



Eugene, Oregon

Community Greenhouse Gas Inventory

Sector-Based Inventory for 2010 – 2015

Consumption-Based Inventory for 2013



Report prepared by Good Company, February 2017



INTRODUCTION

In the effort to better understand our community's carbon emissions, the City of Eugene has engaged Good Company to complete an update to the community's greenhouse gas (GHG) inventory. A GHG inventory quantifies the GHG emissions associated with a specific boundary – such as operational control within an organization or the geographic boundary of a community – for a specific period of time. By conducting inventories at regular intervals, community stakeholders can understand trends and manage emissions from specific sources and activities. The results of the GHG inventories will be used to support a 2017 update of the Eugene community's Climate and Energy Action Plan (CEAP) and provides the foundation for a GHG emissions tracking and management system related to the City's Climate Recovery Ordinance (No. 20567).

FINDINGS IN BRIEF

- Eugene's 2015 sector-based GHG emissions total **1.59 million MT CO₂e**. The largest sources of community emissions include passenger and freight transportation (32%) followed by commercial (24%) and residential (23%) energy use.
- Eugene's sector-based GHG emissions have decreased by -14% since 2010. This is the result of decreased electricity and natural gas use attributed to warmer winters combined with greater levels of clean electricity generation on the regional electricity grid. Transportation fuel use also decreased by about -7% over the time period.
- The Eugene community's sector-based emission *intensities* also declined between 2010 and 2015. On a per capita basis, emissions have declined by almost -18%, while total population has increased by 4.6 percent. In 2015, the average Eugene resident's sector-based carbon footprint is 9.7 MT CO₂e / person, down from 11.8 MT CO₂e/person in 2010.
- Eugene's consumption-based emissions estimate, which includes production emissions for imported goods, foods and services consumed in Eugene, totals **3.45 million MT CO₂e**. Production emissions for items consumed by the Eugene community totals **1.86 million MT CO₂e**.
- In 2015, the average resident's consumption-based carbon footprint is 21.7 MT CO₂e, roughly 2.2 times greater than the sector based footprint.

