City of Eugene
Inventory of
Greenhouse Gas Emissions
From Internal Operations
2000 and 2005

Prepared by

City of Eugene

Facility Management Division

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City of Eugene Inventory of Greenhouse Gas Emissions from Internal Operations

1. Introduction

In alignment with the values of environmental stewardship, economic prosperity and social equity held by the community of Eugene, the City organization has implemented numerous internal resource conservation programs. These efforts have also resulted in reductions in greenhouse gas (GHG) emissions. Examples of these initiatives include use of alternative fuels and vehicles, a long-term energy management program for City buildings, and energy upgrades at the Wastewater treatment plant such as using methane to generate electricity.

The City of Eugene has completed inventories of both internal City operations and community-wide GHG emissions since 2005. This report is the final piece of the initial quantification phase and completes the work begun with the preliminary internal inventory undertaken in 2005 with the help of University of Oregon students, and continued with the Community GHG Inventory.

The Eugene Sustainability Commission has identified climate change as an important issue and a high priority to address. The 2005 Sustainable Business Initiative Taskforce (SBI) report concludes that proactively addressing climate change through mandatory reductions in greenhouse gas emissions and specifically carbon[1] emissions will have positive economic, social and environmental impacts on our community.

In October 2008, as a result of recommendations from the Sustainability Commission, the City Council adopted a goal of carbon neutrality for all City-owned facilities and City operations by 2020. The goal states:

> *All City-owned facilities and City operations shall be "carbon neutral" (i.e. shall reduce net carbon emissions to zero, or if that is not possible, cancel all remaining emissions through the funding of approved local offset mechanisms or the purchase of approved offsets) by 2020.*

The City's carbon neutral goal is further described as:

> *(1) Carbon emissions of City facilities and operations shall be defined as all Scope I and Scope II emissions as defined by the General Reporting Protocol of the Climate Registry. (2) The policy shall prioritize the reduction of City emissions at source, then funding of offset-style local mitigation (i.e., carbon/ greenhouse gas-reducing) projects over the purchase of offsets from projects that do not result in decreased local emissions or increased local carbon*

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[1]Carbon is a shortened form of carbon dioxide equivalent emissions. All greenhouse gases - including carbon dioxide, methane, nitrous oxide and others - can be described in terms of carbon dioxide equivalency, the amount of CO^2 that would have the same global warming potential, when measured over a specified timescale (generally, 100 years).

> *sequestration. Any selected local mitigation project shall consider and address the major concerns of national and global markets for offsets, including but not limited to additionality, permanence, leakage, monitoring and verification, double counting, and transparency.*

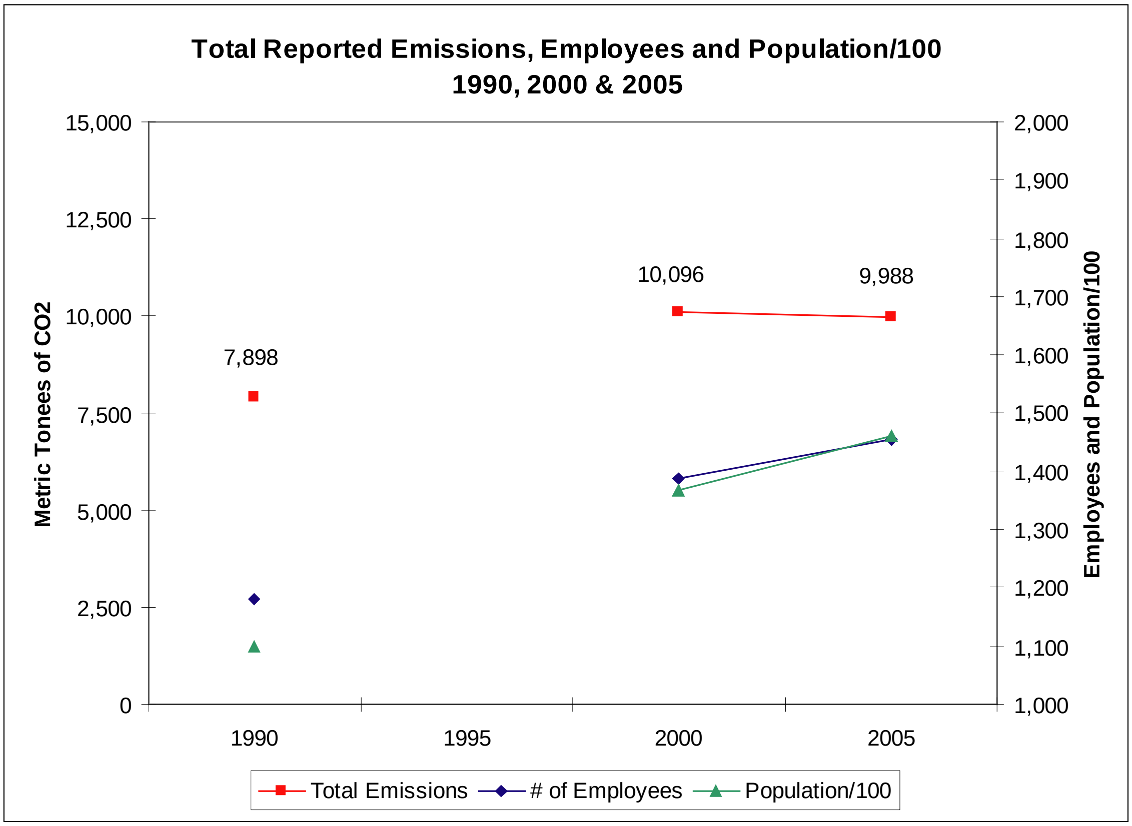
The goal covers all Scope 1 and Scope 2 emissions as defined by regional and international GHG emissions reduction protocols. To reflect the council goal and be consistent with established GHG reporting protocols, this inventory focuses primarily on the "reportable" GHG emissions of Scopes 1 and 2, and secondarily on the Scope 3 emissions related to City internal operations. (Scopes 1, 2, and 3 refer to activity categories differentiated by our ability to directly or indirectly affect emissions levels; they are defined more in-depth on pg 5.)

This inventory provides the foundation for an operational climate action plan. In addition to showing the City of Eugene's GHG emissions by scope, the inventory includes data on emissions by activity sector, energy source, and by City department and major division (Sections 4 and 5). The inventory of the City's operational GHG emissions suggests some of the factors which should be included in developing GHG reductions strategies (Section 7) and some "next steps" toward an organizational climate action plan (Section 8).

2. Executive Summary

The inventory of greenhouse gas emissions from City operations includes an estimated figure for 1990 and calculated figures for the years 2000 and 2005. The most striking finding of the analysis is that after reportable (Scope 1 and 2) GHG emissions increased about one-third between 1990 and 2000, there has been a decrease in GHG emissions between 2000 and 2005, as shown in Figure 1 below. City operations have succeeded in arresting and reversing growth of GHG emissions over the last five years. This is significant due to the continued growth of City staff and services—the amount of GHG emissions per City employee decreased by 5.5% between 2000 and 2005. This result has been achieved primarily with substantial investment in energy efficiency and conservation upgrades, use of hybrid vehicles, and an increase in the use of bio-based fuels.

