



CITY OF WENATCHEE

Community Greenhouse Gas Inventory

Calendar Year 2023

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This City of Wenatchee community greenhouse gas inventory was conducted by Parametrix. Grace Thirkill, Claudia Denton, and Suzy Godber of Parametrix provided data-gathering assistance and facilitated the use of Climate Metrix, a proprietary greenhouse gas inventory tool, to conduct the analysis. They are the primary authors of this report.

Data Collection

Also, a special thank you to additional staff and agencies providing data and guidance, including Chelan Public Utility District No.1 (PUD), Cascade Natural Gas, Chelan County, and Link transit.

Executive Summary

The Our Valley Our Future Post-Carbon Economy Initiative, led by the community-based organization Our Valley Our Future (OVOF), aims to help the Wenatchee Valley transition to a sustainable, low-carbon economy by reducing emissions, supporting renewable energy, and building climate resilience. This Greenhouse Gas (GHG) Inventory Report represents a collaborative endeavor between Sustainable NCW, the City of Wenatchee, and OVOF. It serves as a foundational assessment of our community's current emissions profile, providing critical data to inform policy decisions and sustainability initiatives. By identifying key sources of emissions and tracking progress over time, this report aims to guide our collective efforts in reducing our carbon footprint and advancing toward a more sustainable, resilient future.

This inventory follows the internationally recognized Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories (GPC) and accounts for all significant sources of GHG emissions from activities taking place within the City of Wenatchee's geographic boundary (local emissions). Beyond protocol requirements, the inventory also measures consumption-based emissions from imported goods and food, fuel, and air travel (imported emissions) because they are based on consumption and they are significant. Wenatchee's total 2023 emissions are summarized on the following page in Figure 1.

Definition: MT CO₂e

Metric tons of carbon dioxide equivalent (MT CO₂e) is a unit of measure. Most GHGs are more potent than carbon dioxide in warming the atmosphere. To calculate and compare emissions easily, all gases are calculated and combined into a carbon dioxide equivalent, typically measured in metric tons. This is the unit of measure all GHG emissions are reported in for this inventory.

Summary of Findings

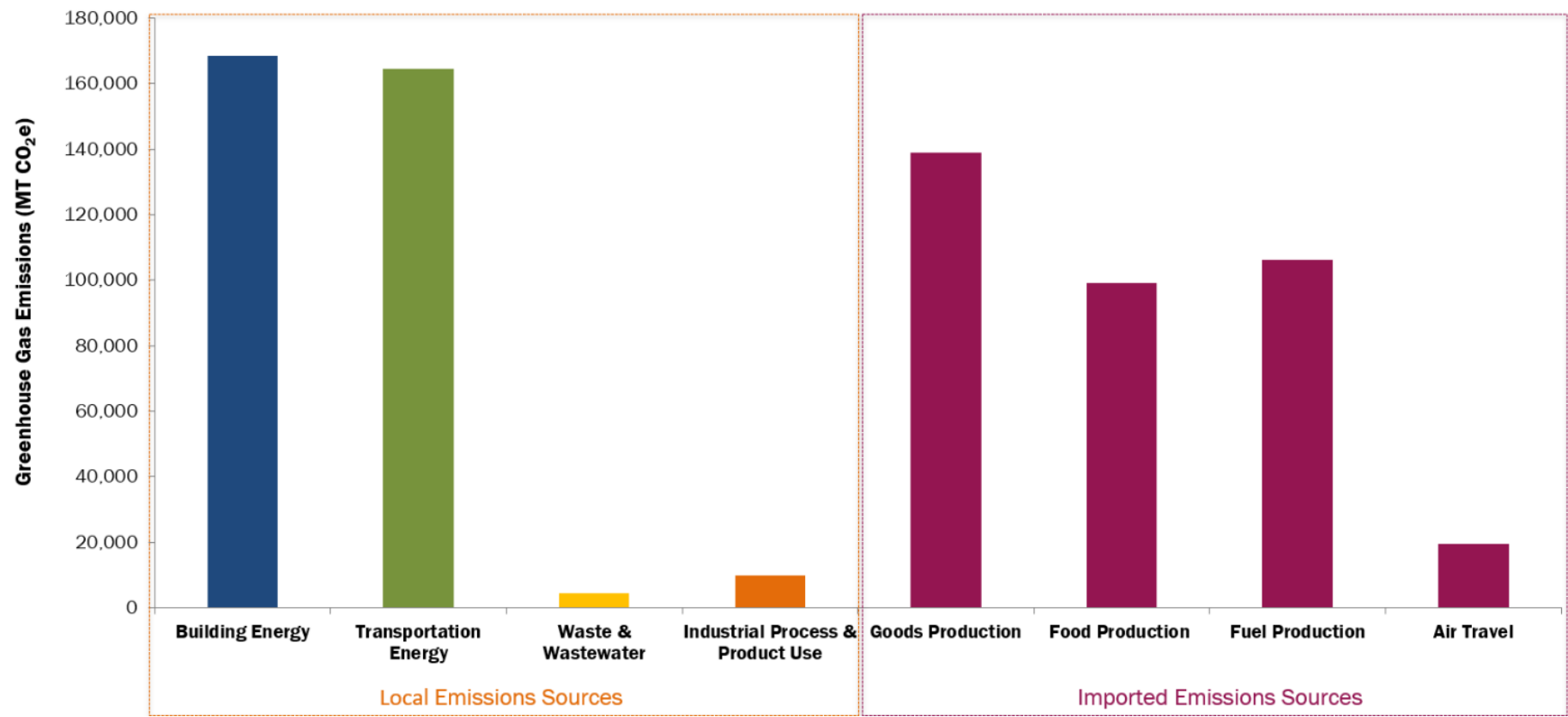
City of Wenatchee 2023 Community GHG Emissions

With a population of 35,526, all 2023 GHG emissions combined (local and imported) for City of Wenatchee totaled **712,286 MT CO₂e**

