emissions by Vehicle Type



On-Road Vehicles | Scope 1

On-road vehicles produced 641,379 $MTCO_2e$ in 2022 (68% of transportation emissions, 28% of total emissions). Emissions have decreased 6% since 2016. In 2022, on-road vehicle miles traveled totaled 1,274,389,860, decreasing 1% since 2016.

On-road vehicle emissions are estimated using both the Spokane Regional Transportation Council's (SRTC) travel demand model and state data from the Highway Performance Monitoring System (HPMS). The new SRTC regional travel demand model uses an updated methodology to analyze travel patterns and future transportation needs in the Spokane region. The travel model reproduces VMT patterns by factoring in elements such as population growth, economic development, transportation infrastructure, and changes in land use. Since the new SRTC travel model uses different methodologies than the previous 2019 base model, prior GHG inventories required retroactive updates to ensure consistency and replicability across VMT totals for all inventory years.

In addition to its new regional travel demand model, SRTC is currently working on developing regional VMT goals that will inform the City of Spokane's Comprehensive Plan and Climate Planning updates.

Gasoline passenger, light-duty, and heavy-duty vehicles produced 68% of on-road transportation emissions.

Figure 25. On-Road Vehicle VMT and Per-Capita VMT.

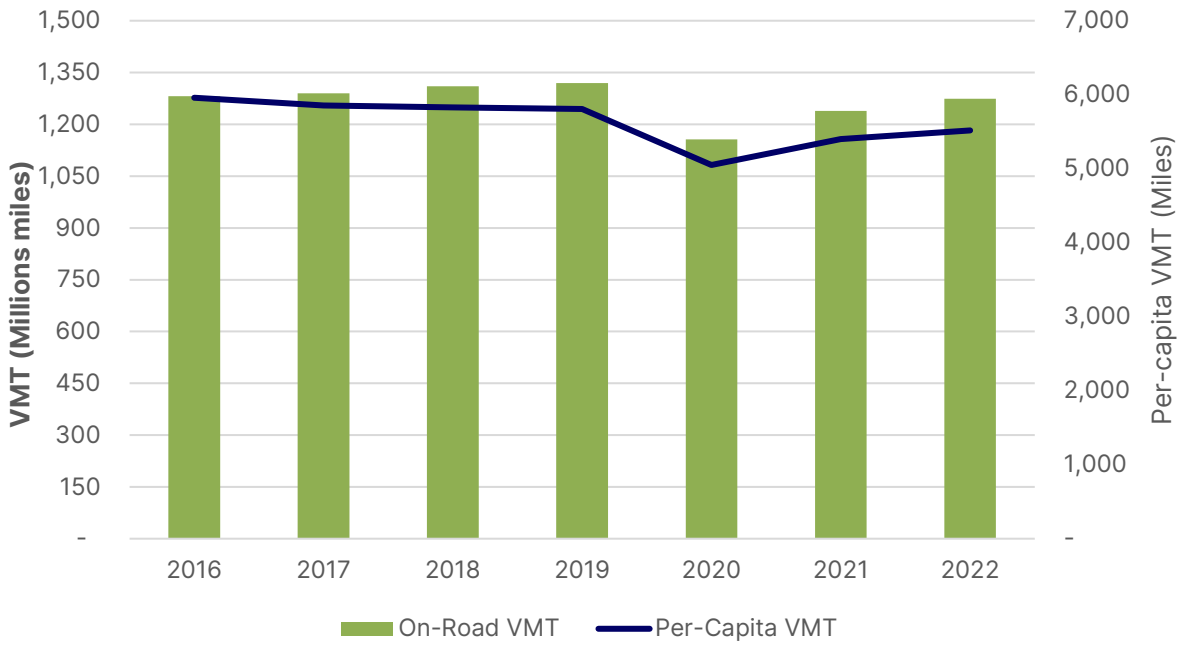
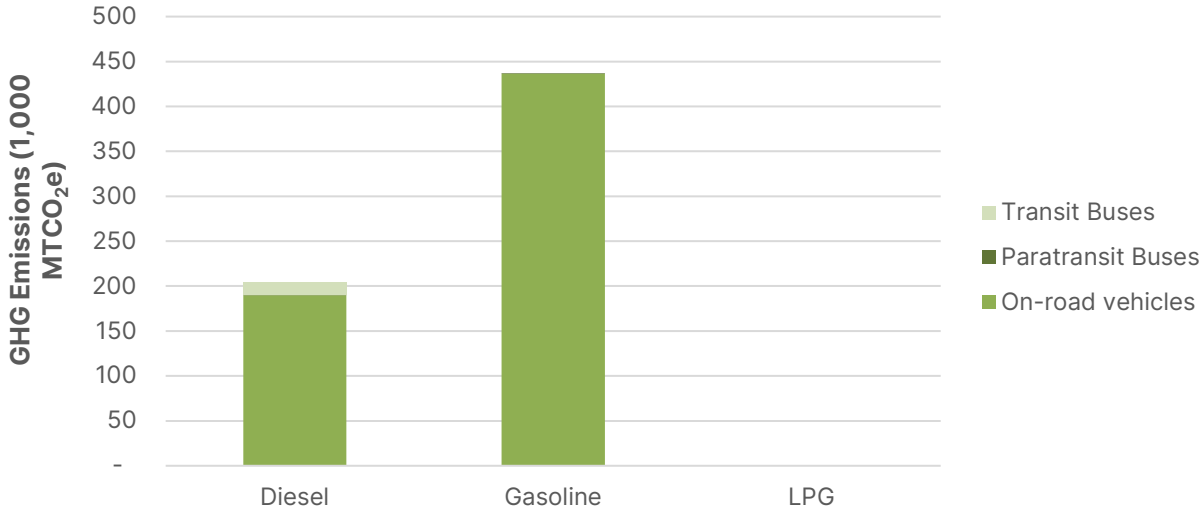


Figure 26. Transportation Emissions, by Fuel and Vehicle Type for 2022



In 2022, approximately 51% of on-road vehicle emissions came from freight vehicles, while 49% came from passenger vehicles, shown in Figure 27 below. This breakdown by vehicle type demonstrates the higher carbon footprint of large freight trucks that often run on diesel and are less fuel efficient. In 2022, 68% of on-road vehicle miles traveled came from passenger vehicles (including motorcycles), while only 32% came from freight vehicles.

Figure 27. On-Road Emissions, by Vehicle Type for 2022

On-Road Vehicles	2022
GHG emissions	626,724 $MTCO_2e$
Activity data	1,274,389,860 vehicle miles traveled
Emissions Factors	2022 Transportation Factor Set (Appendix C)
Activity Data Sources	Spokane Regional Transportation Council
GPC Reference	II.1.1

Transit Vehicles	2022
GHG emissions	14,655 $MTCO_2e$
Activity data	1,439,659 gallons
	8,647,883 vehicle miles traveled
Activity Data Sources	2022 Transportation Factor Set (Appendix C)
GPC Reference	Spokane Transit Authority
GHG emissions	II.1.1

Off-Road Vehicles & Equipment | Scope 1

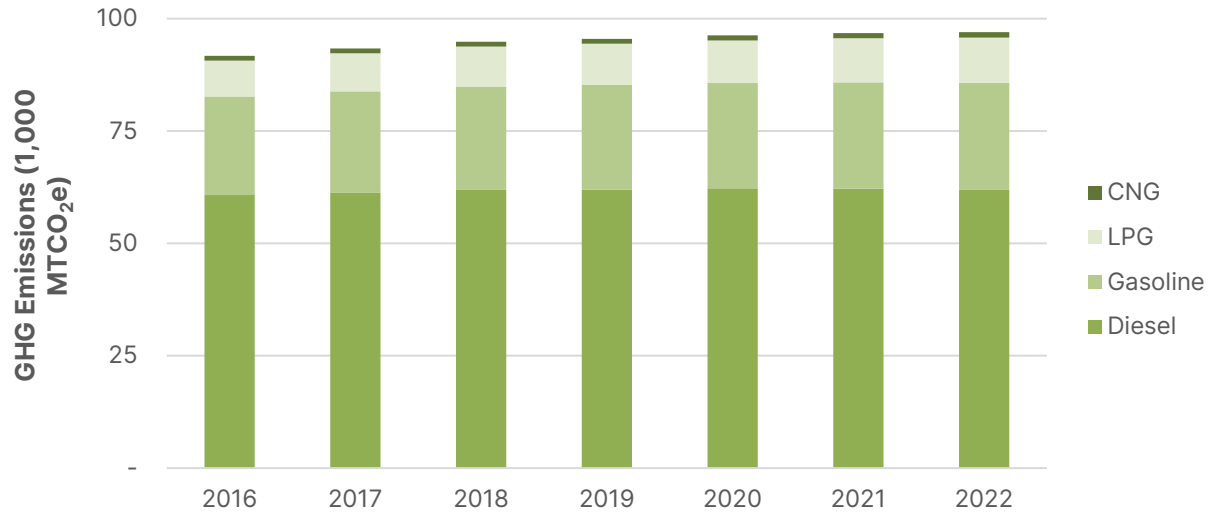
Off-road vehicles and equipment include machinery like forklifts, backhoes, tractors, golf carts, lawn mowers, and leaf blowers that typically run on fossil fuels but are not intended for use as passenger or freight vehicles.

Off-road vehicles and equipment produced 96,973 $MTCO_2e$ (10% of transportation emissions, 4% of total emissions). Emissions have **increased 6%** since 2016. Most emissions are from **agricultural, industrial, construction and mining, commercial, and lawn and garden equipment.**

Emissions are estimated using the EPA's Motor Vehicle Emission Simulator (MOVES) Nonroad Engines, Equipment, and Vehicles model. This model generates

emissions for Spokane County; population is used to scale emissions down to the city level.

Figure 28. Annual Off-Road Vehicle and Equipment Emissions, by Fuel Type



Off-Road Vehicles	2022
GHG emissions	96,973 $MTCO_2e$
Activity data	N/A – calculated using U.S. EPA MOVES NONROAD model
Emissions Factor	
Activity Data Sources	U.S. EPA MOVES NONROAD model
GPC Reference	II.5.1

Rail | Scope 1

Rail transportation produced 142 $MTCO_2e$ in 2022 (less than 1% of transportation emissions, less than 1% of total emissions). Three railroad companies operate through the City of Spokane:

- **Amtrak** – provided estimated total diesel consumed within city limits to estimate emissions.
- **Union Pacific (UP)** – did not provide inventory data. As a proxy, GHG emissions were calculated using the annual percentage change of Amtrak fuel use and applied to previous UP emissions estimates.
- **Burlington Northern Santa Fe (BNSF)** – did not provide inventory data.

Amtrak	2022
GHG emissions	142 $MTCO_2e$
Activity data	13,811 gallons
Emissions Factor *ClearPath Default*	0.0103027 $MTCO_2e$/gallon
Activity Data Sources	Amtrak
GPC Reference	II.2.1

Union Pacific	2022
GHG emissions	0.0008364 $MTCO_2e$
Activity data	N/A – based on $MTCO_2e$ provided by UP
Emissions Factor	
Activity Data Sources	Union Pacific Railroad
GPC Reference	II.2.1

Emission Reduction Actions

Below are some resources for further information or actions that you can take to help reduce emissions that come from the transportation sector.

- Reduce your Vehicle Miles Traveled by taking the bus.
  - How to Ride the Bus | Spokane Transit Authority
  - Bus Routes & Schedules | Spokane Transit Authority
- Reduce your Vehicle Miles Traveled by taking a rideshare.
  - Rideshare | Spokane Transit Authority
- Reduce your Vehicle Miles Traveled by using a Park & Ride.
  - Park & Ride Locations | Spokane Transit Authority
- Reduce your Vehicle Miles Traveled by using a shuttle.
  - STA Shuttle Park | Spokane Transit Authority
- Reduce your Vehicle Miles Traveled by riding your bike.
  - Bicycle and Pedestrian Resources | City of Spokane
  - Spokane Regional Bike Map | SRTC
- Reduce your Vehicle Miles Traveled by using WheelShare.
  - WheelShare: Spokane's Shared Mobility Program | City of Spokane
- Work from home if you are able or encourage telework options for your employees.
  - Statewide telework and hybrid work resources | Washington State Office of Financial Management
- Participate in your employer's Commute Trip Reduction (CTR) program.
  - Spokane County Commute Trip Reduction | CommuteSmartNW
- Take advantage of personal electric vehicle programs and incentives.
  - Electric transportation for your home | Avista
- Sign your business up for electric vehicle programs and incentives.
  - For Your Business | Avista
  - Electric Vehicle Incentives & Programs | Avista
- Encourage electric transportation in your community.
  - Electric transportation community partnerships and outreach | Avista

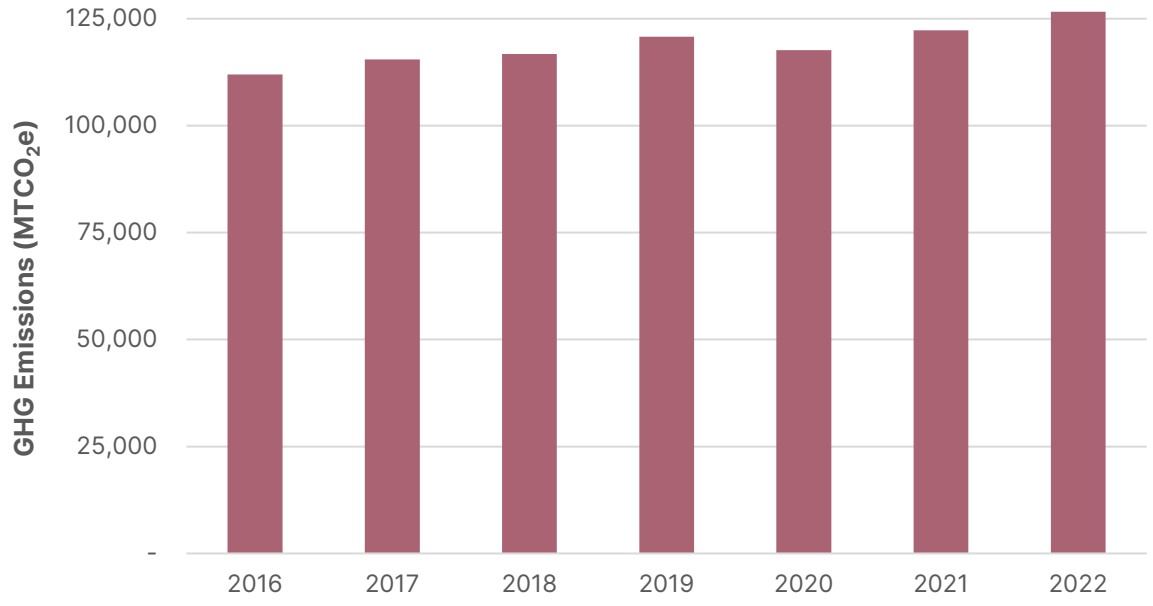
Refrigerants

Emissions from leakage of refrigerant systems and products releases Scope 1 GHGs. Refrigerant uses include refrigeration systems, fire suppression equipment, and vehicle air conditioning.

Refrigerant emissions are **estimated using national estimates** reported by the U.S. Environmental Protection Agency (EPA), scaled down to Spokane using population.

Estimated refrigerant leakage produced 126,649 $MTCO_2e$ in 2022 (6% of total emissions) and 0.55 $MTCO_2e$ per capita in 2022. **National refrigerant use has increased**, causing these emissions to increase 13% since 2016. In 2019 and 2021, Washington passed refrigerant management laws which aim to reduce emissions from the use of fluorinated gases, hydrofluorocarbons (HFCs), and other substitutes for ozone depleting substances. These policies require that new equipment must be manufactured without HFCs or use refrigerants with a lower GWP. The implementation of these refrigerant management laws should help to reduce emissions from refrigerant usage in Spokane.

Figure 29. Annual Refrigerants Emissions



Refrigerants	2022
GHG emissions	126,649 $MTCO_2e$
Activity data	N/A – used EPA calculated $MTCO_2e$
Emissions Factor	

Refrigerants	2022
Activity Data Sources	U.S. EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2019
GPC Reference	IV.2

Emission Reduction Actions

Below are some resources for further information or actions that you can take to help reduce emissions that come from the refrigerants sector.

- Learn more about refrigerant contributions to whole-life carbon emissions of buildings.
  - Refrigerants and their contribution to global warming | Net Zero Carbon Guide
  - High-GWP Refrigerants | California Air Resources Board
- Transition to low-GWP refrigerants.
  - Transitioning to Low GWP Alternatives | US EPA
- Prevent refrigerant leaks through regular maintenance.
  - Refrigerant Leak Prevention | US EPA

Solid Waste

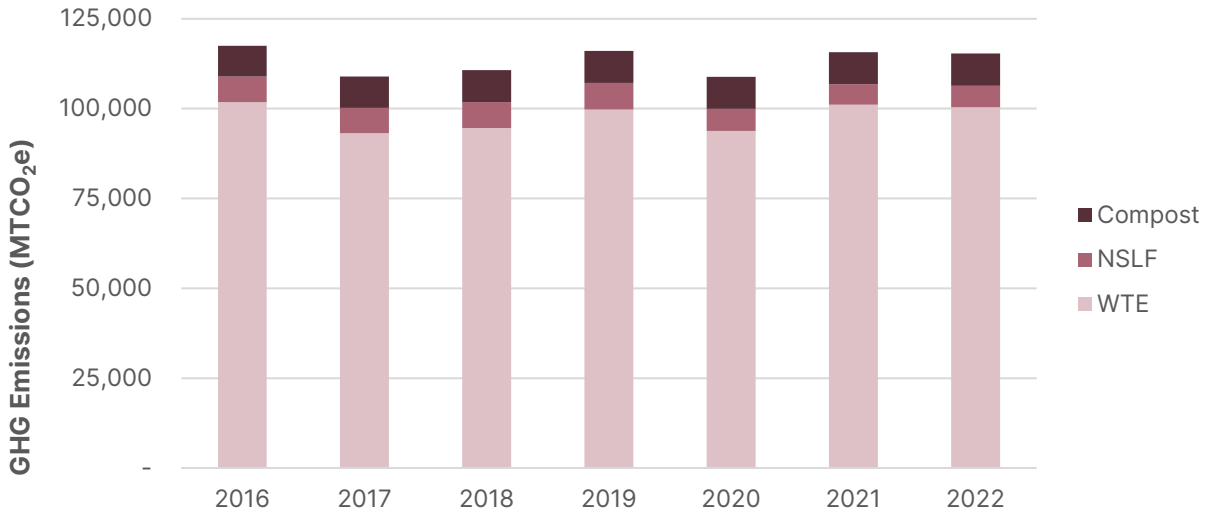
Overview

Solid waste activities produced 115,455 $MTCO_2e$ in 2022 (5% of total 2022 communitywide emissions). These emissions result from:

- **Waste-to-Energy (WTE) Facility:** *87% of total solid waste emissions and 0.44 $MTCO_2e$ per capita in 2022.*
  Emissions associated with the combustion of solid waste at the City's WTE facility.
- **Landfill:** *8% of total solid waste emissions and 0.03 $MTCO_2e$ per capita in 2022.*Emissions from methane released as waste-in-place decomposes under anaerobic conditions in the Northside Landfill (NSLF).
- **Compost:** *5% of total solid waste emissions and 0.04 $MTCO_2e$ per capita in 2022.*
  Consumption of electricity and natural gas in solid waste facilities.

Solid waste emissions have **decreased 2%** since 2016, primarily from a **16% decrease in emissions from the landfill** over that same time period.

Figure 30. Annual Communitywide Solid Waste Emissions



The LGOP does not provide quantification methodologies to estimate the GHG reductions or benefits associated with recycling, but this information can be reported optionally. These emissions would be considered "Scope 3" as Spokane's recycled waste is exported outside of the City's boundaries. Spokane has opted

not to include these emissions in the GHG inventory due to data and analysis limitations.

Waste-to-Energy Facility | Scope 1

The City's WTE facility received a total of 271,624 tons of waste in 2022, producing 100,478 $MTCO_2e$ (87% of solid waste emissions and 4% of communitywide emissions).

Refer to the *Solid Waste Operations* section of this report for more details, including an analysis of the actual 2022 emissions generated at the City's WTE facility compared to the greenhouse gas (GHG) emissions impact the same volume of waste would have had in a typical landfill with similar weather patterns as Spokane.

