

# *Appendix 7*

## **METRO GREENHOUSE GAS INVENTORY**



# Regional greenhouse gas inventory

The carbon footprint of residents and businesses inside the Portland metropolitan region

The Portland metropolitan region is a national leader in arresting the rise in greenhouse gas emissions; however, our current efforts fall far short of what is needed to meet carbon reduction goals established in state law. Moreover, within 25 years, we can expect to be joined by one million new neighbors. Energy instability and climate change require us to rethink everything from where we live to where we get our food to how we get around.

To refocus the region's efforts to address climate change, Metro conducted a Regional Greenhouse Gas Inventory for the Portland metropolitan region. The inventory was intended to establish a snapshot of the region's greenhouse gas emission sources in order to make investment decisions that can have the greatest effect in reducing greenhouse gas (GHG) emissions.

The chart below summarizes the greenhouse gas emissions from residential and business activities throughout the Portland metropolitan area. Emissions stemming from activities within the Metro boundary are estimated at 31 million metric tons for 2006. As detailed in the following pages, these emissions are in some cases:

**Direct** – such as gasoline combustion;

**Indirect** – from beyond our borders in the region such as electricity imports; and,

**Remote** – associated with activities that end with final consumption here in the community, such as the production of many goods and much of our food.

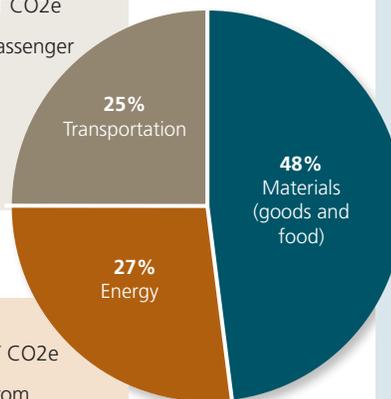
## Metro Area Greenhouse Gas Emissions

31 Million Metric Tons Carbon Dioxide Equivalent (MMT CO<sub>2</sub>e)

### Transportation

Estimated emissions: 7.8 MMT CO<sub>2</sub>e

- Vehicle miles traveled by passenger vehicles and light trucks
- Operation of public transportation system (TriMet)



### Materials (goods and food)

Emissions related to the production, manufacture and disposal of materials, goods and food  
Estimated emissions 14.9 MMT CO<sub>2</sub>e

- Manufacture of products and food (from inside and outside the region) consumed by metro residents and businesses
- Freight movement of materials, goods and food (heavy truck, rail, air)
- Waste management and recycling system (collection, landfills)

### Energy

Estimated emissions: 8.2 MMT CO<sub>2</sub>e

- Natural gas consumption from residents and businesses
- Fossil fuel consumption from utilities' imported electricity

For additional details, contact Mike Hoglund at Mike.Hoglund@oregonmetro.gov.

Good Company performed this analysis, in partnership with Metro staff.

## Methodology

The inventory estimates the greenhouse gas emissions of residents and businesses inside the Metro boundary, which includes nearly 1.5 million people in Multnomah, Washington and Clackamas counties.

Most analyses<sup>1</sup> of the Northwest and of cities in the region focus on direct emissions from the use of fossil fuels and therefore have focused on energy and transportation systems. However, recent Environmental Protection Agency (EPA) research<sup>2</sup> suggests that those emissions for which we are indirectly responsible— especially those resulting from the production of material goods – comprise a large share of our emissions and are ignored by conventional analyses. There are trade-offs in the approach used here. The calculations related to material flows (goods, food and waste) rely on national data with regional adjustments, rather than direct measurements. The Portland metropolitan region’s material consumption, however, is not so different from national averages and the methodology provides a sense of scale with a clear message: consumption matters as much as energy and transportation.

It is important to stress that these results are estimates. This analysis builds on recent work by EPA to assemble a new kind of emissions inventory, but it is an evolving process based on the current state of the data and clarity around what type of information is needed. The inventory uses regional data for the consumption of energy and transportation, and makes regional adjustments to national data related to the consumption of materials and food.<sup>3</sup>

1 “2008 Seattle Community Greenhouse Gas Inventory,” City of Seattle, [www.seattle.gov/climate/docs/2008-community-summary.pdf](http://www.seattle.gov/climate/docs/2008-community-summary.pdf) or “CO2 Emissions from Fossil Fuels by Sector,” Sightline Institute [www.sightline.org/maps/charts/Climate-EmBySector](http://www.sightline.org/maps/charts/Climate-EmBySector).

2 “Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices,” EPA (2009), [www.epa.gov/oswer/docs/ghg\\_land\\_and\\_materials\\_management.pdf](http://www.epa.gov/oswer/docs/ghg_land_and_materials_management.pdf).