20
MT CO₂e
Per Capita

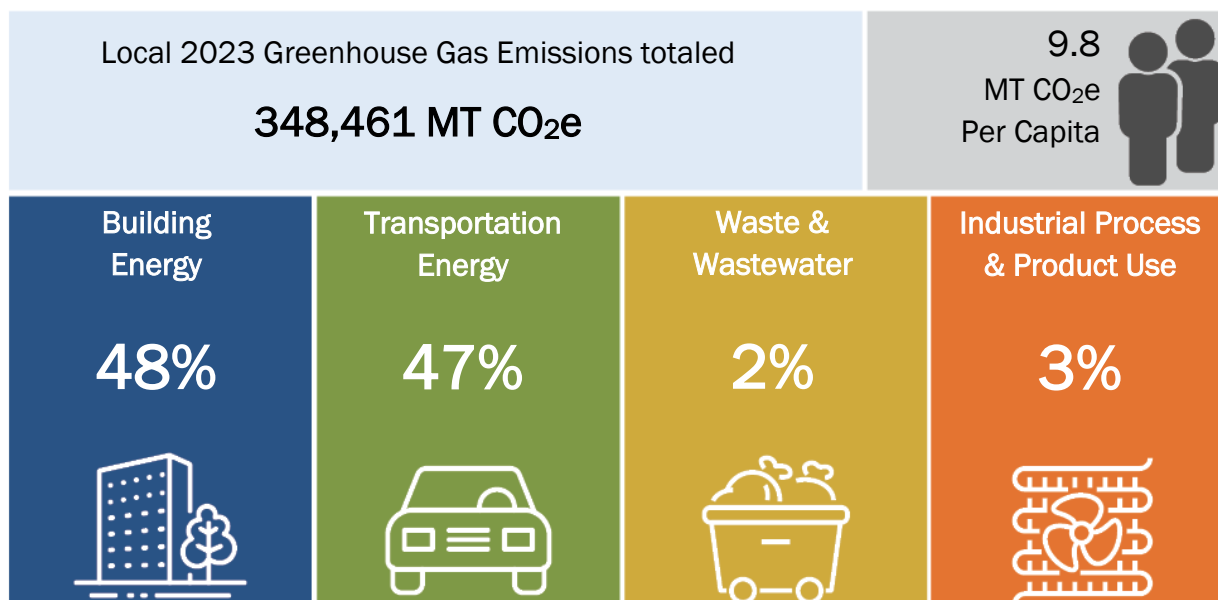


Figure 1: Wenatchee's 2023 Emissions



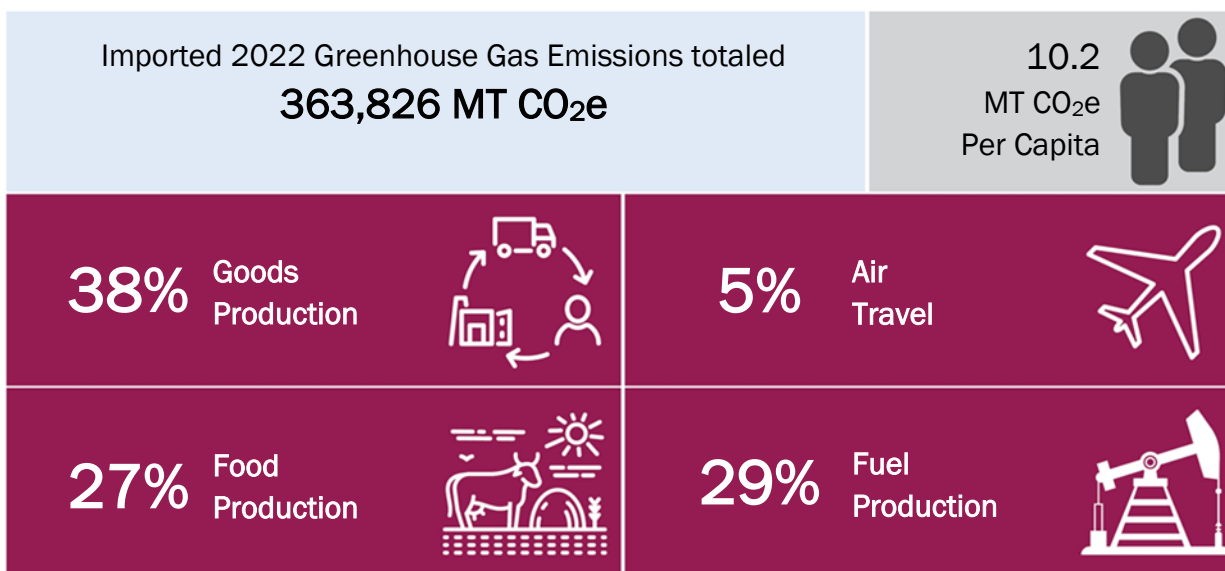
Local Emissions

Local emissions include emissions from activities occurring within Wenatchee's geographic boundary and include building energy, transportation energy, industrial process & product use, and waste & wastewater.



Imported Emissions

Imported emissions include emissions generated outside of the community during the production of goods, food, fuel, and service products consumed by Wenatchee residents and include the activities listed below.



Introduction

Wenatchee's community GHG inventory estimates the GHG emissions associated with the geographic boundaries of the city. This report represents Wenatchee's carbon footprint, and it provides a baseline for future GHG emissions tracking. This inventory can be used to better understand how different sectors impact emissions. The inventory will help provide context to evaluate future mitigation strategies and to inform further investment in community-level climate mitigation work and regional efforts with public agencies, utilities, nonprofit partners, and the business community.

Wenatchee's community GHG inventory includes the following emissions sources:

Building Energy: Energy usage in residential, commercial, and industrial buildings is a major source of GHG emissions for most communities. These emissions result from the combustion of natural gas and the generation of electricity from fossil fuels to heat water and power buildings. Small quantities of other combusted fuels are also included. Additionally, this inventory includes an estimate of natural gas lost during local distribution which releases methane, a potent greenhouse gas pollutant.

