

Oregon's Consumption-Based Greenhouse Gas Emissions Inventory

2023 Update Report

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Document information

This document was prepared by Oregon Department of Environmental Quality. It provides updates to selected material previously presented in [Oregon's Consumption-Based Greenhouse Gas Emissions 1990-2021](#) (published September 12, 2024).

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Executive summary

Oregon's consumption-based emissions inventory (CBEI) estimates the full lifecycle greenhouse gas emissions associated with the goods, services, fuel and electricity consumed by Oregonians, regardless of where in the world those emissions physically arise. This report updates CBEI results through calendar year 2023.

Oregon has been a leader in the application of this method since it produced the nation's first subnational consumption-based inventory in 2011.

2023 Total Emissions

In 2023, Oregon's consumption-based emissions totaled 91.0 million metric tons of CO₂ equivalent (MTCO₂e). In comparison, Oregon's sector-based greenhouse gas inventory, which describes emissions physically arising within Oregon's borders, gives a total of 58.5 million MTCO₂e for the same year. The two inventories share some locally-arising emissions in common, but CBEI reveals additional emissions associated with Oregon's consumption of goods and services produced elsewhere. The large scale of these additional emissions demonstrates the significance of supply chain emissions in Oregon's true climate footprint.

What Oregonians Consume

Six broad categories of consumption account for approximately 72 percent of total consumption-based emissions. Vehicles and parts represent the largest share at 18 percent (16.3 million MTCO₂e), driven primarily by use-phase emissions (fuel burning). Food and beverages follow at 15 percent (13.9 million MTCO₂e), with nearly all emissions occurring in supply chains and production. Other high emission categories include appliances (including HVAC), services, other manufactured goods, and construction,

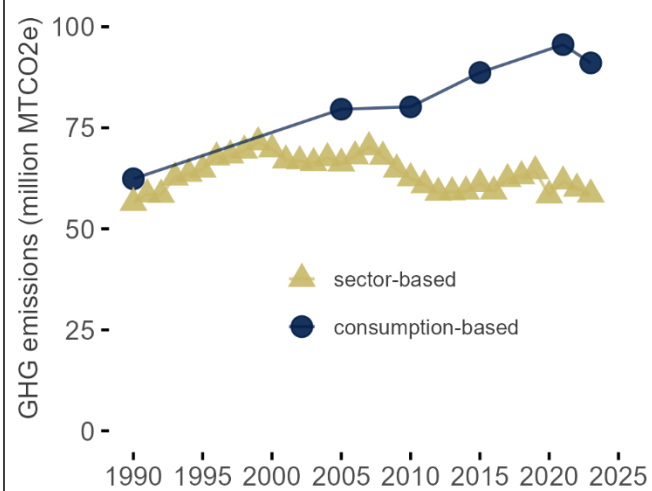
Where Emissions Occur

Only about one-third of Oregon's 2023 consumption-based emissions (33 percent) physically originate within the state. The remaining two-thirds are generated in other U.S. states (41 percent) or foreign countries (26 percent), reflecting Oregon's deep integration into global supply chains and the offshoring of emissions-intensive production.

Who Is Consuming

Households are responsible for approximately 73 percent of Oregon's consumption-based emissions (66.5 million MTCO₂e), with vehicles, food and beverages, and appliances as their highest-impact categories. Business capital and inventory formation accounts for 16 percent (15.0 million MTCO₂e), and government consumption for 10 percent (9.5 million MTCO₂e).

Figure ES-1. Oregon's consumption- and sector-based emissions, 1990-2023



Trends Over Time

Oregon's sector-based and consumption-based emissions have diverged over the past three decades (see Figure ES-1). Oregon's sector-based GHG emissions rose by less than 4 percent between 1990 and 2023, despite economic and population growth. During the same span of time, Oregon's consumption-based emissions rose by more than 45 percent. The gap between the two inventories has widened over time - from roughly 5 million MTCO₂e in 1990 to approximately 32.5 million MTCO₂e in 2023.

A structural shift has occurred in Oregon's emissions footprint.

- Use-phase emissions (from driving vehicles and operating appliances) have declined, from 40 percent of the CBEI total in 2005 to 29 percent in 2023. This is the result of state and federal policy attention leading to energy efficiency investments, appliance standards, and electricity decarbonization.
- Production-phase emissions (from producing goods, including the goods Oregonians import) have risen, from 51 percent of total consumption-based emissions in 2005 to 58 percent in 2023. Because many of these emissions arise in other states and countries, they are largely invisible to consumers and have received comparatively limited policy attention.

A similar trend can be observed when contrasting energy (electricity and fuels) and materials. Between 2005 and 2023, emissions from the direct consumption of energy fell by 5.1 million MTCO₂e, while emissions from the consumption of materials rose by 8.2 million MTCO₂e.

These results illustrate the increasing importance of addressing materials, supply chains and consumption in Oregon's climate strategy.

There was a small decline in the state's total consumption-based emissions between 2021 and 2023, from 95.6 to 91.0 million MTCO₂e. This 4.8 percent decline matched a similar 5.2 percent decline in the state's sector-based inventory during the same interval. It is unclear if this is the beginning of a new trend or a short-term anomaly.

Policy Implications

Until recently, consumption-based emissions were widely viewed as "out of reach" for climate mitigation. In September 2024, responding to a directive from the Oregon Legislature, DEQ published [Opportunities to Reduce Greenhouse Gas Emissions Caused by Oregon's Consumption](#), which quantified numerous emissions-reduction ideas using a consumption-based perspective. This report revealed significant and often overlooked opportunities to reduce consumption-based emissions through both incentives and regulation. The report also identified significant potential for co-benefits associated with many of these options.

Achieving meaningful reductions in Oregon's overall carbon footprint will require policy frameworks that address not only direct emissions within the state's borders, but also the upstream supply chain emissions driven by Oregon's consumption of materials, food, energy, and services. Many of Oregon's consumption-based emissions may originate out of state, but they stem from decisions made inside Oregon's borders, and opportunities to reduce those emissions are not out of reach.

Table of contents

Document information	2
Non-discrimination statement.....	2
Executive summary.....	3
Introduction	7
Background and Context: Oregon’s CBEI.....	7
Results.....	8
2023 Top-Line Results	8
2023 Consumption-Based Greenhouse Gas Emissions by Category and Life-Cycle Stage	9
2023 Consumption-Based Greenhouse Gas Emissions by Category and Location of Emissions	11
2023 Consumption-Based Emissions by Category and Type of Consumer	13
Oregon Consumption-Based Emissions Over Time	15
Emissions by Spending Category, 2005 – 2023	15
Consumption and Emissions by Type of Consumer, 2005 – 2023	17
Consumption- and Sector-Based Emissions, 1990-2023	19
Consumption-Based Emissions by Metacategory (Materials, Services, Fuels, Electricity), 2005–2023	21
Consumption-Based Emissions by Life Cycle Phase, 2005 – 2023	23
Drivers of Change in Consumption-Based Emissions.....	25

Introduction

This report updates key results of Oregon's consumption-based greenhouse gas emissions inventory through calendar year 2023. Unless otherwise stated, methods and conventions are the same as in [Oregon's Consumption-Based Greenhouse Gas Emissions 1990-2021](#), published Sept. 12, 2024. Look in that document for more complete information.

Background and Context: Oregon's CBEI

Consumption sits at the core of economic activity and, by extension, at the center of most human-caused greenhouse gas emissions. In a globally interconnected economy, the impacts of consumption are rarely confined to the place where goods and services are used.

Oregonians rely on products and energy systems that span regions and countries, meaning the emissions tied to everyday purchases often occur far beyond state borders. A consumption-based greenhouse gas emissions inventory accounts for this reality by tracing emissions across the full supply chain of what Oregonians consume, recognizing that emissions generated elsewhere still contribute to Oregon's overall climate impact.

In 2011, Oregon was the first state in the U.S. to publish a statewide consumption-based greenhouse gas emissions inventory (CBEI). Oregon's CBEI estimates the total global emissions associated with consumption by Oregon households, governments, and businesses.

While CBEI overlaps in part with the state's more conventional sector-based inventory – for example both inventories count emissions from local energy use and in-state production – the CBEI differs in key ways. The sector-based approach captures emissions produced within the state boundaries of Oregon, including those tied to exports, whereas the consumption-based approach focuses on emissions embodied in goods and services consumed in Oregon, including imports. Together, these perspectives offer a more complete picture of the state's carbon footprint than either inventory would alone. Consequently CBEI reveals opportunities for emissions reductions that could otherwise go unacknowledged.

Considering both inventories in tandem is essential for informed climate action. Relying solely on a sector-based view risks overlooking cost-effective reduction strategies, creating a false sense of progress if in-state emissions fall while consumption-driven emissions rise, and unintentionally encouraging the relocation of emissions-intensive businesses outside the state. By incorporating consumption-based accounting, Oregon strengthens its ability to assess its true climate impact and identify meaningful pathways to reduce emissions.