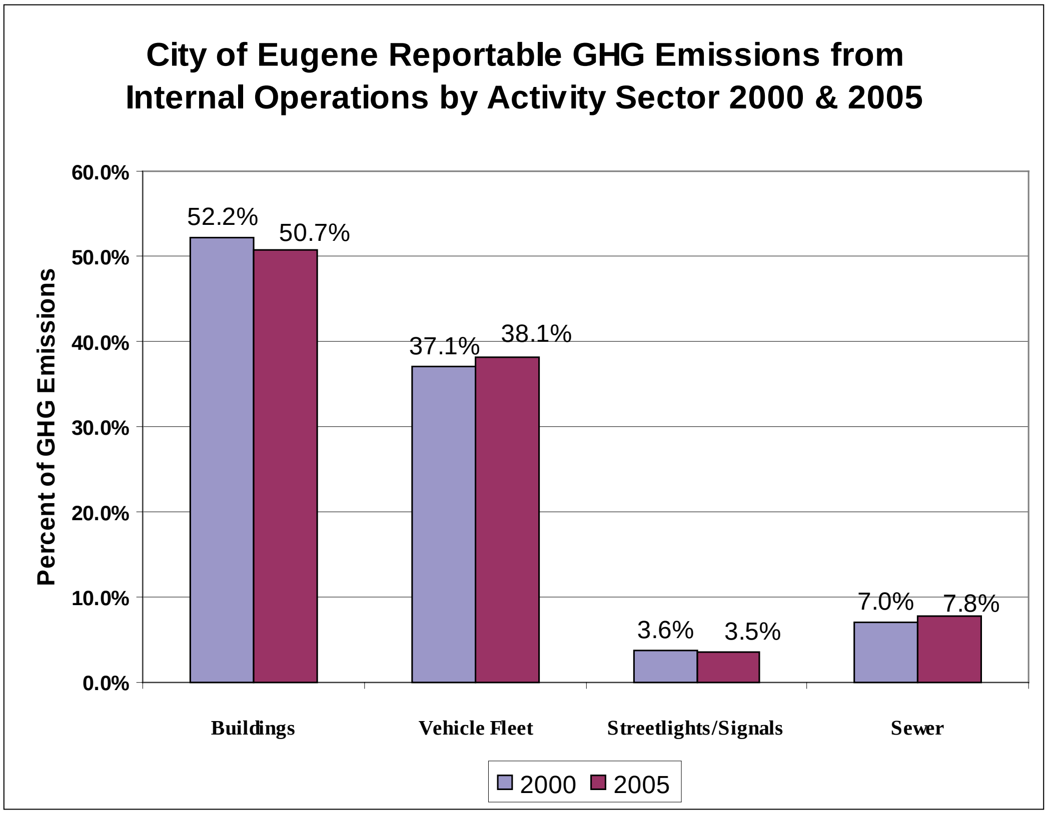
Figure 1



The inventory results described are based on the Scope 1 and 2 GHG emissions from City operations since the council's adopted goal of carbon neutrality for City operations by 2020 focuses on Scope 1 and 2 emissions.

The analysis also shows the GHG emissions by activity sectors within City operations (see Figure 2). For both 2000 and 2005, building use (51% of emissions in 2005, down from 52% in 2000) had the highest emissions. The City's vehicle fleet is the activity with the second largest impact on GHG emissions, accounting for 38% of internal City emissions in 2005 and 37% in 2000. Combined, these two activities accounted for about 90% of reportable City emissions in both years.

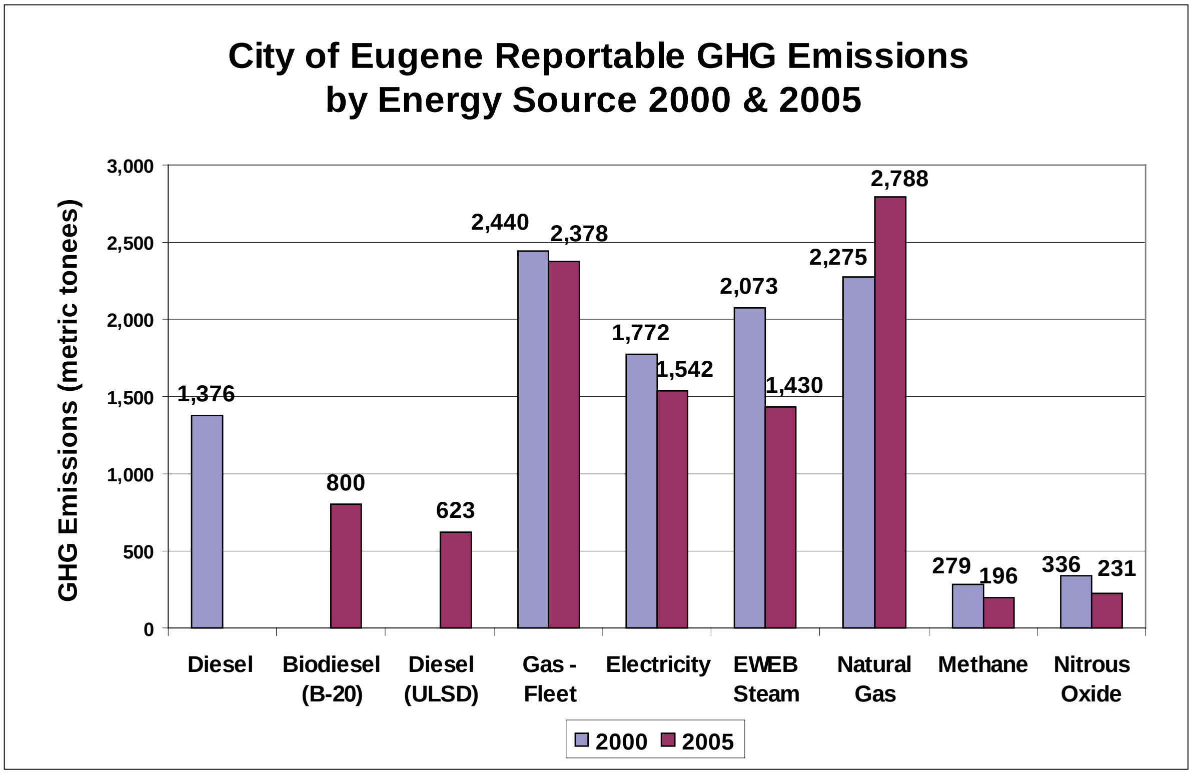
Figure 2



GHG emissions can also be considered in terms of the underlying energy source (Figure 3). Gasoline used in the City's vehicle fleet, produced the largest proportion of emissions in 2000, 23% of reportable emissions, increasing slightly to 24% of emissions in 2005. The City's use of natural gas was the largest source of reportable GHG emissions in 2005, increasing to 28% of reportable emissions from about 22% in 2000. During the same period, GHG emissions from the City's use of steam decreased from 19% of reportable emissions in 2000 to 14% in 2005. GHG emissions related to the City's use of electricity also decreased, from 17% of reportable emissions in 2000 to 15% in 2005.

Diesel fuel, which was the fifth largest source of GHG emissions in 2000, was completely replaced by the use of biodiesel and ultra-low sulfur diesel by 2005. The two remaining sources of GHG emissions – methane and nitrous oxide – are process emissions from the operation of the wastewater collection and treatment system.