Transportation: This category includes emissions from gasoline, diesel, electricity used by passenger vehicles, rail, and transit.

Waste & Wastewater: Landfilling organic matter (such as food scraps and paper) produces methane, a potent greenhouse gas. The treatment of wastewater also produces GHG emissions from nitrous oxide and methane generation.

Industrial Process & Product Use (refrigerants): Refrigerant emissions come from transportation and building cooling systems such as air conditioners and refrigerators. Refrigerants are powerful global warming gases. Therefore, relatively small losses have a large climate impact.

Imported Emissions: These emissions are generated outside of the community during the production of goods, food, fuels, and service products consumed by residents. Imported emissions are also known as consumption-based emissions.

Inventory Results

The following section details the results of the GHG inventory for the Wenatchee community for 2023. These emissions include both **local** and **imported** emissions. Further details on emissions by each sector are also provided. All emissions are reported in metric tons carbon dioxide equivalent (MT CO₂e). *A detailed table of emissions figures and methodology are provided in Appendix A and Appendix B.*

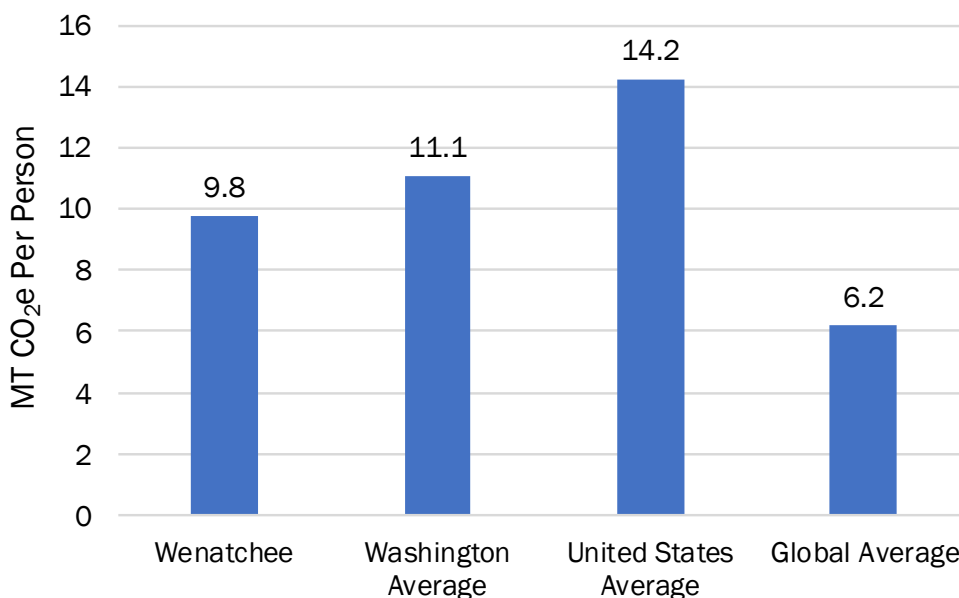
Local Emissions

Protocols refer to **local emissions** as sector-based emissions that are generated from local sources within the community, such as vehicles and buildings. These emissions are generated close to home and are most often under the community's **direct control**. The Wenatchee community generated 348,461 MT CO₂e of local emissions which averages about 9.8 MT CO₂e per resident.

Average Per Capita Comparison

Compared to global and state of Washington per capita emissions averages, the 9.8 MT CO₂e per person is slightly lower than the Washington state average of 11.1 MT CO₂e per person and considerably lower than the U.S. average of 14.2 MT CO₂e and is considerably higher than the global average of 6.2 MT CO₂e per person (Figure 2).¹

Figure 2: Comparison of Per Capita Emissions



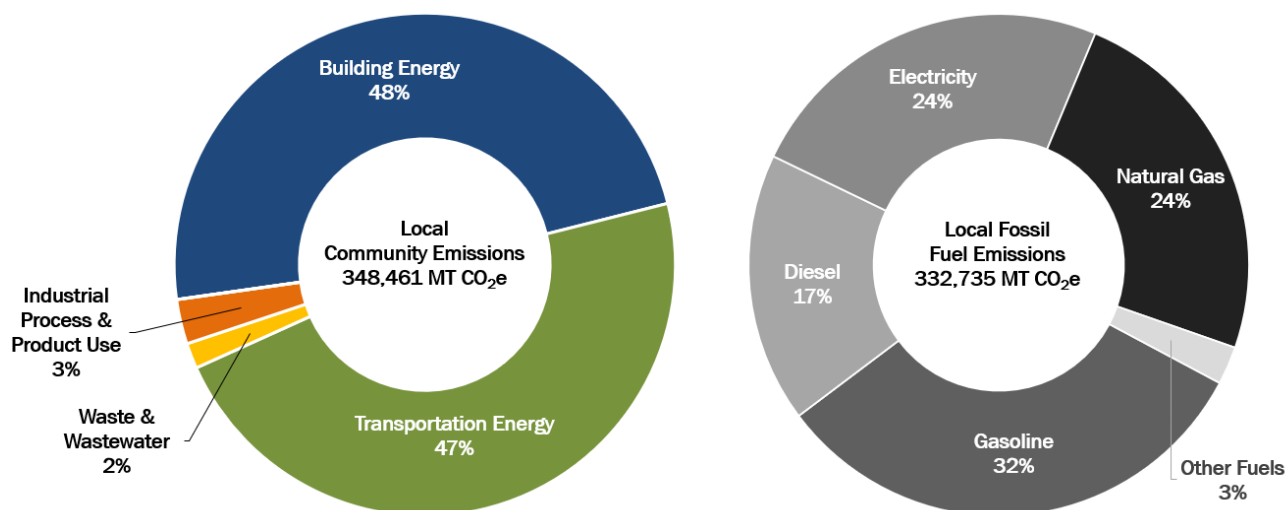
¹ Data from World Bank. For details, visit <https://data.worldbank.org/indicator/EN.ATM.CO2E.PC>.

