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MAKING A GREAT PLACE

Metro

Greenhouse Gas Emissions Inventory Fiscal Year 2012-2013

For Metro internal and business operations

December 2013

About Metro

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

A regional approach simply makes sense when it comes to providing services, operating venues and making decisions about how the region grows. Metro works with communities to support a resilient economy, keep nature close by and respond to a changing climate. Together we're making a great place, now and for generations to come.

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For more information on Metro's Climate Smart Communities scenarios project, visit:
http://www.oregonmetro.gov/index.cfm/go/by.web/id=36945

GLOSSARY

Anthropogenic: Made or generated by a human or caused by human activity. The term is used in the context of global climate change to refer to gaseous emissions that are the result of human activities, as well as other potentially climate-altering activities, such as deforestation.

Biogenic: Made or generated by natural processes. The term is used in the context of global climate change to refer to carbon dioxide generated during combustion or decomposition of biologically-based material, such as forest or agricultural products. For landfills where organic materials are decomposing, methane generated from an anaerobic environment is considered an "anthropogenic" or human-caused emissions source while methane that is flared and therefore transformed back into carbon dioxide is considered biogenic because this CO_2 would be released under any circumstance as this material decomposes as part of the natural carbon cycle.

Carbon Dioxide Equivalent (CO_2e): The common unit used to measure the six greenhouse gases regulated under the Kyoto Protocol. Since each gas contributes a different level of atmospheric warming, CO_2e is calculated by multiplying each gas by its global warming potential.

Climate Change[1]: A change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

Emissions Factor: A representative value that relates the quantity of a pollutant released into the atmosphere with an activity associated with the release of that pollutant. Emissions factors are usually expressed as the weight of pollutant divided by a unit weight, volume, distance, or duration of the activity emitting the pollutant (e.g., pounds CO_2 emitted per gallon of fuel burned).

Greenhouse Gas (GHG): A gas that absorbs radiation at specific wavelengths within the spectrum of radiation (infrared radiation) emitted by the Earth's surface and by clouds. The gas in turn emits infrared radiation from a level where the temperature is colder than the surface. The net effect is a local trapping of part of the absorbed energy and a tendency to warm the planetary surface. Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), Hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) are the six Kyoto greenhouse gases covered by the United Nations Framework Convention on Climate Change (UNFCCC).

Global Warming Potential (GWP): Global Warming Potential factors represent the heat-trapping ability of each greenhouse gas relative to that of carbon dioxide.

Intergovernmental Panel on Climate Change (IPCC): The IPCC is a scientific intergovernmental body set up by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP). The IPCC is open to all member countries of WMO and UNEP and was established to provide decision-makers and others interested in climate change with an objective source of information about climate change.

Scopes 1, 2 and 3: The World Resource Institute and World Business Council on Sustainable Development developed a classification system for different types of GHG emissions for GHG accounting purposes. Scope 1 emissions come directly from owned equipment and buildings. Scopes 2 and 3 are indirect emissions from sources shared by the reporting institution with other entities. This concept is discussed more thoroughly in the section on Boundaries below.

[1] Definition provided by United Nations Framework Convention on Climate Change (UNFCCC).

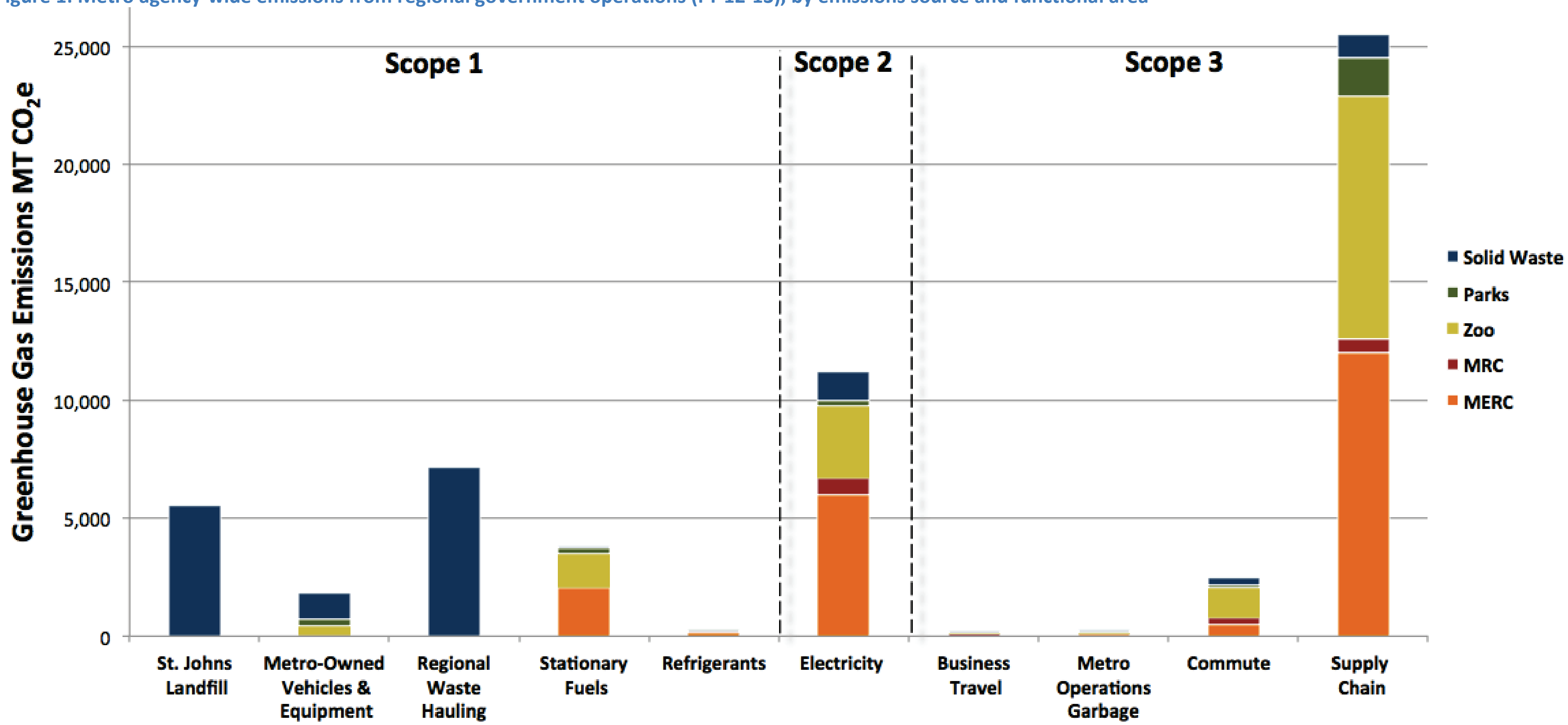
EXECUTIVE SUMMARY

Metro has made a commitment to address the sustainability of its internal operations and has identified climate change as a critical component of this effort. In 2010, Metro conducted a baseline greenhouse gas (GHG) inventory based on calendar year 2008 (CY 2008) data[2]. Using these results, Metro adopted a goal to reduce direct and indirect operational GHG emissions 80% below 2008 levels by 2050. This report, showing data from fiscal year 2012-2013 (FY 12-13), provides an update to the baseline. GHG emissions are reported in metric tons of carbon dioxide equivalent (MT CO_2e).

FY 12-13 Analysis Results: Overview

In FY 12-13 Metro operations generated a total of 58,173 MT CO_2e from both direct and indirect sources (see Figure 1). These emissions come from five functional areas: Metropolitan Exposition Recreation Commission facilities (Oregon Convention Center, Portland'5 Centers for the Arts, and the Portland Expo Center), the Oregon Zoo, Solid Waste facilities (South and Central transfer stations, hazardous waste facilities, St. Johns Landfill, Metro's paint facility, and community waste transportation to landfills), Regional Parks, and the Metro Regional Center (MRC).

Figure 1: Metro agency-wide emissions from regional government operations (FY 12-13), by emissions source and functional area



[2] GHG Emissions Baseline Inventory, for Metro internal and business operations, 2008: http://library.oregonmetro.gov/files//metro_internal_ghg_inventory_8-10.pdf

Comparison of Results: CY 2008 vs. FY 12-13

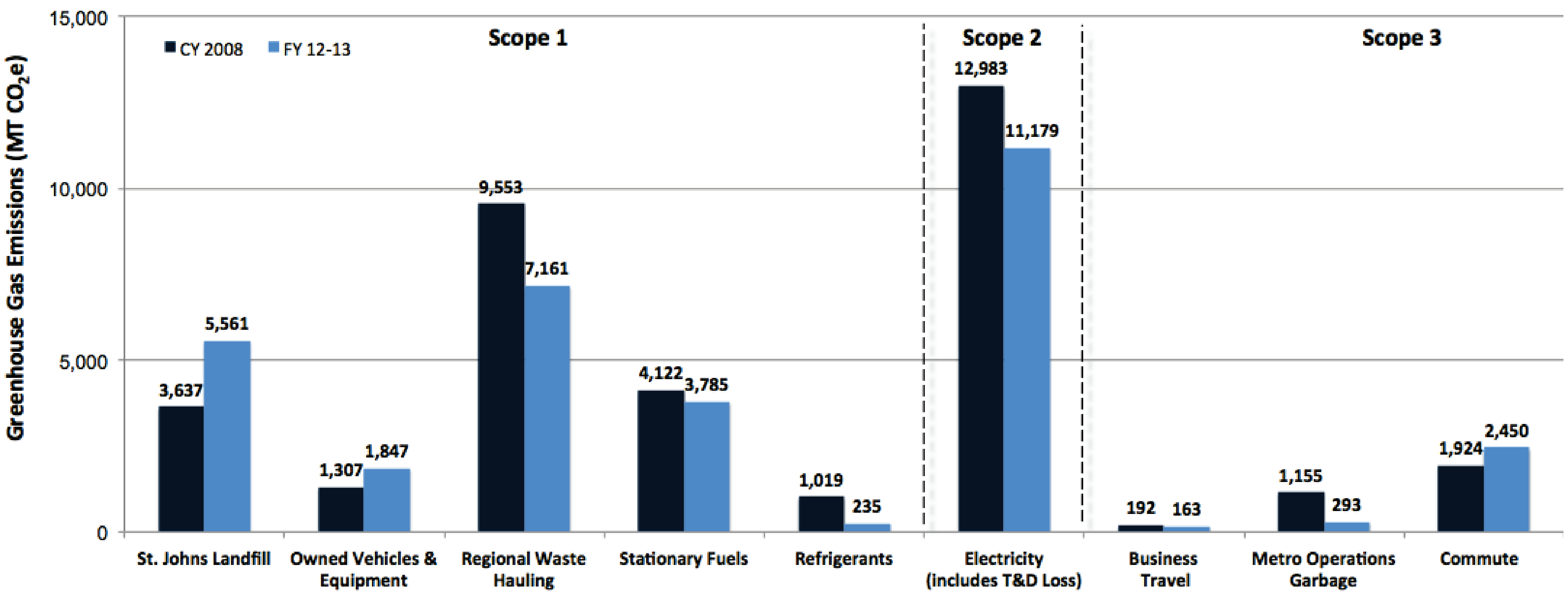
Overall, non-supply chain emissions decreased nearly 9% from 35,892 MT CO_2e in CY 2008 to 32,673 MT CO_2e in FY 12-13. While this is a significant reduction, it is not quite on pace to meet Metro's ambitious goal of an 80% reduction of non-supply chain emissions over CY 2008 levels by 2050. Emissions sources that increased since CY 2008 include:

- Owned vehicles and equipment: the increase shown here is likely due to incomplete data in CY 2008, rather than a significant increase in fuel consumption in FY 12-13.
- St. Johns Landfill: Ash Grove Cement no longer purchases Metro's landfill gas, causing more emissions to be attributed to Metro's operations.
- Commute: Survey data show that commute distances are increasing. Despite this, trips by solo drivers at many facilities are decreasing.

Emissions sources that decreased since the baseline include:

- Regional waste hauling: A decrease in community-generated solid waste due primarily to the economic downturn led to this 25% reduction in emissions from transportation of that waste to landfills.
- Electricity and stationary fuels: Electricity decreased by 15% and stationary fuels (primarily natural gas) by 8% due to energy efficiency projects.
- Refrigerants: New equipment replacements have led to fewer leaks.
- Business travel: Reductions are due to reduced air travel.
- Metro operations garbage: Recycling and compost programs have led to higher diversion rates. Since 2008, Columbia Ridge Landfill, where Metro waste is disposed, has begun using its landfill gas to generate electricity resulting in a lower emissions factor.

Figure 2: Emissions comparison between CY 2008 and FY 12-13, by emissions source and scope



Note: The methodology used in estimating Metro's supply chain emissions is based on average emissions factors for various sectors of the US economy. Therefore it is not sophisticated enough to track emissions reductions where Metro has already begun to implement sustainable purchasing policies. For this reason, Metro's formal emissions reduction goals are calculated using all emissions results except supply chain. Finally, because of accounting systems changes, apples-to-apples year-over-year supply chain emissions comparisons are not possible. For these reasons, supply chain emissions are not shown in Figure 2.

INTRODUCTION

Metro has made a commitment to systematically address the sustainability of all Metro internal government operations and practices, and has identified climate change as a critical component of this effort. Metro's Sustainability Plan for Internal Operations identifies environmental impacts of Metro's operations, sets a baseline from which to measure progress over time and creates a framework of specific strategies and actions to complete in order to meet the goals set by Metro Council in the areas of climate change, waste, toxics, water and habitat. This plan was adopted by Metro Council in 2010[3]. See a summary in Table 1 below.

Metro Greenhouse Gas Emission Reduction Goal
(for internal operations)

Reduce direct and indirect greenhouse gas emissions (CO_2e) from Metro operations 80% below 2008 levels by 2050.

Table 1: Metro's GHG emissions reduction goals summary

Indicators and interim targets for tracking Metro's GHG emissions reduction goal		
	SCOPES 1, 2 and 3 EMISSIONS (excluding Supply Chain) **Reduction targets (quantitative)**	SCOPE 3 SUPPLY CHAIN EMISSIONS **Process targets (qualitative)**
3 Years (2013)	Arrest GHG emissions	Develop a process to quantify supply chain emissions reductions and establish quantitative targets.
5 Years (2015)	15% reduction	Advance efforts to reduce supply chain emissions based on current best practices and available tools and data.
10 Years (2020)	25% reduction	
15 Years (2025)	40% reduction	
40 Years (2050)	80% reduction	

In 2010, Metro conducted a baseline greenhouse gas (GHG) inventory based on 2008 data.[4] Based on the results of the baseline inventory, Metro adopted a sustainability goal to reduce direct and indirect GHG emissions from internal operations 80% below 2008 levels by 2050. GHG emissions are reported in metric tons of carbon-dioxide equivalent (MT CO_2e). This report, showing data from fiscal year 2012-2013 (FY 12-13), provides an update to the baseline inventory to demonstrate how Metro is progressing towards this goal.

In addition, Metro also made a public proclamation in 2009 in support of the Global Day of Climate Action and the efforts to stabilize atmospheric carbon levels at 350 ppm.[5]

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[3] Metro Council resolution No. 10-4198, "For the Purpose of Adopting Metro's Sustainability Plan and Authorizing the Metro Chief Operating Officer to Implement the Plan."

[4] GHG Emissions Baseline Inventory, 2008, for Metro internal and business operations, August 2010. http://library.oregonmetro.gov/files//metro_internal_ghg_inventory_8-10.pdf

[5] Metro Council resolution No. 09-4080, "For the Purpose of Proclaiming October 24, 2009 as a Global Day of Climate Action and recognizing the number 350 as a message to the Copenhagen Conference on climate change," 2009.

Policy Context

The Intergovernmental Panel on Climate Change (IPCC), the United Nations body that regularly convenes climate scientists, has identified human activity as the primary cause of the climate change that has occurred over the past few decades and quickened in recent years. Consensus statements from the IPCC including the Fifth Assessment Report (AR5)[6] released in September 2013 indicate that human-caused emissions are responsible for the warming that is already happening (95-100% confidence level) and must be reduced significantly – by more than 50% globally, and by 80% in wealthier nations that are the largest emitters – by mid century in order to avoid the worst potential climate impacts on human economies. Action towards emissions reductions is taking place at the international, national, regional, state, and local levels as shown in the table below.

Table 2: Overview of policy activity related to GHG emissions management

SCALE	RECENT ACTIVITY
International	The world's leaders have been meeting annually to determine what steps can be taken to address climate change on a global level. The climate talks in Doha, Qatar in December 2012 added a second period to the Kyoto Protocol (formerly expected to expire in 2012), which will run from 2013 to 2020. Since the Kyoto Protocol signatories only cover about 14% of global GHG emissions, the second outcome from Doha was a commitment to develop an international "legally binding" agreement to reduce GHG emissions by *all* nations (including those like the United States that have not ratified the Kyoto Protocol) by 2015, which is expected to come into effect by 2020. This will be the focus of future international climate talks.
Federal	In the absence of climate change legislation from US Congress, the Supreme Court granted EPA the authority to manage GHG emissions under the Clean Air Act in 2007. EPA has issued mandatory GHG reporting guidelines for large emitters and has focused on setting emissions limits for power plants and oil refineries. Other energy and economic stimulus legislation passed by the federal government supports renewable energy development and other climate-related initiatives.
Regional	The Regional Greenhouse Gas Initiative (RGGI), begun in 2008, enacted the first mandatory cap-and-trade program in the US and has focused on CO_2 emissions from power plants. It is expected to reduce emissions by 10% (over 2009 levels) by 2018. In 2011, six states (Oregon, Washington, Arizona, New Mexico, Utah and Montana) left the Western Climate Initiative and joined North America 2050, an organization working towards achieving meaningful emissions reductions. California, and the Canadian provinces of British Columbia, Manitoba, Ontario and Quebec remain members of the Western Climate Initiative and are looking for ways to coordinate GHG policies.
State	In Oregon, recent legislation includes climate and energy bills targeting fuels, solar power opportunities, and GHG emissions from land use and transportation. Dozens of states are taking similar actions. Metro has been a key player in scenario planning to assist the state in meeting its GHG reduction goals under SB 1059 and HB 2001. California has enacted the most ambitious climate legislation of any US state with AB-32, the California Global Warming Solutions Act, which requires the state to reduce GHG emissions 30% below 1990 levels by 2020 and 80% by 2050 via a cap-and-trade system. Regulated entities include large industrial emitters and the electricity-generating sector, and will eventually cover fuel distributors.
Local	At the local level, over 1,000 cities from all 50 states have signed the US Conference of Mayors Climate Protection Agreement, including 16 in Oregon. A comprehensive GHG inventory is the first step toward fulfilling a signatory's commitments. While most communities are still at an early stage, we hope Metro's work here will provide a good example to other communities in Oregon.

[6] International Panel on Climate Change, Fifth Assessment Report, Summary for Policy Makers, September 2013: http://www.climatechange2013.org/images/uploads/WGIAR5-SPM_Approved27Sep2013.pdf

Mandatory Reporting in Oregon

Oregon Department of Environmental Quality (DEQ) requires GHG reporting for a wide range of entities. Entities that hold a Title V air pollution permit or an Air Contamination Discharge Permit (ACDP), or have at least one discrete emissions source that meets or exceeds the emissions threshold of 2,500 MT CO_2e are required to report emissions information annually.[7]

Metro holds a Title V air pollution permit for St. Johns Landfill and is subject to DEQ mandatory reporting. Therefore, the emissions associated with the methane management practices at St Johns Landfill reported in this inventory follow state DEQ reporting requirements, although, as DEQ requires reporting on a calendar basis and this report displays results on a fiscal year basis, some adjustments to the calculations have been made.