3 *This analysis is focused on final consumption that happens in residential and commercial contexts. Industrial emissions resulting from the manufacture of goods for export to and consumption by other communities do not appear in these numbers, as that inclusion would have produced confusing double-counting. However, there is room for future analysis to provide a complementary set of accounts to look at the carbon footprint of employment and production in the Metro region.*

## Metro's role in managing the region's greenhouse gas emissions

As a regional government with responsibility for land use and transportation planning, as well as waste reduction and disposal, there are many ways in which Metro can provide leadership in reducing greenhouse gas emissions. Metro has three distinct, but overlapping, roles related to GHG management:

**Legislative obligations** Under legislation passed in 2009 (House Bill 2001)<sup>4</sup>, Metro, as the Metropolitan Planning Organization (MPO) for the Portland metropolitan area, must plan for reductions in transportation-related carbon emissions. The State of Oregon will provide Metro with greenhouse gas reduction targets in 2011.

**Planning authority** Metro has a central role in planning and/or operating the systems of waste management, transportation and land use for the region. Many stakeholders and elected officials in the Metro region increasingly seek to incorporate GHG concerns into decision making.

**Education and data provision** Metro plans to include insights from this analysis to inform its on-going collaborations with other regional partners in resource efficiency, economic development, planning for livability and climate action.

Metro provides planning, policy making, and services to preserve and enhance the region's quality of life. Our regional vision for Making the Greatest Place, based on values established by residents in the 2040 Growth Concept, includes:

**VIBRANT COMMUNITIES** People live and work in vibrant communities where they can choose to walk for pleasure and to meet their everyday needs.

**ECONOMIC PROSPERITY** Current and future residents benefit from the region's sustained economic competitiveness and prosperity.

### **SAFE AND RELIABLE TRANSPORTATION**

People have safe and reliable transportation choices that enhance their quality of life.

### **ENVIRONMENTAL LEADERSHIP**

The region is a leader in minimizing contributions to global warming.

**CLEAN AIR AND WATER** Current and future generations enjoy clean air, clean water and healthy ecosystems.

### **EQUITY**

The benefits and burdens of growth and change are distributed equitably.

<sup>4</sup> Oregon House Bill 2001, also known as the Oregon Jobs and Transportation Act, is the transportation funding plan adopted by the 2009 Legislature. [www.leg.state.or.us/09reg/measures/bb2000.dir/bb2001.en.html](http://www.leg.state.or.us/09reg/measures/bb2000.dir/bb2001.en.html)

## SOURCE-BY-SOURCE SUMMARY OF GREENHOUSE GAS EMISSIONS

### Energy (natural gas and electricity)

*Energy used in buildings is the source of 27 percent of the region's greenhouse gas emissions.*

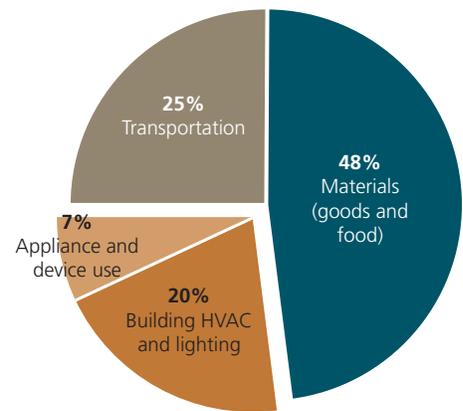
Lighting, heating and cooling buildings and the operation of appliances by residences, commercial establishments, and industrial buildings account for 8.2 million metric tons of carbon dioxide equivalent.

For many long-time residents of the Northwest, it may come as a surprise that electricity consumption is responsible for so much of the carbon footprint, considering a large portion of our energy is derived from hydropower. Yet as the region's economy and population have grown, the hydroelectric system has not been able to completely serve the region's needs – and coal and gas have, for the most part, filled the gap. Renewable energy sources are still a small share of total greenhouse gas emissions (2.1 percent), though growing rapidly.<sup>5</sup>

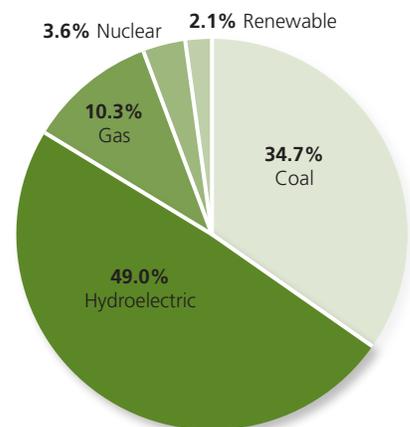
The electric utilities serving the Portland metro area, Portland General Electric (PGE) and Pacific Power, have made investments in renewable energy and energy efficiency. The pie chart below shows the mix of energy for the Northwest Power Pool. A state-mandated Renewable Portfolio Standard (RPS) will require the largest utilities in Oregon to provide 25 percent of their retail sales of electricity from renewable sources of energy in 2025.<sup>6</sup> Implementation of the standards will result in commensurate reductions in GHG emissions from Northwest power supplies.

