CITY OF
BAINBRIDGE ISLAND

Climate Change Advisory Committee Regular Meeting
Wednesday, December 17, 2025

City Hall Council Conference Room
280 Madison Ave N
Bainbridge Island, WA

and

Remote Meeting on Zoom
https://bainbridgewa.zoom.us/j/83875258271
or Telephone: US: +1 253 215 8782
Webinar ID: 838 7525 8271

Agenda

1. **Call to Order / Roll Call**
2. **Approval of Agenda / Conflict of Interest Disclosure**
3. **Public Comment**

   In person public comment is accepted at this time on any topic of public interest. Each commenter will have three minutes, or such amount as the meeting chair determines, to speak. Public comment is not taken on individual agenda items during the meeting. Public comment is simply received by the Committee, with no response, and the Committee cannot deliberate on items that are not on the agenda. The lack of comment is not an endorsement or a denial of the comment.

   Please refer to guidelines and instructions for public comment, including orderly behavior and civility in remarks, on the City's website. Remote public comment is allowed with advance notice by 4:00 p.m. on the business day before the meeting by emailing cityadmin@bainbridgewa.gov, provided that all remote commenters shall be required to display their true name and to keep their camera turned on to show their true uncovered face while delivering their comments.

4. **Climate Manager Updates**

   4.A Presentation on microgrids from Kate Pederson, Department of Commerce
   4.B Presentation on the 2023 Greenhouse Gas Inventory from Andrea Martin, Cascadia Consulting

4.C Solarize Bainbridge update, Laura Ryser
4.D Overview of CAP update, Laura Ryser

5. Regular Business

5.A Approve Meeting Minutes, Kevin Thomas
5.B Comprehensive Plan Review and Planning Commission Request to Review Draft Language, Kevin Thomas

6. Adjournment

The City of Bainbridge Island's meetings are wheelchair accessible. The City also provides auxiliary aids and services for effective communication such as assistive listening devices, closed captioning, and print materials in digital format. For other reasonable accommodations and/or modification to programs, services, or activities, please contact the ADA Coordinator, Anshu Wahi at awahi@bainbridgewa.gov or 206-947-0803 as soon as possible, preferably at least two business days prior to the meeting.

2023 Greenhouse Gas Emissions Inventory

Findings Summary for Bainbridge Island
December 2025

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Objectives & Methodology

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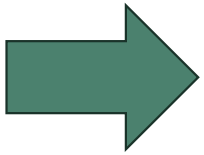
Objectives

- Update **2023** GHG emissions inventories for:
  - **Municipal government operations**
  - **Community**
- Update the **2023** communitywide **contribution analysis** to illuminate drivers of inventory trends.



Better understand Bainbridge Island's sources of GHG emissions to inform climate action planning and implementation.

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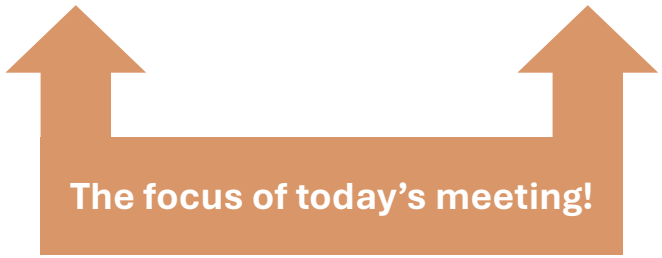
Types of GHG Inventories

Community Inventories	Government Operations Inventories	Consumption Based Inventories
Quantifies emissions that are generated either within a community's geographic boundaries, or directly from community activities.	Quantifies emissions that are generated from activities that are under a local government's sphere of influence.	Quantifies **all** direct or indirect emissions that are generated by a community or organization, regardless of location.



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GHG Inventory Methodology

- **Protocols:**
  1. **U.S. Community Protocol:** *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions*
  2. **Greenhouse Gas Protocol:** *Global Protocol for Community-Scale Greenhouse Gas Inventories*

- **Inventory platform:**
  - **ClearPath**, following the guidance of the protocols listed above.

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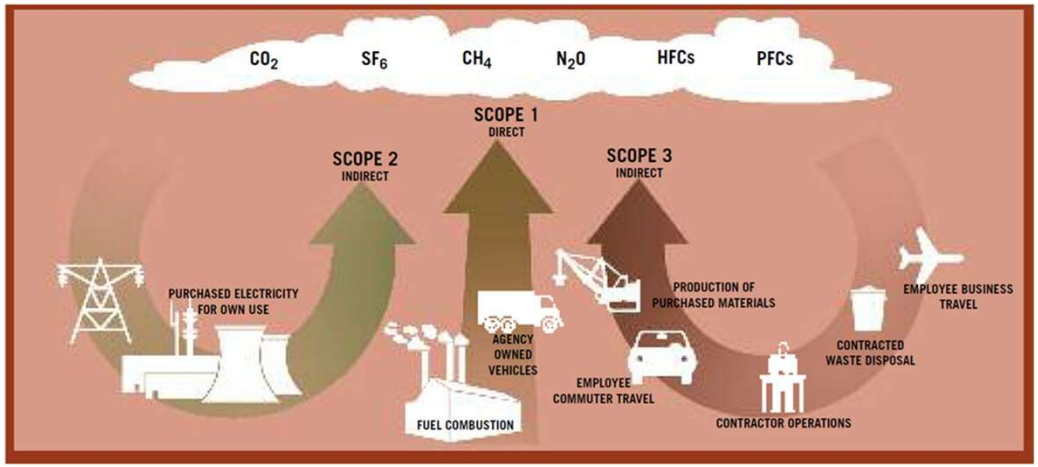
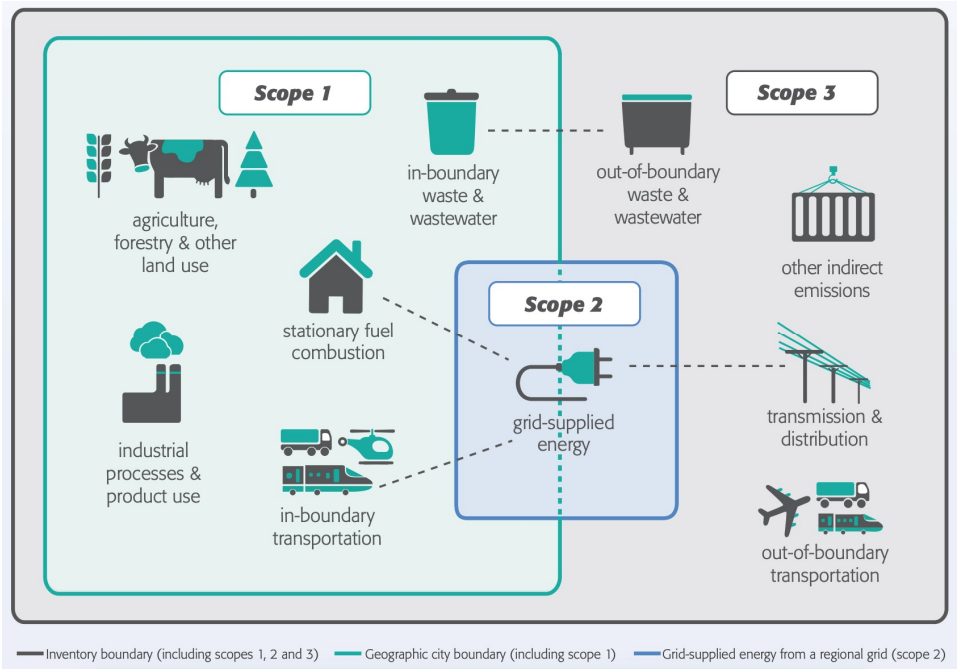
GHG Inventory Scopes

Municipal



Communitywide



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Bainbridge Island GHG Inventory Sources

Community Inventory

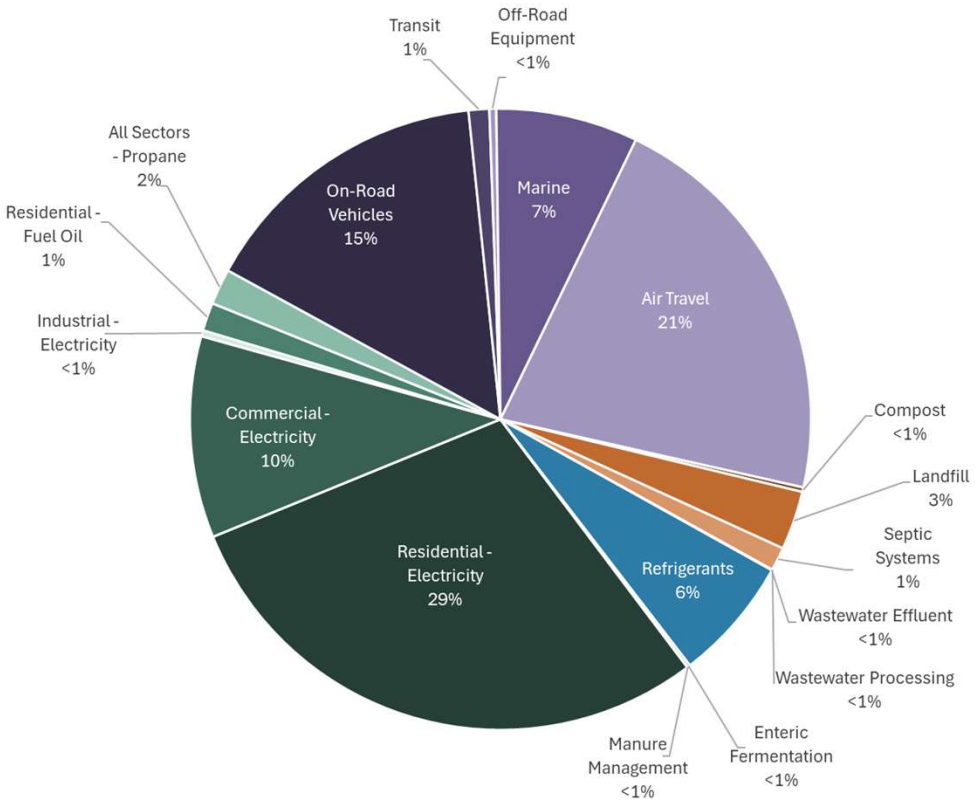
1. **Residential Energy**
   - Electricity
   - Fuel Oil
2. **Non-Residential Energy (Commercial and Industrial)**
   - Electricity
3. **Propane (Residential, Commercial, Industrial)**
4. **Solid Waste & Wastewater Treatment**
   - Compost, Landfill
   - Wastewater Treatment, Septic Systems
5. **Process & Fugitive Emissions**
   - Refrigerants
6. **Agriculture**
   - Enteric Fermentation
   - Manure Management

Government Operations Inventory

1. **Building & Facilities Energy**
   - Electricity
   - Electricity – Streetlights & Traffic Signals
   - Propane
2. **Transportation and Other Mobile Sources**
   - On-Road Vehicles
   - Off-Road Equipment
   - Employee Commute
3. **Solid Waste, Potable Water, & Wastewater**
   - Compost, Landfill
   - Wastewater Treatment Process
4. **Process & Fugitive Emissions**
   - Refrigerants

Communitywide Emissions

2023 Community Emissions



- **Total = 167,667 $MTCO_2e$**
- **Largest sources:**
  - **Residential Energy**
    - **Electricity (29%)**
  - **Transportation & Other Mobile Sources**
    - **Air Travel (21%)**
    - **On-Road Vehicles (15%)**

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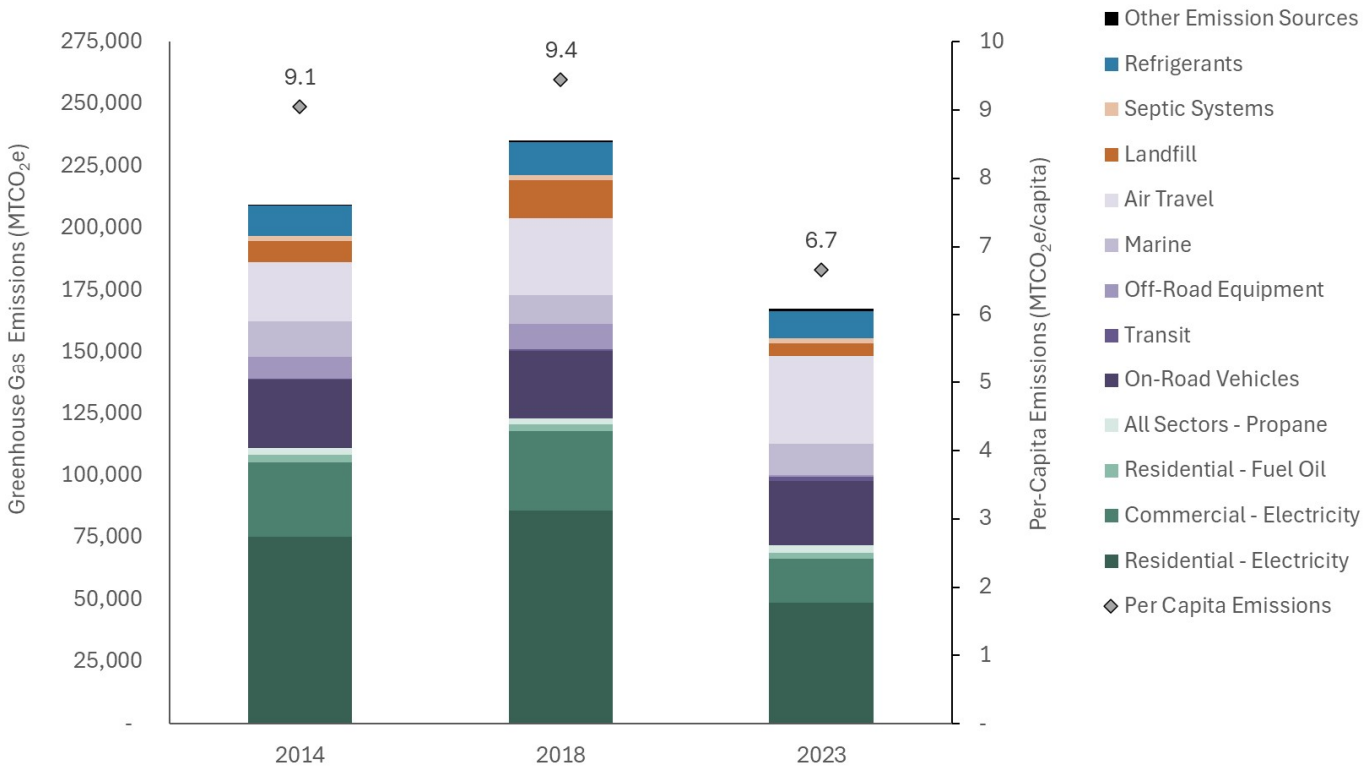
Communitywide Emission Trends



Since 2014:

- 20% decrease in emissions
- 26% per-capita decrease in emissions
- Driven by cleaner electricity

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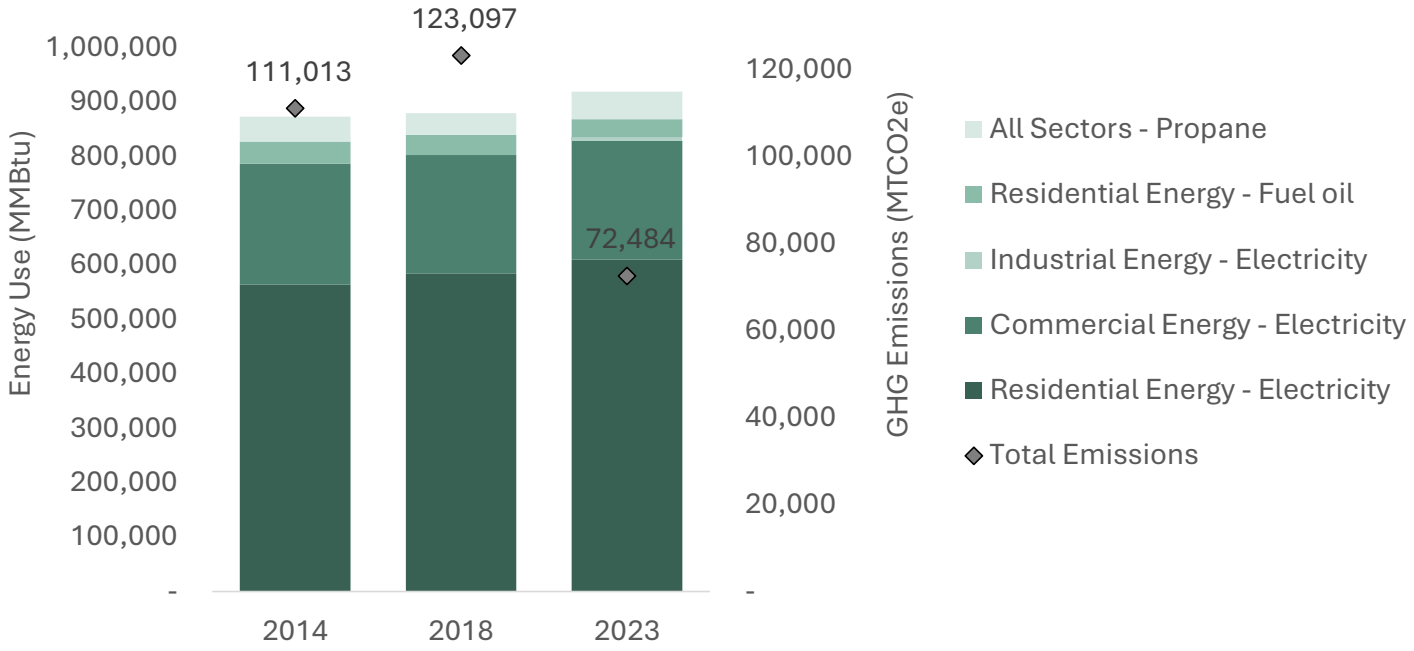
Detailed Findings: Energy



Since 2014:

- Residential electricity consumption increased 6%
- Non-residential electricity consumption increased 7%
- Increase in PSE green power program participation & renewables in PSE's fuel mix.