ODEQ has updated CBEI periodically, creating results for data years 1990, 2005, 2010, 2015, and 2021. This report extends results to 2023. It builds on more than a decade of leadership in this area, while maintaining a consistent methodological foundation and setting the stage for future refinements.

Results

2023 Top-Line Results

2023 Consumption-Based Greenhouse Gas Emissions in Total, and Compared to Sector-Based Emissions

In 2023, Oregon's consumption-based greenhouse gas emissions (**CBEs**) were estimated to total 91.0 million metric tons of carbon dioxide equivalent (**MTCO₂e**). In comparison, the state's sector-based inventory totaled 58.5 million MTCO₂e.

Figure 1 represents the overlap and breadth of the two inventories.

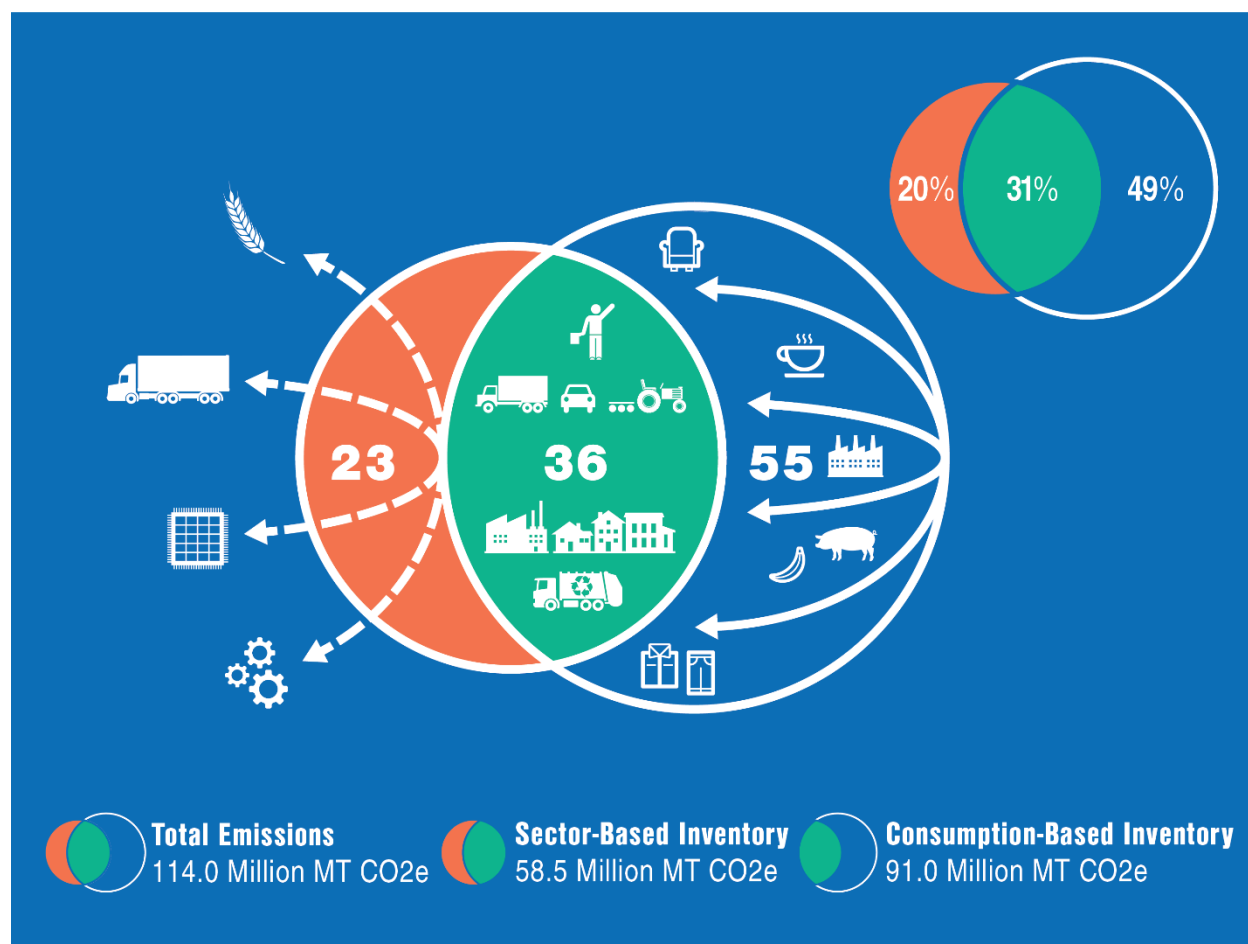


Figure 1. Comparison of Oregon's 2023 sector- and consumption-based greenhouse gas emissions

The intersecting portion of Figure 1's Venn diagram illustrates the emissions counted in both inventories. These total approximately 36 million MTCO₂e of emissions, including direct emissions from vehicle and appliance use by households and governments, emissions from in-state electricity generation serving household and government demand, and other commercial

and industrial emissions occurring within Oregon that are part of supply chains satisfying Oregon-based consumption.

The orange crescent on the left side of Figure 1 represents emissions that arose within Oregon but were associated with exported goods or services. These emissions are part of sector-based totals, but do not appear in the consumption-based inventory. In 2023, these emissions were estimated at approximately 23 million MTCO₂e.

The blue crescent on the right side of Figure 1 represents emissions generated in other states and countries in the course of producing goods and services consumed by Oregon households, businesses, and governments. These “imported emissions” are part of consumption-based totals but do not appear in the sector-based inventory.

The scale of these imported emissions is worth emphasizing. At approximately 55 million MTCO₂e, in 2023, they are nearly equivalent in magnitude to Oregon's entire sector-based inventory of 58.5 million MTCO₂e. Oregon's consumption-based inventory therefore brings into focus an additional set of emissions, and a corresponding set of reduction opportunities, that is almost as large as the traditional sector-based inventory on which most of Oregon's climate policy has historically been built.

2023 Consumption-Based Greenhouse Gas Emissions by Category and Life-Cycle Stage

Figure 2 and Table 1 report on Oregon's consumption-based greenhouse gas emissions, by spending category and life-cycle stage – i.e. *when* in the material life cycle the emissions occur. Life cycle stages in this chart are “pre-purchase” (including production and distribution), use, and post-consumer disposal. (See [Oregon's Consumption-Based Greenhouse Gas Emissions 1990-2021](#) for more detail on these terms.)

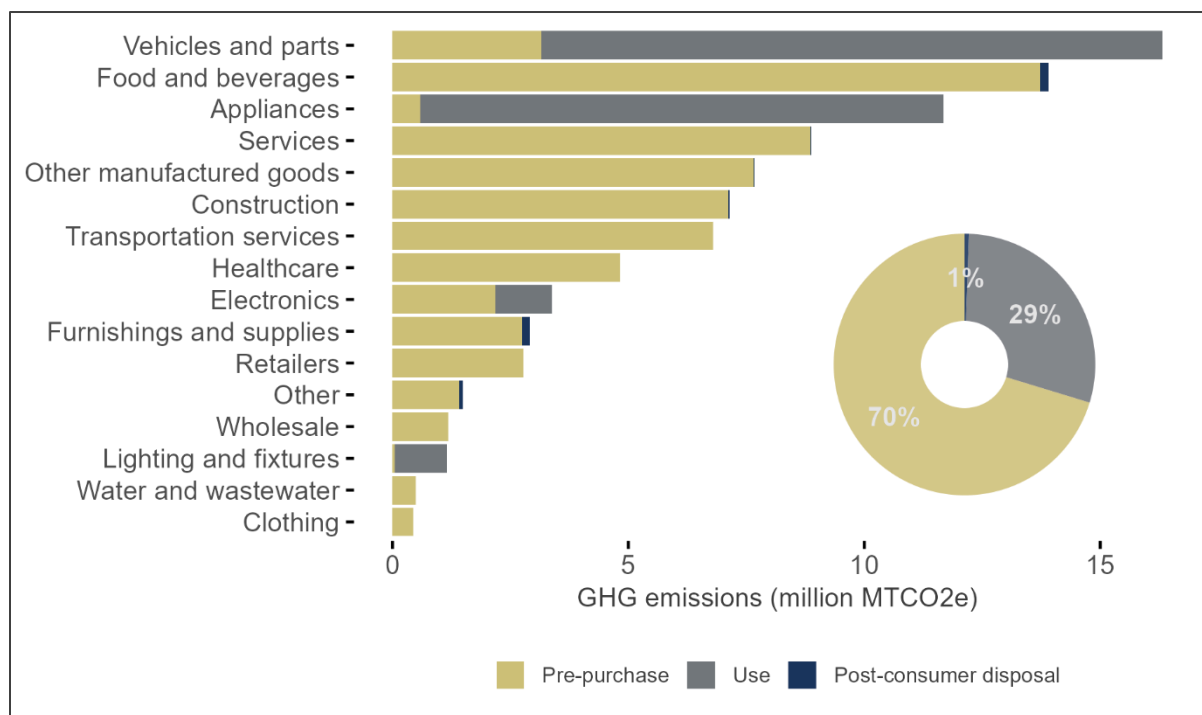


Figure 2. Oregon 2023 Consumption-Based GHG emissions, by category and life-cycle phase (Million MTCO₂e)

Approximately 70 percent of Oregon’s CBEs occur “pre-purchase,” before final consumers have even touched or used products. About 29 percent occur in the “use” phase, mostly due to fuel burning or electricity consumption as vehicles or appliances are used. Only 1 percent are attributed to post consumer disposal activities, for example landfilling.