WTE Facility	2022
GHG emissions	100,478 $MTCO_2e$
Activity data	271,624 tons – used EPA reported $MTCO_2e$
Emissions Factor	
Activity Data Sources	City of Spokane
GPC Reference	I.4.4

Northside Landfill | Scope 1

City of Spokane's (closed) Northside Landfill produced 5,992 $MTCO_2e$ in 2022 (5% of solid waste emissions). These emissions have **decreased 16%** since 2016.

Emissions from the closed Southside Landfill (SSLF) are excluded from the communitywide inventory as the landfill is located outside of the City's geographic boundary; however, these emissions are included in the government operations inventory as the facility is owned/operated by the City.

NSLF	2022
GHG emissions	5,992 $MTCO_2e$
Activity data	used EPA reported Metric Tons of CH_4
Emissions Factor	
Activity Data Sources	City of Spokane
GPC Reference	III.1.1

Compost | Scope 3

Barr-Tech LLC is a private business that provides composting services to Spokane's community. Barr-Tech did not respond to requests for composting tonnage data for the purposes of this inventory.

In the absence of measured data, this inventory **relies on compost tonnage reported to the Washington Department of Ecology** (Ecology) for Spokane County and used population to scale the county data to the city level.

Estimated compost tonnage produced 8,986 $MTCO_2e$ in 2022 (8% of solid waste emissions, less than 1% of communitywide emissions).

Washington passed organics management laws in 2022 and 2024. These laws aim to divert organic materials away from landfills through prevention, food rescue, and organics management facilities[26]. Several actions that will be implemented through these laws include creating grant programs related to food waste reduction and organic material policy implementation, and new or modified requirements for organic material collection services, product labeling, and compost procurement programs. The implementation of these organics management laws should help reduce Waste-to-Energy emissions but will likely increase compost emissions moving forward as those laws go into effect.

Compost	2022
GHG emissions	8,986 $MTCO_2e$
Activity data	64,973 tons
Emissions Factor *ClearPath Default*	0.1383 $MTCO_2e$/ton
Activity Data Sources	Washington Department of Ecology: Recovered Material, Collection, and Sector Data (2018)
GPC Reference	III.2.2

Emission Reduction Actions

Below are some resources for further information or actions that you can take to help reduce emissions that come from the waste sector.

- Learn more about how waste is managed.
  - Solid Waste Education Programs | City of Spokane
  - Spokane Materials and Recycling Technology (SMaRT) Center | Spokane County
- Reduce the amount of waste you produce.
  - Waste Reduction | City of Spokane
  - Yard/Food Waste Reduction | Spokane County
- Reduce waste through recycling.

[26] https://ecology.wa.gov/waste-toxics/reducing-recycling-waste/organics-and-food-waste/2022-organics-management-law

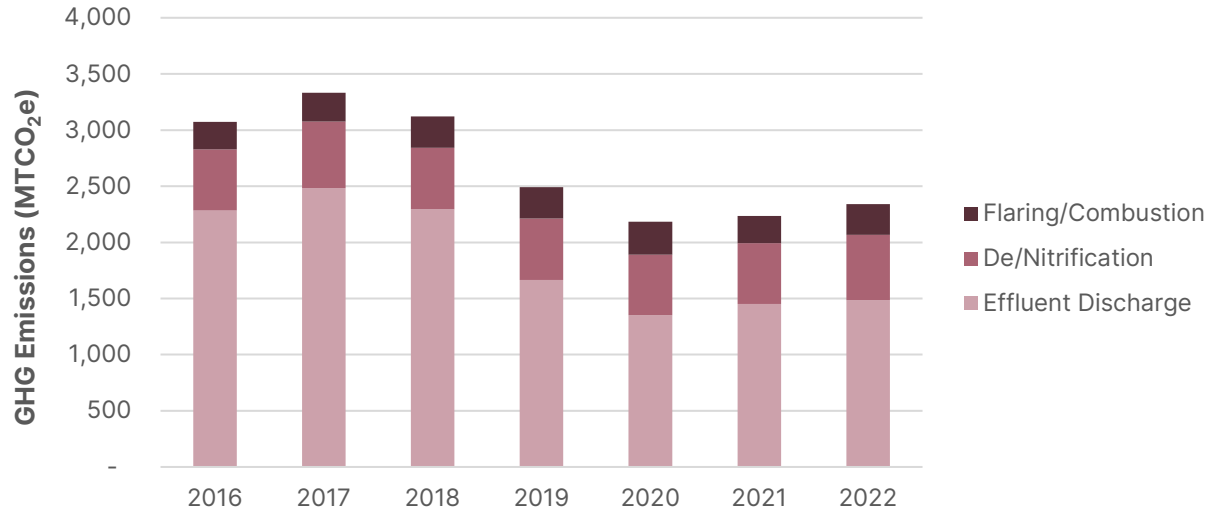
  - Recycling Services | City of Spokane
  - Recycle Right, Spokane County! | Spokane County
- Reduce waste through composting.
  - Composting Services | City of Spokane
  - Composting Resources | Spokane County
  - Spokane County Waste Ambassadors Program | Spokane County
- Provide recycling containers at your next event.
  - Event Recycling with the Waste Reduction Lending Library | Spokane County
- Encourage waste reduction in your community.
  - Spokane County Waste Ambassadors | Spokane County

Wastewater

The treatment of wastewater includes several processes that generate Scope 1 GHG emissions including the nitrification and denitrification of wastewater, discharging effluent to rivers and estuaries, and the flaring and combustion of digester gas.

Wastewater treatment processes at the City's **Riverside Park Water Reclamation Facility (RPWRF)** produced 2,341 $MTCO_2e$ in 2022 (less than 1% of communitywide emissions) *and 0.01 $MTCO_2e$ per capita in 2022*. These emissions have **decreased 24%** since 2016 due to cleaner effluent from plant upgrades.

Figure 31. Annual Wastewater Treatment Process Emissions by Source



Flaring of Digester Gas	2022
GHG emissions	250 $MTCO_2e$
Activity data	220,000 scf/day
Emissions Factor *ClearPath Default*	0.0011354 $MTCO_2e$/scf/day
Activity Data Sources	City of Spokane
GPC Reference	III.4.1 and III.4.3

Combustion of Digester Gas	2022
GHG emissions	23 $MTCO_2e$
Activity data	400,228 cubic feet of digester gas/day
Emissions Factor *ClearPath Default*	0.000057 $MTCO_2e$/scf/day
Activity Data Sources	City of Spokane
GPC Reference	I.3.1

Nitrification/Denitrification	2022
GHG emissions	581 $MTCO_2e$
Activity data	243,100 people
Emissions Factor *ClearPath Default*	0.002389 $MTCO_2e$/person
Activity Data Sources	City of Spokane
GPC Reference	III.4.1 and III.4.3

Effluent Discharge	2022
GHG emissions	1,487 $MTCO_2e$
Activity data	Daily N Load = 1,900 kg N/day
Activity data	243,100 people
Emissions Factor *ClearPath Default*	0.006118 $MTCO_2e$/person
Activity Data Sources	City of Spokane
GPC Reference	III.4.1 and III.4.3

Emission Reduction Actions

Below are some resources for further information or actions that you can take to help reduce emissions that come from the wastewater sector.

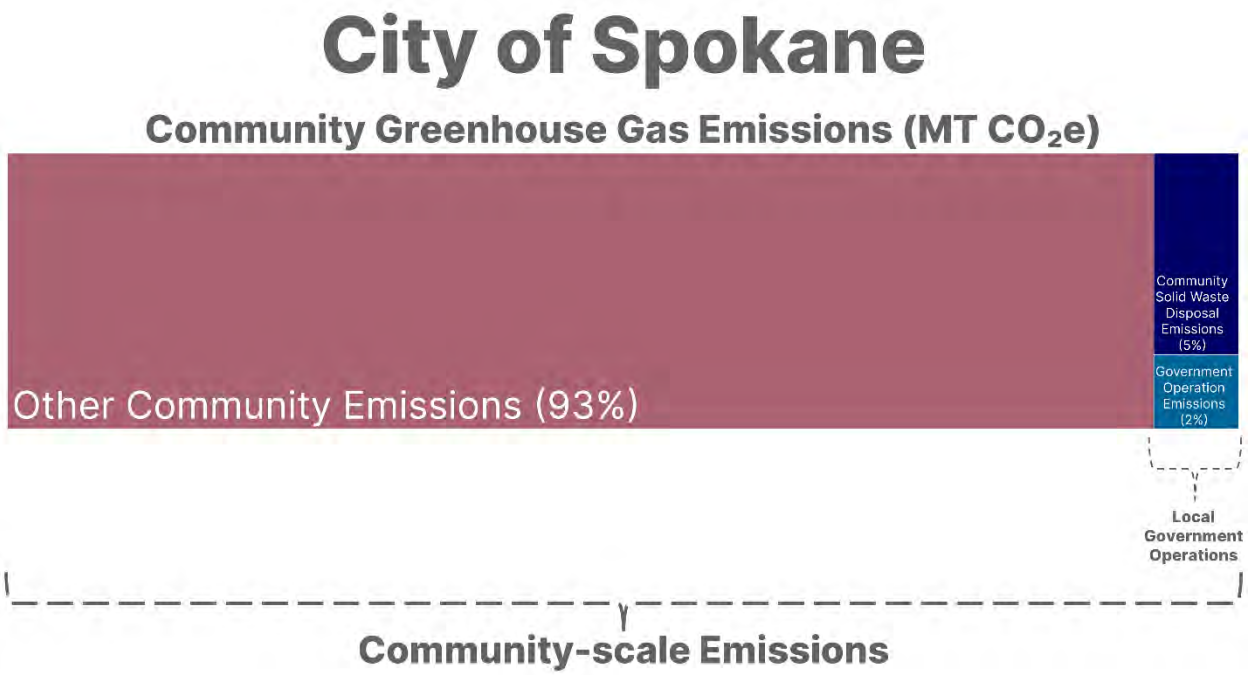
- Buy water efficient fixtures and appliances.
  - WaterSense | US EPA
  - Consumer Guide to Home Water Efficiency Fact Sheet | US Department of Energy
- Reduce the amount of food waste that goes down the drain.
  - Wasted Food Scale | US EPA
- Reduce residential and commercial water use.
  - Water Wise Spokane | City of Spokane
  - SpokaneScape Lawn Replacement Program | City of Spokane
  - Start Saving | US EPA
- Participate in residential, commercial, and multi-family rebate programs.
  - Water Wise Rebates | City of Spokane

Government Operations Greenhouse Gas Inventory

Overview

Spokane's Government Operations produced 148,058 metric tons of carbon dioxide equivalent ($MTCO_2e$) in 2022 – approximately **6.5% of communitywide emissions**.

Figure 32. Local Government Emissions in Relation to All Community Emissions



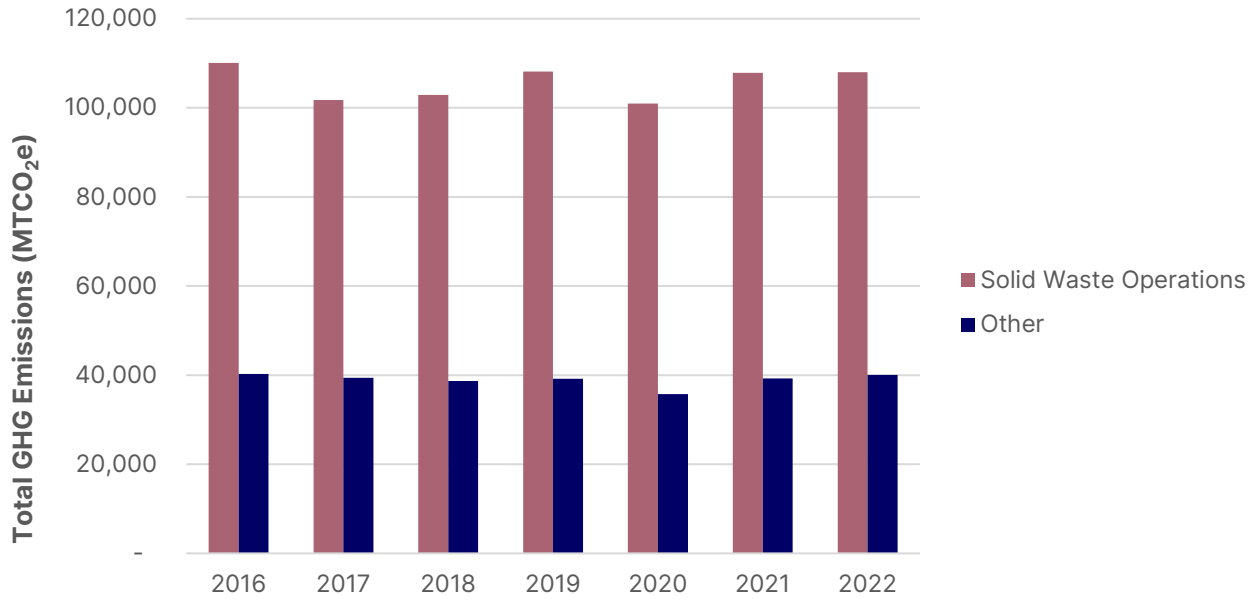
Greenhouse gas (GHG) emissions sources in this inventory include:

- **Solid Waste Operations**: *73% of government operations emissions*
  City's Waste to Energy (WTE) facility, the North and South Side Landfills, grid electricity, and natural gas consumption within facilities.
- **Vehicles & Equipment Fleet**: *9% of government operations emissions*
  On- and off-road fleet vehicles and equipment.
- **Wastewater Operations**: *7% of government operations emissions*
  Process emissions from wastewater treatment and grid electricity and natural gas consumption within facilities.
- **Water Systems**: *5% of government operations emissions*
  Grid electricity and natural gas consumption in water systems facilities.
- **Streetlights & Traffic Signals**: *1% of government operations emissions*

Grid electricity consumed to power City's streetlights and traffic signals.

- **Other**: *5% of government operations emissions*
  Grid electricity, natural gas, and kerosene consumption in City buildings and facilities that do not fall within one of the operational categories above. Also includes emissions from employee commuting and business travel as well as refrigerants.

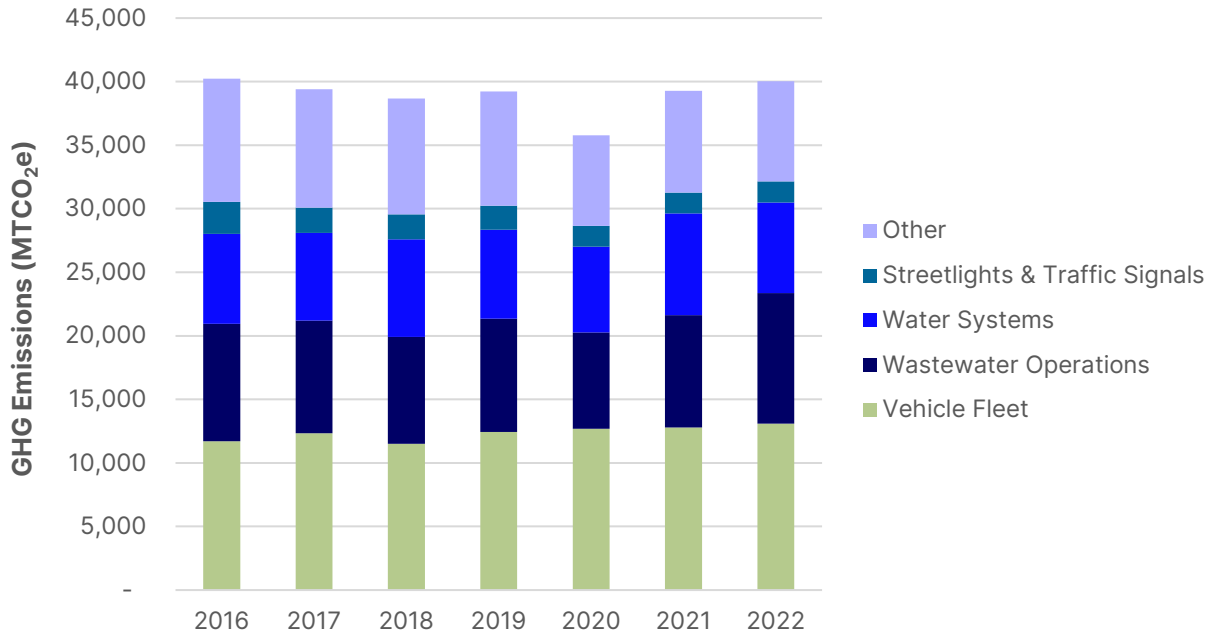
Figure 33. Overview of Government Operations Emissions



Total emissions from government operations have **decreased 2%** since 2016. This decrease primarily comes from a reduction in emissions from solid waste operations; electricity consumption from buildings, facilities, streetlights, and traffic signals; wastewater processes, and employee commuting.

Since the City's WTE facility is an atypical emissions source compared to peer governments, Figure 34 shows total emissions excluding Solid Waste Operations. These emissions overall have decreased 1% since 2016. Emissions sources that have increased since 2016 include natural gas and electricity energy consumption for wastewater and solid waste operations, on-road fleet vehicles, and natural gas consumption in other buildings and facilities.

Figure 34. Overview of Government Operations Emissions without Solid Waste Operations



Self-Generated Energy

The City of Spokane's three primary utilities (Solid Waste, Water, and Wastewater), also generate electricity or biogas in their operations. These self-generated energy sources help offset energy purchases from Avista which helps reduce costs and emissions.

Renewable Electricity

Avista's electricity generation resource mix currently includes approximately 51% energy from renewables.[27] Electricity that the City of Spokane purchases from Avista is generated by a higher proportion of renewable energy sources due to City Hall's enrollment in Avista's Solar Select® (solar electricity) program.[28] Due to the use of Solar Select energy, approximately **55%** of the City's electricity consumption from Avista comes from renewable energy sources.

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[27] https://deptofcommerce.app.box.com/s/l9sqx4bcfnko3omrpk4tv8n0vbzcvsdz/file/1673766736695

[28] https://www.myavista.com/energy-savings/green-options/community-renewable-options

Solid Waste Operations

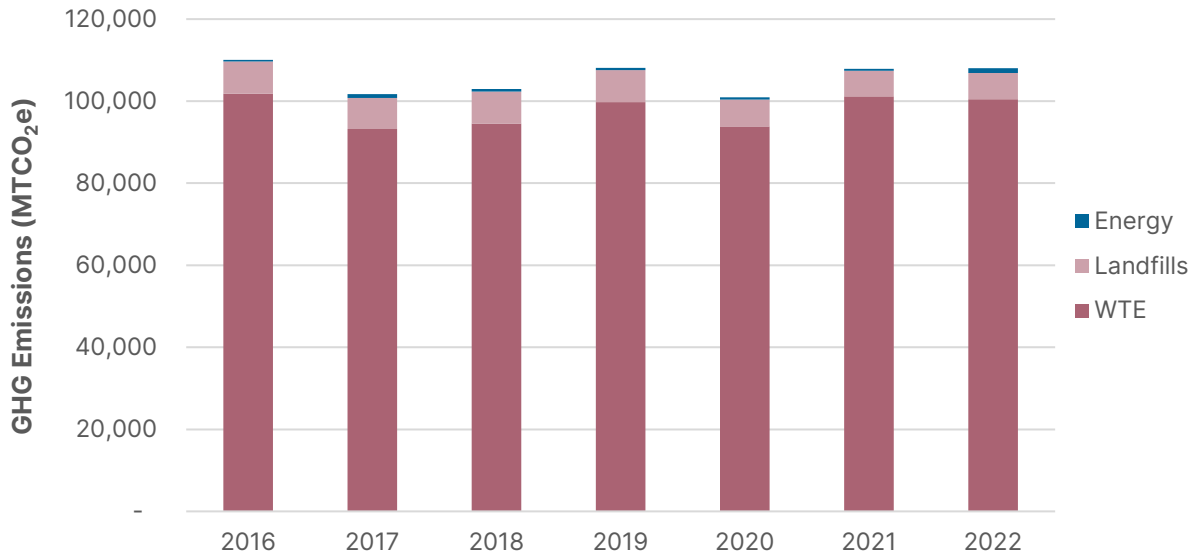
Overview

Solid Waste Operations contributed 73% of the total 2022 government operations emissions (108,013 MT CO_2e). These emissions result from:

- **Waste-to-Energy (WTE) Facility:** *93% of total solid waste emissions*
  Emissions associated with the combustion of solid waste at the City's WTE facility.
- **Landfills:** *6% of total solid waste emissions*
  Emissions from methane released as waste-in-place decomposes under anaerobic conditions in the City's landfills.
- **Energy:** *1% of total solid waste emissions*
  Consumption of electricity and natural gas in solid waste facilities.