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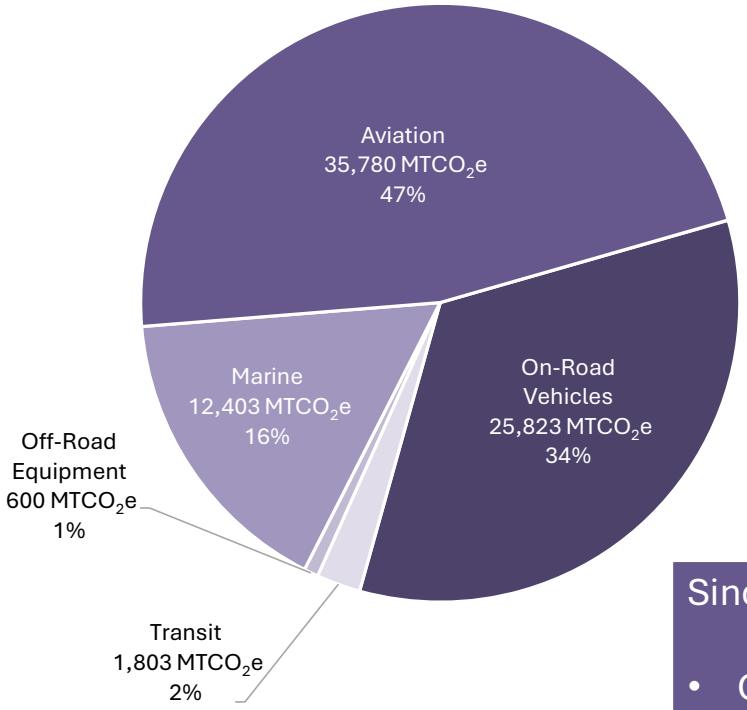
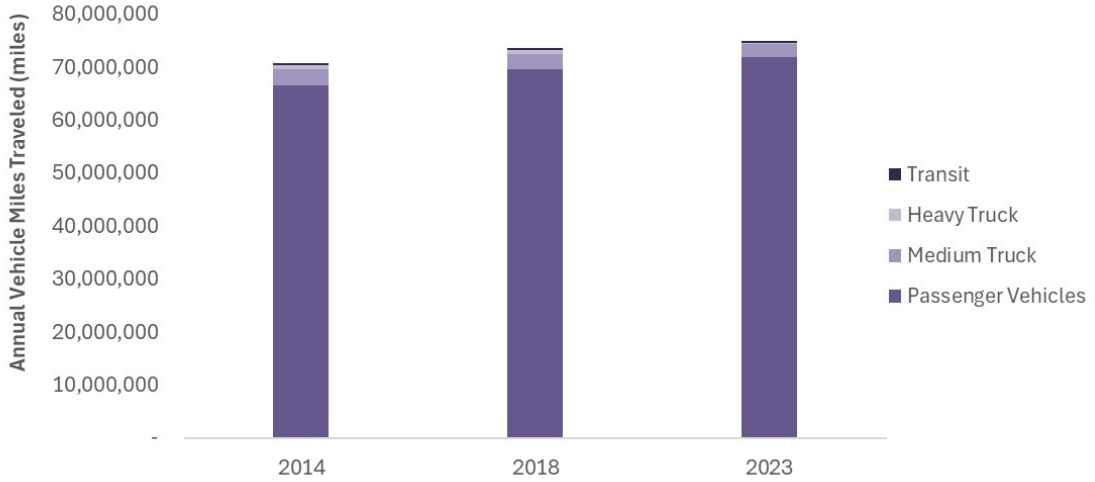
Detailed Findings: Transportation





Since 2014:

- Overall transportation emissions increased 1%.
- VMT increased 6%.
- On-road emissions decreased by 6%.
- Aviation emissions increased 49% (*note that these are estimated from SeaTac fuel consumption trends and county-level passenger surveys*).

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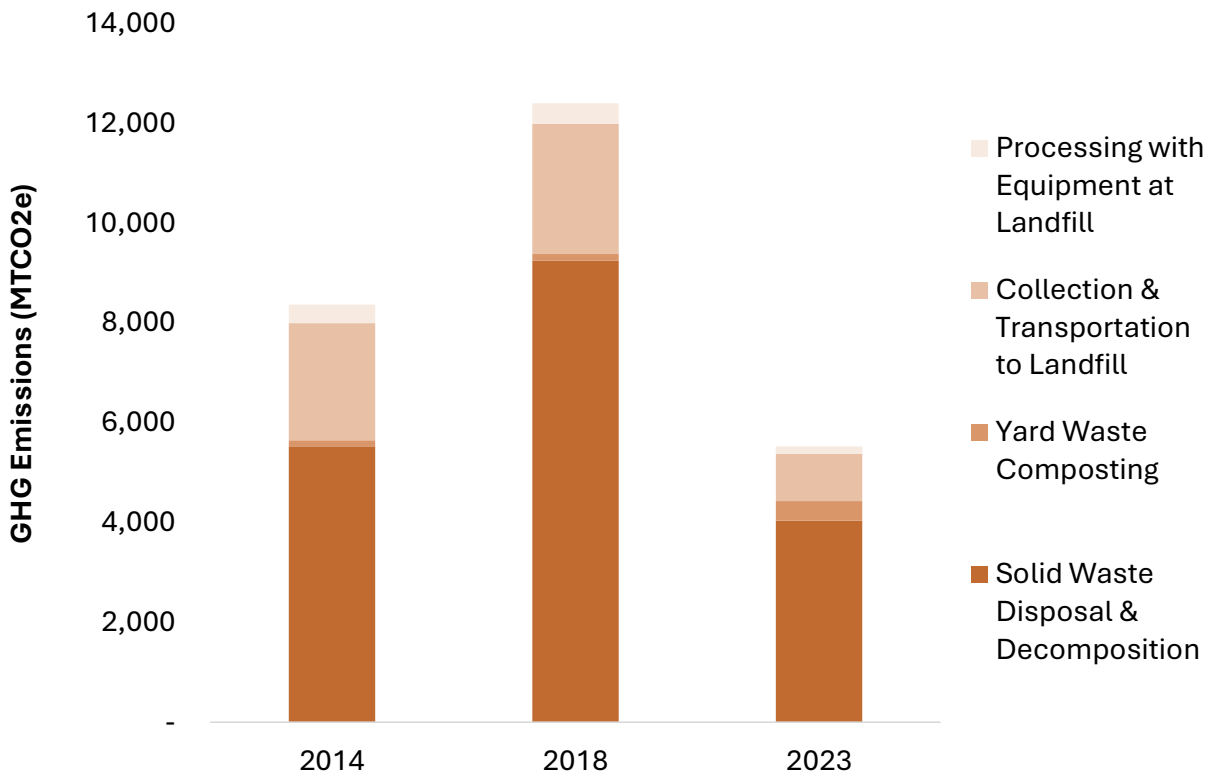
Detailed Findings: Solid Waste



Since 2014:

- 34% emissions reduction
- 61% increase in composting tonnage
- 18% increase in single family landfilled waste tonnage
- Significant decrease in multi-family / commercial landfilled waste tonnage *(may be updated with improved past data)*

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What's driving emissions changes?

- **Quantifies drivers of observed inventory trends, such as:**
  - Weather
  - Energy grid
  - Population growth
  - Per-capita energy consumption
  - Economy
  - Fuel switching

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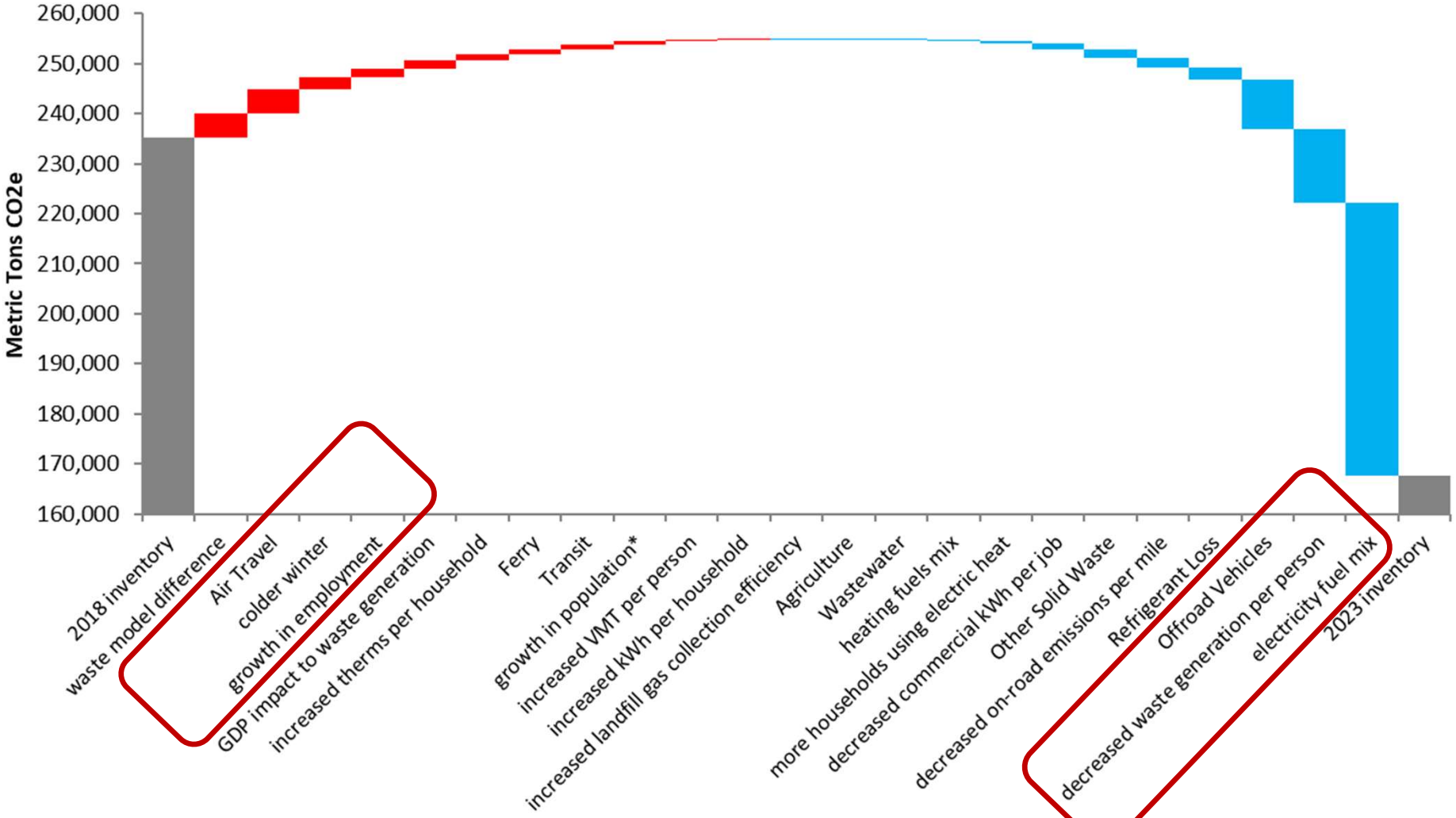
Contribution Analysis – Results



Communitywide Takeaways

- Trending in the right direction!
- Majority of emissions from the **residential energy** and **transportation** sectors.
- Largest changes in electricity (-), waste generation (-), and air travel (+) emissions.
- Notes/caveats:
  - Some sectors (e.g., air travel) are downscaled to city-level based on county-level estimates.
  - Propane and fuel oil are estimated based on downscaled state-level per-capita consumption data & city Census heating fuel data.
  - Need to revisit 2014/208 commercial & multi-family tonnage data.

Municipal (Government Operations) Emissions

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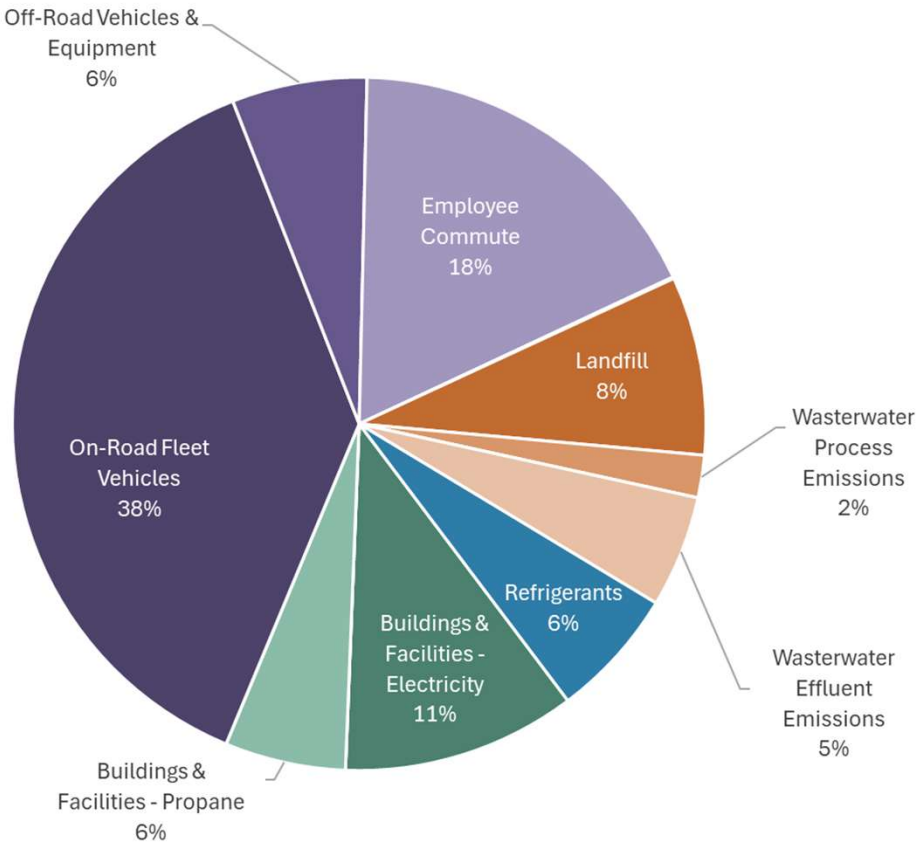
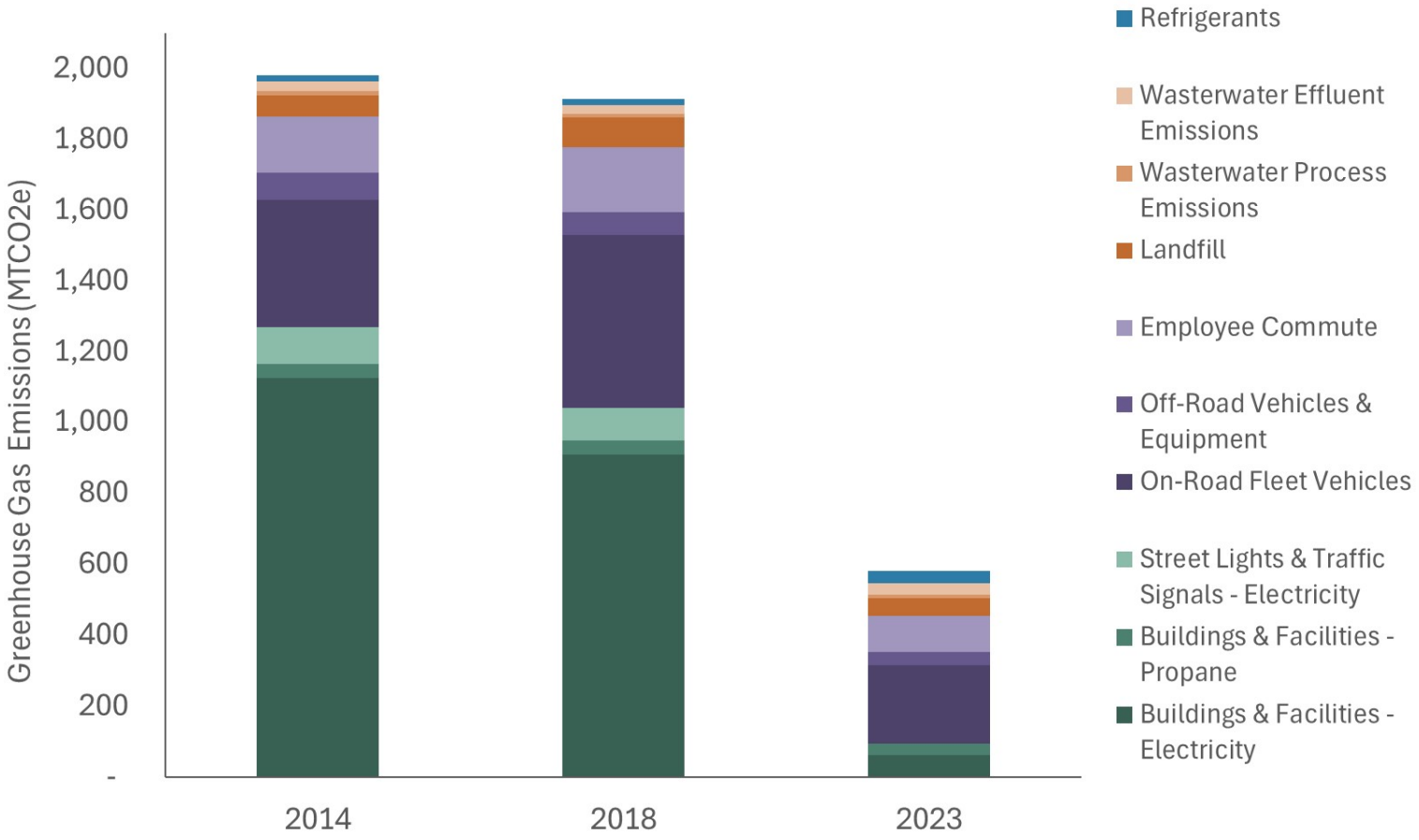
2023 Municipal (Government Operations) Emissions

- **Total = 581 $MTCO_2e$**
- **3% of communitywide**
- **Largest emissions sources**
  - **Buildings/Facilities**
    - **Electricity (11%)**
  - **Transportation & Other Mobile Sources**
    - **On-Road Vehicles (38%)**
    - **Off-Road Equipment (6%)**



Municipal Emissions Trends



Since 2014:

- 71% decrease in emissions
- Driven by reduction in electricity & fleet vehicle emissions

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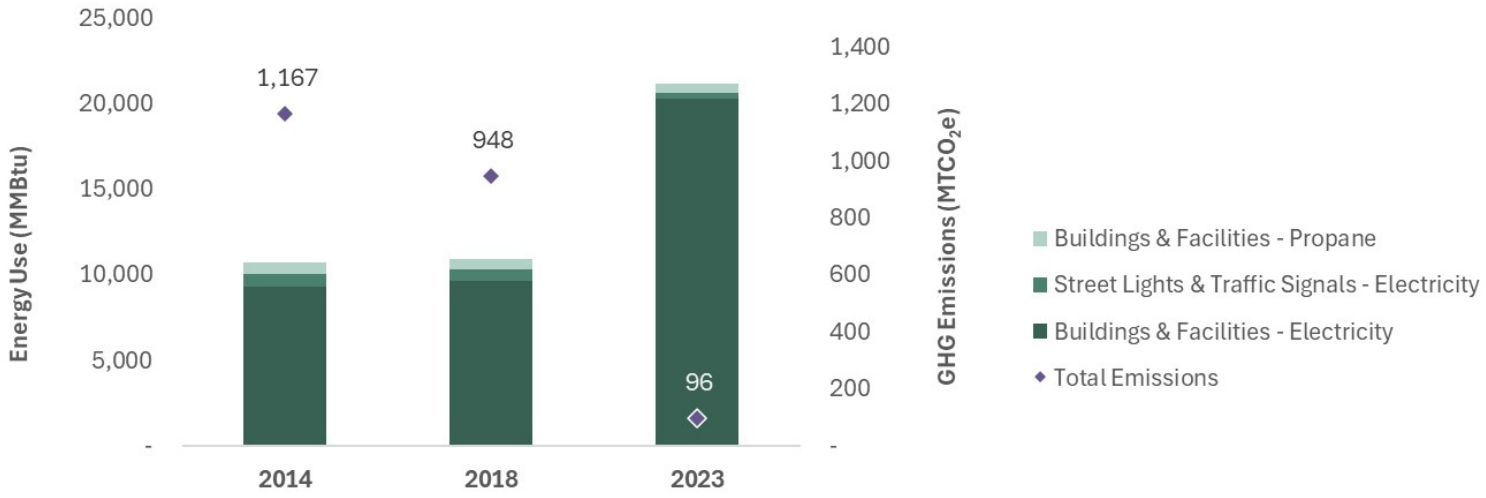
Detailed Findings: Buildings & Facilities



