OLYMPIA, WASHINGTON

2021 Inventory of Community-Wide Greenhouse Gas Emissions

Prepared For:

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Produced By:

ICLEI – Local Governments
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ICLEI – Local Governments for Sustainability USA

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Executive Summary

The City of Olympia recognizes that greenhouse gas (GHG) emissions from human activity are catalyzing profound climate change, the consequences of which pose substantial risks to the future health, well-being, and prosperity of our community.

In 2021, the City of Olympia joined the Cities Race to Zero Campaign, demonstrating Olympia's support and commitment for inclusive climate action in line with the goals of the Paris Agreement. In April 2022, Olympia City Council formalized Olympia's Race to Zero commitment, pledging to reduce community-wide greenhouse gas emissions 59% below 2019 levels by 2030 and achieve net-zero emissions by 2040. The 2020 Thurston Climate Mitigation Plan (TCMP), which was jointly developed by the Cities of Lacey, Olympia, and Tumwater, and Thurston County, includes more than 70 strategies and actions to significantly reduce regional greenhouse gas emissions. Regional implementation of the TCMP will help Olympia and our partner jurisdictions achieve local and regional GHG reductions goals.

Conducting an inventory of GHG emissions can provide useful information for prioritizing among possible actions designed to reduce GHG sources. Conducting a series of GHG inventories can help identify trends and further aid local governments in determining how to allocate resources.

Olympia's most recent, city-specific, greenhouse gas inventory was completed in 2021. This sector-based inventory for the Olympia community used 2019 data and was prepared using the "U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions" (USCP). The USCP is a nationally accepted method for calculating emissions at a community-wide scale. This method calculates the GHG emissions based on activities occurring within Olympia's city limits, such as transportation, energy use, and production of waste. The USCP method does not estimate emissions that are generated from goods and services produced outside of city limits.

This report provides the results of Olympia's second sector-based community-wide GHG inventory. It only represents emissions from within Olympia's city limits and 2021 emissions data. This updated inventory was calculated using the USCP methodology, ICLEI's ClearPath Climate Planner tool, and used data provided by the City of Olympia, local utilities, public transit providers, and Google Environmental Insights Explorer.

Thank you to all the individuals who contributed time and data to this effort. An updated inventory would not have been possible without your time and support.

Key Findings

Figure 1 shows community-wide emissions by sector. The largest contributor is Transportation & Mobile Sources with 34% of emissions. The next largest contributors are Commercial Energy (27%) and Residential Energy (22%). Upstream, Solid Waste, Industrial Energy, Water & Wastewater, and Process & Fugitive were responsible for the remaining (less than 17%) emissions.

The Inventory Results section of this report provides a detailed profile of emissions sources within Olympia; information that is key to guiding local reduction efforts. These data will also provide a baseline against which the City will be able to compare future performance and demonstrate progress in reducing emissions.

EMISSIONS AT A GLANCE

1 Transportation
34%

2 Commercial Energy
27%

3 Residential Energy
22%

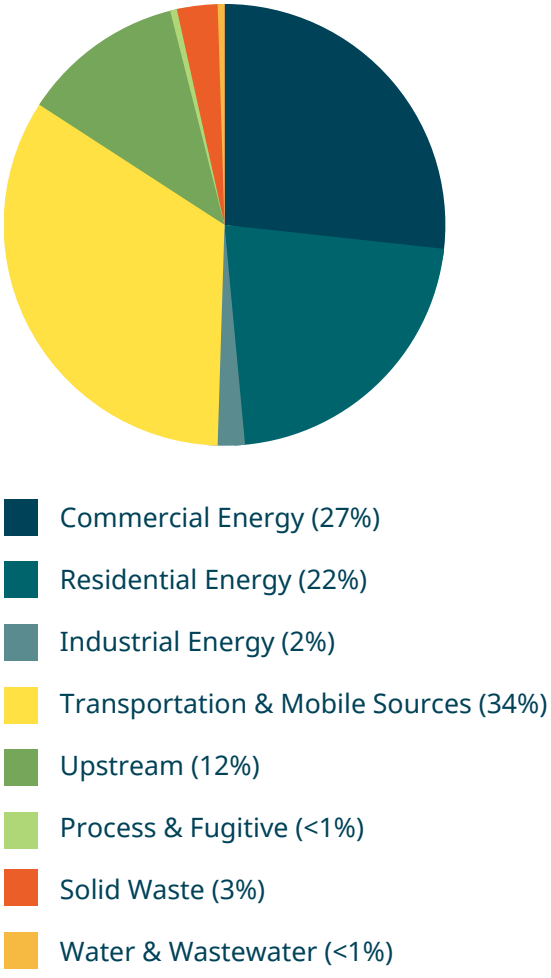

Figure 1: Community-Wide Emissions by Sector

Introduction to Climate Change

Naturally occurring gases dispersed in the atmosphere determine the Earth's climate by trapping solar radiation. This phenomenon is known as the greenhouse effect. Overwhelming evidence shows that human activities are increasing the concentration of greenhouse gases and changing the global climate. The most significant contributor is burning fossil fuels for transportation, electricity generation and other purposes, which introduces large amounts of carbon dioxide and other greenhouse gases into the atmosphere.