Figure 3

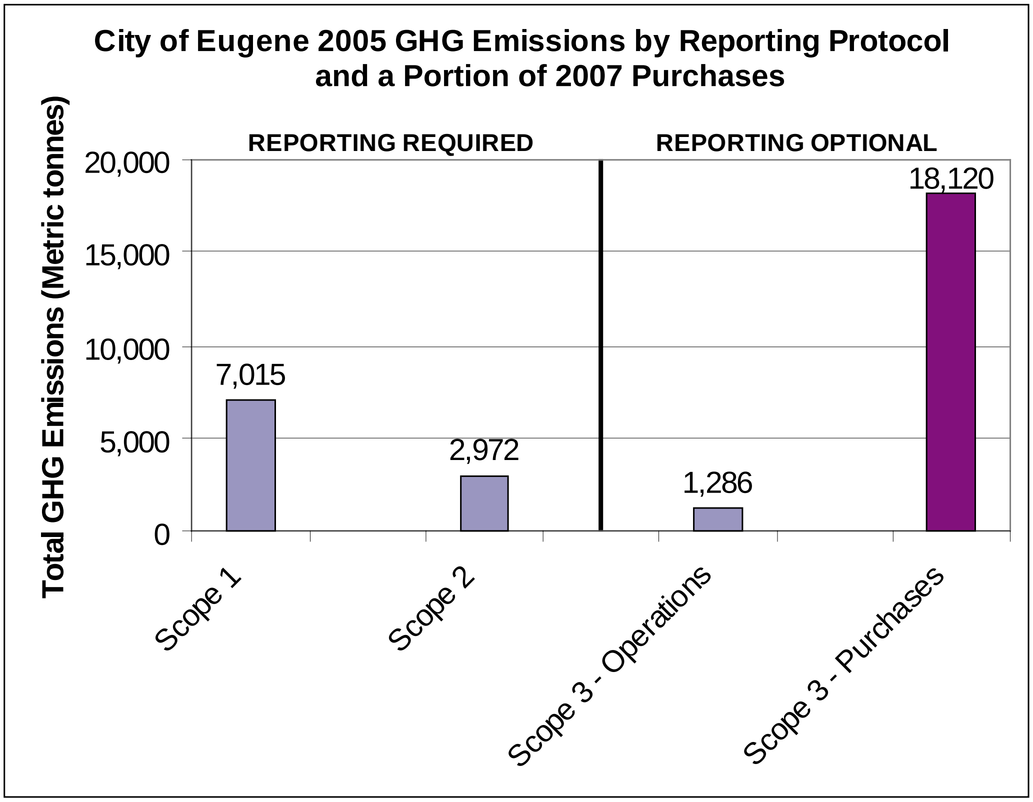


A third way to evaluate GHG emissions is by their "scope". Scope is defined by the degree of direct or indirect control an entity has over the emissions related to its activities. According to the International Council for Local Environmental Initiatives - Local Governments for Sustainability (ICLEI) Local Government Operations Protocol, Scope 1 includes all direct GHG emissions from energy consumption, such as vehicle fuels and natural gas in buildings, excluding CO^2 emissions from biomass combustion; Scope 2 includes indirect GHG emissions related to the consumption of electricity, steam, heating, or cooling energy purchased from a third party or utility; Scope 3 includes all other indirect emissions not covered in Scope 2, i.e. upstream and downstream sources outside the City's direct control to manage, including employee commuting, waste management and GHG emissions embodied in materials and services purchased by the City.

The inventory focuses on Scope 1 and 2 but also includes estimates of GHG emissions from Scope 3 activities. As shown in Figure 4, Scope 3 emissions are much larger than Scope 1 and 2 emissions combined, if embodied emissions in goods and services purchased by the City are included.

Scope 3 emissions result from those activities for which direct and indirect energy consumption is not under the City's management control, making them difficult to quantify. In addition to being outside the ability of City operation to control, it is not clear who is responsible for the emissions; there is a high potential for double-counting by different entities; there is often an absence of relevant data; and there is a lack of consensus within the GHG quantification community on how they should be measured. Due to these issues, current GHG quantification protocols provide reporting entities the option of evaluating and reporting Scope 3 emissions, however there is not a specific protocol for their quantification.

Figure 4



Scope 3 emissions are separated into an "operations" component that includes employee commute and waste disposal, and a component that represents the energy embodied in a portion of the City's purchases of goods and services.

Given current GHG reporting protocols and the council's goal of carbon neutrality based on Scope 1 and 2 emissions sources, Sections 4 and 5 of this inventory focus on reportable Scope 1 and 2 emissions. Section 6 presents a more complete review of Scope 3 emissions. While there is much uncertainty around the measurement and reporting of Scope 3 emissions, with further analysis there are many initiatives the City could also undertake to decrease these emissions.

3. Methodology for the Inventory

The purpose of this inventory is to determine the quantity of greenhouse gas emissions produced by the City of Eugene operations in the course of delivering services to the community. The inventory indicates the types of emissions produced from City activities and from which parts of the organization. This inventory establishes a baseline, from which the effect of operational changes on City emissions can be measured over time. The City's operational inventory is a subset of the community-level inventory—everything in this more detailed inventory has already been included in the broader community inventory.

This inventory was completed using the protocol and software developed by ICLEI-Local Governments for Sustainability. As a member of ICLEI, the GHG inventory software, training for staff, ongoing support, and education are available to the organization.

The ICLEI Clean Air and Climate Protection software "Government Analysis" module used for the GHG inventory has seven sectors into which data were entered: Buildings, Vehicle Fleet, Employee Commute, Streetlights, Water/Sewage, Waste and Other. These sectors reflect the broad categories of emissions-producing activities engaged in by most municipalities.

The inventory uses, as much as possible, actual measured data from activity within the City organization. This is in keeping with the intended purpose of the analysis, which is to guide specific operational decisions by City staff with regard to their GHG impacts.

The year 2000 was chosen as a baseline year for the internal inventory. Two primary factors influenced this choice. First, a number of large energy efficiency upgrades came on-line in early 2001, followed by Fleet's first purchases of hybrid vehicles and the introduction of biofuels. A year was chosen that was prior to these changes in order to capture the information about how they affected City emissions. Secondly, 2000 was the furthest year back for which reliable data for some measures was available, especially for the solid waste volume measurements. As a benchmark to measure changes in the City's internal emissions, the year 2005 was chosen to align with the community inventory which also used 2005 as a measure of "current" GHG emissions.

An estimate of GHG emissions for 1990 provides an "order of magnitude" estimate of what 1990 levels may have been for internal City operations. The 1990 estimate was also included, in part, to provide a general reference point to the community inventory, which used 1990 as a "benchmark" year. This information is not as accurate as the 2000 and 2005 data, since it was estimated by "backcasting".

3.1 Reportable Scope 1 and Scope 2 Emissions

The City of Eugene's Scope 1 and 2 emission sources include the use of electricity, natural gas, steam, vehicle fuels, wastewater and solid waste. The City's utility tracking system allowed compilation of very detailed information from monthly utility bills for use in many of the analytic tasks. In order to provide information for a preliminary internal GHG inventory, undertaken in 2006, the City's utility tracking capability was expanded to include not only buildings, but also streetlights and signals, and the operation of the Wastewater treatment plant. With these additions, the vast majority of the City's energy use is now tracked. For a small number of leased facilities, where utility bills are not paid directly, energy use on a per square foot basis has been estimated.

Information on vehicle fleet fuel use was available from the Public Works Fleet Division. Data for 2005 was readily available, but data for the baseline year of 2000 required hand-entry and compilation from a previous data management system's hard copy data.

The Wastewater Treatment Plant and associated pump stations create two types of GHG emissions. Emissions from the direct use or consumption of energy (buildings, pumping and vehicle fuels) are included as described above. A second type of emissions comes from the material flowing through the plant. Those emissions are dependent, in part, on how that material is handled, or "processed". With the exception of methane, information on the process-related emissions from the Wastewater Treatment Plant is not currently collected on a regular basis. However, a separate inventory of process-specific emissions at the Wastewater Treatment Plant was developed concurrently with the internal GHG inventory. Air-borne emissions of Nitrous Oxide (N_20) from treatment plant processes were added from the Wastewater process-specific emissions inventory into the internal emissions inventory to provide a more complete picture of internal City emissions. As the Wastewater Treatment Plant serves both Eugene and Springfield, Eugene's portion of total plant and pump station emissions was allocated based on Eugene's proportion of the plant's service area population.

The compiled data for 2000 and 2005 were entered into the ICLEI Clean Air and Climate Protection software. The software applies factors to convert all energy and waste data into common carbon dioxide equivalent units or CO^2e, (in this report simply called CO^2). All emissions data in this report is expressed in metric tonnes (MT) of CO^2e, the international standard for measuring and comparing CO^2 emissions.

The conversion factors (also called CO^2 coefficients) are provided in the program, but can be adjusted to reflect local conditions. (See Appendix 1) ICLEI model default values were used for vehicle fuels and natural gas since they accurately reflect the City's fuel use. However, it was necessary to customize the coefficients for EWEB steam and electricity. EWEB steam is generated with natural gas and then piped under pressure to customer locations, resulting in significantly lower energy efficiency than the direct use of gas. Working with EWEB, a custom coefficient for steam that takes system efficiency into account was calculated for 2000 and 2005. EWEB electricity has a CO^2 coefficient that is significantly lower than the regional average, due to the high percentage of hydroelectric power. EWEB also provided more accurate CO^2 coefficients for electrical energy for 2000 and 2005.