Since 2014:

- Electricity consumption has increased
- Electricity emissions have decreased (94%)
- Emissions reduction driven by green power purchases

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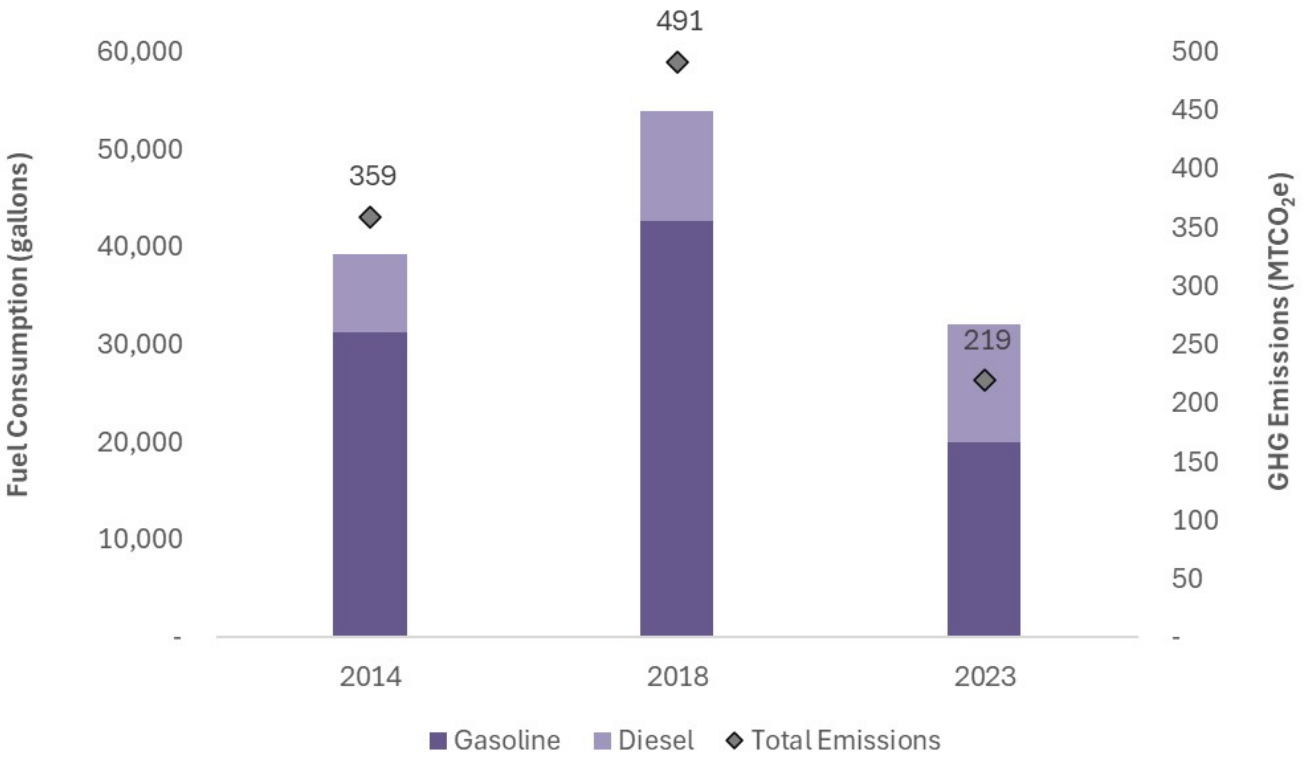
Detailed Findings: Transportation



Since 2014:

- 39% decrease in on-road fleet emissions
- 52% decrease in off-road vehicle & equipment emissions
- 36% decrease in employee commuting emissions

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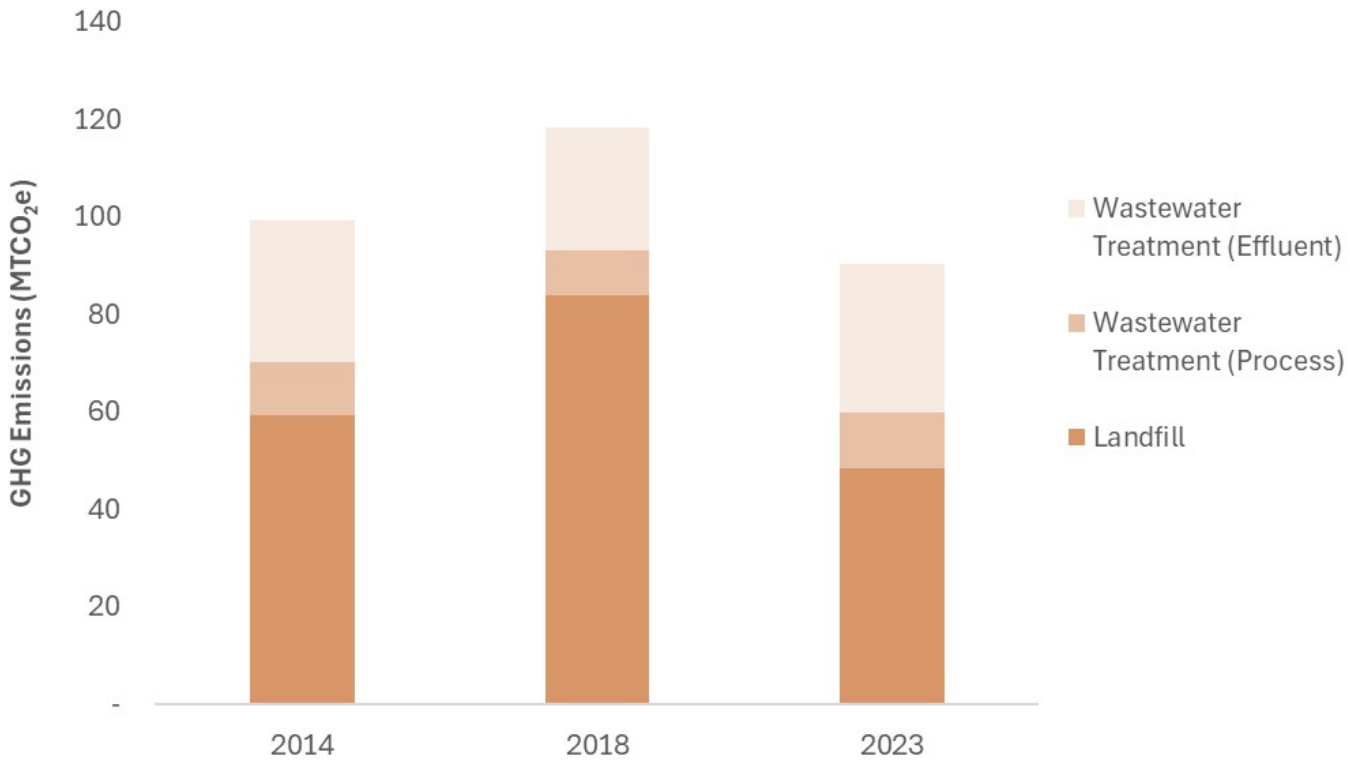
Detailed Findings: Solid Waste & Wastewater



Since 2014:

- 18% decrease in landfilled waste emissions
- 4% increase in wastewater treatment emissions

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Government Operations Takeaways

- **Fleet vehicles** contribute the majority (~70%) of emissions and are **decreasing** over time.
- **Facility electricity** emissions decreased substantially due to green power purchases.
- **Employee commute** emissions have decreased, likely due to mode shift and telework options.

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Thank you!

Questions?

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Bainbridge Island Greenhouse Gas Inventory Report

2023 GHG INVENTORY UPDATE

DECEMBER 2025

CASCADIA CONSULTING GROUP, INC.

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Contents

Key Terms

ACS	American Community Survey (from the U.S. Census Bureau)
BOD	Biochemical oxygen demand (a metric of the effectiveness of wastewater treatment plants)
EIA	United States Energy Information Association
EPA	United States Environmental Protection Agency
CO_2e	Carbon dioxide equivalent
GHG	Greenhouse gas (limited to CO_2, CH_4, N_2O, and fugitive gases in this inventory)
GWP	Global Warming Potential
HFC	Hydrofluorocarbon
$MTCO_2e$	Metric tons of carbon dioxide equivalent
MOVES	Motor Vehicle Emission Simulator model (developed by EPA to quantify emissions from mobile sources)
MPG	Miles per gallon
NONROAD	Part of MOVES model developed by EPA to quantify non-road mobile emissions
O&M	Operations and Maintenance
ODS	Ozone depleting substance
PFC	Perfluorocarbon
PSCAA	Puget Sound Clean Air Agency
PSE	Puget Sound Energy
PSRC	Puget Sound Regional Council
SF_6	Sulfur hexafluoride
TCR	The Climate Registry
USDA	United States Department of Agriculture
WARM	Waste Reduction Model (model developed by EPA to quantify solid waste emissions)
WSDOT	Washington State Department of Transportation
WWTP	Wastewater Treatment Plant
VMT	Vehicle Miles Traveled

Executive Summary

The *City of Bainbridge Greenhouse Gas Inventory Report* summarizes past and current communitywide and municipal greenhouse gas (GHG) emissions for 2014, 2018, and 2023. These inventories provide a consistent, comparable assessment of how emissions have changed over time and establish a technical foundation for future climate action.

Climate change poses a growing global threat. In response, Bainbridge Island has committed to reducing its GHG emissions while preparing for climate change impacts. To support this commitment, the City completed a 2023 update of its comprehensive greenhouse gas inventory. These inventories quantify the amount of climate pollution produced across the community and by municipal operations and serve as foundational tools for tracking progress, informing decisions, and targeting future emission-reduction efforts.

Methodology

The 2023 inventory was developed using best-practice methodologies and aligned with the *U.S. Community Protocol for Accounting and Reporting of GHG Emissions* (USCP) and the *Local Government Operations Protocol* (LGOP). Both communitywide and municipal inventories included emissions from key greenhouse gases (carbon dioxide, methane, nitrous oxide, flourinated gases) and emissions sources—including building energy, transportation, solid waste, wastewater, and refrigerants. Emissions are reported for the 2014, 2018, and 2023 calendar years. Analyses were performed in Microsoft Excel and the ICLEI ClearPath 1.0 tool.[1]

Government Operations GHG Emissions

In 2023, the Bainbridge Island government operations produced an estimated **581 MTCO$_2$e**—about **0.3% of total communitywide GHG emissions** that year. The City's largest sources of emissions were from on-road fleet vehicles (38%), employee commuting (18%), facility electricity consumption (11%), and landfilled waste (8%)). Overall government operations emissions have **decreased 71%** since 2014, driven primarily by purchases of renewable electricity (Figure 2).

Figure 1. City government operations GHG emissions.

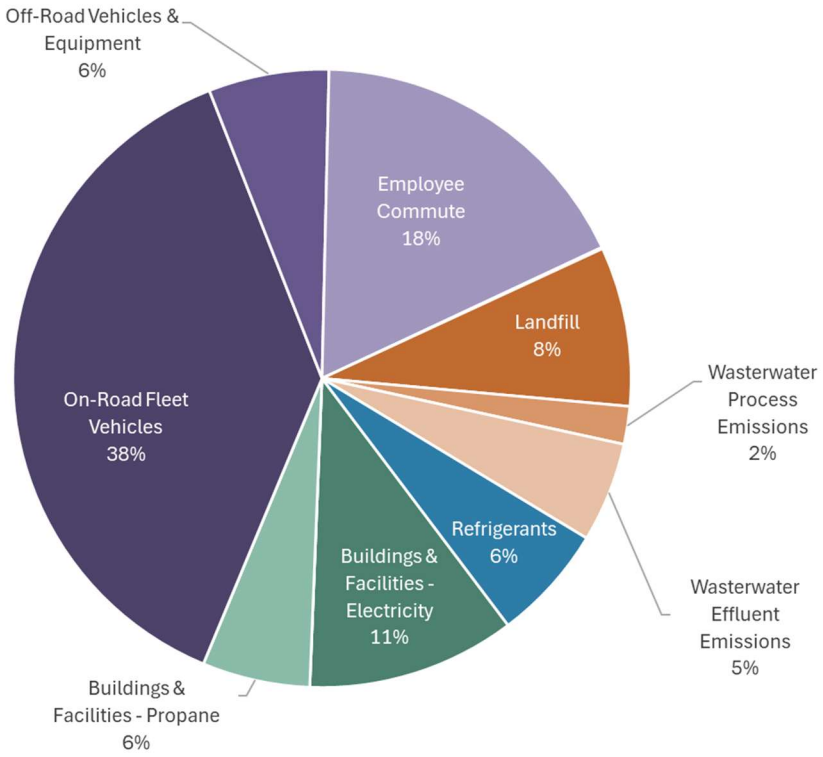
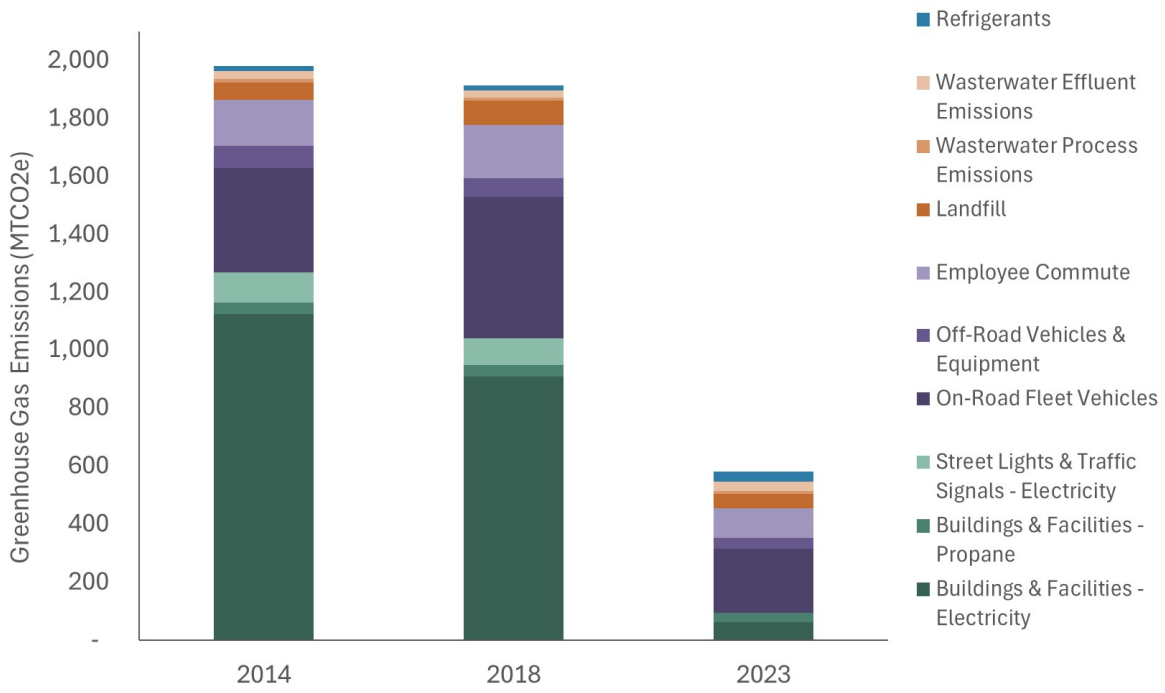


Figure 2. Municipal GHG emissions trends.



Communitywide GHG Emissions

In 2023, the Bainbridge Island community produced an estimated **167,667 metric tons of carbon dioxide equivalent** ($MTCO_2e$)—equivalent to approximately **6.7 $MTCO_2e$ per capita**. As shown in Figure 3, the city's largest sources of communitywide emissions in 2023 were from **residential electricity consumption** (29%), **community air travel** (21%), and **on-road vehicles** (16%). Overall communitywide emissions have **decreased 20% since 2014** and **29% since the previous inventory (2018)**, driven primarily by reductions in electricity emissions (Figure 4).

Figure 3. Communitywide 2023 GHG emissions.