Solid waste emissions have **decreased 2%** since 2016—primarily driven by decreases in landfill emissions. Emissions from the waste-to-energy facility have remained fairly stable since 2016, while grid electricity and natural gas consumption increased by 199% and 109%, respectively. Since the waste-to-energy facility generates its own energy, these increases come from purchases of electricity and natural gas that are needed during maintenance outages or during wet weather conditions that lead to moist solid waste.

Figure 35. Annual Government Operations Solid Waste Emissions

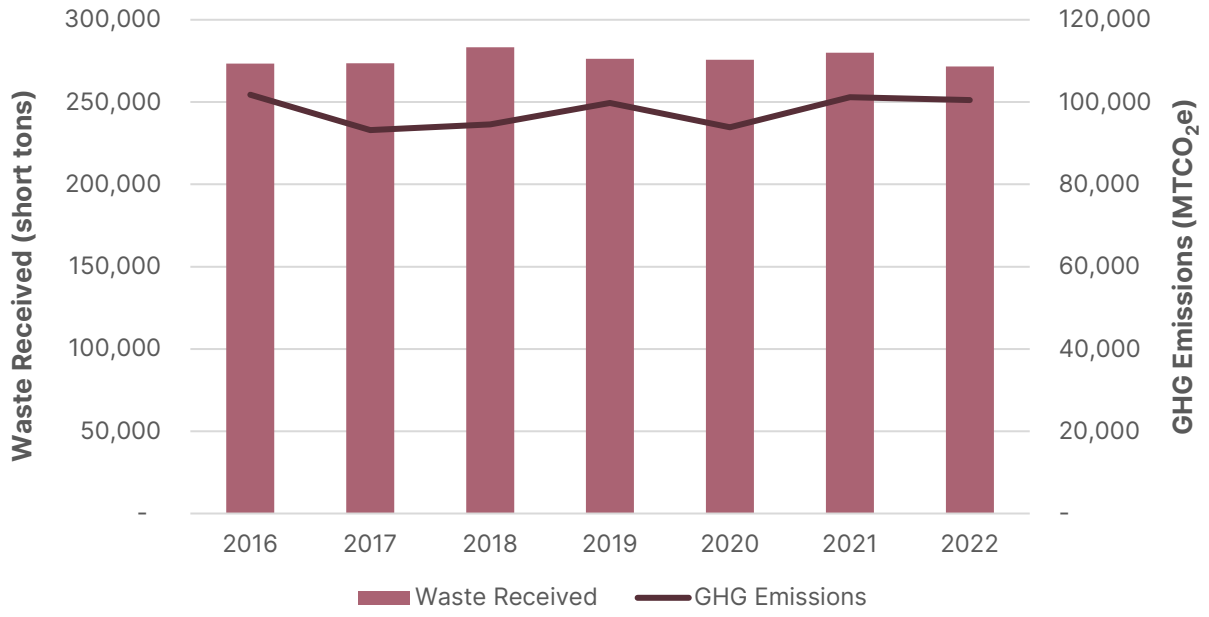


Waste-to-Energy Facility | Scope 1

Spokane's WTE facility combusts municipal solid waste to recover energy that is used onsite (excess is sold to Avista as electricity). The City landfills ash left behind from combusted waste.[29] The WTE facility meets Spokane's Regional Clean Air Policy, the Washington State Department of Ecology standards, and the Spokane Regional Health District standards.[30]

The City's WTE facility received a total of 271,624 tons of waste in 2022, contributing 100,477 $MTCO_2e$ (93% of solid waste operations emissions and 68% of total government operations emissions). Facility waste received (tons) and facility emissions ($MTCO_2e$) have declined 1% since 2016 (Figure 36).

Figure 36. Waste-to-Energy Facility Tonnage and Emissions Trends



[29] The inert ash resulting from the WTE process (and other materials bypassed from the WTE facility) are shipped to the Roosevelt Regional Landfill in Klickitat County, Washington. Bypassed material consists of a mixture of inert materials and other municipal solid waste generated by Spokane County as a whole. The Scope 3 emissions related to this exported waste have not been included in this inventory as the waste primarily consists of inert materials. Transportation emissions from moving those materials outside of City boundaries are not included.

[30] Waste to Energy Plant - City of Spokane, Washington (spokanecity.org)

WTE Facility	2022
GHG emissions	100,477 $MTCO_2e$
Activity data	271,624 tons – used EPA reported $MTCO_2e$
Emissions Factor	
Activity Data Sources	City of Spokane

WTE Analysis

Based on ICLEI's ClearPath tool, landfilling the same amount of waste (271,624 tons) noted above would have produced 47% less direct emissions; however:

- Utilizing the WTE facility diverted 8,306 tons of **ferrous metals** to recycling, avoiding 14,845 $MTCO_2e$.[31]
- The facility produced 444,246 MMBtu of **energy**, avoiding 34,392 $MTCO_2e$.[32]
- When the avoided emissions from WTE are considered, the remaining **emissions impact from WTE in Spokane is 5% less than the landfill impact would have been**. Refer to Figure 37 for a summary.

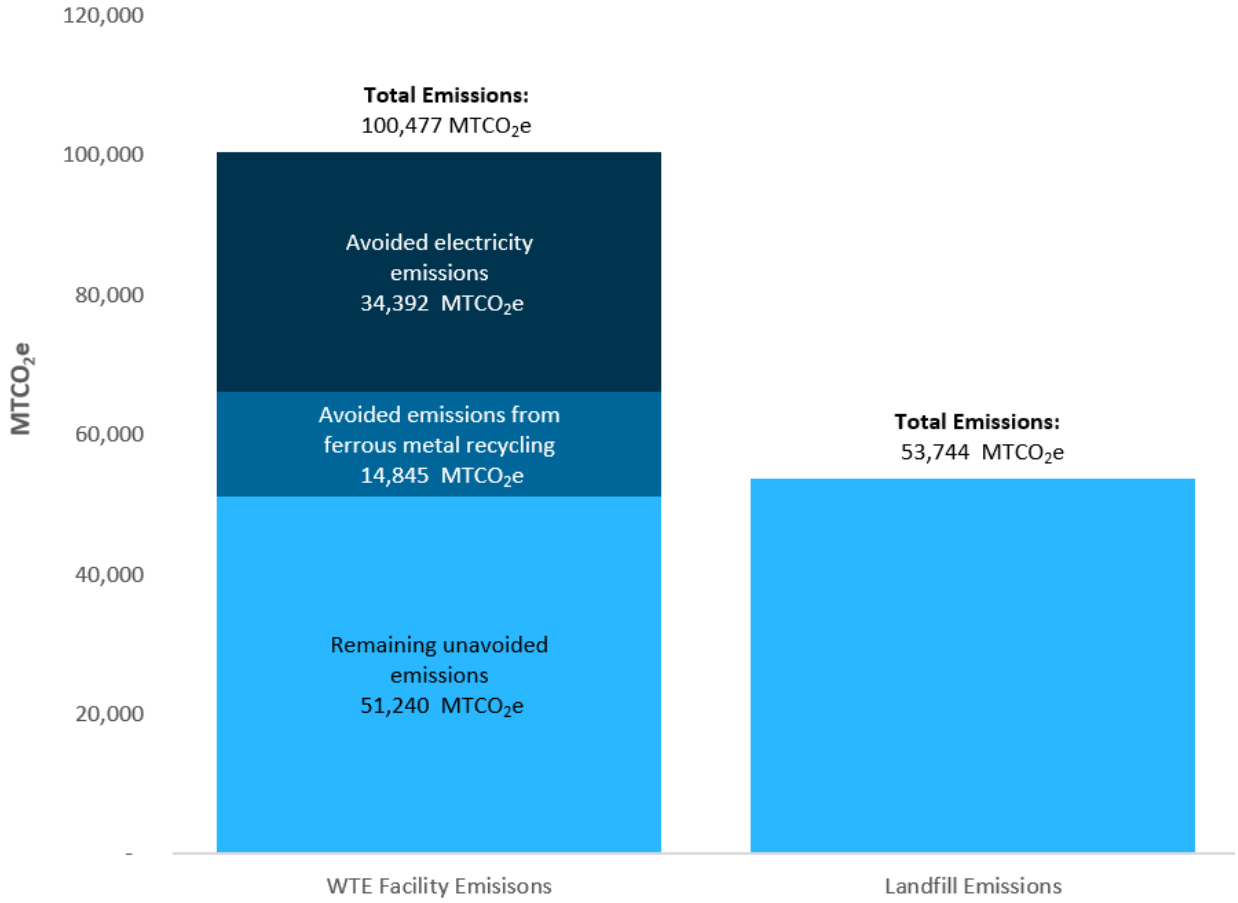
Additionally, the City of Spokane manages the community's waste within city boundaries, reducing the transportation emissions for shipping municipal solid waste versus landfilling. Differences in emissions from trucking and transportation and other detailed life cycle elements were not evaluated as part of this high-level comparative assessment. The results of this high-level analysis in the last inventory indicated the need for a full life cycle assessment to understand the comprehensive benefits of using WTE compared to landfilling. The Department of Ecology completed a life cycle analysis in 2024 to determine if WTE electricity could be used as an alternative compliance option for the State of Washington's Clean Energy Transformation Act[33]. The Department of Ecology has not made a determination about the use of WTE electricity as an alternative compliance option yet.

[31] Ferrous metal emissions were calculated using recycled steel carbon footprint calculations: https://www.sustainable-ships.org/stories/2022/carbon-footprint-steel

[32] Electricity emissions were calculated using the 2022 Avista emissions factor.

[33] https://apps.ecology.wa.gov/publications/documents/2307063.pdf

Figure 37. WTE GHG Emissions Compared to Landfilled Waste, for 2022



Landfills | Scope 1

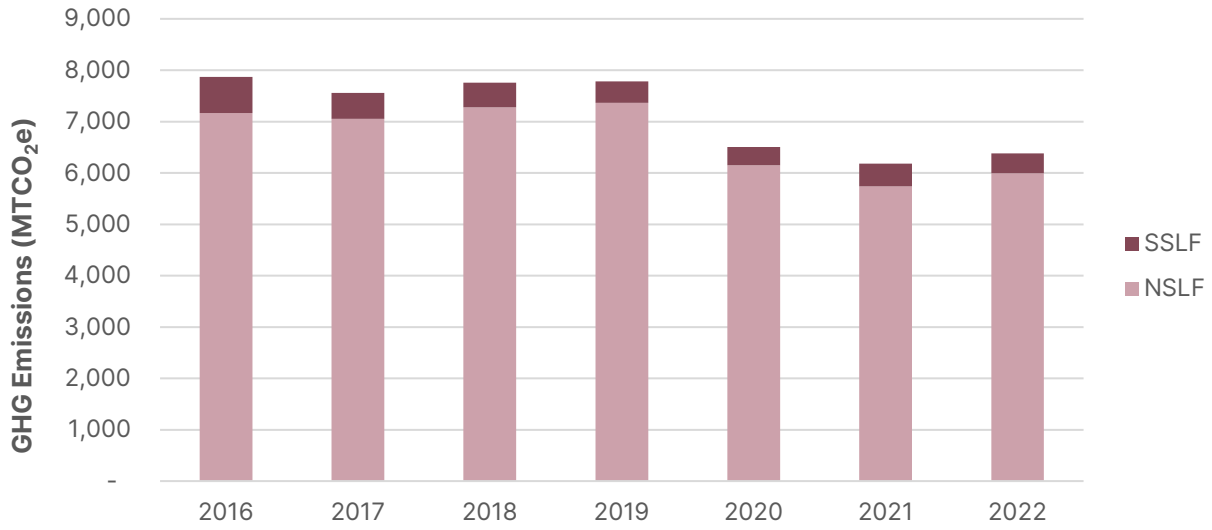
City of Spokane's landfills produced 6,381 $MTCO_2e$ in 2022 (6% of emissions from Solid Waste Operations; 4% of total government operations emissions).

The majority (94%) of landfill emissions were from the Northside Landfill (NSLF) and the remaining 6% from the Southside Landfill (SSLF).

- **NSLF** produced 5,992 $MTCO_2e$ in 2022, a **16% decrease** from 2016.
  - The NSLF closed to the public in 1988 but has an open Municipal Solid Waste Cell that accepts waste on a limited basis.
- **SSLF** produced 389 $MTCO_2e$ in 2022, a **44% decrease** from 2016.
  - The SSLF is outside of the City of Spokane's geographic boundaries but is included in the government operations inventory as it is owned and operated by the City.

- The SSLF closed to the public in 1987 and no longer accepts waste but still produces a small amount of emissions due to waste-in-place.

Figure 38. Annual Landfill Emissions



NSLF	2022
GHG emissions	5,992 $MTCO_2e$
Activity data	N/A – used reported Metric Tons of CH_4
Emissions Factor	
Activity Data Sources	City of Spokane

SSLF	2022
GHG emissions	389 $MTCO_2e$
Activity data	N/A – used reported Metric Tons of CH_4
Emissions Factor	
Activity Data Sources	City of Spokane

Energy

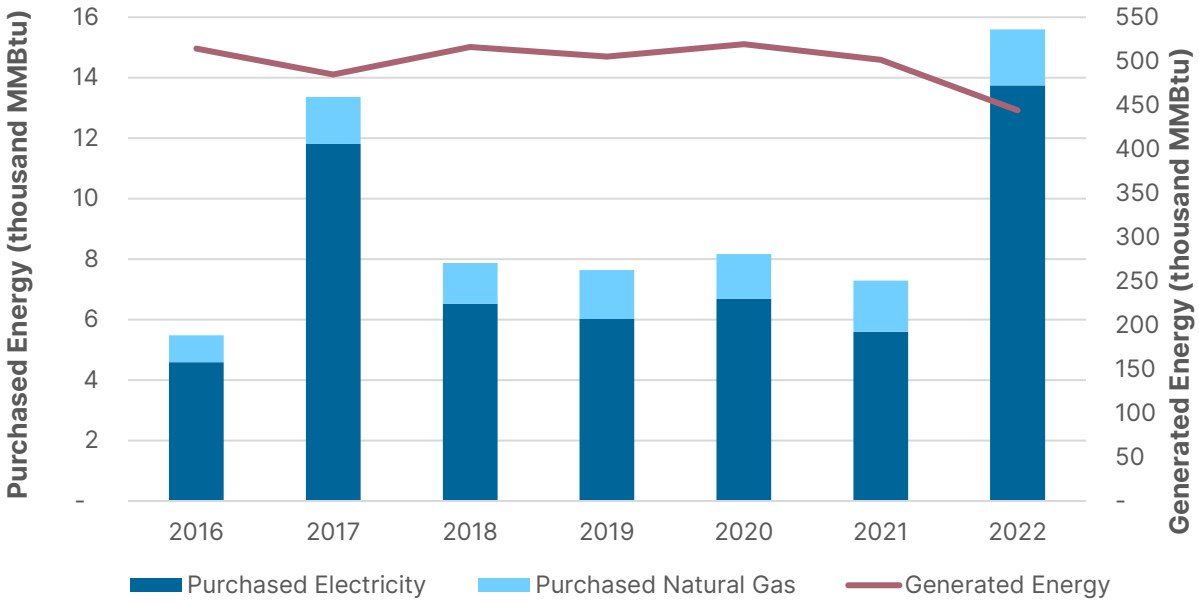
The City of Spokane's Solid Waste Operations energy consumption produced 1,163 $MTCO_2e$ in 2022 (1% of Solid Waste Operations emissions; less than 1% of total government operations emissions).

- **Electricity** (Scope 2) – 1% of solid waste energy emissions
- **Natural Gas** (Scope 1) – less than 1% of solid waste energy emissions

Energy emissions within Solid Waste Operations have **increased 163%** since 2016 from the **increase in purchased electricity and natural gas consumption** (199% and 2019% increase since 2016, respectively). Over the same time period, the WTE facility **generated 14% less energy** due to longer maintenance downtime

that comes from turbine/generator maintenance versus standard seasonal maintenance. This deeper maintenance of the turbine and generator equipment typically occurs every 5 years and is reflected in the 2017 electricity and natural gas trends as well.

Figure 39. Annual Solid Waste Energy Purchased and Generated



Electricity Consumption	2022
GHG emissions	1,065 $MTCO_2e$
Activity data	4,029,039 kWh
Emissions Factors	Avista Emissions Factor 2022 (Appendix C)
Activity Data Sources	Avista Utilities

Natural Gas Consumption	2022
GHG emissions	98 $MTCO_2e$
Activity data	18,496 therms
Emissions Factors *ClearPath Default*	0.005328047 $MTCO_2e$/therm
Activity Data Sources	Avista Utilities

Operational Efforts by the City of Spokane

The Solid Waste Department is continually looking for ways to reduce operational emissions. Currently, these efforts have been implemented at various stages:

- Electricity generation
- Electric Vehicles
- Renewable Fuels
- Recycling Contamination AI/Camera Demonstration

- Paint Recycling
- Textile Recycling
- Emissions Lifecycle Assessment
- Carbon Capture Feasibility Analysis
- Landfill Solar Development

Vehicles & Equipment Fleet

Overview

Emissions from City-owned vehicles and equipment produced 13,096 $MTCO_2e$ in 2022 (9% of total government operations emissions).

- **On-Road Fleet Vehicles:** *94% of vehicle & equipment emissions*
  Emissions from City-owned fleet vehicles (primarily diesel and gasoline powered vehicles).
- **Off-Road Vehicles and Equipment:** *6% of vehicle & equipment emissions*
  Emissions from City-owned off-road vehicles and equipment (primarily diesel powered).

Emissions from vehicles and equipment have **increased 12%** since 2016. In 2022, the City's Fleet Services released the Spokane Green Fleet Playbook that outlines the strategies and actions required to reduce fleet emissions.