To determine GHG emissions for 1990, backcasting was undertaken for building and fleet fuel use by using the annual rate of change between two known points, 1994 and 2000, applied backward from 1994 to 1990. For streetlight/signal and wastewater plant emissions the 2000 GHG emissions per capita were used to estimate 1990 levels based on the change in Eugene's population. These estimates were then included in the ICLEI model.

3.2. Scope 3 Emissions

The City's Scope 3 emission sources include vehicle fuels used by City employees commuting to work, disposal of the City's solid waste from internal operations, and the embodied energy in goods and services purchased by the City.

Employee commute information for 2000 and 2005 was available from recent surveys undertaken by the City's Transportation Options team. 1990 employee commute figures were backcasted using 2000 emissions per full time equivalent (FTE), applied to the 1990 FTE.

Information on internal City solid waste volumes for 2000 was furnished by the Solid Waste and Recycling program within the Planning and Development Department (PDD). Data for 2005 waste volume was available from waste hauler service records.

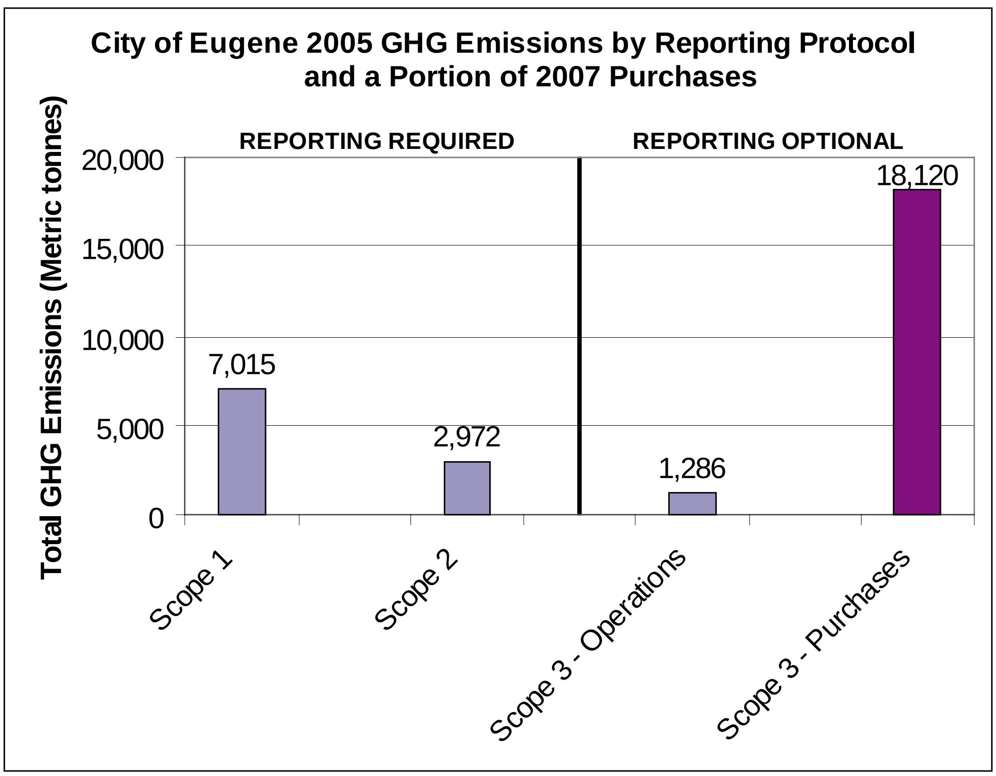
An initial estimate of the potential emissions from a portion of the goods and services purchased by the City of Eugene was provided by the Good Company, a Eugene firm specializing in sustainability research and consulting. See Section 6 for discussion of Scope 3 emissions.

4. Analysis of Inventory Findings

The analysis of the City's GHG emissions from operations is based on the concept of "Scope", a regional, national and internationally recognized method to define responsibility for measuring and controlling emissions. Various reporting methodologies, including ICLEI, the Western Regional Climate Registry as well as others, categorize emissions into three "scopes", based on the degree of direct or indirect control an entity has over the emissions related to its activities. Under the ICLEI Local Government Operations Protocol, Scope 1 includes all direct GHG emissions; Scope 2 includes indirect GHG emissions related to the consumption of energy produced by and purchased from a third party or utility, and Scope 3 includes all other indirect emissions not covered in Scope 2, i.e. upstream and downstream sources outside the City's direct control to manage. It is expected that future reporting required under both ICLEI and the Western Regional Climate Registry will be based on the concept of "Scope", with public reporting required for Scope 1 and Scope 2 emissions and optional reporting of Scope 3.

Figure 4, repeated below from the executive summary, shows the relative GHG emissions from City activities by Scope.

Figure 4



For the City of Eugene's operations, GHG emissions in Scope 1 include: natural gas used in buildings; emissions from wastewater treatment; and all fuels used in the vehicle fleet–biodiesel, diesel, ultra-low sulfur diesel and gasoline. Scope 2 emissions include: electricity for buildings, wastewater operations, streetlights and signals; and EWEB steam used in City buildings. Scope 3 emissions include gasoline from employee commuting, and waste products produced by City operations as well as goods and services. Table 1 shows the specific components of each of the three Scope areas for the City of Eugene's operations in 2005.

Table 1

2005 City of Eugene
Internal Greenhouse Gas Emissions
By Scope

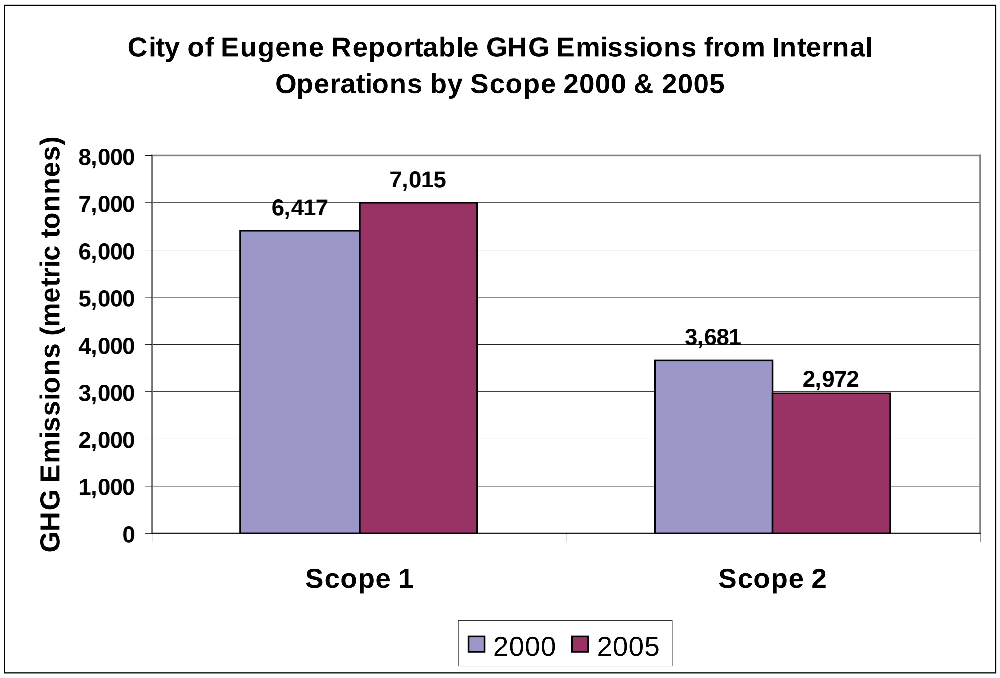
Scope 1	Metric Tonnes
Natural Gas--Buildings	2,738
Gasoline--Vehicles	2,378
Biodiesel (B-20)--Vehicles	800
Diesel (ULSD)--Vehicles	623
Methane-WW treatment	196
Natural Gas--WW treatment	49
Nitrous Oxide-WW treatment	231
Scope 1 Total	7,015
Scope 2	
EWEB Steam--Buildings	1,430
Electricity-Buildings	895
Electricity--WW treatment	302
Electricity--Streetlights & Signals	345
Scope 2 Total	2,972
Scope 3 - Operations	
Gas--Empl. Commute	1,633
Food Waste	57
Plant Debris	-57
Wood/Textiles	-58
Paper Products	-289
All Other Waste	0
Scope 3 Total	1,286
Scope 3 - Purchasing	
Partial Regional Purchases	18,120

The goal of carbon neutrality by 2020 adopted by the City Council in October 2008, covers all Scope 1 and Scope 2 emissions. This inventory focuses primarily on the "reportable" GHG emissions of Scopes 1 and 2, and secondarily on the Scope 3 emissions (outlined in Section 6, and in Appendix 2) related to City internal operations. .