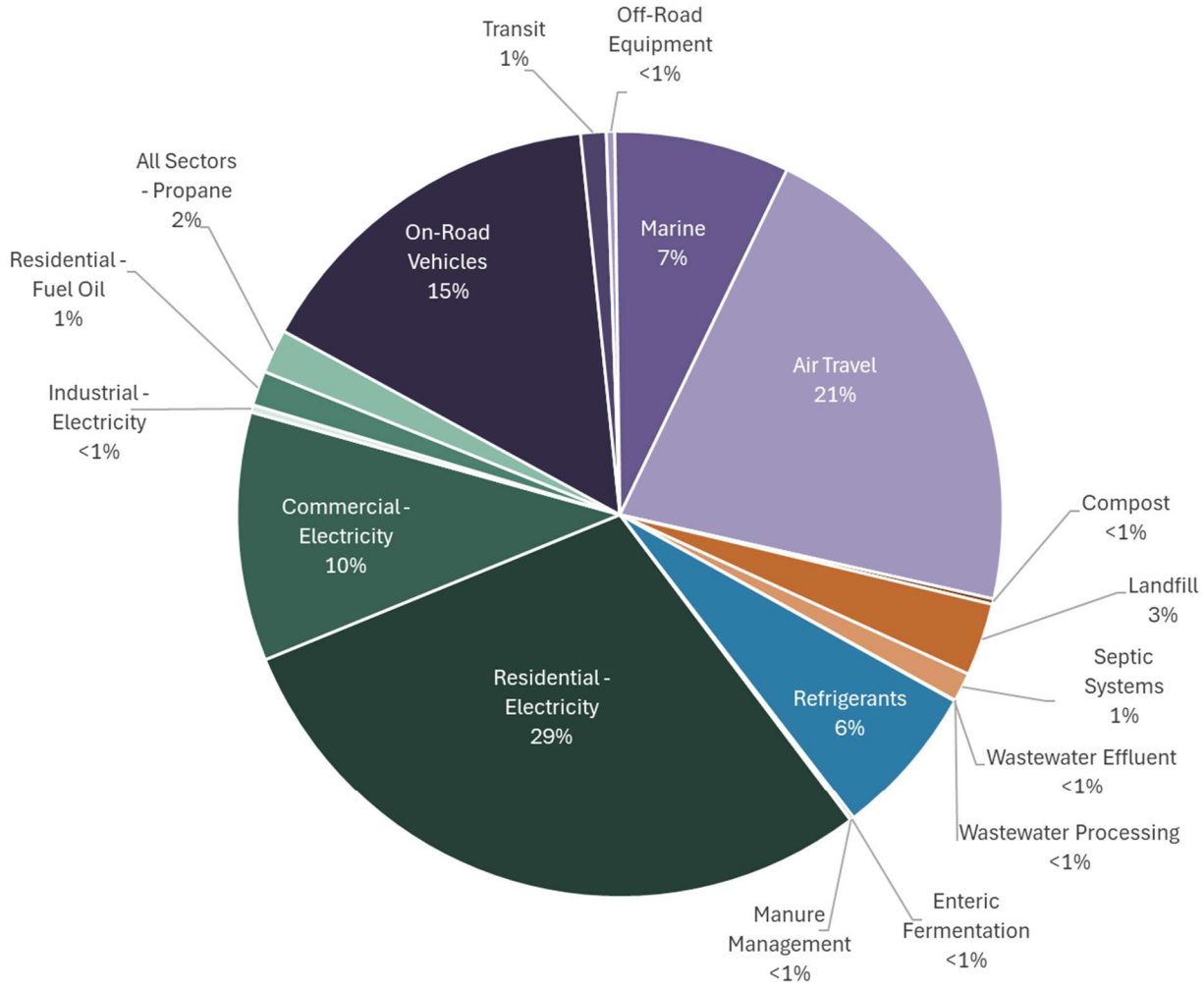
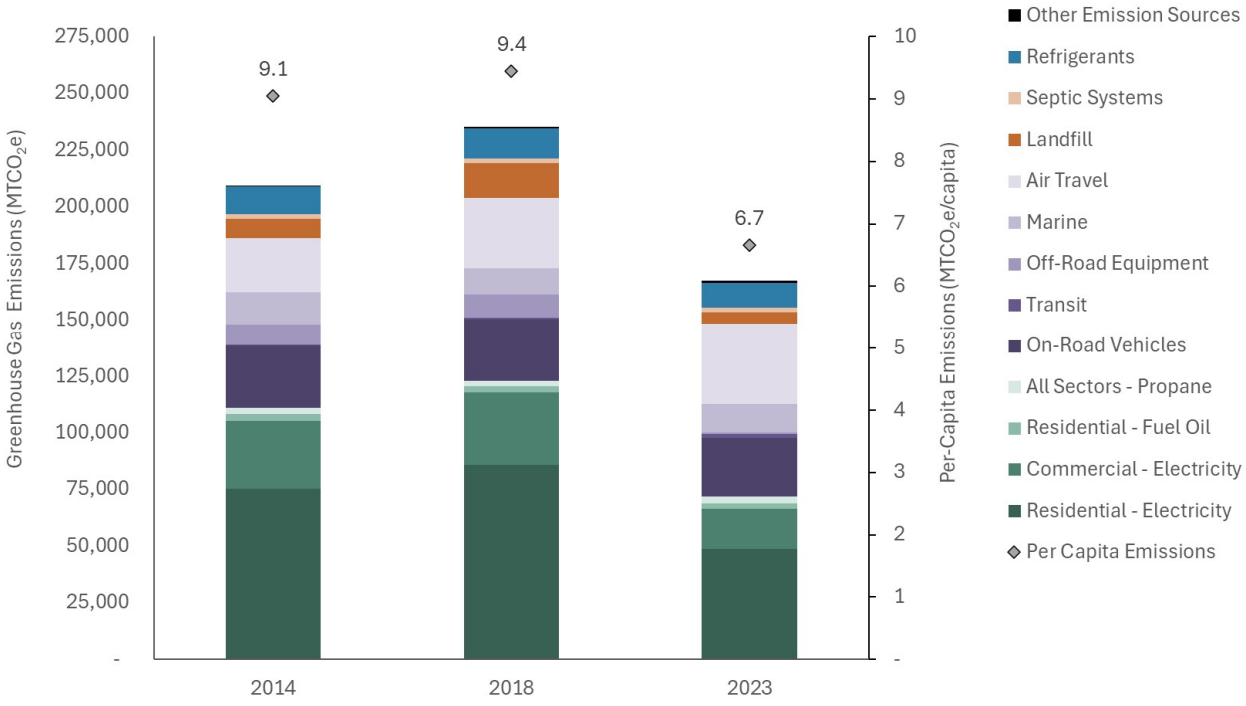


Figure 4. Communitywide GHG emissions trends.



Methodology

The 2023 inventory was developed using best-practice methodologies and aligned with the *U.S. Community Protocol for Accounting and Reporting of GHG Emissions* (USCP) and the *Local Government Operations Protocol* (LGOP). Both communitywide and municipal inventories included key emissions sources from these protocols, including building energy, transportation, solid waste, wastewater, and refrigerants. Emissions are reported for the 2014, 2018, and 2023 calendar years. Analyses were performed in Microsoft Excel and the ICLEI ClearPath 1.0 tool.[2]

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

Introduction

Greenhouse gas (GHG) inventories help jurisdictions understand their emissions profile, track progress toward climate goals, and identify effective strategies to reduce climate pollution. By quantifying emissions from key activities within a defined geographic boundary and time period, inventories illuminate trends, highlight accomplishments, and identify opportunities for continued improvement.

This *Greenhouse Gas Inventory Report* presents an updated assessment of **Bainbridge Island's 2023 greenhouse gas emissions**. The city previously completed inventories for **2014 and 2018**, which established a baseline understanding of communitywide and municipal emissions. This report builds on those earlier efforts by updating the analysis with **2023 data**—allowing the city to evaluate progress over the past decade, understand key drivers of change, and better inform future climate planning.

The 2023 update includes two primary inventories:

- **Community inventory** – Estimates emissions generated by activities within the Bainbridge Island community, including residential and commercial energy use, on-road and off-road transportation, solid waste, wastewater, agriculture, refrigerants, and other relevant sources.

- **Government (municipal) operations inventory** – Accounts for emissions associated with municipal operations, such as energy used in buildings and facilities, fleet fuel consumption, wastewater treatment, solid waste, and refrigerant leakage. This helps the city track its operational footprint and identify opportunities for reduction across departments.

In addition, the report provides:

- **Communitywide contribution analyses** – These analyses examine the key drivers of year-to-year changes in emissions—such as weather variability, transportation activity, or shifts in energy use—to help contextualize trends across 2014, 2018, and 2023.

Together, these components create a comprehensive and comparable view of Bainbridge Island's emissions over time. The 2023 update deepens the city's understanding of progress to date, highlights major sources and drivers of emissions, and offers insights that can guide next steps in achieving Bainbridge Island's long-term climate objectives.

Methodology

The project team used the following guiding principles in completing the City of Bainbridge Island's 2023 GHG analyses:

- **Replicability and transparency** to ensure the inventory can be updated consistently in future years.
- **Retroactive updates** to 2014 and 2018 GHG inventories for consistency and replicability.
- **Consistency** with past Bainbridge Island inventories and available data sources.
- **Accuracy**, including incorporation of all relevant sectors, use of locally specific data whenever possible, and alignment with industry best practices.

GHG Inventory Protocols

The 2023 GHG inventories were developed in accordance with established industry standards:

- **Communitywide emissions** followed ICLEI's *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions* (USCP) and the *Global Protocol for Community-Scale Greenhouse Gas Inventories* (GPC).
- **Municipal operations emissions** followed ICLEI's *Local Government Operations Protocol* (LGOP).

Using these protocols ensures a consistent and comparable approach across inventory years and with other cities.

All calculations were performed in ClearPath. Local data were used whenever available; when not available, regional data from Kitsap County, King County, or state and national datasets were scaled for Bainbridge Island. Data quality was evaluated for each input, with most data categorized as medium quality due to necessary assumptions.

Emission Sources & Calculation Approach

Consistent with protocols, the GHG inventories focus on the following greenhouse gases: [3]

- **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.

GHG emissions were calculated by combining:

- **Activity data** — the level of activity producing emissions (e.g., electricity consumption, natural gas usage, vehicle miles traveled, solid waste generated).
- **Emission factors (EFs)** — values that convert activity levels into GHG emissions (e.g., $MTCO_2e$ per kWh or per mile traveled).

The communitywide inventory includes emissions from activities that occur within Bainbridge Island, as well as out-of-boundary emissions associated with electricity generation and solid waste transported to landfill. Emissions are categorized by **scope**, which reflects where emissions occur: **Scope 1** includes direct in-boundary emissions; **Scope 2** includes emissions from purchased electricity; and **Scope 3** includes other upstream or downstream emissions that occur outside the community boundary. GHG emissions are reported in **metric tons of carbon dioxide equivalent** ($MTCO_2e$).

Table 1 summarizes all **emissions sources included in the community inventory**, indicates whether they are required by the *U.S. Community Protocol*, and identifies their associated scope categories. The community inventory includes sources from all three scopes, including building energy, various transportation modes, and solid waste and wastewater management.

Table 2 summarizes **emissions sources included in the municipal inventory**, whether they are required by the Local Government Operations Protocol, and their associate scope category. The municipal operation emissions inventory accounts for the GHG emissions resulting from Bainbridge Island City government operations. Bainbridge Island's government provides a range of

municipal services including police, streets, planning, zoning, and general administration services. The City also operates the water and wastewater utilities for a portion of the island.

Table 1. Community inventory emissions and scope categories.

		Included in this inventory?		
Emissions Type	**Required?**	**Scope 1**	**Scope 2**	**Scope 3**
Residential Energy				
Electricity	×		✓	
Propane	×	✓		
Fuel Oil	×	✓		
Commercial Energy				
Electricity	×		✓	
Propane	×	✓		
Industrial Energy				
Electricity	×		✓	
Propane		✓		
Transportation				
On-Road Passenger & Freight Vehicles	×	✓		
On-Road Transit Vehicles		✓		
Off-road Vehicles and Equipment		✓		
Air Travel				✓
Ferry				✓
Solid Waste, Potable Water, and Wastewater [4]				
Solid Waste	×			✓
Potable Water Use Energy*	×		✓	
Wastewater Treatment	×		✓	
Other Process & Fugitive Emissions	×	✓		
Agriculture		✓		

[4] Potable water use energy—energy associated with treating and distributing potable water systems on the Island (e.g., from pumping stations)—is included in the non-residential energy consumption sector. Energy used for pumping individual wells is included in the residential energy consumption sector.

Table 2. Municipal inventory emissions and scope categories.

		Included in this inventory?		
Emissions Type	**Required?**	**Scope 1**	**Scope 2**	**Scope 3**
Buildings and Facilities Energy				
Electricity	×		✓	
Stationary Fuel Consumption	×	✓		
Streetlights and Traffic Signals	×		✓	
Transportation				
On-Road Fleet Vehicles	×	✓		
Off-Road vehicles	×	✓		
Employee Commute				✓
Solid Waste, Potable Water, and Wastewater				
Solid Waste				✓
Wastewater Treatment	×	✓		
Refrigerant Leakage	×	✓		

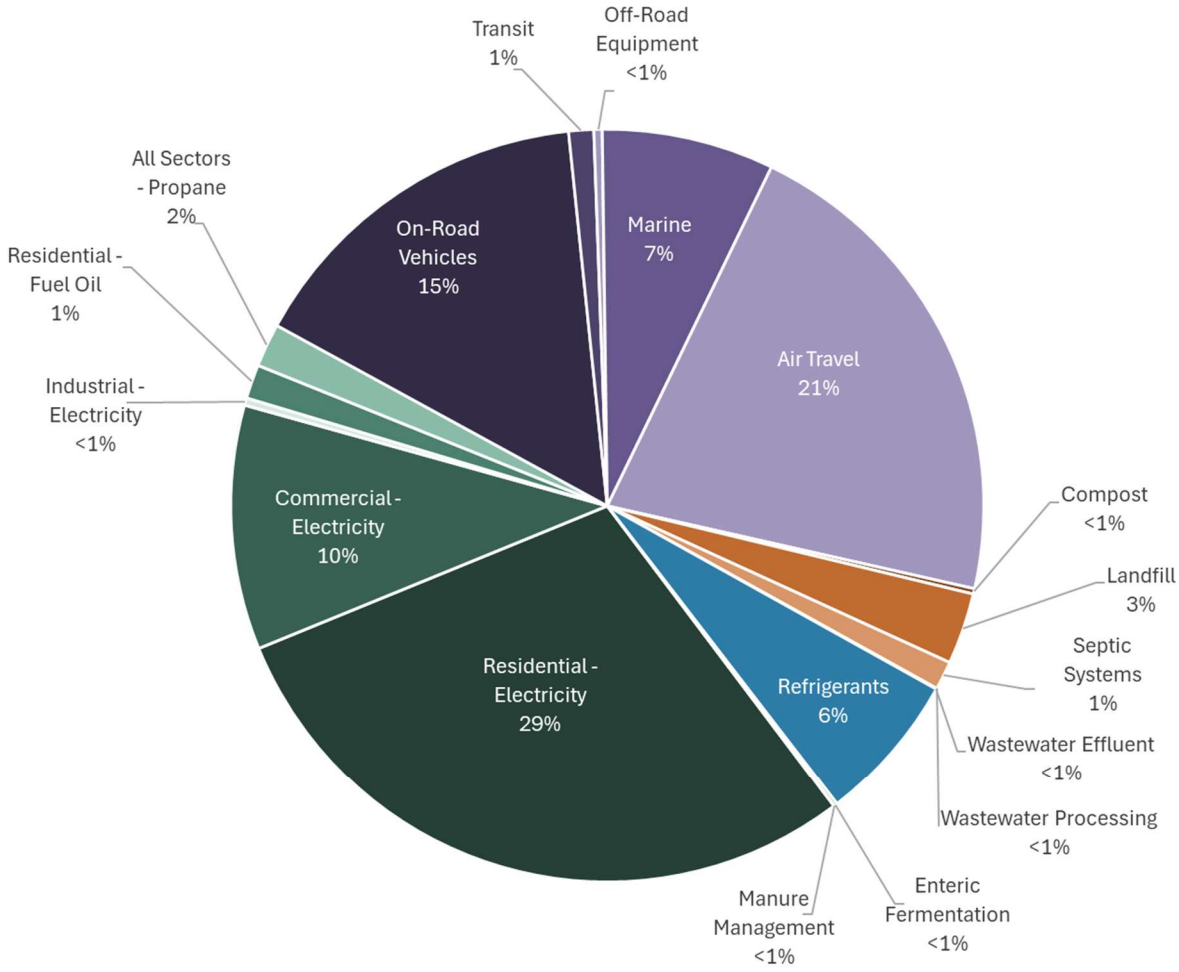
Detailed methodologies and data considerations for each emissions source are provided in **Appendix A: Methodology**.

Inventory Findings & Trends

Communitywide Emissions Results

In 2023, the Bainbridge Island community produced an estimated **167,667 metric tons of carbon dioxide equivalent ($MTCO_2e$)**—or about **6.7 $MTCO_2e$ per capita**. As shown in Figure 5, the largest contributors to communitywide emissions in 2023 were **residential electricity use** (29%), **community air travel** (21%), and **on-road vehicles** (15%).

Figure 5. Communitywide 2023 GHG emissions.



Communitywide emissions have **steadily declined** over the past decade, decreasing **20% since 2014** and **29% since 2018** (Figure 6; Table 3). Per-capita emissions also dropped significantly—a **26% decrease since 2018**—reflecting both absolute reductions and continued population growth.

These downward trends are driven primarily by **substantial reductions in electricity-related emissions** due to a shift to less carbon-intensive electricity sources. State policies such as the WA Clean Energy Transformation Act support this observed trend, driving energy utilities within the state to shift to less carbon-intensive energy sources. Reductions in landfilled waste and some transportation categories also contributed to overall declines.

At the same time, the composition of emissions has shifted. **Air travel now accounts for a growing share of total emissions**, becoming one of the most significant sources in 2023 (note that local air travel emissions are highly estimated based on county-level travel trends and fuel consumption at SeaTac airport). While other major sectors have experienced decreases, rising emissions from air travel partially offset progress in other areas.

Figure 6. Communitywide GHG emissions trends.

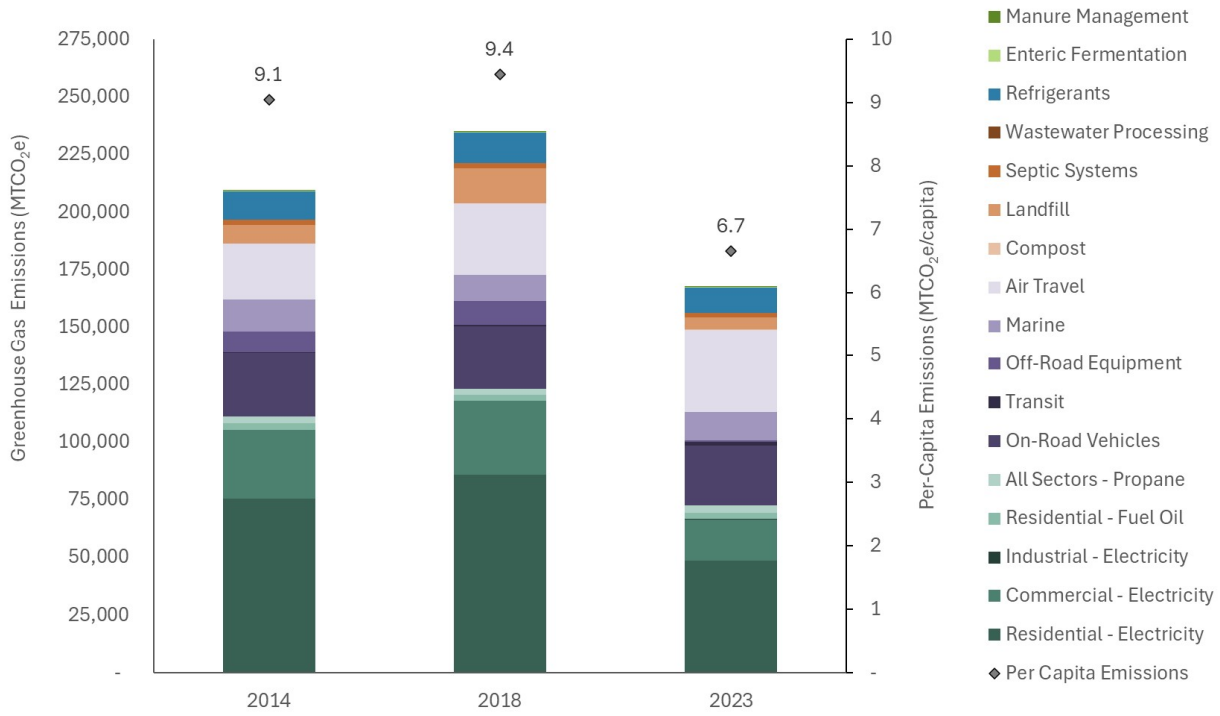


Table 3. Communitywide emissions trends, by sector ($MTCO_2e$).