Mandatory Reporting at the Federal Level

US Environmental Protection Agency (EPA) has also issued mandatory reporting guidelines, finalized in September 2009, with a reporting threshold of 25,000 MT CO_2e per year from a discrete source (e.g. a smokestack or boiler).[8] Metro does not have reporting responsibilities under this set of guidelines and is unlikely to meet this threshold in the future.

[7] For more information on Oregon's rules, visit DEQ's GHG reporting page www.deq.state.or.us/aq/climate/reporting.htm.

[8] For more information on Federal rules, visit EPA's GHG rulemaking page http://www.epa.gov/climatechange/emissions/ghgrulemaking.html

BOUNDARIES

Metro sought to include the widest possible boundaries (emissions sources and facilities) in this inventory, while following standard GHG inventory protocols and providing consistency with the baseline inventory. GHG inventory protocols define emissions as either direct (owned) or indirect (shared). This inventory captures nearly all the significant direct and indirect emissions associated with Metro's operations. Emissions source and facility exclusions are noted in Table 3.

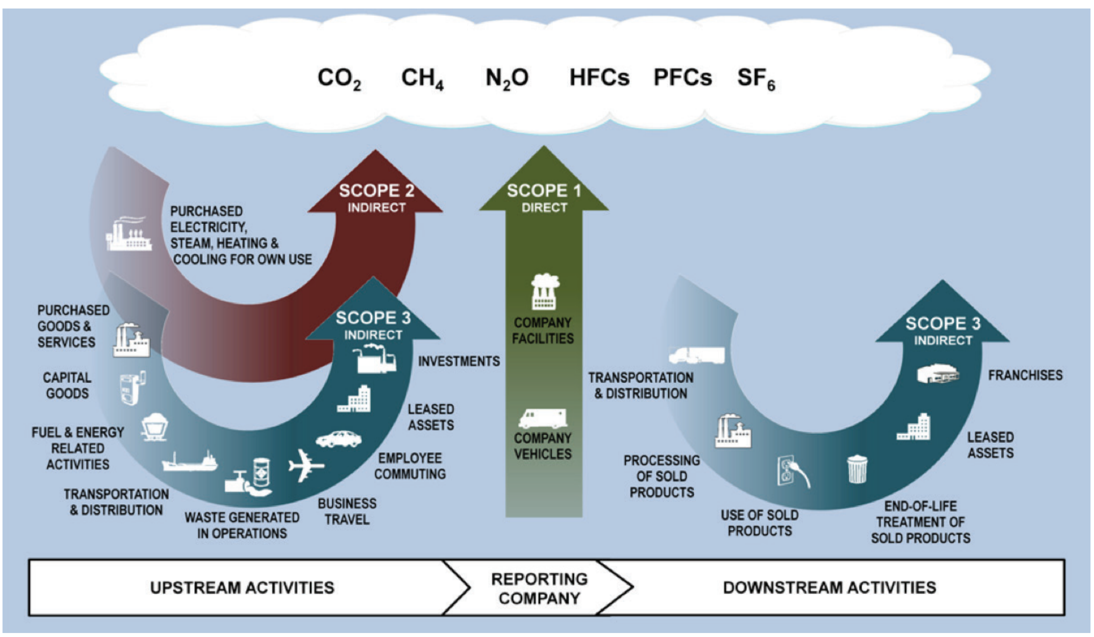
To distinguish direct from indirect emissions sources, three "Scopes" are defined for traditional GHG accounting and reporting.[9] Figure 2 illustrates the three emissions Scopes.

Scope 1: All direct GHG emissions from equipment and facilities owned and/or operated by Metro.

Scope 2: Indirect GHG emissions from purchased electricity.

Scope 3: All other indirect emissions sources that result from Metro activities but occur from sources owned or controlled by another company or entity, including: business travel, embodied emissions in material goods purchased and services contracted by Metro, emissions from landfilled solid waste, and emissions associated with Metro employee commute patterns.

Figure 2: Greenhouse gases and accounting and reporting Scopes[10]



In an effort to organize Metro's diverse operations portfolio, all facilities are grouped by type and referred to as functional areas. Table 3 includes the description of the five functional areas and the types of facilities included within each. Table 4 describes the emissions sources included in the inventory.

[9] Source: WRI/WBSCD Greenhouse Gas Protocol, Corporate Accounting and Reporting Standard (Revised Edition), Chapter 4.
[10] Source: WRI/WBSCD Greenhouse Gas Protocol, Corporate Value Chain (Scope 3) Accounting and Reporting Standard

Table 3: GHG Inventory Facility Boundaries

METRO FUNCTIONAL AREA	FACILITIES INCLUDED IN THE INVENTORY	FACILITIES EXCLUDED FROM INVENTORY
Solid Waste	Metro South Transfer Station Metro South Hazardous Waste Facility Metro Central Transfer Station Metro Central Hazardous Waste Facility MetroPaint St. Johns Landfill	Killingsworth Fast Disposal Landfill (KFD)
Metropolitan Exposition Recreation Commission (MERC) Visitor Venues	Oregon Convention Center Portland Expo Center Portland'5[11] Keller Auditorium Portland'5 Arlene Schnitzer Hall Portland'5 Antoinette Hatfield Hall/Admin	
Oregon Zoo	64-acre zoo and all exhibits	
Metro Regional Center (MRC)	Office building	
Regional Parks	Blue Lake Park Borland Field Station Chinook Landing & Gleason Boat Launch Cooper Mountain Nature Park Glendoveer Golf Course Oxbow Park Smith and Bybee Lakes	Beggars Tick Wildlife Refuge Cemeteries Mount Talbert Nature Park Metro Natural Areas Properties Rental Properties

[11] Portland'5 refers to Portland'5 Centers for the Arts, formerly Portland Center for the Performing Arts.

Table 4: Description of Metro's operational GHG emissions sources

EMISSIONS SCOPE	EMISSIONS SOURCE	EMISSIONS SOURCE DESCRIPTION
Scope 1 (Direct Emissions)	**St. Johns Landfill**	St. Johns Landfill is a 238-acre closed landfill, located on the North Portland Peninsula near the confluence of the Columbia and Willamette rivers, which generates landfill gas (LFG) from the decaying solid waste. Ash Grove Cement did not purchase any LFG in FY 12-13. Therefore all LFG was captured and flared. Fugitive methane releases are calculated and included in this inventory as well as trace methane and nitrous oxide emissions from the flaring process. CO_2 emissions from the flaring process are considered biogenic and are reported separately. As a Title V air pollution permit holder, Metro must meet DEQ reporting requirements related to the methane management practices at this landfill.
	Owned Vehicles & Mobile Equipment	Metro owns 148 on-road vehicles and 304 pieces of off-road equipment that consume gasoline and diesel fuels. It was assumed all fuel meets the state guidelines for biofuel blends (E10 for gasoline and B5 for on-road diesel) except for select vehicles at MRC and Borland Field Station that use an E85 ethanol-gasoline blend. Transportation impacts from visitors to Metro-operated facilities and upstream emissions from the extraction and transportation of fuels to the point of purchase are outside the boundary of this inventory.
	Regional Waste Hauling	Metro operates a contract with Walsh Trucking Co to transfer community-generated solid waste from Metro's transfer stations to various landfills (primarily Columbia Ridge Landfill in Arlington, OR). This emissions source is included under Scope 1 because Metro purchases the fuel for these contracted vehicles directly and because the vehicle fleet was designed to Metro specifications.
	Stationary Fuels	Metro consumes natural gas for space and water heating, and propane in equipment used by the Solid Waste and Parks functional areas. Additionally, Metro consumes a small quantity of diesel fuel in back-up electricity generators at many facilities; however, in most cases this data cannot be separated from diesel used in mobile fuels and is included in the owned vehicle results.
	Refrigerants	Refrigerants are used in HVAC and commercial food refrigeration systems at all of Metro facilities. Metro facilities do not yet have a system for tracking refrigerant recharge agency-wide. Where possible actual data on refrigerant purchases was collected. In other cases, such as at Metro Regional Center, Metro Central and South transfer stations and household hazardous waste facilities, the latex paint facility and St. Johns Landfill, data was unavailable and an estimation methodology was used. See Appendix A for details. Metro uses the following refrigerants that contribute to global warming and deplete the ozone: HCFC-22 (R-22) and CFC-11. These two chemicals are on the phase-out list through the Montreal Protocol and Clean Air Act Regulations. The other refrigerants used at Metro include: R-401A; R-404A; R-410A; R-414 (A and B); and R-417C.
Scope 2 (Indirect Emissions)	**Electricity**	Metro calculated the electricity consumption from all facilities included in the inventory boundary. Transmission and distribution line losses (T&D losses) due to friction, as electricity travels along power lines are included in this emissions source.
Scope 3 (Indirect Emissions)	**Business Travel**	Business travel includes employees' use of airlines, rental cars, and personal vehicles for travel associated with training, conferences, and meetings. Data for business travel by light rail or bus was unavailable and therefore excluded from this inventory.
	Metro Operations Garbage	This category includes landfilled solid waste from Metro operations. Data gaps are noted in each functional area discussion. Waste volumes do not include recycling or compost from Metro operations. Community-generated solid waste from Metro residences and businesses that is processed at Metro-run transfer stations is also not included.
	Commute	In FY 12-13 Metro employed 1,658 full-time employees (straight headcount). Commute survey information provided data on the percentage of trips by mode and average one-way trip mileage.
	Supply Chain	This category provides an estimate of the embodied GHG emissions in the manufacture of goods and services purchased by Metro (including water).

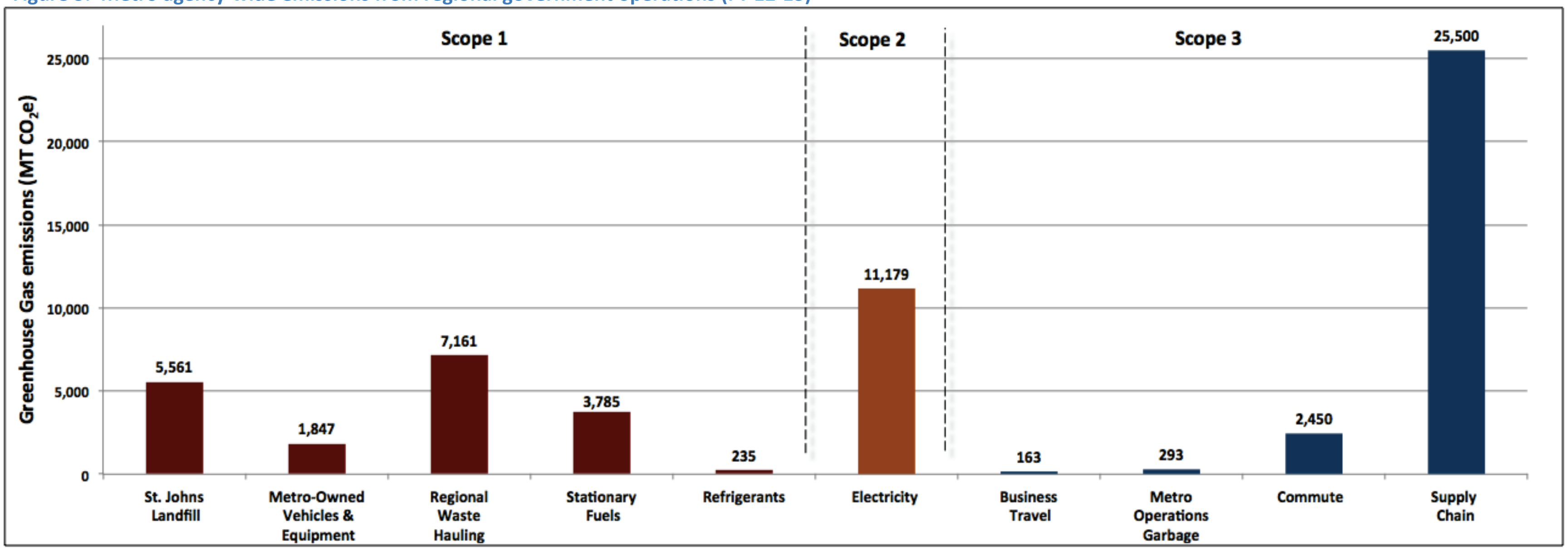
AGENCY-WIDE INVENTORY RESULTS

FY 12-13 Agency-Wide Summary

In FY 12-13 Metro's operations generated **58,173 MT CO_2e** from all three Scopes (see Figure 3). Estimated indirect Scope 3 Supply Chain emissions total 25,500 MT CO_2e, or 44%.[12] While Metro has less control over indirect Scope 3 sources, they come from mission-critical activities and Metro can influence them over time. This analysis calculated an additional 8,180 MT CO_2e of biogenic emissions from St. Johns Landfill and 558 MT CO_2e from plant-based bioethanol and biodiesel used in vehicles (not shown in Figure 3). GHG accounting best practices suggest reporting these emissions, but separately. See Appendix A for more information. Unique to Metro's operations are the Scope 1 emissions associated with St. Johns Landfill and Regional Waste Hauling, which represent 39% of non-supply chain emissions.

Scopes 1 and 2 yield 29,768 MT CO_2e. For sense of scale, this is equivalent[13] to annual emissions from 6,202 passenger vehicles. **Scope 3 yields 28,406 MT CO_2e.** This is equivalent to annual emissions from 5,918 passenger vehicles. **Total internal operations emissions of 58,173 MT CO_2e represent less than 0.2% of community emissions.**[14]

Figure 3: Metro agency-wide emissions from regional government operations (FY 12-13)



[12] Supply Chain emissions are rounded to demonstrate the level of uncertainty for this emission source.

[13] EPA GHG Equivalencies Calculators: http://www.epa.gov/cleanenergy/energy-resources/calculator.html#results

[14] See Metro's Regional Greenhouse Gas Inventory at http://library.oregonmetro.gov/files/regional_greenhouse_gas_inventory.pdf

Supply Chain: Embodied Emissions in Purchases

A life-cycle GHG analysis using Carnegie Mellon's Economic Input-Output Life-Cycle Assessment (EIO-LCA) model was conducted for all Metro purchases including goods, food, and services for all functional areas for FY 12-13.[15] The EIO-LCA analysis estimates the upstream GHG emissions generated by raw material extraction, production, and transportation of goods and services, and associated waste disposal, up to the point of retail. The responsibility for these emissions is shared between the goods manufacturers, service providers, and Metro – the organization demanding the products and services.

The methodology used here provides a sense of scale of supply chain emissions compared to the other emissions sources. It also provides prioritization guidance on where to focus future sustainable procurement efforts. As it is based on average emissions factors for various sectors of the US economy, it is not detailed enough to capture emissions reductions from implemented sustainable purchasing policies. This inventory used the same methodology as in the baseline assessment. And, as in the baseline inventory, results are aggregated into seven categories (see Figure 4):

Food (48%): Includes food purchased for resale (Oregon Zoo, MERC visitor venues), animal feed (Oregon Zoo), and to a lesser extent food served.

Buildings Construction (30%): Includes the labor and materials in building construction, renovation and maintenance services.

Professional Services (7%): Includes various professional services such as accounting, advertising, legal, management consulting, employment, education, architecture and engineering, real estate, insurance, etc.

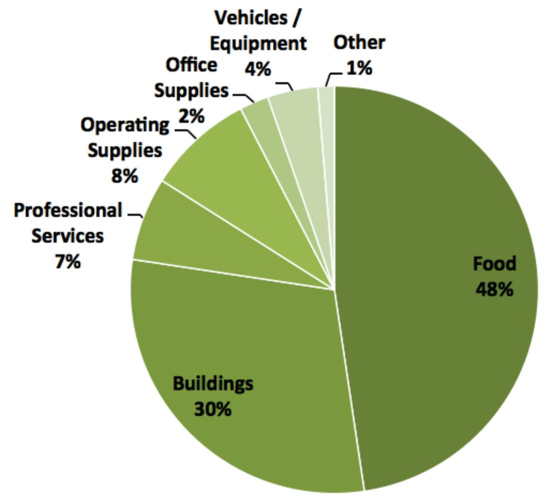
Operating Supplies (8%): This category includes general operating supplies as well as postage and delivery.

Office Supplies (2%): Includes paper and printing, all other supplies commonly found in office settings as well as information technology hardware, software, and services.

Vehicles and Equipment (4%): This category includes the purchase, rental, and maintenance of vehicles and equipment.

Other Goods and Services (1%): Includes "all other" goods and services not included in the first six categories that were not large enough to be grouped into a separate category. This category includes widely disparate economic sectors that range from: art, exhibits, permitting services, meetings, animal care, parking operations, grants, staff development, and education, etc.

Figure 4: Metro supply chain emissions (FY 12-13), by purchasing category



[15] Carnegie Mellon University Green Design Institute. (2008) Economic Input-Output Life Cycle Assessment (EIO-LCA), US 1997 Industry Benchmark model [Internet], Available at: http://www.eiolca.net.

Comparison of Results: CY 2008 vs. FY 12-13

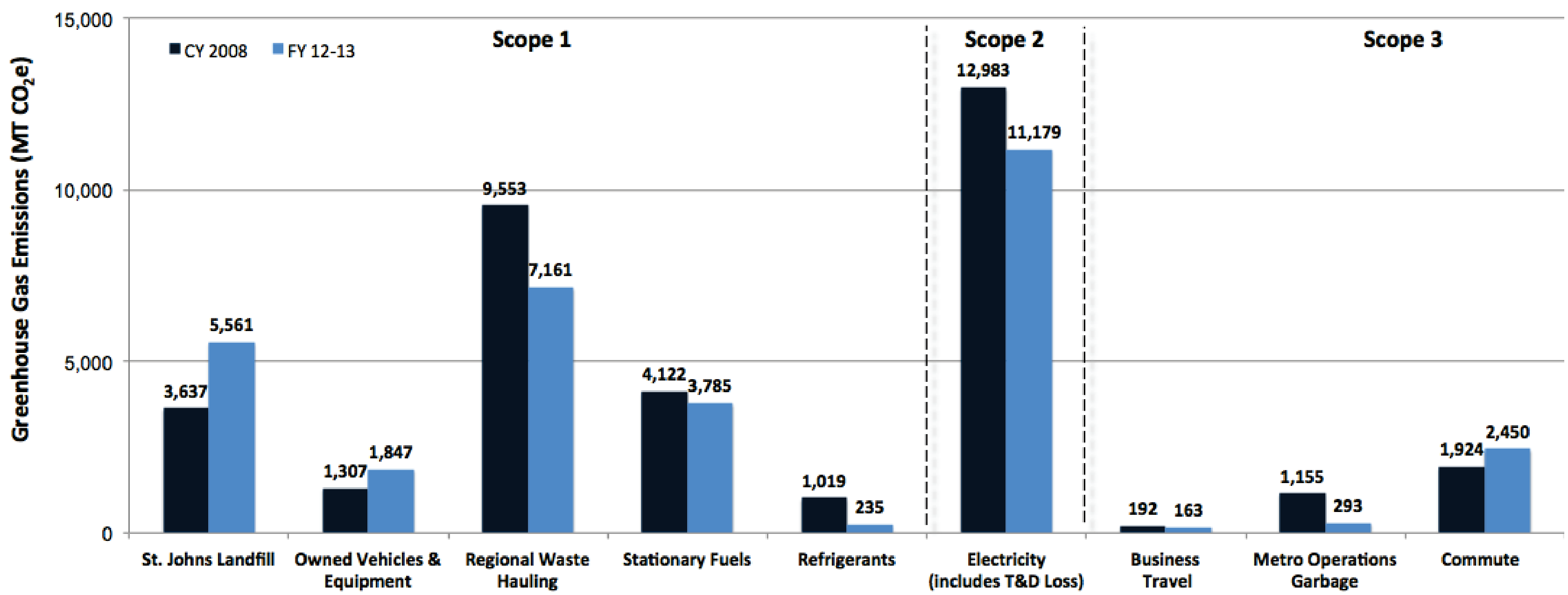
Overall, non-supply chain emissions decreased nearly 9% from 35,892 MT CO_2e in CY 2008 to 32,673 MT CO_2e in FY 12-13. Emissions sources that increased since CY 2008:

- Owned vehicles and equipment: the increase shown here is likely due to incomplete data in CY 2008, rather than a significant increase in fuel consumption in FY 12-13.
- St. Johns Landfill: Ash Grove Cement no longer purchases Metro's landfill gas, causing more emissions to be attributed to Metro's operations.
- Commute: Survey data show that commute distances are increasing. Despite this, trips by solo drivers at many facilities are decreasing.