Local Emissions by Sector and Fossil Fuel Type

Wenatchee's local emissions are shown on the left side of Figure 3 (below) and primarily come from **building energy** and **transportation**. The right side of Figure 3 details fossil fuel use. Note that almost all emissions from buildings and transportation are from fossil fuels (95% of local emissions). However, not all building or transportation energy sources contribute to emissions. Electricity generated from zero-carbon sources, such as hydropower, does not contribute to the city's emissions; biogenic fuels, such as renewable diesel and biodiesel, contribute minimal emissions.

Industrial process & product use and **waste & wastewater** sources produce non-energy emissions. These emissions include, but are not limited to, greenhouse gases from waste processing and water treatment, such as methane, as well as high-global warming potential (GWP) gases – such as refrigerants. The emissions from these non-fossil sources are further discussed in the corresponding sector sections.

Figure 3: 2023 Local Community Emissions and Fossil Fuel Emissions Details



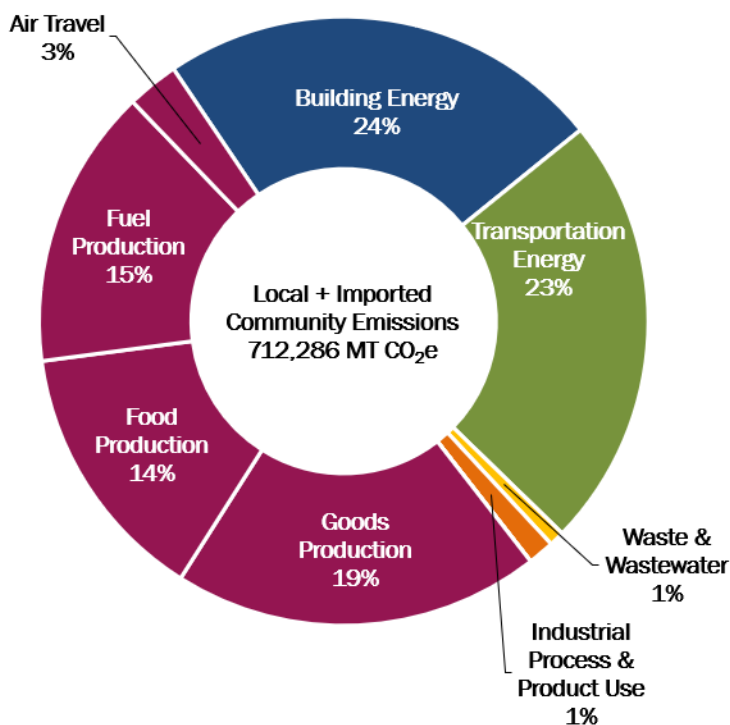
Imported Emissions

In addition to accounting for local emissions, the inventory also estimates **imported (consumption-based) emissions**, which are generated outside of Wenatchee to produce and provide the imported goods, food, air travel, and production and transport of fuels consumed by local households. Imported emissions total 363,826 MT CO₂e, about 10.2 MT CO₂e per capita, in addition to sources of local emissions. Imported emissions are referred to as “Other Scope 3” in GCP protocol. While reporting these emissions is typically optional due to measurement challenges, they are included here because the data exists to estimate them, they represent significant sources of emissions, and opportunity exists to reduce them.

Figure 4 compares the scale of local, sector-based emissions to imported emissions from household consumption. Within **goods**, the largest purchasing categories include other manufactured goods (includes medical supplies and medicine, personal care and cleaning, toys, recreation, paper, office supplies, etc.), building materials, and clothing. Within **food**, the largest emissions are from the production of meats, particularly beef products.

Upstream emissions from **fuel production** (gasoline, diesel, electricity, and natural gas) and **air travel** from flights taken by residents (regardless of airport location) are also significant sources of imported emissions.

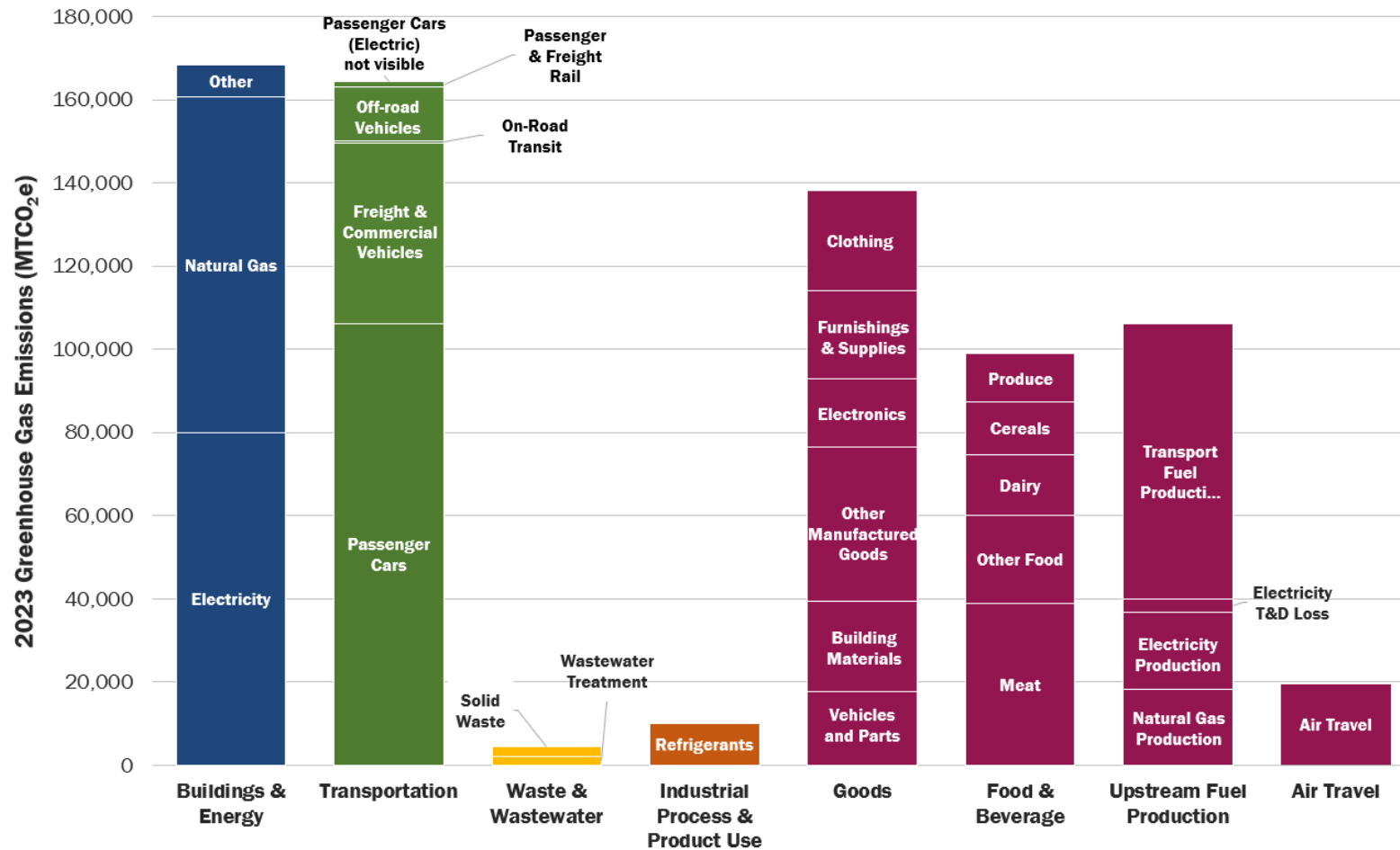
Figure 4: 2023 Emissions with Consumption