Spending categories differ in their emissions. Vehicles and parts account for 18 percent of Oregon’s CBEs, with the majority of those occurring during the use phase. Although emissions from the production of vehicles and parts contribute relatively little when compared to emissions from vehicle use, at 3.2 million MTCO₂e, emissions from producing vehicles purchased by Oregon far exceed emissions from the use of lighting by all households and governments.

Emissions from consumption of food and beverages follow closely at 15 percent, but differ in their emissions profile, as nearly all associated emissions occur during the pre-purchase production phase. These emissions primarily originate on farms and ranches, with some occurring elsewhere in the supply chain including food manufacturing, packaging and freight.

Overall, 72 percent of total emissions are concentrated within six categories: vehicles, food and beverages, appliances (including HVAC devices such as furnaces), services, other manufactured goods, and construction. This distribution underscores the importance of targeting both use-phase and production-phase emissions across a relatively small number of high-impact consumption categories.

Table 1. Oregon 2023 consumption-based GHG emissions, by category and life-cycle phase (Million MTCO₂e)

Category	Pre-purchase	Use	Post-consumer disposal	Total	% of total
Vehicles and parts	3.2	13.2	0.0	16.3	18%
Food and beverages	13.7	0.0	0.2	13.9	15%
Appliances	0.6	11.1	0.0	11.7	13%
Services	8.9	0.0	0.0	8.9	10%
Other manufactured goods	7.7	0.0	0.0	7.7	8%
Construction	7.1	0.0	0.0	7.1	8%
Transportation services	6.8	0.0	0.0	6.8	7%
Healthcare	4.8	0.0	0.0	4.8	5%
Electronics	2.2	1.2	0.0	3.4	4%
Furnishings and supplies	2.7	0.0	0.2	2.9	3%
Retailers	2.8	0.0	0.0	2.8	3%
Other	1.4	0.0	0.1	1.5	2%
Wholesale	1.2	0.0	0.0	1.2	1%
Lighting and fixtures	0.1	1.1	0.0	1.2	1%
Water and wastewater	0.5	0.0	0.0	0.5	1%
Clothing	0.4	0.0	0.0	0.4	0%
Total	64.0	26.5	0.5	91.0	100%

*Notes: Totals may not add exactly due to rounding. *Use phase emissions from these categories are zero, although in some cases emissions may be associated with the use of products in one category but assigned to another category. For example, emissions associated with washing clothes are included under the use phase of “appliances.”*

2023 Consumption-Based Greenhouse Gas Emissions by Category and Location of Emissions

Figure 3 and Table 2 reveal that although Oregon's consumption-based emissions are driven by the purchasing behavior of Oregon-based residents, governments and businesses, the physical origin of those emissions is largely located elsewhere. Approximately, only **one-third of Oregon's consumption-based emissions (33%) are estimated to originate physically within the state**, while the remaining **two-thirds (67%) are generated beyond Oregon's geographic boundaries**. This reflects the reality that a substantial portion of emissions occur during the production phase of goods and services manufactured outside Oregon's borders.

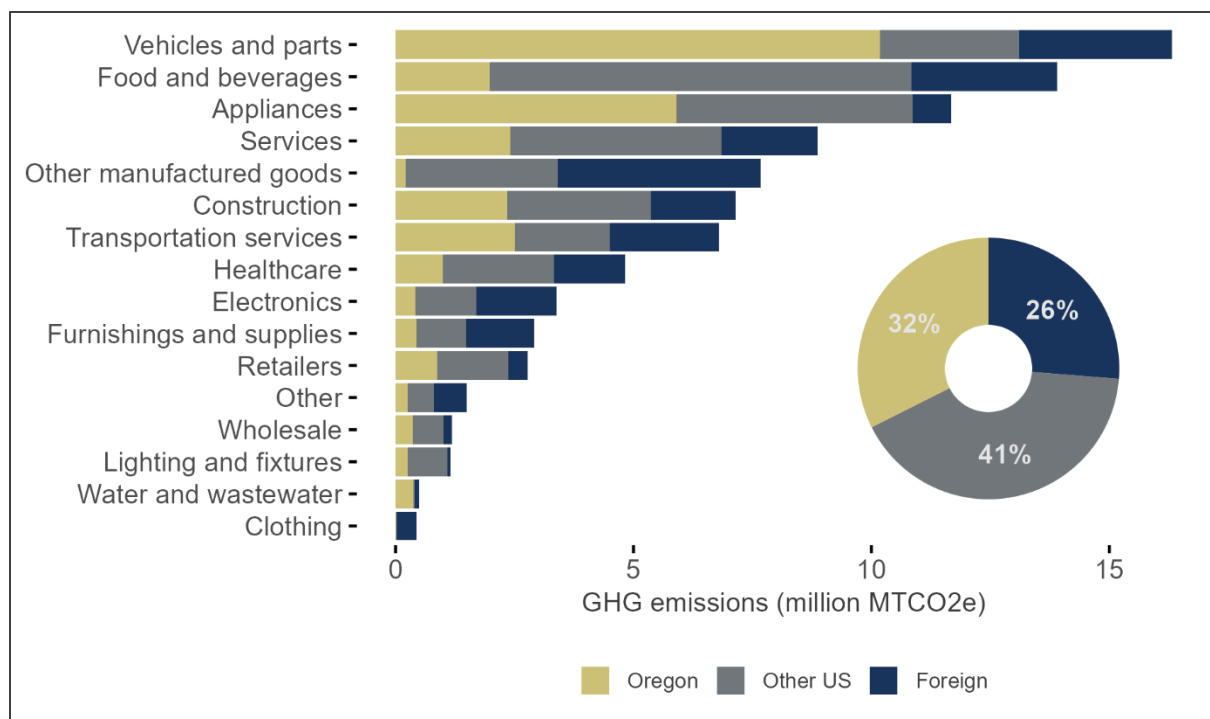


Figure 3. Consumption-based emissions by category and region of origin (Million MTCO₂e)

The location of emissions varies by type of consumption. For example, nearly all emissions associated with clothing are a result of foreign manufacturing, while food-related emissions primarily occur elsewhere in the U.S., such as in California and the Midwest. The only category where more than half of emissions occur in Oregon is vehicles and parts (due to vehicle use).

This geographic disconnect between the point of consumption and the point of emission has important implications for climate policy. Because emissions produced elsewhere in response to Oregon's demand still contribute to the global atmospheric conditions experienced by Oregonians, the causal link between in-state consumption and out-of-state emissions warrants direct policy consideration. Addressing only emissions that occur within Oregon's borders captures an incomplete picture of the state's true climate impact and limits the state's response to our contribution to global climate change.

Table 2. Consumption-based emissions by category and region of origin (million MTCO₂e)

Category	In Oregon	Other US	Foreign	Total
Vehicles and parts	10.2	2.9	3.2	16.3
Food and beverages	2.0	8.9	3.1	13.9
Appliances	5.9	5.0	0.8	11.7
Services	2.4	4.4	2.0	8.9
Other manufactured goods	0.2	3.2	4.3	7.7
Construction	2.3	3.0	1.8	7.1

Transportation services	2.5	2.0	2.3	6.8
Healthcare	1.0	2.3	1.5	4.8
Electronics	0.4	1.3	1.7	3.4
Furnishings and supplies	0.4	1.1	1.4	2.9
Retailers	0.9	1.5	0.4	2.8
Wholesale	0.4	0.7	0.2	1.2
Lighting and fixtures	0.3	0.8	0.1	1.2
Water and wastewater	0.4	0.0	0.1	0.5
Clothing	0.0	0.0	0.4	0.4
Other	0.3	0.5	0.7	1.5
Total	29.5 (32-33%)	37.6 (41%)	23.9 (26%)	91.0

2023 Consumption-Based Emissions by Category and Type of Consumer

Figure 1 and **Error! Reference source not found.** illustrate consumption-based emissions for 2023 by spending category and type of consumer.

Similar to 2021 results, Oregon's 2023 CBEI links approximately **73 percent of Oregon's CBEs to household consumption**. Government consumption was associated with 10 percent, and business capital and inventory with 16 percent. (See [Oregon's Consumption-Based Greenhouse Gas Emissions 1990-2021](#) for more detail on these terms.)