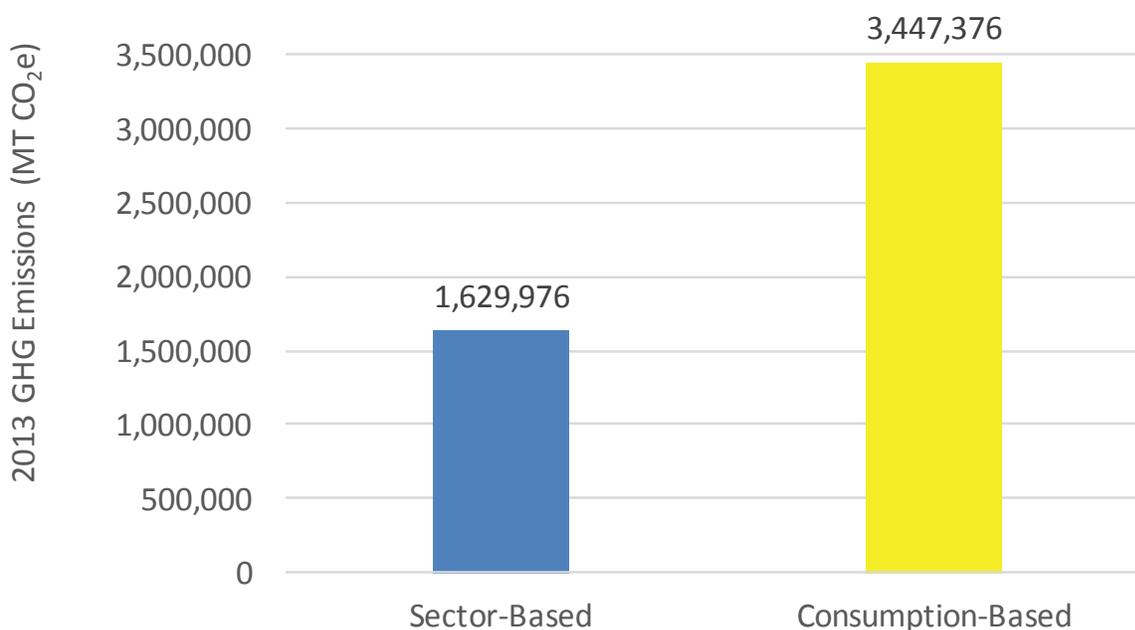
INVENTORY APPROACH

This inventory documents the community of Eugene, Oregon’s greenhouse gas emissions (GHGs) for calendar years 2010 through 2015. Inventory results are presented using two types of inventory methodologies – Sector-Based and Consumption-Based.

- **Sector-based emissions inventories** (or in-geographic boundary inventories) include local emissions from energy use by homes, businesses, and vehicles as well as emissions from landfilling solid waste and wastewater treatment.
- **Consumption-based emissions inventories** include local, sector-based emissions, but also include emissions that are generated during production and delivery of imported goods, energy and food consumed within the Eugene community, and exclude sector based emissions from local production that are exported.

These two inventory types together offer a more comprehensive view of the Eugene community’s GHG emissions. The community has greater control over sector-based emissions sources, as well as better data, which is why this accounting methodology is most often used to set emissions mitigation goals. Consumption-based emissions from the production of imported goods, food, energy, and services are more difficult to measure and track, but when accounted for make up a significant portion of the community’s emissions. Figure 1 compares community emissions using sector-based and consumption based GHG accounting methodologies.

Figure 1: Comparison of 2013 Sector-Based and Consumption-Based Community Emissions.



SECTOR-BASED (IN-BOUNDARY) INVENTORY

Eugene’s sector-based emissions inventory (SBEI) totaled **1.59 million metric tons** of carbon dioxide equivalent (MT CO₂e)¹ for calendar year 2015. These emissions are summarized on Figures 2 & 3. See page 6 for further discussion of electricity-related emissions including location-based and market-based accounting methods. Emissions from the residential, commercial, and industrial (RCI) sectors are dominated by electricity and natural gas energy use. A small portion of RC emissions are the result of fugitive loss of refrigerant gases from cooling equipment. Transportation emissions are primarily from the combustion of gasoline (E10) and diesel (B5) fuels in local, on-road passenger and freight vehicles as well as off-road equipment.² Landfilled solid waste disposal and wastewater treatment emissions make up the remaining sources.

Figure 4 (on the next page) details Eugene’s Sector-Based emissions for the period between 2010 and 2015, showing a -14% reduction in that period. Eugene’s per capita emissions declined by -19% as population increased by 4.6%. During this period, total natural gas use and the associated emissions declined by about -2.6%. The residential sector led the reduction, which is attributed to relatively warm winters over the last two years.

Electricity use (kilowatt-hours consumed) declined by 4.7% between 2010 and 2015. Electricity emissions have also decreased due to warmer winters over the last two years and an increase in the share of electricity production on our regional electricity grid over the from hydroelectric and wind generation.

Use of transportation fuels and the associated emissions have decreased between 2010 and 2015. Gasoline emissions have decreased by about -8%, while diesel emissions have decreased by about -2%. Solid waste emissions, as reported by Lane County for Short Mountain Landfill, increased by 14% over the time period.

Figure 2: Eugene 2015 emissions by sector (using location-based electricity accounting)