4.1 Results by Scope

Overall, between 2000 and 2005 the combined Scope 1 and 2 emissions decreased slightly – about 1.14% or 108 MT. Scope 1 emissions increased by about 598 MT during this period, while Scope 2 emissions decreased by 709 MT. The fact that the City of Eugene's GHG emissions decreased between 2000 and 2005 reflects both the City's focus on energy conservation and the City's commitment to the principles of sustainability adopted by the City Council in 2000. The City's experience in reversing growth in GHG emissions will also provide an important springboard for implementing future GHG reduction strategies.

Figure 5

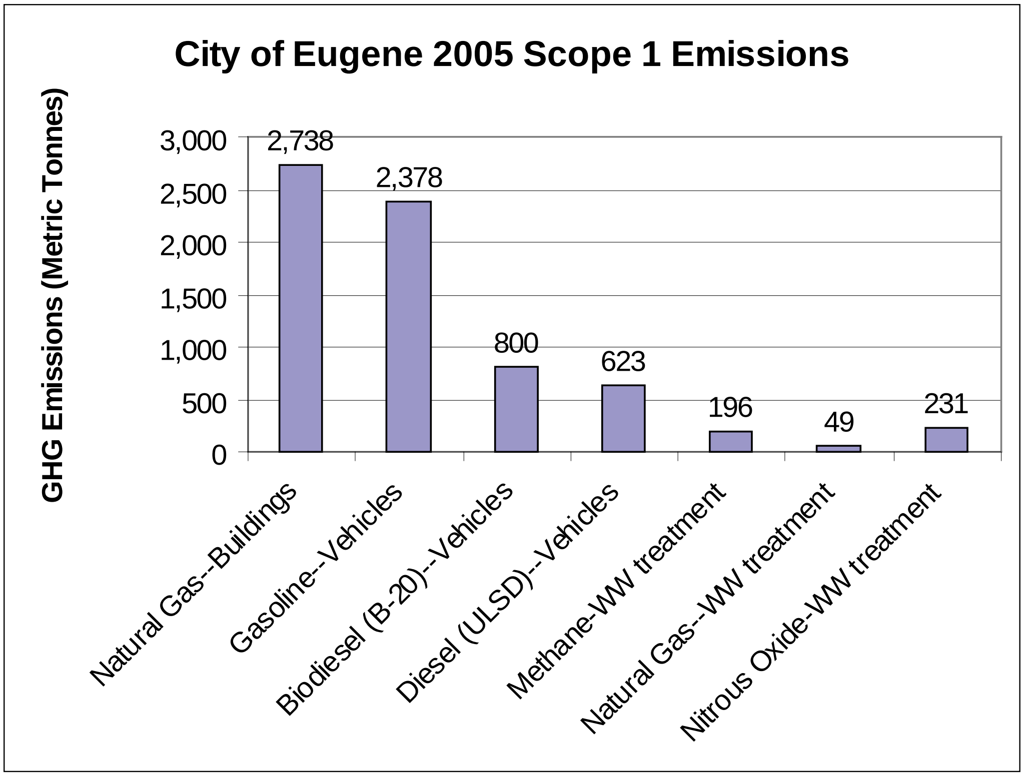


Scope 1

Scope 1 is the largest contributor of reportable GHG emissions for the City. This category increased from 64% of total emissions in 2000 to 70% in 2005.

During 2005, natural gas used in City buildings and gasoline consumed by fleet vehicles are the largest emission sources within Scope 1. (See Figure 6 below) Between 2000 and 2005, natural gas use increased by about 480 MT. This reflected both an increase in total square footage of City buildings using natural gas as an energy source and the expansion of Amazon Pool, which uses natural gas as the primary energy source for heating pool water. During the same period, emissions from fleet vehicle fuels showed mixed performance. Gasoline emissions decreased slightly (about 33 MT) while diesel fuel emissions increased by about 100 MT.

Figure 6



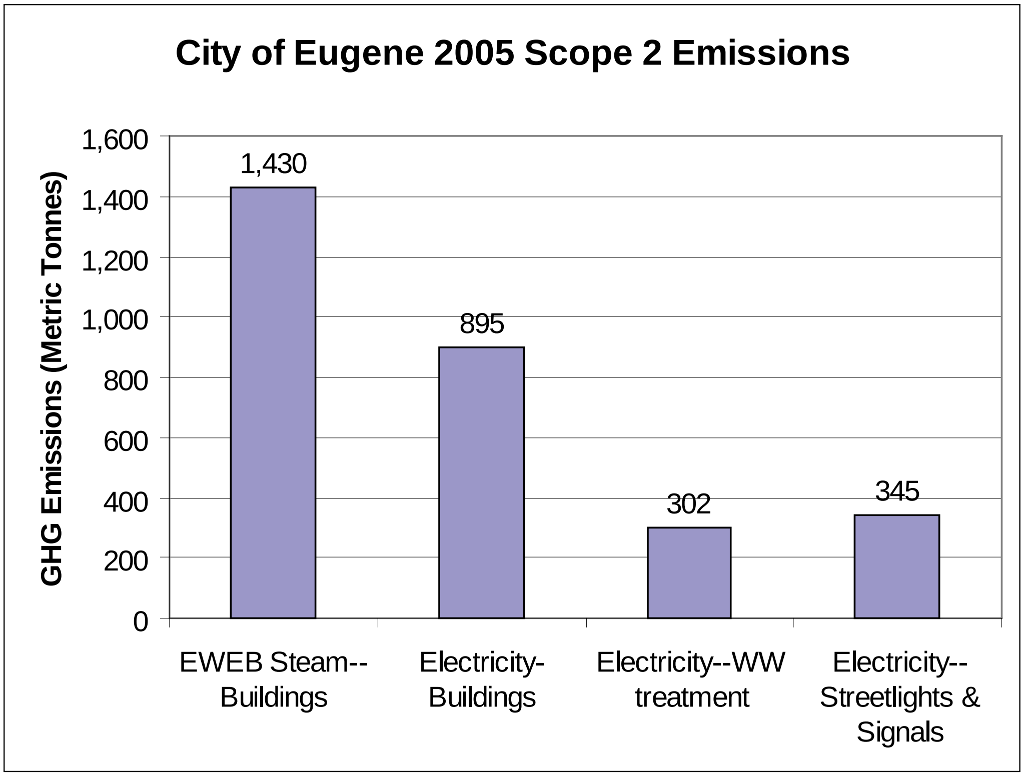
Scope 2

For the City of Eugene, Scope 2 emissions consist entirely of electricity and steam purchased from EWEB. Between 2000 and 2005, Scope 2 emissions from City operations decreased 18 percent, from 3,846 MT in 2000 to 3,143 MT in 2005.

The City's use of EWEB steam for building heating was the largest source of Scope 2 emissions in 2005 (Figure 7 below). Emissions from steam heating decreased markedly from 2000, by over 640 MT, due in large part to the elimination of the old Library and Sears buildings from the City system. Energy conservation projects in a number of City facilities and parking structures also contributed to this decrease.

Building electrical use also decreased, even with the addition of about 250,000 square feet (12 percent increase) to the City's building inventory. Energy used in City streetlights and traffic signals decreased at the same time the signal system expanded, due to energy saving measures implemented by the Public Works Department. Electrical use by the Wastewater Treatment Plant is heavily influenced by increased population and economic activity, which increases the demand for sewer services. However, electrical energy use by the Wastewater Treatment Plant increased only slightly, while population increased by 7% during the same period. The slow growth in energy consumption at the Wastewater Treatment Plant is primarily due to the use of methane captured during the treatment process that is used to generate about half of the electricity required to operate the plant.