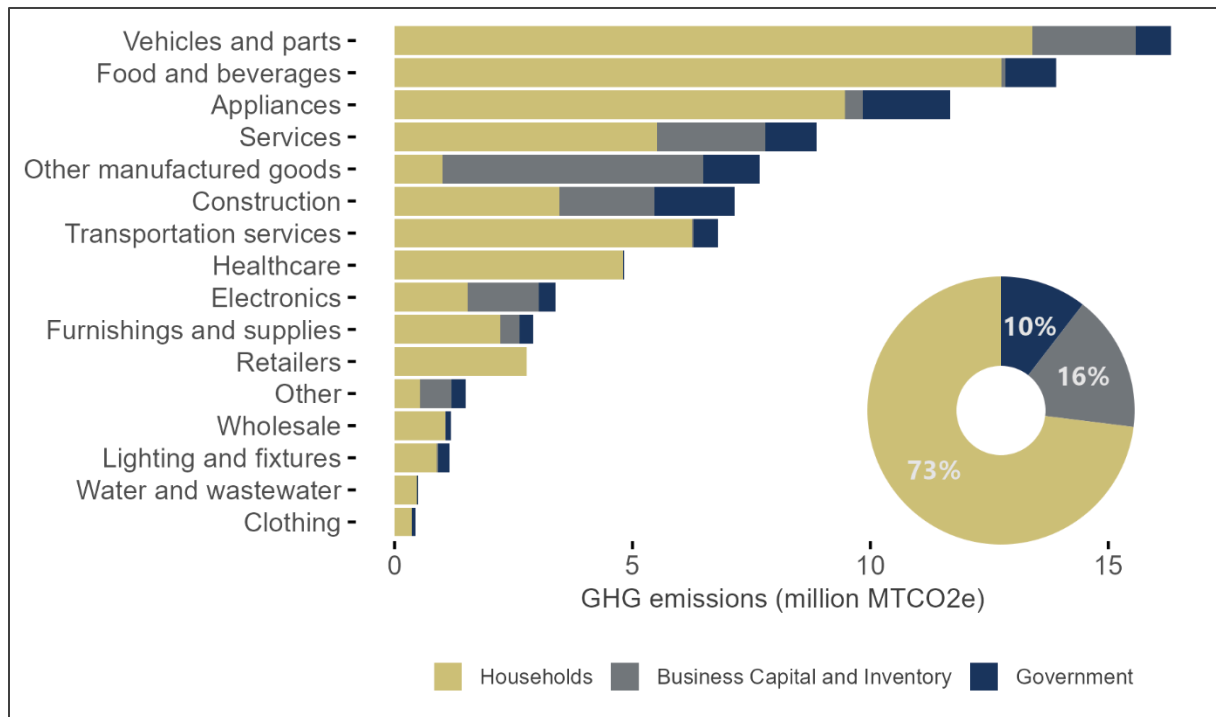


Figure 4. Oregon 2023 Consumption-Based Emissions, by emissions category and consumer type (Million MTCO₂e)

The different types of consumers have different patterns of emissions.

- Household consumption is linked to high emissions for vehicles and parts (13.4 million MTCO₂e), food and beverage (12.8 million MTCO₂e), and appliances (9.5 million MTCO₂e).
- Government consumption is linked to prominent emissions for appliances (1.8 million MTCO₂e), construction (1.7 million MTCO₂e), and other manufactured goods (1.2 million MTCO₂e).
- Business capital and inventory consumption is linked to notable emissions for “other manufactured goods” (a category which includes items such as manufacturing equipment, other heavy machinery, and heavy transportation equipment. 5.5 million MTCO₂e), services (2.3 million MTCO₂e), and vehicles and parts (2.2 million MTCO₂e).

Any consumption-based approach to curbing emissions should consider a robust focus on the three highest volume and impact areas highlighted in **Table 3**, as these categories account for about 46 percent of total CBEs for Oregon.

Table 3. Oregon 2023 Consumption-based emissions by emissions category and consumer type (million MTCO₂e)

Category	Households	Government	Business Capital and Inventory	Total
Vehicles and parts	13.4	0.7	2.2	16.3

Food and beverages	12.8	1.1	0.1	13.9
Appliances	9.5	1.8	0.4	11.7
Services	5.5	1.1	2.3	8.9
Other manufactured goods	1.0	1.2	5.5	7.7
Construction	3.5	1.7	2.0	7.1
Transportation services	6.3	0.5	0.0	6.8
Healthcare	4.8	0.0	0.0	4.8
Electronics	1.5	0.4	1.5	3.4
Furnishings and supplies	2.2	0.3	0.4	2.9
Retailers	2.8	0.0	0.0	2.8
Wholesale	1.1	0.1	0.0	1.2
Lighting and fixtures	0.9	0.2	0.0	1.2
Water and wastewater	0.5	0.0	0.0	0.5
Clothing	0.4	0.1	0.0	0.4
Other	0.5	0.3	0.7	1.5
Total	66.5	9.5	15.0	91.0
	73%	10%	16%	

Oregon Consumption-Based Emissions Over Time

Emissions by Spending Category, 2005 – 2023

Figure 5 and Table 4 show how Oregon's CBEs in individual spending categories have evolved over roughly two decades.

The biggest contributors to CBE totals remain consistent over all the years: vehicles and parts, food and beverages, and appliances. Within some spending categories, however, there appear to be trends. Emissions linked to services, construction, and transportation services appear to be increasing, while those linked to lighting and clothing seem to be decreasing.

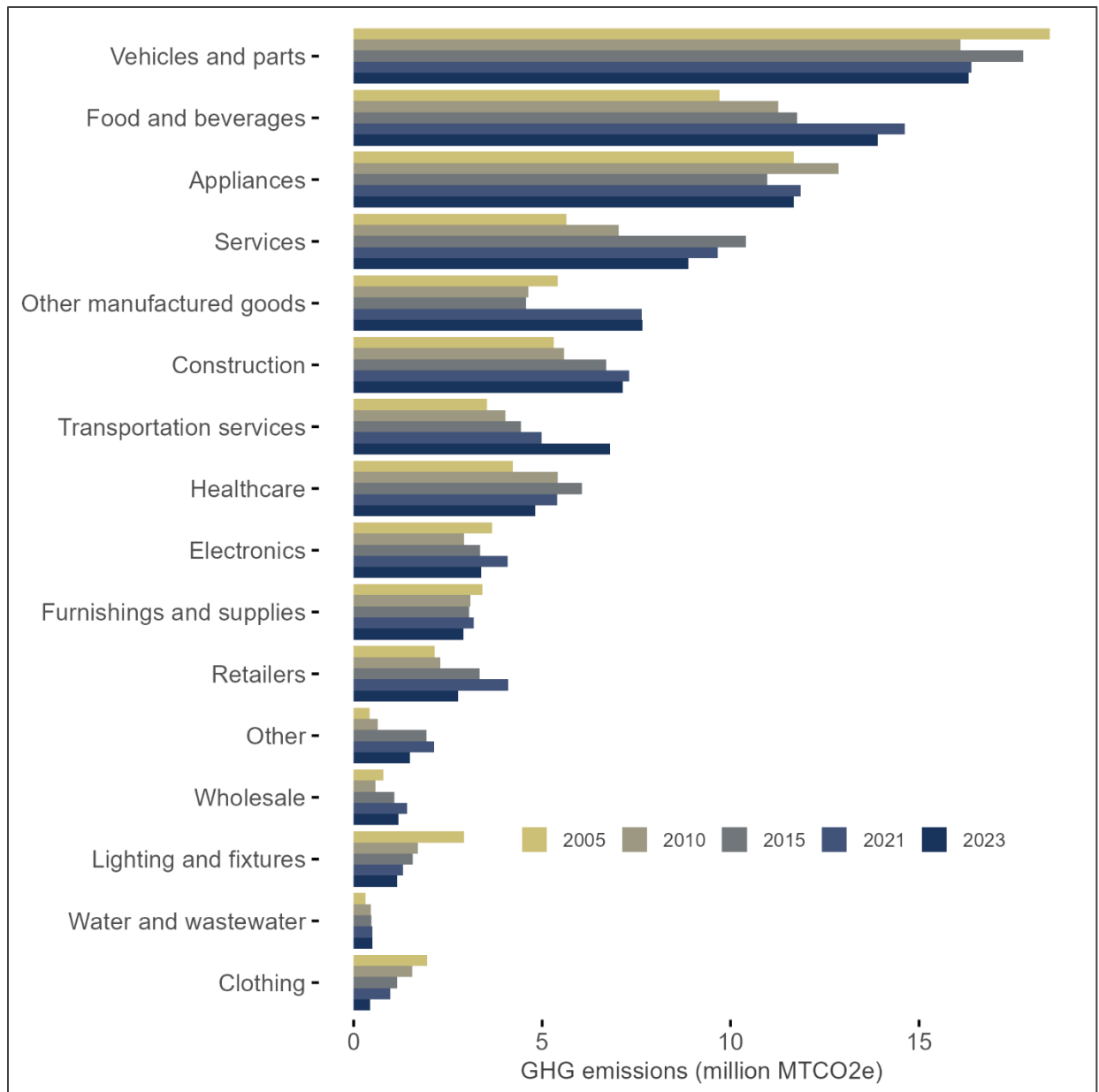


Figure 5. Oregon consumption-based GHG emissions by category, 2005 – 2023 (Million MTCO₂e)