Collectively, these gases intensify the natural greenhouse effect, causing global average surface and lower atmospheric temperatures to rise, threatening the safety, quality of life, and economic prosperity of global communities. Although the natural greenhouse effect is needed to keep the earth warm, a human-enhanced greenhouse effect with the rapid accumulation of GHG in the atmosphere leads to too much heat and radiation being trapped. The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report confirms that human activities have unequivocally caused an increase in carbon emissions [1]. Many regions are already experiencing the consequences of global climate change, and Olympia is no exception.

[1] IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [MassonDelmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press.

Climate change—which manifests through both extreme events and gradual shifts in prevailing conditions—is already having profound impacts on the natural environment, built assets, and quality of life in the Pacific Northwest. In the City of Olympia, we are already experiencing climate impacts such as rising temperatures, extreme heat, and more frequent flooding of the downtown area due to sea level rise. Other climate impacts include a growing risk of wildfires and exposure to wildfire smoke. These hazards threaten many sectors within Olympia, including tourism, recreation, the economy, public health, and the surrounding natural environment.

For example, in the coming decades, sea level rise and increased precipitation intensity is expected to cause significant flooding in downtown Olympia, impacting businesses and critical public infrastructure and services. Seasonal flooding, combined with subsidence of the City from its location atop fill, make Olympia particularly susceptible to the impacts of sea level rise. Rising temperatures, extreme heat, and exposure to wildfire smoke also present a significant risk to public health, particularly for vulnerable populations; and contribute to increased summer drought stress, impacting regional agriculture and ecosystems.

Many communities in the United States have started to take responsibility for addressing climate change at the local level. Reducing fossil fuel use in the community can have many benefits in addition to reducing greenhouse gas emissions. More efficient use of energy decreases utility and transportation costs for residents and businesses. Retrofitting homes and businesses to be more efficient creates local jobs. In addition, when residents save on energy costs, they are more likely to spend at local businesses and add to the local economy. Reducing fossil fuel use improves air quality, and increasing opportunities for walking and bicycling improves residents' health.

Greenhouse Gas Inventory as a Step Toward Carbon Neutrality

Facing the climate crisis requires the concerted efforts of local governments and their partners, those that are close to the communities directly dealing with the impacts of climate change.

Cities, towns and counties are well placed to define coherent and inclusive plans that address integrated climate action — climate change adaptation, resilience and mitigation. Existing targets and plans need to be reviewed to bring in the necessary level of ambition and outline how to achieve net-zero emissions by 2050 at the latest. Creating a roadmap for climate neutrality requires Olympia to identify priority sectors for action, while considering climate justice, inclusiveness, local job creation and other benefits of sustainable development.

To complete this inventory, Olympia utilized tools and guidelines from ICLEI - Local Governments for Sustainability (ICLEI), which provides authoritative direction for greenhouse gas emissions accounting and defines climate neutrality as follows:

> The targeted reduction of greenhouse gas (GHG) emissions and GHG avoidance in government operations and across the community in all sectors to an absolute net-zero emission level by 2050 at the latest. In parallel to this, it is critical to adapt to climate change and enhance climate resilience across all sectors, in all systems and processes.

To achieve ambitious emissions reduction, and move toward climate neutrality, Olympia has adopted 2030 and 2040 science-based targets (SBTs), as well as a regional climate mitigation plan. The Thurston Climate Mitigation Plan provides a regional framework to significantly reduce local greenhouse gas emissions, and Olympia is currently in the process of identifying city-specific targets to achieve the the City's climate goals. Climate action is an opportunity for our community to experience a wide range of co-benefits, such as creating socio-economic opportunities, reducing poverty and inequality, and improving the health of people and nature.

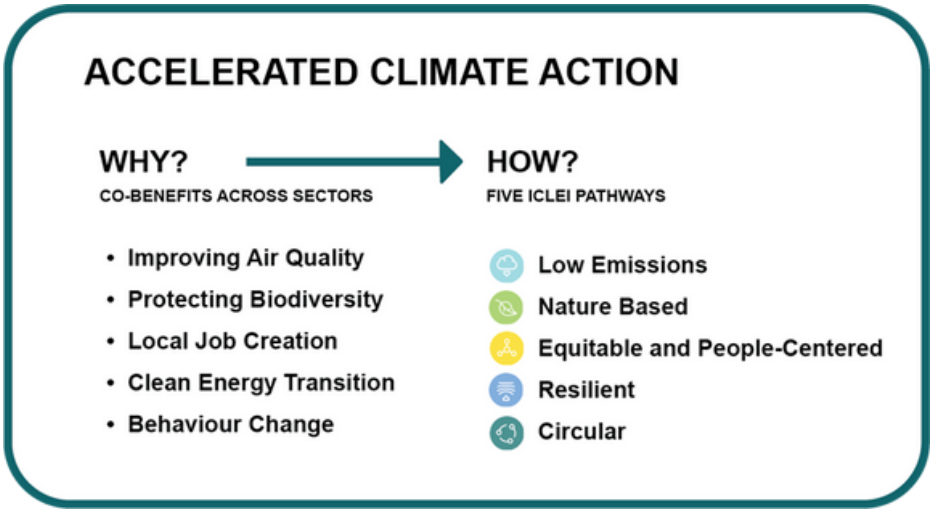

Figure 2: Co-Benefits and ICLEI Pathways to Accelerated Climate Action

ICLEI Climate Mitigation Milestones

In response to the climate emergency, many communities in the United States are taking responsibility for addressing emissions at the local level. Since many of the major sources of greenhouse gas emissions are directly or indirectly controlled through local policies, local governments have a strong role to play in reducing greenhouse gas emissions within their boundaries, as well as influencing regional emissions through partnerships and advocacy. Through proactive measures around land use patterns, transportation demand management, energy efficiency, green building, waste diversion, and more, local governments can dramatically reduce emissions in their communities. In addition, local governments are primarily responsible for the provision of emergency services and the mitigation of natural disaster impacts.

