THURSTON CLIMATE MITIGATION COLLABORATIVE

THURSTON COUNTY, WA

2022 Inventory of Community-Wide Greenhouse Gas Emissions

Prepared For:

Thurston Climate Mitigation Collaborative

Produced By:

ICLEI – Local Governments for Sustainability USA
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ICLEI – Local Governments for Sustainability USA

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Tables and Figures

Executive Summary

The Thurston Climate Mitigation Collaborative (TCMC) is a consortium of four local government partners—Thurston County, City of Lacey, City of Olympia, and City of Tumwater—that are working together to reduce local greenhouse gas (GHG) emissions that contribute to global climate change. In 2020, the four partners published the Thurston Climate Mitigation Plan (TCMP), which includes the mutual goal of reducing community-wide net GHG emissions 45% by 2030 and 85% by 2050, relative to a 2015 baseline [1].

A GHG emissions inventory is one way the TCMC tracks progress toward meeting the adopted targets. The emissions inventory uses local data to estimate the relative contribution of emissions from different sectors within our geographic boundaries, including energy in buildings, transportation, agriculture, and solid waste. The Thurston Climate Action Team and Thurston Regional Planning Council completed GHG inventories for geographic Thurston County from 2010 to 2021. Thurston County contracted with ICLEI on behalf of the TCMC to complete this 2022 GHG emissions inventory.

Total 2022 GHG emissions in Thurston County are estimated at 3,258,925 metric tons CO2e (MTCO2e) — about 10.9 MTCO2e per person. 2022 emissions are approximately 6.6% higher than the 2015 baseline, but 5.8% lower than the peak in 2019. Much like the rest of the world, emissions are not on track to meet the 2030 and 2050 targets (Figure 1). However, per capita emissions have decreased 4.3% since 2015.

In addition to GHG inventories, the TCMC monitors and reports on its progress through Annual Progress Reports, which detail the actions each jurisdiction is taking to reduce emissions across the TCMP's five sectors: Buildings & Energy, Transportation & Land Use, Wastewater & Waste, Agriculture & Forests, and Cross-Cutting. Learn more about the TCMC's work at the new collaborative website www.ThurstonClimateCollaborative.org.

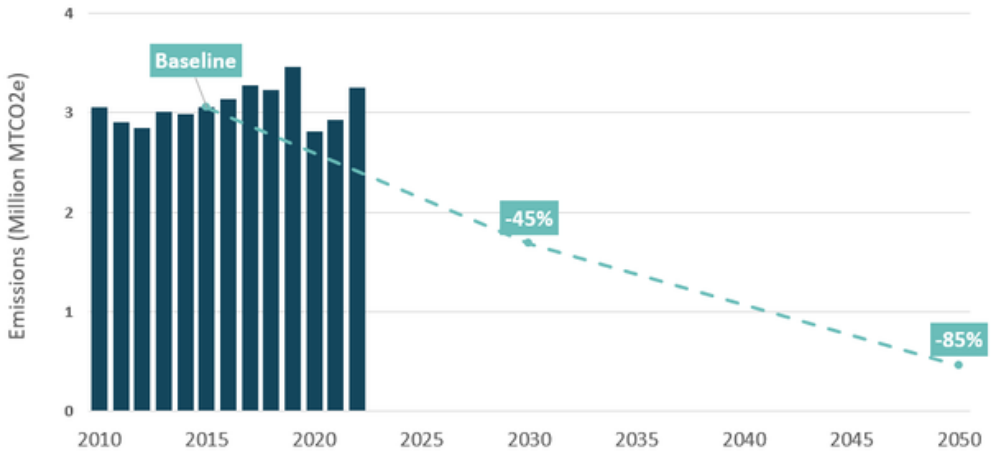


Figure 1: Thurston County Emissions and Reduction Targets

[1] Thurston Climate Mitigation Plan. December 2020. https://www.trpc.org/909/Thurston-Climate-Mitigation-Plan

Key Findings

Figure 1 shows community-wide emissions by sector. The largest single-sector contributor is Transportation with 36% of emissions. However, the total Energy sector is larger than Transportation, accounting for 54% of emissions (Residential Energy 26%, Commercial Energy 17%, Upstream Impacts 8%, and Industrial Energy 3%). The other sectors included in the inventory are Agriculture (3%), Fugitive Emissions (3%), Solid Waste (3%), and Wastewater (1%). The Thurston Climate Mitigation Plan (TCMP) identifies actions to reduce emissions across these sectors.

