

# MEMORANDUM

TO: Climate Action Steering Committee  
 FROM: Michael Ambrogi, Senior Planner  
 Thurston Regional Planning Council  
 DATE: November 15, 2021  
 SUBJECT: Consumption-Based Greenhouse Gas Emissions Inventory

## Requested Action

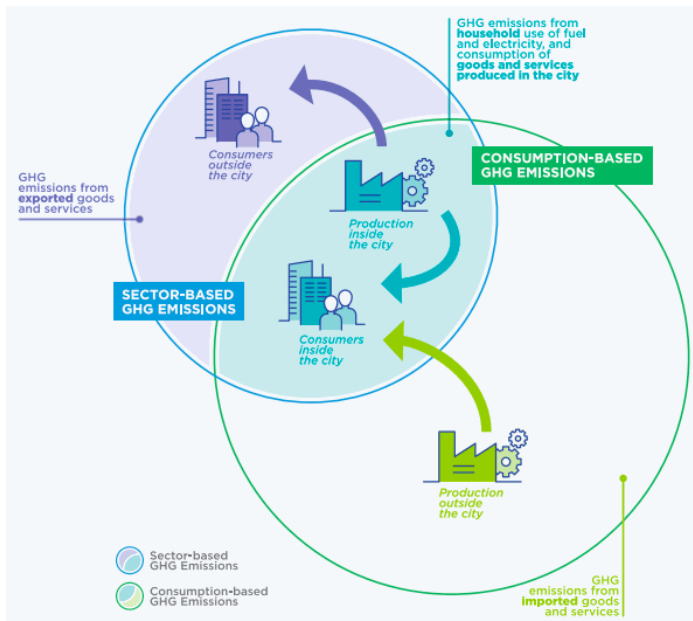
Discuss and provide direction on next steps for developing an inventory of consumption-based emissions.

## Background

Thurston County and the Cities of Lacey, Olympia, and Tumwater have agreed to common greenhouse emissions reduction targets:

- 45% below 2015 levels by 2030, and
- 85% below 2015 levels by 2050.

An accurate greenhouse gas emissions inventory is key to tracking progress towards meeting the region’s greenhouse gas emissions targets. There are two types of inventories: sector-based and consumption-based. Sector-based inventories — the most common type — include emissions generated by defined sectors (e.g., buildings and transportation within a geographic boundary. Consumption-based inventories include all emissions generated by residents of an area, regardless of where the greenhouse gases are actually emitted.



**Figure 1:** Comparison of Sector-based and Consumption-based Greenhouse Gas Emissions Inventories.

Adapted from C40 Knowledge Hub (<https://bit.ly/3okvaF8>)

The difference between the two types of inventories can be significant: the state of Oregon estimated that the emissions generated by consumption were about 40 percent greater than emissions generated within the state's borders. Regions that export goods and services may have consumption-based inventories that are less than their sector-based inventory. In Minnesota — a major exporter of agricultural products — emissions due to consumption are about 5 percent less than emissions generated within the state's borders.

The Thurston Climate Action Team (TCAT) has prepared a sector-based emissions inventory for Thurston County since 2010 using the ClearPath software available from ICLEI<sup>1</sup>. The draft Phase 4 work program includes funding for TRPC to continue to update the sector-based inventory. The funding would cover both staff time and licensing fees for the ClearPath software to ensure consistency with TCAT's inventories.

However, a detailed consumption-based emissions inventory has not been completed for the Thurston Region. The Thurston Climate Mitigation Plan recognizes this gap in the emissions inventory in Action G4.3:

*Methods and baseline data to track additional emissions sources and supplemental indicators identified as gaps in the Thurston Climate Mitigation Plan (i.e., consumption-side emissions, baseline sequestration information, equity indicators).*

This memo looks at some initial findings for including a consumption-based emissions inventory in Phase 4 of the Thurston Climate Mitigation Plan.

## Methods for Calculating Consumption-Based Emissions

### **Environmentally Extended Input-Output Models**

Consumption-based emissions estimates are typically completed using an environmentally extended input-output (EEIO) model. Input-output models are economic models that examine the relationships — and interdependencies — between economic sectors and regions. Environmentally extended input-output models expand on the basic model by including the emissions associated with those relationships, not just the amount of product or money exchanged.

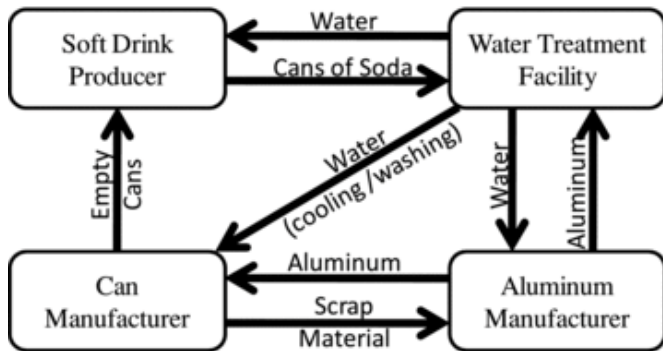
While EEIO models provide reasonable estimates of the greenhouse gases emitted to produce an item, the vast number of transactions in an economy means that they must rely on assumptions and averages. Consumption-based emissions inventories commissioned by state or local jurisdictions may refine national models to take into account regional differences, such as the source of electricity or proximity to resources.