ICLEI provides a framework and methodology for local governments to identify and reduce greenhouse gas emissions, organized along with Five Milestones, also shown in Figure 2:

1. Conduct an inventory and forecast of local greenhouse gas emissions;
2. Establish a greenhouse gas emissions Science-Based Target [3];
3. Develop a climate action plan for achieving the emissions reduction target;
4. Implement the climate action plan; and,
5. Monitor and report on progress.

This report represents the completion of ICLEI's Climate Mitigation Milestone Five, and provides a foundation for continued work to reduce greenhouse gas emissions in Olympia.

Figure 3: ICLEI Climate Mitigation Milestones

[3] Science-Based Targets are calculated climate goals, in line with the latest climate science, that represent your community's fair share of the ambition necessary to meet the Paris Agreement commitment of keeping warming below 1.5°C. To achieve this goal, the Intergovernmental Panel on Climate Change (IPCC) states that we must reduce global emissions by 50% by 2030 and achieve climate neutrality by 2050. Equitably reducing global emissions by 50% requires that high-emitting, wealthy nations reduce their emissions by more than 50%.

Inventory Methodology

Understanding a Greenhouse Gas Emissions Inventory

The first step toward achieving tangible greenhouse gas (GHG) emission reductions requires identifying baseline emissions levels and sources and activities generating emissions in the community. This report presents emissions from the Olympia community as a whole. A government operations inventory is mostly a subset of the community inventory, as shown in Figure 3. For example, data on commercial energy use by the community include energy consumed by municipal buildings, and community vehicle-miles-traveled estimates include miles driven by municipal fleet vehicles.

Figure 4: Relationship of Community and Government Operations Inventories

As local governments continue to join the climate protection movement, the need for a standardized approach to quantify GHG emissions has proven essential. This inventory uses the approach and methods provided by the U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions (Community Protocol), which is described below.

Three greenhouse gases are included in this inventory: carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O). Many of the charts in this report represent emissions in "carbon dioxide equivalent" (CO2e) values, calculated using the Global Warming Potentials (GWP) for methane and nitrous oxide from the IPCC 5th Assessment Report.

Table 1: Global Warming Potential Values (IPCC, 2014)

Greenhouse Gas	Global Warming Potential
Carbon Dioxide (CO2)	1
Methane (CH4)	28
Nitrous Oxide (N2O)	265

Community Emissions Protocol

Version 1.2 of the U.S. Community Protocol for Accounting and Reporting GHG Emissions [4] was released by ICLEI in 2019, and represents a national standard in guidance to help U.S. local governments develop effective community GHG emissions inventories. It establishes reporting requirements for all community GHG emissions inventories, provides detailed accounting guidance for quantifying GHG emissions associated with a range of emission sources and community activities, and provides a number of optional reporting frameworks to help local governments customize their community GHG emissions inventory reports based on their local goals and capacities.

The community inventory in this report includes emissions from the five Basic Emissions Generating Activities required by the Community Protocol. These activities are:

- Use of electricity by the community
- Use of fuel in residential and commercial stationary combustion equipment
- On-road passenger and freight motor vehicle travel
- Use of energy in potable water and wastewater treatment and distribution
- Generation of solid waste by the community

The community inventory also includes the following activities:

- Upstream impacts of electricity and fuels
- Process and fugitive emissions from natural gas distribution

Quantifying Greenhouse Gas Emissions

Sources and Activities

Communities contribute to greenhouse gas emissions in many ways. Two central categorizations of emissions are used in the community inventory: 1) GHG emissions that are produced by "sources" located within the community boundary, and 2) GHG emissions produced as a consequence of community "activities."

Table 2: Source vs. Activity for Greenhouse Gas Emissions (GHG)

Source	Activity
Any physical process inside the jurisdictional boundary that releases GHG emissions into the atmosphere.	The use of energy, materials, and/or services by members of the community that result in the creation of GHG emissions.

[4] ICLEI. 2012. US Community Protocol for Accounting and Reporting Greenhouse Gas Emissions. Retrieved from http://www.icleiusa.org/tools/ghg-protocol/community-protocol

By reporting on both GHG emissions sources and activities, local governments can develop and promote a deeper understanding of GHG emissions associated with their communities. A purely source-based emissions inventory could be summed to estimate total emissions released within the community's jurisdictional boundary. In contrast, a purely activity-based emissions inventory could provide perspective on the efficiency of the community, even when the associated emissions occur outside the jurisdictional boundary. The division of emissions into sources and activities replaces the scopes framework that is used in government operations inventories, but that does not have a clear definition for application to community inventories.

Base Year

The inventory process requires the selection of a base year with which to compare current emissions. Olympia community GHG emissions inventory utilizes 2019 as its baseline year because it is the most recent year for which the necessary data are available.

Quantification Methods

GHG emissions can be quantified in two ways:

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

Activity Data x Emission Factor = Emissions

Most emissions sources in this inventory are quantified using calculation-based methodologies. Activity data refer to the relevant measurement of energy use or other GHG-generating processes such as fuel consumption by fuel type, metered annual electricity consumption, and annual vehicle miles traveled. Please see the appendices for a detailed listing of the activity data used in composing this inventory.