The Inventory Results section of this report provides a detailed profile of emissions sources within Thurston County, WA, information that is key to guiding local reduction efforts. These data will also provide a baseline against which the Thurston Climate Mitigation Collaborative (TCMC) will be able to compare future performance and demonstrate progress in reducing emissions.

EMISSIONS AT A GLANCE

1 **Transportation** 36%

2 **Residential Energy** 26%

3 **Commercial Energy** 17%

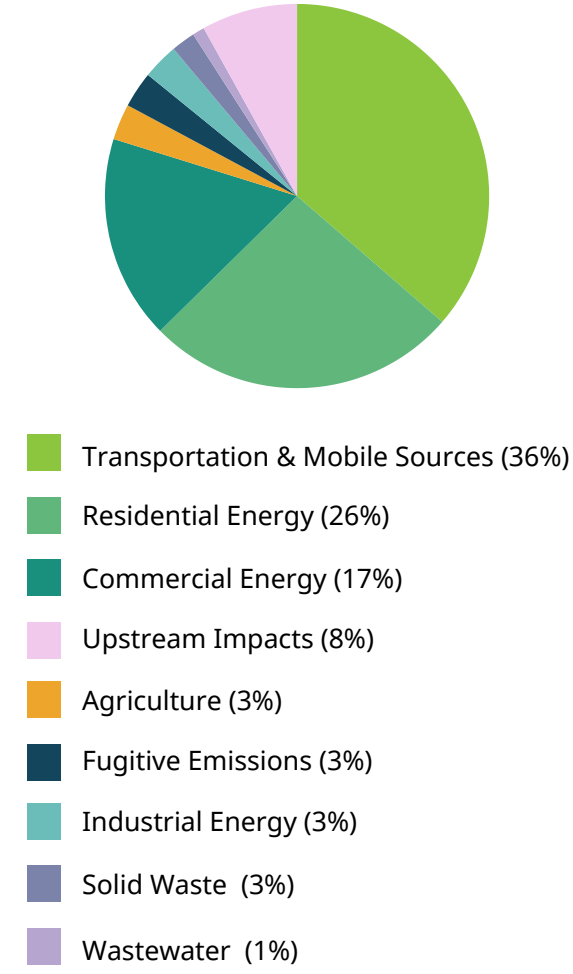


Figure 2: Community-Wide Emissions by Sector

Inventory Methodology

Understanding a Greenhouse Gas Emissions Inventory

The first step toward achieving measurable greenhouse gas (GHG) emission reductions is to identify baseline emission levels that can be tracked over time. The TCMC adopted a baseline year of 2015. This report presents calculated emissions from emission-generating sources and activities within the geographic boundary of Thurston County, WA in 2022.

As local governments across the globe take action to monitor and reduce GHG emissions, the need for a standardized approach to quantify emissions has proved essential. This inventory uses the approach and methods provided by the U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions (Community Protocol).

Three greenhouse gases are included in this inventory: carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O). Many of the charts in this report represent emissions in "carbon dioxide equivalent" (CO2e) values, calculated using the Global Warming Potentials (GWP) for methane and nitrous oxide from the IPCC 6th Assessment Report [2]. GWP is defined as the heat-trapping ability of each GHG relative to that of CO2.

Table 1: Global Warming Potential Values (IPCC, 2021)

Greenhouse Gas	Global Warming Potential
Carbon Dioxide (CO2)	1
Methane (CH4) (Fossil Origin)	29.8
Methane (CH4) (Non-Fossil Origin)	27.2
Nitrous Oxide (N2O)	273

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

Community Emissions Protocol

Version 1.2 of the U.S. Community Protocol for Accounting and Reporting GHG Emissions (USCP) [3] was released by ICLEI in 2019, and represents a national standard in guidance to help U.S. local governments develop effective community GHG emissions inventories. It establishes reporting requirements for all community GHG emissions inventories, provides detailed accounting guidance for quantifying GHG emissions associated with a range of emission sources and community activities, and provides a number of optional reporting frameworks to help local governments customize their community GHG emissions inventory reports based on their local goals and capacities. The sectors of this inventory match the sectors outlined in the USCP.

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

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

The community inventory also includes the following activities:

- Wastewater treatment processes
- Off-road, air, and rail passenger and freight motor vehicle travel
- Upstream emissions from electricity, natural gas, other fuels. These are emissions associated with the production of fuel and the production of electricity from specific fuel types [2]
- Transmission and demand losses from electricity
- Fugitive emissions from natural gas distribution

Quantifying Greenhouse Gas Emissions

Sources and Activities

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

Table 2: Source vs. Activity for Greenhouse Gas Emissions

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

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

By reporting on both GHG emission sources and activities, local governments can develop and promote a deeper understanding of GHG emissions associated with their communities. An example of source-based emissions is the direct emission of GHGs from the tailpipes of vehicles traveling within Thurston County. On the other hand, an example of activity-based emissions comes from landfill waste. The Roosevelt Regional Landfill is located outside of Thurston County; the inventory only accounts for the portion of landfill emissions that are related to waste disposal by Thurston residents.