Total Emissions

Local and imported emissions combine for a total of **712,286 MT CO₂e** (shown below in Figure 5), or **20 MT CO₂e per resident**.

Figure 5: Full Breakdown of Wenatchee's 2023 Emissions Sources

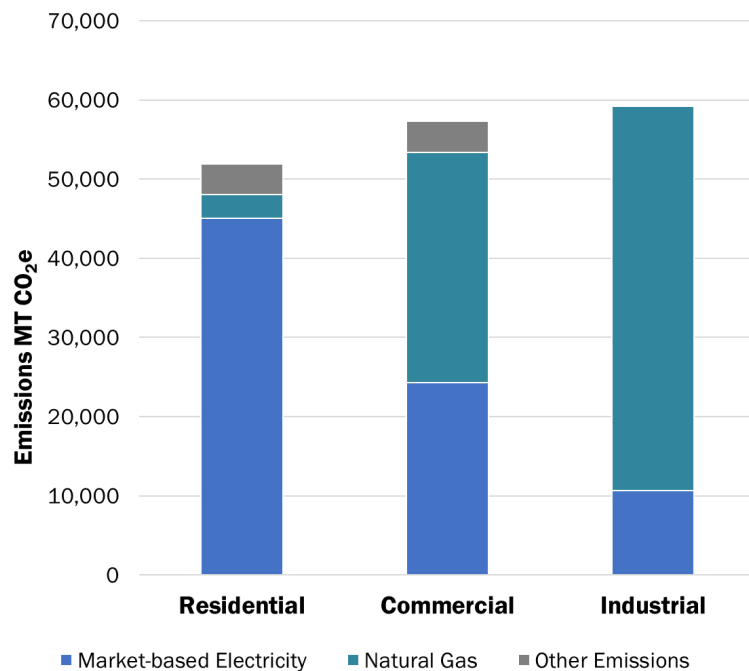


Inventory Highlights

Building Energy

Energy used in buildings is Wenatchee's largest source of local GHG emissions, accounting for 48% of local emissions. These emissions come from a mix of electricity, natural gas use, and other stationary combusted fuels, and they result in 168,324 MT CO₂e.² The market-based electricity accounting method uses utility-specific factors and accounts for the use of renewable energy, i.e. hydropower, in the community as well as voluntary community participation in utility-sponsored green power programs.

Figure 6: Building Energy Emissions by Source



By energy type, natural gas and electricity had the largest impact (both 48% of total building emissions). Although about 80% of electricity is sourced from hydropower from Chelan PUD, about 20% is from unspecified sources and those emissions are what are predominantly reflected below. Appendix B: Electricity Accounting section further discusses the use of market-based emissions factors. There is limited access to natural gas in the county, but natural gas has more emissions per unit of energy compared to electricity. Other fuels were a smaller source of emissions which include combustion of fuel oil and propane (4%). Figure 6 shows emissions by subsector and energy type. Fugitive natural gas escaping from local distribution systems was reported by Cascade Natural Gas and accounts for 0.4% of total building emissions and is included in natural gas emissions.