Sector	2014	2018	2023	Change from Baseline	% Change from Baseline
Residential Energy	81,275	91,172	54,367	(26,908)	-33%
Electricity	75,363	85,898	48,797	(26,566)	-35%
Fuel Oil	3,038	2,803	2,445	(593)	-20%
Non-Residential Energy	29,738	31,925	18,117	(11,621)	-39%
Electricity	29,738	31,925	18,117	(11,621)	-39%
Propane (Residential & Non-Residential)	2,874	2,471	3,125	251	9%
Transportation	75,315	80,778	76,409	1,094	1%
On-Road Passenger & Freight Vehicles	27,448	27,330	25,823	(1,624)	-6%
On-Road Transit Vehicles	590	781	1,803	1,213	206%
Air Travel	24,023	31,002	35,780	11,757	49%
Ferry Travel	14,051	11,334	12,403	(1,648)	-12%
Other Off-Road Vehicles and Equipment	9,204	10,331	600	(8,604)	-93%
Solid Waste & Wastewater Treatment	10,503	17,562	7,639	(2,864)	-27%
Compost	119	132	389	270	227%
Landfill	8,250	15,248	5,139	(3,110)	-38%
Wastewater Treatment	48	51	61	14	28%
Septic Tanks	2,086	2,131	2,049	(37)	-2%
Other Process & Fugitive Emissions	12,209	13,332	10,860	(1,348)	-11%
Refrigerants	12,209	13,332	10,860	(1,348)	-11%
Agriculture	351	331	275	(76)	-22%
Enteric Fermentation	319	297	239	(79)	-25%
Manure Management	33	34	36	3	9%
TOTAL	209,390	235,101	167,667	(41,724)	-20%

Overall, the 2023 emissions profile reflects:

- **Strong communitywide progress**, especially from lower-carbon electricity;
- **Changing sector contributions**, with air travel emerging as a major source; and
- **Continued divergence between total and per-capita emissions**, indicating that reductions are keeping pace with population growth.

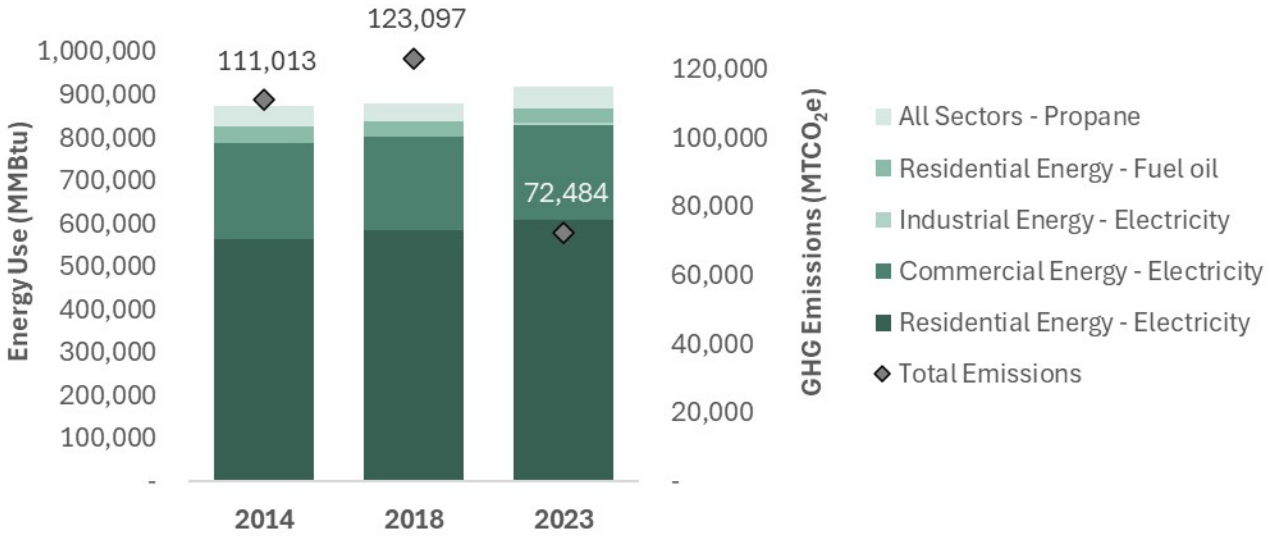
More detailed trends and sector-level drivers are provided in the following sections of this report.

Building Energy

Building energy emissions include electricity, propane, and fuel oil used in **residential, commercial, and industrial buildings**. Figure 7 summarizes energy use trends from 2014, 2018, and 2023, including both on-site fuel combustion and upstream emissions associated with fuel extraction, production, and transport.

In 2023, building energy accounted for approximately **43%** of total communitywide emissions—**32% from residential buildings (54,367 $MTCO_2e$)** and **11% from commercial and industrial facilities (18,117 $MTCO_2e$)**. Since 2014, total building energy emissions have decreased **35%**, driven largely by a cleaner electricity grid.

Figure 7. Community building energy use and emissions trends.



ELECTRICITY

Electricity remains the dominant source of building energy emissions on Bainbridge Island. Combined residential, commercial, and industrial electricity emissions decreased from **105,101 $MTCO_2e$ in 2014** to **67,918 $MTCO_2e$ in 2023**—a **35% reduction** (Figure 7).

This decline is primarily driven by the **decarbonization of Puget Sound Energy's electricity fuel mix**, shown in Table 4. Between 2014 and 2023:

- **Coal decreased** from 35% to 18% of PSE's mix.
- **Wind increased** from 3% to 22%.
- **Natural gas increased** from 20% to 30%, reflecting fuel switching away from higher-carbon sources.

These changes lowered the emissions factor for electricity and contributed directly to declining emissions from both residential and non-residential buildings, even as consumption increased.

Table 4. Puget Sound Energy (PSE) electricity generation fuel mix trends.[5]

Electricity Generation Fuel Type	2014	2018	2023
Biomass	0%	0%	0%
Coal	35%	38%	18%
Cogeneration	4%	0%	0%
Geothermal	0%	0%	0%
Hydro	36%	33%	30%
Landfill Gas	0%	0%	0%
Natural Gas	20%	21%	30%
Nuclear	1%	1%	0%
Other	0%	0%	0%
Petroleum	0%	0%	0%
Solar	0%	0%	0%
Waste	0%	0%	0%
Wind	3%	6%	22%

Electricity use has grown modestly across the community. **Residential electricity consumption increased about 6%** from 2014 to 2023, and **non-residential use increased about 7%**, reflecting changes in population, employment, and commercial activity. Despite these increases, emissions declined overall due to cleaner electricity fuel sources.

Electricity-related emissions also incorporate **transmission and distribution losses** (grid losses), which make up a small fraction of total emissions and have remained relatively stable over the analysis period.

Since 2014, Bainbridge Island residents significantly increased their participation in PSE's Green Power Program. The **Green Power Program** allows customers to purchase renewable energy to support regional clean energy development.

[5] Electricity Fuel Mix | Puget Sound Energy (PSE)

PROPANE AND FUEL OIL

Delivered fuels (propane and fuel oil) together accounted for approximately **3% of total communitywide emissions** in 2023—**3,125 $MTCO_2e$ from propane** and **2,445 $MTCO_2e$ from fuel oil**.

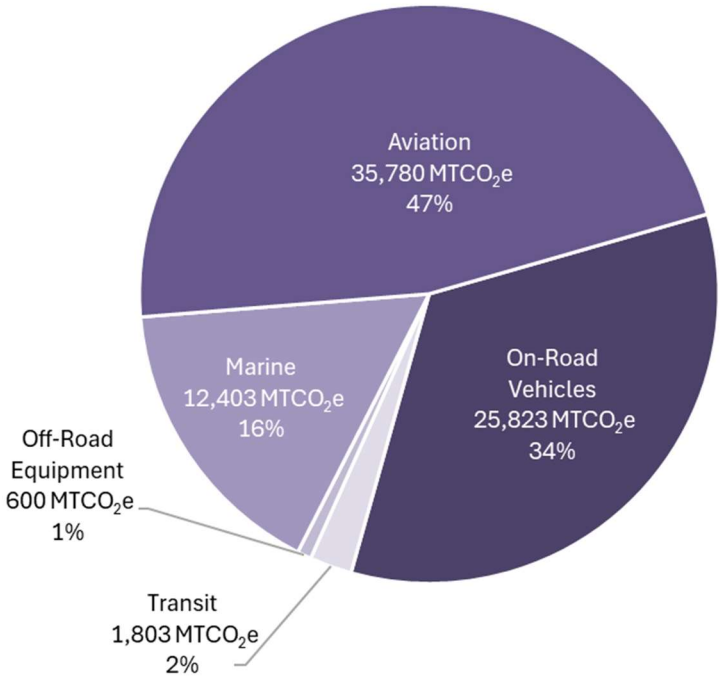
Combined emissions from these fuels have decreased **11% since 2014**, consistent with gradual declines in the number of buildings using delivered fuels for heating or cooking and slow transitions toward electricity and heat pumps. Although small relative to electricity, delivered fuels remain a persistent emissions source due to long equipment replacement cycles.

Transportation

The transportation sector includes emissions from **on-road vehicles, off-road equipment, aviation, transit, and marine vessels**. In 2023, transportation accounted for approximately **76,409 $MTCO_2e$**—or **3.0 $MTCO_2e$ per capita**—making it **the largest contributor** to Bainbridge Island's communitywide emissions (46%). As shown in Figure 8, emissions from aviation, on-road vehicles, and marine travel make up the vast majority of transportation-related emissions.

Overall transportation emissions increased **1% since 2014**, reflecting a combination of rising activity levels in certain categories (e.g., air travel and transit) and reductions in others (e.g., on-road passenger vehicles and ferry travel).

Figure 8. Community transportation 2023 GHG emissions.



ON-ROAD VEHICLES

On-road vehicle emissions include passenger vehicles and freight/service vehicles (light-, medium-, and heavy-duty). Passenger vehicles account for most on-road emissions.

In 2023, on-road vehicles produced **25,823 $MTCO_2e$**, or **34% of transportation emissions**.

Despite an overall **6% increase in vehicle miles traveled (VMT)** between 2014 and 2023 (Table 5; Figure 9), **on-road emissions decreased by 6%**. This decline is attributable to:

- **Improved vehicle fuel efficiency**, demonstrated by lower average emissions per mile ($MTCO_2e$/mile).
- **A decreasing share of VMT from medium and heavy trucks**, which experienced notable reductions in activity (−17% and −35%, respectively).
- **Gradual turnover of the regional passenger vehicle fleet** toward more efficient and lower-emitting technologies.

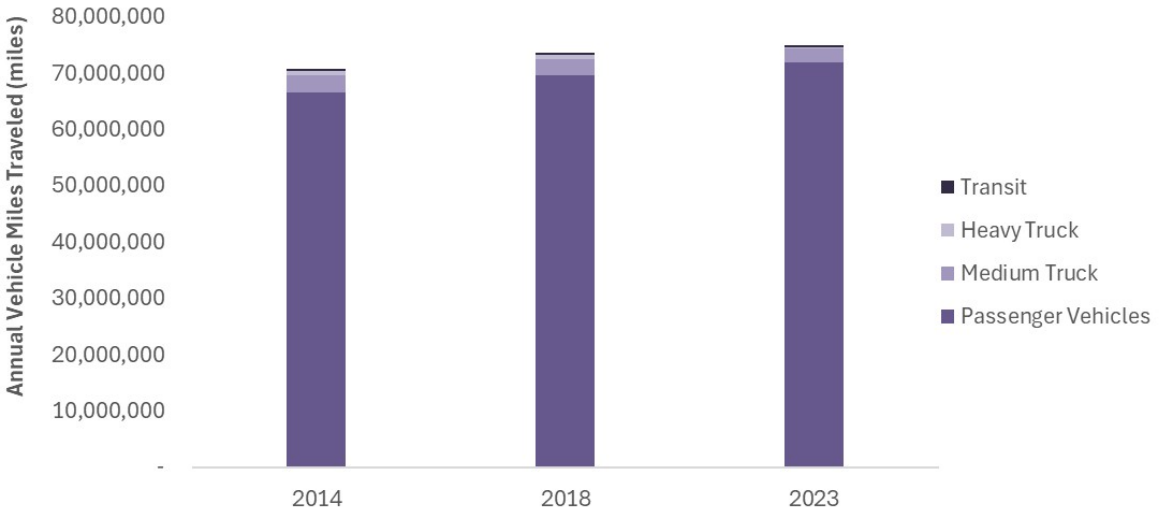
Transit vehicle emissions increased from **590 $MTCO_2e$ in 2014** to **1,803 $MTCO_2e$ in 2023**, consistent with modest increases in service levels or ridership on routes serving the island.

Table 5. Annual vehicle miles traveled estimated for Bainbridge Island.

Type	2014	2018	2023	Difference from Baseline	% Change from Baseline
Passenger vehicle	66,612,870	69,543,904	71,815,260	5,202,390	8%
Medium truck	3,011,067	2,993,763	2,513,424	(497,643)	-17%
Heavy Truck	708,280	708,118	245,324	(462,956)	-65%
Transit bus [6]	394,450	397,634	397,995	3,545	1%

[6] Miles for transit buses are in annual revenue miles.

Figure 9. On-road vehicle miles traveled by vehicle type.



OFF-ROAD VEHICLES & EQUIPMENT

Off-road vehicles and equipment made up **less than 1% of total communitywide emissions** in 2023 (600 $MTCO_2e$). These emissions come from construction, landscaping, agricultural, airport-support, recreation, and other non-road equipment. The largest source of off-road emissions is construction equipment, making up 36% of off-road equipment emissions.

Emissions from this category decreased **93% since 2014**, likely reflecting:

- lower reported activity levels,
- increased equipment efficiency or electrification, or
- changes in equipment inventories across sectors.

FERRY TRAVEL

Marine vessel emissions related to Bainbridge Island's share of Washington State Ferry travel decreased **12% since 2014**. This reduction is consistent with **decreased ferry fuel consumption** on the Seattle–Bainbridge route and operational changes made over the past decade.

In 2023, Bainbridge Island's share of ferry travel accounted for an estimated **2.4 million gallons of fuel**, compared to **2.2 million gallons in 2014**, though the emissions factor and engine/route efficiency improvements offset some of the growth in fuel consumption

AIR TRAVEL

Air travel is the **largest share of transportation emissions**, accounting for **35,780 $MTCO_2e$ (47%)** of transportation-related emissions and **21% of total communitywide emissions**.

Aviation emissions increased **49% since 2014**, driven by:

- population growth on Bainbridge Island,
- increasing travel demand among residents and visitors, and
- overall increases in fuel consumption and flight activity through Seattle-Tacoma International Airport between 2014 and 2023.

Air travel in 2023 exceeds emissions from other transportation mobile sources making it one of the most significant—and most difficult to reduce—sources of communitywide emissions.

Air travel emissions associated with Bainbridge Island residents and visitors were estimated using county-specific passenger survey data and jet fuel consumption data from Seattle-Tacoma International Airport (SeaTac) provided by the Port of Seattle. Jet fuel use was allocated to Bainbridge Island based on SeaTac passenger enplanement survey results at the county-level, downscaled to the city-level based on local population and employment. Using this approach, approximately 0.5% of SeaTac's fuel consumption was attributed to Bainbridge Island residents and visitors.

OTHER OFF-ROAD VEHICLES & EQUIPMENT

Other off-road equipment (e.g., construction, industrial, and recreation equipment not included above) accounted for **<1% of transportation emissions** and declined **93%** since 2014.

Solid Waste and Wastewater

The solid waste and wastewater sector includes emissions from the **generation, transportation, and disposal of solid waste** as well as emissions from **treatment of wastewater** produced within Bainbridge Island. Solid waste emissions are generated from landfill decomposition, collection and hauling, landfill equipment, and composting. Wastewater emissions include process emissions from treatment facilities and fugitive emissions from septic systems.

In 2023, solid waste and wastewater together accounted for approximately **5% of total communitywide emissions**. Emissions from solid waste decreased **27% since 2014**, driven by reductions in the amount of landfill-bound waste and improvements in waste management practices (Figure 10; Table 7). Bainbridge Disposal reported composting **2,762 tons of yard waste** in 2023, generating **389 $MTCO_2e$** from decomposition.

SOLID WASTE

Solid waste emissions fell from **8,369 $MTCO_2e$ in 2014** to **5,529 $MTCO_2e$ in 2023**, a **34% reduction**, with changes varying across processes (Figure 10; Table 7):

- **Landfill disposal and decomposition:** decreased by **1,486 $MTCO_2e$ (−27%)**, reflecting reduced waste tonnage and improved waste diversion.

- **Collection and transportation:** decreased by **1,403 MTCO$_2$e (−60%)**, consistent with reduced waste volumes and hauling-related emissions.
- **Landfill equipment:** declined by **221 MTCO$_2$e (−60%)**.
- **Yard waste composting:** increased from **119 MTCO$_2$e to 389 MTCO$_2$e (+270 MTCO$_2$e)** due to higher reported volumes of composted material.

Landfilled waste is transported from Bainbridge Island to **Columbia Ridge Landfill** in Arlington, OR, approximately 330 miles from Bainbridge Island. Due to this long distance, landfill collection and transportation related emissions make up about 17% of emissions from community solid waste disposal. This distance means that avoiding the generation of landfilled waste—either by producing less waste overall or composting/recycling—presents a considerable emissions reduction opportunity for Bainbridge Island.

Although composting emissions increased in absolute terms, composting remains a **much lower-emission disposal method** than landfilling. A shift from landfill disposal to composting reduces overall solid waste emissions, as composting produces much fewer methane emissions—a potent greenhouse gas—compared to landfilling. Overall, compost tonnage has increased and landfilled tonnage has decreased over time (Table 6).

Table 6. Solid waste disposal tonnage trends, by sector.

Sector	2014	2018	2023	Difference from Baseline	% Change from Baseline
Multi-family & commercial landfill disposal (short wet tons)	*9,864*	*10,948*	*1,400*	*(8,464)*	*-86%*
Single family landfill disposal (short wet tons)	*4,322*	*7,995*	*5,112*	*790*	*18%*
Compost (short wet tons)	*1,712*	*1,900*	*2,762*	*1,050*	*61%*
Total	**15,898**	**20,843**	**9,274**	**(6,625)**	**-42%**

Figure 10. Solid waste emissions trends, by source.

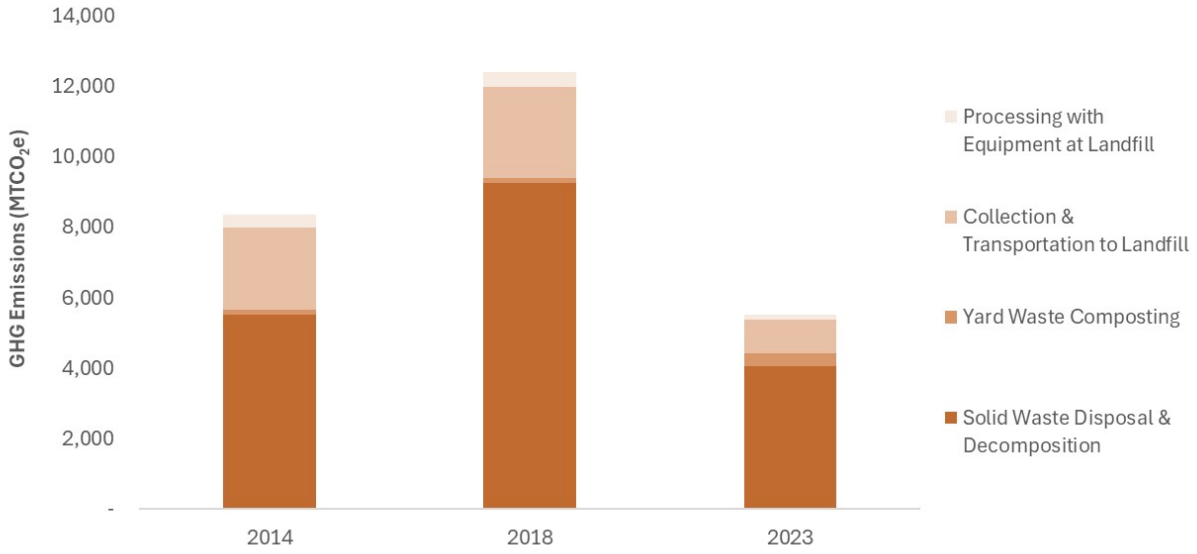


Table 7. Summary of solid waste emissions, by process.