Figure 40. Vehicle and Equipment Emissions in 2022

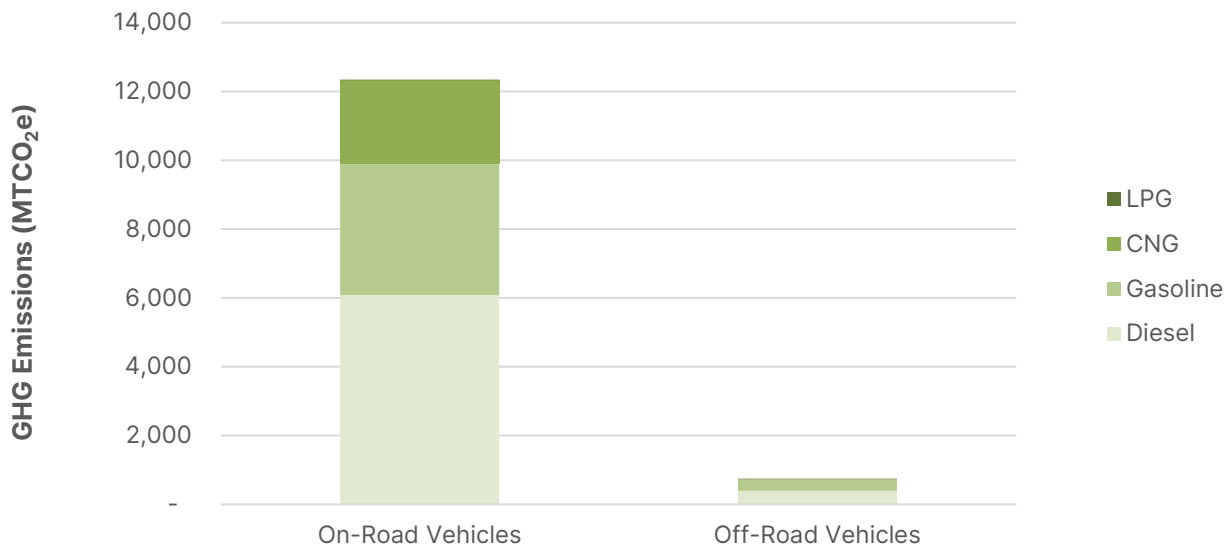
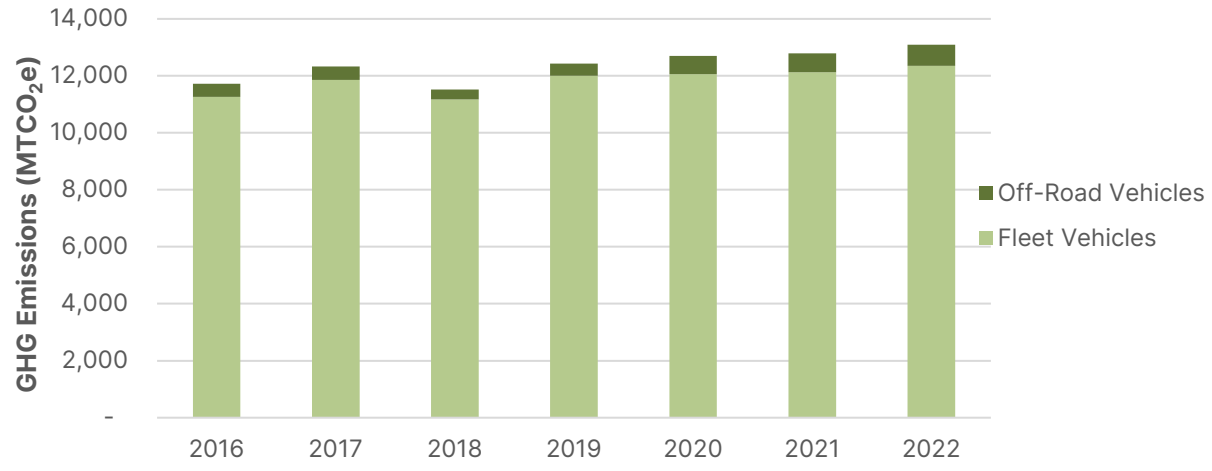


Figure 41. Annual Emissions from Fleet Vehicles & Off-Road Equipment

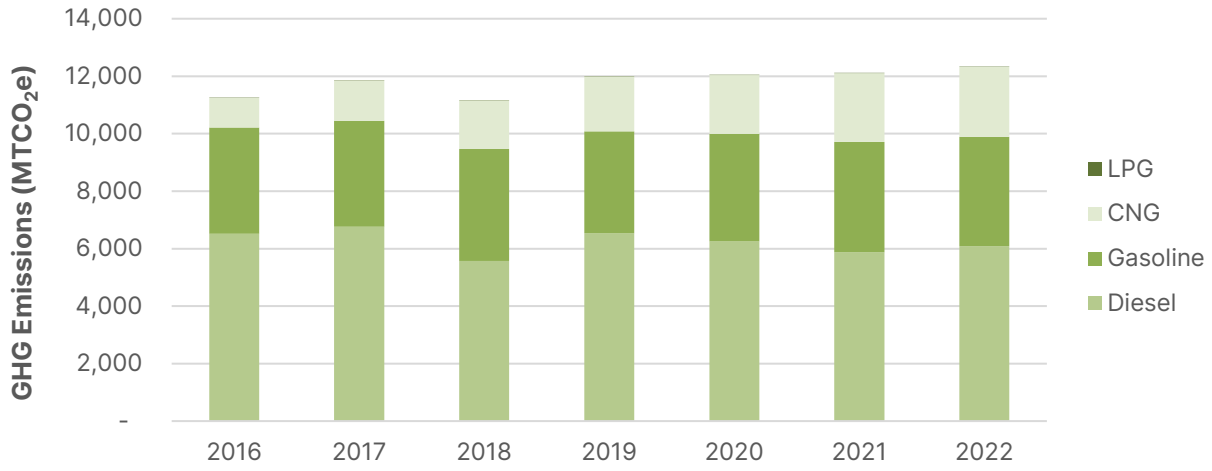


Fleet Vehicles | Scope 1

The City of Spokane's fleet vehicles produced 12,348 $MTCO_2e$ in 2022 (94% of vehicle emissions; 8% of total government operations emissions). These emissions have **increased 10%** since 2016.

The majority of 2022 fleet emissions are from **diesel-powered vehicles** (49%) followed by gasoline (31%) and compressed natural gas (CNG, 20%). Emissions from LPG-powered and electric vehicles make up less than 1% of fleet emissions.

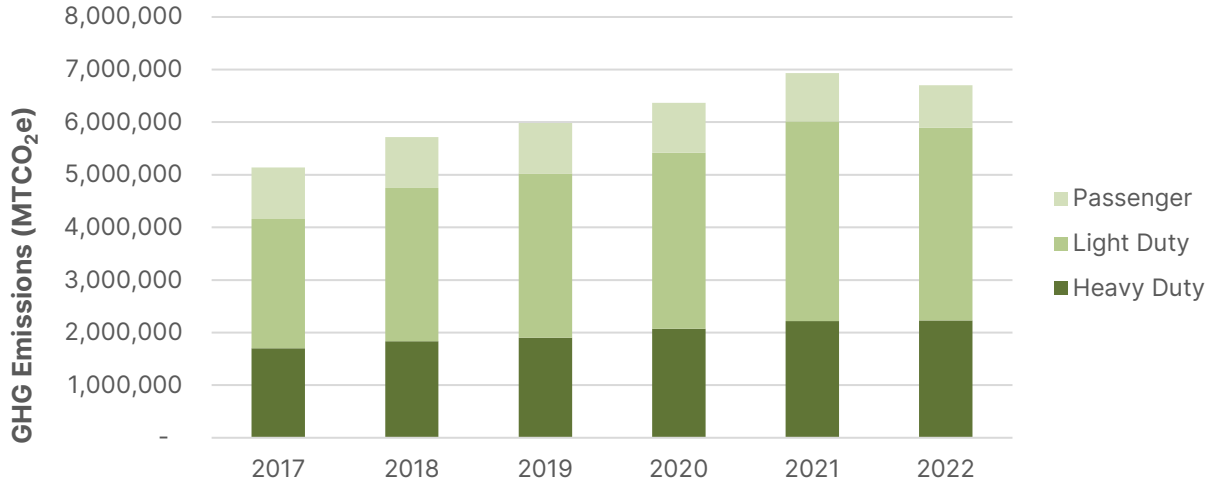
Figure 42. Annual Fleet Vehicle Emissions, by Fuel Type



Fleet vehicle miles traveled (VMT) have increased by 12% since 2016, primarily due to higher mileage from heavy- and light-duty vehicles, while passenger vehicle VMT declined by 16% during the same period. In 2022, light-duty vehicles accounted for 55% of total VMT, followed by heavy-duty vehicles (33%) and

passenger vehicles (12%). Enhancements to the fleet vehicle data management system have improved mileage tracking across the fleet, leading to an observed increase in VMT that may not be proportionally reflected in the more accurate fuel consumption data.

Figure 43. Annual Fleet VMT by Vehicle Type[34]



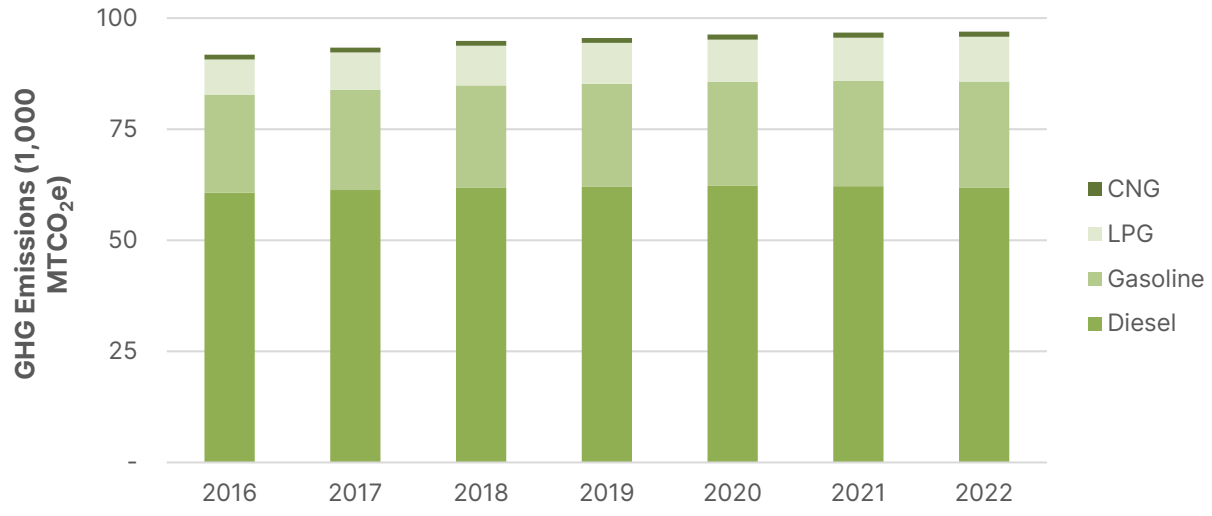
On-Road Vehicles	2022
GHG emissions	12,348 $MTCO_2e$
Activity data	6,705,009 VMT
Emissions Factors	2022 Transportation Factor Set (Appendix C)
Activity Data Sources	City of Spokane

Off-Road Vehicles & Equipment | Scope 1

Off-road vehicles and equipment produced 748 $MTCO_2e$ in 2022 (6% of vehicle emissions, less than 1% of total government operations emissions). The majority (52%) of off-road vehicle and equipment emissions are from **diesel-powered vehicles and equipment**. Off-road vehicle emissions have **increased 63%** since 2016 (Figure 44). The improvement in data collection for off-road vehicles and equipment partially contributes to this increase.

[34] Data for 2016 were unavailable at the time of this inventory for this breakout.

Figure 44. Annual Offroad Fleet Emissions, by Fuel Type



Off-Road Vehicles (Gasoline)	2022
GHG emissions	23,836 $MTCO_2e$
Activity data	N/A – $MTCO_2e$ provided by U.S. EPA MOVES
Emissions Factors	
Activity Data Sources	City of Spokane

Off-Road Vehicles (Diesel)	2022
GHG emissions	61,890 $MTCO_2e$
Activity data	N/A – $MTCO_2e$ provided by U.S. EPA MOVES
Emissions Factors	
Activity Data Sources	City of Spokane

Off-Road Vehicles (CNG)	2022
GHG emissions	1,165 $MTCO_2e$
Activity data	N/A – $MTCO_2e$ provided by U.S. EPA MOVES
Emissions Factors	
Activity Data Sources	City of Spokane

Off-Road Vehicles (LPG)	2022
GHG emissions	10,082 $MTCO_2e$
Activity data	N/A – $MTCO_2e$ provided by U.S. EPA MOVES
Emissions Factors	
Activity Data Sources	City of Spokane

Operational Efforts by the City of Spokane

The Fleets Department, and the various departments served by them, are continually looking for ways to reduce operational emissions. Currently, these are the primary efforts that are being taken that are at various stages:

- EV infrastructure and charging stations
- RNG-powered solid waste collection vehicles
- Renewable diesel usage
- Reduce idling of vehicles
- Operational changes for less trips and reduced miles driven for leaf collection, snow plowing, and debris disposal
- Electronic routing for sweeping & snow plowing
- Use of satellite material locations for winter materials to reduce miles driven

Wastewater Operations

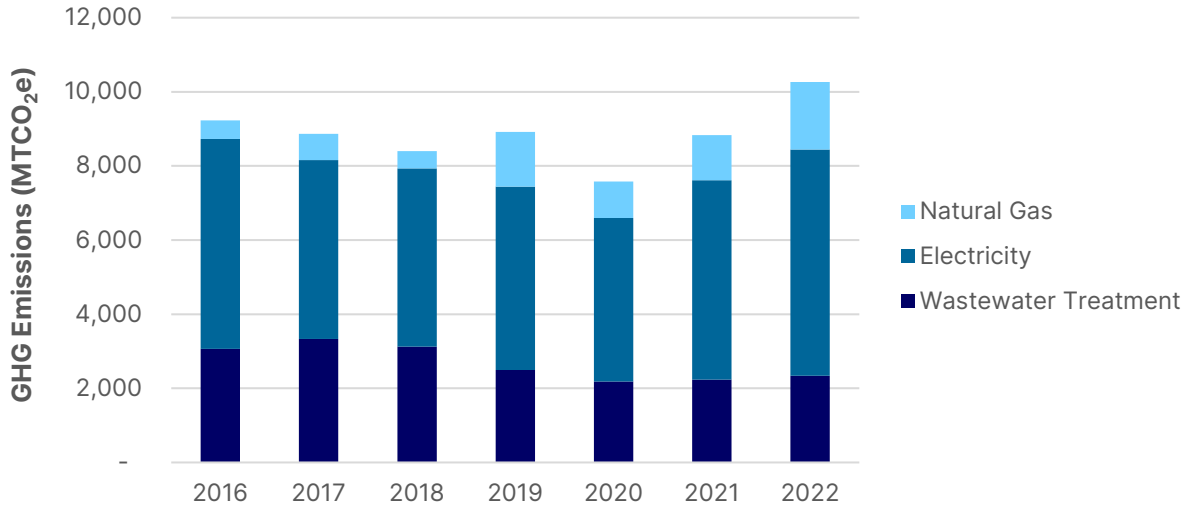
Overview

Wastewater facility operations contributed 7% of total government operations emissions in 2022 (10,264 $MTCO_2e$). These emissions result from:

- **Energy Consumption:** *77% of total wastewater emissions*
  Emissions associated with electricity and natural gas consumption.
- **Wastewater Treatment Process:** *23% of total wastewater emissions*
  Emissions from effluent discharge, nitrification and denitrification processes, flaring of digester gas, and combustion of digester gas at the Riverside Park Water Reclamation Facility.

Wastewater emissions have **increased 11%** since 2016.

Figure 45. Annual Wastewater Operations Emissions, by Source



Energy Consumption

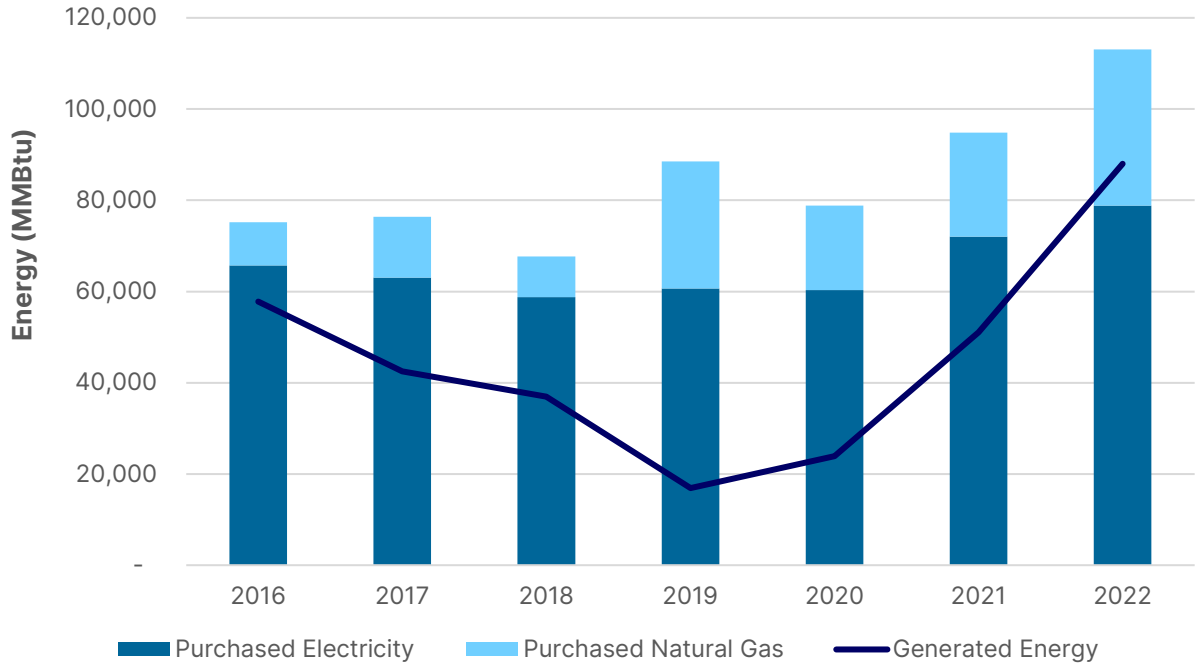
Riverside Park Water Reclamation Facility (RPWRF) energy consumption produced 7,923 $MTCO_2e$ in 2022 (77% of wastewater emissions; 5% of total government operations emissions).

- **Electricity** (Scope 2) – 77% of wastewater purchased energy emissions
- **Natural Gas** (Scope 1) – 23% of wastewater purchased energy emissions

Wastewater treatment facility energy consumption emissions have **increased 28%** since 2016 due to a **262% increase in purchased natural gas consumption**

(+24,775 MMBtu) due to the completion of the Next Level Treatment facility that requires significant natural-gas heating[35]. This highlights the balancing of environmental concerns that must take place. To get a cleaner river, more energy is required to run the processes required to remove pollutants. RPWRF also generates energy from the combustion of biogas that is produced through the wastewater treatment process (Figure 46).

Figure 46. Annual Wastewater Operations Energy Purchased and Generated



Electricity Consumption	2022
GHG emissions	6,103 $MTCO_2e$
Activity data	23,096,096 kWh
Emissions Factors	Avista Emissions Factor 2022 (Appendix C) Inland Power & Light Emissions Factor 2022 (Appendix C)
Activity Data Sources	Avista Utilities Inland Power & Light

Natural Gas Consumption	2022
GHG emissions	1,821 $MTCO_2e$
Activity data	342,315 therms
Emissions Factors ClearPath Default	0.005318 $MTCO_2e$/therms

[35] https://my.spokanecity.org/news/stories/2023/12/14/riverside-treatment-plant-protects-the-spokane-river/

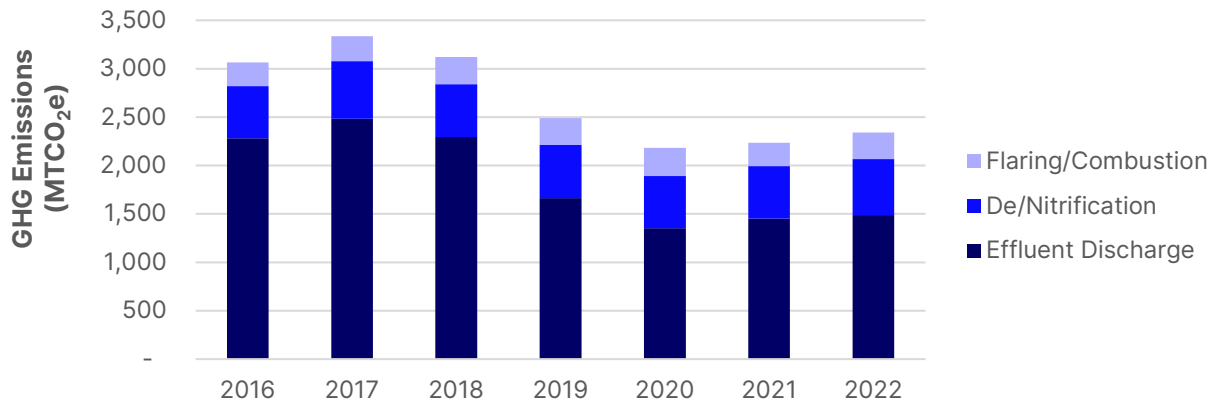
Activity Data Sources	Avista Utilities

Wastewater Treatment Processes | Scope 1

Wastewater treatment includes several processes that generate GHG emissions: for example, the nitrification and denitrification of wastewater, discharging effluent to rivers and estuaries, and the flaring and combustion of digester gas.

Wastewater treatment processes produced 2,341 $MTCO_2e$ in 2022 (23% of wastewater emissions; 2% of total government operations emissions). RPWRF's emissions have **decreased 24%** since 2016. The Next Level Treatment facility addition, and other upgrades, have led to decreases in effluent emissions.