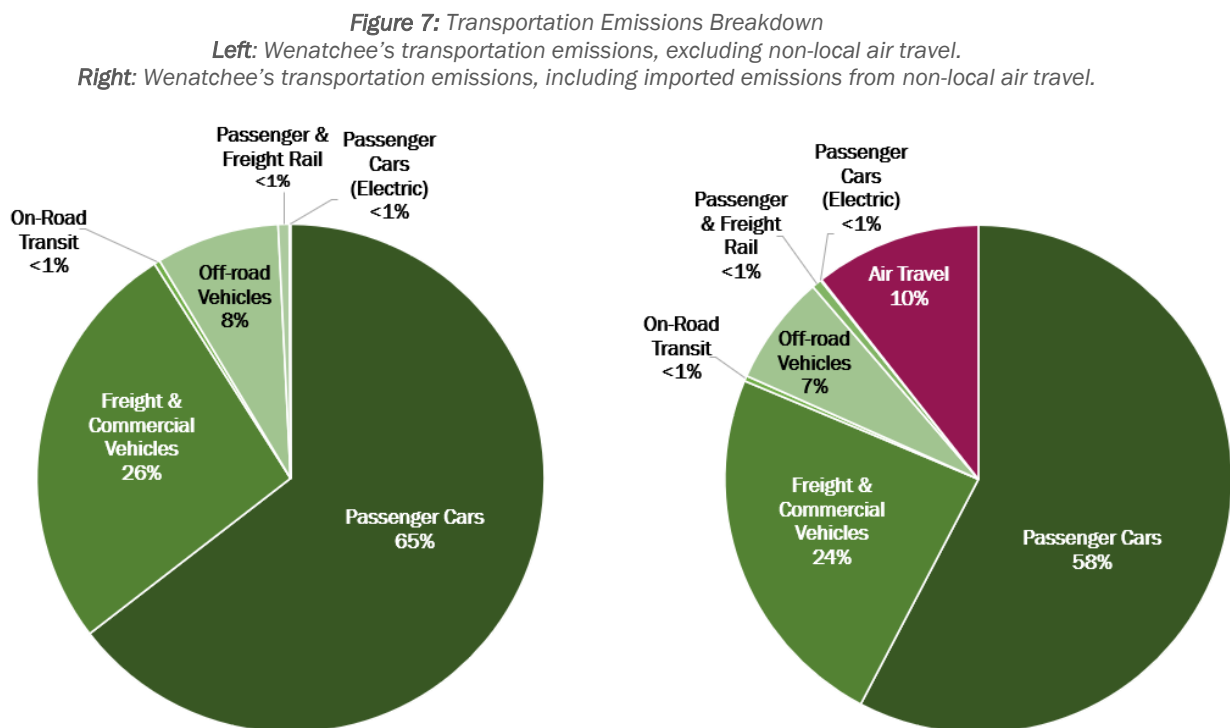
² All emissions estimates use market-based accounting for electricity unless otherwise noted. Market-based electric accounting totals 168,324 MT CO₂e, while location-based accounting totals 299,298 MT CO₂e. See Appendix B:

Electricity for information about market-based versus location-based accounting.

Transportation

Transportation emissions are the second-largest source of local emissions for Wenatchee, totaling 164,411 MT CO₂e (47% of local emissions). On-road passenger vehicles were the leading source of local transportation emissions and are responsible for 65% of local transportation emissions. These emissions originate from gasoline, primarily used by passenger vehicles. This category also includes the small amount of electricity used by electric vehicles (<1%). Diesel, primarily used by on-road freight and commercial vehicles, come as next-highest at 26%. The next-largest category is off-road vehicles, which can come from construction, farming, landscaping, or other non-road vehicles and mobile equipment, and accounted for 8% of total emissions. Transit and rail accounted for <1% of local transportation emissions.

Many residents travel by airplane, whether within the Wenatchee boundary or not (for example, those traveling by air from Pangborn Memorial Airport), and this additional air travel is part of the community's imported emissions. As is shown in Figure 7, emissions from non-local air travel (magenta) are a significant source of emissions in addition to local transportation emissions (green). Imported air travel emissions are estimated at about 19,538 MT CO₂e.



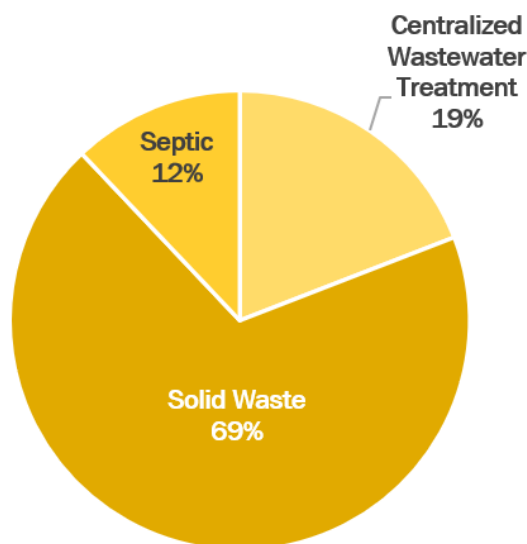
Waste & Wastewater

Solid waste disposal and wastewater treatment emissions are Wenatchee's smallest source of emissions and total 5,722 MT CO₂e, 2% of local emissions. Figure 8 illustrates the breakdown of emissions from solid waste, septic, and centralized wastewater treatment, which come from non-energy sources.

Wenatchee's solid waste emissions are estimated to total 3,938 MT CO₂e. The City of Wenatchee has no landfills that handle municipal waste within its geographic boundaries. Waste was landfilled at Waste Management's Greater Wenatchee Regional Landfill in Douglas County. The proportion of methane emissions associated with the waste generated by the Wenatchee community are accounted here, even though these emissions occur outside of the Wenatchee city limits.

Wastewater is processed by the City of Wenatchee and is included in the analysis. Total wastewater process emissions are estimated to total 1,093 MT CO₂e. Additionally, there are an estimated 2,500 people served by septic systems in the City. Septic systems are more GHG intensive than centralized wastewater treatment because of the different treatment processes. Emissions from septic systems are estimated to total 690 MT CO₂e.