Known emission factors are used to convert energy usage or other activity data into associated quantities of emissions. Emissions factors are usually expressed in terms of emissions per unit of activity data (e.g. lbs CO2/kWh of electricity). For this inventory, calculations were made using ICLEI's ClearPath Climate Planner tool.

Community Emissions Inventory Results

The total community-wide emissions for the 2021 inventory are shown in Table 3 and Figure 5.

Table 3: Community-Wide Emissions Inventory

Sector	Fuel or Source	2021 Usage	Usage Unit	2021 Emissions (Mt CO2e)
Residential Energy	Electricity	215,886,575	kWh	109,009
	Distillate Fuel Oil	16,228	MMBtu	45,906
	Propane	19,029	MMBtu	423
	Wood	47,318	MMBtu	1,266
	Natural Gas	8,095,718	Therms	613
Residential Energy Total				**133,869**
Commercial Energy	Electricity	323,493,011	kWh	131,789
	Natural Gas	6,787,806	MMBtu	36,102
Commercial Energy Total				**167,891**
Industrial Energy	Electricity	30,564,760	kWh	12,452
	Natural Gas	91,944	MMBtu	488
Industrial Energy Total				**12,940**
Transportation & Mobile Sources	Gasoline	374,444,458	VMT	149,332
	Diesel	38,780,455	VMT	55,640
	Public Transit	1,400,895	VMT	1,956
Transportation & Mobile Sources Total				**206,928**
Solid Waste	Waste Sent to Landfill	30,571	Tons	15,071
	Combustion of Landfill Gas	3,530,426,839	Cubic Feet	453
	Flaring of Landfill Gas	84,042,476	Cubic Feet	220
	Compost	6,393	Tons	901
Solid Waste Total				**16,645**
Water & Wastewater	Combustion of Digester Gas			8
	Flaring of Digester Gas			32
	N2O			102
	Methanol			122
Water & Wastewater Total				**264**

*Blank cells are a result of variability in the format of available data by sector and fuel or source type.

Table 3: Community-Wide Emissions Inventory (continued)

Sector	Fuel or Source	2021 Usage	Usage Unit	2021 Emissions (Mt CO2e)
Process and Fugitive	Natural Gas Distribution**	14,948,515	Therms	2,594
Process & Fugitive Emissions Total				**2,594**
Upstream Impacts***	Electric Power	599,011,508	kWh	45,241
	Natural Gas	1,494,851	MMBtu	18,119
	Residential Fuel Oil	16,228	MMBtu	218
	Propane	19,029	MMBtu	242
	Electricity Transmission and Distribution Losses	569,944,346	kWh	11,842
Upstream Impacts Total				**75,662**
Total Emissions				**616,793**

*Blank cells are a result of variability in the format of available data by sector and fuel or source type.

**Process & Fugitive emissions from Natural Gas Distribution accounts for leakage in local natural gas distribution systems.

***Upstream Impacts refers to GHG emissions that occur as part of the extraction and refining of fuels (e.g., direct releases of methane from coal mines).

Figure 5 shows the distribution of community-wide emissions by sector. Transportation is the largest contributor, followed by Residential & Commercial Energy.

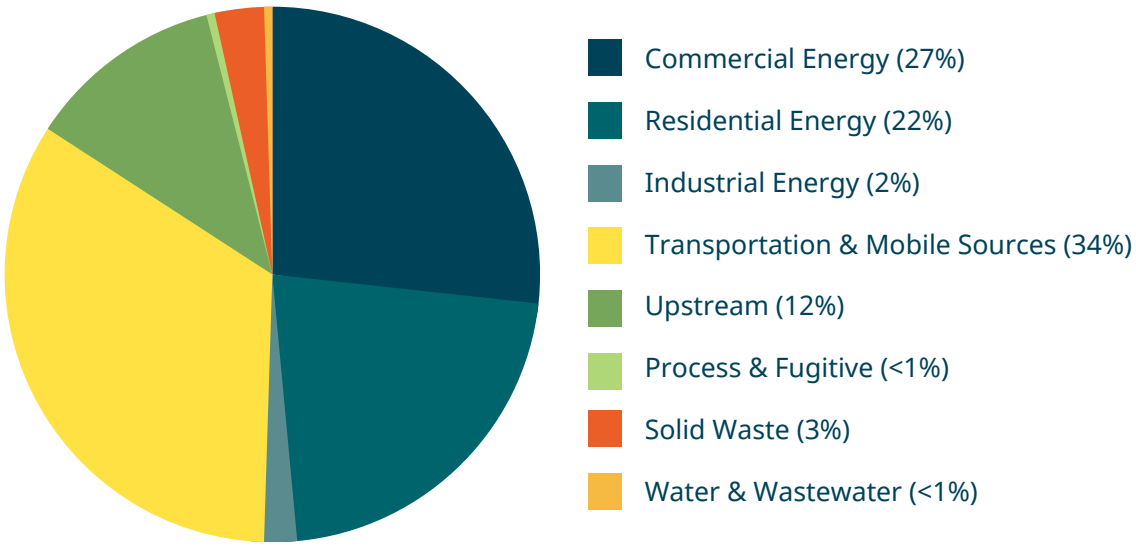

Figure 5: Community-Wide Emissions by Sector

Contribution Analysis

This report presents a contribution analysis of the 2019 and 2021 sector-based inventories, which explores the drivers of Olympia's emissions trends. The contribution analysis, conducted using a tool developed by ICLEI USA, quantifies the impacts of a select set of drivers (e.g., weather, population growth, and utility fuel mix) on GHG inventories across two years, assuming no changes to operational or organizational boundaries. The intention of the contribution analysis is to better explain what caused observed changes between inventory years.