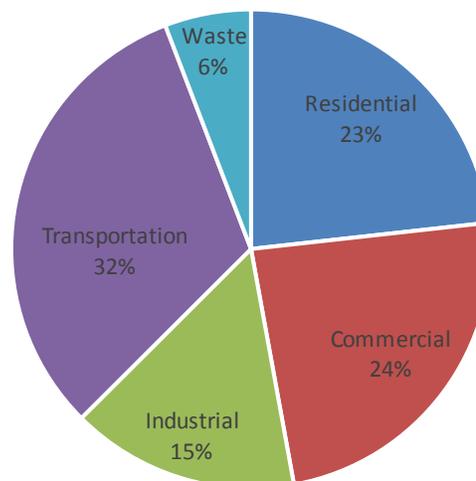
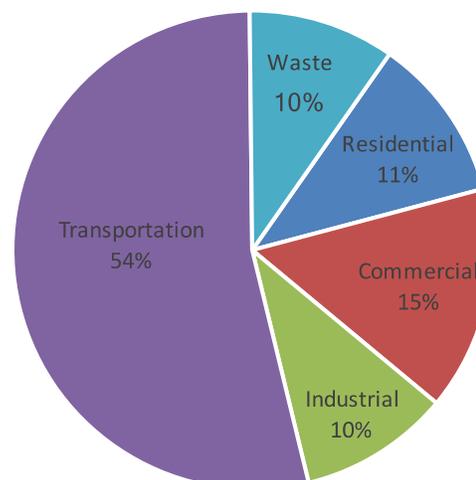


Figure 3: Eugene 2015 emissions by sector (using market-based electricity accounting)



¹ Metric tons of carbon dioxide equivalent (MT CO₂e) is the international standard unit for measurement and reporting of greenhouse gas emissions.

² Oregon’s Renewable Fuel Standard requires that all motor gasoline (with limited exceptions) is E10 (10% ethanol and 90% gasoline). Diesel fuel is required to be B5 (5% biodiesel and 95% diesel).

Figure 4: Detailed summary Eugene’s 2010 – 2015 GHG sector-based emissions by sector and energy type. *Note - This table includes emissions using two accounting methods for electricity – Location-based and Market-based. These two methods are described in more detail on the following page. The Sector sub-totals (light blue highlighted rows) include location-based emissions for electricity.*

Total Emissions (MT CO2e / year)	2010	2011	2012	2013	2014	2015	Change since 2010
Residential	465,375	485,023	385,764	402,095	377,561	362,041	-22%
Electricity (Location-Based)	367,984	381,316	285,929	297,644	279,024	271,079	-26%
Electricity (Market-Based)	28,736	14,888	12,245	20,591	12,869	11,609	-60%
Natural Gas	70,766	76,436	74,735	78,713	73,192	65,617	-7%
Other Fuels	14,406	14,848	12,066	12,704	12,311	12,311	-15%
Refrigerant Loss	12,219	12,423	13,034	13,034	13,034	13,034	7%
Commercial & Industrial	772,057	771,818	661,533	668,344	662,973	643,006	-17%
Electricity (Location-Based)	553,970	546,276	435,045	433,446	427,547	428,631	-23%
Electricity (Market-Based)	43,259	21,329	18,631	29,986	19,896	18,356	-58%
Natural Gas	178,255	185,538	190,444	201,296	197,907	176,856	-1%
Other Fuels	27,613	27,581	23,010	20,568	24,485	24,485	-11%
Refrigerant Loss	12,219	12,423	13,034	13,034	13,034	13,034	7%
Transportation	527,170	511,405	490,492	478,854	488,914	492,829	-7%
Gasoline (E10)	377,602	360,313	349,540	340,019	343,787	346,540	-8%
Diesel (B5)	149,568	151,092	140,952	138,835	145,127	146,289	-2%
Waste	82,381	78,168	86,953	80,684	84,894	93,565	14%
Landfilled Solid Waste	80,030	75,817	84,251	77,982	82,192	90,863	14%
Wastewater Treatment Process	2,351	2,351	2,702	2,702	2,702	2,702	15%
Total Emissions (Location-Based)	1,846,983	1,846,414	1,624,741	1,629,976	1,614,341	1,591,440	-14%
Total Emissions (Market-Based)	997,024	955,040	934,643	949,463	940,535	921,696	-8%
Per Capita Emissions (Location-Based)	11.8	11.8	10.3	10.2	10.1	9.7	-18%
Per Capita Emissions (Market-Based)	6.4	6.1	5.9	6.0	5.9	5.6	-12%

*Note: Refrigerant emissions are scaled per capita based on State of Oregon GHG reporting. The most recent Oregon data available, at the time of conducting Eugene’s community inventory, was for calendar year 2012. This data is used as a proxy for 2013 – 2015.