Figure 8: Waste & Wastewater Emissions Breakdown



Industrial Process & Product Use

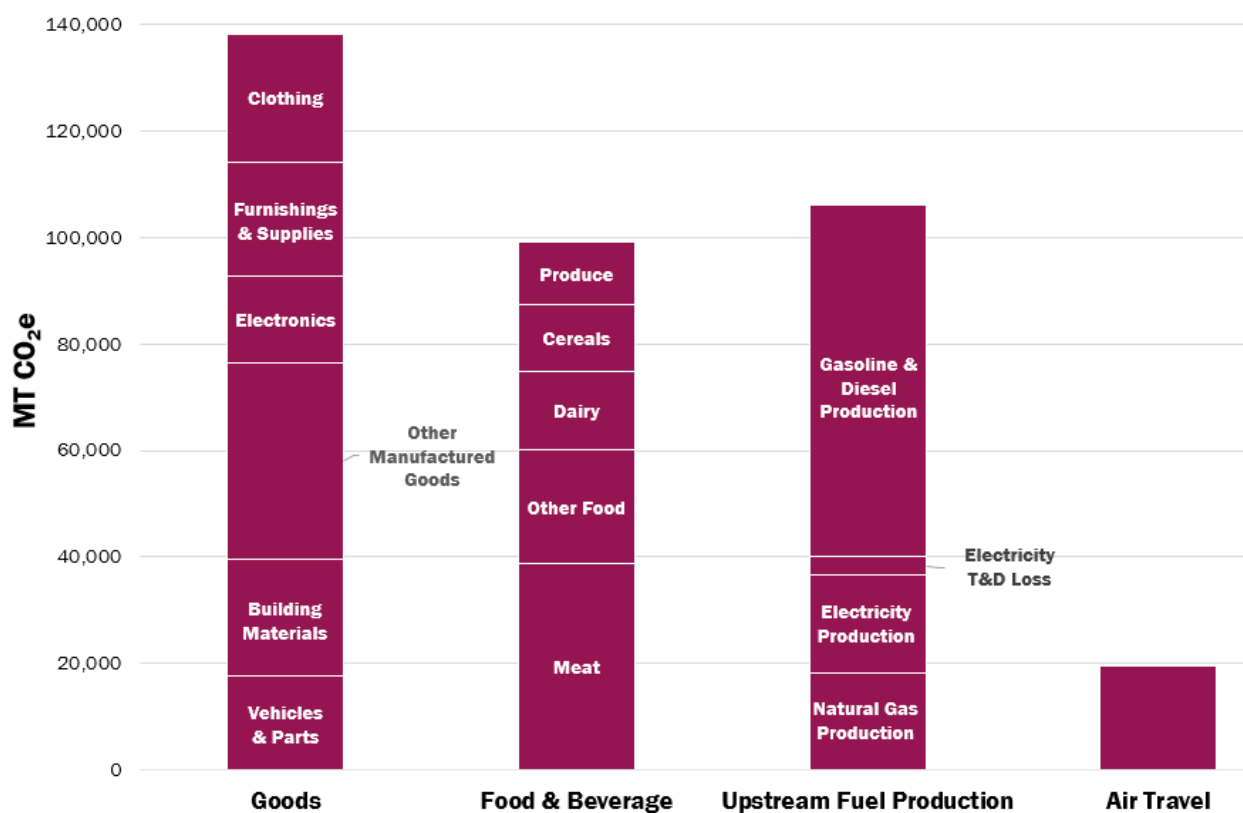
Industrial Process & Product Use (IPPU) emissions are Wenatchee's second smallest source of local emissions (3%). IPPU emissions are non-energy sources of emissions and come from unintentional leaks or discharges of gases from equipment or facilities. They come from refrigeration systems (air conditioning, refrigerators, freezers) or specialized industrial gases — chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF₆), nitrogen trifluoride (NF₃) — and have a large climate impact, up to 23,500 times the global warming potential of an equivalent weight of CO₂ depending on the gas.

Fugitive loss of refrigerants from residential and commercial buildings and vehicle air conditioning and refrigeration equipment are the only source of Wenatchee's IPPU emissions. Fugitive refrigerants are estimated to be 10,004 MT CO₂e.

Imported Emissions from Consumption of Goods and Services

Wenatchee's inventory goes beyond GPC requirements to highlight the known large sources of imported emissions from consumption activities. This means that the community has less control over these emissions compared with sources of local emissions. These imported emissions will be in another community's local accounting. That said, these emissions are included in the inventory because they are large, they are caused by local demand, and opportunities exist to reduce these emissions locally by reducing consumption. These emissions were estimated at 275,639 MT CO₂e and make up 51% of total emissions (Figure 9).

Figure 9: Imported Emissions Breakdown



Within goods, the largest purchasing categories include other manufactured goods, building materials, and clothing. Within food, the largest emissions are from the production of meats, particularly beef products. Upstream emissions from fuel production (gasoline, diesel, electricity, and natural gas) and air travel from flights taken by residents (regardless of airport location) are also significant sources of imported emissions.

Category Descriptions

- **Goods:** These emissions are from extracting, manufacturing, and transporting raw materials into final products such as building materials, cars, furniture, and clothing.
- **Food & Beverage:** These emissions are from agriculture (energy for irrigation, production of fertilizers, methane emissions from livestock, etc.) and transportation of raw materials and finished products. Categories include produce, cereals, dairy, meat, and others.
- **Upstream Fuel Production:** Process and energy emissions from the extraction and production of fuel products (electricity from household outlets, gasoline pumped into cars, natural gas combusted by furnaces, etc.). These upstream emissions are considered at the community scale for electricity, natural gas, gasoline, and diesel (not available for propane and fuel oil). These emissions are separate from those that are generated when the fuel is used in your car or house.
- **Air Travel:** Emissions associated with air travel by the community (regardless of the airport's location).

Appendix A: Detailed Emissions Breakdown

Table 1 below provides detailed emissions breakdowns for all categories for both market-based and location-based accounting. The figures represented in this report are market-based accounting. Details on the difference between market-based and location-based accounting are provided in Appendix B: Electricity Accounting.