Base Year

The inventory process requires the selection of a base year with which to compare current emissions. When the Thurston Climate Mitigation Plan was developed, the partners chose 2015 as the baseline year for the county-wide greenhouse gas emissions inventory.

Quantification Methods

GHG emissions can be quantified in two ways:

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

Activity Data x Emission Factor = Emissions

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

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

Community Emissions Inventory Results

The total community-wide emissions for the 2022 inventory are shown in Table 3 and Figure 5. For a comparison of 2015 and 2022 emissions, see Table 4.

Table 3: Community-Wide Emissions Inventory

Sector	Fuel or Source	2022 Usage	Usage Unit	2022 Emissions (Mt CO2e)
Residential Energy	Electricity	1,449,620,288	kWh	596,913
	Natural Gas	3,700,139	MMBtu	196,786
	Distillate Fuel Oil	70,012	MMBtu	5,213
	Propane	437,784	MMBtu	27,168
	Wood	1,386,635	MMBtu	13,508
Total Residential Energy				**839,588**
Commercial Energy	Electricity	1,087,121,251	kWh	447,646
	Natural Gas	1,989,070	MMBtu	105,785
Total Commercial Energy				**553,431**
Industrial Energy	Electricity	137,117,075	kWh	56,461
	Natural Gas	578,865	MMBtu	30,723
Total Industrial Energy				**87,184**
Transportation & Mobile Sources	On-Road Gasoline	1,762,794,908	VMT	710,800
	On-Road Diesel	210,636,112	VMT	303,360
	Off-Road	1,307,318	MMBtu	94,769
	Maritime	210,341	MMBtu	15,277
	Rail	452,616	MMBtu	33,759
	Aviation	340,723	Gallons gasoline and jet kerosene	3,174
Total Transportation & Mobile Sources				**1,161,138**

Table 3: Community-Wide Emissions Inventory (continued)

Sector	Fuel or Source	2022 Usage	Usage Unit	2022 Emissions (Mt CO2e)
Solid Waste	Waste Sent to Landfill	227,150	Tons	101,392
	Composting	33,302	Tons	4,595
	Flaring of Landfill Gas	144,000	Cubic ft/day	75
	Rail Transport Outside of County	220	Miles per round-trip	1034
	Truck Transport Outside of County	17	Miles per round-trip	541
Total Solid Waste				**107,637**
Wastewater	N2O Process & Effluent Fugitives	161,484	Population served	435
	Septic	55,413	Septic Systems	16,416
	Combustion of Digester Gas	140,659	scf/day	8
	Methanol used for nitrogen removal	0.16	MT CO3OH/day	64
Total Wastewater				**16,923**
Agriculture	Enteric Fermentation	N/A - Multiple types of animals	N/A	64,981
	Manure Management	N/A - Multiple types of animals	N/A	45,587
	Ferilized Land	5,045	Fertilized acres	1,498
Total Agriculture				**112,066**
Fugitive Emissions	Fugitive emissions from natural gas distribution	6,268,074	MMBtu	11,574
	Hydroflourocarbons	N/A - multiple types of gases	N/A	95,629
Total Fugitive Emissions				**107,203**

Sector	Fuel or Source	2022 Usage	Usage Unit	2022 Emissions (Mt CO2e)
Upstream Impacts	Electricity Transmission and Distribution Losses	2,673,858,616	kWh	56,152
	Upstream Electricity	2,810,225,405	kWh	137,823
	Upstream Natural Gas	6,268,074	MMBtu	73,269
	Upstream Fuel Oil	70,012	MMBtu	949
	Upstream HGL (Propane on report)	437,784	MMBtu	5,563
Total Upstream Impacts				**273,756**
Total Gross Emissions				**3,258,925**

Figure 5 shows the distribution of community-wide emissions by sector. Transportation is the largest contributor, followed by Residential Energy and Commercial Energy. The total of all emissions in the Energy sector (Residential, Commercial, Industrial, and Upstream Impacts) account for 54% of county-wide emissions.