Table 4. Oregon consumption-based GHG emissions (million MTCO₂e) by category, 2005 - 2023

Category	In Oregon	Other US	Foreign	Total
Vehicles and parts	10.2	2.9	3.2	16.3
Food and beverages	2.0	8.9	3.1	13.9
Appliances	5.9	5.0	0.8	11.7
Services	2.4	4.4	2.0	8.9
Other manufactured goods	0.2	3.2	4.3	7.7

Construction	2.3	3.0	1.8	7.1
Transportation services	2.5	2.0	2.3	6.8
Healthcare	1.0	2.3	1.5	4.8
Electronics	0.4	1.3	1.7	3.4
Furnishings and supplies	0.4	1.1	1.4	2.9
Retailers	0.9	1.5	0.4	2.8
Wholesale	0.4	0.7	0.2	1.2
Lighting and fixtures	0.3	0.8	0.1	1.2
Water and wastewater	0.4	0.0	0.1	0.5
Clothing	0.0	0.0	0.4	0.4
Other	0.3	0.5	0.7	1.5
Total	29.5	37.6	23.9	91.0

Consumption and Emissions by Type of Consumer, 2005 – 2023

The 2023 CBEI results suggest a gradual redistribution of emissions among consumer types over the past few decades. Spending patterns are a factor in this shift.

Figure 6 and Table 5 show final “consumption” or “demand” (spending measured in inflation-adjusted dollars) for the three consumer types: households, governments, and business capital and inventory formation. (Note that much spending by businesses, such as spending on supplies or energy, are not classified as final consumption, because they are necessary to satisfy demand by actual end users of products and services. See [Oregon’s Consumption-Based Greenhouse Gas Emissions 1990-2021](#) for more detail.)

In absolute terms, total demand rose steadily in Oregon between 2005 and 2023, from approximately \$228 to \$371 billion (2023 dollars). Most of this growth took place after 2010. Final demand also rose in each consumer category, while the distribution of final demand among those categories evolved modestly. The household share of demand declined, from about 68 percent in 2005 to 64 percent in 2023. The government share increased, from 14 percent in 2005 to around 18 percent in both 2021 and 2023. Business capital and inventory formation decreased between 2005 and 2010, then recovered and grew, accounting for approximately 18 percent of total demand by 2023.

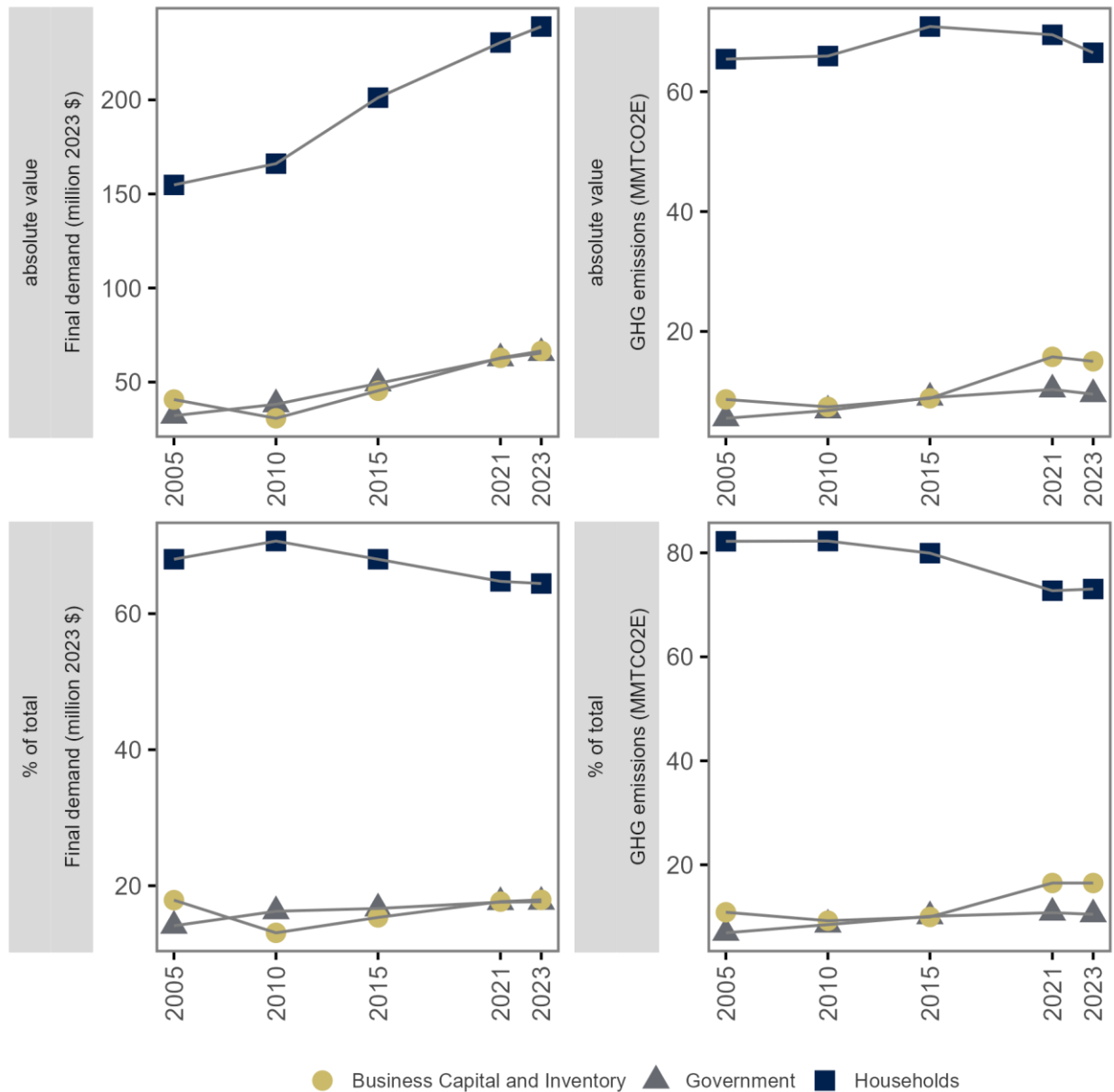


Figure 6. Oregon consumption (final demand) and consumption-based emissions, by type of consumer, 2005 - 2023

These spending trends influenced trends in CBEs. Figure 6 and Table 6 show that household CBEs increased modestly between 2005 and 2015, then declined slightly through 2021 and more noticeably by 2023, even as real (inflation-adjusted) consumption continued to rise. By 2023, household emissions declined to 66.5 million MTCO₂e, down from a peak of 70.9 MTCO₂e in 2015, while still remaining above 2005 levels.

In contrast, emissions associated with consumption by government and business capital and inventory were notably higher in 2021 and 2023 than in earlier years. Government-linked emissions rose steadily from 2005 through 2021, increasing from 5.5 to 10.3 million MTCO₂e, before declining slightly to 9.5 million MTCO₂e in 2023. This echoes a general growth in government consumption. Emissions from business capital and inventory formation follow a similar trajectory to spending patterns, declining between 2005 and 2010, then rebounding and increasing significantly through 2021, with a slight decrease to 15.0 in 2023 from 15.8 in 2021. As previously observed, the sharp rise in business-linked emissions between 2015 and 2021 outpaced growth in spending, suggesting a shift toward more emissions-intensive investments.

Table 5. Oregon consumption (final demand), by type of consumer, 2005 – 2021 (real [inflation-adjusted] 2023 US \$, in billions)

Type of Consumer	2005	2010	2015	2021	2023
Households	154.8	166.1	201.2	230.5	239.0
Government	32.1	38.2	49.3	62.6	65.4
Business Capital and Inventory	40.7	30.7	45.4	62.9	66.5
Total	227.7	235.0	295.9	356.0	370.9

Table 6. Oregon consumption-based GHG emissions, by type of consumer, 2005 – 2023 (Million MTCO₂e)

Type of Consumer	2005	2010	2015	2021	2023
Households	65.4	66.0	70.9	69.5	66.5
Government	5.5	6.8	8.9	10.3	9.5
Business Capital and Inventory	8.7	7.4	8.8	15.8	15.0
Total	79.6	80.2	88.7	95.6	91.0

In 2023, households continue to represent the largest share of Oregon’s CBEs, at about 73 percent, but their contribution has declined from 82 percent in 2005. Government’s share, at 10 percent in 2023, is larger than its 2005 share of 7 percent. Business capital and inventory’s share, at 16 percent, is greater than its 2005 share of 11 percent.