Process	Emissions ($MTCO_2e$)			
	2014	2018	2023	Difference from Baseline
Solid Waste Disposal & Decomposition	5,527	9,250	4,041	(1,486)
Yard Waste Composting	119	132	389	270
Collection & Transportation to Landfill	2,352	2,611	949	(1,403)
Processing with Equipment at Landfill	371	412	150	(221)
Total	**8,369**	**12,404**	**5,529**	**(2,840)**

WASTEWATER TREATMENT

Wastewater-related emissions—including process emissions from treatment and fugitive emissions from septic systems—made up **approximately 1% of communitywide emissions** in 2023.

As shown in **Table 6**, total wastewater emissions remained relatively stable since 2014, declining by **1% overall**:

- **WWTP process emissions** increased by **4 $MTCO_2e$ (+28%)**, due to higher volumes of wastewater treated alongside population growth.
- **WWTP effluent emissions** increased by **10 $MTCO_2e$ (+28%)**, also driven by higher wastewater flows.

- **Septic system emissions** decreased slightly by **37 MTCO$_2$e (–2%)**, despite population growth. Septic emissions are scaled based on estimated population on septic systems, and minor changes reflect updated population estimates and wastewater generation assumptions.

While process and effluent emissions increased modestly in absolute terms, they remain **very small compared to other sectors**, and the wastewater sector as a whole continues to contribute only a limited share of communitywide greenhouse gas emissions.

Table 8. Summary of wastewater treatment and septic tank emissions.

Source	GHG Emissions (MTCO$_2$e)				
	2014	2018	2023	Difference from Baseline	% Change from Baseline
WWTP Process	13	14	17	4	28%
WWTP Effluent	35	37	44	10	28%
Septic Tanks	2,086	2,131	2,049	(37)	-2%
Total	**2,134**	**2,182**	**2,110**	**(24)**	**-1%**

Other Process & Fugitive Emissions

Emissions from other process and fugitive sources include **hydrofluorocarbons (HFCs)**, **perfluorocarbons (PFCs)**, and **sulfur hexafluoride (SF$_6$)**. These gases—primarily associated with refrigeration, air conditioning, electrical transmission systems, and industrial processes—accounted for **6% of Bainbridge Island's communitywide emissions in 2023**.

As shown in Table 9, emissions from this category totaled **10,860 MTCO$_2$e** in 2023, an **11% decrease since 2014**. HFCs remain the dominant gas, making up **98% of emissions** within this category. This reflects the widespread use of HFCs in refrigeration and cooling systems and the release of refrigerants during equipment servicing or end-of-life disposal. Note that these data are downscaled based on national emissions trends, so trends may not be fully reflective of local activity.

Trends among gases include:

- **HFCs:** decreased **11%** since 2014 due to gradual turnover of older, higher-GWP refrigerants and improved handling practices.
- **PFCs:** increased sharply (+469%), but absolute emissions remain extremely small (17 MTCO$_2$e).
- **SF$_6$:** decreased **21%**, likely reflecting changes in electrical system equipment and leak management.

Although relatively small compared to transportation and building energy, this sector is important because these gases have **very high global warming potentials**. Continued reductions will

depend on the adoption of low-GWP refrigerants and improved refrigerant recovery and disposal practices.

Table 9. Summary of emissions from other processes and fugitive sources.

GHG	GHG Emissions ($MTCO_2e$)				
	2014	2018	2023	Difference	% Change from Baseline
HFC	12,058	13,234	10,728	(1,331)	-11%
PFC	3	3	17	14	469%
SF_6	147	95	116	(31)	-21%
Total	**12,209**	**13,332**	**10,860**	**(1,348)**	**-11%**

Agriculture

Agricultural emissions on Bainbridge Island come primarily from **enteric fermentation** (methane emissions from livestock digestion) and **manure management**. Agricultural activity on the island is modest, and emissions from this sector accounted for **less than 1%** of communitywide emissions in 2023.

Based on Kitsap County agricultural census data, scaled to Bainbridge Island using proportional land area, the island supported an estimated **893 livestock animals** in 2023—an **11% increase** from 2014 (Table 10). The composition of livestock has shifted over time:

- **Cattle populations decreased by 33%**, which drove a **25% reduction in enteric fermentation emissions**, as cattle account for the majority of methane emissions in this category.
- **Horse populations decreased by 15%**, resulting in a small reduction in associated emissions.
- **Goats increased significantly (+83%)**, though absolute emissions remain small due to their low per-animal emission rate.
- **Poultry increased by 22%**, but poultry contribute very little to CH_4 or N_2O emissions.
- **Swine decreased by 35%**, also resulting in very small overall emissions changes.

Despite overall livestock increases, total agricultural emissions remain extremely low. Manure management emissions increased **9% since 2014**, consistent with the modest rise in livestock counts.

Given the small scale of agricultural activity on Bainbridge Island, emissions from this sector remain relatively stable and are **not a major driver of communitywide emissions trends**.

Table 10. Agricultural acres and population trends, by livestock.

Animal	Animal Population			
	2014	2018	2023	% Change from Baseline
Horses	98	100	83	-15%
Sheep	41	82	41	0%
Goats	35	44	64	83%
Cattle	92	81	62	-33%
Poultry	517	538	630	22%
Swine	20	30	13	-35%
Total	**803**	**875**	**893**	**11%**

Communitywide Contribution Analysis

Introduction

In 2023, Bainbridge Island's 25,180 residents and 9,827 households generated an estimated **167,667 MTCO$_2$e** in communitywide emissions. Since 2018, the population increased by **1%**, the number of households increased by **4%**, and total communitywide emissions decreased by **20%**. To understand the forces behind these changes, the City applied ICLEI USA's *Analyzing Drivers of Change in Greenhouse Gas Emissions Inventories* tool to attribute inventory changes to underlying economic, social, technological, and environmental factors.

Results

The contribution analysis shows that Bainbridge Island's emissions reductions during this period were driven primarily by **substantial decarbonization of Puget Sound Energy's electricity fuel mix**, which produced the single largest decrease in emissions. Reductions in **per-capita waste generation**, along with improvements in **commercial energy efficiency** and **on-road vehicle emissions per mile**, further contributed to downward pressure.

Several factors exerted upward pressure on emissions, including a **colder winter**, **employment growth**, modest **population growth**, and **more vehicle miles traveled per person**. Increases were also observed in **air travel**, **off-road vehicle activity**, and several smaller categories (e.g., refrigerants, wastewater), which together added to total emissions.

The **"waterfall" charts** on the following pages (Figure 11 and Figure 12) illustrate how these drivers interact to produce the net reduction between 2018 and 2023. Unlike the simple trend charts presented in the previous section, these figures show not only how emissions or underlying activities have changed over time, but also the relative contribution of different factors driving those changes. Understanding these drivers helps the City better interpret observed emissions trends, including the extent to which changes may be driven by factors outside of the City's direct control versus areas where local action can have a meaningful impact on future emissions reductions.

Figure 11. High-level summary of major drivers of communitywide inventory increases and decreases.

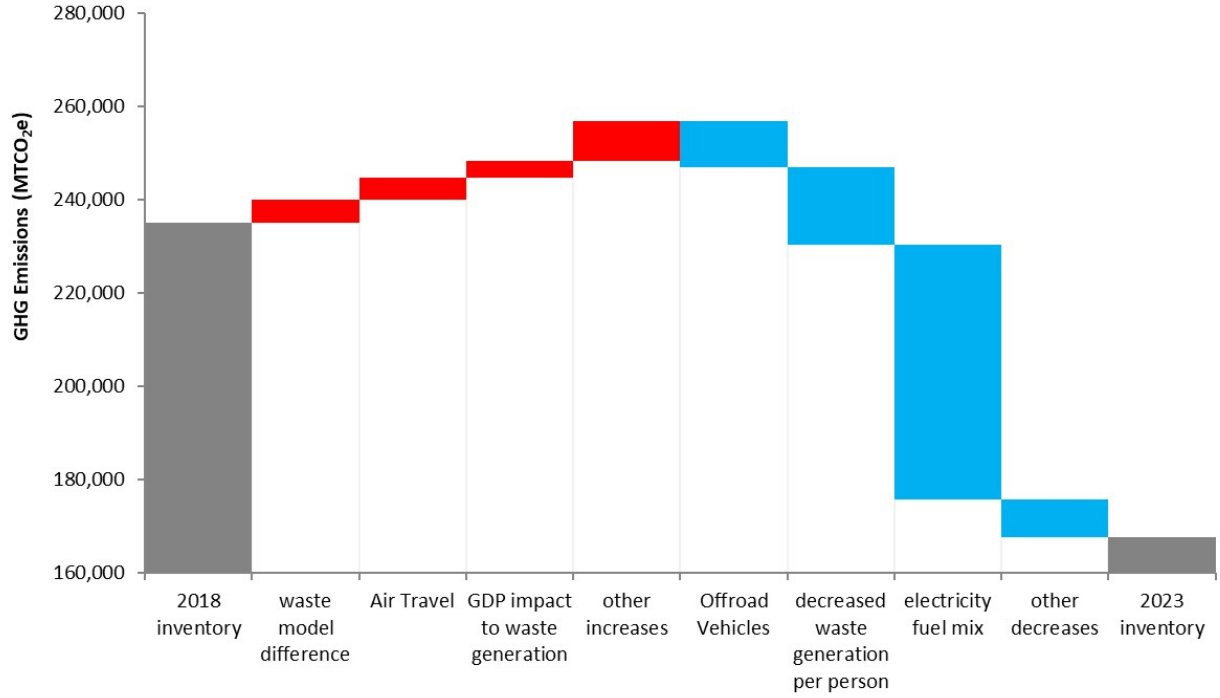
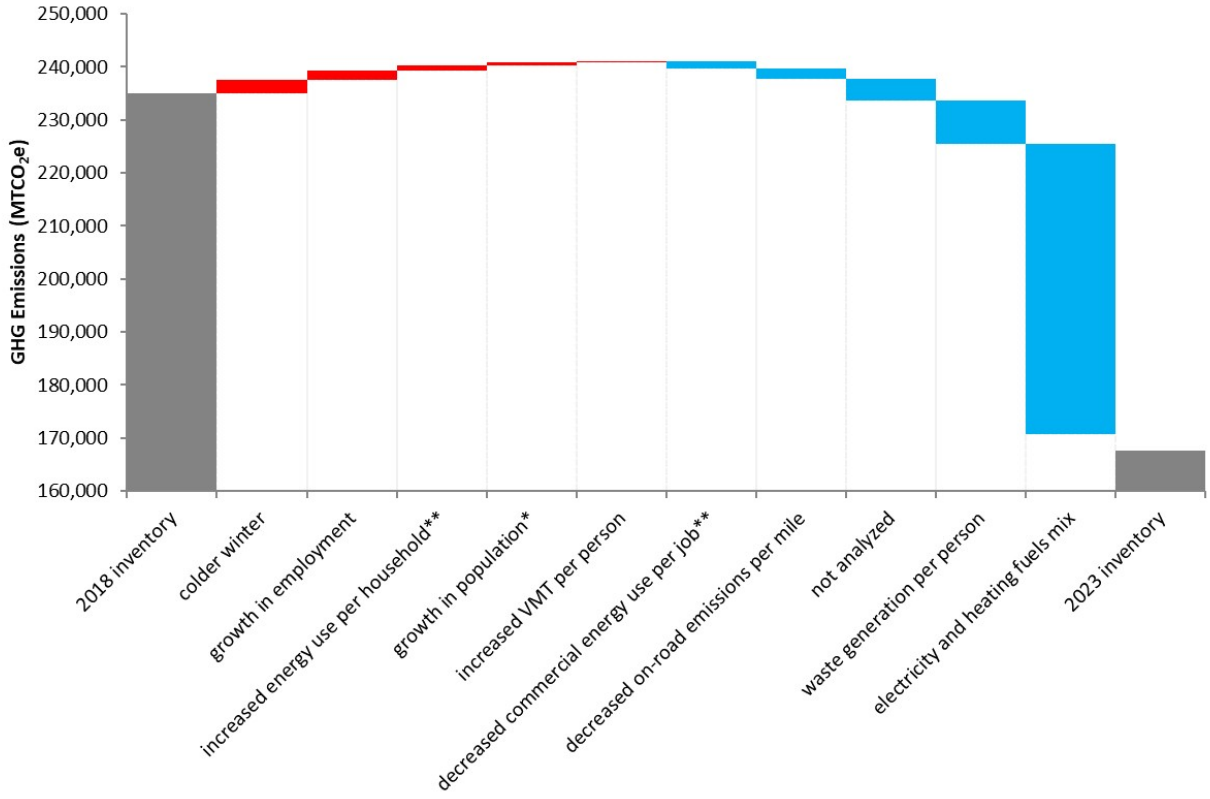


Figure 12. Detailed depiction of major drivers of inventory increases and decreases.



These factors were the dominant contributors to the overall 20% decline in emissions.

- **Electricity fuel mix (−54,544 $MTCO_2e$)**
  The most significant driver of emission reductions. Changes in PSE's electricity generation portfolio—including increased wind and other renewables—substantially lowered the carbon intensity of electricity used within Bainbridge Island.

- **Decreased waste generation per person (−14,735 $MTCO_2e$)**
  Waste generation has declined, reducing per-capita disposal and lowering landfill emissions.

- **Off-road equipment (−9,731 $MTCO_2e$)**
  Off-road emissions—such as construction, landscaping, and recreational equipment—fell sharply between 2018 and 2023, becoming one of the largest contributors to overall reductions (as reflected in the waterfall chart).

- **Decreased commercial energy use per job (−1,277 $MTCO_2e$)**
  Efficiency improvements in the commercial sector reduced electricity and fuel use per employee.

- **Decreased on-road emissions per mile (−1,982 $MTCO_2e$)**
  Improvements in vehicle efficiency lowered the emissions intensity of driving, even as VMT increased slightly.

Conversely, several factors exerted upward pressure on emissions during the same period, reflecting demographic, economic, and activity-based changes across the community:

- **Air Travel (+4,778 $MTCO_2e$)**
  Increased estimated air travel activity tied to SeaTac departures.

- **Colder Winter (+2,526 $MTCO_2e$)**
  Higher heating demand due to colder 2023 winter conditions.

- **Growth in Employment (+1,695 $MTCO_2e$)**
  Increased commercial activity and energy use associated with job growth.

- **GDP-Related Impact to Waste Generation (+1,606 $MTCO_2e$)**
  More waste generation linked to higher economic activity.

- **Increased Energy Use per Household (+853 $MTCO_2e$)**
  Slight rise in household energy consumption.

- **Growth in Population (+641 $MTCO_2e$)**
  Higher overall activity levels due to more residents.

- **Other Increases (+approximately 1,068 $MTCO_2e$)**
  (Includes smaller contributions from wastewater, refrigerants, agriculture, and other sources not individually attributed in the tool.)

Government Operations Emissions Results

The government operations ("municipal") inventory summarizes GHG emissions from **city-owned and operated facilities, fleet vehicles, equipment, and government-managed waste and wastewater activities**. Although some sector names align with those used in the communitywide inventory, municipal emissions represent only the subset associated with City operations and are therefore much smaller in scale than total communitywide emissions. In 2023, Bainbridge Island's municipal operations produced an estimated **581 $MTCO_2e$**, representing approximately **0.3%** of total communitywide emissions. As shown in Table 11, the largest sources of municipal emissions in 2023 were:

- **On-road fleet vehicles** (219 $MTCO_2e$; 38%)
- **Employee commute** (103 $MTCO_2e$; 18%)
- **Solid waste and wastewater** (91 $MTCO_2e$; 16%)

Municipal emissions declined **71% since 2014**, primarily due to a near elimination of electricity-related emissions from government buildings and streetlights as the City became an EPA green power parter, transitioning to a fully renewable electricity supply through the purchase of 100% green power (Figure 14; Figure 15). The remaining electricity emissions correspond to transmission and distribution losses from the green power purchased, which is not currently covered by the City's green power purchases.

Table 11. Government operations GHG emissions trends ($MTCO_2e$).

Sector	2014	2018	2023	Change from Baseline	% Change from Baseline
Builds & Facilities Energy	1,167	948	33	(1,071)	-92%
Electricity	1,024	818	63	(961)	-94%
Propane	40	40	33	(7)	-18%
Electricity - Streetlights & Traffic Signals	103	91	-	(103)	-100%
Transportation & Other Mobile Sources	596	184	359	(237)	-40%
On-Road Fleet Vehicles	359	491	219	(140)	-39%
Off-Road Vehicles & Equipment	77	64	37	(40)	-52%
Employee Commute	160	184	103	(57)	-36%
Solid Waste and Wastewater	99	118	91	(9)	-9%
Compost	<1	<1	<1	<1	205%
Landfill	59	84	48	(11)	-18%
Wastewater Treatment (Process)	11	9	11	<1	4%
Wastewater Treatment (Effluent)	29	25	30	1	4%
Other Process & Fugitive Emissions	17	17	35	18	102%
Refrigerants	17	17	35	18	102%
TOTAL	1,982	1,914	581	(1,401)	-71%

Figure 13. Government operations 2023 GHG emissions.