Emissions sources that decreased since the baseline:

- Regional waste hauling: A decrease in community-generated solid waste due primarily to the economic downturn led to this 25% reduction in emissions from waste transportation.
- Electricity and stationary fuels: Electricity decreased by 15% and stationary fuels (primarily natural gas) by 8% due to energy efficiency projects.
- Refrigerants: Equipment replacement has led to fewer leaks.
- Business travel: Reductions are due to reduced air travel.
- Metro Operations Garbage: Recycling and compost programs have led to higher diversion rates. Since 2008, Columbia Ridge Landfill, where Metro waste is disposed, has begun using its landfill gas to generate electricity, resulting in a lower emissions factor.

Figure 8: Emissions comparison between CY 2008 and FY 12-13, by emissions source and scope



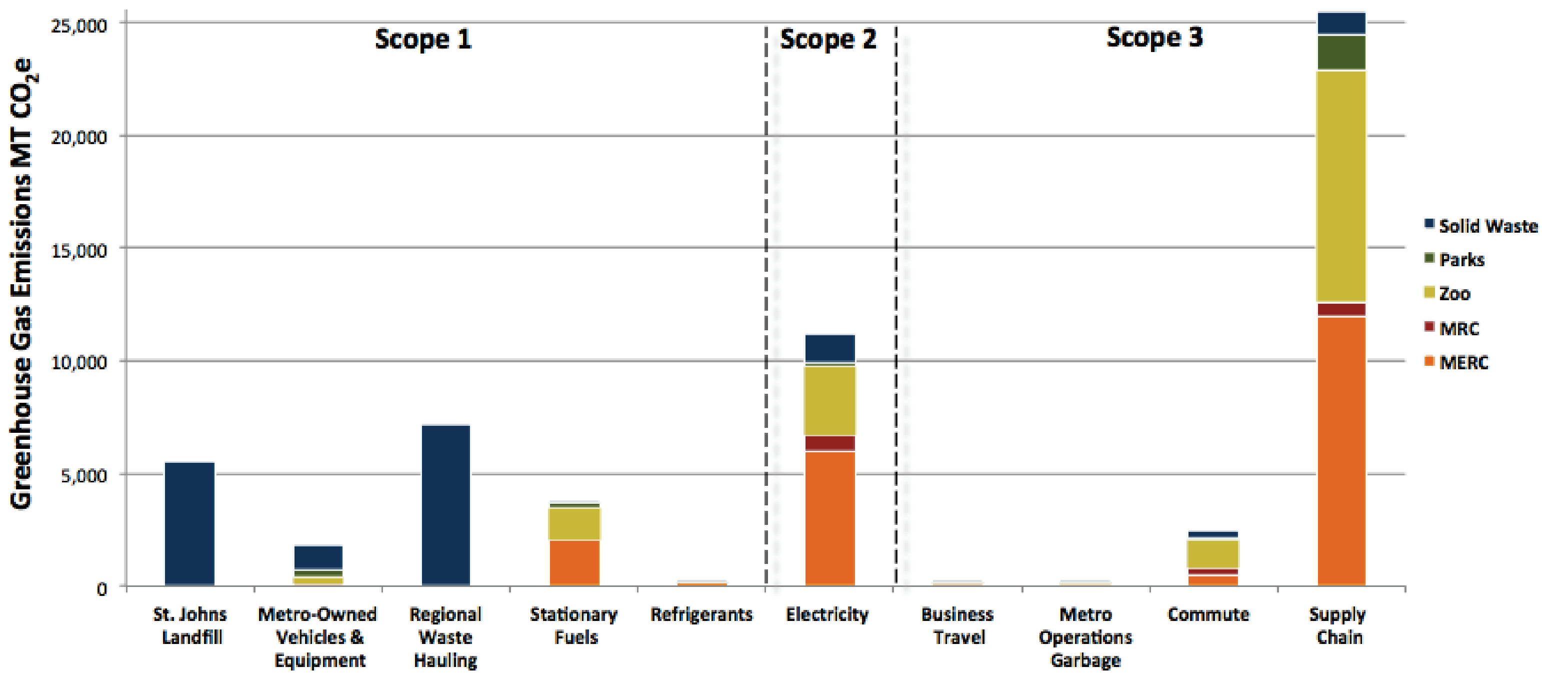
FUNCTIONAL AREA INVENTORY RESULTS

Overview

Metro's operations are broken down into five functional areas. More than 93% of agency-wide emissions come from the largest three functional areas.

- Metropolitan Exposition Recreation Commission – MERC (36% of agency-wide emissions): Oregon Convention Center, Portland'5 Centers for the Arts (Portland'5), and the Portland Expo Center.
- Oregon Zoo (29%): 64-acre zoo and exhibits.
- Solid Waste (28%): South and Central transfer stations and hazardous waste facilities, landfill gas emissions from St. Johns Landfill, MetroPaint facility, and hauling of community-generated solid waste to landfill.
- Regional Parks (4%): Blue Lake Park, Oxbow Park, Howell Territorial Park, Stafford Field Station, Borland Field Station, Native Plant Center, Glendoveer Golf Course, Graham Oaks Park, and Smith & Bybee Wetlands. See the Boundaries section for excluded facilities.
- Metro Regional Center – MRC (3%): Office building and parking garage.

Figure 9: Metro agency-wide greenhouse gas emissions (FY 12-13), by emissions scope and functional area



Functional Area Results: Metropolitan Exposition Recreation Commission (MERC)

MERC visitor venues include the Oregon Convention Center (OCC), the Portland Expo Center (Expo), and Portland'5 Centers for the Arts (Portland'5). As shown in Figure 5, in FY 12-13 MERC facilities generated 20,767 MT CO_2e, or **roughly 36% of Metro's total operational emissions**.

The majority of MERC emissions come from indirect sources (Scopes 2 and 3) as shown in Figure 5. The three largest emissions sources for MERC include embodied emissions within purchased goods and services in the supply chain, electricity, and stationary fuels (primarily natural gas). The following page provides some detail about how these emissions are split between the three visitor venues.

Figure 5: MERC greenhouse gas emissions as a share of total regional government operation emissions (FY 12-13)

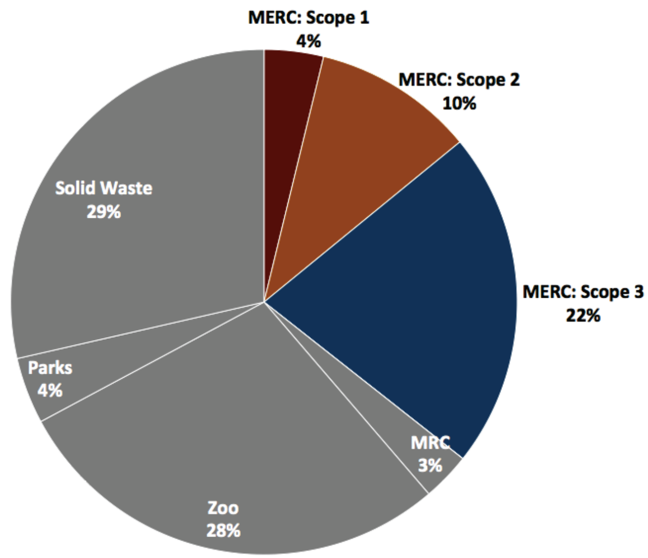
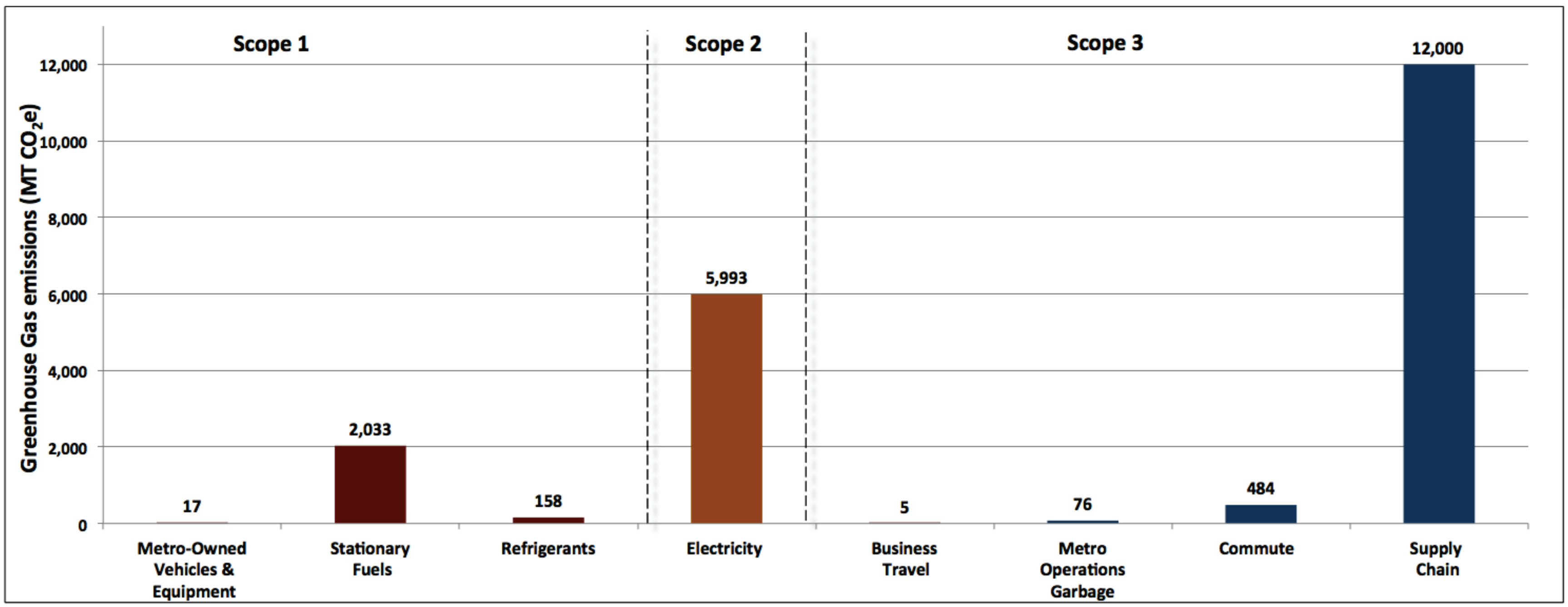


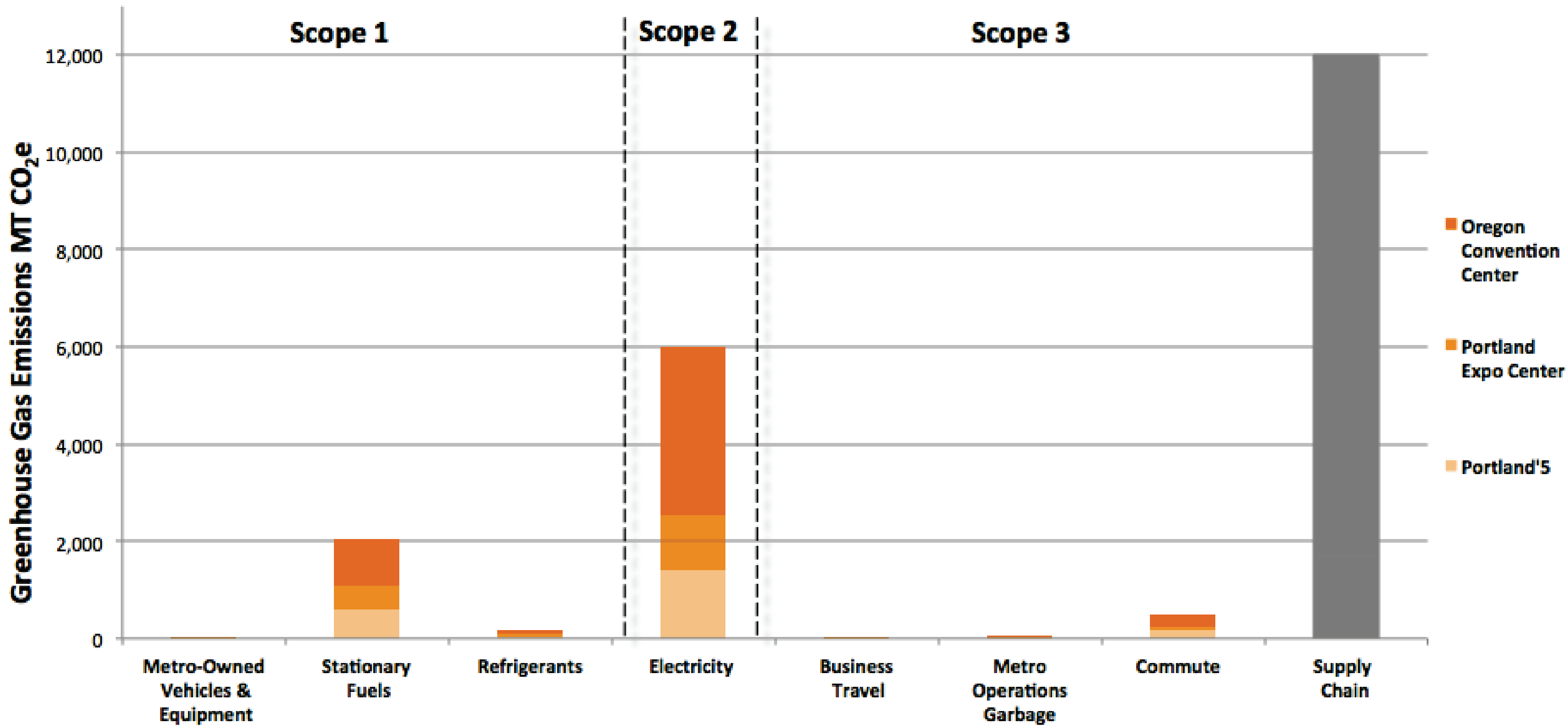
Figure 6: MERC functional area greenhouse gas emissions results, by scope (FY 12-13)



Comparison of FY 12-13 Emissions for Metropolitan Exposition Recreation Commission (MERC) Visitor Venues

Non-supply chain emissions from the three MERC venues total 8,768 MT CO_2e in FY 12-13 (supply chain emissions are excluded because they cannot be separated by venue). Within this subtotal, OCC represents approximately 55% of the emissions, while Expo and Portland'5 represent 20% and 25%, respectively. Figure 7 shows the emissions breakdown by emissions source and venue. All emissions sources are described in Table 5 below.

Figure 7: MERC FY 12-13 emissions, by source and visitor venue



Note: The Supply Chain bar is gray because it is not separated by the three venues. It represents the total supply chain emissions from all three MERC visitor venues.

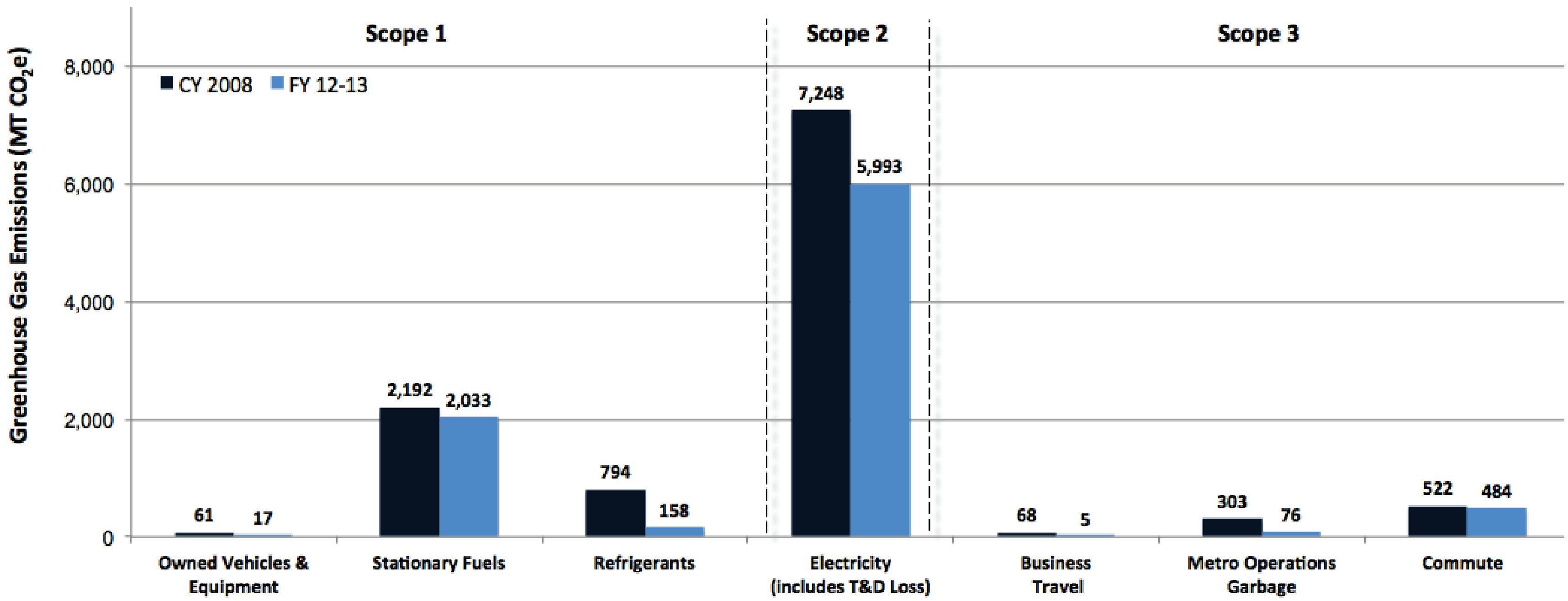
Table 5: Fuel consumption and activity data for MERC visitor venues (FY 12-13)

EMISSIONS SCOPE	EMISSIONS SOURCE	EMISSIONS SOURCE DESCRIPTION
Scope 1 (Direct Emissions)	**Owned Vehicles & Mobile Equipment**	MERC venues operate fleet vehicles that use E10 and B5 fuels as mandated by the state. OCC consumed 331 gallons of E10, 243 gallons of B5 and 602 gallons of propane. Expo consumed 786 gallons of E10 (90% gasoline, 10% ethanol), 20 gallons of B5 (95% diesel, 5% biodiesel) and 237 gallons of propane. Portland'5 consumed approximately 55 gallons of E10 in its one van and no diesel or propane.
	Stationary Fuels	MERC facilities consumed a total of 381,231 therms of natural gas and 1,166 gallons of diesel. Of the natural gas usage, OCC was responsible for 47%, Expo for 23%, and Portland'5 for 30%. Of the diesel consumption, OCC was responsible for 52%, Expo 22%, and Portland'5 26%.
	Refrigerants	MERC sites use CFC-12, HCFC-22, R-404A, R414A and R417-C in air conditioning equipment and chillers. These chemicals have global warming potentials ranging from 10,600 (CFC-12) to 1,820 (R-417C). HCFC-22 and CFC-12 are being phased out under the Montreal Protocol because (in addition to contributing to climate change) they deplete the ozone layer.
Scope 2 (Indirect Emissions)	**Electricity**	MERC venues consumed a total of 15,066,606 kWh of electricity. Of this, OCC consumed 58% (8,729,444 kWh), Expo consumed 19% (2,793,632 kWh), and Portland'5 consumed the remaining 24% (3,543,530 kWh).
Scope 3 (Indirect Emissions)	**Business Travel**	Business travel emissions are entirely from air travel. MERC employees flew approximately 13,132 passenger miles – 6,832 passenger miles for OCC (52%), 2,806 for the Expo Center (21%), and 3,493 for Portland'5 (27%).
	Metro Operations Garbage	MERC visitors and (to a lesser extent) employees generated approximately 1,070 short tons of solid waste including recycled and composted materials. The various MERC facilities have achieved varying solid waste diversion rates: 39% at Arlene Schnitzer Hall (Portland'5), 48% at the Keller Auditorium (Portland'5), 54% recycled at Expo, 69% at the OCC and nearly 76% at Hatfield Hall (Portland'5). Of landfilled materials (excluding recycling and compost) for all MERC venues, OCC is responsible for 44%, Expo for 42%, and Portland'5 for 13%.
	Commute	HR records indicate that MERC venues employed 412 people in FY 12-13 (headcount). Based on employee commute survey data, average one-way commute distances range between 8 and 11 miles for MERC employees. At OCC, 56% of commute trips were made by a solo driver, whereas Portland'5 had a solo driver trip rate of only 26%. Data was not available on mode split for Expo, so to be conservative it was assumed that 100% of trips were by a solo driver.
	Supply Chain	Supply chain emissions represent the embodied emissions in MERC purchased goods and services (including water). During FY 12-13, MERC venues spent nearly $17 million, which resulted in roughly 12,000 MT CO_2e and an average carbon intensity of 706 MT CO_2e per $1 million spent. More than 94% of supply chain emissions were from three categories of purchases: food (70%), building construction and maintenance (15%), and professional services (9%).