Figure 47. Annual Wastewater Treatment Process Emissions, by Source



Flaring of Digester Gas	2022
GHG emissions	250 $MTCO_2e$
Activity data	400,228 cubic feet of digester gas/day
Emissions Factor ClearPath Default	0.000624 $MTCO_2e$/scf/day
Activity Data Sources	City of Spokane

Combustion of Digester Gas	2022
GHG emissions	23 $MTCO_2e$
Activity data	400,228 cubic feet of digester gas/day
Emissions Factor ClearPath Default	0.000057 $MTCO_2e$/scf/day
Activity Data Sources	City of Spokane

Nitrification/Denitrification	2022
GHG emissions	581 $MTCO_2e$
Activity data	243,100 people
Emissions Factor ClearPath Default	0.002389 $MTCO_2e$/person
Activity Data Sources	City of Spokane

Effluent Discharge	2022
GHG emissions	1,487 $MTCO_2e$
Activity data	Daily N Load = 1,900 kg N/day
Activity data	243,100 people
Emissions Factor ClearPath Default	0.006118 $MTCO_2e$/person
Activity Data Sources	City of Spokane

Operational Efforts by the City of Spokane

The Wastewater Department is continually looking for ways to reduce operational emissions. Currently, these are the primary efforts that are being taken that are at various stages:

- Biogas reuse
- Electric vehicles
- Digester flare reductions
- Conserving water by recycling treated wastewater to clean membranes

Water Systems

Overview

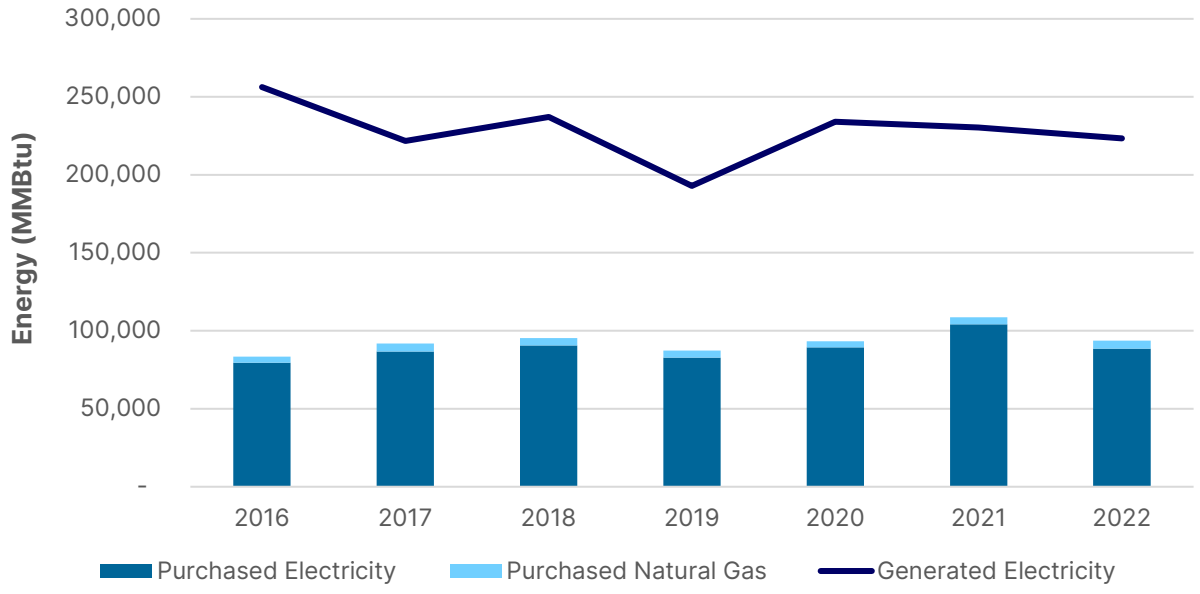
Energy consumed to produce and deliver potable water produced 5% of total government operations emissions in 2022 (7,132 MT CO_2e). These emissions have **increased 1%** since 2016.

- **Electricity** (Scope 2) – 96% of water system energy emissions
- **Natural Gas** (Scope 1) – 4% of water system energy emissions

The City's **Upriver Hydroelectric Dam** also produces energy (hydropower) that pumps water to the community. The dam **generated 13% less energy** (-32,969 MMBtu) in 2022 compared to 2016.

The dam is a run-of-the-river hydroelectric facility so precipitation cycles can create wide variability in these annual generation amounts. The City's Water Conservation Master Plan presents goals, targets, strategies and actions to conserve the community's water supply and to sustainably manage it for future generations.

Figure 48. Annual Water Operations Energy Purchased and Generated



Electricity Consumption	2022
GHG emissions	6,851 MTCO₂e
Activity data	25,925,652 kWh
Emissions Factors	Avista Emissions Factor 2022 (Appendix C)

	Inland Power & Light Emissions Factor 2022 (Appendix C)
Activity Data Sources	Avista Utilities Inland Power & Light

Natural Gas Consumption	2022
GHG emissions	281 $MTCO_2e$
Activity data	52,790 therms
Emissions Factors ClearPath Default	0.005318 $MTCO_2e$/therm
Activity Data Sources	Avista Utilities

Operational Efforts by the City of Spokane

The Water Department is continually looking for ways to reduce operational emissions. Currently, these are the primary efforts that are being taken that are at various stages:

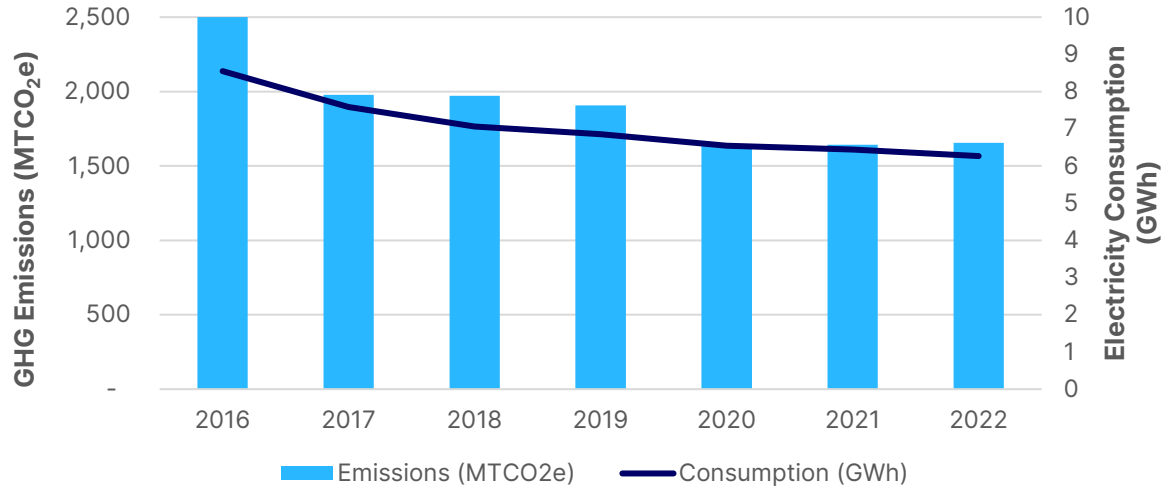
- Upriver Hydroelectric Generation
- Electric Vehicles
- Mechanical upgrades
- Lighting upgrades to LED
- Efficient window upgrades
- Pumping strategies
- Well pump upgrades
- Water Wise conservation programs
- SpokaneScape upgrades

Streetlights & Traffic Signals

Overview

Streetlights and traffic signal **electricity consumption** (Scope 2) produced 1,656 $MTCO_2e$ in 2022 (1% to total government operations emissions). Emissions have **decreased 34%** since 2016 due to a 27% decrease in electricity consumption and 10% reduction in Avista's electricity emissions factor. The City has over 10,000 streetlights with most of them having been converted to LED since 2015.[36]

Figure 49. Annual Streetlight & Traffic Signal Electricity Consumption and Emissions



Electricity Consumption	2022
GHG emissions	1,656 $MTCO_2e$
Activity data	6,265,778 kWh
Emissions Factors	Avista Emissions Factor 2022 (Appendix C)
Activity Data Sources	Avista Utilities

Operational Efforts by the City of Spokane

The Streets Department is continually looking for ways to reduce operational emissions. Many of those actions are listed in the Fleets and Vehicles section, in addition to:

- Installation of LED lights
- Upgrading streetlights and traffic signals to LEDs

[36] https://my.spokanecity.org/streets/signs-and-lights/

Other Emissions Sources

Overview

Emissions that do not fall into one of the previous categories (solid waste, vehicles, wastewater, water, streetlights) are presented as "Other" emissions below. These emissions are 5% of total 2022 government operations emissions (7,890 MT CO_2e).

- **Building Energy:** *76% of "other" emissions*
  Consumption of electricity and natural gas in government owned and operated buildings and facilities not accounted for in the above report sections.
- **Employee Commute and Business Travel:** *22% of total "other" emissions*
  Emissions occurring from employee commute and business travel.
- **Refrigerants:** *2% of total "other" emissions*
  Fugitive emissions that result from refrigerant leakage.

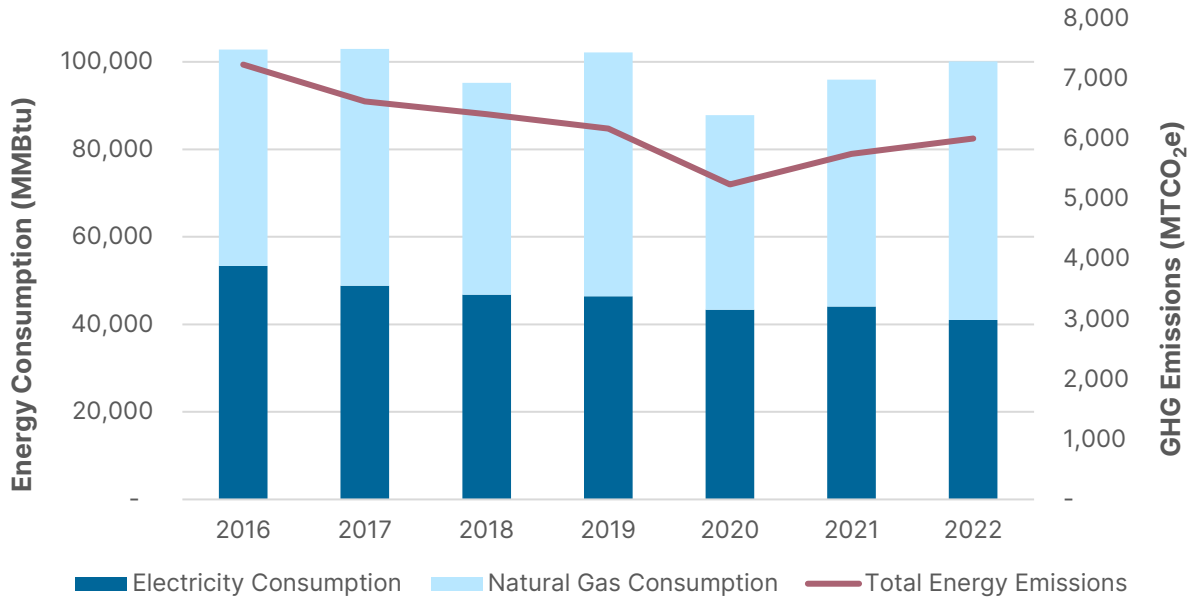
Energy

Energy consumed in buildings and facilities other than solid waste, wastewater, water facilities produced 6,000 $MTCO_2e$ in 2022 (4% of total government operations emissions).

- **Electricity** (Scope 2) – 48% of "other" energy emissions
- **Natural Gas** (Scope 1) – 52% of "other" energy emissions
- **Kerosene** (Scope 1) – <1% of "other" energy emissions

These energy emissions have **decreased 17%** since 2016. Facility electricity emissions have decreased by 38% while natural gas emissions have increased 19% since 2016. Similar to increases in communitywide natural gas, this is likely primarily due to the increase of heating degree days from colder temperatures. Additionally, 10% of 2022's electricity in "other" buildings was provided through **Avista's Solar Select® program** (100% renewable electricity) at City Hall, which contributed to the reduction in electricity emissions since 2016.

Figure 50. Other Sources of Energy Consumption and Emissions



Electricity Consumption	2022
GHG emissions	2,856 $MTCO_2e$
Activity data	12,007,355 kWh
Emissions Factors	Avista Emissions Factor 2022 (Appendix C) Avista Solar Select® Emissions Factor 2022 (Appendix C) Inland Power & Light Emissions Factor 2022 (Appendix C)
Activity Data Sources	Avista Utilities Inland Power & Light

Natural Gas Consumption	2022
GHG emissions	3,143 $MTCO_2e$
Activity data	590,999 therms
Emissions Factors ClearPath Default	0.005318 $MTCO_2e$/therm
Activity Data Sources	Avista Utilities

Kerosene Consumption	2022
GHG emissions	2 $MTCO_2e$
Activity data	165 gallons
Emissions Factors ClearPath Default	0.010220 $MTCO_2e$/gallons
Activity Data Sources	City of Spokane

Employee Commute | Scope 3

Employee commuting produced 1,556 $MTCO_2e$ in 2022. Employee commute emissions **decreased 30% since 2016,** largely due to an increase in remote work since COVID-19. The City does not have direct control over employee commute

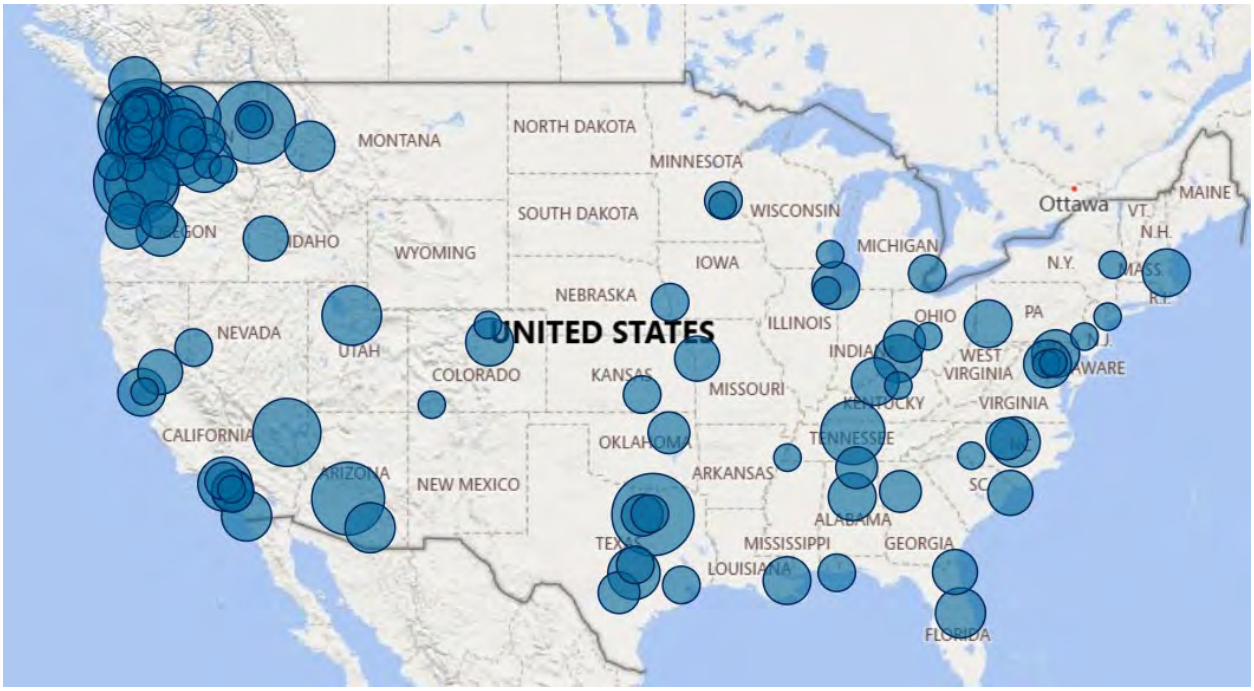
choices; however, the City does encourage alternative commute options through the commute trip reduction program. This data is only collected during commute surveys every few years so there is not comparative data for every year since the 2016 baseline.

Employee Commute	2022
GHG emissions	1,556 $MTCO_2e$
Activity data Emissions Factors	N/A – obtained calculated $MTCO_2e$ from survey reports
Activity Data Sources	Washington State Department of Transportation Commute Trip Reduction Employer Survey Reports

Business Travel | Scope 3

Business travel produced 175 $MTCO_2e$ in 2022 (less than 1% of total government operations). The **majority (74%) of these emissions are from air travel** and 26% from personal vehicles. Business travel by car and air increased by 5% since 2016. Figure 51 maps these travel destinations. This data is resource intensive to obtain the data for, so it is only collected every inventory reporting year and as a result, there is not comparative data for every year since the baseline.

Figure 51. Business Travel Destinations in 2022



Air Travel	2022
GHG emissions	130 $MTCO_2e$
Activity data	776,280 aviation passenger miles
Emissions Factors ClearPath Default	0.000167 $MTCO_2e$/aviation passenger mile
Activity Data Sources	City of Spokane

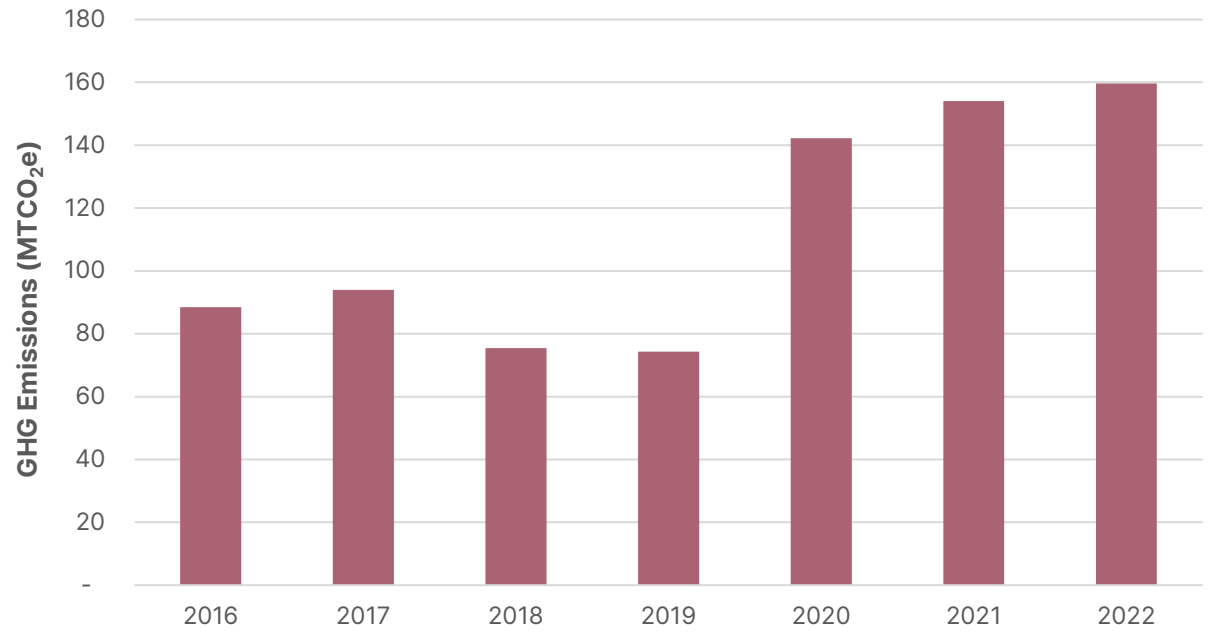
Ground Travel	2022
GHG emissions	45 $MTCO_2e$
Activity data	125,398 vehicle miles traveled
Emissions Factors	2022 Transportation Factor Set (Appendix C)
Activity Data Sources	City of Spokane

Refrigerants | Scope 1

Fugitive emissions from refrigerants produced 160 $MTCO_2e$ in 2022 (less than 1% of total government operations emissions). These emissions have **increased 80%** since 2016, though as a small emissions source, the increase is equivalent to only 71 $MTCO_2e$. Data on refrigerant recycling is not available so every volume purchased during the calendar year is calculated when estimating emissions.