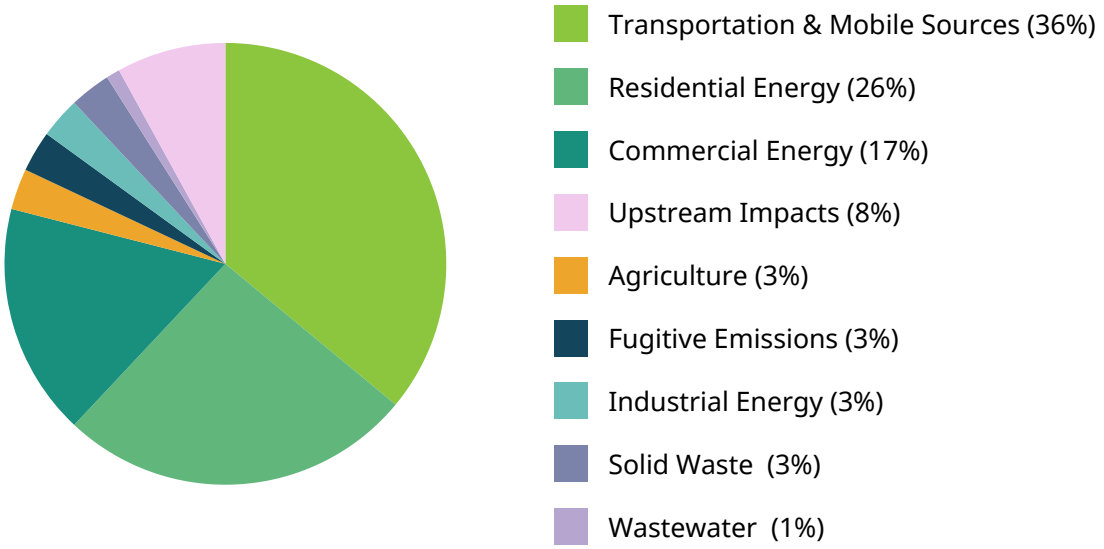


Figure 3: Community-Wide Emissions by Sector

Table 4: 2015 and 2022 Community-Wide Emissions Inventory Comparison

Sector	Fuel or Source	2015 Usage	2022 Usage	2015 Emissions	2022 Emissions	Percent Change
Residential Energy	Electricity	1,241,099,148	1,449,620,289	580,819	596,913	3%
	Natural Gas	2,830,912	3,700,139	150,566	196,786	31%
	Distillate Fuel Oil	56,166	70,012	4,182	5,213	25%
	HGL (Propane on report)	341,515	437,784	21,711	27,168	25%
	Wood	1,302,058	1,386,635	12,970	13,508	4%
Total Residential Energy				**770,248**	**839,588**	**9.00%**
Commercial Energy	Electricity	963,956,491	1,087,121,251	451,120	447,646	-1%
	Natural Gas	1,441,767	1,989,070	76,683	105,785	38%
Total Commercial Energy				**527,803**	**553,431**	**4.86%**
Industrial Energy	Electricity	119,530,793	137,117,076	55,939	56,461	1%
	Natural Gas	100,133	578,865	5,315	30,723	478%
Total Industrial Energy				**61,254**	**87,184**	**42.33%**
Transportation & Mobile Sources	On-Road Gasoline	1,890,366,013	1,762,794,908	762,092	710,800	-7%
	On-Road Diesel	166,268,478	210,636,112	252,836	303,360	20%
	Off-Road	*Not included	210,341	120,225	94,769	-21%
	Maritime	*Not included	452,616	5,334	15,277	186%
	Aviation	253,247	340,723	2,396	3,174	32%
	Rail	*Not included	452,616	*Not included	33,759	N/A
Total Transportation & Mobile Sources				**1,142,883**	**1,161,138**	**1.60%**

*Rail, Maritime, and Off-Road fuel usage data was not available until release of 2020 NEI Tool in 2023. Only estimated emissions were provided in the 2017 NEI Tool.

Table 4: 2015 and 2022 Primary Community-Wide Emissions Comparison (continued)

Sector	Fuel or Source	2015 Usage	2022 Usage	2015 Emissions	2022 Emissions	Percent Change
Solid Waste	Landfill emissions	168,977	227,150	51,780	101,392	96%
	Composting	25,295	33,302	1,761	4,595	161%
	Flaring of Landfill Gas	Not Included	144,000	Not Included	75	N/A
	Rail transport out of County	220	220	813	1,034	27%
	Truck Transport out of County	17	17	402	541	35%
Total Solid Waste				**54,756**	**107,637**	**96.57%**
Wastewater	N2O Process & Effluent	135,634	161,484	369	435	18%
	Septic	53,365	55,413	16,112	16,416	2%
	Combustion of Digester Gas	161,922	140,659	11	8	-26%
	Methanol used for nitrogen removal	0.24	0.16	108	64	-41%
Total Wastewater				**16,600**	**16,923**	**1.94%**
Agriculture	Enteric Fermentation & Maure Managment	N/A	N/A	66,602	110,568	66%
	Fertilized Land	3,866	5,045	1,148	1,498	30%
Total Agriculture				**67,750**	**112,066**	**65.41%**