Comparison of CY 2008 and FY 12-13 Emissions for Metropolitan Exposition Recreation Commission (MERC)

Overall, Metro's non-supply chain emissions from MERC venues decreased nearly 22% from 11,188 MT CO_2e in CY 2008 to 8,768 MT CO_2e in FY 12-13 (see Figure 8).

Figure 8: Comparison of MERC CY 2008 and FY 12-13 emissions, by source



Emissions that Decreased over the CY 2008 Baseline

All MERC emissions sources decreased compared with the CY 2008 baseline. MERC's largest emissions source is electricity, and efficiency efforts to date have focused on this source. Both OCC and Portland'5 have completed lighting retrofits, replacing nearly all incandescent bulbs with compact fluorescents and have moved on to utilize more efficient LED bulbs in certain applications. MERC venues have focused on phasing out certain refrigerants, as required by the Montreal Protocol, as well as replacing older equipment which can lead to fewer leaks overall. Metro has also engaged in better tracking of its solid waste. Recycling and composting programs have led to higher materials recovery rates. For commute, despite an increase in average commute distance, more accurate survey data showing a reduction in trips by solo drivers led to this decrease in emissions. In the baseline inventory modal split information was only available for OCC. The other two venues were conservatively estimated as having all commute trips taken by a solo driver. For this inventory, modal split information was available for both OCC and Portland'5, reducing the number of trips by a solo driver.

MERC venues seek better ways to track their emissions reduction initiatives in the future to show both cost and GHG savings over time.

Intensity Metrics

Metro is interested in selecting appropriate metrics to generate emissions intensities, which will help to manage emissions performance over time. Examples of emissions intensity metrics for MERC visitor venues include GHG emissions per 1,000 gross square feet of facility space, GHG emissions per million dollars of revenue, GHG emissions per 1,000 visitors and GHG emissions per event. Figure 10 below shows MERC venue performance for these intensity metrics for FY 12-13. At this time, Metro has selected these emissions intensities to begin tracking for MERC venues. Baseline data from CY 2008 was not available (except emissions per 1,000 square feet), so there is no way to make comparisons yet, but it is recommended that these metrics be tracked in future inventories. By tracking emissions intensity performance over time, Metro can determine if it is getting more efficient per unit of service provided, despite future growth. This can be seen in Figure 9 where all three MERC venues reduced their GHG emissions per square foot of building space since 2008.

Figure 9: Comparison of MERC CY 2008 and FY 12-13 building area intensity metric

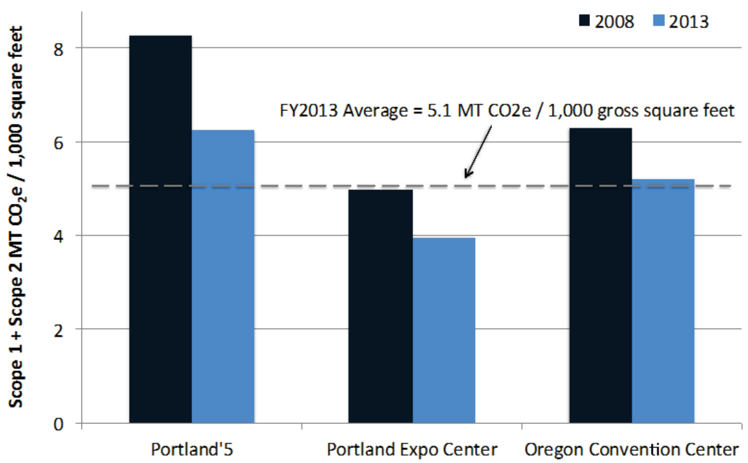
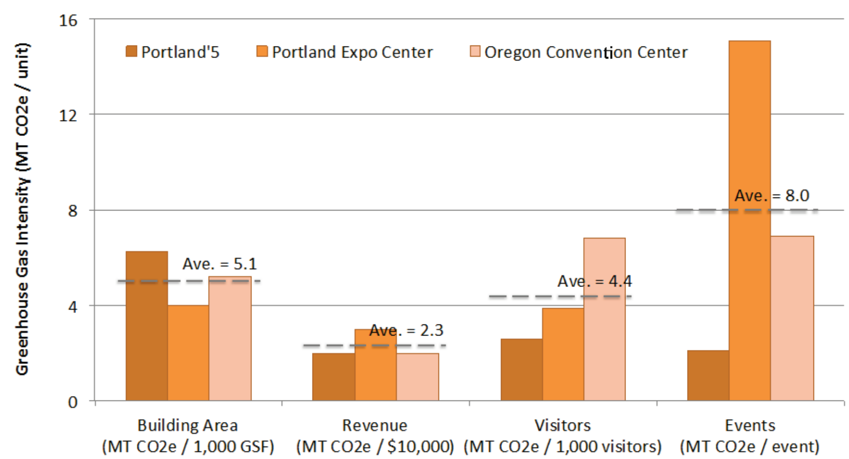
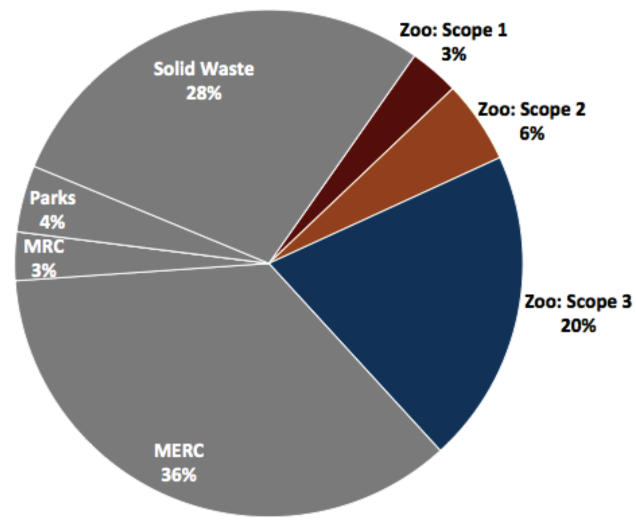


Figure 10: Comparison of MERC FY 12-13 intensity metrics, by visitor venue



Functional Area Results: Oregon Zoo

Figure 11: Zoo greenhouse gas emissions as a share of total regional government operation emissions (FY 12-13)



In FY 12-13 the Oregon Zoo generated 16,574 MT CO_2e or **roughly 29% of Metro's total operational emissions** (see Figure 11).

The majority of Zoo emissions come from indirect sources (Scopes 2 and 3), as shown in Figure 20. The three largest emissions sources for the Zoo include embodied emissions within purchased goods and services in the supply chain, electricity, and stationary fuels (specifically natural gas). The Zoo employed 732 FTE in FY 12-13, so commute emissions are also significant. All emissions sources are described in Table 6 below.

Figure 12: Oregon Zoo functional area greenhouse gas emissions results, by scope (FY 12-13)

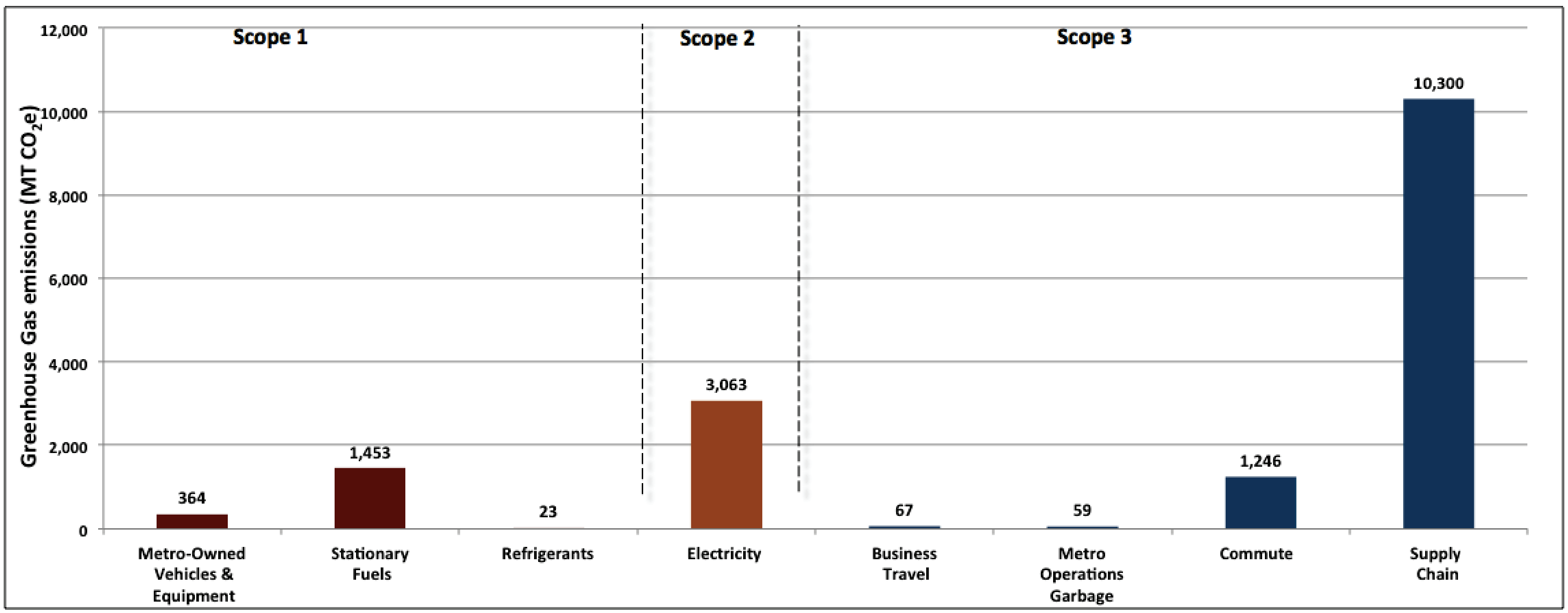


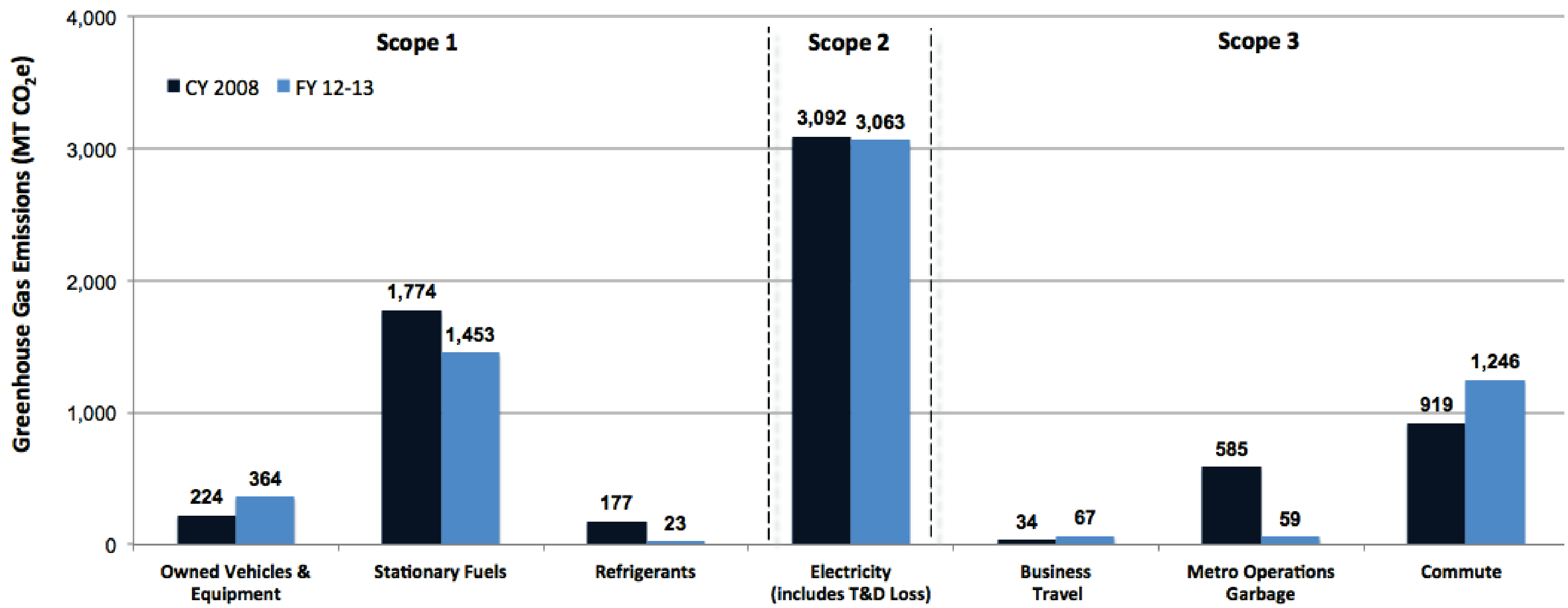
Table 6: Fuel Consumption and activity data for Oregon Zoo (FY 12-13)

EMISSIONS SCOPE	EMISSIONS SOURCE	EMISSIONS SOURCE DESCRIPTION
Scope 1 (Direct Emissions)	**Owned Vehicles & Mobile Equipment**	Oregon Zoo consumed 11,289 gallons of E10 (90% gasoline, 10% ethanol), 26,872 gallons of B5 (95% diesel, 5% biodiesel), and 980 gallons of propane in the zoo train, mobile vehicles, and equipment.
	Stationary Fuels	The Zoo consumed 270,606 therms of natural gas, 1,727 gallons of stationary diesel and no stationary propane.
	Refrigerants	The Zoo uses HCFC-22 in its air conditioning equipment and chillers. This refrigerant has a global warming potential of 1,700. HCFC-22 is being phased out under the Montreal Protocol because (in addition to contributing to climate change) it depletes the ozone when leaked.
Scope 2 (Indirect Emissions)	**Electricity**	The Zoo consumed 7,700,020 kWh of electricity.
Scope 3 (Indirect Emissions)	**Business Travel**	Zoo employees traveled 3,646 miles in rental vehicles and 4,226 miles in reimbursed personal vehicles (this does not include commute). They flew approximately 161,964 passenger miles and traveled 173 passenger miles by inter-city bus.
	Metro Operations Garbage	Zoo visitors and (to a lesser extent) employees generated approximately 1,335 short tons of waste, but achieved a diversion rate of nearly 77% between recycling and compost (food waste, yard waste, manure). This means only 309 tons of garbage are landfilled.
	Commute	Oregon Zoo employed 732 FTE during FY 12-13. Based on employee commute survey data, average one-way commute distance is approximately 12 miles. Solo drivers made roughly 60% of commute trips. Remaining trips were made by alternative means (walk, bike, carpool, MAX, bus, etc.)
	Supply Chain	Supply chain emissions represent the embodied emissions in Zoo purchased goods and services (including water). During FY 12-13 the Zoo spent $14 million, which resulted in 10,300 MT CO_2e and an average carbon intensity of 735 MT CO_2e per $1 million spent. More than 93% of supply chain emissions were from three categories of purchases: construction and maintenance (41%), food for humans and animals (36%), and operational supplies (16%). The Zoo has been engaged in numerous construction projects related to a bond measure including a new tiger plaza, beaver exhibit, aviary, flamingo habitat, Wildlife Live, and construction of a service road.

Comparison of CY 2008 and FY 12-13 Emissions for Oregon Zoo

Overall, Metro's non-supply chain emissions from the Zoo decreased nearly 8%, from 6,812 MT CO_2e in CY 2008 to 6,286 MT CO_2e in FY 12-13 (see Figure 13). The changes are discussed below, by emissions source.

Figure 13: Comparison of Oregon Zoo CY 2008 and FY 12-13 emissions, by source



Emissions that Increased over the CY 2008 Baseline

Three emissions sources increased compared to the baseline: Owned Vehicles and Equipment, Business Travel, and Commute. Owned Vehicle and Equipment fuel usage increased as a result of three main changes. First the steam engine, a major consumer of diesel, was down in 2008 when the baseline was measured. Second, the Zoo added 6 large vans since 2008 and, third, a shuttle bus that is a major consumer of gasoline was added to the fleet. Business travel emissions increased primarily due to an increase in air travel. Commute emissions increased due to an increase in commute distance and an increase in trips by solo drivers.

Emissions that Decreased over the CY 2008 Baseline

A reduction in natural gas consumption caused the decrease in emissions from stationary fuels. Currently there is no system in place at Metro to track the results of energy efficiency projects in order to connect specific projects to resulting emissions reductions. For the reduction in refrigerant emissions, it is not known if this is due to a lack of data or reduced refrigerant leakage. The decrease in Metro Operations Garbage emissions is a result of successful recycling and composting programs that have achieved a 77% material recovery rate at the Zoo. Additionally, since 2008, the landfill that accepts the majority of Metro's solid waste stopped flaring the methane and started using its landfill gas to generate electricity. This reduced the emissions rate of the solid waste disposed of at Columbia Ridge Landfill.

Emissions that Stabilized Compared to the CY 2008 Baseline

Electricity emissions changed by less than 1%.

Functional Area Results: Solid Waste

In FY 12-13 Metro's Solid Waste functional area operations generated **16,558** MT CO_2e (Scopes 1-3). This represents approximately **28% of Metro's total operational emissions**. As can be seen in Figure 14, the overwhelming majority of the Solid Waste functional area emissions come from Scope 1, or those direct emissions over which Metro has the most control. This is in contrast to all the other functional areas where the majority of emissions come from indirect emissions sources (Scopes 2 and 3).

Figure 15 shows that the largest sources of Metro Solid Waste functional area emissions are from regional waste hauling and fugitive methane releases from St. Johns Landfill. All emissions sources are described in Table 7.