What is Driving the Trends

ICLEI USA ran the contribution analysis on the City's GHG emission trends for 2019-2021. Although emissions increased due to population growth and hotter summers, overall emissions reductions were achieved by change in electricity fuel mix to cleaner fuels and decreased vehicle miles traveled (VMT) per person.

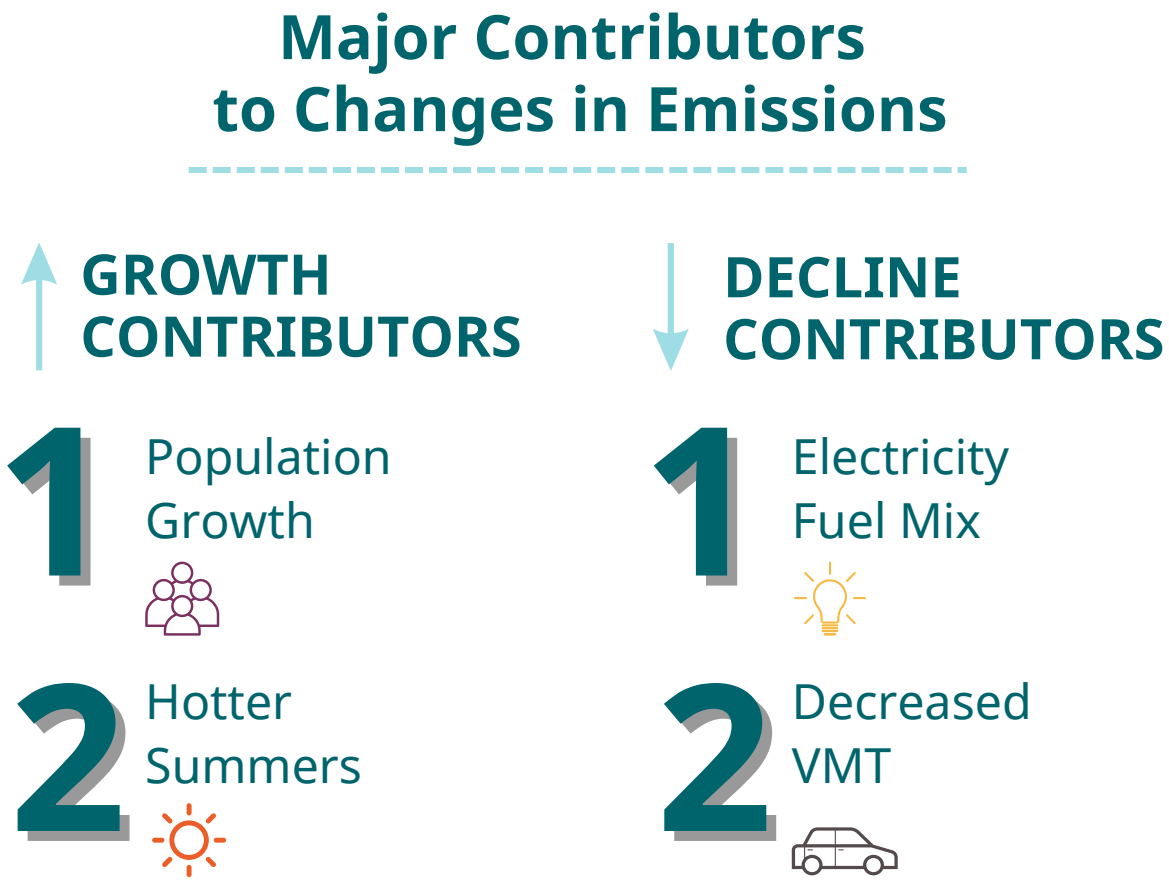

Figure 6: Major Contributors to Changes in Emissions

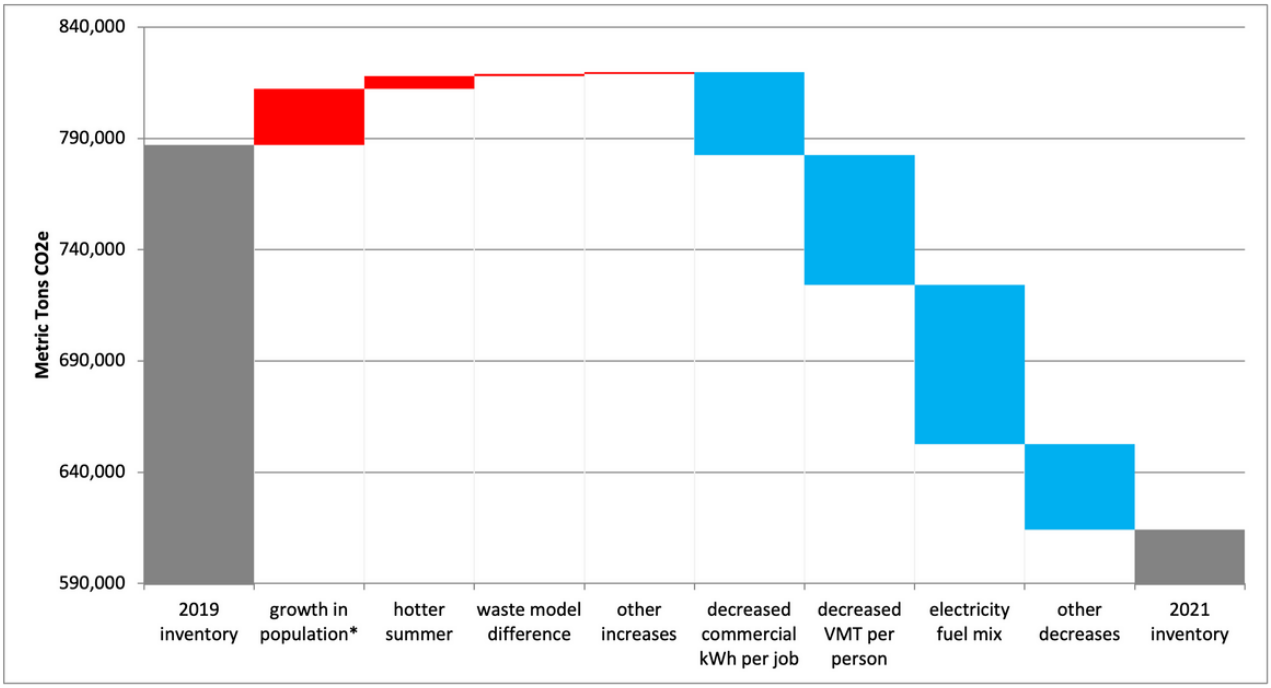

Figure 7: Contribution Analysis Largest Contributors
*includes effects of population on residential energy, VMT, and waste generation

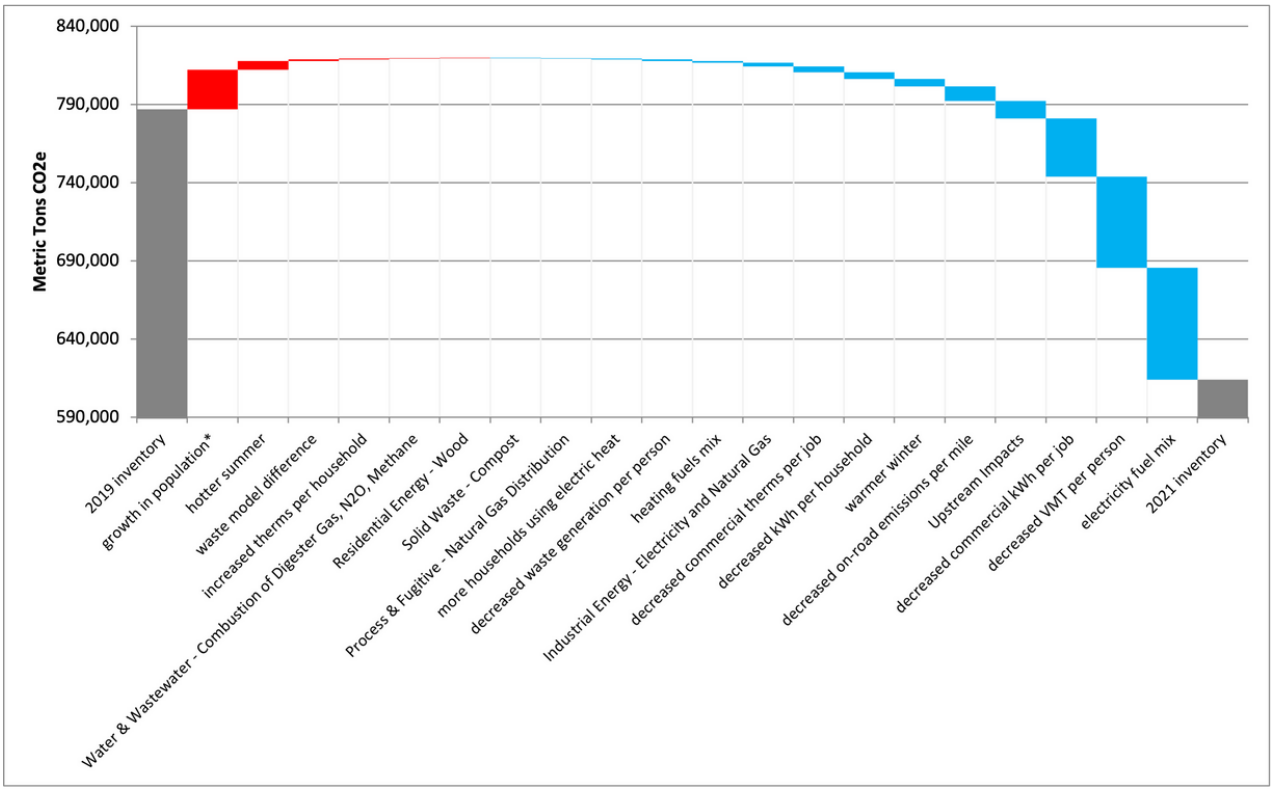

Figure 8: Contribution Analysis Detail Overview
*includes effects of population on residential energy, VMT and waste generation

Contribution Analysis Conclusion

The ability to track performance in a meaningful way is enabled by the generation of high-quality local data about emissions generating activities themselves, as well as several local conditions and contextual factors. Fully describing the built environment, transportation, and waste management systems with data enables communities to meaningfully track trends and formulate data-driven policy to create more sustainable communities. For Olympia, cleaner electricity fuel mix and decreasing VMT show the largest causes for decreases in overall community emissions while population growth and hotter summers lead to the highest increases in community emissions. In the future, annexations in Olympia may cause an increase in GHG emissions attributed to the City of Olympia by expanding the City's boundaries and increasing population. Developing programs to continue reducing emissions can have a significant impact on overall City emissions.