Table 4: 2019 and 2021 Primary Community-Wide Emissions Comparison (continued)

Sector	Fuel or Source	2015 Usage	2022 Usage	2015 Emissions	2022 Emissions	Percent Change
Fugitive Emissions	Fugitive emissions from natural gas distribution	4,372,812	6,268,074	7,470	11,574	55%
	Hydroflourocarbons	N/A	N/A	127,244	95,629	-25%
Total Process & Fugitive Emissions				**134,714**	**107,203**	**-20.42%**
Upstream Impacts	Electricity TDL	2,324,588,447	2,673,858,616	52,109	56,152	8%
	Upstream Electricity	2,324,588,447	2,810,225,405	170,696	137,823	-19%
	Upstream Natural Gas	4,372,812	6,268,074	52,779	73,269	39%
	Upstream Fuel Oil	56,166	70,012	761	949	25%
	Upstream HGL (Propane on report)	341,515	437,784	4,340	5,563	28%
Total Upstream Impacts				**280,685**	**273,756**	**-2.47%**
Total Gross Emissions				**3,056,693**	**3,258,925**	**6.62%**

Comparison Discussion

Changes in Methodology

Before comparing the 2015 and 2022 inventories, we must acknowledge that some methodologies have changed as new data sources became available and old data sources stopped being updated. These changes include the following:

- The 2015 inventory did not include railway emissions and only included maritime emissions reported by the Port of Olympia. The EPA included rail and maritime emissions (county-wide) for the first time in its most recent release of the National Emissions Inventory (NEI). These were included in the 2022 inventory, but there is no data available to retroactively add to inventories before 2020. The 9,943 metric ton increase in maritime emissions is mostly due to this change in data source. Likewise, all 33,759 metric tons of CO2e from railway emissions are a new addition. Combined, maritime and railway emissions account for 1.5% of total CO2e emissions in 2022.
- Hydrofluorocarbon (HFC) emissions data was collected from the US EPA 2017 national inventory for previous years. For the 2022 inventory, it was collected from the EPA's 2020 National Emissions Inventory (NEI) tool (released in 2023). The 2020 NEI tool has more detailed HFC data than previously used data.
    - The inventories show a 25% decrease in HFC emissions from 2015 to 2022, which translates to a reduction of 31,365 MT CO2e. It is unknown what portion of this reduction is due to decreased activity versus changes in the data sets.
- 2022 is Thurston County's first GHG Inventory to use IPCC AR6 GWP values, which slightly alters the calculations to convert CH4 and NO2 emissions to CO2e emissions.
    - If AR5 GWP values are applied to the 2022 inventory, total emissions are reduced by 366 MT CO2e. This change is negligible in comparison to the activity changes outlined below.

Other methodology is consistent with previous inventories and can be found in the Appendices.

Comparison Discussion

Changes in Activities and Emissions

As shown in Table 4, Thurston County's total gross emissions increased by 6.6% (202,233 MTCO2e) between 2015 and 2022. As noted above, 43,702 MT CO2e (1.5% of total inventoried emissions) may be due to methodological changes in maritime and railway emissions. The following are the major changes within specific sectors and activities:

- Transportation
  - On-road gasoline VMT decreased by 7%.
  - On-road diesel VMT increased by 20%.
  - Total on-road emissions reduced by 0.08%, which translates to an emissions reduction of 768 MT CO2e.
- Electricity
  - Total electricity use increased by 15%.
  - Residential electricity use increased by 16.8%, commercial use by 12.8%, and industrial use by 14.7%.
  - However, total emissions from electricity decreased by 1.2% because of a lower emissions factor resulting from PSE's investments in cleaner generation.
- Natural Gas
  - Residential natural gas use (and associated emissions) increased by 31% and commercial natural gas increased by 38%.
  - Industrial natural gas use increased by 478%. This includes a large spike from 2016 to 2017, when industrial natural gas use increased by 628% in just one year. From 2017 to 2022, industrial natural gas use decreased by 21%. TCMC Partners and Puget Sound Energy have not identified an explanation for these fluctuations.
  - Total change in natural gas use across all sectors (including losses) increased by 42%, which translates to an emissions increase of 121,221 MT CO2e. It is the largest increase in emissions activities.
- Solid Waste
  - The amount of waste being sent to the landfill increased by 34% from 2015 to 2022.
  - Emissions from waste sent to the landfill increased by 96%, which translates to an emissions increase of 49,612 MT CO2e. It is the second-largest increase in emissions activities.
  - Total waste emissions nearly doubled.
- Agriculture
  - Animal agriculture (enteric fermentation and manure management) increased by 66%, which translates to an emissions increase of 43,966 MT CO2e. It is the third largest increase in emissions activities.