Figure 14: Solid Waste functional area GHG emissions as a share of total regional government operation emissions (FY 12-13)

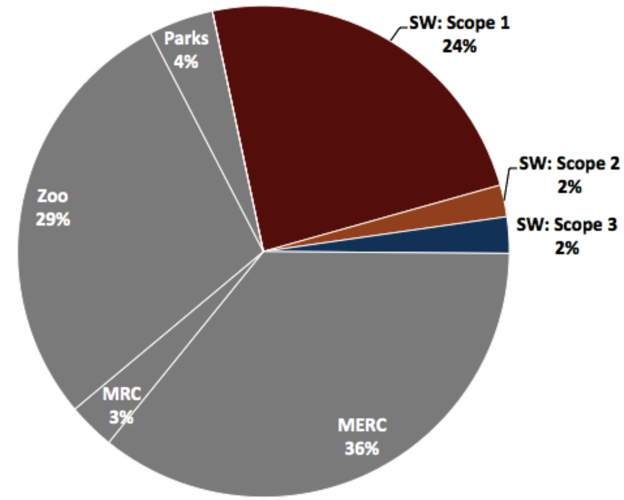


Figure 15: Solid Waste functional area greenhouse gas emissions results by scope (FY 12-13)

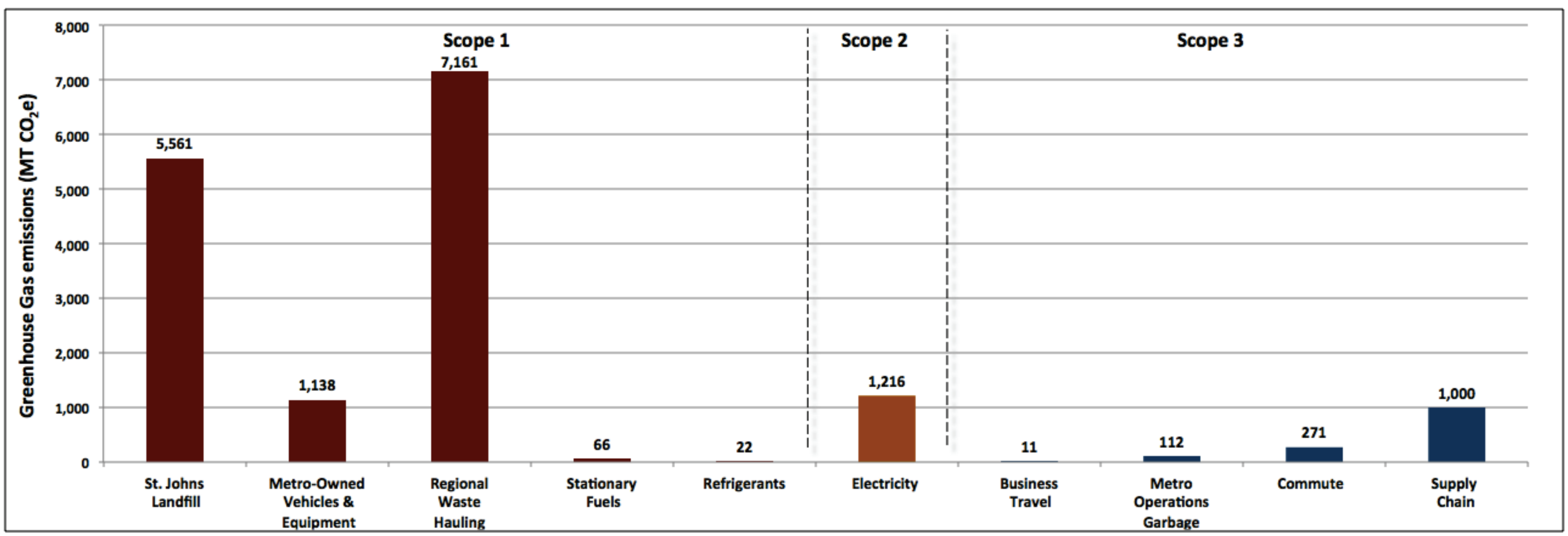


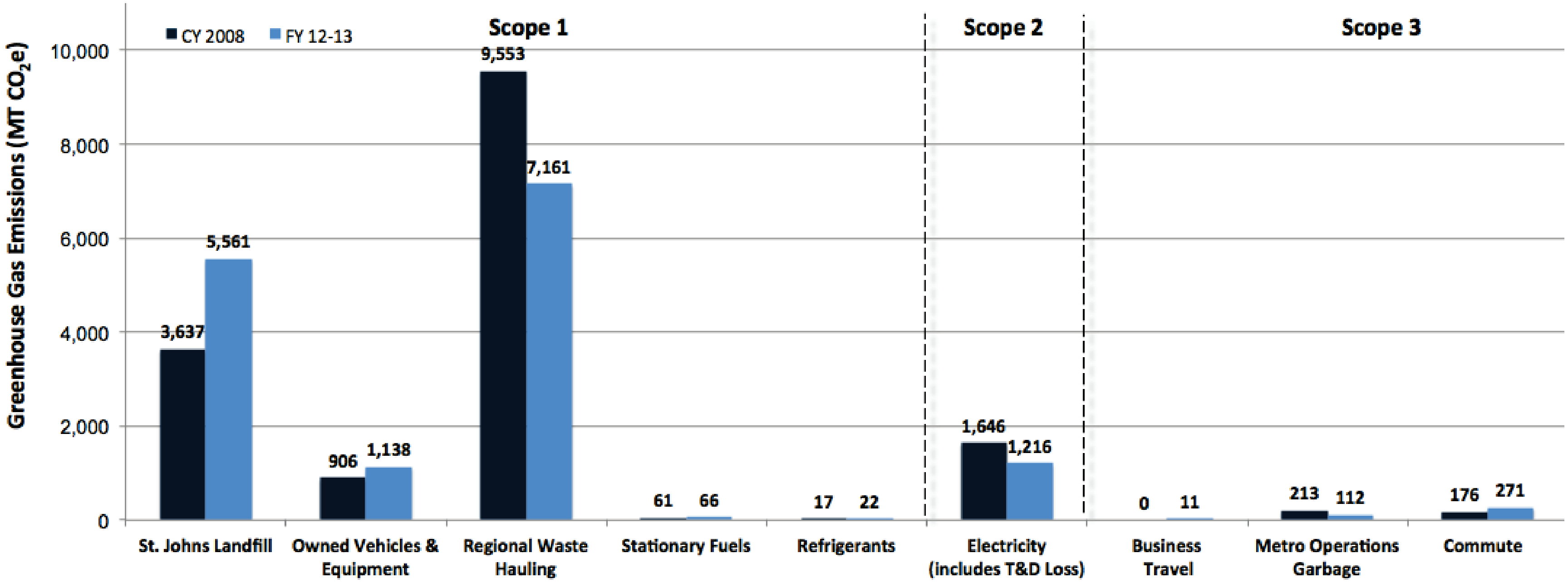
Table 7: Fuel consumption and activity data for Solid Waste functional area (FY 12-13)

EMISSIONS SCOPE	EMISSIONS SOURCE	EMISSIONS SOURCE DESCRIPTION
Scope 1 (Direct Emissions)	**St. Johns Landfill**	St Johns landfill generated 185,862,719 cubic feet of LFG in FY 12-13 with no sales to Ash Grove Cement. CO_2 emissions from flared methane are considered biogenic and part of the natural carbon cycle (see Appendix A) and are not included in Figure 15. Emissions in Figure 15represent only the non-biogenic emissions from fugitive methane releases, and methane and nitrous oxide emissions from incomplete combustion in the LFG flaring process.
	Owned Vehicles & Mobile Equipment	Metro contracts with Republic Services Inc. to manage the South Transfer Station and Recology to manage the Central Transfer Station. Metro provides reimbursement for all fuel purchases. Additionally, Metro owns vehicles used at St. Johns Landfill, MetroPaint and the hazardous waste facilities. In FY 12-13 this functional area consumed 14,017 gallons of E10 (90% gasoline, 10% ethanol), 108,473 gallons of B5 (95% diesel, 5% biodiesel) and 17,168 gallons of propane.
	Regional Waste Hauling	Metro operates a contract with Walsh Trucking Co to transfer community-generated solid waste from Metro's transfer stations to landfills (primarily Columbia Ridge Landfill in Arlington, OR). Metro purchases the fuel and specifies the vehicles that Walsh can use. In FY 12-13 Metro purchased 738,028 gallons of diesel fuel (B5) for regional waste hauling.
	Stationary Fuels	The Solid Waste functional area consumed 12,114 therms of natural gas, 204 gallons of propane and 64 gallons of stationary diesel.
	Refrigerants	The Solid Waste functional area uses HCFC-22 and R-410A refrigerants in its equipment. The global warming potential of each is 1,700 and 1,725 respectively. HCFC-22 is being phased out under the Montreal Protocol because, in addition to contributing to climate change, it depletes the ozone.
Scope 2 (Indirect Emissions)	**Electricity**	The Solid Waste functional area consumed 3,056,718 kWh for FY 12-13. Nearly 83% of total electricity consumption was by the two transfer stations. (Note: Electricity consumption at Metro Central hazardous waste facility is measured on the same meter as Metro Central Transfer Station and could not be separated.)
Scope 3 (Indirect Emissions)	**Business Travel**	Business travel emissions are almost entirely from air travel (more than 99% of the total) and reimbursed employee-owned vehicle travel. Solid Waste employees flew approximately 27,800 passenger miles in FY 12-13.
	Metro Operations Garbage	The Solid Waste functional area generated approximately 590 short tons of landfilled garbage (not including recycling or compost) at MetroPaint and St. Johns Landfill. Note: this does not include the community-generated solid waste processed at the transfer stations (see discussion below).
	Commute	Based on employee commute survey data, average one-way commute distances for the various Solid Waste facilities range between 8 and 19 miles. At St. Johns Landfill only 64% of commute trips are by a solo driver, while the employees at other facilities drive alone for between 80% and 84% of commute trips.
	Supply Chain	Supply chain emissions represent the embodied emissions in Solid Waste functional area purchased goods and services (including water). During FY 12-13 the Solid Waste functional area spent more than \$3 million, which resulted in 1,000 MT CO_2e and an average carbon intensity of 333 MT CO_2e per \$1 million spent. Supply chain emissions were distributed among five categories of purchases: professional services (32%), building construction and maintenance (24%), operating supplies (20%), office supplies (13%), and vehicles and equipment (9%).

Comparison of CY 2008 and FY 12-13 Emissions for Solid Waste Functional Area

Overall, Metro's non-supply chain emissions from the Solid Waste functional area decreased nearly 7% from 16,676 MT CO_2e in CY 2008 to 15,558 MT CO_2e in FY 12-13 (see Figure 16). The changes are discussed below, by emissions source.

Figure 16: Comparison of Solid Waste CY 2008 and FY 12-13 emissions, by source



Emissions Sources that Increased over the CY 2008 Baseline

St. Johns Landfill emissions increased between CY 2008 and FY 12-13 primarily due to the fact that Ash Grove Cement stopped purchasing LFG for its operations. In CY 2008, Ash Grove Cement purchased roughly 75% of St. Johns LFG for use in as an industrial energy source. According to GHG protocols, LFG emissions sold to a third party are outside the boundaries of an entity's GHG inventory and do not need to be reported. In FY 12-13, Ash Grove did not purchase any LFG. The decrease in natural gas prices likely contributed to this decision by Ash Grove Cement. By not selling the LFG, Metro must include the fugitive methane and other non-biogenic emissions from the LFG generation in its GHG inventory. In place of sending this resource off-site to Ash Grove, Metro has been flaring its LFG to convert the methane to carbon dioxide.

It has been determined that the emissions baseline for Owned Vehicles and Equipment was incompletely reported in 2008. Therefore, this year's increase in emissions is more about an incomplete baseline rather than a significant increase in fuel use. The 8% increase in Stationary Fuels is driven by an increase in stationary diesel consumption from 15 to 64 gallons. Natural gas emissions and propane emissions both decreased within this category. The increase in Refrigerants was due to more leaks of HCFC-22 in FY 12-13 as well as additional leaks of a new refrigerant, R-410 A, that did not leak in CY 2008.

Data was not available to report business travel emissions in CY 2008. Emissions in FY 12-13 come overwhelmingly from air travel. Commute emissions increased as a result of an increase in commute distance and more trips being taken by solo drivers.

Emissions Sources that Decreased over the CY 2008 Baseline

The main reason for the drop in emissions in Regional Waste Hauling is that community waste generation has decreased by 28% (primarily due to the economic downturn), resulting in a reduced need for waste hauling. Since CY 2008, Metro has also required fuel economy upgrades for Walsh's long-haul trucks, which have contributed to lower emissions. Additional efficiencies have been achieved with custom equipment that increased the vehicle payload, reducing the overall number of loads/trips needed.

While Metro has not tracked the impacts of all energy efficiency projects implemented since CY 2008, it is assumed that efficiency projects are responsible for this decrease. In FY 11-12, Metro Central completed a lighting retrofit with the Energy Trust of Oregon that contributed to electricity savings from the Solid Waste functional area.

While the quantity of landfilled garbage from Metro Operations Garbage increased from 461 tons in CY 2008 to nearly 590 tons in FY 12-13, the total emissions decreased due to a change in methane management techniques at Columbia Ridge Landfill in Arlington, OR. In 2008, methane generated at the landfill was flared, while in FY 12-13 the landfill used the methane to generate electricity. This new practice lowers the emissions factor.

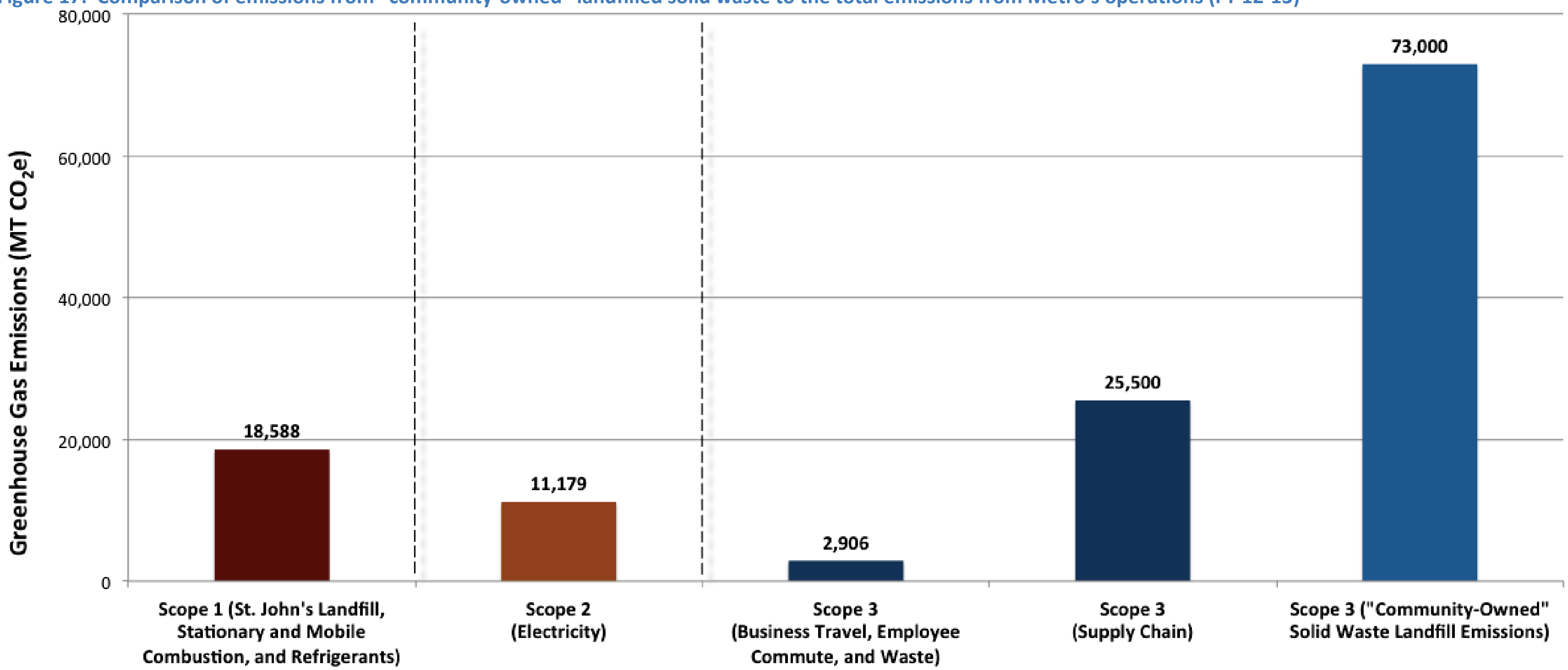
Community-Generated Waste

Metro is responsible for a number of solid waste-related activities including the operation of St. Johns Landfill, MetroPaint operations, purchase of fuel used by the long-haul waste hauling fleet and the operation of the two regional transfer stations and hazardous waste facilities (Metro South and Metro Central). Another significant solid-waste related emissions source is landfill disposal of solid waste that is aggregated and processed at Metro-operated transfer stations on behalf of the community.

These solid waste handling activities are conducted on behalf of Metro *residents and businesses* that generate the waste, and as such the associated emissions are considered (for the purpose of this analysis) "community-owned". The scale of GHG emissions associated with landfilling this community waste are included here because Metro pays for the operation of the transfer stations and for the disposal of the solid waste brought to those stations, and provides community education about waste reduction opportunities and strategies. However, Metro outsources operation of the transfer stations and has no control over GHG management techniques at landfills where the waste is taken. Therefore, the management of this emissions source is shared between the community generating the waste, Metro, the transfer station operator, and finally the landfill operators.

Figure 17 compares the scale of total emissions from Metro's operations (Scopes 1, 2 and 3) to the scale of emissions associated with landfilling this "community-owned" solid waste. As can be seen on Figure 17, the scale of these "community owned" landfill emissions is large, relative to Metro's other emissions sources. However, the "community owned" landfill emissions have decreased significantly since CY 2008, due to a lower annual volume of waste being processed at the transfer stations and the fact that Columbia Ridge Landfill has begun to use LFG to generate electricity, thus lowering the emissions factor of landfill operations.

Figure 17: Comparison of emissions from "community-owned" landfilled solid waste to the total emissions from Metro's operations (FY 12-13)



Functional Area Results: Regional Parks

In FY 12-13 Regional Parks generated 2,477 MT CO_2e, or **roughly 4% of Metro's total operational emissions** (see Figure 18).

The majority of Parks emissions come from indirect sources (Scopes 3), as shown in Figure 19. The largest emissions source from Parks is embodied emissions within purchased goods and services in the supply chain. Other emissions sources are significant but evenly distributed between vehicles, natural gas consumption (stationary fuels), electricity, and commute. All emissions sources are described in Table 8 below.