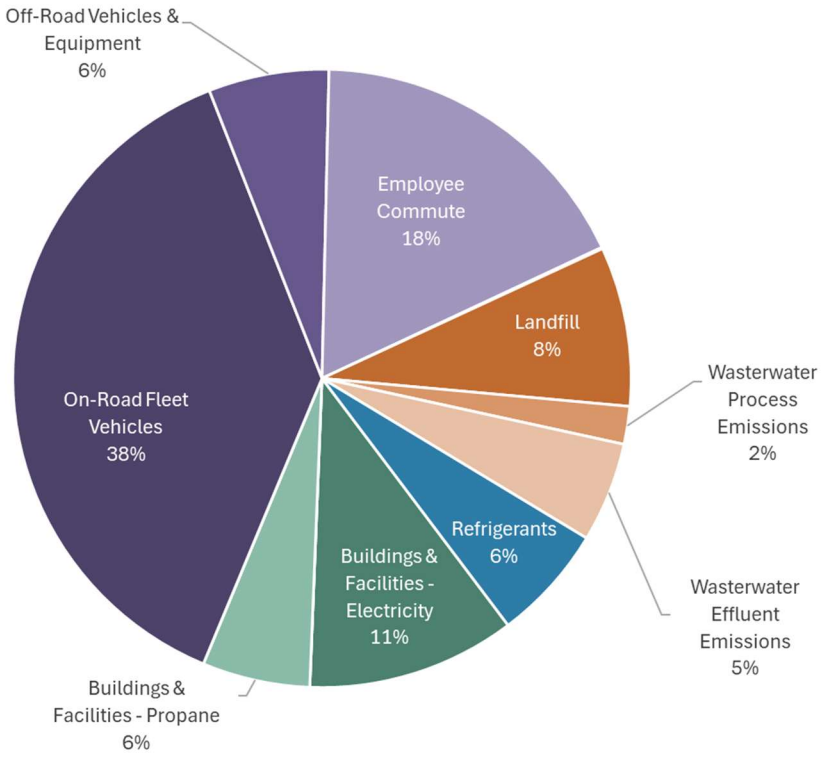
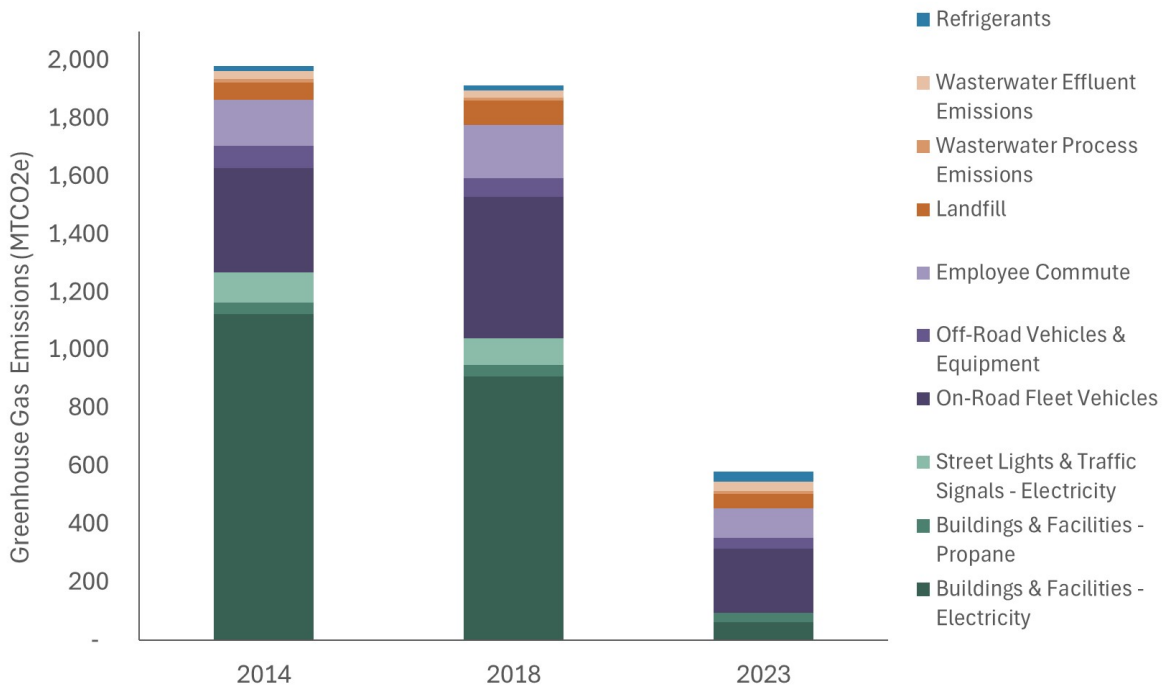


Figure 14. Municipal GHG emissions trends.



Buildings and Facilities Energy

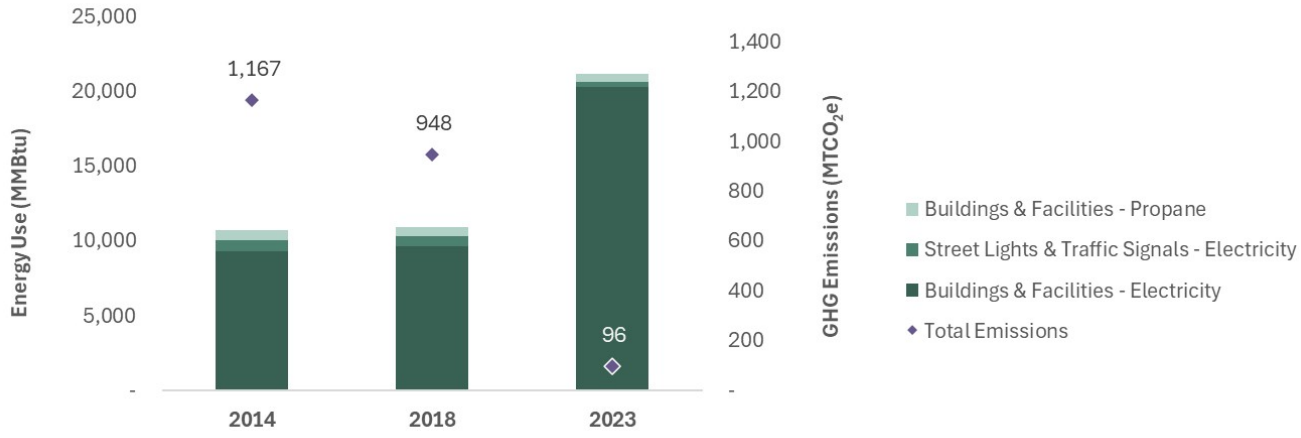
In 2023, emissions from municipal buildings and facilities totaled **96 $MTCO_2e$**, representing **17%** of overall municipal emissions (Figure 13). This category includes energy used to heat, cool, and power city-owned buildings and infrastructure.

ELECTRICITY

Electricity-related emissions for municipal buildings fell from **1,024 $MTCO_2e$ in 2014** to **63 $MTCO_2e$ in 2023**—a **94% reduction**. This decline reflects the City's shift to a **100% renewable electricity supply** for municipal operations (e.g., green power and solar participation), which eliminated emissions associated with municipal electricity use. The remaining electricity emissions correspond to transmission and distribution losses from the green power purchased from PSE, which is not currently covered by the City's green power purchases.

Even as energy consumption increased across facilities (Figure 15), emissions did not rise due to green power purchases.

Figure 15. Government operations energy use and emissions trends.



PROPANE (STATIONARY FUEL COMBUSTION)

Municipal propane use generated **33 $MTCO_2e$ in 2023**, an **18% decrease since 2014** (Figure 15). Propane use remains one of the few remaining sources of building-related emissions and is used for heating at certain facilities.

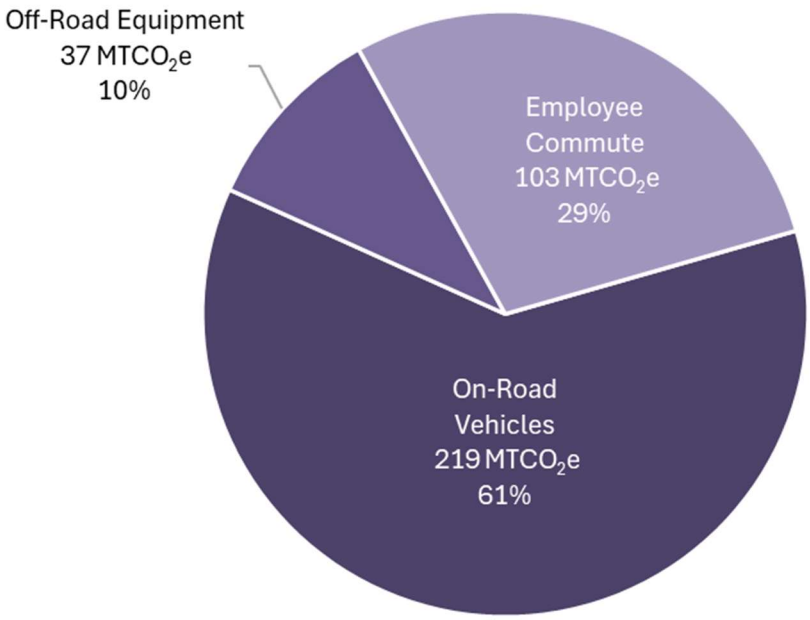
STREETLIGHTS AND TRAFFIC SIGNALS

Emissions from streetlights and traffic signals decreased from **103 $MTCO_2e$ in 2014** to **0 $MTCO_2e$ in 2023**, consistent with the City's shift to renewable electricity.

Transportation & Mobile Sources

Transportation activities were the **largest contributor** to municipal emissions in 2023, accounting for **69%** of the total (359 $MTCO_2e$). Sources include **on-road fleet vehicles**, **off-road equipment**, and **employee commuting** (Figure 16**)**.

Figure 16. Municipal transportation emissions, by source.



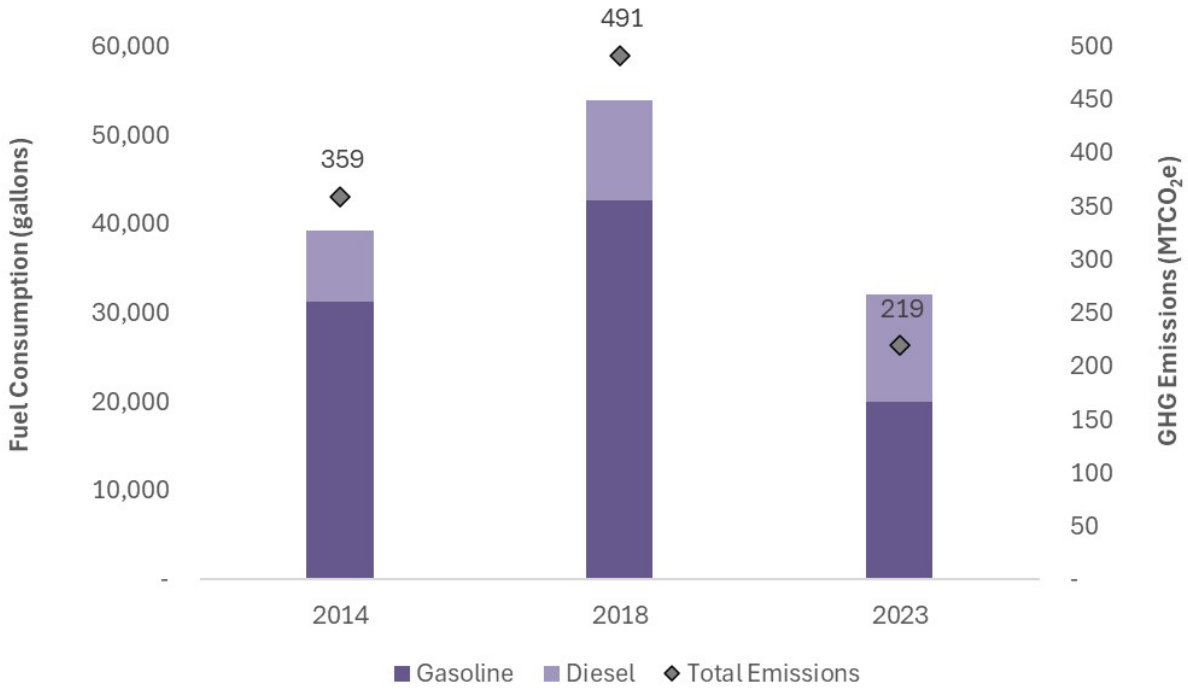
ON-ROAD FLEET VEHICLES

On-road fleet vehicles produced **219 $MTCO_2e$** in 2023 (61% of transportation emissions). These emissions reflect gasoline and diesel consumption from city-operated passenger vehicles, trucks, and specialty vehicles.

On-road fleet vehicle emissions decreased **39% since 2014 and 55% since 2018** (Figure 17), likely linked to:

- reduced fleet fuel use.
- turnover in the fleet toward more efficient vehicles.
- potential operational changes reducing vehicle miles traveled.

Figure 17.Government operations fuel usage and emissions trends.



OFF-ROAD VEHICLES & EQUIPMENT

Off-road equipment (e.g., lawnmowers, boats, forklifts) generated **37 $MTCO_2e$** in 2023. This represents a **52% decrease** since 2014, likely reflecting reduced usage, improved efficiency, or updated equipment inventories (Figure 16).

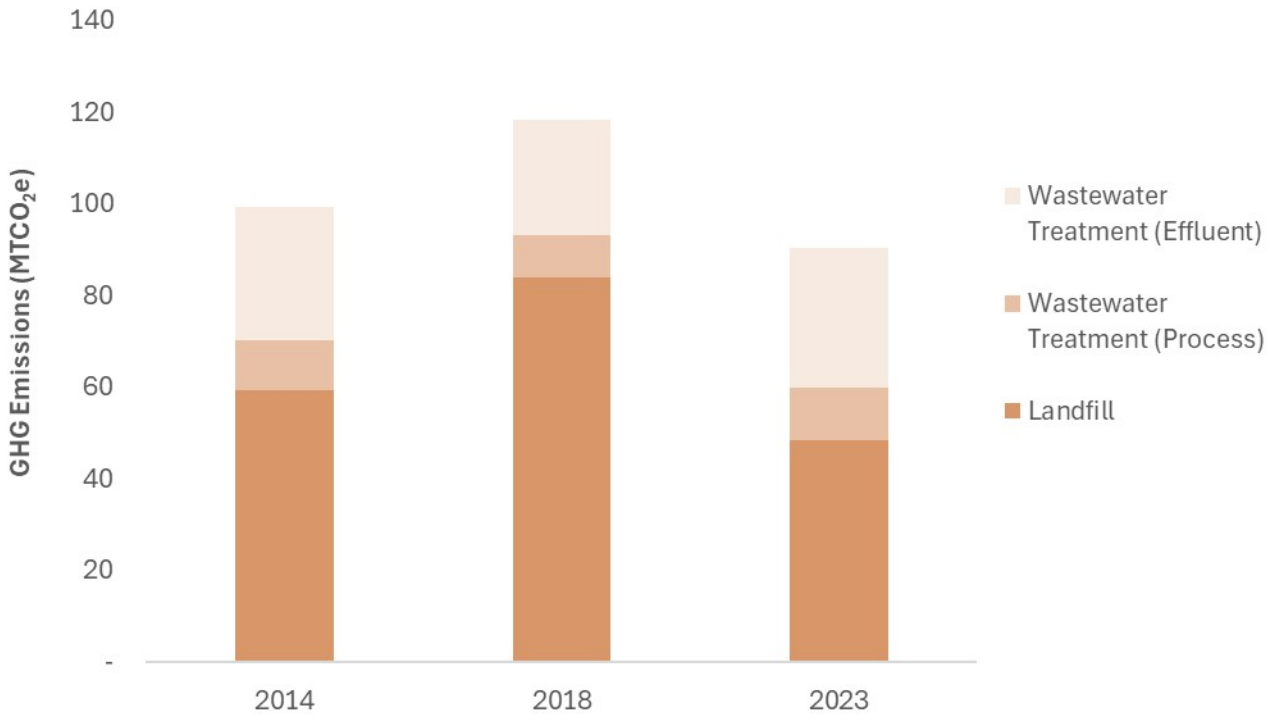
EMPLOYEE COMMUTE

Employee commute emissions totaled **103 $MTCO_2e$ in 2023**, accounting for **29%** of municipal transportation emissions. This reflects a **36% decrease since 2014** and a **44% decrease since 2018**, driven by shifts in commuting patterns and increased telework adoption. This decrease is particularly notable, as most employees live off-island.

Solid Waste and Wastewater

The solid waste and wastewater sector contributed **91 $MTCO_2e$** in 2023, or **16%** of total municipal emissions. Overall, emissions from this sector have declined since 2014 and 2018 (Figure 18).

Figure 18. Municipal solid waste & wastewater emissions trends.



LANDFILL

Emissions from the disposal of government-generated solid waste contributed **48 $MTCO_2e$** in 2023, accounting for **53%** of emissions within this sector. Landfill emissions decreased **18%** since 2014, reflecting reductions in waste disposed and changes in operational waste practices.

WASTEWATER TREATMENT

Municipal wastewater treatment process emissions (11 $MTCO_2e$) and effluent emissions (30 $MTCO_2e$) together accounted for **7%** of total municipal emissions. Both increased approximately **4%** since 2014, consistent with increases in wastewater generation resulting from population and facility activity changes.

Refrigerants

Refrigerant-related emissions totaled **35 MTCO$_2$e** in 2023 (7% of municipal emissions). This represents a **102% increase** since 2014, driven by an increased number of facilities requiring cooling equipment and leakage from stationary HVAC systems and mobile refrigerants in fleet vehicles. Although relatively small in magnitude, refrigerants are high–global warming potential gases, so improved refrigerant management, maintenance, and recovery practices represent a meaningful reduction opportunity.

Conclusion

The 2023 greenhouse gas (GHG) inventories for both the Bainbridge Island community and municipal operations provide a clear picture of current emissions and long-term trends. Communitywide emissions totaled **167,667 $MTCO_2e$** in 2023, a **20% decrease since 2014**, while municipal operations contributed **581 $MTCO_2e$**, just **0.3%** of the community total, and have declined **71%** over the same period.

Much of this progress is driven by a cleaner regional electricity grid and the City's transition to **100% renewable electricity** for all municipal buildings and infrastructure. As a result, electricity-related emissions have fallen sharply across the community and been nearly eliminated for municipal operations.

Even with this progress, the inventories highlight several areas where continued action is needed. **Transportation** remains the largest contributor to emissions for both the community and the City—driven by on-road vehicles, air travel, and marine travel communitywide, and by fleet vehicles and employee commuting for municipal operations. **Delivered building fuels** (propane and fuel oil) also remain notable contributors at the community scale, while propane use, landfill waste, wastewater treatment, and refrigerants represent the remaining sources for municipal operations.

Together, these inventories show that Bainbridge Island has achieved meaningful reductions since 2014, especially in building energy emissions. Going forward, the greatest opportunities for further reductions lie in **transportation decarbonization**, **building electrification**, **waste and refrigerant management**, and **continued municipal leadership** through efficient operations and fleet transitions. These findings provide a strong foundation for shaping next steps and supporting ongoing climate action on Bainbridge Island.

Appendix A: Methodology

This appendix outlines detailed methodology used to estimate communitywide and municipal GHG emissions summarized in this report. This methodology section includes data sources and key assumptions. It also highlights limitations and uncertainties associated with the data and methods to provide context for GHG emissions results.

Methodology and Data Sources

GHG emissions data comes from a variety of federal, state, and local sources. Ideally, data sources can be provided at the local level to ensure the most accurate GHG emissions estimates.

Calculating GHG emissions involves identifying and applying emission factors to activity data, summarized in Table 12 below. The GHG inventories used locally specific data as much as possible, based on data availability.

- **Activity data** quantifies the amount of activity that ultimately generates emissions. Examples of activity data include kilowatt hour of electricity consumed, vehicle miles traveled (VMT), and tons of waste generated.

- **Emission factors** are values that are used to determine the amount of a specific GHG emitted based on one unit of activity data. Examples of emission factors include metric tons of carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), or CO_2 equivalence emitted per kilowatt hour of electricity consumed, per ton of waste generated, or per VMT.

Data quality is assessed and reported on a **High (H), Medium (M),** and **Low (L)** scale in accordance with GHG inventory best practices (Table 12 and Table 13):

- A ***High*** rating indicates data are detailed and specific to the local geography
- A ***Medium*** rating indicates data are more general or modeled with robust assumptions and may not be specific to the local geography, but are downscaled from a slightly broader geography (e.g., state-level)
- A ***Low*** rating indicates data are highly modeled, uncertain, or a default value was used based on national characteristics.

Communitywide

Table 12. Key data sources for the Bainbridge Island's communitywide inventory.