Figure 7

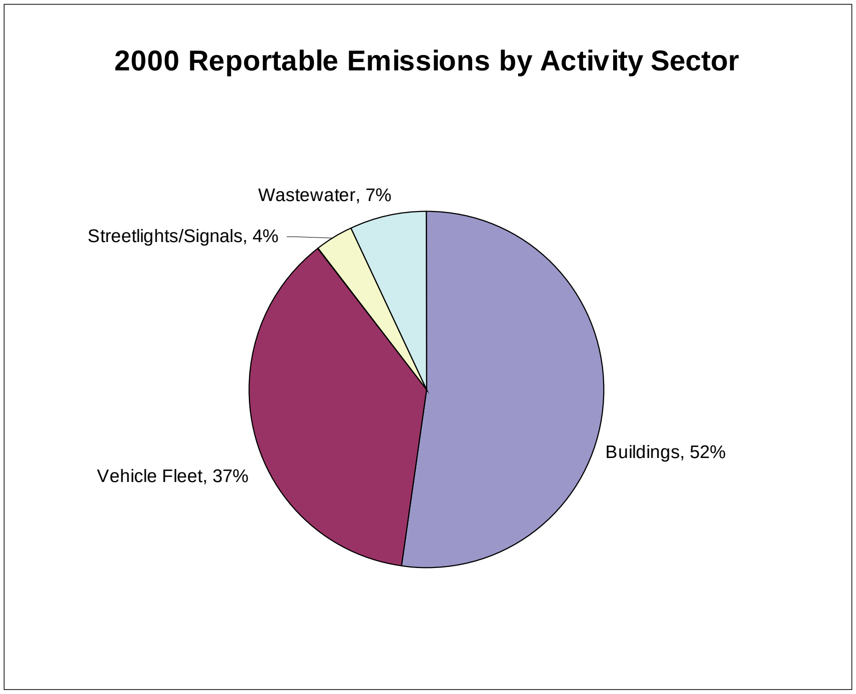


4.2 Results by Activity Sector

GHG emissions from internal City operations can also be classified by activity sector, including: buildings, vehicle fleet (which includes gas-powered mobile and stationary equipment e.g. lawn mowers and generators), streetlights and signals, and wastewater. Figure 8 shows reportable GHG emissions from City operations for the year 2000. Each activity includes a mix of Scope 1 and Scope 2 emissions sources. Looking at GHG emissions by activity sector can help focus strategies on areas with high emissions.

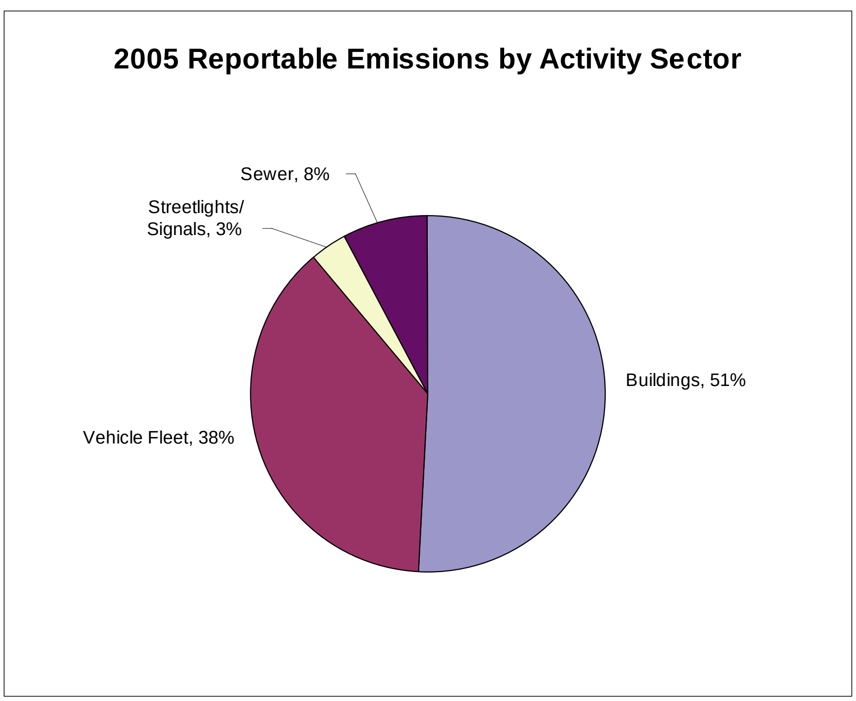
In 2000, buildings accounted for 52% or 5,270 MT of City GHG emissions while fleet vehicles contributed 37% or 3,749 MT. Wastewater-related emissions and the streetlights and signal system use of electricity were minor contributors (11% combined) to reportable emissions in 2000.

Figure 8



Emissions in 2005 show a slight overall decrease from the year 2000, and there was little change in the relative emissions contribution of the activity sectors. In 2005, 51% (5,064 MT) of emissions were from City buildings, 38% (3,805 MT) from the City's vehicle fleet, and 11% from the wastewater and streetlights/signals activity sectors. (Figure 9)

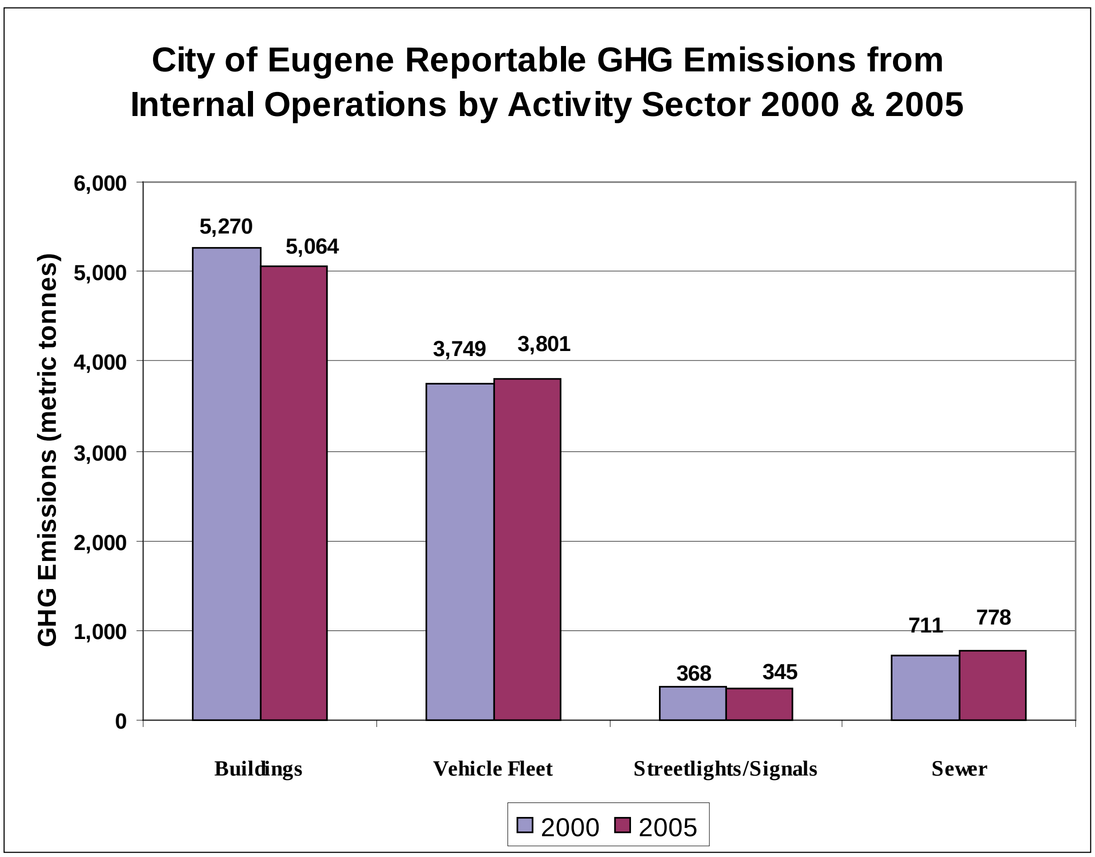
Figure 9



While the overall proportion of reportable emissions for each activity sector was relatively constant from 2000 to 2005, the change in volume of emissions within the sectors was more significant. The comparison of GHG emissions for each activity sector between 2000 and 2005 is shown in Figure 10 below. There is a difference in the performance of each major sector. Building-related emissions decreased by about 4%, while emissions related to fleet increased by 2%.