Currently, the energy use documented in this section happens almost entirely in buildings, but the distinction between building energy and transportation energy is likely to blur somewhat with the introduction of electric vehicles.

Metropolitan area greenhouse gas emissions with energy split



Regional sources of electricity Northwest Power Pool (NWPP)



<sup>5</sup> The discussion of the regional electric grid draws on the most recent eGRID data from EPA, which reflects the electric power industry's structure as of December 31, 2007. <http://cfpub.epa.gov/legridweb/>

<sup>6</sup> A Renewable Portfolio Standard for Oregon [www.oregon.gov/ENERGY/RENEW/RPS\\_home.shtml](http://www.oregon.gov/ENERGY/RENEW/RPS_home.shtml)

## Transportation

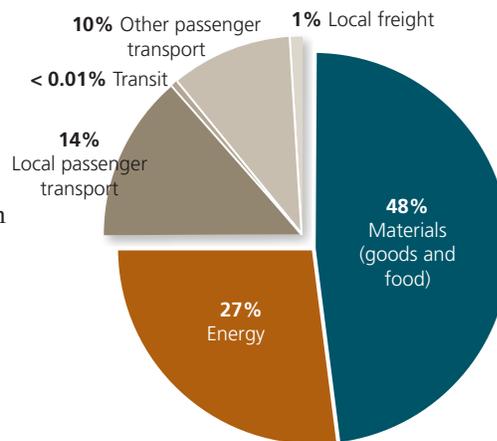
Transportation is responsible for about 25 percent of the region's greenhouse gas emissions. These emissions come mainly from on-road commercial and individual vehicles and air travel, with small shares from rail, marine and transit sources.

One impetus for this analysis is the state mandated goal for emissions reductions from light-duty vehicles<sup>7</sup> by 2035 (to be determined by the Oregon Department of Transportation and the Oregon Department of Land Conservation and Development in 2011). The segment labeled "Local passenger transport" (14 percent of total regional emissions) is the share of Metro-area emissions that will be addressed by this goal.

Commuter trains and buses account for less than 0.1 percent. The 10 percent share labeled "Other passenger transport" consists of long-distance ground transportation (e.g. rail) and air travel.<sup>8</sup>

While local freight is accounted for in this transportation analysis, it is important to note that some of the transportation on which we rely is long-distance transportation of goods from far beyond the region's borders. The emissions from freight movement of these goods are calculated in emissions associated with material consumption and not within the transportation section of emissions.

Metropolitan area greenhouse gas emissions with transportation split



<sup>7</sup> The legislation specifies that the emissions goal applies to vehicles weighing up to 10,000 pounds.

<sup>8</sup> This analysis uses national per capita averages from the EPA report previously cited, in the absence of local data or explicit guidance from any widely accepted protocol or methodology.

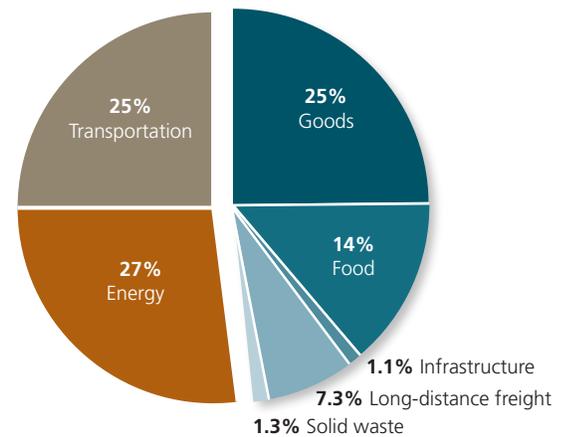
## Materials, goods and food (production, movement and disposal)

Nearly 48 percent of community greenhouse gas emissions are estimated to come from the resource extraction, manufacture and distribution of materials, goods, and food for final use and consumption by residents and business operators. A small component of these emissions is also associated with the landfill disposal of food and products. These life-cycle stages of manufacturing and distribution, which are generally invisible to consumers, are a large and important part of our carbon footprint and are excluded from most GHG inventories.

“Goods” (25 percent) and “food” (14 percent) include the life cycle greenhouse gas emissions of items such as clothing, furniture, cars, food and beverages. It also includes packaging of products and single-use items that are quickly relegated to the waste stream.