Figure 4 accounts for electricity emissions using two methods – Location-Based and Market-Based³ - based on Greenhouse Gas Protocol's *Scope 2 Guidance*. The *Global Community GHG Protocol* requires users to report using the location-based method, which uses an average emissions factor for the Northwest's regional electricity grid to calculate emissions (i.e. Northwest Power Pool). The Guidance suggests conducting a sensitivity analysis using the market-based method. This accounting method uses EWEB's utility-specific carbon intensity⁴, based on its owned and contracted generation resources, to calculate emissions. Eugene's market-based emissions are about 18 times less carbon intensive than the regional average. This is because EWEB, as a public utility, predominantly contracts with Bonneville Power Administration (BPA) who's generation supply is largely from low-carbon, hydroelectric and nuclear resources and EWEB's owned, low-carbon resources which include hydro and wind.

Figure 5 presents Eugene's energy-related emissions, by energy type, including both the location-based and market-based electricity-accounting methodologies. This graphic highlights the significance of the electric accounting methodology used when presenting results. Scope 2 protocol guidance describes the Location-based method as a representation of the average GHG impacts associated with electricity use within a defined geographic territory and time period. While the Market-based method represents electricity that has been purposefully chosen via the GHG impacts associated with EWEB's electricity supply contracts that serve the community. Both methods are useful for different purposes; together, they provide a fuller documentation and assessment of risks, opportunities, and changes to emissions from electricity supply over time. See Greenhouse Gas Protocol's *Scope 2 Guidance* for details.

Figure 5: Comparison community emissions, by fuel type, using location- and market-based electricity accounting methodologies.



CONSUMPTION-BASED INVENTORY

In 2013, the City of Eugene, working with the Oregon Department of Environmental Quality, completed a consumption based inventory (CBEI), that estimated an emissions total of 3.45 million MT CO₂e. Emission sources found to be significant in the sector-based inventory are also significant in the

³ For details about these two accounting methodologies see Greenhouse Gas Protocol's *Scope 2 Guidance*.

⁴ Utility-specific factors are provided by Oregon Department of Environmental Quality (ODEQ) based on EWEB regulatory reporting.

consumption-based inventory, such as building and vehicle energy use. Many of these emissions are shown on Figure 6 in the Product Use column. Figure 6 also shows the significance of emissions generated outside of Eugene during production of goods, food, energy and services in the Production column. As in the sector-based inventory, waste disposal represents a relatively small fraction of the community's emissions.

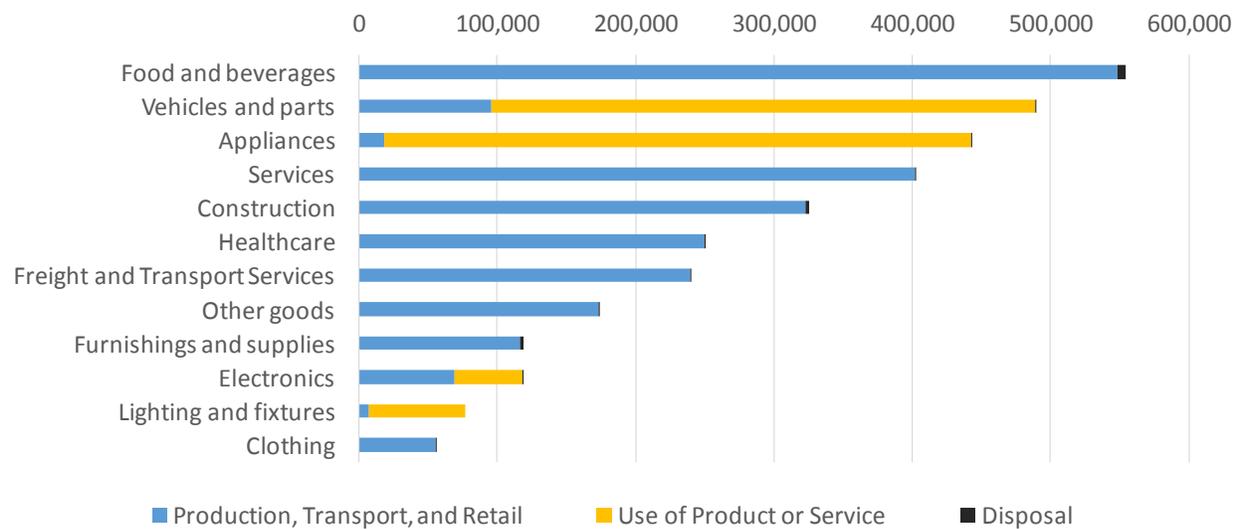
Figure 6: Summary of the Eugene's community's 2013 consumption-based emissions.