As noted in the discussion of emissions by scope, even though building energy use decreased between 2000 and 2005, the City's building inventory increased by 12 percent. Opening of the new Library involved a switch from steam energy used to heat the old Library to natural gas in the new, larger building. In addition the total water volume of the Amazon Pool complex was doubled in 2002. The 4% decrease in total building energy emissions, reflects both success of the City's energy conservation program, and the impact of reducing the use of steam energy in favor of more efficient fuel sources.

Figure 10



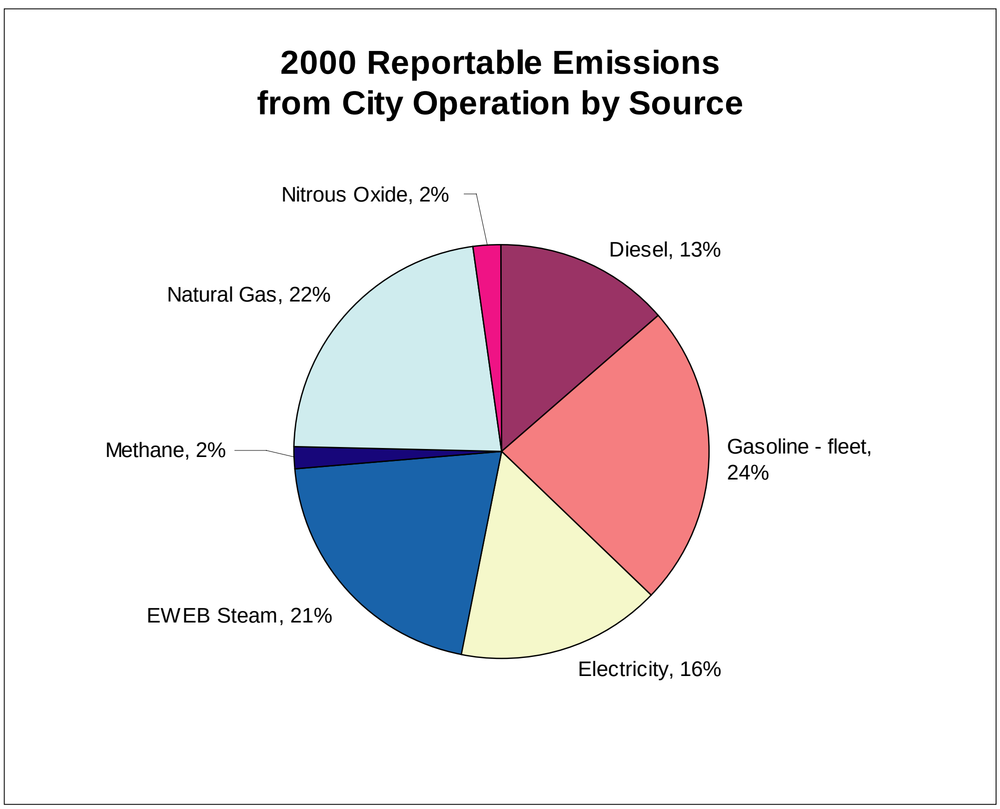
The City's streetlight and traffic signal system used less electricity between 2000 and 2005, decreasing electrical use by about 6% even though the City's network of street lights increased by 14% during the same period. This reduction in energy consumption, and associated emissions was due to the Public Works Department's adoption of higher efficiency lighting, including the system-wide adoption of green Light Emitting Diodes (LED's) in traffic signals. Wastewater Treatment Plant emissions reflect the increase in total sewage volumes as a result of growth in the Eugene-Springfield metro area.

4.3 Results by Energy Source

To be most effective, greenhouse gas reduction strategies need to target the major energy sources producing emissions, and the energy sources that can most effectively reduce GHG emissions. This section shows the composition of the City's internal GHG emissions by energy source in 2000 and 2005, and compares the change in volume of emissions by energy source between 2000 and 2005.

In 2000, gasoline used in the City vehicle fleet was the single largest source (24%) of GHG emissions from internal operations. When combined with diesel emissions (13%), vehicle fuels comprised 37% of emissions from internal operations. (Figure 11)

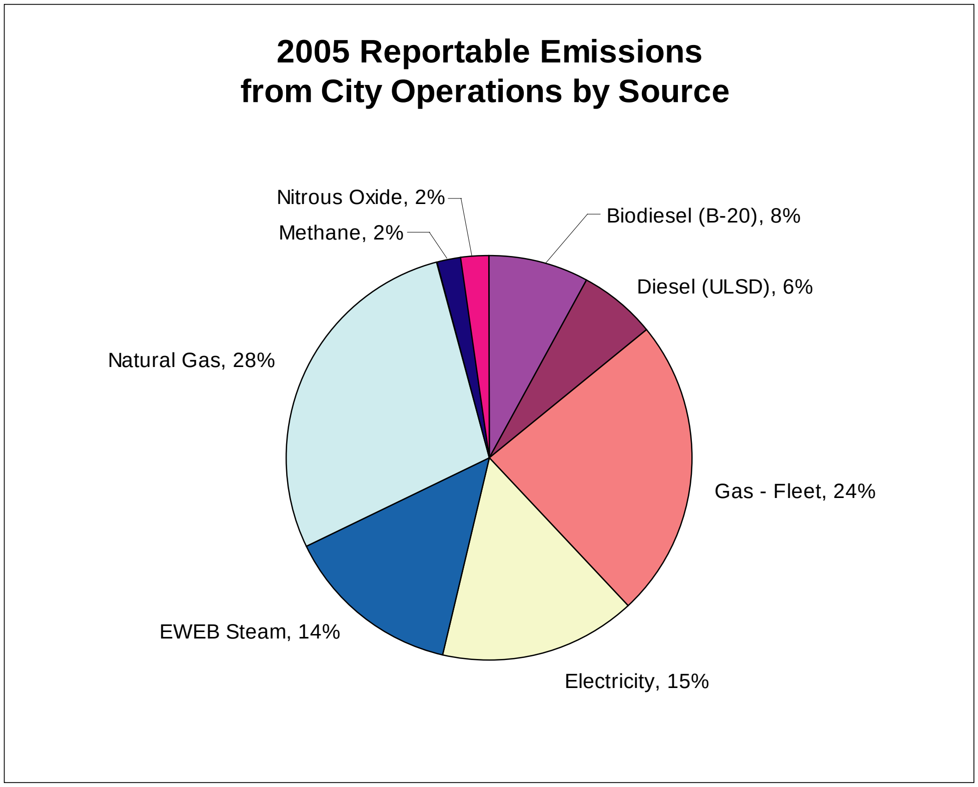
Figure 11



The use of natural gas (22 %) and steam energy (21 %), in City buildings, were the next largest contributors to GHG emissions in 2000. Electrical energy at 16% was the fourth largest source of operational GHG emissions in 2000.

In 2005, the mix of GHG emissions changed, with emissions from consumption of natural gas increasing to 28% of internal GHG emissions (Figure 12). The proportion of City GHG emissions from steam decreased from 21% to 14%. The proportion of GHG emissions from vehicle fuels – gasoline, biodiesel, and Ultra-Low Sulfur Diesel (ULSD) – stayed relatively constant, amounting to 28% of operational emissions in 2005.