Greenhouse Gas Emissions Forecasts

The Thurston Climate Mitigation Collaborative's (TCMC's) most recent community-wide greenhouse gas (GHG) inventory includes emissions from activities and sources that took place within Thurston County during the 2022 calendar year. Using the 2022 GHG inventory as a baseline, ICLEI prepared a basic "business-as-usual" forecast for 2030.

Business-As-Usual (BAU) Forecast

The BAU forecast (Figure 3) is a projection of emissions through the year 2050. The projected emissions estimated population growth [4], changes in automotive fuel efficiency standards [5], and changes to the carbon intensity of grid electricity [6]. Thurston County's 2022 emissions were 3,258,925 MT CO2e. If no local actions are taken, Thurston County's 2050 emissions are projected to be 2,014,347 MT CO2e. This is a 38% reduction in emissions. The electric grid will be much cleaner in 2030, but it will not reduce emissions enough to accomplish the TCMC's goal of reducing emissions 45% by 2030.

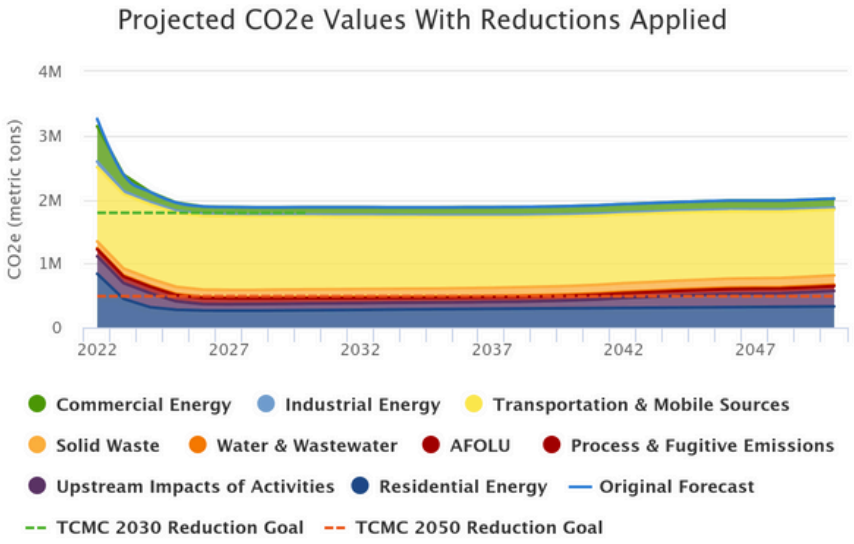


Figure 4: Business-As-Usual Forecast for Community-Wide Emissions from 2022-2050

*The 2022 Organics Management Law (HB1799) establishes statewide goals to reduce organic material being disposed of in landfills by 75%. This is intended to reduce non-fossil methane emissions. This law is not factored into the BAU forecast, but will likely reduce waste- related emissions between now and 2030 if implementation goes as planned.

[4] Washington Office of Financial Management. 2022 Growth Management Act population projections for counties. March 2, 2023. https://ofm.wa.gov/washington-data-research/population-demographics/population-forecasts-and-projections
[5] ICLEI's Carbon Intensity Reference Sheet
[6] Puget Sound Energy. Beyond Net Zero Carbon by 2045. January 2021. https://www.pse.com/en/press-release/details/pse-sets-beyond-net-zero-carbon-goal

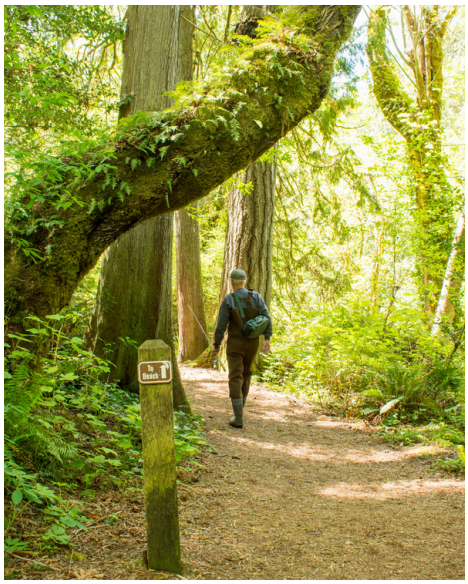
Conclusion

Based on annual GHG inventory data collected by the TCMC, emissions in Thurston County increased from 2015 to 2019, dropped more than 18% in one year from 2019 to 2020, then increased again from 2020 to 2022. The 2019-2020 change was largely due to an abrupt decrease in on-road transportation emissions (15.3%) as a result of the COVID-19 pandemic. On-road emissions increased 7.0% from 2020-2021 and then again 7.7% from 2021-2022. These data indicate that the pandemic's effect on countywide GHG emissions was temporary, and emissions are unfortunately exhibiting an upward trajectory once again.

