



Eastside Cities Greenhouse Gas Emissions Inventory

2023 Methodology Report

Prepared by Cascadia Consulting Group, Inc.

January 2025



Inventory Approach

Scope

The cities of Bellevue, Redmond, Kirkland, Issaquah, and Mercer Island (Eastside Cities) partnered to complete updated greenhouse gas (GHG) inventories for each city's communitywide and municipal operations. These inventories were completed for calendar year **2023** for the cities of Bellevue, Redmond, and Mercer Island, and included emission sources and sectors intended to align closely with the methodology used for the 2022 Eastside Cities GHG inventories.

The community-level inventories were completed in compliance with ICLEI's *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions* and the government operations inventories were completed in compliance with ICLEI's *Local Government Operations Protocol*.

Inventory Platform

Emissions were calculated using a combination of [ICLEI's ClearPath platform](#) and Microsoft Excel.¹ ClearPath is the leading software platform used by local governments to complete communitywide and government operations GHG inventories in the United States.

Inventory Processes & Data Sources

Conducting these inventories involved identifying and applying activity data and emission factors, summarized in Table 1 and Table 2 and detailed in the following sections:

- **Activity data** quantify levels of activity that generate GHG emissions, such as vehicle miles traveled and kWh of electricity consumed.
- **Emission factors** translate activity levels into emissions (e.g., MTCO_{2e} per kWh).

¹ Microsoft Excel was utilized to perform more detailed calculations than what is currently possible in ClearPath.

Community

Table 1. Key approaches and data sources for 2023 communitywide inventories.

Sector	Activity Data	Emission Factors
Transportation		
On-road vehicles	<ul style="list-style-type: none"> Modeled vehicle miles traveled by vehicle type. The BKR model was used for Bellevue, Kirkland, and Redmond and the PSRC model was used for Mercer Island and Issaquah. 	<ul style="list-style-type: none"> Vehicle carbon intensities (MTCO₂e/mile) based on PSRC modeling
Non-road vehicles and equipment	<ul style="list-style-type: none"> County-level emissions from non-road vehicles (EPA MOVES) by sector (e.g., construction, lawn/garden) and fuel type, downscaled to cities by population 	
Aviation <i>Note: Aviation was included as “Information Only” in these inventories, so these emissions are not counted as part of communities’ total emissions.</i>	<ul style="list-style-type: none"> Fuel consumption data (SeaTac, Boeing Field), downscaled equitably to cities using passenger survey data (SeaTac), population (US Census), and average household income (US Census) 	<ul style="list-style-type: none"> EPA emission factors, by fuel type (US EPA)
Public transit	<ul style="list-style-type: none"> Modeled transit vehicle miles traveled (PSRC; BKR model) 	<ul style="list-style-type: none"> Average vehicle fuel economies for KC Metro and Sound Transit (NTD Database) EPA emission factors for fuels (US EPA)
Building Energy		
Electricity	<ul style="list-style-type: none"> Electricity consumption from PSE’s standard service and through green power programs, by sector (Puget Sound Energy) Grid loss rates (Puget Sound Energy) 	<ul style="list-style-type: none"> Utility-specific emission factors (Puget Sound Energy)
Natural gas	<ul style="list-style-type: none"> Natural gas consumption, by sector (Puget Sound Energy) Natural gas leakage rates (Puget Sound Energy) 	<ul style="list-style-type: none"> Utility-specific emissions factor (Puget Sound Energy)
Fuel oil	<ul style="list-style-type: none"> Washington state energy consumption estimates (EIA), downscaled by: <ul style="list-style-type: none"> Local households heated using fuel oil (US Census) Local employment, by sector (PSRC) 	<ul style="list-style-type: none"> ClearPath default emission factor (US EPA)
Propane	<ul style="list-style-type: none"> Washington state energy consumption estimates (EIA), downscaled by: <ul style="list-style-type: none"> Local households heated using propane (US Census) Local employment, by sector (PSRC) 	<ul style="list-style-type: none"> ClearPath default emission factor (US EPA)

Eastside Cities Greenhouse Gas Emissions Inventory

Sector	Activity Data	Emission Factors
Solid Waste & Wastewater		
Solid waste and compost generation & disposal	<ul style="list-style-type: none"> Annual tons disposed and composted, as reported by City staff from haulers Landfill and composted waste characterization (King County Solid Waste Division) 	<ul style="list-style-type: none"> EPA WARM v15 model
Wastewater process emissions	<ul style="list-style-type: none"> Process emissions for South Plant and Brightwater Plant, scaled by population served (King County Wastewater Treatment Division) 	
Refrigerants		
Refrigerants	<ul style="list-style-type: none"> Nationally reported fugitive gas emissions, scaled by local population (US EPA) 	

Government Operations

Table 2. Key approaches and data sources for 2022 government operations inventories.