Refrigerants	2022
GHG emissions	160 $MTCO_2e$
Activity data	0.104326369 MT of HFC-134a released
Emissions Factor	N/A – activity data stated in MT of HFC
Activity Data Sources	City of Spokane

Figure 52. Annual Refrigerant Emissions



Operational Efforts by the City of Spokane

Various departments are continually looking for ways to reduce operational emissions. Currently, these are the primary efforts that are being taken that are at various stages:

- Building HVAC upgrades
- Avista Solar Select Program for City Hall[37]
- Commute Trip Reduction program
- Telework policy
- Use of Microsoft Teams and other remote meeting solutions
- Business travel policy

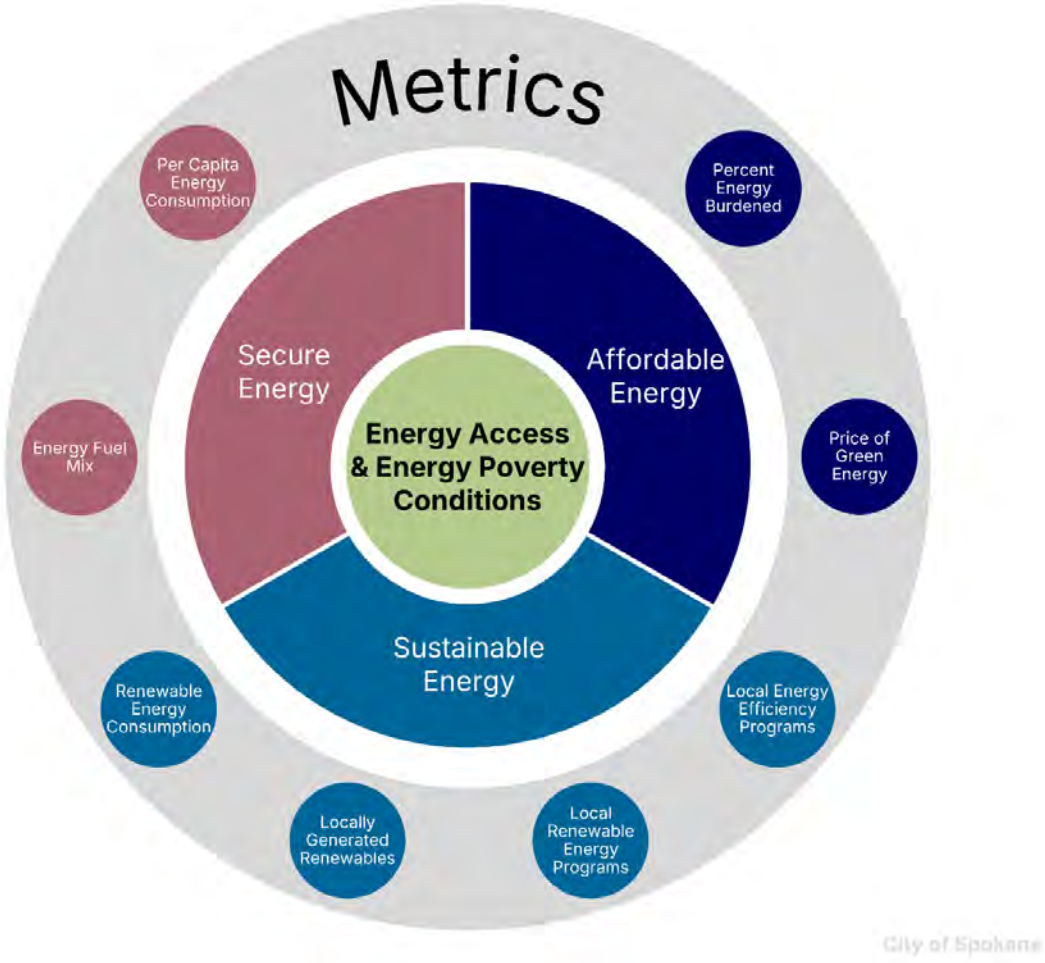
[37] https://www.myavista.com/energy-savings/green-options/community-renewable-options

Energy Access & Poverty Assessment

This section analyzes the energy access and poverty conditions of the City of Spokane considering three key energy attributes, in alignment with requirements from the Global Covenant of Mayors:[38]

- **Secure energy**
- **Sustainable energy**
- **Affordable energy**

Figure 53. Community Energy Access and Poverty Assessment Metrics



[38] https://www.globalcovenantofmayors.org/wp-content/uploads/2022/11/Energy-Access-and-Poverty-Pillar-Annex-to-the-CRF.pdf

Mandatory indicators are indicated with asterisks (*). The assessment must include at least one mandatory indicator for each energy attribute.

Secure Energy

Key indicators for secure energy are summarized below:

Indicator	2022 Value	Source & Notes
Average yearly energy consumption per capita*	8,981 kWh/capita	2022 GHG emissions inventory
Percent energy consumption (MMBtu) per capita from i) electricity, ii) natural gas, iii) other sources	i) Electricity: 43% ii) Natural gas: 55% iii) Other sources: 2%	2022 GHG emissions inventory

Sustainable Energy

Key indicators for sustainable energy are summarized below:

Indicator	2022 Value	Source & Notes
Total energy generated from renewable energy source within local boundary*	305,084,022 kWh	• Includes Upper Falls, Monroe Street, and Upriver hydroelectric facilities and WTE facility • 2022 GHG emissions inventory • Avista website (https://www.myavista.com/about-us/about-our-energy-mix)
Energy consumption from renewable energy sources*	3,608,366 MMBtu (51% of total)	• 2022 GHG emissions inventory • Avista Utilities (2022 WA Utility Fuel Mix Disclosure Report; WA Dept. of Commerce)

Affordable Energy

Key indicators for affordable energy are summarized below:

Indicator	2022 Value	Source & Notes
Percentage of households or population spending up to X% of income on energy service*	13% of total population is energy burdened low-income households ("Energy burdened" is defined as households spending more than 6% of their household income on energy bills)	For Spokane County, from Low-Income Energy Assistance 2023 Legislative Report (WA Department of Commerce)

Emissions Forecast & Target Recommendations

Understanding past emissions is important for tracking and monitoring process. However, understanding the actions currently underway and forecasting future emissions is important to enabling more efficient and effective prioritization and planning of emissions reduction policies and actions.

Cascadia completed a customized "wedge analysis" model that forecasts anticipated future greenhouse gas (GHG) emissions and depicts emission reduction scenarios for the City of Spokane's communitywide GHG emissions. This wedge estimated business-as-usual (BAU) and adjusted business-as-usual (ABAU) scenarios. To provide context for selecting GHG emissions reduction targets, Cascadia forecasted two future GHG emissions scenarios, described in detail below and presented in Figure 54 and its associated table. Key takeaways include:

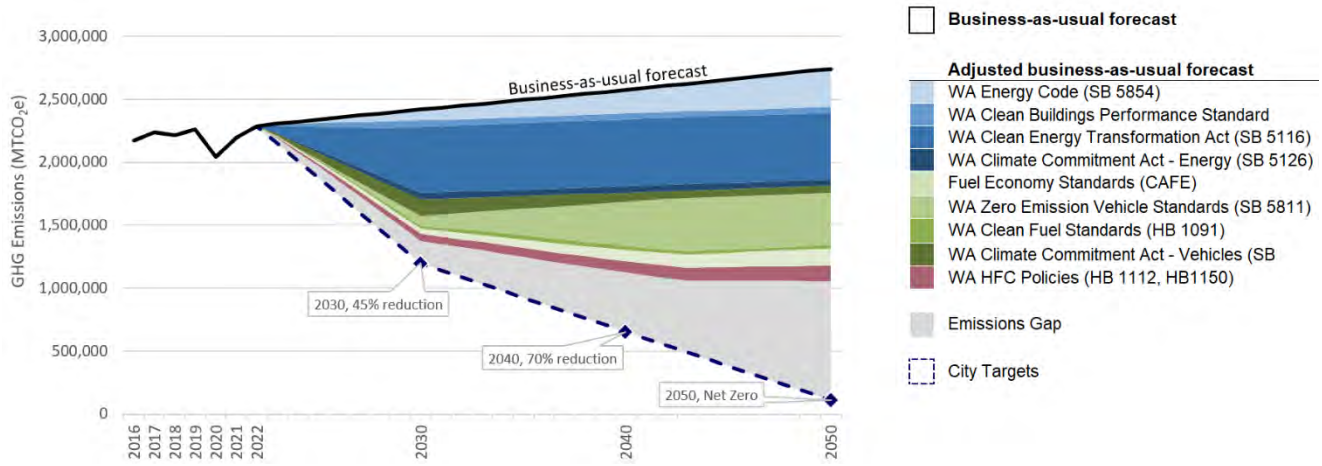
- Without federal, state, or local climate action, Spokane's total GHG emissions are expected to **increase 20%** from 2022 to 2050 under a BAU scenario.
- When considering the anticipated impacts of state and federal policies[39], Spokane's total GHG emissions are expected to **decrease 54%** from 2022 to 2050 under an ABAU scenario.

This model visualizes the following emission reduction targets (compared to a 2016 baseline):

- **45%** by 2030 (1,195,068 $MTCO_2e$)
- **70%** by 2040 (651,855 $MTCO_2e$)
- **95%** by 2050 (108,643 $MTCO_2e$)

[39] The selected policies were largely modeled due to the presence of significant implications on activities in Spokane. In addition, these policies have a defined timeframe and targets, and legislative "teeth" which increase confidence in the impacts that will result from these policies. For more information regarding the policies modeled, see *Appendix E: Emission Forecast Assumptions*.

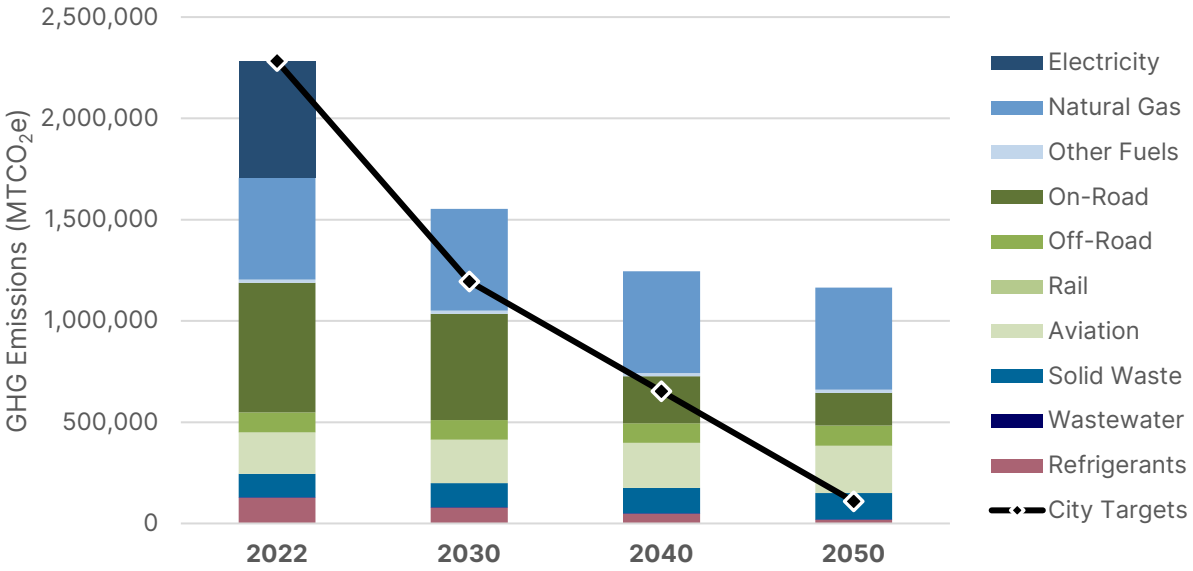
Figure 54. Spokane BAU and ABAU Emissions Forecast through 2050



Description	2022	2030	2040	2050
Business-as-usual (BAU) emissions – emissions forecast based on Spokane's 2022 GHG emissions profile, assuming no climate action (programs, policies, standards) at the local, state, or federal level.	2,283,457	2,418,202	2,574,884	2,741,650
Impact of SB5854 (WA Energy Code) – see Appendix E: Emission Forecast Assumptions.	-	85,295	188,345	300,679
Impact of (HB1257 and SB5722) (WA Clean Buildings Performance Standard) – see Appendix E: Emission Forecast Assumptions.	-	51,549	47,928	44,841
Impact of (SB 5116) (WA Clean Energy Transformation Act) – see Appendix E: Emission Forecast Assumptions.	-	526,544	529,951	533,244
Impact of (SB 5126) (WA Climate Commitment Act) – see Appendix E: Emission Forecast Assumptions.	-	178,538	123,616	108,978
Impact of Federal Fuel Economy (CAFE) standards – see Appendix E: Emission Forecast Assumptions.	-	42,743	90,920	135,078
Impact of Chapter 173-423 WAC (WA Zero Emission Vehicle Standards) – see Appendix E: Emission Forecast Assumptions.	-	82,743	348,290	411,735
Impact of Chapter 173-424 WAC (WA Clean Fuel Standards) – see Appendix E: Emission Forecast Assumptions.	-	21,953	34,820	27,419
Impact of HB 1112 and HB 1150 (WA HFC Policies) – see Appendix E: Emission Forecast Assumptions.	-	53,616	89,120	124,625
Adjusted business-as-usual (ABAU) emissions – adjusted BAU forecast to account for the impacts of adopted federal and state policies.	2,283,457	1,375,221	1,121,892	1,055,051
Difference between BAU and ABAU emissions	-	1,042,981	1,452,993	1,686,599

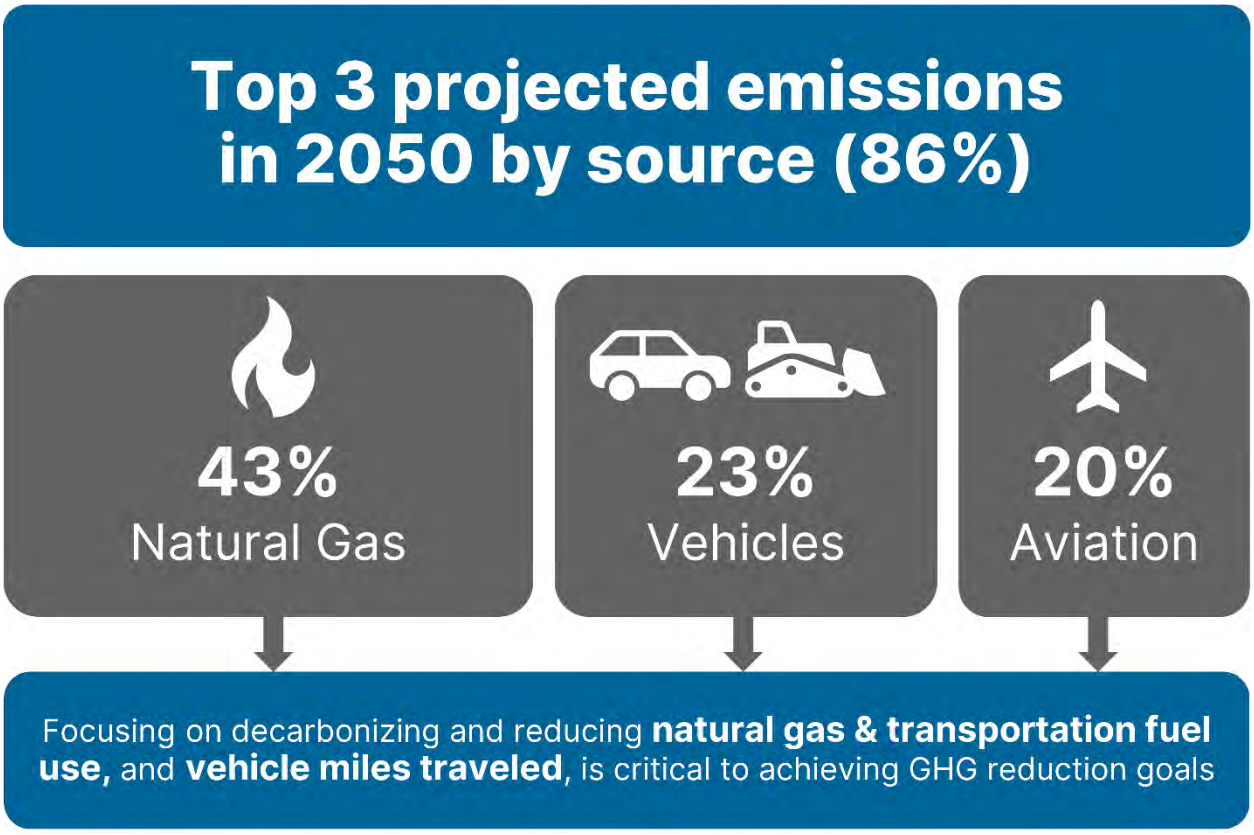
When accounting for the impact of these federal and state policies, the City of Spokane's emissions are projected to decrease significantly over the next few decades; however, these policies will not reduce the City's emissions to its goal of reaching carbon neutrality (95% emission reduction) by 2050. Figure 55 illustrates the remaining emissions by sector for key milestone years (2030, 2040, and 2050) compared to the City's GHG emission reduction targets.

Figure 55. Remaining Emissions by Sector



When considering the impact of these federal and state policies, the largest remaining emission sources—making up 43%, 23%, and 20% of remaining emissions respectively—include natural gas, transportation (including on-road vehicles and off-road equipment), and aviation.

Figure 56. Top Remaining Projected Emission Sources in 2050

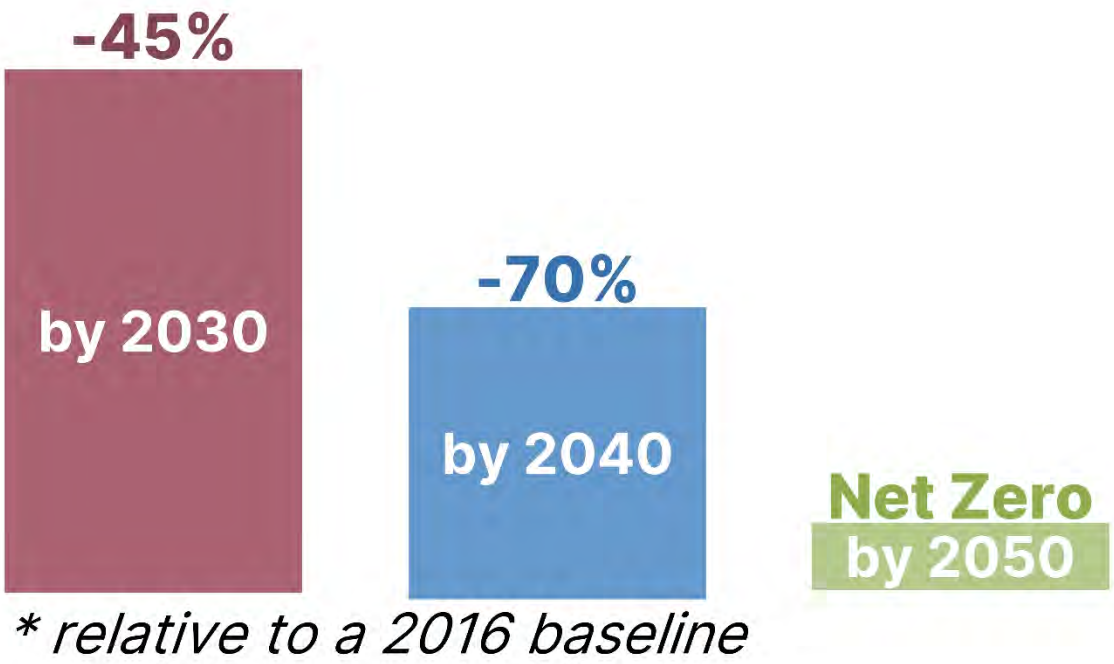


Current Emissions Reduction Targets

In addition to the new requirements from the State, cities should set greenhouse gas reduction targets to reduce the community's contributions to climate change and improve local air quality, ensuring a healthier environment for residents. These targets can also drive economic growth and resiliency by encouraging innovation and the development of renewable technologies as well as reducing resource consumption costs. Additionally, proactive measures can help cities avoid future regulatory penalties.

Consistent with its municipal powers under Washington State Law and RCW 70A.45.020[40], it is the goal of the City of Spokane to reduce anthropogenic GHG emissions created by any activities within the boundaries of the City of Spokane from 2016 baseline levels to 45% below 2016 levels by 2030; 70% below 2016 levels by 2040; and 95% below and net zero emissions, by the year 2050[41].