Overall, this report estimates that GHG emissions in Thurston County increased approximately 6.6% from the baseline year 2015 until 2022. During this period, the County's population grew by approximately 10.7%. So, while total emissions are going in the wrong direction, per capita emissions (emissions per individual resident) are slightly decreasing in Thurston County. Nonetheless, the TCMC recognizes that the region is not on track to meet its adopted GHG emission targets for 2030 and 2050.

As in prior years, buildings and energy account for the largest share of the county's emissions (54%), and in particular the residential energy sector which accounts for 26% of the total. In 2024-2025, the TCMC is embarking on two major regional initiatives targeting GHG emissions in the residential energy sector. These initiatives are 1) an Energy Efficiency and Electrification Campaign to provide outreach, incentives and technical support with a focus on low-to-moderate income residents; and 2) a Home Energy Score Model Ordinance to provide homebuyers/occupants an assessment of home energy performance, expected energy costs, and recommendations for cost-effective improvements. These regional efforts augment the actions being taken by each individual jurisdiction, which are reported in the latest TCMC Annual Progress Report.

The inventory shows transportation as the second largest GHG contributor, accounting for 36% of total emissions. All four TCMC jurisdictions are implementing strategies to reduce transportation emissions by increasing use of active forms of travel, adoption of electric vehicles, and efficiency of the transportation system. Each TCMC jurisdiction is working on Comprehensive Plan Updates in 2024-2025, which will include development of a new Climate Change Element emphasizing policies to reduce vehicle miles traveled (VMT) in alignment with TCMP Strategy T1: Set land use policies that support increased urban density and efficient transportation networks and reduce urban sprawl [7].



[7] Thurston Climate Mitigation Plan. December 2020. https://www.trpc.org/909/Thurston-Climate-Mitigation-Plan

The TCMC Staff Team, Executive Committee, and Community Advisory Workgroup will review and consider these GHG inventory data in ongoing discussions about how the Thurston region can meet its established emission reduction targets. Further emission forecasting and scenario analyses as part of the Comprehensive Plan Update process will help the TCMC identify and prioritize local actions. Any new priorities will be integrated into the TCMP according to its established update schedule, which prescribes minor administrative updates every other year and a full plan review and update every six years.

Completion of another GHG inventory every three to five years is recommended to assess progress resulting from any actions implemented. The detailed methodology section of this report, as well as notes and attached data files in the ClearPath Climate Planner tool and a master data Excel file provided to the TCMC will be helpful to complete a future inventory consistent with this one.

Climate mitigation actions produce environmental, economic, and social benefits beyond direct reduction of GHG emissions. The TCMP articulates 12 regional goals that emphasize these co-benefits, such as creating vibrant neighborhoods, preserving forests and farmlands, protecting air and water quality, and ensuring residents have resources to meet their daily needs. Through the ongoing collaboration of the TCMC, Thurston County and the cities of Lacey, Olympia, and Tumwater are working to support the strength and resilience of the whole Thurston community.

Appendix: Methodology Details

Energy

Table 5: Energy Data Sources

Activity	Data Source	Data Gaps/Assumptions
Residential, Commercial, and Industrial Electricity	Puget Sound Energy (PSE)	N/A
Residential, Commercial, and Industrial Natural Gas	Puget Sound Energy (PSE)	N/A
Residential Propane, Fuel Oil, and Wood	US Census table B25040 and EIA Table CT4	EIA Table CT4 scaled down from Washington to Thurston County using household counts from table B25040
Commercial/Industrial Other Fuels	No data used	EIA data for Washington not considered to be accurate to scale down for Thurston County. No industrial facilities within Thurston County reporting to EPA.