Sector	Activity Data	Emission Factors
Transportation		
Vehicle fleet	<ul style="list-style-type: none"> Gallons of fuel, vehicle type, and miles travelled, as reported by City staff 	<ul style="list-style-type: none"> ClearPath default emission factors (US EPA)
Employee commute	<ul style="list-style-type: none"> Average one-way commute, number of employees, and working days as reported by WSDOT CTR Employer Survey (Bellevue, Redmond, and Issaquah) Employee Survey (Mercer Island) City staff estimates (Kirkland) 	<ul style="list-style-type: none"> WSDOT CTR Employer Survey (Redmond & Issaquah) ClearPath default emission factors (US EPA)
Business travel	<ul style="list-style-type: none"> Air miles traveled, as reported by City staff 	<ul style="list-style-type: none"> ClearPath default emission factors (US EPA)
Building Energy, Streetlights/Traffic Signals, and Water Conveyance		
Electricity	<ul style="list-style-type: none"> Electricity consumption from PSE's standard service and through green power programs (Puget Sound Energy) Grid loss rates (Puget Sound Energy) 	<ul style="list-style-type: none"> Utility-specific emission factors (Puget Sound Energy)
Natural gas	<ul style="list-style-type: none"> Natural gas consumption (Puget Sound Energy) Natural gas leakage rates (Puget Sound Energy) 	<ul style="list-style-type: none"> Utility-specific emission factor (Puget Sound Energy)
Fuel oil/diesel	<ul style="list-style-type: none"> Consumption for generators (City staff) 	<ul style="list-style-type: none"> ClearPath default emission factors (US EPA)
Solid Waste		
Solid waste generation & disposal	<ul style="list-style-type: none"> Annual tons disposed and composted (City staff) Landfill waste characterization studies (King County Solid Waste Division) 	<ul style="list-style-type: none"> ClearPath default emission factors
Refrigerants		
Refrigerants	<ul style="list-style-type: none"> Annual tons of refrigerants used in City facilities and vehicles (City staff) 	

Data Limitations and Assumptions

Notable limitations of the approach and data sources are summarized below.

Community

Transportation

- **Non-Road Vehicles and Equipment:** The EPA MOVES model estimates emissions at the County level, so emissions were scaled from County to City level by population for this analysis.
- **Aviation:** Aviation emissions were estimated by equitably attributing emissions from fuel consumption at Seattle-Tacoma International Airport and Boeing Field, using population and average household income data. The 2023 household income data from the US Census was unavailable for all cities at the time of this analysis, so 2021 data was used as a proxy. Some jurisdictions opted to include aviation as “Information Only” in these inventories, so these emissions are not counted as part of communities’ total emissions, while other jurisdictions opted to count these as part of the communities’ total emissions.

Building Energy

- **Electricity:** Electricity provided through Puget Sound Energy’s green power programs, such as Green Direct and Community Solar, was assumed to be carbon neutral. This assumption is based on information provided by Puget Sound Energy and guidance provided by ICLEI and standard protocols.
- **Electricity:** These inventories use utility-specific emission factors to estimate emissions from electricity use, rather than regional eGRID emission factors that were used in previous inventories. Puget Sound Energy’s fuel mix has varied over time as the utility uses different amounts of individual fuels to generate electricity. Since 2011, PSE’s annual emission factor has been reported as reaching up to 35% higher than the utility’s 2011 emission factor – one metric which may account for fluctuation in emissions from electricity over time.
- **Propane and fuel oil:** In the PSREA project, propane and fuel oil emissions were estimated using EIA sales data. With this update, these emissions were estimated using EIA consumption data for WA state to improve the accuracy of estimations.

Solid Waste & Wastewater

- **Compost:** Emissions from composted waste were estimated using King County's most recent residential and commercial organics studies, completed in 2018 and 2019.
- **Wastewater:** In 2022, KC WTD provided each plant's calculated emissions. To estimate emissions by jurisdiction, a per-capita emission factor was determined based on the approximate population served by each plant, and this factor was applied to each jurisdiction's population. In 2023, KC WTD did not provide emissions per-plant, but just provided total emissions. Emissions were separated by plant assuming the same distribution as in 2022. Emissions were then estimated for each jurisdiction by applying a per-capita emission factor based on the approximate population served by each plant, as usual.

Refrigerants

- Emissions from refrigerants were scaled from national data based on population.
- The EPA has not released the 2023 *Inventory of U.S. Greenhouse Gas Emissions and Sinks*, so 2022 refrigerant emissions were scaled to 2023 for this analysis.

Government Operations

Each of the Eastside Cities collects and maintains records differently. Due to the variation in data available, each City's municipal operations inventory was completed using slightly different activity data and methodologies for certain emission sources (e.g., employee commute, refrigerants), as noted in Table 2.