Table 1: Detailed Emissions Breakdown

Emissions Sector / Sub-Sector	2023 Emissions MT CO ₂ e		Per capita	
	*Market-based	Location-based	*Market-based	Location-based
Building Energy	168,324	299,298	4.7	8.4
Residential Buildings				
Electricity	45,045	118,809	1.3	3.3
Natural Gas		2,969		0.1
Other Fuels		3,829		0.1
Commercial Buildings				
Electricity	24,261	63,990	0.7	1.8
Natural Gas		28,884		0.8
Other Fuels		3,880		0.1
Industrial Facilities				
Electricity	10,675	28,155	0.3	0.8
Natural Gas		48,090		1.4
Fugitive Emissions from Natural Gas Systems		693		0.02
Transportation	164,411	164,679	4.6	4.6
On-Road Passenger Vehicles				
Gasoline Vehicles		106,109		3.0
Electric Vehicles	129	339	0.004	0.01
On-Road Freight & Commercial Vehicles		43,481		1.2
On-Road Transit	622	680	0.02	0.02
Off-Road Vehicles and Equipment		12,909		0.4
Passenger and Freight Rail	1,161	1,161	0.03	0.03
Waste & Wastewater	5,722		0.2	
Solid Waste Disposal		3,938		0.1
Wastewater Treatment		1,093		0.03
Septic Systems		690		0.02
Industrial Process & Product Use	10,004		0.3	
Refrigerants (Product Use)		10,004		0.3
Imported Emissions from Consumption	363,826	399,613	10.2	11.2
Household Consumption				
Goods		139,008		3.9
Food		99,106		2.8
Upstream Energy Production	106,174	141,961	3.0	4.0
Air Travel		19,538		0.5
Local Emissions	348,461	479,703	9.8	13.5
Local + Imported	712,287	879,316	20.0	24.8

Appendix B: Methodology & Protocols

Protocol and Inventory Boundaries

This inventory follows [Global Protocol for Community-Scale Greenhouse Gas Emission Inventories](#) (GPC) by Greenhouse Gas Protocol (GHGP). This inventory also follows GHGP's [Scope 2 Guidance](#) for location-based and market-based electricity accounting emissions and ICLEI's [U.S. Community Protocol](#) for guidance on calculation of consumption-based emissions (i.e., Other Scope 3).

Parametrix's carbon calculator tool *Climate Metrix – Community* was used for GHG emissions calculations. Emissions are documented in the Inventory Audit Trail. *Climate Metrix – Community* is an Excel-based calculator that documents all activity data, emissions factors, and emissions calculations used in the inventory. The audit trail catalogs all data, calculation, and resource files used to complete the inventory. These resources are highly detailed and will allow those conducting future inventories to replicate the methods used in this inventory.

GHG emissions presented in this report are represented in metric tons of carbon dioxide equivalent (MT CO₂e). The gases considered in the analysis are consistent with protocol and include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), chlorofluorocarbons (CFCs), sulfur hexafluoride (SF₆), and perfluorocarbons (PFCs) per the Kyoto Protocol. All GHG calculations use 100-year global warming potentials as defined in the International Panel on Climate Change's Fifth Assessment Report (IPCC AR5).

Scopes

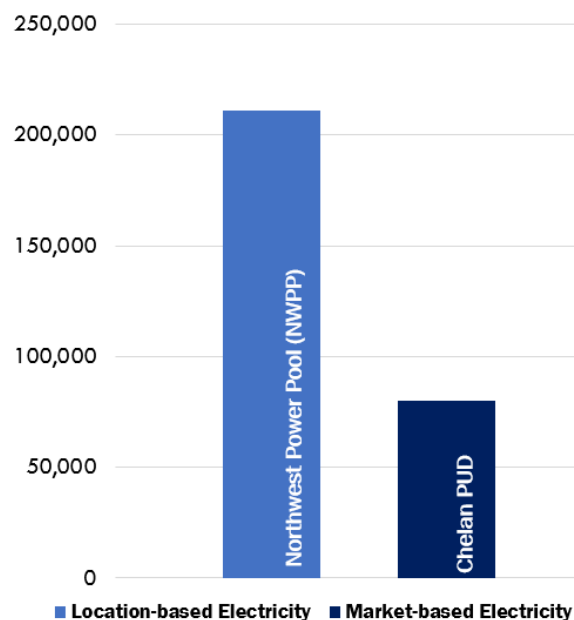
As described above, community GHG emissions are often organized by sector (buildings, transportation, waste, etc.). Another way to organize them is by their origin location, either within a community or outside; these are referred to as "scopes." Scope categories distinguish those emissions that occur within the geographic boundaries (Scope 1) from those that occur outside the boundaries but are driven by activity from within the geographic boundary (Scope 2 and Scope 3).

Electricity Accounting

Activity data was collected directly from Chelan PUD. Data provided was split by residential, commercial, and industrial. The GPC and Scope 2 guidance requires that communities report electricity emissions using two accounting methods: market-based and location-based.³ **Market-based accounting** is based on the GHG intensity of electricity contracts with local utilities and is used in most of the figures presented in this report as the GPC protocols' recommended methodology to track progress toward goals over time. Market-based accounting captures the emissions savings from the 80% hydroelectric grid mix supplied by Chelan PUD. The remaining emissions reflect the other fossil sources. **Location-based accounting** is calculated using the regional electricity grid's (Northwest Power Pool) GHG intensity and represents the average impacts of electricity use and efficiency efforts for the region. Figure 10 displays electricity emissions using both accounting methods.

- **Market-based method** (or utility-specific) represents emissions specific to the utility and considers community purchase of Renewable Energy Certificates (such a program is not available at Chelan PUD, but they do offer credit for those generating excess solar to feed the grid). Market-based electricity accounting is commonly used for target and goal tracking and is useful to assess and manage GHGs associated with electricity generation and supply. It also highlights benefits for energy-efficiency actions, particularly in communities served by utilities with very low GHG electricity. That is, the less electricity used in the community, the more low-GHG electricity there is available for export to communities with more GHG-intensive electricity sources.

Figure 10: Electricity Emissions (MT CO₂e)
Using Both Accounting Methods



- **Location-based method** (or regional grid) multiplies an organization's electricity use by the average emissions intensity of a specific regional electricity grid that is published by the Environmental Protection Agency (eGRID 2023).⁴ Note that over time, there may be differences in emissions results for inventory years due to the use of an updated eGRID emissions factor (typically released every 1 to 2 years). Location-based electricity accounting offers a means of assessing the average impact of electricity use on the regional electricity grid.

³ For details, visit http://www.ghgprotocol.org/scope_2_guidance.

⁴ http://www.epa.gov/system/files/documents/2025-1/eGRID2023_summary_tables_rev1.pdf