Table 6: Emissions Factors for Electricity Consumption

Emissions Factor/ Year	CO2 (lbs./MWh)	CH4 (lbs./GWh)	N2O (lbs./GWh)	Data Gaps and Assumptions
Puget Sound Energy 2022	907.8	0	0	CO2 emissions are actually CO2e emissions from PSE's 2022 Greenhouse Gas Inventory

Transportation

Table 7: Transportation Data Sources

Activity	Data Source	Data Gaps/Assumptions
Transportation on-road	Thurston Regional Planning Council	VMT breakdown methodology utilizes the Washington State vehicle mix from the State Inventory Tool and TRPC's pass-through rates (Percent of VMT associated with vehicles neither starting nor ending their trip in Thurston County) that were calculated for previous years. These estimates include Intercity Transity estimate
Transportation Off-Road	EPA National Emissions Inventory	Data utilizes EPA 2020 NEI Retrieval Tool.
Railway Emissions	EPA National Emissions Inventory	Data utilizes EPA 2020 NEI Retrieval Tool.
Maritime Emissions	EPA National Emissions Inventory	Data utilizes EPA 2020 NEI Retrieval Tool.
Aviation Transportation	Olympia Regional Airport (ORA)	Detailed flight information was not given, assumed 100% local attribution.

Table 8: MPG and Emissions Factors by Vehicle Type

Fuel	Vehicle Type	MPG	CH4 (g/mile)	N2O (g/mile)
Gasoline	Passenger car	0.0084	0.0069	0.0084
Gasoline	Light truck	0.0117	0.0087	0.0117
Gasoline	Heavy truck	0.0719	0.0611	0.0719
Gasoline	Motorcycle	0.0084	0.0069	0.0084
Diesel	Passenger car	0.0005	0.001	0.0005
Diesel	Light truck	0.001	0.0015	0.001
Diesel	Heavy truck	51	0.0048	51
Diesel	Transit Bus	0.0084	0.0069	0.0084

Wastewater

Table 9: Wastewater Data Sources

Activity	Data Source	Data Gaps/Assumptions
Wastewater Energy Use	LOTT Clean Wastewater Alliance	N/A
Fugitive Emissions	LOTT Clean Wastewater Alliance	N/A

Solid Waste

Table 10: Solid Waste Data Sources

Activity	Data Source	Data Gaps/Assumptions
Solid Waste Generation	Thurston County Public Works	N/A
Flaring of Landfill Gas	Thurston County Public Works	N/A
Compost	Thurston County Public Works	N/A

Agriculture (AFOLU)

Table 11: Agriculture Data Sources

Activity	Data Source	Data Gaps/Assumptions
Enteric Fermentation	US EPA State Inventory and Projection Tool (2023 version) & 2022 USDA Agriculture survey	N/A
Manure Management	US EPA State Inventory and Projection Tool (2023 version) & 2022 USDA Agriculture survey	N/A
Fertilized Land	US EPA State Inventory and Projection Tool (2023 version) & 2022 USDA Agriculture survey, TCAT	TCAT created an emission factor using Washington State information in the State Implementation and Projection Tool 7 developed by the US Environmental Protection Agency. Specifically, the emission factor (0.297 MTCO2e/acre) is based on statewide values for (1) direct and indirect N2O emissions from soils and (2) total Washington cropland and grassland.

Fugitive Emissions

Table 12: Fugitive Emissions Data Sources

Activity	Data Source	Data Gaps/Assumptions
Fugitive Emissions from Natural Gas Distribution	Puget Sound Energy (PSE)	Utilizes a default value of 0.3% (three tenths of one percent) from EDF User Guide for Natural Gas Leakage Rate Modeling Tool

Upstream Impacts

Table 13: Upstream Impacts Data Sources

Activity	Data Source	Data Gaps/Assumptions
Electricity Transmission and Distribution Losses	Puget Sound Energy (PSE), EPA eGRID	5.1% grid loss factor from eGRID applied to PSE's reported usage
Upstream Electricity	Puget Sound Energy (PSE)	Calculations from US Community Protocol section BE. 5.
Upstream Natural Gas	Puget Sound Energy (PSE)	Calculations from US Community Protocol section BE. 5.
Upstream Fuel Oil	U.S. Energy Information Administration	Calculations from US Community Protocol section BE. 5.
Upstream Propane	U.S. Energy Information Administration	Calculations from US Community Protocol section BE. 5.

Inventory Calculations

The 2022 inventory was calculated following the US Community Protocol and ICLEI's ClearPath Climate Planner Climate Planner software. As discussed in Inventory Methodology, the IPCC 6th Assessment was used for global warming potential (GWP) values to convert methane and nitrous oxide to CO2 equivalent units. ClearPath Climate Planner's inventory calculators allow for input of the sector activity (i.e. kWh or VMT) and emission factor to calculate the final carbon dioxide equivalent (CO2e) emissions.