Next Steps

The inventory should be used to focus and prioritize actions to reduce emissions. Based on the inventory results, the following areas have the greatest potential for emissions reduction:

- Land use planning: Implement land use policies and plans that support increased urban density and efficient transportation networks.
  - Improve infrastructure to incentivize public transit usage, walking, and biking.
  - Work with Intercity Transit to maintain and improve public transportation options.
  - Vehicle electrification: Support the transition from internal combustion engine vehicles (passenger, transit fleets, municipal fleets, etc.) to electric-powered vehicles.
- Community electricity use
  - Increase distributed commercial and residential solar
  - Support state action to decarbonize the electric grid
  - Improve the energy efficiency of new and existing buildings
- Community stationary fuel use
  - Electrify buildings: Convert gas-powered appliances (e.g., space and water heaters) to electric
- Solid Waste
  - Improve recycling and composting programs to reduce organic waste content in waste streams
  - Transition the economy from linear to circular with a focus on reducing material consumption and increasing material reuse

Completion of another GHG inventory in two to five years is recommended to assess progress resulting from any actions implemented. Staff capacity and funding availability will need to be taken into consideration when deciding how often to produce inventories. A USCP Dash Emissions Profile may also be completed in interim years when a full inventory will not be completed. The Dash Emissions Profile includes community-wide greenhouse gas (GHG) emissions from energy use in buildings and from on-road transportation, which together typically represent at least 80% of emissions in a US Community Protocol Standard inventory for communities in the US. The detailed methodology section of this report, as well as notes and attached data files in the ClearPath Climate Planner tool and a master data Excel file provided to the Olympia, will be helpful to complete future inventories consistent with this one.

Conclusion

Completion of the Five ICLEI Climate Mitigation Milestones is an iterative process. It is important for local governments to regularly inventory greenhouse gas emissions, monitor/evaluate progress, and refine climate action targets and strategies. This inventory marks the completion of Milestone Five of the Five ICLEI Climate Mitigation Milestones. The next steps are to forecast emissions, review emissions-reduction targets, and build upon the existing Thurston Climate Mitigation Plan with a more robust local framework that identifies specific quantified strategies that can cumulatively meet those targets.

The Intergovernmental Panel on Climate Change (IPCC) states that to meet the Paris Agreement commitment of keeping warming below 1.5°C we must reduce global emissions by 50% by 2030 and reach climate neutrality by 2050. Equitably reducing global emissions by 50% requires that high-emitting, wealthy nations reduce their emissions by more than 50%. More than ever, it is imperative that countries, regions, and local governments set targets that are ambitious enough to slash carbon emissions between now and mid-century.

Science-Based Targets are climate goals in line with the latest climate science. They represent the City's fair share of the ambition necessary to meet the Paris Agreement commitment to keep warming below 1.5°C. Community education, involvement, and partnerships will be instrumental to achieve a science-based target.

To support the bold climate action of Olympia, ICLEI calculated the City's 2030 Science-Based Targets [10] based on the 2019 inventory:

- **Per-Capita SBT: 62.8%**
- **Absolute SBT: 59.0%**

To meet and exceed our science-based target, Olympia has officially committed to reducing emissions to zero by 2030 through ICLEI's Race to Zero campaign.

In addition, Olympia will continue to track key energy use and emissions indicators on an on-going basis. It is recommended that communities update their inventories on a regular basis, especially as plans are implemented to ensure measurement and verification of impacts. Regular inventories also allow for "rolling averages" to provide insight into sustained changes and can help reduce the chance of an anomalous year being incorrectly interpreted. This inventory shows that community-wide transportation patterns as well as residential and commercial energy will be particularly important to focus on. Through these efforts and others, Olympia can achieve environmental, economic, and social benefits beyond reducing emissions.

[10] "Science Based Climate Targets: A Guide for Cities." Science Based Targets Network, November 4, 2021. https://sciencebasedtargetsnetwork.org/.
[11] Usa, Iclei. "Race to Zero." ICLEI USA, April 7, 2021. https://icleiusa.org/race-to-zero/.

Appendix: Methodology Details

Energy

Table 4: Energy Data Sources

Activity	Data Source	Data Gaps/Assumptions
Residential Fuel Oil Consumption	U.S. Energy Information Administration	Estimated using EIA and census bureau data.
Residential Propane Consumption	U.S. Energy Information Administration	Estimated using EIA and census bureau data.
Residential Wood Consumption	U.S. Energy Information Administration	Estimated using EIA and census bureau data.
Residential, Commercial, and Industrial Electricity Consumption	Puget Sound Energy	No data gaps or assumptions identified.
Residential, Commercial, and Industrial Natural Gas Consumption	Puget Sound Energy	No data gaps or assumptions identified.
LOTT Natural Gas Usage	Measured Usage - PSE - County data for the City of Olympia	No data gaps or assumptions identified.

Table 5: Puget Sound Energy (2021) Emissions Factors for Electricity Consumption

Emissions Factor/ Year	CO2 (lbs./MWh)	CH4 (lbs./GWh)	N2O (lbs./GWh)	Data Gaps and Assumptions
Puget Sound Energy 2021	894	63	9	No data gaps or assumptions identified.