Figure 57. Current City of Spokane Emissions Reduction Goals



[40] https://app.leg.wa.gov/rcw/default.aspx?cite=70A.45.020
[41] https://my.spokanecity.org/smc/?Section=15.05.020

Target Recommendations

The City's emissions reduction targets currently align with the Washington state emissions reduction targets. This means the City currently meets the required State standards for emission reduction goals, but as a community, it is important to review these targets when developing new goals and policies. To ensure alignment with global best practices, the City's emissions reduction targets should align with Global Covenant of Mayors (GCoM) requirement for target setting[42]. Currently, the City's adopted targets comply with seven of the eight categories outlined by GCoM standards.

Category	Description
Boundary (4.1)	The target boundary is consistent with all emissions sources included in the GHG emissions inventory.
Target type (4.2)	The City has set "Base year emissions targets" which reduce emissions by a specified quantity relative to a base year.
Target year (4.3)	The City has selected both a long-term target year (2050), and interim target years (2030 and 2040).
Base year (4.4)	The base year for the City's emission reduction targets is 2016 due to the following considerations: – The base year has high quality and reliable data available. – The base year is a correct representation of the normal emission profile. – The base year is aligned with science-based target method and or the country's NDC.
Ambition (4.5)	These targets are not as ambitious as the current Biden Administration NDC targets.
Units (4.6)	The City's emission reduction targets are reported as a percentage (%) reduction from the base year. The absolute emissions in the target years are also reported in $MTCO_2e$.
Use of transferable emissions (4.7)	The City's targets do not include any emissions allowances or offset credits from market mechanisms outside the target boundary that are used toward meeting a target.
Conditionality (4.8)	No conditional components have been identified beyond official government policy.

The United States' most recently updated Nationally Determined Contribution (NDC) is the 2035 climate target submitted by the Biden Administration in late

[42] https://www.globalcovenantofmayors.org/wp-content/uploads/2023/11/CRF7-0-2023-09-14-final.pdf

2024, which outlines a 61-66% reduction below 2005 levels[43]. Using population data to estimate the City of Spokane's GHG emissions in 2005, an updated target of **67%** reduction by 2035 (compared to a 2016 baseline) is recommended for the City of Spokane in order to align with the United States' most recent NDC.

In addition, in 2021, President Biden submitted an NDC with a target of reducing U.S. greenhouse gas emissions 50-52% from the 2005 baseline in 2030. In order to align with this target, it is recommended that the City update their 2030 interim target to aim for a **55%** reduction from 2016 emissions.

The table below outlines updated recommended targets for the City (compared to a 2016 baseline), in order to align, or exceed the United States' most recent NDC's, as well as recommended science-based targets required for the World Wide Fund for Nature's (WWF) One Planet City Challenge (OPCC), in which the City participates[44].

Target Year	Current Target	NDC Target	WWF Target[45]
2030	45%	55%	64%
2035	N/A	67%	72%
2040	70%	74%	80%
2050	95%	95%	95%

[43] https://bidenwhitehouse.archives.gov/briefing-room/statements-releases/2024/12/19/fact-sheet-president-biden-sets-2035-climate-target-aimed-at-creating-good-paying-union-jobs-reducing-costs-for-all-americans-and-securing-u-s-leadership-in-the-clean-energy-economy-of-the-future/
[44] The World Wide Fund for Nature's (WWF) target-setting applies to only Scope 1 and 2 emissions, while the City of Spokane's community also produces Scope 3 emissions.
[45] Calculated in alignment with WWF's OPCC framework found here: https://wwfint.awsassets.panda.org/downloads/wwf_opcc_assessment_framework_and_technical_details_2021_04_08.pdf

Recommendations for Future Inventories

This report summarizes the 2022 emissions profile for the Spokane community and City operations. Emissions reduction efforts should focus on the largest sources of emissions as well as those over which the City and community have the greatest influence.

Figure 58. Communitywide GHG Emissions Summary (2022)

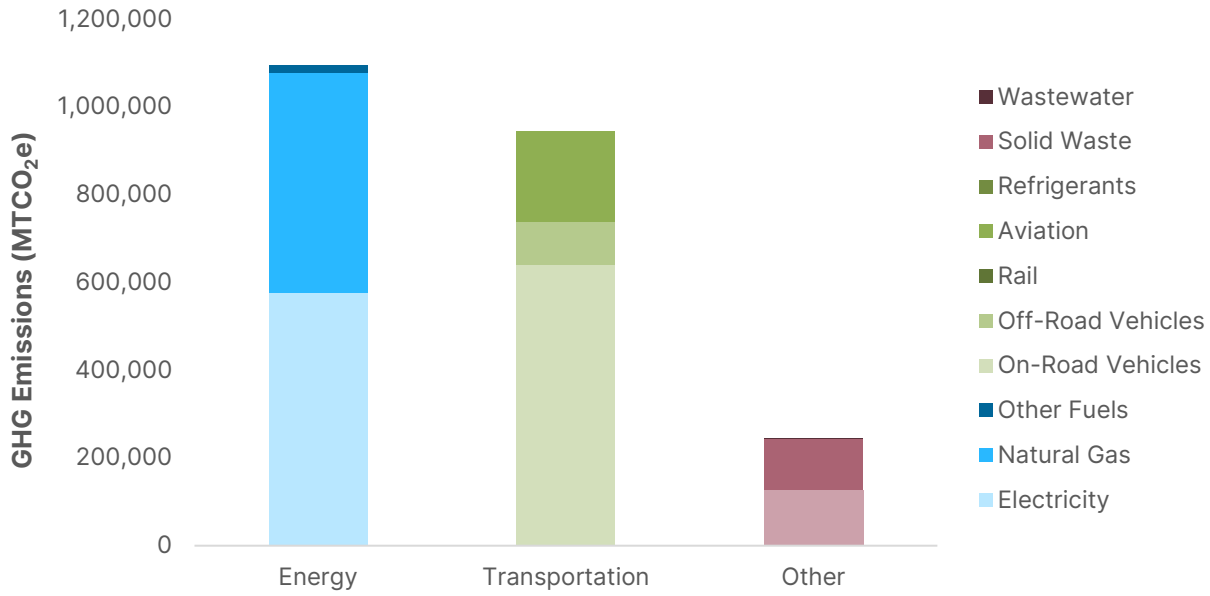
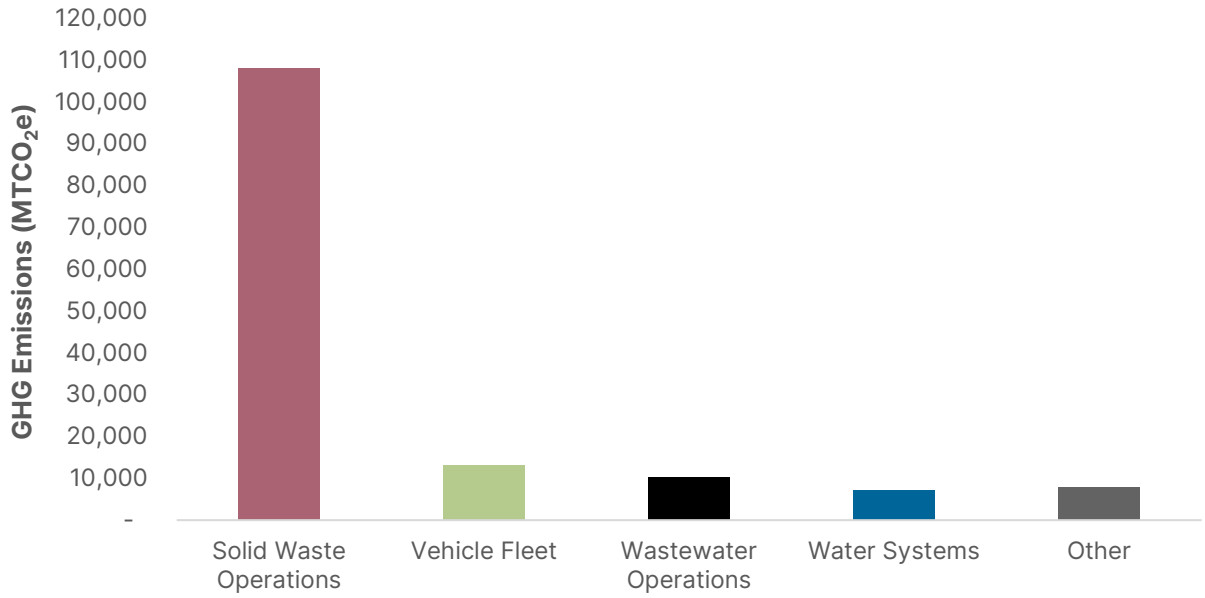


Figure 59. Government Operations GHG Emissions Summary (2022)



Improvements for Future Inventories

The inventory findings described above represent the best available data, assumptions, and calculation methodologies at this time. The following updates would improve completeness and accuracy of future communitywide inventories:

- **Obtain missing datasets from private sector** – Emissions data from several private entities were not available for the completion of this inventory, including: BNSF rail transportation data and Barr-Tech composting data.
- **Obtain local datasets** – County, state, and national datasets were used in the absence of local data for propane, fuel oil, wood, and kerosene consumption, public transit, off-road vehicles and equipment, rail transportation, refrigerants, and compost. If localized datasets become available in the future, they should be used in lieu of scaling down broader datasets.
- **Ensure consistency in transportation VMT model methodology**. VMT travel models use updated methodology to calculate more accurate transportation VMT totals. If methodology for future VMT models is updated retroactive updates should be made to previous inventories to ensure replicability.
- **Wastewater emissions estimations** – Emissions are currently calculated based on biochemical oxygen demand (BOD) and population served estimates. These assumptions can cause large variations in the emissions calculations that use them as inputs. Monitoring data improvements in this sector would be useful.
- **Fleet refrigerant recycling** – Emissions are currently calculated based on total refrigerants purchased during the calendar year. If recycling percentage or amounts can be determined those could be more accurately estimated instead of assuming all purchased refrigerants are leaked.
- **Complete a consumption-based inventory** – Emissions are calculated as an estimate of the emissions associated with the consumption of goods and services that were consumed by a jurisdiction's residents during the calendar year. These inventories are used as a tool to identify emissions being produced outside of a jurisdiction's geographic boundaries by production, transportation, consumption, and disposal.

Future Climate Action Planning Efforts

GHG inventories provide foundational information about City of Spokane's primary communitywide and government operations emissions which provides insights for future climate action planning efforts.

As part of the **Climate Planning**[46] process, the City of Spokane is also currently working on a Climate Risk and Vulnerability Assessment (CRVA) that will be completed by June 30, 2025. Combined with this GHG inventory, a policy audit, and various public engagement efforts, the community will be well informed from a climate perspective when moving into the policy and goal setting phase of Comprehensive Plan updates. Once those policies and goals are set (by June 30, 2026), action planning, implementation, funding, and progress tracking will ensure the City of Spokane meets those goals.

Figure 60. Climate Informed Planning Process

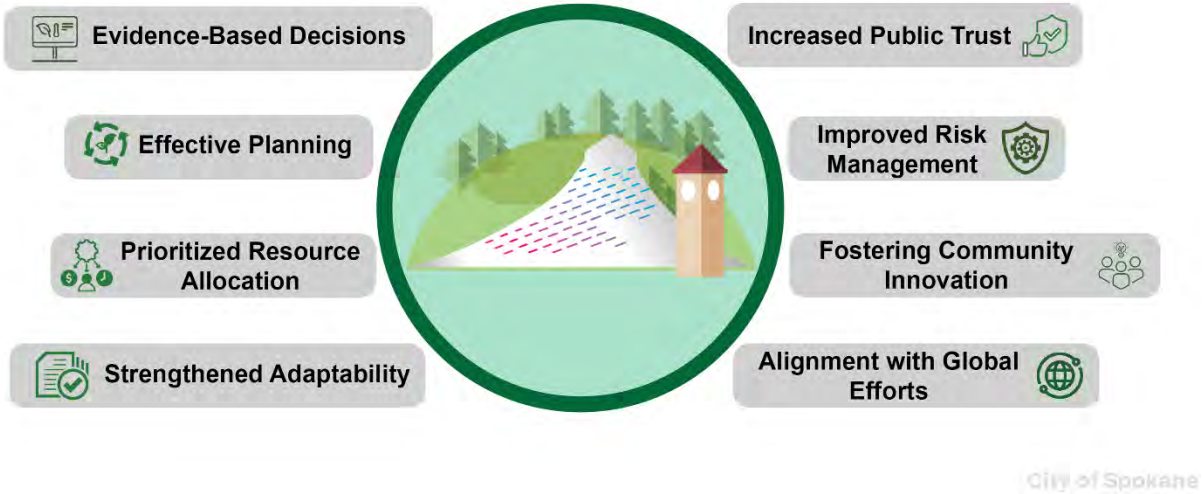
[46] https://my.spokanecity.org/planspokane/climate-planning/

Data-informed policymaking for climate issues is crucial because it ensures that decisions are based on accurate, reliable, and up-to-date information. Benefits of utilizing the latest data to set goals and policies as a community include:

- **Evidence-Based Decisions**: Provides a solid foundation for crafting policies that effectively address climate challenges by relying on scientific and empirical evidence.
- **Effective Planning**: Helps policymakers identify the most effective strategies for reducing greenhouse gas emissions and vehicle miles traveled, leading to better outcomes and accountability.
- **Prioritized Resource Allocation**: Ensures that resources are allocated efficiently and prioritized toward actions that yield the greatest cost-effective environmental benefits.
- **Strengthened Adaptability**: Allows for continuous monitoring and adjustment of policies based on new data and changing circumstances, ensuring ongoing relevance and effectiveness.
- **Increased Public Trust**: Builds public trust and support for policies by demonstrating that decisions are grounded in objective, transparent data.
- **Improved Risk Management**: Identifies and mitigates potential risks associated with climate change, ensuring long-term resilience and sustainability.
- **Fostering Community Innovation**: Encourages the development and adoption of innovative technologies and practices to address climate issues that take into account the community's lived experience and input.
- **Alignment With Global Efforts**: Aligns local policies with state, national, and global climate goals and commitments, contributing to collective efforts to combat climate change.

By relying on data-informed policymaking, the City and community can create more effective, efficient, and sustainable solutions to tackle climate issues.

Figure 61. Benefits of Data-Informed Climate Policymaking



Get Involved!

Get involved in climate planning! Every action matters. The largest impacts individuals can make for the community is by setting the 20-year vision and goals for reducing greenhouse gas emissions in the City of Spokane.

- **Stay Informed:** Follow the City of Spokane on social media and sign up for email updates to stay up-to-date on the latest developments in Spokane's climate planning efforts. Knowledge is power, and your engagement helps drive positive change.
- **Attend Events:** Look out for upcoming community workshops and events throughout 2025 and 2026 to chat, share information, and hear your thoughts on climate planning.
- **Share Your Voice:** Your input is crucial in shaping thecity's response to growing greenhouse gas mitigation and adapting to climate hazards. Join the City of Spokane for community workshops, town hall meetings, and online surveys to share your ideas, concerns, and priorities.

Appendices

Appendix A: Emissions Summary Tables

Table 3. Annual Communitywide GHG Emissions ($MTCO_2e$).

	2016	2017	2018	2019	2020	2021	2022
Energy	**1,017,275**	**1,066,640**	**1,001,699**	**1,041,323**	**975,556**	**1,005,613**	**1,094,000**
Electricity	**615,248**	**574,962**	**591,974**	**595,673**	**514,051**	**543,067**	**575,957**
Residential	286,285	279,654	284,382	289,767	259,497	273,200	291,242
Commercial	307,283	276,429	288,054	286,271	237,581	253,675	269,057
Industrial	21,680	18,879	19,538	19,636	16,974	16,191	15,658
Natural Gas	**386,430**	**472,595**	**392,711**	**432,219**	**446,821**	**446,683**	**501,999**
Residential	208,722	261,680	244,816	269,814	244,558	239,927	271,206
Commercial	160,147	190,311	142,847	157,826	174,684	179,689	202,645
Industrial	12,905	15,607	2,441	2,662	11,543	10,958	11,935
Distribution Losses	4,657	4,997	2,607	1,916	16,036	16,108	16,213
Other Fuels	**15,597**	**19,083**	**17,014**	**13,431**	**14,684**	**15,863**	**16,044**
Residential	15,597	19,083	17,014	13,431	14,684	15,863	16,044
Transportation	**923,084**	**940,919**	**983,178**	**981,195**	**836,507**	**949,786**	**945,012**
On-Road Vehicles	678,921	676,366	684,837	688,471	607,053	646,395	641,379
Off-Road Equipment	91,734	93,373	94,867	95,536	96,277	96,764	96,973
Rail	192	166	164	165	162	109	142
Aviation	152,237	171,014	203,309	197,022	133,016	206,518	206,518
Other	**232,549**	**227,780**	**230,606**	**239,387**	**228,644**	**240,261**	**244,445**
Solid Waste	**117,502**	**108,929**	**110,703**	**116,084**	**108,834**	**115,743**	**115,455**
Combustion	101,781	93,188	94,571	99,773	93,765	101,090	100,478
Composting	8,553	8,685	8,852	8,948	8,911	8,927	8,986
NSLF	7,168	7,056	7,280	7,364	6,158	5,726	5,992
Process & Fugitive	**111,973**	**115,518**	**116,782**	**120,812**	**117,628**	**122,283**	**126,649**
HFCs	111,973	115,518	116,782	120,812	117,628	122,283	126,649
Wastewater	3,074	3,333	3,121	2,490	2,183	2,236	2,341
Total Emissions	**2,172,907**	**2,235,339**	**2,215,483**	**2,261,904**	**2,040,708**	**2,195,660**	**2,283,457**

Table 4. Annual Per Capita Communitywide GHG Emissions ($MTCO_2e$/capita)

	2016	2017	2018	2019	2020	2021	2022
Energy	**4.73**	**4.84**	**4.46**	**4.58**	**4.26**	**4.38**	**4.74**
Electricity	**2.86**	**2.61**	**2.63**	**2.62**	**2.24**	**2.37**	**2.49**
Residential	1.33	1.27	1.27	1.28	1.13	1.19	1.26
Commercial	1.43	1.25	1.28	1.26	1.04	1.11	1.17
Industrial	0.10	0.09	0.09	0.09	0.07	0.07	0.07
Natural Gas	**1.80**	**2.14**	**1.75**	**1.90**	**1.95**	**1.95**	**2.17**
Residential	0.97	1.19	1.09	1.19	1.07	1.05	1.17
Commercial	0.74	0.86	0.64	0.69	0.76	0.78	0.88
Industrial	0.06	0.07	0.01	0.01	0.05	0.05	0.05
Distribution Losses	0.02	0.02	0.01	0.01	0.07	0.07	0.07
Other Fuels	**0.07**	**0.09**	**0.08**	**0.06**	**0.06**	**0.07**	**0.07**
Residential	0.07	0.09	0.08	0.06	0.06	0.07	0.07
Transportation	**4.29**	**4.27**	**4.38**	**4.32**	**3.65**	**4.14**	**4.09**
On-Road Vehicles	3.16	3.07	3.05	3.03	2.65	2.82	2.78
Off-Road Equipment	0.43	0.42	0.42	0.42	0.42	0.42	0.42
Rail	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aviation	0.71	0.78	0.90	0.87	0.58	0.90	0.89
Other	**1.08**	**1.03**	**1.03**	**1.05**	**1.00**	**1.05**	**1.06**
Solid Waste	**0.55**	**0.49**	**0.49**	**0.51**	**0.48**	**0.50**	**0.50**
Combustion	0.47	0.42	0.42	0.44	0.41	0.44	0.44
Composting	0.04	0.04	0.04	0.04	0.04	0.04	0.04
NSLF	0.03	0.03	0.03	0.03	0.03	0.02	0.03
Process & Fugitive	**0.52**	**0.52**	**0.52**	**0.53**	**0.51**	**0.53**	**0.55**
HFCs	0.52	0.52	0.52	0.53	0.51	0.53	0.55
Wastewater	**0.01**	**0.02**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
Total Emissions	**10.10**	**10.14**	**9.86**	**9.96**	**8.91**	**9.57**	**9.89**
Population	215,114	220,444	224,683	227,121	228,989	229,400	230,900