Sector	Activity Data	Quality	Emission Factors	Quality
Residential Energy				
Electricity	• City-wide consumption provided by PSE.	H	• PSE reported emissions factors (PSE Greenhouse Gas Inventory, 2023).	H
Stationary Fuel Combustion	• Local propane sales tax information for Bainbridge Island (2023). • EIA's average propane price per gallon of fuel for 2023.	M	• CO_2, CH_4, and N_2O emission factors defaults from ClearPath.	M
Electricity Transmission & Distribution Losses	• See "Electricity" eGRID Western region grid gross loss percentage (2023)	M	• PSE reported emissions factors (PSE Greenhouse Gas Inventory, 2023).	H
Non-Residential Energy				
Electricity	• City-wide consumption provided by PSE.	H	• PSE reported emissions factors (PSE Greenhouse Gas Inventory, 2023).	H
Electricity Transmission & Distribution Losses	• See "Electricity" eGRID Western region grid gross loss percentage (2023).	M	• PSE reported emissions factors (PSE Greenhouse Gas Inventory, 2023).	H
Transportation				
On-Road Vehicles	• Passenger and freight vehicle VMT, provided by travel model data, for proportion of Kitsap County VMT occurring in Bainbridge Island. • Reported transit vehicle miles traveled by fuel type for each transit agency from the National Transit Database (NTD)	M	• U.S. Environmental Protection Agency (EPA) EF Hub average EFs (by vehicle & fuel type).	L
Off-Road Vehicles & Equipment	• EPA Motor Vehicle Emission Simulator (MOVES) model outputs, by county for proportion of Kitsap County activity occurring in Bainbridge Island.	M	• N/A (data reported in emissions).	L
Air travel	• Emissions from Seattle-Tacoma International Airport (SEA) were attributed to individual counties in combination with passenger survey data, population, and household income data from the U.S. Census.	M	• CO_2, CH_4, and N_2O emission factors defaults from ClearPath.	H
Ferry travel	• Ferry fuel price, from EIA, and cost, from WSDOT.	M	• CO_2, CH_4, and N_2O emission factors defaults from ClearPath.	H
Solid Waste and Wastewater				
Solid Waste Generation	• City-wide tonnage provided by Bainbridge Disposal. Where local waste characterization data were unavailable, Department of Ecology regional characterizations were used.	M	• Waste characterizations from 2020 WA Waste Characterization Study, for Kitsap County.	M

Solid Waste Collection & Transportation	• City-wide tonnage provided by Bainbridge Disposal. • Round-trip mileage to disposal site estimated on Google maps.	M	• CO_2, CH_4, and N_2O emission factors defaults from ClearPath.	L
Yard Waste Composting	• City-wide tonnage provided by Bainbridge Disposal.	M	• CO_2, CH_4, and N_2O emission factors defaults from ClearPath.	L
Landfill Processing	• City-wide tonnage provided by Bainbridge Disposal.	M	• CO_2, CH_4, and N_2O emission factors defaults from ClearPath.	L
Wastewater Treatment Facility	• Wastewater treatment facility processes determined based on desktop research and confirmed with City staff. • Population served by wastewater treatment facility estimated by multiplying the number of sewer connections by the average household size from U.S Census data.	M	• CO_2, CH_4, and N_2O emission factors defaults from ClearPath.	L
Septic Tanks	• Population data estimated based on number of septic systems reported to the Kitsap Department of Health and the number of sewer connections in the community.	M	• CO_2, CH_4, and N_2O emission factors defaults from ClearPath. • Fugitive emissions calculated using Community Protocol WW.11 Alternative Method for Methane Emissions from Septic Systems if Only the Population is Known.	L
Other Process and Fugitive Emissions				
Refrigerant Leakage	• HFC and PFC tonnage from Annex in U.S. EPA GHG Inventory Sources and Sinks, scaled down to Bainbridge Island population. • SF_6 tonnage and customer data from PSE, scaled down to Bainbridge Island customers.	L	• HFC and PFC GWP from IPCC 5th Assessment Report, with adjustment for climate-carbon feedback. • SF_6 100-Year GWP from U.S. EPA GHG Sources and Sinks • Emissions calculated using Community Protocol Alternative Method BE.7.1.A	H
Agriculture				
Enteric Fermentation and Manure Management	• Animal population and pastureland from USDA Agricultural Census, for Kitsap County. • Agricultural acres with livestock on Bainbridge Island and waste management system, from Kitsap County Conservation District. • Typical animal mass and B_o, Volatile solids and excreted nitrogen, and methane conversion factors from U.S. EPA GHG Inventory Sources & Sinks, 2022 Annexes.	M	• EF, 100-year GWP for CH_4 and N_2O, and volatilization nitrogen loss from U.S. EPA GHG Inventory Sources & Sinks, 2022 Annexes. • EF for nitrogen volatilization and runoff/leaching from U.S. Community Protocol, Appendix G. • Indirect N_2O emissions calculated using U.S Community Protocol, Appendix G.	M

Residential Energy

- Electricity consumption data was provided by the utility serving Bainbridge Island, PSE. Emissions from electricity transmission and distribution (T&D) losses were included using PSE specific emission factors.

- Stationary fuel combustion consisted of residential fuel oil, with data from EIA and the number of households from American Community Survey. Residential fuel oil emissions were calculated using 2023 U.S. EIA residential fuel oil consumption data for the state of Washington. Statewide total residential fuel sales were allocated to counties using U.S. Census American Community Survey (ACS) home heating fuel data

- Propane usage for residential, commercial, and industrial sectors was estimated using local sales tax data and EIA information on average propane fuel prices per gallon. Propane data is compiled and cannot be split into

Non-Residential Energy

- Electricity consumption data was provided by the utility serving Bainbridge Island, PSE. Emissions from electricity transmission and distribution (T&D) losses were included using PSE specific emission factors.

Transportation

- On-road vehicle miles traveled were derived from Puget Sound Regional Council's travel model data and account for all mileage within the Kitsap County boundary regardless of trip origin or destination. Emissions for Bainbridge Island are assumed proportional to the share of Kitsap County VMT occurring in Bainbridge Island city limits. Share of average weekday VMT occurring in Bainbridge Island was calculated from 2023 travel model data and includes all vehicle types. Bainbridge Island VMT shares represents all trips to/from Bainbridge Island as well as those driving through the city boundaries. The PSRC data reported VMT and emissions for passenger vehicles, medium trucks, heavy trucks, and transit. In ClearPath, we reported medium trucks as light trucks. For medium- and heavy-duty freight emissions, VMT was multiplied by fuel- and vehicle-specific emissions factors from the 2023 EPA Emission Factors Hub. For light-duty vehicles, 2023 vehicle registration data from Kitsap County was used to estimate VMT by fuel type, which was then multiplied by fuel-specific emissions factors from the EPA Emission Factors Hub. The vehicle registration data was also used to create a weighted emissions factor for light-duty gasoline vehicles, based on the split between passenger vehicles and light trucks in Bainbridge Island.

- Transit annual revenue miles and fuel consumption data for Kitsap County were acquired from the National Transit Database from the Federal Transit Administration. These data were scaled down to Bainbridge Island by population.

- The Port of Seattle supplied jet fuel consumption data for SeaTac Airport for 2023, of which 0.5-1% was attributable to Bainbridge Island. SeaTac passenger enplaning surveys and population and employment statistics were used to assign the above fraction of the total airshed emissions to the Bainbridge Island community.

- Ferry fuel consumption was derived from EIA data on diesel fuel price and from WSDOT data on the reported fuel cost for the Bainbridge Island route in fiscal year 2023.

- Off-road emissions were calculated from the nonroad module of the EPA MOVES model for 2023. The model estimates emissions at the county level, which were then scaled down to Bainbridge Island by population. Emissions include common non-road equipment, including construction, agriculture, lawn/gardening, and recreational equipment.

FERRY EMISSIONS ATTRIBUTION

Accounting for emissions related to ferry transportation can be complicated by the fact that ferries typically travel between multiple jurisdictions. To simplify the methodology for calculating these emissions, the U.S. Community Protocol recommends allocating portions of the total emissions related to ferry transportation according to the number of stops located in each jurisdiction. For example, for the Bainbridge Island-Seattle ferry, this would equate to a 50/50 split of emissions since there is one ferry stop in each city. This is the calculation approach that was used in this community inventory.

However, another possible method for attributing emissions to a particular jurisdiction is by ridership and examining the proportion of ferry riders from each city. To test that the 50/50 allocation was the correct choice for Bainbridge Island, we performed a sensitivity analysis using a ridership-based methodology. Using data reported by Washington State, we assumed that where travelers were heading in the evening on a weekday was likely where they reside. Based on this assumption and available data, we examined the proportion of total ferry travelers that end in Bainbridge Island in the evening versus elsewhere. Using this technique, we deduced that 47% of weekday ferry commuters are residents of Bainbridge Island—a value that is very close to the original 50% estimate.

Given that this proportion strongly aligns with the 50/50 approach recommended by the U.S. Community Protocol, we ultimately followed the U.S. Community Protocol attribution approach to align with the robust and established methodology used by other communities in the region.

Solid Waste and Wastewater

- Bainbridge Disposal single-family tonnages and Kitsap County waste characterization data, along with default emissions factors provided in ClearPath, were used to calculate emissions from waste disposal and composting. Multi-family and commercial tonnages were not directly available and were estimated using a single-family to multi-family + commercial ratio of 32:68, based on the transfer station survey data collected for the 2020 Washington Waste Characterization Study.

- Landfill methane collection scenario confirmed "typical" by Columbia Landfill Annual precipitation from National Weather Service, Arlington, OR.
- Wastewater emission calculations required data from Kitsap County Sewer District #7 and the City of Bainbridge Island wastewater treatment plants. City and District staff provided the data.
- Data required for higher quality calculations in ClearPath, such as BOD5 or population specifically using septic systems (including unpermitted systems), were not available. Therefore, fugitive septic tank emissions were estimated based on the number of Bainbridge Island residents not served by a sewer connection.

Other Process & Fugitive Emissions

- Data on fugitive refrigerant HFC and PFC emissions at city scales is scarce. The U.S. EPA's 2019 Inventory of GHG Sources and Sinks and scaled the data to Bainbridge Island by population.
- PSE's greenhouse gas inventories from 2023 provided fugitive electric transmission and distribution emissions data for SF6. We scaled the data to Bainbridge Island using PSE customer data.

Agriculture

- The USDA provides publicly available data on the number of animals by county, which was scaled down to Bainbridge Island according to the ratio of livestock to land area. Kitsap County Conservation District provided data on manure management systems. The EPA provides national-level animal enteric and manure emissions factors, and state-level emissions factors for cattle.

Government Operations

Table 13. Data Sources for Bainbridge Island's government operations GHG emissions inventories.

Sector	Activity Data	Quality	Emission Factors	Quality
Building & Facilities Energy				
Electricity	• kWh consumption compiled from PSE bills	H	• PSE reported emissions factors (PSE Greenhouse Gas Inventory, 2023).	H
Stationary Fuel Combustion	• Gallons of propane based on municipal purchasing information provided by O&M	H	• CO2, CH4, and N2O emission factors defaults from ClearPath.	M
Streetlights and Traffic Signals	• Quantity, type, and wattage of each streetlight and traffic signal transcribed from PSE bills • Installed wattage used to estimate electricity consumption in kWh	M	• PSE reported emissions factors (PSE Greenhouse Gas Inventory, 2023).	H
Vehicle Fleet				
On-Road Fleet Vehicles	• Total fuel volumes by fuel type provided by Public Works staff • VMT for each vehicle and fuel type were estimated based on the 2018 inventory percentage of total fuel type attributed to each vehicle type, as VMT data by vehicle was unavailable for 2023	H	• U.S. Environmental Protection Agency (EPA) EF Hub average EFs (by vehicle & fuel type).	H
Off-Road Vehicles	• Fuel volumes by fuel type provided by Public Works staff • As 2023 fuel volumes were unavailable for specific vehicles, 2018 percentages of total fuel for each fuel type were applied to each category of off-road vehicles to estimate fuel use for each fuel type and off-road vehicle combination	H	• Default emissions factors provided in ClearPath by equipment and fuel type	M
Employee Commute	• $MTCO_2e$ obtained from Commute Trip Reduction survey conducted by WSDOT	M	• N/A; value converted to $MTCO_2e$ by WSDOT	N/A
Solid Waste and Wastewater				
Solid Waste Generation	• Bin sizes, pickup frequency, average fullness, and waste type were transcribed from solid waste bills • Estimated cubic yards of waste were then converted to tons using EPA solid waste weight conversions	M	• ClearPath default emissions factors used to estimate all future methane emissions resulting from the decomposition of each waste type	L
Wastewater Treatment Facility	• Wastewater treatment facility processes determined based on desktop research and confirmed with city staff • Population served by wastewater treatment facility estimated by multiplying the number of sewer connections (city staff) by the average household size (ACS)	M	• Local Government Operations Protocol equations 10.8 and 10.10 used to calculate N_2O emissions • CH_4 emissions were not applicable since the system is aerobic	L

Sector	Activity Data	Quality	Emission Factors	Quality
Refrigerant Leakage				
Refrigerant Leakage from Building Heating and Cooling Equipment	• List of heating/cooling equipment provided by city staff • Equipment categorized by type and refrigerant used	L	• Emissions calculated using Equation 6.35 and the default factors in Table 6.4 of the Local Government Operations Protocol	L

Building and Facility Energy

- City staff compiled electricity consumption data from PSE electricity bills for the City of Bainbridge Island's municipal operations.
- Facilities maintenance and purchasing records were used to compile total gallons of propane used in buildings and facilities.
- Past inventories estimated the total electricity usage of streetlights and traffic signals operated by the City of Bainbridge Island by counting the number, wattage, and types of streetlights and traffic signals included in the individual monthly PSE electricity bills. Equation 6.15 in the Local Government Operations Protocol is used to convert wattage to estimated electricity consumption in kWh. We assumed an average daily operating time of 12 hours for streetlights and 8 hours for traffic signals. City staff compiled 2023 electricity data for streetlights in alignment with previous inventories.

Transportation

- On-road and off-road vehicles and equipment were categorized into standard vehicle types (i.e., passenger car, light-duty truck, heavy-duty truck, etc.) based on provided vehicle descriptions and make/model information, in alignment with previous inventories. Total fuel gallons by fuel type were available for 2023, but fuel used by each fleet vehicle and equipment were not. VMT data was available for the list of fleet vehicles provided. 2018 fuel data by vehicle type and fuel type were used to estimate the proportion of each fuel type used by each vehicle and equipment category. . Off-road emissions were estimated using ClearPath default emission factors. On-road emissions were estimated using EPA EF Hub average emission factors by vehicle & fuel type.
- City staff provided gasoline volumes for police boat use separately.
- We obtained total emissions (in MTCO2e) associated with employee commuting from the Commute Trip Reduction Survey conducted by WSDOT.

Solid Waste and Wastewater

- City staff provided data on waste generation for the City of Bainbridge Island's municipal operations.

- The data shared indicated the disposal bin volume, the pickup frequency, the estimated fullness, and the waste stream (i.e., recycling, yard waste, trash, etc.). We assumed that waste described as yard waste was composted, waste described as solid waste was landfilled, and that waste described as recycling was recycled. We converted annual volumes of waste by type into tons of waste by type using EPA solid waste weight conversions. We then used King County waste composition information and ClearPath default emissions factors to estimate emissions associated with waste generation and composting.

- We estimated wastewater treatment N2O emissions using Equation 10.7 and 10.10 of the Local Government Operations Protocol. Population served was estimated by Bainbridge Island City staff. Default nitrogen load information was used since local data was not available.

Refrigerant Leakage

- We acquired a list of heating/cooling equipment used in municipal buildings from Bainbridge staff. We did an online search of the equipment models and serial numbers to determine how to best categorize each piece of equipment. Using these categorizations, we estimated emissions from operational refrigerant leakage using Equation 6.35 and Table 6.4 of the Local Government Operations Protocol.

- Additional emissions associated with the disposal of refrigerants used in the old police station heating/cooling equipment were also included in 2023 as the building was torn down.

Action Minutes CCAC - Nov 19, 2025

Called to order at 5:31 PM PT.

Member Attendees: Bill Dowey, Ray Victurine, Mike Cox, Steve Richards, Sanjay Bhatt, Derik Broekhoff, Kevin Thomas
City Climate Manager: Laura Rÿser
City Staff: Maurie Harbick
Absent Member: Michael Kleeman
Council Liaison: Kirsten Hytopoulus

- **Climate Manager Updates**
    - Maurie Harbick returns for his final update on the work he has been doing on the EV Charging Proposal.
        - Maurie acknowledges the written feedback that Sanjay has provided.
        - He will hand off his final report to Laura as his internship ends in early Dec.
        - Sanjay recommends setting milestones where percentages would be adjusted based on increases in new vehicle registrations for EVs on the island.
        - Steve points out that there is an important question about shared vs dedicated chargers.
        - We close with a discussion of the possibility of adding a consideration regarding a ride share program that might be used to offset space requirements.
    - Solarize Campaign Updates
        - Laura provides updates: the City is moving forward with plans to activate a year-long public solarize campaign on the island with the help from Olympia Community Solar, a non-profit that has executed similar efforts with other cities in the greater Seattle-Tacoma area.
        - ACTION: She will follow-up with additional details with members of the original ETIPP subcommittee.
    - Plans for the Upcoming CCAC Meeting in Dec
        - Kate Pedersen from the WA Dept of Commerce will be coming to talk about the funding landscape and microgrids.
        - Andrew from Cascadia will be coming to talk about the GHG inventory.
            - ACTION: Laura to share the draft report before the next CCAC meeting.
    - Questions about City Solar Code
        - Sanjay raises questions about the City's solar codes.
            - ACTION: Laura has checked in with Legal and Planning about this; she will share more info about this with the members.
    - Assessment of City Buildings for Additional Solar & Battery Storage
        - Efforts went well; Laura is now looking at how to fund that.

    - Discussion of Possible Outreach Methods and Revisions to the CAP
        - Kevin raises questions about how we as CCAC members could do something like a newsletter.
        - ACTION: Laura will come to Jan meeting with her updated priorities for 2026.
        - ACTION: Kevin will get back to the committee members with suggestions about how to divide up the work for revising the CAP.
- **Regular Business**
    - Agenda approved.
    - Minutes from the October meeting approved.
    - No conflicts of interest disclosures.
    - No public comment.
    - Kevin gives an update on the review of the sub area plan.
        - ACTION: Kevin will send out Ray's draft; the subcommittee will meet to help refine and handle member input; will return to Dec meeting with a draft from the CCAC.
        - ACTION: Kevin to confirm potential assignments for committee members to help revise the CAP.
        - ACTION: Kevin to follow up with Laura about the potential for PSE to join a CCAC meeting, to meet with a CCAC subcommittee.
    - Mike gives an update on the review of the draft of the revisions to the ground water management plan.
        - ACTION: Mike will send the peer review.
    - Steve asks about where things stand with efforts around the City considering an ordinance related to gas-powered lawn equipment.
    - Mike asks about how the new Council members will be briefed on the work of the CCAC.
    - Laura will have an end-of-year report on the CAP at the end of Jan.

Meeting adjourned at 7:12PM.