Figure 18: Parks greenhouse gas emissions as a share of total regional government operation emissions (FY 12-13)

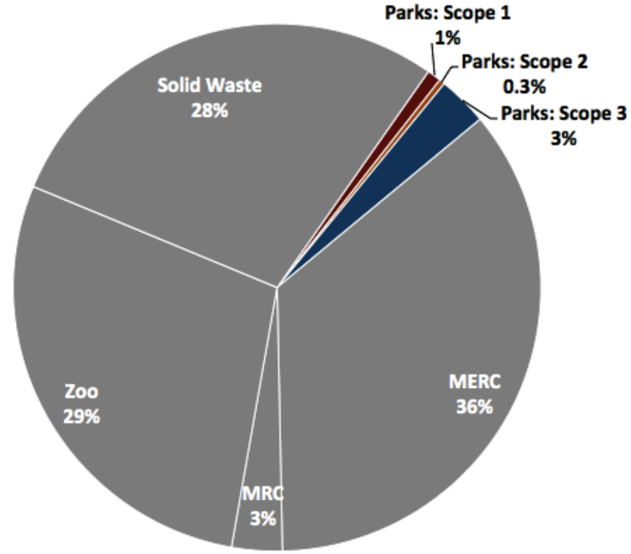


Figure 19: Regional Parks functional area greenhouse gas emissions results, by scope (FY 12-13)

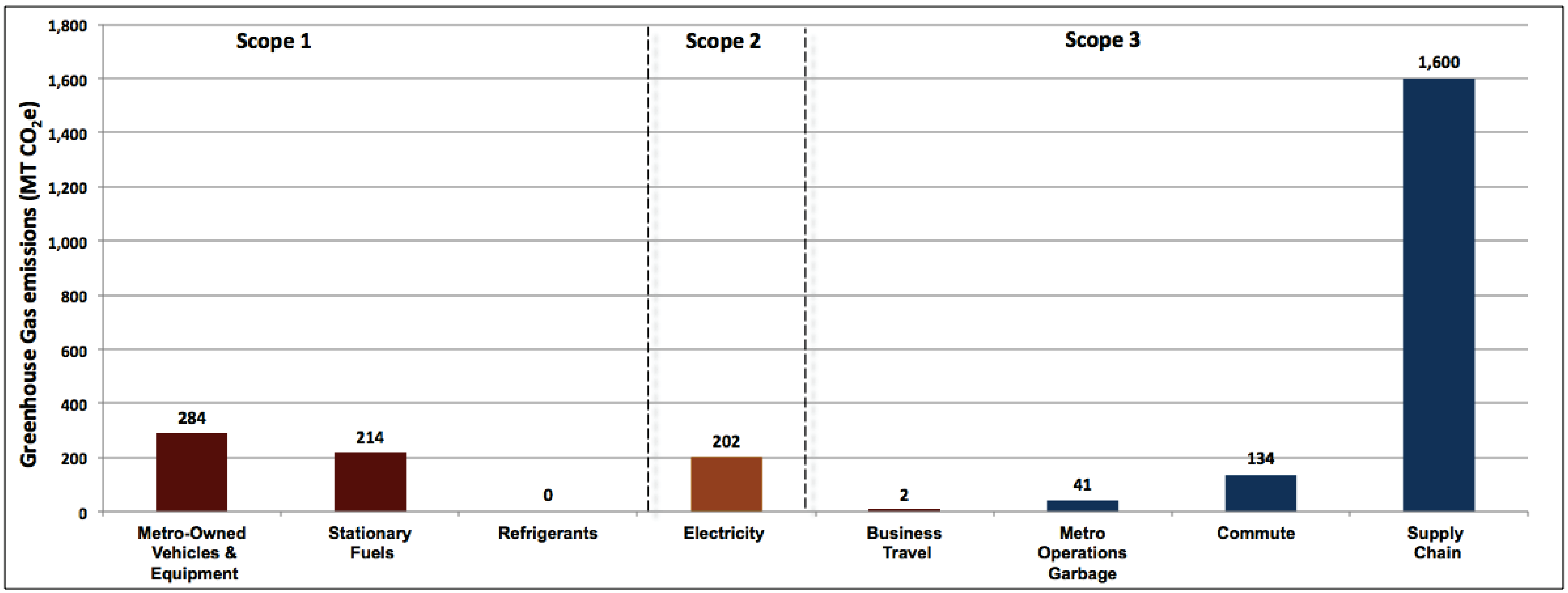


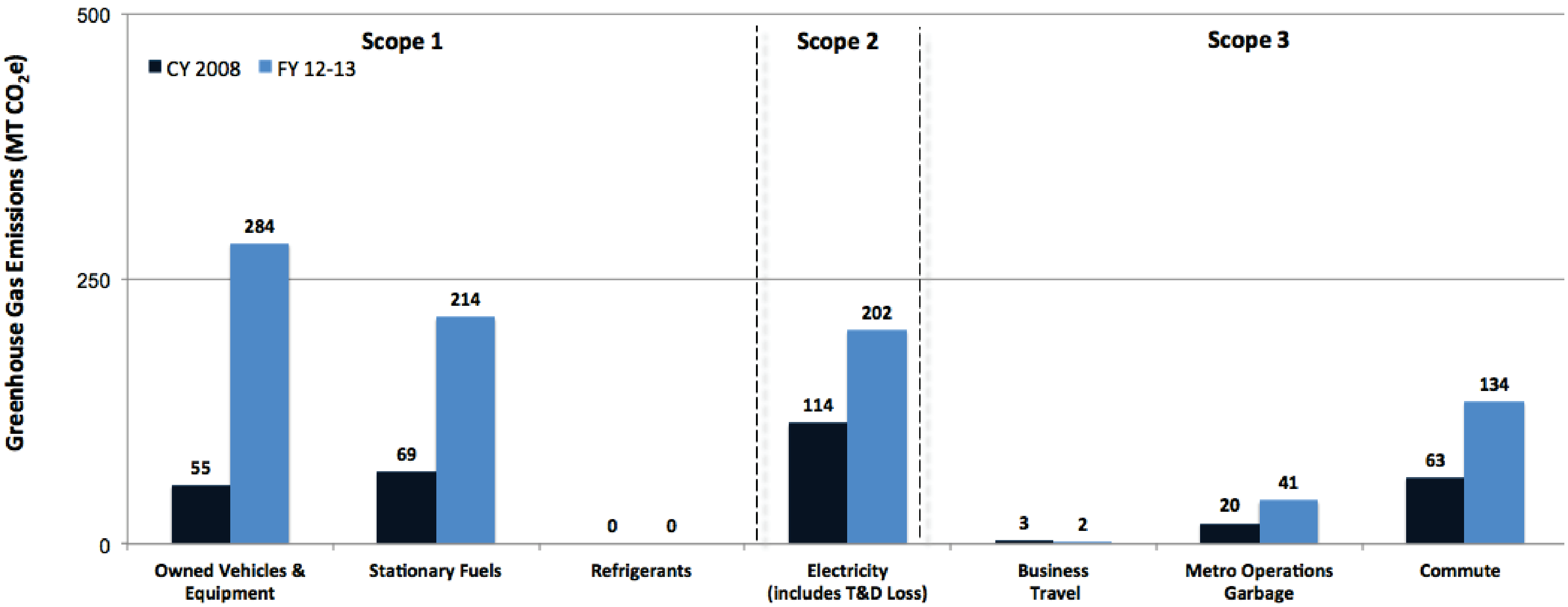
Table 8: Fuel consumption and activity data for Parks (FY 12-13)

EMISSIONS SCOPE	EMISSIONS SOURCE	EMISSIONS SOURCE DESCRIPTION
Scope 1 (Direct Emissions)	**Owned Vehicles & Mobile Equipment**	Parks operates fleet vehicles and equipment that consume gasoline, diesel and propane. All fuel consumed by Parks is assumed to be an E10 blend (90% gasoline and 10% ethanol) or a B5 blend (95% diesel and 5% biodiesel) except at Borland Field Station, where select vehicles use an E85 blend (15% gasoline, 85% ethanol). When fuel blends are split into each respective fuel type, Parks consumed 22,605 gallons of gasoline, 2,347 gallons of ethanol (E100), 6,948 gallons of diesel, 561 gallons of biodiesel (B100) and 1,956 gallons of propane.
	Stationary Fuels	Parks facilities consumed a total of 4,578 therms of natural gas for space heating and 1,242 gallons of propane.
	Refrigerants	Parks facilities utilize refrigerators and chillers but recorded no refrigerant leaks in FY 12-13 from this equipment.
Scope 2 (Indirect Emissions)	**Electricity**	Parks consumed a total of 506,653 kWh of electricity.
Scope 3 (Indirect Emissions)	**Business Travel**	Business travel emissions are exclusively from air travel. Parks employees flew approximately 5,236 passenger miles.
	Metro Operations Garbage	Parks visitors and employees at Blue Lake Park, Oxbow Park and Glendoveer Golf Course generated approximately 215 short tons of landfilled solid waste. This figure does not include recycling or compost. Data on garbage generation for all other parks was unavailable and therefore excluded. Future inventories should attempt to capture solid waste generation at all parks. Materials recovery rates at these facilities are: 2.4% at Blue Lake Park, 4.8% at Oxbow Park, and 9.3% at Glendoveer Golf Course.
	Commute	Based on employee commute survey data, average one-way commute distance for Parks employees is 14 miles. Parks commuters traveled 81% of the time as solo drivers.
	Supply Chain	Supply chain emissions represent the embodied emissions in purchased goods and services (including water). During FY 12-13 Parks spent \$4.6 million, which resulted in 1,600 MT CO_2e and an average carbon intensity of 348 MT CO_2e per \$1 million spent. More than 94% of supply chain emissions were from three categories of purchases: building construction and maintenance (76%), vehicles and equipment (11%), and professional services (7%). Parks had no emissions from food purchases.

Comparison of CY 2008 and FY 12-13 Emissions for Regional Parks

Overall, Metro's non-supply chain emissions from Regional Parks increased from 324 MT CO_2e in CY 2008 to 896 MT CO_2e in FY 12-13. This is the only functional area that had an overall increase in emissions compared to the baseline. The primary reason for the emissions increases is attributed to incomplete data in the baseline inventory. With no centralized data collection system for most of these emissions sources, and with the seasonal operation of Parks, this is the most challenging functional area to get complete data.

Figure 20: Comparison of Regional Parks CY 2008 and FY 12-13 emissions, by source



NOTE: Due to the difficulty in data collection, CY 2008 data is assumed to be incomplete for several Parks emissions sources including: Owned Vehicles and Equipment, Stationary Fuels, Metro Operation Garbage, and Commute resulting in the large differences between the annual results.

Functional Area Results: Metro Regional Center (MRC)

In FY 12-13, MRC generated 1,768 MT CO_2e or **roughly 3% of Metro's total operational emissions**.

The majority of MRC emissions come from indirect sources (Scopes 2 and 3). The largest emissions sources for MRC include embodied emissions within purchased goods and services in the supply chain, electricity, and stationary fuels (only natural gas). All emissions sources are described in Table 9 below.

Figure 21: MRC greenhouse gas emissions as a share of total regional government operation emissions (FY 12-13)

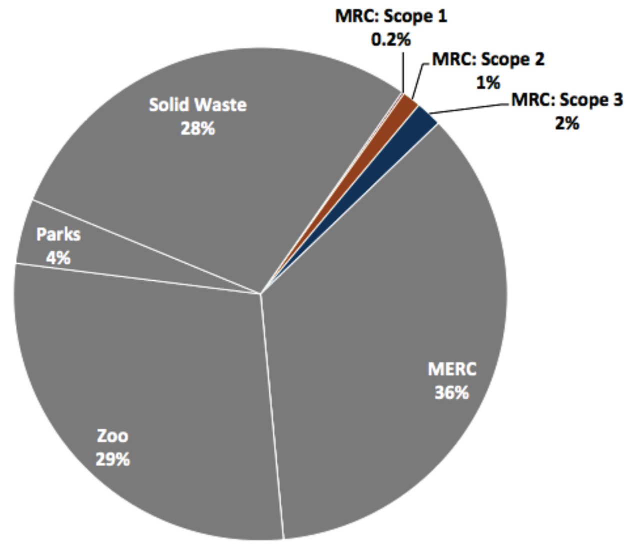


Figure 22: MRC functional area greenhouse gas emissions results, by scope (FY 12-13)

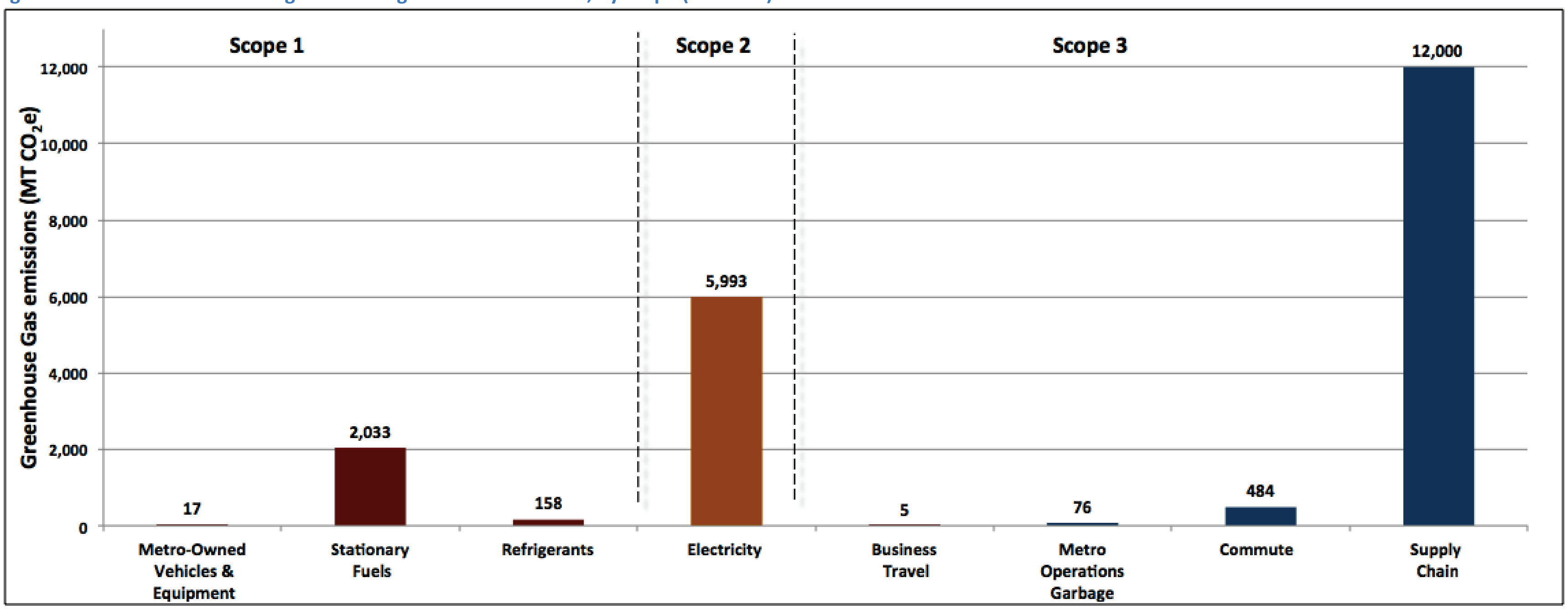


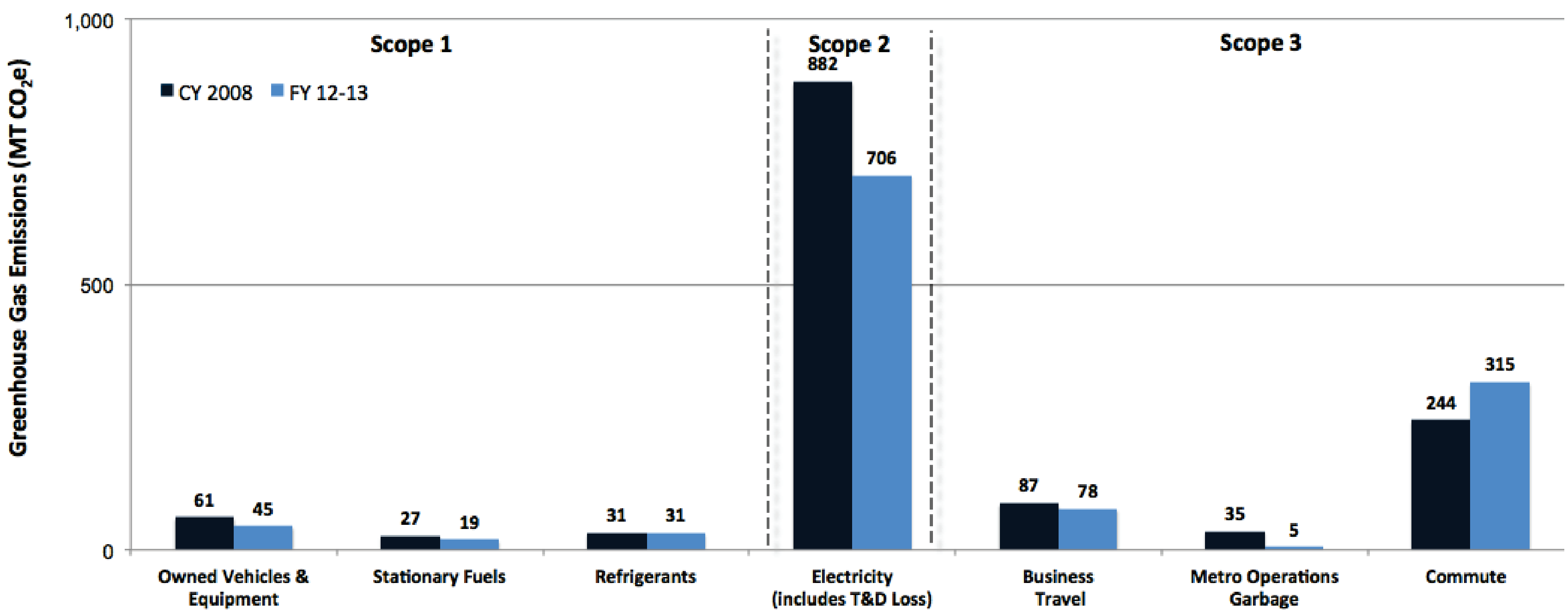
Table 9: Fuel consumption and activity data for MRC (FY 12-13)

EMISSIONS SCOPE	EMISSIONS SOURCE	EMISSIONS SOURCE DESCRIPTION
Scope 1 (Direct Emissions)	**Owned Vehicles & Mobile Equipment**	MRC operates fleet vehicles and equipment that consume gasoline, diesel and propane. All fuel consumed by MRC is assumed to be an E10 blend (90% gasoline and 10% ethanol) or a B5 blend (95% diesel and 5% biodiesel) except where select vehicles use an E85 blend (15% gasoline, 85% ethanol). When fuel blends are split into each respective fuel type, MRC-based fleet vehicles consumed 4,982 gallons of gasoline, 573 gallons of ethanol (E100), 9 gallons of diesel, 0.4 gallons of biodiesel (B100) and 7 gallons of propane.
	Stationary Fuels	MRC facilities consumed a total of 3,527 therms of natural gas.
	Refrigerants	MRC equipment uses HCFC-22 and R-404A in its air conditioning equipment and chillers, and lost 40 pounds and 4 pounds, respectively. These chemicals have global warming potentials of 3,260 (R-404A) and 1,700 (HCFC-22). HCFC-22 is being phased out under the Montreal Protocol because (in addition to contributing to climate change) it depletes the ozone layer.
Scope 2 (Indirect Emissions)	**Electricity**	MRC consumed a total of 1,774,513 kWh of electricity.
Scope 3 (Indirect Emissions)	**Business travel**	Business travel emissions are from air and ground travel. MRC employees flew approximately 184,680 passenger miles. Employees also drove almost 11,000 miles in rented and employee-owned gasoline vehicles. Employees traveled almost 3,000 passenger miles by intercity rail and an additional 346 passenger miles by bus.
	Metro Operations Garbage	MRC employees generated approximately 25 short tons of landfilled solid waste. MRC has a 57% materials recovery rate (recycling and compost).
	Commute	Metro employed 373 people at MRC during FY 12-13. Based on employee commute survey data, average one-way commute distance is 7 miles. MRC commuters traveled 43% of the time by single-occupant vehicle, 11% by carpool, 9% by bus and 15% by light rail.
	Supply chain	Supply chain emissions represent the embodied emissions in MRC purchased goods and services (including water). During FY 12-13 MRC spent \$1.7 million, which resulted in 600 MT CO_2e and an average carbon intensity of 390 MT CO_2e per \$1 million spent. More than 83% of supply chain emissions were from two categories of purchases: vehicles and equipment (66%) and office supplies (17%).