Category	Production, Transportation, and Retail	Product Use	Disposal	Total Emissions	Per-Capita Emissions	Percent of Total
Food and beverages	547,984	-	6,304	554,288	3.5	16%
Vehicles and parts	96,107	392,547	84	488,738	3.1	14%
Appliances	18,349	423,810	5	442,163	2.8	13%
Services	401,993	-	568	402,561	2.5	12%
Construction	322,772	-	2,728	325,500	2.0	9%
Healthcare	250,006	-	92	250,098	1.6	7%
Freight and Transport Services	238,985	-	5	238,990	1.5	7%
Other manufactured goods	173,102	-	53	173,155	1.1	5%
Furnishings and supplies	116,615	-	2,747	119,362	0.7	3%
Electronics	69,330	48,898	44	118,271	0.7	3%
Retailers	134,807	-	-	134,807	0.8	4%
Lighting and fixtures	6,776	69,940	-	76,716	0.5	2%
Clothing	55,097	-	94	55,191	0.3	2%
Other	54,574	-	8	54,581	0.3	2%
Water and wastewater	12,948	-	6	12,954	0.1	0%
Total Emissions	2,499,445	935,195	12,736	3,447,376	21.7	100%
Per-Capita Emissions	15.7	5.9	0.1	21.7		
Percent of Total	73%	27%	0.4%	100%		

Production of food and beverages, vehicles, construction materials, air travel services, furnishings, electronics, and clothing are all significant consumption categories for the community. Figure 6 (on the next page) summarizes select categories from Figure 5 in graphic form to show the scale of emissions by lifecycle stage for select consumption categories.

Figure 7 highlights the need to develop and implement GHG mitigation strategies differently depending on the category of consumption. For example, selecting food types, based on the carbon intensity of production would be an effective strategy to reduce this large source of community emissions. Whereas for vehicles, the majority of emissions are generated during use so climate action strategies should focus on selecting vehicles for efficiency and that utilize low-carbon fuels.

Figure 7: Lifecycle emissions, split by lifecycle stage, for select consumption categories.



INVENTORY METHODOLOGY

The Eugene **sector-based inventory** follows ICLEI's U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions in combination with the more recent Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories and Scope 2 Guidance by World Resource Institute and ICLEI. Electricity-related emissions accounting guidance is provided by Greenhouse Gas Protocol's *Scope 2 Guidance*. ICLEI'S web-based *ClearPath* Community-Scale Emissions Management Software was used to calculate all greenhouse gas (GHG) emissions for the Eugene's Community Inventories, 2010 - 2015. Data and calculation files are cataloged in a corresponding audit trail comprised organized by inventory year.

The Eugene **consumption-based inventory** incorporates Eugene's sector-based emissions into a consumption-based emissions inventory model that was developed by Stockholm Environment Institute for Oregon Department of Environmental Quality (ODEQ) to support completion of the State of Oregon's 2005 Consumption-Based Inventory. ODEQ staff used the 2010 version of the Oregon model to estimate the Eugene community's 2013 consumption-based emissions.

All community GHG emissions presented in this report are represented in metric tons of carbon dioxide equivalent (MT CO₂e). Quantities of individual GHGs are accounted for in the ICLEI's *ClearPath* carbon calculator and include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), CFCs, PFCs, and sulfur hexafluoride (SF₆) per the Kyoto Protocol. All GHG calculations use the global warming potentials (GWP) as defined in the International Panel on Climate Change's 5th Assessment Report (IPCC AR5).