Table 5. Annual Government Operations GHG Emissions ($MTCO_2e$)

	2016	2017	2018	2019	2020	2021	2022
Solid Waste Operations	**110,092**	**101,734**	**102,932**	**108,134**	**100,936**	**107,883**	**108,013**
WTE	101,781	93,188	94,571	99,773	93,865	101,195	100,477
Electricity	396	903	534	491	489	418	1,065
Natural Gas	47	83	71	86	79	90	98
NSLF	7,168	7,056	7,280	7,364	6,147	5,739	5,984
SSLF	700	504	476	420	356	441	389
Vehicle Fleet	**11,721**	**12,331**	**11,518**	**12,428**	**12,700**	**12,788**	**13,096**
On-Road Vehicles	11,262	11,859	11,174	11,999	12,054	12,123	12,348
Off-Road Equipment	459	472	344	429	646	664	748
Wastewater Operations	**9,232**	**8,865**	**8,404**	**8,919**	**7,580**	**8,829**	**10,264**
Electricity	5,663	4,823	4,810	4,951	4,412	5,378	6,103
Natural Gas	503	707	473	1,478	984	1,214	1,821
Flaring Digester Gas	232	246	270	274	286	230	250
Combustion Digester Gas	15	11	9	4	6	13	23
Process N_2O - WW	537	595	548	548	538	540	581
Process N_2O - Effluent	2,282	2,483	2,294	1,664	1,353	1,453	1,487
Water Systems	**7,065**	**6,903**	**7,672**	**6,994**	**6,743**	**8,022**	**7,132**
Electricity	6,856	6,633	7,422	6,749	6,531	7,783	6,851
Natural Gas	209	270	250	245	213	239	281
Streetlights & Traffic Signals	**2,513**	**1,979**	**1,972**	**1,908**	**1,634**	**1,642**	**1,656**
Electricity	2,513	1,979	1,972	**1,908**	**1,634**	**1,642**	**1,656**
Other	**9,712**	**9,330**	**9,107**	**8,975**	**7,112**	**7,988**	**7,890**
Buildings & Facilities	**7,228**	**6,614**	**6,402**	**6,164**	**5,235**	**5,745**	**6,000**
Grid Electricity	4,596	3,736	3,828	3,202	2,873	2,987	2,856
Natural Gas	2,631	2,877	2,574	2,962	2,362	2,758	3,143
Kerosene	1	1	1	1	-	-	2
Employee Commute	**2,396**	**2,622**	**2,629**	**2,737**	**1,735**	**2,088**	**1,730**
Employee Commute	2,231	2,461	2,461	2,565	1,578	1,922	1,556
Business Travel - Car	33	32	33	34	40	42	45
Business Travel - Air	132	129	135	137	117	124	130
Refrigerants	**88**	**94**	**75**	**74**	**142**	**154**	**160**
Refrigerants	88	94	75	**74**	**142**	**154**	**160**
Total Emissions	**150,336**	**141,142**	**141,605**	**147,357**	**136,706**	**147,150**	**148,058**

Appendix B: Data Providers and Contact Information

Communitywide GHG Inventory

Energy

Data Input	Data Provider - Name	Data Provider - Email
Avista: • Electricity consumption • Electricity emissions factors • Natural gas consumption	John Lyons (Avista) & Janna Loeppky (Avista)	John.Lyons@avistacorp.com Janna.Loeppky@avistacorp.com
IPL: • Electricity consumption	Ian Swan (IPL)	ians@inlandpower.com

Transportation

Data Input	Data Provider - Name	Data Provider - Email
On-Road – vehicle miles traveled	Ryan Stewart (Spokane Regional Transportation Council)	rstewart@srtc.org
On-Road – High Performance Monitoring System (HPMS) Annual VMT Data	Heath Bright (WSDOT)	brighth@wsdot.wa.gov
Transit vehicle miles traveled	Brian Conley (Spokane Transit Authority)	bconley@spokanetransit.com
Rail – Amtrak	Laura Fotiou (Amtrak)	Laura.Fotiou@amtrak.com
Rail - BNSF	Ashley Lane (BNSF)	ashley.lane2@bnsf.com
Rail – Union Pacific (UP)	Melissa Schop (UP)	meschop@up.com
Aviation – Spokane International Airport	Spokane Regional Clean Air Agency	publicinfo@spokanecleanair.org
Aviation – Felts Field Airport	Spokane Regional Clean Air Agency	publicinfo@spokanecleanair.org

Solid Waste

Data Input	Data Provider - Name	Data Provider - Email
WTE emissions report	Jen Lennon (City of Spokane)	jlennon@spokanecity.org

NSLF data emissions report	Jen Lennon (City of Spokane)	jlennon@spokanecity.org

Wastewater

Data Input	Data Provider - Name	Data Provider - Email
Wastewater emissions report	Jeff Donovan (City of Spokane)	jdonovan@spokanecity.org

Government Operations GHG Inventory

Energy

Data Input	Data Provider - Name	Data Provider - Email
Avista: • Electricity consumption • Natural gas consumption	Logan Callen (City of Spokane)	lcallen@spokanecity.org
IPL: • Electricity consumption	Logan Callen (City of Spokane)	lcallen@spokanecity.org

Solid Waste Operations

Data Input	Data Provider - Name	Data Provider - Email
WTE emissions report	Jen Lennon (City of Spokane)	jlennon@spokanecity.org
NSLF/SSLF data emissions report	Jen Lennon (City of Spokane)	jlennon@spokanecity.org

Vehicles & Equipment Fleet

Data Input	Data Provider - Name	Data Provider - Email
VMT and fuel consumption by vehicle/equipment ID	Brandon Paschal (City of Spokane)	bpaschal@spokanecity.org

Wastewater Operations

Data Input	Data Provider - Name	Data Provider - Email
Wastewater emissions report	Jeff Donovan (City of Spokane)	jdonovan@spokanecity.org

Other Emissions Sources

Data Input	Data Provider - Name	Data Provider - Email
Employee commute - CTR reports	Logan Callen (City of Spokane)	lcallen@spokanecity.org
Business travel - personal vehicle miles traveled report	Logan Callen (City of Spokane)	lcallen@spokanecity.org
Business travel - aviation miles traveled report	Logan Callen (City of Spokane)	lcallen@spokanecity.org

Appendix C: Factor Sets

ClearPath requires the following Factor Set inputs to calculate GHG emissions.

2022 Transportation

Gasoline	Passenger Vehicle	Light Truck	Heavy Truck	Transit Bus	Paratransit Bus	Motorcycle
MPG	24.8	18.1	7.3	7.3	7.3	44.0
g CH_4/mi	0.0078	0.011	0.032	0.032	0.032	0.0672
g N_2O/mi	0.0061	0.0073	0.0041	0.0041	0.0041	0.0069
Diesel	Passenger Vehicle	Light Truck	Heavy Truck	Transit Bus	Paratransit Bus	Motorcycle
MPG	24.8	18.1	7.3	7.3	7.3	44.0
g CH_4/mi	0.0302	0.029	0.0095	0.0095	0.0095	0.0302
g N_2O/mi	0.0192	0.0214	0.0431	0.0431	0.0431	0.0192
Data Sources:	ICLEI Defaults					

2022 Waste Characterization

Waste Type	Percent of Total Waste
Percentage Mixed MSW	0.00%
Percentage Newspaper	0.38%
Percentage Office Paper	0.22%
Percentage Corrugated Cardboard	6.06%
Percentage Magazines / Third Class Mail	1.94%
Percentage Food Scraps	14.21%
Percentage Grass	0.00%
Percentage Leaves	2.33%
Percentage Branches	0.47%
Data Sources:	State of Washington Department of Ecology: 2020-2021 Washington Statewide Waste Characterization Study

2022 Grid Electricity

Avista Emissions Factor 2022	
CO_2 kg/MWh	262.6
CH_4 kg/GWh	25.7
N_2O kg/GWh	3.53
Data Sources:	Avista Utilities

Avista Solar Select ® Emissions Factor 2022	
CO_2 kg/MWh	0
CH_4 kg/GWh	0
N_2O kg/GWh	0
Data Sources:	Avista Utilities

Inland Power & Light Emissions Factor 2022	
CO_2 lb/MWh	602.1
CH_4 lb/GWh	56.0
N_2O lb/GWh	8.0
Data Sources:	U.S. EPA Emissions & Generation Resource Integrated Database (eGRID)

Appendix D: Biogenic Emissions Summary

Biogenic emissions refers to the carbon contained in organic materials that was originally removed from the atmosphere through natural processes and would eventually cycle back to the atmosphere through natural degradation processes.

The combustion of biomass (non-fossilized organic material from plants, animals, and other organisms) produces both anthropogenic and biogenic emissions. Biogenic emissions also result from forestry and land management practices. These emissions are included in this report for informational purposes.

Sources of Biogenic Emissions in Inventory:

- **Waste to Energy Combustion –** combustion of biomass at Spokane's WTE facility emitted 129,420 MT of biogenic CO_2 in 2022.
- **Wastewater Treatment** – combustion of biogas at RPWRF emitted 4,582 MT of biogenic CO_2 in 2022.
- **Land Use Changes** (see detailed section below)

Emissions and Removals from Forests and Trees

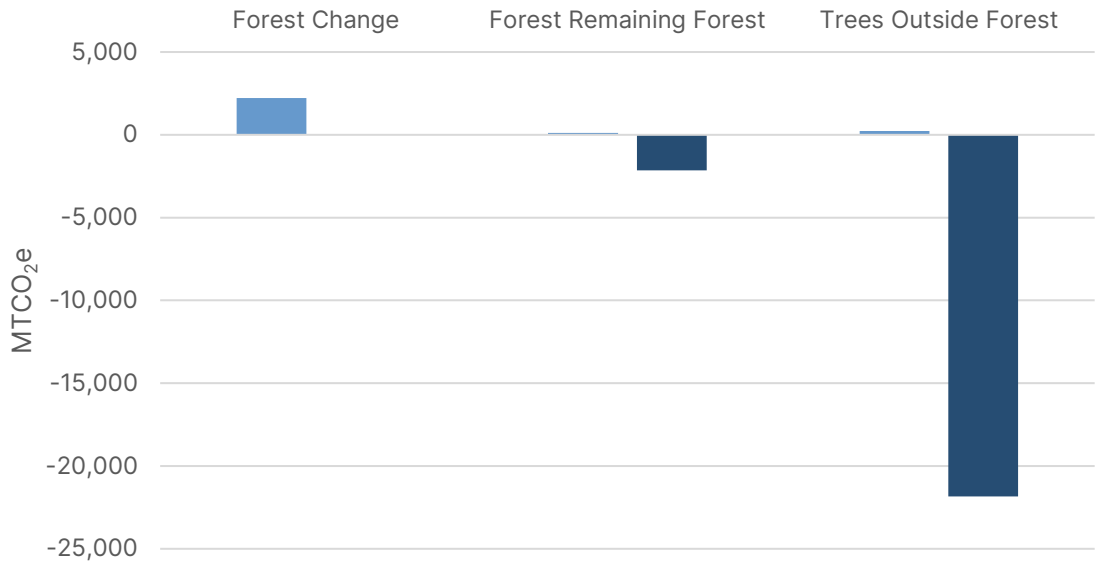
Emissions and sequestration from land use changes were estimated using ICLEI's Land Emissions and Removals Navigator (LEARN) tool (Figure 62). The latest data available is from 2016 to 2019. Land change types during this period include:

- **Forest Change**
  - Forest to grassland: 62 $MTCO_2e$/year
  - Forest to settlement: 2,072 $MTCO_2e$/year
  - Forest to other: 95 $MTCO_2e$/year
- **Forest Remaining Forest**
  - Undisturbed forest: -2,137$MTCO_2e$/year
  - Insect/disease: -6 $MTCO_2e$/year
  - Harvest/other: 122 $MTCO_2e$/year
- **Trees Outside Forest**
  - Tree canopy loss: 302 $MTCO_2e$/year
  - Canopy maintained/gained: -21,845 $MTCO_2e$/year

The largest source of **emissions** was **conversion of forest to settlement**; the largest source of emissions **removals** was **tree canopy maintained/gained**. As

part of Spokane Municipal Code section 12.02.905, it is the City's Urban Forestry goal to have thirty percent (30%) of the total land area within the City to be healthy and functioning tree canopy coverage by 2030.

Figure 62. Annual Emissions and Removals from Land Use Change (2016-2019)



Appendix E: Emission Forecast Assumptions

Forecast Growth Rates

The model uses the projected changes in demographics in the following table to forecast Spokane's future emissions:

- The number of people who live in Spokane (Population)
- The number of people who work in Spokane (Employment)
- The number of people who live and/or work in Spokane (Service Population)

	2022	2030	2040	2050
Population (1)	230,900	239,288	249,769	260,249
Employment (2)	105,372	119,587	135,539	153,618
Service Population (3)	336,272	358,876	385,308	413,868

Data Sources:

1. **Spokane County Growth Management Act projections.**
2. **Washington Employment Security Department "Long-term alternative occupational employment projections".**
3. **Calculated sum of Spokane's population and employees.**

Adjusted Business-As-Usual Policy Assumptions

The "adjusted business-as-usual" (ABAU) forecast adjusts the BAU forecast to account for the impacts of adopted federal and state policies (still assuming no climate action at the local level). The emission reductions associated with these policies count toward Spokane's overall emission reductions and progress towards targets. The following table summarizes eight key policies reflected in the ABAU forecast.

Policy	Level	Key Assumptions in Forecast/Model
WA Energy Code (SB 5854)	State	**Overview:** SB 5854 requires residential and nonresidential construction permitted under the 2031 state energy code to achieve a 70% reduction in annual net energy consumption (compared to a 2006 baseline). State energy codes will be adopted from 2013-2031 to incrementally move towards achieving the 70% reduction by 2031. **Key Assumptions:** – Assume a 70% reduction in annual net energy consumption in new buildings, compared to a 2016 baseline.
WA Clean Buildings Performance Standards (HB1257 and SB5722)	State	**Overview:** Requires all new and existing commercial buildings over 20,000 square feet to reduce their energy use intensity (EUI) by 15%, compared to the 2009-2018 average. **Key Assumptions:** – Assume that all buildings in each Tier comply by their target date by reducing their EUI by 15% compared to the 2016 GHG inventory. – Tier 1: o Buildings greater than 220,000 square feet must comply by June 1, 2026 o Buildings greater than 90,000 square feet must comply by June 1, 2027 o Buildings greater than 50,000 square feet must comply by June 1, 2028 – Tier 2: o Buildings greater than 20,000 sf, but less than 50,001 sf by July 1, 2027.
WA Clean Energy Transformation Act (SB 5116)	State	**Overview:** CETA applies to all electric utilities serving retail customers in Washington and sets specific milestones: By 2025, utilities must eliminate coal-fired electricity from their state portfolios; By 2030, utilities must be greenhouse gas neutral, with flexibility to use limited amounts of electricity from natural gas if it is offset by other actions; By 2045, utilities must supply Washington customers with electricity that is 100% renewable or non-emitting, with no provision for offsets **Key Assumptions:** – Assume a straight-line transition to zero-emission electricity beginning in 2023, reaching carbon neutral by 2030.
WA Climate Commitment Act (SB 5126)	State	**Overview:** The State estimates that CCA will account for 26.2 million $MTCO_2e$ in statewide reductions by 2030. 2018 total emissions = 99.57 million $MTCO_2e$. Thus, the state anticipates that CCA will reduce total WA emissions 26% compared to 2018 levels. Key regulated CCA sectors

Policy	Level	Key Assumptions in Forecast/Model
		relevant to the geographic inventory include electricity, natural gas, and transportation fuels. **Key Assumptions:** – Assume CETA addresses emissions reductions in electricity sector. – Apply -10% emissions factor adjustment to natural gas (assuming increase in hydrogen or RNG in fuel mix) by 2030. – Apply -23.5% fuel emissions factor reduction estimate to transportation emissions to 2030 and -30% to 2040 (includes reductions from CFS).
Federal Fuel Economy Standards (CAFE)	Federal	**Overview:** Corporate Average Fuel Economy (CAFE) standards are regulated by the DOT and supported by the EPA, calculates average fuel economy levels for manufacturers and sets related GHG standards. Passenger Cars and Light Trucks require an industry-wide fleet average of approximately 49 mpg for passenger cars and light trucks in model year 2026, increasing fuel efficiency 8% annually for model years 2024-2025 and 10% annually for model year 2026. This also will also increase the estimated fleetwide average by nearly 10 miles per gallon for model year 2026, relative to model year 2021. **Key Assumptions:** – Based on PSRC Vision 2050 modeling (assumed to be the most comprehensive modeling of this policy done within WA), assumed the following changes in vehicle emissions intensity (gCO_2e/mile): o Light duty vehicles: 33% reduction from 2018 to 2050. o Heavy duty vehicles: 26% reduction from 2018 to 2050.
WA Zero Emission Vehicle Standards (Chapter 173-423 WAC)	State	**Overview:** For new light-duty (i.e., passenger) vehicles (LDVs), the Advanced Clean Cars I regulations (which have been adopted by Washington) require a progressively stringent zero-emissions vehicle (ZEV) sales share, culminate in a 100% sales requirement by 2035. Manufacturers must sell enough clean vehicles to meet the credit requirement for each model year. **Key Assumptions:** – The average vehicle owner will have their vehicle for 15 years before replacing it. – 9% of new LDV sales will be electric by 2025. – 35% of new LDV sales will be electric by 2026. – 43% of new LDV sales will be electric by 2027. – 51% of new LDV sales will be electric by 2028. – 59% of new LDV sales will be electric by 2029. – 68% of new LDV sales will be electric by 2030. – 76% of new LDV sales will be electric by 2031. – 82% of new LDV sales will be electric by 2032. – 88% of new LDV sales will be electric by 2033. – 94% of new LDV sales will be electric by 2034. – 100% of new LDV sales will be electric by 2035.
WA Clean Fuel Standards (Chapter 173-424 WAC)	State	**Overview:** The Clean Fuel Standard requires a 20% reduction in the carbon intensity of transportation fuels by 2034, compared to a 2017 baseline level. Reductions in carbon intensity may be achieved through cleaner fuels or by purchasing clean fuel credits from cleaner producers

Policy	Level	Key Assumptions in Forecast/Model
		such as those providing electricity as fuel. Boats, trains, aircraft, and military vehicles & equipment are excluded. **Key Assumptions:** – Therefore, compared to baseline, we will model the following for fuel carbon intensities: o 3.5% reduction in per-gallon gasoline & diesel vehicle (passenger, heavy duty, transit) emissions from cleaner fuels (NOT EVs) by 2030 o 10% reduction in per-gallon gasoline & diesel vehicle (passenger, heavy duty, transit) emissions from cleaner fuels (NOT EVs) by 2034. o Maintain 10% reduction levels to 2050.
WA Organics Management Law	State	**Overview:** Washington's Organics Management Law includes House Bill 1799, passed in 2022, and House Bill 2301, passed in 2024. The Organics Management Law establishes statewide goals of diverting 75% of organic material to landfills by 2030, and recovering 20% of disposed edible food by 2025 (both relative to 2015 levels). These house bills include several actions to be implemented such as: – Creating grant programs related to food waste reduction and organic material management policy implementation, – Implementing new requirements for organic material collection service requirements for local governments, residents, and businesses, – Modifying the labeling requirements related to the plastic vs. non-plastic products and packaging, – Modifying compost procurement programs and requirements. While the WA Organics Management Law has been successfully passed and does include required changes to organics collection, product packaging, implementation of new grant programs, etc., there is not significant confidence in the emission reductions that might result from the changes to Washington's organics management. As a result, this law was not included in this model but could be considered as an addition in future years if there is increased confidence in its impacts.
WA HFC Policies	State	**Overview:** HB 1112 requires that new equipment be manufactured without HFCs or using refrigerants with a lower global warming potential (GWP) in a phased approach through 2024. Equipment covered by the law are being phased in each year, starting with 2020, and penalties apply for non-compliance. In 2021, HB 1050 applied Clean Air Act provisions for ozone depleting substances to HFCs and extended restrictions on higher GWP HFCs to new equipment such as ice rinks and stationary air conditioning. **Key Assumptions:** Based on state modeling, assumes the following reductions in HFC emissions. – 34% by 2030. – 85% by 2050.