Comparison of CY 2008 and FY 12-13 Emissions for Metro Regional Center (MRC)

Overall, Metro's non-supply chain emissions from MRC venues decreased about 10%, from 1,367 MT CO_2e in CY 2008 to 1,202 MT CO_2e in FY 12-13 (see Figure 23). The changes are discussed below by emissions source.

Figure 23: Comparison of MRC CY 2008 and FY 12-13 emissions, by source



Emissions that Increased over the CY 2008 Baseline

Commute: The average commute distance per employee increased from 5.75 one-way miles to 7.3 based on the commute survey results, and the percent of commute trips made by solo drivers increased from 38% to 43%.

Emissions that Decreased over the CY 2008 Baseline

The most significant emissions reduction is from electricity, where Metro has invested in several efficiency projects focused on lighting efficiency and improved building control systems. With help from the Energy Trust of Oregon, Metro has completed several projects to replace lighting fixtures with higher efficiency models and install occupancy sensors. Other projects have focused on installation of timers to control ventilation and hot water systems. Some of these projects have also reduced natural gas consumption, which is the primary reason for the drop in emissions from stationary fuels.

Owned Vehicle emissions reductions are due to reduced gasoline consumption. The reduction in air travel caused Business Travel emissions to decrease. Finally, the decrease from Metro Operations Garbage emissions is a result of a 57% materials recovery success rate (between compost and recycling) and the fact that Columbia Ridge Landfill reduced its GHG emissions factor by using its landfill gas to generate electricity (instead of flaring the LFG).

Emissions that Stabilized Compared to the CY 2008 Baseline

Refrigerants: Actual data on refrigerant leaks was not available for MRC in CY 2008 or FY 12-13. In both years the same methodology was used to estimate likely refrigerant leaks using guidance from The Climate Registry.

SUSTAINABILITY EFFORTS AND CLIMATE ACTION AT METRO

Sustainability Plan

Since the Metro Sustainability Plan was adopted in 2010, the organization's efforts to reduce GHG emissions have focused on energy efficiency. Three guiding principles frame Metro's work in the area of reducing GHG emissions from operations: reduce energy demand, address emissions from all three Scopes, and use most current climate science to guide actions.

Guiding Principles for Greenhouse Gas Emission Reduction at Metro

- **Reduce Energy Demand First**. Metro's top priority should be to improve facility energy efficiency. Purchase and/or on-site generation of renewable energy should be a second priority. Procurement of high-quality carbon offsets (that meet certain criteria) should not be considered until these avenues have been fully pursued.
- **Address Emissions from all Three Scopes.** Metro should address all GHG emissions sources: energy, transport, and materials from all three emissions scopes.
- **Use Most Current Climate Science to Guide Actions.** Metro has chosen to use the findings from the IPCC (Intergovernmental Panel on Climate Change), which outline what is necessary in terms of the scale of emissions reductions needed to avoid catastrophic climate change (change beyond the point that we can't adapt) to guide its actions.

In FY 12-13 Metro completed 22 energy efficiency projects with Energy Trust of Oregon support, which are expected to save 1.7 million kWh of electricity and 25,000 therms of natural gas per year.

Data Systems

After the baseline GHG inventory in 2010, Metro learned much about how to organize data systems for GHG calculations, and worked to improve data systems to more easily capture the necessary information. These improvements allow this report to reflect a more accurate and complete picture of the organization's carbon footprint. However, there is room for continued data system improvement. The highest priority improvements for the next update include:

- **Supply Chain**: Currently Metro uses two separate accounting systems for MERC and non-MERC facilities, and similar purchases are not always categorized the same way in each system. Additionally, as employees record their purchases there is room for interpretation of the available expense categories that introduces uncertainty in the way these expenses are categorized in this analysis. Developing a single accounting system for all facilities and providing guidance on how to categorize purchases would further improve the results quality.
- **Fleet**: Since the baseline, Metro hired a Fleet Manager and began utilizing AssetWorks, a software program to track fleet information including fuel consumption and vehicle miles

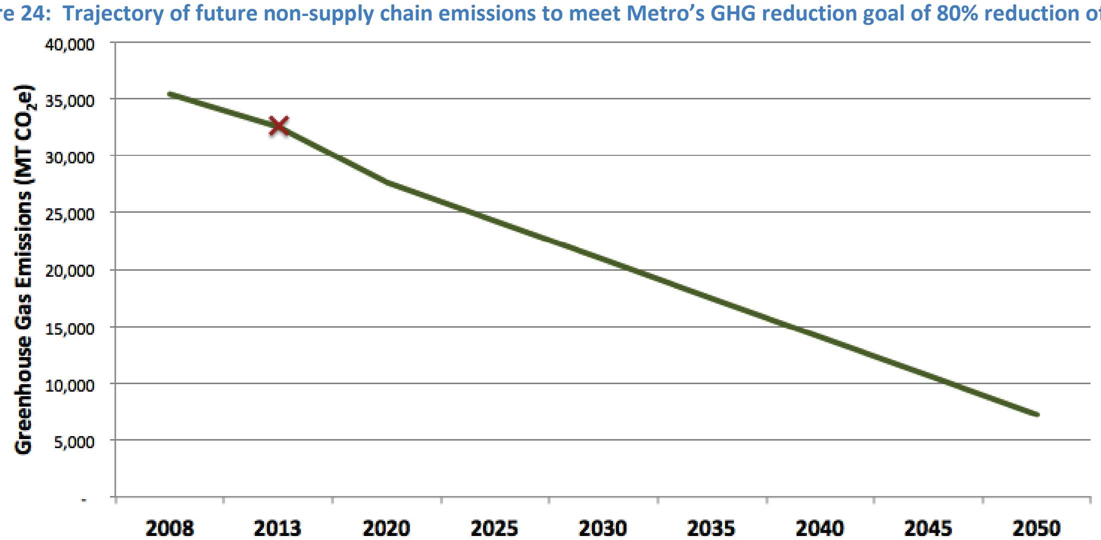
traveled. Unfortunately, not all Metro's vehicle and equipment fuel consumption information is entered into AssetWorks. Developing an agency-wide system to track fleet fuel is necessary.

- **Parks**: Of all the functional areas, data was most difficult to collect from Regional Parks due to the lack of a centralized data tracking and reporting system for these properties.
- **Commute**: Past commute surveys have not captured modal split data for all Metro employees.
- **Refrigerants**: There is no agency-wide refrigerant tracking or reporting system. Refrigerant loss and recharge is not currently tracked for many pieces of equipment.

Progress Towards Goals

Metro's GHG reduction goal is to reduce all emissions (excluding Supply Chain) from the CY 2008 baseline by 80% by 2050. CY 2008 non-supply chain emissions totaled 35,892 MT CO_2e. An 80% reduction of this amount is a total carbon footprint of only 7,178 MT CO_2e in 2050, despite future growth in services, square footage, or employees. The trajectory of Metro's ambitious emissions reduction goal is shown below in Figure 24 with Metro's actual FY 12-13 actual emissions shown.

Figure 24: Trajectory of future non-supply chain emissions to meet Metro's GHG reduction goal of 80% reduction of CY2008 emissions by 2050



As seen in Figure 24, with Metro's significant emissions reductions between CY 2008 and FY 12-13, it is nearly on track to meet this ambitious goal by 2050. However, if Metro continues at its current pace of emissions reductions, in 2050 its emissions will still be 20% higher than its goal. As the economy continues to improve, it will be necessary to continue to invest in efficiency projects throughout the institution, while focusing on the projects that will provide the most cost and GHG emissions savings over time.

Next Steps

In addition to continuous improvement in energy efficiency, Metro is pursuing solar photovoltaic (PV) for on-site electrical generation at several facilities and venues, and is looking for ways to decrease the carbon footprint of its supply chain through sustainable procurement and contracts.

APPENDIX A: METHODS, DATA PROTOCOLS, AND SENSTIVITY ANALYSIS

This inventory follows the Local Government Operations Protocol, which provides the highest-consensus guidelines for minimum reporting and was developed jointly by The Climate Registry and other organizations.[16] However, the protocol only requires emissions in Scopes 1 and 2. Scope 3 is usually considered an optional emissions reporting category and has typically been ignored by conventional inventories. Including Scope 3 emissions in a GHG inventory presents a more accurate picture of an organization's carbon footprint and better illustrates the potential regulatory and financial risks associated with carbon emissions. While Metro may not have complete or direct control over all Scope 3 emissions, it can influence all emissions sources to varying degrees.

This analysis drew on high-consensus public-domain tools for emissions factors and methods. Some sources (such as embodied emissions in purchases) were estimated by combining available budget data with careful assumptions, while others, such as natural gas use, had more direct data (billing information). The following is a description of the completeness of data for the major categories, as well as assumptions made to calculate estimated emissions. All assumptions detailed in the following methodology section apply to the analysis completed for all functional areas, unless otherwise noted.

All emissions are reported in metric tons of carbon-dioxide equivalent (MT CO_2e).

The analysis attempts to cover all six "Kyoto gases" including: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and the groups of high Global Warming Potential (GWP) gases, hydrofluorocarbons (HFCs). Metro had no releases of sulfur hexafluoride (SF_6) or perfluorocarbons (PFCs).

Overwhelmingly, the direct and indirect CO_2e emissions are CO_2 from combustion of fossil fuels.

Changes to CY 2008 Baseline Emissions Results

All CY 2008 emissions were updated as part of this inventory to use the newest emissions factors (The Climate Registry Default Emissions Factors for 2013). This allowed for an apples-to-apples comparison of year-over-year emissions differences based on changes in activity data rather than changes in emissions factors.

One other notable change was made to CY 2008 baseline data. In the baseline report, the number of people employed by Metro (used in commute calculations) was based on a calculated full-time equivalent (FTE) employee value. This caused baseline commute emissions to be under-represented and did not provide a credible way of comparing baseline commute emissions calculations to FY12-13 commute emissions where employees were calculated using a straight headcount instead of a FTE value. Metro's Human Resources Department was able to confirm that the straight headcount numbers at the end of FY 08-09 were slightly higher but similar to that of FY 12-13. Therefore to remedy this issue, Good Company used the employee headcount numbers from FY 12-13 to recalculate CY 2008 commute numbers. By doing this, the change in commute emissions between the two years can be attributed entirely to differences in commute distance and modal split of commute trips.

[16] The Local Government Operations (LGO) Protocol was developed as a collaboration of The Climate Registry (TCR), the California Air Resources Board (CARB), the California Climate Action Registry (CCAR, now the Climate Action Reserve), and ICLEI Local Governments for Sustainability. The LGO Protocol follows the same format as The Climate Registry's General Reporting Protocol (GRP).

Landfill Gas from St. Johns Landfill

The emissions reported for St. Johns Landfill are exclusively attributable to landfill gas (LFG) flow, not St. Johns Landfill facility operation emissions. In other words, all of the emissions for St. Johns Landfill from owned vehicle fuel use (gasoline and diesel) and refrigerants (Scope 1); electricity consumption (Scope 2); and the supply chain, water, garbage disposal, employee commute, and business travel (Scope3) are included in the respective emissions source totals for the Solid Waste functional area.

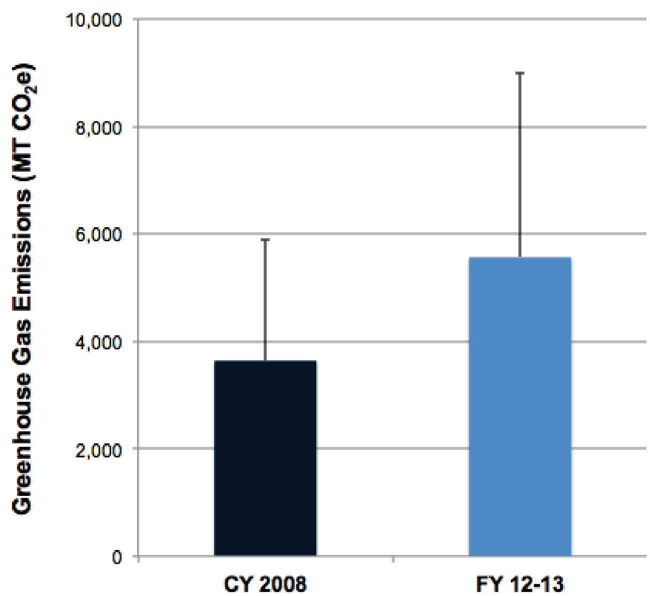
Metro determines the amount of LFG that is collected from the landfill using data collected from onsite flow and composition monitoring devices. Continuous monitoring systems record flow data to a central St. Johns computer. Methane concentration is also measured with a portable instrument each workday and recorded. It is assumed that approximately 48% of the direct St. Johns Landfill gas is methane and that 95% of LFG is collected and flared. Fugitive methane emissions from uncollected LFG and trace amounts of methane and nitrous oxide from the flaring process are estimated and included in this analysis.

The Local Government Operations Protocol (LGOP) does not consider all LFG as anthropogenic (human caused). The carbon dioxide portion of LFG is considered biogenic, or naturally occurring, and not contributing to human-caused climate impacts. Additionally, when LFG is flared, turning the methane in the LFG back into CO_2, resulting emissions are considered biogenic because this CO_2 would be released under any circumstance as this material decomposes as part of the natural carbon cycle.

In September 2013, the International Panel on Climate Change released its Fifth Assessment Report (AR5)[17].

This report builds on previous IPCC findings that there is a consensus among the world's leading climate scientists that humans are causing climate change and that the planet is warming faster than previously thought. One new discovery in this report is that methane is a more potent greenhouse gas than previously known. The IPCC now estimates that the 100-year global warming potential (GWP) of methane is 34, instead of the previously documented 21. As GWP is a measure of the heat trapping ability of different molecules relative to carbon dioxide, this means that every molecule of methane released into the atmosphere causes 34 times more warming than a molecule of carbon dioxide.

Figure 25: Sensitivity Analysis of St Johns Landfill emissions using GWP of 21 (bar) and 34 (line) for CY 2008 and FY12-13.



This finding is particularly notable for emissions from St. Johns Landfill where the emissions are dominated by fugitive methane releases. The numbers in this analysis use the older GWP figure of 21, but if the new GWP were applied, the GHG emissions rates would increase by nearly 62%. In Figure 25 the color bar shows the emissions from St. Johns Landfill using a GWP of 21 and the sensitivity bar shows what the results would be if the GWP of 34 were used. As this IPCC document was made public halfway through this project, this report calculates emissions using the previous GWP; however, it is recommended that future analyses use the newest global warming potentials.

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[17] International Panel on Climate Change, Fifth Assessment Report, Summary for Policy Makers, September 2013: http://www.climatechange2013.org/images/uploads/WGIAR5-SPM_Approved27Sep2013.pdf

Owned Vehicles and Equipment (Fleet)

In the baseline inventory, data on fuel consumption by owned vehicles and equipment was incomplete due to the fact that there was no single inventory of all Metro vehicles and that Metro uses multiple fuel vendors and no single department tracked all fuel use. Since then, most Metro vehicles were inventoried in the new AssetWorks management system (note that MERC facilities are not included in this system) and a new staff person has been tasked with tracking fleet fuel consumption. These actions improved data quality for this inventory, although gaps still exist.

Notes about how the data was collected for fleet from each functional area are included here:

MRC

- All vehicles housed at MRC were assigned to the MRC fleet. All other program-specific vehicles were separated.

Oregon Zoo

- Diesel fuel purchases are tracked monthly at an on-site fuel tank. Building generators, fleet vehicles, the four train engines and miscellaneous equipment (e.g., leaf blowers) all draw from the same fuel tank and therefore all diesel consumption was attributed to vehicles and equipment.
- Gasoline is primarily used by vehicles, but equipment such as leaf blowers and lawnmowers are also powered by gasoline. However, fuel use is not tracked by end use, therefore all gasoline use was assigned to the vehicle fleet.

Parks

- Fleet vehicle use was separated by primary park site.

Solid Waste

- Because Solid Waste Enforcement vehicles are tracked separately from the Metro fleet, emissions from the five Solid Waste Enforcement vehicles are included in the Solid Waste fleet emissions, despite being stationed at MRC.
- The total miles driven by the MetroPaint box truck (delivery truck) are used as a proxy for the box truck at Metro Central since vehicle use data are not tracked at Metro Central.
- Fuel use or mileage records are not available for solid waste education or toxics reduction vehicles.

State regulations require that all gasoline sold in Oregon is a blend of 10% ethanol and 90% gasoline (E10) and all diesel is a blend of 5% biodiesel and 95% diesel (B5). The City of Portland has a higher alternative fuel blending requirement for fuel sold within city limits. For most Metro facilities, determining the point of sale was too difficult, so it was assumed that all fuel met the state biofuel blending requirements. At MRC and Borland Field Station some vehicles can run on an E85 blend (15% gasoline, 85% ethanol).

GHG protocols require that emissions from combustion of fossil-based fuels be reported separately from plant-derived biofuels. For Metro's activities the use of these fuels is limited to mobile vehicles. Emissions reported in the body of the report *only* include fossil-based GHG emissions (also known as anthropogenic or human-cased). The biogenic emissions related to the plant-derived biofuels used by Metro's fleet equals 557 MT CO_2e. These emissions are reported separately because they are assumed to be part of the biological carbon cycle.

Conducting a life-cycle analysis comparing the carbon intensity of different fuel feedstocks can show the benefit of using bio-fuels. Biofuels can have very different life-cycle carbon-intensities based on raw materials used for production and energy intensity of the production processes. When selecting biofuels for use in Metro's fleets, it is important to select fuels based on life-cycle carbon intensity to ensure the greatest carbon reduction benefit. There are current limitations to this, given that life-cycle emissions of biofuels are still being studied, and new biofuels are constantly under development. Despite this fast-changing landscape and the limited life-cycle assessments of biofuels, there are recent analyses of fossil fuel and biofuel pathways by the California Air Resources Board (CARB) and the Oregon Department of Environmental Quality (DEQ) that apply to the fuels available in Oregon. [18]

Regional Waste Hauling

Metro manages a contract with Walsh Trucking Co to transfer community-generated solid waste from Metro's transfer stations to state landfills (primarily Columbia Ridge Landfill in Arlington, OR). Metro directly purchases the fuel for these vehicles and manages a contract outlining required the vehicle specifications. Developing a system for tracking fuel consumption for these vehicles would improve data quality. Fuel consumption for shuttle (goat) vehicles used for regional waste hauling is not directly tracked. It was estimated based on total dollars spent on fuel and an average monthly fuel price.

Stationary Fuels

Natural Gas

Billing records from NW Natural are tracked regularly in Utility Manager. These records were used to determine the total volume of natural gas burned at all facilities that use natural gas.

Emissions factors based on an average US heat content (provided by The Climate Registry's Default Emissions Factors, 2013) were used to calculate emissions from burning natural gas. Both Metro data for natural gas consumption and the methodology for this emissions source are considered highly accurate.

Propane

Metro uses propane in equipment at Blue Lake Park and St. Johns Landfill. Data is collected from bills and entered into Utility Manager. Both Metro data for propane consumption and the methodology (The Climate Registry's Default Emissions Factors, 2013) for this emissions source are considered highly accurate.

Stationary Diesel

The total number of stationary backup generators at Metro facilities is unknown. All functional areas have diesel generators, excluding MRC. However, fuel use specifically for generators is often not tracked or is not differentiated from other diesel consumption. Therefore, it is possible that a portion of the generator emissions are accounted for in fleet emissions or not reported at all. As generators are only used in back-up or emergency situations, this omission will be extremely small.