Another challenge with EEIO models is their complexity. Staff from the Oregon Dept. of Environmental Quality estimated that their initial consumption-based emissions inventory cost \$90,000 in consultant costs plus staff time, with periodic updates requiring \$2,500 in data purchases plus 150-400 hours of staff time. Most inventories are developed by states or large cities. Smaller cities often derive their inventories from a state one. Because of the time

---

<sup>1</sup> TCAT's sector-based emissions inventory includes some limited emissions from consumption, notably electricity for buildings in Thurston County (most of which is generated outside County borders) and solid waste disposal (at the Roosevelt Regional Landfill in Klickitat County).

needed to develop an inventory and the lag in data availability, the data in inventories tends to be two to five years old by the time they are published.



**Figure 2:** Simplified example of the industries and transactions needed to produce a can of soda. An EEIO model looks at not just the goods exchanged but also the emissions associated with each unit produced.

Adapted from Hawkins and Matthews, 2009 (<https://bit.ly/3CZ0HAq>)

### Cool Climate

One consumption-based greenhouse gas emissions inventory that differed from the standard EEIO model was the Cool Climate tool developed by the University of California Berkeley. This resource provides zip code-level estimates of households’ emissions using national household surveys, economic models, and local data. It is not clear how often the data are updated.

**Table 1:** Estimate of Consumption-Based Greenhouse Gas Emissions in Thurston County Using Cool Climate

Row Labels	Households (TRPC, 2021 est.)	Tons CO2e/Yr per Household (Cool Climate)	Tons CO2e/Yr
98501	19,200	45.5	873,000
98502	14,500	45.1	654,000
98503	16,600	45.7	758,000
98506	8,300	45.3	376,000
98512	13,000	49.7	646,000
98513	13,500	54.0	729,000
98516	10,700	51.4	550,000
98530	200	56.5	11,000
98531	700	44.9	31,000
98576	2,100	53.3	112,000
98579	4,800	51.8	248,000
98589	3,000	52.8	158,000
98597	9,100	49.0	446,000
<b>Thurston County</b>	<b>115,900</b>	<b>48.3</b>	<b>5,594,000</b>

## ICLEI / ClearPath

ICLEI's ClearPath software provides a consistent methodology for member jurisdictions to develop sector-based emissions inventory. At this time, ICLEI does not have resources for developing consumption-based emissions inventories. However, ICLEI often provides new technical resources for its members so resources may be available in the future.

## Decision Options

TRPC identified three options for including a consumption-based greenhouse gas emission inventory in the TCMP monitoring program. One or more of these options could be implemented at the same time.

The Multijurisdictional Staff Team is recommending that the Thurston region use the nationally available Cool Climate emissions estimates, at least for the short term. A more detailed consumption-based emissions inventory could be developed in the future if assistance is available from the Dept. of Ecology, ICLEI, or other sources.

### **Option 1: Use the Cool Climate emissions estimates (Recommended)**

- Pros Low cost. Uses already-published data. Could be used as an interim option until more affordable options are available
- Cons National analysis that may not account for local consumption (e.g. vehicle efficiency, water use, source of building materials). Update frequency is unknown.

### **Option 2: Encourage the Dept. of Ecology or other state agency to develop a Washington consumption-based emissions inventory**

- Pros Funded at the state level. Could be tailored using locally available consumption data (state, county, or city). Methodology could be consistent with other state EEIO models.
- Cons Cost and time for state to develop inventory. Unknown if there is interest at the state level for such an inventory.

### **Option 3: Develop a Thurston County consumption-based emissions inventory (Not Recommended)**

- Pros Greatest ability to tailor the inventory using locally available consumption data (state, county, or city). Methodology could be consistent with other state EEIO models. Would have the greatest control over data, methodology, and update frequency.
- Cons Most expensive option. Would require contracting with consultant to develop econometric model. Would take time to develop.

## Examples of Consumption-Based Emissions Estimates

TRPC reviewed examples of consumption-based emissions inventories for cities and states. Below are a few examples.

- **Oregon Dept. of Environmental Quality** — Published in 2011 with updates released in 2013 and 2015. Developed by the Stockholm Environment Institute. One of the first subnational consumption-based inventories.  
<https://www.oregon.gov/deq/mm/pages/consumption-based-ghg.aspx>
- **Minnesota Pollution Control Agency** — Uses the methodology inventory developed by Stockholm Environment Institute for Oregon DEQ.  
<https://www.pca.state.mn.us/air/consumption-related-emissions>
- **City of Salem** — Published in 2020. Prepared by the Verdis Group.  
<https://www.cityofsalem.net/Pages/greenhouse-gas-inventory-report.aspx>
- **City of Eugene** — Developed by Oregon DEQ. Uses the methodology inventory developed by Stockholm Environment Institute for Oregon DEQ.  
<https://www.eugene-or.gov/4284/Climate-Action-Plan-20> (Appendix 6 of Climate Action Plan 2.0)
- **City of San Francisco** — Published in 2011. Developed by Stockholm Environment Institute.  
<https://sfenvironment.org/download/sf-consumption-based-emissions-inventory>
- **C40 Cities** — Developed by the University of Leeds, University of New South Wales, and Arup for the 79 member cities of C40. Published in 2018.  
<https://resourcecentre.c40.org/resources/consumption-based-ghg-emissions>
- **Cool Climate** — Zip code-level estimate of carbon footprint per household. Developed by the University of California Berkeley.  
<https://coolclimate.org/maps>