Consumption- and Sector-Based Emissions, 1990-2023

As mentioned in the earlier section on “Background and Context,” Oregon uses multiple types of inventories to measure and manage GHG emissions. This report largely concerns results from the consumption-based inventory, with results available for 1990, 2005, 2010, 2015, 2021, and 2023 (see [Oregon’s Consumption-Based Greenhouse Gas Emissions 1990-2021](#) for more

detail on the 1990 estimate). Meanwhile, the sector-based inventory has results available annually from 1990 through 2023.

Figure 7 shows the comparative timelines of these two inventories. Oregon's CBEs rose steadily between 1990 and 2021, reaching a high of 95.6 million MTCO₂e before declining to 91.0 million MTCO₂e in 2023. Sector-based emissions followed a contrasting course: they climbed during the 1990s, peaked at 71.4 million MTCO₂e in 1999, and have generally decreased since then, with some fluctuations across individual years. Levels dropped sharply in 2020 to 58.3 million MTCO₂e in connection with the COVID-19 public health emergency, rebounded to 61.7 million MTCO₂e in 2021, and then declined again to 58.5 million MTCO₂e in 2023, returning to levels similar to those recorded in 2020 as post-pandemic consumption patterns readjusted. Both inventories declined by approximately 5 percent between 2021 and 2023.

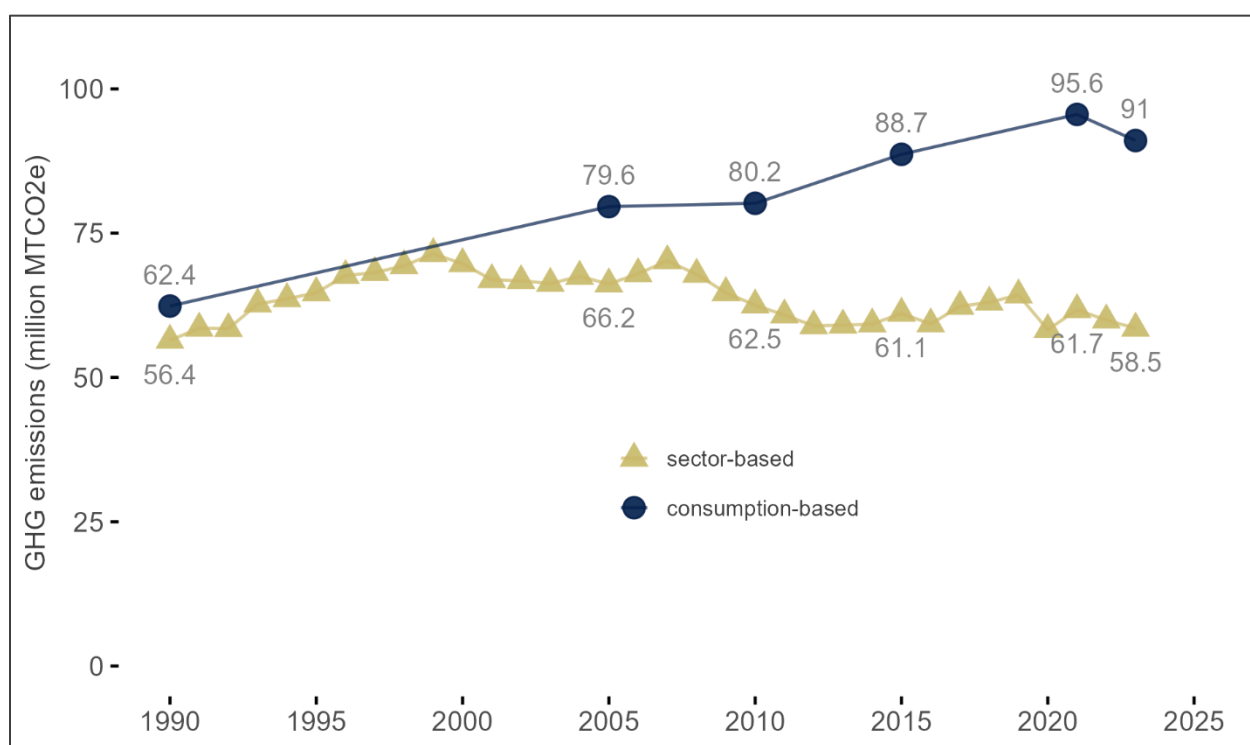


Figure 7. Oregon consumption-based and sector-based GHG emissions, 1990 – 2023

The gap between the two inventories has continued to widen over time. In 1990, consumption-based emissions were roughly 5 million MTCO₂e higher than sector-based emissions. By 2021 this difference had expanded to 34 million MTCO₂e. Although the gap narrowed slightly to about 32.5 million MTCO₂e in 2023, it remains large relative to historical levels. Several factors likely contribute to this persistent divergence, including rising overall consumption, increased dependence on imported goods and services, continued offshoring of production, and the fact that Oregon's own sector-based emissions have declined more rapidly than those of other states and countries producing goods consumed within Oregon. See the section on "Drivers of Change" for more discussion.

Consumption-Based Emissions by Metacategory (Materials, Services, Fuels, Electricity), 2005–2023

One useful perspective for examining CBEs is the lens of “metacategories.” This method groups all consumption into four broad categories: materials, services, fuels, and electricity. Emissions are attributed to the category of the consumed product itself. For example, even when emissions from materials are primarily linked to the energy used during production, they are recorded under “materials,” since the demand for those materials ultimately drives the energy use. In this approach, electricity and fuels refer only to direct final demand from consumers (households and governments).

Figure 8, Figure 9, and Table 1 illustrate Oregon’s consumption-based emissions by metacategory over the span 2005-2023.

- In all years studied, materials represent the largest share of consumption-based emissions. They were responsible for 47 percent of the total in 2023 (42.7 million MTCO₂e).
- Services have been the second biggest metacategory for CBEs in recent years, making up 24 percent of total emissions in 2023 (22.0 million MTCO₂e). CBEs linked to services expanded considerably between 2005 and 2015.
- Fuels accounted for 20 percent of emissions in 2023 (18.1 million MTCO₂e), and have showed little absolute variation over all the periods studied.
- Electricity continues to show a steady decline, reaching 8.3 million MTCO₂e in 2023, the lowest level recorded to date, and representing 9 percent of total consumption-based emissions. This reflects an approximately 31 percent reduction from 2005 (12.0 million MTCO₂e), consistent with ongoing decarbonization of Oregon’s electricity mix and improvements in efficiency.

Overall, total consumption-based emissions fell from 95.6 million MTCO₂e in 2021 to 91.0 million MTCO₂e in 2023, a reduction of roughly 5 percent. This represents the first observed decline in Oregon’s consumption-based emissions since monitoring began. See the section on “Drivers of Change” for more discussion.