Transportation

Table 6: Transportation Data Sources

Activity	Data Source	Data Gaps/Assumptions
On-Road Gasoline and Diesel Consumption	Google Environmental Insights Explorer	No data gaps or assumptions identified.
Public Transit	InterCity Transit	Data from InterCity Transit was downscaled from total service population to Olympia's population.

For vehicle transportation, it is necessary to apply average miles per gallon and emissions factors for CH4 and N2O to each vehicle type. The factors used are shown in Table 8.

Table 7: MPG and Emissions Factors by Vehicle Type

Fuel	Vehicle Type	MPG	CH4 (g/mile)	N2O (g/mile)
Gasoline	Passenger car	25.30	0.0084	0.0069
Gasoline	Light truck	18.20	0.012	0.0087
Gasoline	Heavy truck	5.38	0.072	0.061
Gasoline	Para Transit Bus	18.20	0.01170	0.0087
Gasoline	Motorcycle	44.00	0.00840	0.0069
Diesel	Passenger car	25.30	0.00050	0.0010
Diesel	Transit Bus	18.20	0.00100	0.0015
Diesel	Light truck	18.20	0.0010	0.0015
Diesel	Heavy truck	6.56	0.0051	0.0048

Wastewater

Table 8: Wastewater Data Sources

Activity	Data Source	Data Gaps/Assumptions
Combustion of Digester Gas	LOTT Clean Water Alliance	No data gaps or assumptions identified.
Flaring of Digester Gas	LOTT Clean Water Alliance	No data gaps or assumptions identified.
N2O	LOTT Clean Water Alliance	No data gaps or assumptions identified.
Methanol	LOTT Clean Water Alliance	No data gaps or assumptions identified.

Solid Waste

Table 9: Solid Waste Data Sources

Activity	Data Source	Data Gaps/Assumptions
Waste Sent to Landfill	Olympia Public Works Waste ReSources	The most recent available data for waste characterization was from 2014 and does not include waste collected by private haulers.
Combustion of Landfill Gas	Roosevelt Regional Landfill	Data does not include waste collected by private haulers.
Flaring of Landfill Gas	Roosevelt Regional Landfill	Data does not include waste collected by private haulers.
Compost	Olympia Public Works Waste ReSources	Total tonnage of compost included yard and food waste and does not include waste collected by private haulers.

Table 10: 2014 Olympia Waste Composition

2014 Olympia Waste Composition	Percentage
Mixed MSW	26.5
Newspaper	0.8
Office Paper	5.7
Corrugated Cardboard	3.6
Magazines / Third Class Mail	0.5
Food Scraps	19.8
Grass	0.67
Leaves	0.67
Branches	0.67
Dimensinoal Lumber	6.5

Fugitive Emissions

Table 11: Fugitive Emissions Data Sources

Activity	Data Source	Data Gaps/Assumptions
Fugitive Emissions from Natural Gas Distribution	Puget Sound Energy	No data gaps or assumptions identified.

Upstream Impacts

Table 12: Upstream Data Sources

Activity	Data Source	Data Gaps/Assumptions
Electric Power	Puget Sound Energy	Calculations from US Community Protocol section BE.5.
Electricity Transmission and Distribution Losses	Puget Sound Energy	5.1% grid loss factor.
Natural Gas	Puget Sound Energy	Calculated following US Community Protocol section BE.5.
Fuel Oil Upstream Impacts	U.S. Energy Information Administration	Calculated following US Community Protocol section BE.5.
Propane Upstream Impacts	U.S. Energy Information Administration	Calculated following US Community Protocol section BE.5.

Inventory Calculations

The 2021 inventory was calculated following the US Community Protocol and ICLEI's ClearPath Climate Planner Climate Planner software. As discussed in Inventory Methodology, the IPCC 5th Assessment was used for global warming potential (GWP) values to convert methane and nitrous oxide to CO2 equivalent units. ClearPath Climate Planner's inventory calculators allow for input of the sector activity (i.e. kWh or VMT) and emission factor to calculate the final carbon dioxide equivalent (CO2e) emissions.

Contribution Analysis

The contribution analysis was calculated using Olympia's 2019 and 2021 community-wide GHG inventories and following the Greenhouse Gas Emissions Inventory Contribution Analysis Toolkit Guide and associated Excel-based tool.

Table 13: Contribution Analysis Data Sources

Data	Description	Source
Population	Jurisdiction population for each inventory year	United States Census Bureau
Households	Total number of households in jurisdiction for each inventory year	United States Census Bureau
Households using propane and heating oil	Number of households in Olympia using propane and oil for heating for each inventory year.	United States Census Bureau
Commercial indicator	Total primary jobs in Olympia. Note that 2020 was the most recent year with available data; therefore, 2019 data was used for 2021 total primary jobs due to the potential impacts of COVID-19 on employment rates in 2020.	United States Census Bureau OnTheMap tool
Residential natural gas customers	Number of residential natural gas customers in each inventory year	Puget Sound Energy
Monthly electricity and natural gas usage	Monthly aggregate commercial and residential electricity usage and number of customers between 2013 and 2016 (for analysis, time period does not need to include inventory years).	Data was unavailable from Puget Sound Energy for Olympia at the time of analysis. This data was obtained from King County's 2017 contribution analysis and used as a proxy.
Daily average or high and low temperature	Daily temperatures from Olympia Airport, Washington between 2013 and 2021.	National Oceanic and Atmospheric Administration's Climate Data Online