Refrigerants

Metro uses refrigerants at all facilities. The majority of refrigerants are used for rooftop HVAC systems and commercial food refrigeration units. The emissions associated with this source result from refrigerant leaks due to aging seals and gaskets within equipment. The types of refrigerants used are reported above in Table

[18] For more information on the GHG benefits of using bio-fuels see California Air Resources Board Low Carbon Fuel Standard Program, available at: http://www.arb.ca.gov/fuels/lcfs/lcfs.htm. CARB's Low Carbon Fuel Standard, available at: http://www.arb.ca.gov/fuels/lcfs/lcfs.htm or Oregon DEQ's low carbon fuels standards, available at: http://www.deq.state.or.us/aq/committees/lowcarbon.htm

4. Many facilities were able to report data on refrigerant purchases used to fill leaks within FY 12-13. At facilities where this data is not currently tracked, an estimation methodology using average leak rates based on refrigerant capacity within Metro-specific equipment was used as a proxy, following guidance provided by The Climate Registry. This method was used for the following facilities: MRC, Metro Central Transfer Station and Hazardous Waste facility, Metro South Transfer Station and Hazardous Waste facility, MetroPaint, and St. Johns Landfill.

The confidence level for this emissions category is moderate given the data limitations. Comprehensive data collection systems should be established at all Metro facilities in preparation for future inventories and to improve the accuracy of the results for this emission source. While refrigerants may not represent a large share of Metro's total GHG emissions, refrigerants have high global warming potentials relative to other GHGs – small leaks in HVAC or refrigerant units can have a large effect relative to the size of loss. As Metro continues to replace equipment as part of the EPA-driven phase-out of ozone depleting chemicals under the Montreal Protocol, refrigerant leaks should decrease, since newer equipment is less prone to leaking.

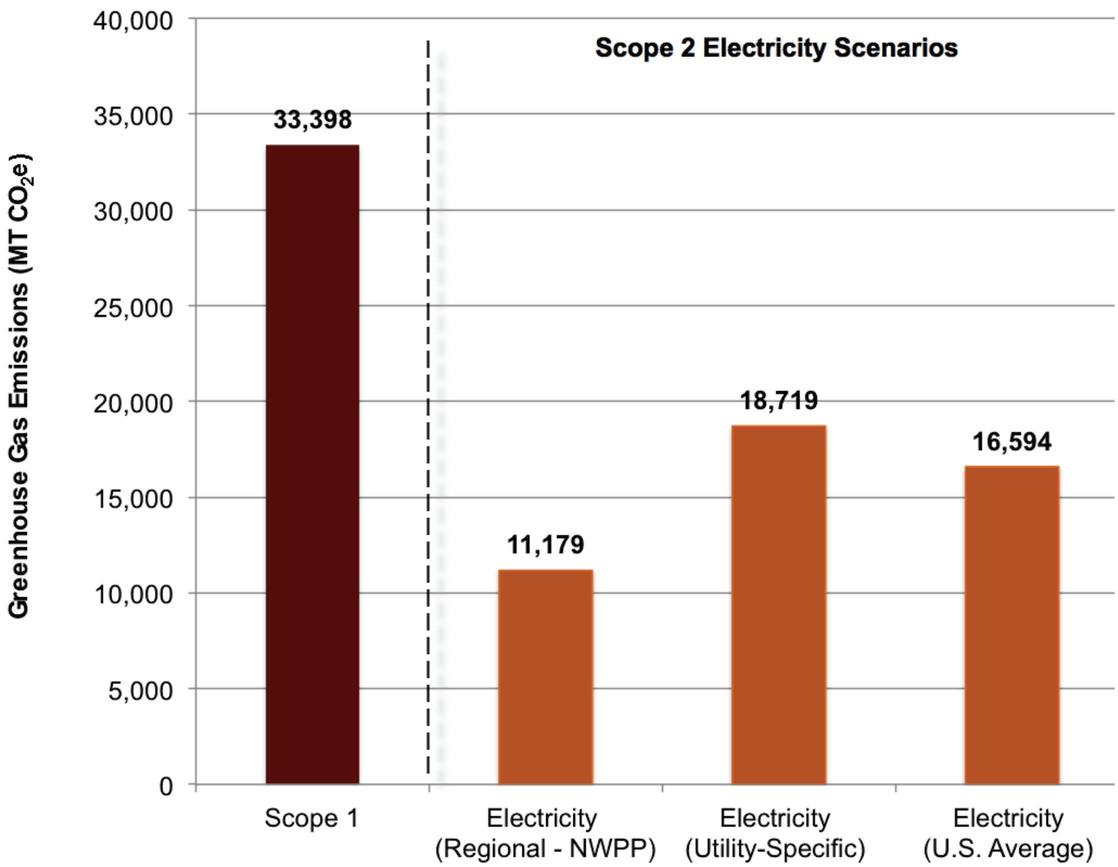
Electricity

Pacific Power and PGE are the electric utility providers for Metro facilities. Billing data from both utility companies is regularly tracked via Utility Manager. The data related to electricity consumption is complete and results for this emissions category should be considered highly accurate.

Emissions reported in this inventory were calculated using EPA eGRID regional emissions factors for the Northwest Power Pool (NWPP – see below). This is consistent with inventory best practices and provides an opportunity for more meaningful comparisons with other GHG inventories in the region. Emissions associated with transmission and distribution line losses (based on a US average loss factor of 6.5%) are also included in this total.

It is important to note that there is some question about which emissions factor (utility-specific, regional eGRID, or US national grid) is the most meaningful. While Metro purchases its electricity directly from PGE and Pacific Power, no utility is an island and electricity is traded as a commodity, sometimes over long distances. Figure 26 demonstrates how the emissions totals for Metro's Scope 2 emissions would differ when using these different emissions factors.

Figure 26: Electricity emissions sense of scale scenarios for Metro agency-wide emissions using local, regional and national emissions factors (FY 12-13) compared to total Scope 1 emissions.



Electricity Emissions Factors

Utility Specific[19]: Portland General Electric	=	844 Pounds of CO_2e per MWh
Utility Specific: Pacific Power	=	1,552 Pounds of CO_2e per MWh
Regional: NWPP (eGRID 2012, 2009 data) [20]	=	823.4 Pounds of CO_2e per MWh
National Average (eGRID 2012, 2009 data)	=	1,222 Pounds of CO_2e per MWh

Business Travel

During the baseline inventory, business travel data was challenging and time consuming to collect. Since then, to streamline the process Metro staff have begun collecting air travel itineraries in a spreadsheet, making it easier and more accurate to track and report air miles flown. This is the bulk of Metro's business travel emissions. Other business travel data by inter-city train and bus, rental vehicle, or in personal vehicles submitted for reimbursement were estimated using accounting information. This data was gathered by looking at expenditures and estimating fuel consumption and miles driven using reimbursement rates or average fuel prices where applicable.

[19] Portland General Electric and Pacific Power utility-specific emissions factors were provided by Oregon Department of Environmental quality based on data collected from the utilities for data year 2012.
[20] EPA eGRID2012 Version 1.0 (2009 data): http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

Metro does not track the total miles traveled by employees by in-city public transit. Metro does provide transit passes to benefits eligible employees at a number of facilities; however it is not possible to determine how many business travel miles are traveled by public transit in FY 12-13.

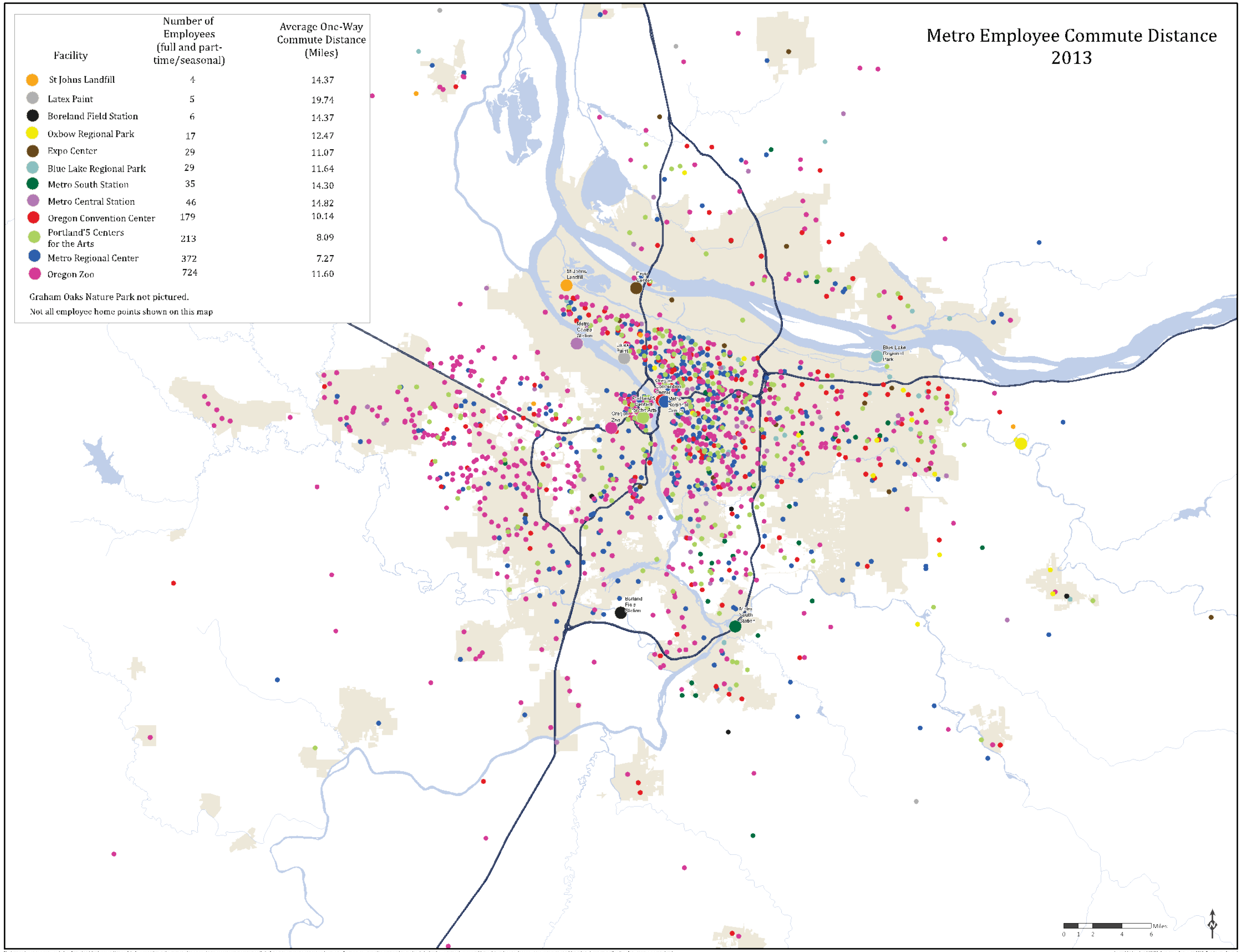
Metro Operations Garbage

Molly Chidsey provided data on waste generation for most of Metro's facilities. Total waste is calculated, as well as the tons of recycling and composted materials, and a materials recovery rate is generated for each facility. Data for Glendoveer Golf Course and St. Johns Landfill was only available for six months of the fiscal year. Full-year data was estimated by doubling reported waste figures. Waste data was not available for all parks and should be captured more completely for future inventories.

How the destination landfill manages its landfill gas will impact the emissions factor used in GHG calculations. Landfills that use LFG to generate electricity have a lower emissions factor than landfills that simply flare the LFG. Landfills that incinerate the waste have even lower emissions factors according to the EPA Waste Reduction Model (WARM). Metro-generated waste can go to any of several landfills throughout the region, but the majority is taken to Columbia Ridge Landfill in Arlington, OR. Columbia Ridge currently uses its LFG to generate electricity. Due to the difficulty in determining which waste goes to which landfill, it was assumed that all Metro Operations Garbage goes to a landfill that uses its landfill gas to generate electricity like at Columbia Ridge.

Commute

Figure 27: Map of Metro commute start locations by final work destination (facility) to illustrate commute distance (FY12-13)



Emissions associated with employee commute are calculated using the results of employee commute surveys and with the assistance of Metro's Data Resource Center (DRC) and human resources staff. It was assumed that employees work 5 days per week with 10 holidays and 13 paid days off per year.

Human resources mapped Metro employees' home addresses and their work location (no employee identification information was included in the data set to ensure employee privacy). These trip start and end locations were geo-coded in GIS to generate total miles traveled by employee (using the most common street route). Sixty-eight addresses are outside the scale of the map. Some employee addresses did not geocode because they were either PO Boxes, missing, or unrecognizable by the locator (the percentage that did not geocode was less than 5%). The average one-way commute distance (miles) was calculated using the total miles traveled by employee by work location.

Figure 27 is a map of all commute start locations, color-coded by final work destination (facility). Commute surveys were conducted by the Lloyd District Transportation Management Association (Lloyd TMA) for 13 Metro facilities and provided information on the percentage of trips taken by different modes (drive alone, carpool, MAX, bus, bike/walk). The Lloyd TMA survey is distributed only to benefits eligible employees on an annual or biennial basis (depending on facility location). This means that at some facilities upwards of 50% of the staff may be excluded from the survey. In these cases, excluded staff was assumed to have similar behavior patterns to surveyed staff. Where there was no survey information for an entire facility, all commute trips were assumed to be by solo drivers as a conservative estimate. Because the Lloyd TMA survey is conducted in summer and asks recipients to report commute patterns for one week only, mode split data may not represent typical annual commuting patterns and possibly overcounts bus, walk and bike commute modes. Given these limitations, these Commute results should be seen as estimates.

Metro staff should work to develop an annual employee commute survey for all Metro employees (including non-benefits eligible employees) that records travel modes and miles traveled supplemental to the Lloyd TMA survey (possibly in the winter to get a better sense of year-round commute habits). Implementing an employee commute survey would provide more accurate data for ongoing tracking and monitoring of employee commute emissions sources.

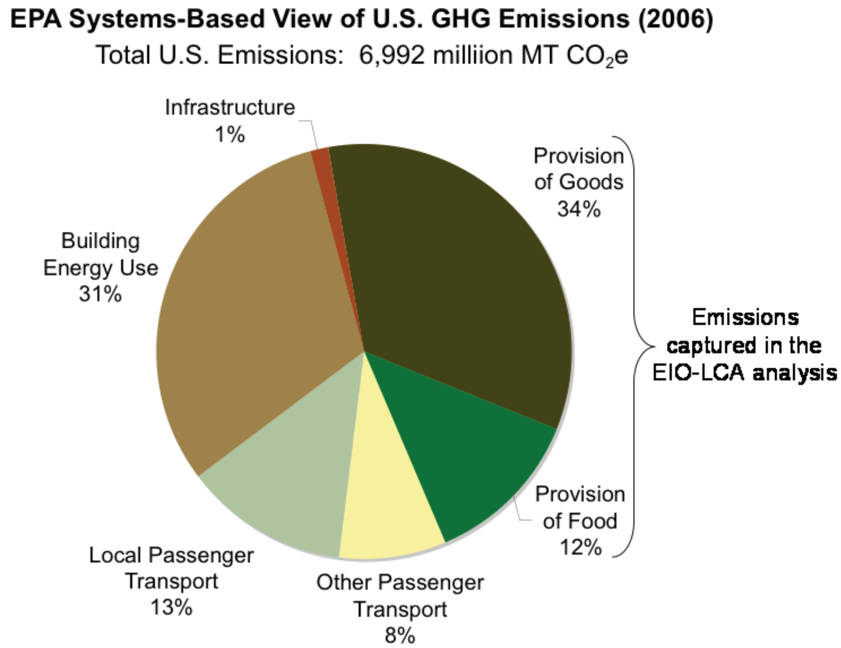
Supply Chain: Embodied Emissions in Purchased Goods and Services

Context and Motivation

The emissions generated by the manufacture and distribution of goods, food, and services are a large share of total emissions for the US economy and for other economies, and the results from this inventory reflect this fact. This result will surprise some readers because common practice for GHG inventories has typically excluded these difficult-to-quantify emissions sources that lie beyond the day-to-day operations and direct control of entities that purchase goods, food, and services.

A recent EPA analysis[21] provides the motivation for including the supply chain in GHG inventories. Figure 28 provides the core insight: the production of goods and food together make up nearly half of all US GHG emissions. The scale of these emissions requires that a thorough GHG inventory and climate action plan include supply chain-specific mitigation strategies, despite the limited precision in current quantification models.

Figure 28: Overview of US GHG Emissions by System (2006)



Description of Method

The approach used for this estimate is Carnegie Mellon University – Green Design Institute's *Economic Input-Output Life Cycle Assessment* (EIO-LCA), US 2002 Industry Benchmark model. Researchers at the Green Design Institute have developed this free online tool (available online at www.eiolca.net) to estimate life-cycle GHG emissions of economic activity in each of 428 sectors of the US economy.

In broad terms, the EIO-LCA estimate stems from multiplying the carbon intensity per dollar of a given economic sector by the expenditure on a category of purchases that matches the economic sector. This product is summed across purchasing categories, which differ in both carbon intensity and total dollars spent.

The model is valuable for simple, cost-effective emissions *estimates* by using aggregate emissions intensity values for all goods and services in the 428 sectors. These estimates are enough understand the sense of

[21] U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response (2008 draft). Opportunities to reduce greenhouse gas emissions through materials and land management practices, unpublished analysis.

scale of supply chain emissions and where to begin efforts in development of sustainable procurement policies by prioritizing the categories that have both the largest expenditure value and greatest carbon intensity. Its weakness is that it cannot provide a detailed estimate for specific processes or products. In order to accurately estimate embodied emissions for a specific purchase, that product's specific supply chain must be assessed. This alternative is typically extremely time-consuming and often relies on data from many private sources that may or may not be available. This also means that after sustainable procurement policies are implemented, this model cannot tell show progress towards emissions reductions. Good Company and many other entities are currently researching and developing new tools to understand the impact of product substitution in terms of embodied emissions reductions.

The model also has several significant sources of uncertainty. The first is that it is based on US industry averages. These averages do not include the influence of major US trading partners such as China on emissions factors, nor does the model have the ability to account for specific sourcing practices such as a higher than average percentage of post-consumer recycled content in paper products. Second, the model relies on a relatively old data set from 2002, which will not capture recent efficiency improvements or best practices that result in lower emissions for specific industrial sectors. Third, organizational accounting codes don't always directly map to the economic sectors included in the model. Finally, this data set also requires adjustments to be made to account for inflation.

As the EIO-LCA tool provides emissions intensities per unit of 2002 dollars, but expenditures were from FY 12-13, an adjustment must be made to account for inflation. For all purchases except those related to construction, the calculations were adjusted by the Consumer Price Index[22], the standard and official measure of retail inflation for the US economy. All construction expenditures (one of the largest areas of procurement) were adjusted by a construction price index (Turner Building Cost Index[23]) that more accurately reflects how the price of construction materials has changed over time.

The results of these corrections made a significant difference, lowering the general (non-construction) procurement footprint estimate by more than 15% and lowering the construction-related procurement footprint by 25%. Because of the central role of prices for purchased goods in using the EIO-LCA methodology, these corrections are likely to bring the overall estimate much closer to the truth.

Water

This supply chain analysis also includes the embodied emissions in purchased drinking water and wastewater services using a more customized emissions factor that is relevant to Metro's context than what is provided in EIO-LCA.

Metro provided data on quantity of treated drinking water and wastewater purchased in FY 12-13. Good Company used emissions factors provided by the Joint Water Commission based in Hillsboro and the Metropolitan Wastewater Management Commission based in Eugene. While these two facilities don't directly provide Metro's drinking water and wastewater services, their emissions intensity more closely matches Metro's conditions and served as a proxy.

[22] More information on the Consumer Price Index may be found on the Bureau of Labor Statistics website, available at: http://www.bls.gov/CPI/.
[23] More information on the Turner Building Cost Index may be found on the Turner Building Cost Index website, available at: http://www.turnerconstruction.com/corporate/content.asp?d=20.