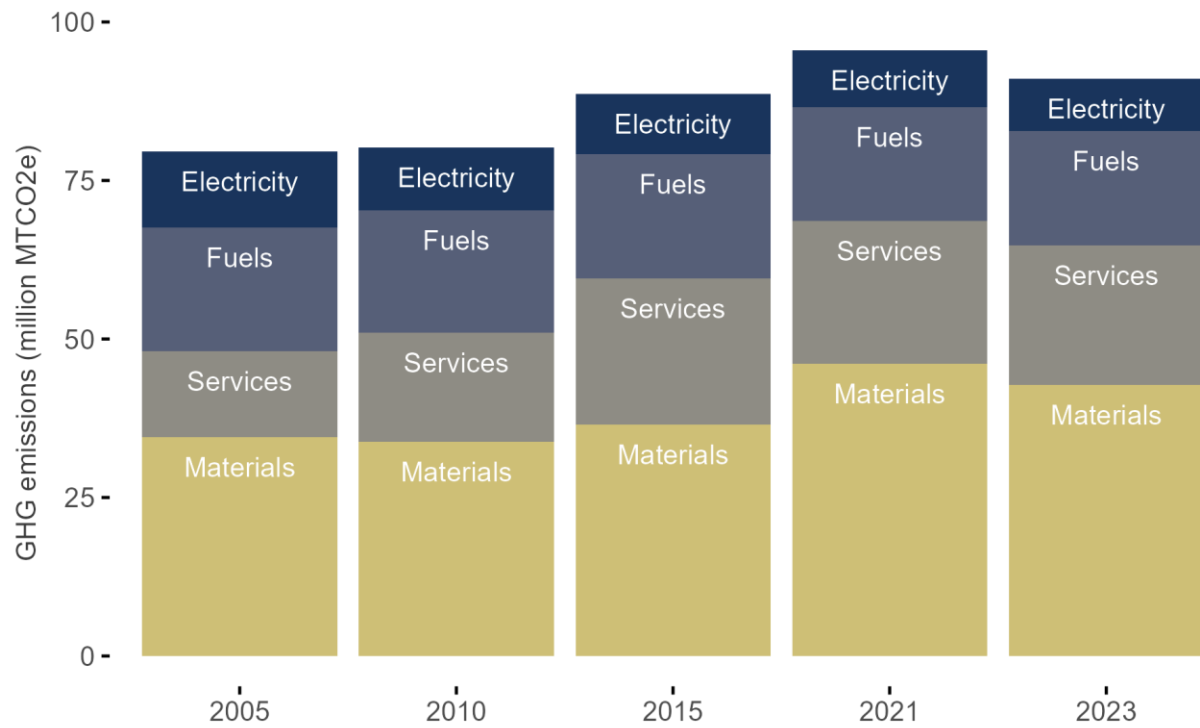


Figure 8. Oregon consumption-based GHG emissions, by metacategory, 2005 – 2023

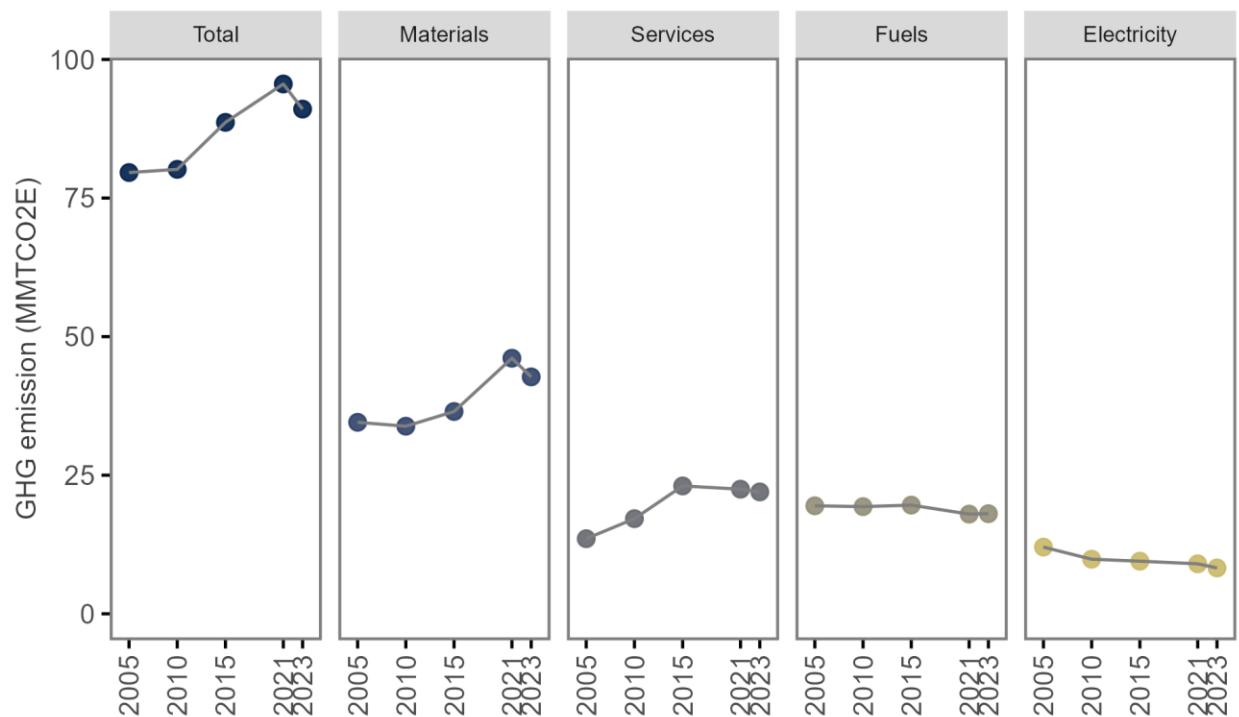


Figure 9. Oregon consumption-based GHG emissions, by metacategory, 2005 – 2023

Table 7. Oregon consumption-based GHG emissions, by metacategory, 2005 – 2023 (million MTCO₂e)

Metacategory	2005	2010	2015	2021	2023
Materials	34.5 (43%)	33.8 (42%)	36.5 (41%)	46.1 (48%)	42.7 (47%)
Services	13.5 (17%)	17.2 (21%)	23.1 (26%)	22.5 (24%)	22.0 (24%)
Fuels	19.5 (24%)	19.3 (24%)	19.6 (22%)	18.0 (19%)	18.1 (20%)
Electricity	12.0 (15%)	9.8 (12%)	9.5 (11%)	9.0 (9%)	8.3 (9%)
Total	79.6	80.2	88.7	95.6	91.0

Consumption-Based Emissions by Life Cycle Phase, 2005 – 2023

Oregon's CBEI represents GHG emissions across the full materials life cycle, from initial production through disposal. Figure 10 and Table 8 show how different phases of the life cycle contribute to total emissions, and how they have changed over time. Here, the life cycle is divided into five phases: production, pre-purchase transportation, wholesale and retail, use, and post-consumer disposal.

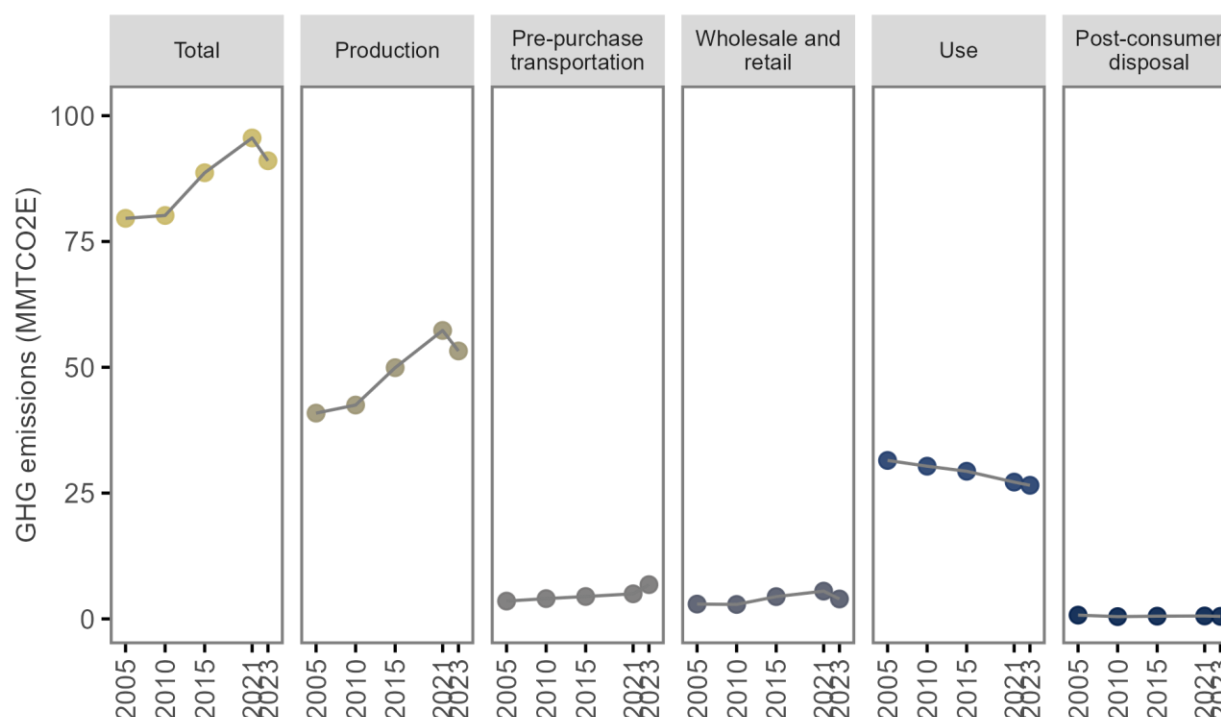


Figure 10. Oregon consumption-based GHG emissions, by life cycle phase, 2005 – 2023

Emissions attributed to the "use" phase, which captures direct energy consumption from driving vehicles and operating appliances (including HVAC), lighting, and electronics, contributed 31.5 million MTCO₂e and represented 40 percent of Oregon's total consumption-based greenhouse gas emissions in 2005. By 2023, these emissions had declined to 26.5 million MTCO₂e, accounting for 29 percent of the total. This reduction is particularly notable given that it occurred alongside substantial population growth over the same period. Much of this decrease can reasonably be attributed to the cumulative effectiveness of conventional climate policy measures: investments in residential energy efficiency, decarbonization of the electricity supply, appliance efficiency standards, and improvements in vehicle fuel economy and technology.

Emissions associated with the "production" phase tell a different story. In 2005, production-phase emissions stood at 40.9 million MTCO₂e, representing 51 percent of Oregon's consumption-based total. By 2021 they had grown to 57.3 million MTCO₂e and 60 percent of the total, before declining to 53.2 million MTCO₂e in 2023, a share of 58 percent. Despite this modest recent decline, production remains by far the largest and fastest-growing life cycle component over the full study period. A significant portion of these emissions are effectively invisible to Oregon consumers, as they originate within supply chains and production facilities located in other states and countries. Upstream emissions of this kind have historically received comparatively limited attention within Oregon's climate policy framework.