The movement of goods and food (7 percent) from distant United States production sites to the Portland metropolitan area are quantified as long-distance freight. This long-distance movement of materials often looms large in our perception, but depending on the item, may in fact be a smaller slice of the item’s overall carbon footprint. For example, freight-related emissions contribute only one-eighth of the total emissions related to the provision of food. Most food-related emissions result from the growing of food (especially feed for animals) and, to a lesser extent, food processing.

Metropolitan area greenhouse gas emissions with materials split



Traditional greenhouse gas emissions analyses exclude the emissions associated with the production and transport of materials, goods and food. When these “upstream” emissions related to material consumption are included (cargo ships, planes, and trucks), the total emissions assigned to our region increase significantly.

The relatively small solid waste slice represents the emissions associated with the “end-of-life” disposal of goods and foods. While this emissions source is a small share of total emissions, several things should be noted. First, the success of regional waste reduction programs in keeping this slice small should not be underestimated. Reuse and recycling that diverts materials from disposal and back into use has significant net carbon reduction impacts compared with use of virgin materials – even when transportation impacts of material collection and hauling are counted. Second, the management of the more “upstream” portion of material flows offers many potential GHG-reducing opportunities, such as promoting new green purchasing strategies for businesses and consumers, reducing energy use, and supporting the internalization of the lifecycle carbon costs of goods into their price. While Metro’s role in materials management has traditionally focused on recycling and disposal, the relationships Metro has developed with households and businesses throughout the region may present collaborative opportunities to lower the region’s greenhouse gas emissions from material use.

The infrastructure section of the chart represents the emissions associated with the construction and maintenance of highways, streets, bridges, tunnels, sewers and pipelines. Most of this slice is in the manufacture, distribution and installation of materials into the built environment.

The aggregate estimate for the Materials, Goods and Food section does not include international trade due to lack of consistent international production data. However, estimates of our “imported carbon footprint” suggest that the materials emissions could in fact be significantly larger, increasing our national carbon footprint by as much as 20 percent.<sup>9</sup>

<sup>9</sup> See “Embodied Environmental Emissions in U.S. International Trade, 1997–2004,” Christopher L. Weber and H. Scott Matthews (2007).

## SUMMARY OF CALCULATION ASSUMPTIONS AND METHODS

A summary of the data sources, assumptions and methods is highlighted below. The technical analysis should be referenced for additional information.

### Energy

Assumptions for natural gas emissions:

- Per capita figures within the Metro jurisdiction were extrapolated from the greenhouse gas inventory in the City of Portland/Multnomah County Climate Action Plan.

Assumptions for electricity emissions:

- Per capita figures within the Metro jurisdiction were extrapolated from the greenhouse gas inventory in the City of Portland/Multnomah County Climate Action Plan.

Other details:

- The regional split between HVAC/lighting and appliances/devices was assumed to be the same as the national split.
- Industrial energy use is only the energy used for the operation of industrial buildings, not for the local manufacture of goods and services. The split of industrial energy (separating building operation from product manufacture) comes from the EPA (2009).

### Transportation

Method for local passenger transportation:

- Emissions were estimated using EPA's MOBILE6 model, with inputs from Metro's regional travel forecast model.

Assumptions for freight:

- A fixed share (15 percent) of freight emissions associated with goods and food was assigned to transportation inside the Metro boundary.

Assumptions for transit:

- Emissions were calculated from TriMet data on electricity consumption for the operation of light rail, and diesel and biodiesel for the operation of buses.

Assumptions for long distance/other:

- Per capita assumptions from EPA's analysis were adjusted by the ratio of local per capita income to national per capita income.

### Materials, Goods and Food (Production, Movement and Disposal)

Per-capita emissions from material goods and food for the United States were attributed to the Metro region, with a few adjustments.

Assumptions

- A certain share (20 percent) of goods and food production was assigned to the region. Emissions from electricity for that share were adjusted by the region's lower carbon intensity (for the electricity component of production).
- Median household income for the Portland metropolitan area is greater than the national average. It is assumed that this difference results in more purchased goods by residents.
- The estimates do not account for international trade due to lack of information on foreign production and supply chains, which would, according to several studies, raise the greenhouse gas emissions related to material consumption.

## Metro

*People places. Open spaces.*

Clean air and clean water do not stop at city limits or county lines. Neither does the need for jobs, a thriving economy and good transportation choices for people and businesses in our region. Voters have asked Metro to help with the challenges that cross those lines and affect the 25 cities and three counties in the Portland metropolitan area.

A regional approach simply makes sense when it comes to protecting open space, caring for parks, planning for the best use of land, managing garbage disposal and increasing recycling. Metro oversees world-class facilities such as the Oregon Zoo, which contributes to conservation and education, and the Oregon Convention Center, which benefits the region's economy.

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