Pre-purchase transportation, which covers the movement of goods prior to point of sale, increased from 3.5 million MTCO₂e in 2005 to 6.8 million MTCO₂e in 2023, the only life cycle category to grow both in absolute and relative terms over the full period. Wholesale and retail emissions fluctuated over the study period, peaking at 5.5 million MTCO₂e in 2021 before falling back to 4.0 million MTCO₂e in 2023, consistent with 2005 levels. Post-consumer disposal remained the smallest contributor throughout, holding steady at approximately 0.5 to 0.7 million MTCO₂e across all years, representing just 1 percent of total consumption-based emissions.

Taken together, these trends underscore a structural shift in the composition of Oregon's consumption-based emissions: the gains achieved through use-phase policy have been largely offset by growth in upstream production emissions, with supply chain activity continuing to drive an increasing share of the state's overall consumption footprint.

Table 8. Oregon consumption-based GHG emissions, by life cycle phase, 2005 – 2023 (million MTCO₂e)

Life Cycle Phase	2005	2010	2015	2021	2023
Production	40.9 (51%)	42.5 (53%)	49.9 (56%)	57.3 (60%)	53.2 (58%)
Pre-purchase transportation	3.5 (4%)	4.0 (5%)	4.4 (5%)	5.0 (5%)	6.8 (7%)
Wholesale and retail	2.9 (4%)	2.9 (4%)	4.4 (5%)	5.5 (6%)	4.0 (4%)
Use	31.5 (40%)	30.3 (38%)	29.3 (33%)	27.2 (28%)	26.5 (29%)
Post-consumer disposal	0.7 (1%)	0.4 (1%)	0.5 (1%)	0.6 (1%)	0.5 (1%)
Total	79.6	80.2	88.7	95.6	91.0

Drivers of Change in Consumption-Based Emissions

As Figure 7 showed, Oregon's total consumption-based greenhouse gas emissions rose approximately 20 percent between 2005 and 2021, then decreased slightly in 2023. Figure 11 and Table 9 explore some of the factors behind these changes.

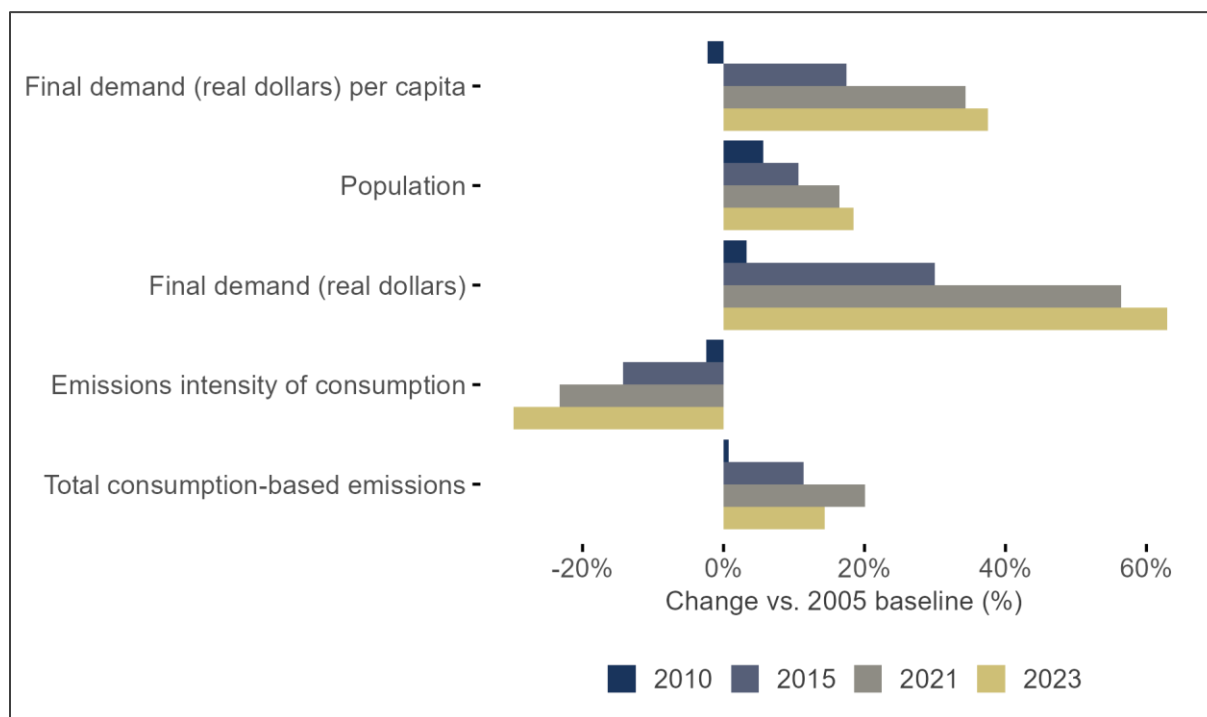


Figure 11. Drivers of change in Oregon's consumption-based GHG emissions

Figure 11 shows several key factors for study years from 2010 to 2023, relative to a 2005 baseline.

In general, consumption (in Figure 11, "final demand") has been increasing.

- After adjusting for inflation, statewide final demand per-capita (in dollars) rose 38 percent from 2005 to 2023. (The low value in 2010 likely reflects the lingering effects of the Great Recession.)
- During the same time period, Oregon's population grew by 18 percent.
- These factors combine to create a 63 percent increase in statewide inflation-adjusted final demand from 2005 to 2023.

Meanwhile, a different factor, **emissions intensities**, helped to mitigate the impacts of this growth in consumption. Emissions intensities, in Figure 11, are the emissions associated with satisfying one average dollar of Oregon consumption. After adjusting for inflation, Oregon's emissions intensities in 2023 were 30 percent lower than 2005. This is the result of decarbonization efforts in Oregon and elsewhere, other efficiency improvements, and shifts in what is purchased. In recent years consumers have spent more on services, which tend to have lower emissions intensities than materials or fuels.

However, the benefits of those improvements in emissions intensities were, by 2021, overridden by the effects of rising overall consumption. Between 2005 and 2021, consumption rose faster than emissions intensities fell. The result was an overall increase in emissions between 2005 and 2021 of 20 percent.

Table 9. Oregon population, per-capita and total consumption (final demand), 5-phase emissions intensities, and consumption-based greenhouse gas emissions, 2005 – 2023

	2005	2010	2015	2021	2023
Per-capita consumption (nominal dollars)	\$45,238.65	\$49,369.05	\$64,476.64	\$84,302.83	\$97,077.55
Per-capita consumption, 2023\$ (real dollars)	\$62,766.48	\$61,349.09	\$73,712.87	\$84,302.83	\$86,330.43
Oregon population	3626938	3831074	4013845	4222611	4296626
Total consumption, 2023\$ (billion \$)	\$227.65	\$235.03	\$295.87	\$355.98	\$370.93
5-phase emissions intensities (kg CO2e/2023\$)	0.35	0.34	0.30	0.27	0.25
Consumption-based GHG emissions (MMTCO2e)	79.6	80.2	88.7	95.6	91.1

In 2023, Oregon’s CBEs declined for the first time, decreasing about 5 percent from the 2021 value. It is currently unclear whether this decline represents an actual change in direction, or whether 2021 was an anomalous year.

On one hand, [some academic observers](#) have proposed that CBEs may have peaked for developed economies such as the United States, of which Oregon is a part. It could be that state, national and global production systems have decarbonized enough that the upward trend in CBEs in import-dependent jurisdictions like Oregon has been arrested.

On the other hand, it is possible that 2021 was a “blip” that does not change the general trend. Some sources, for example [the accounting/consulting firm Deloitte](#), have noted that 2021 was an unusual year economically, as the country was emerging from the COVID pandemic, federal stimulus dollars were flowing, and there was unusually large demand for durable goods and construction. It could be that the decline in CBE from 2021 to 2023 was just a “return to normal.”

In either case, Oregon’s GHG emissions remain far above goal values recommended by its Climate Action Commission in its [2024 report to the legislature](#). Consumption-based emissions for 2023 were 91 million MTCO2e, and relevant goal values are about 34 million by 2030, and 3 million by 2050. Sector-based emissions for 2023 were 58.5 million MTCO2e, while relevant goal values are about 31 million by 2030, and 3 million by 2050.

Meeting these goals will be challenging, so it makes sense to investigate a wide palette of policy approaches. One of the major benefits of doing consumption-based greenhouse gas accounting is that it widens the list of possible policy solutions. A number of them are illustrated and quantified in Oregon DEQ's 2024 report to the state legislature, [Opportunities to Reduce Greenhouse Gas Emissions Caused by Oregon's Consumption](#).