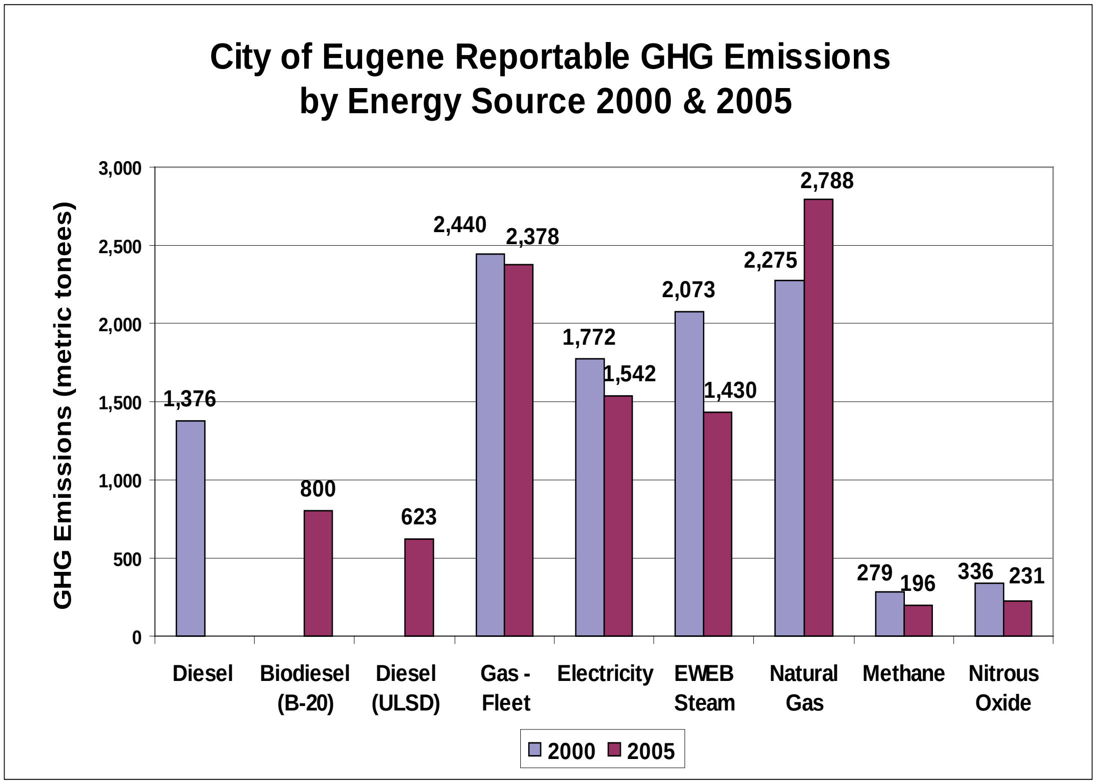
Figure 12



GHG emissions from the City's use of natural gas increased significantly, 23 % between 2000 and 2005 (Figure 13). While emissions from most other energy sources decreased during this time. This trend is likely to continue as downtown City buildings convert from steam to natural gas-fired boilers.

While the GHG emissions from vehicle fuels increased slightly between 2000 and 2005, the City's use of gasoline decreased by about 2.5%, from 2,440 MT in 2000 to 2,378 MT in 2005. Although the City's use of biodiesel and ultra-low sulfur diesel completely replaced standard diesel fuel by 2005, overall emissions from diesel-based fuels increased about 3.5%, from 1,376 MT in 2000 to 1,423 MT in 2005.

Figure 13



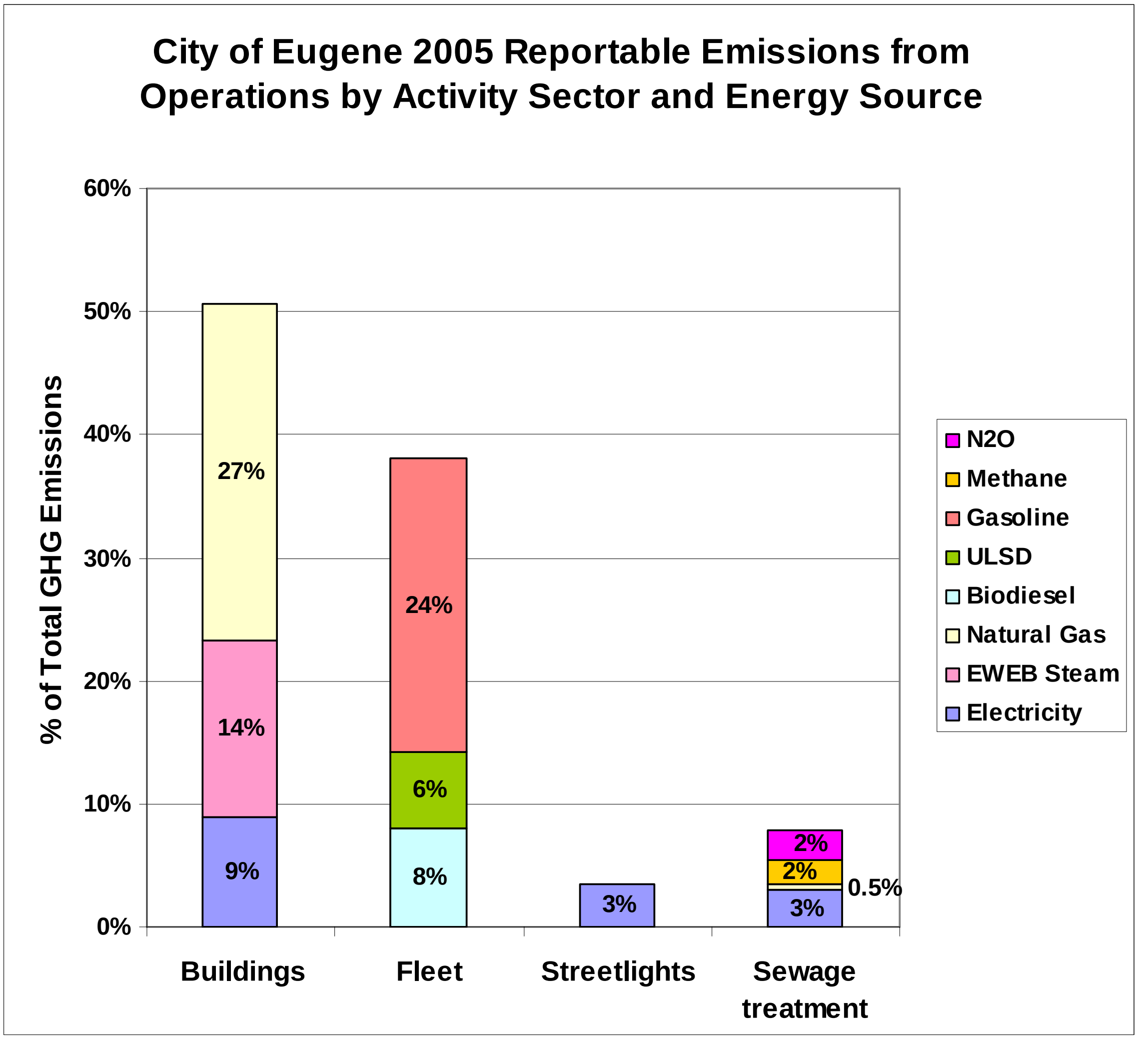
Emissions from electricity used in City buildings, streetlights, signals and at the Wastewater Treatment Plant decreased from 1,772 MT in 2000 to 1,542 MT in 2005. The additional use of electricity in new City buildings and expansion of the street light and traffic signal systems was more than offset by increased efficiency in the use of electricity through building energy improvements and the switch to higher efficiency lighting systems in the City's buildings, street lights and traffic signal systems.

The City's use of energy from EWEB's steam system decreased significantly between 2000 and 2005, from 2,073 to 1,430 MT of GHG emissions. Steam is used almost exclusively in building heating systems during the winter months. Eliminating the old Library and the Sears building from the system, and implementing energy conservation projects that increased heating efficiency in downtown City buildings reduced the City's demand for steam.

4.4 Results Combined by Sector and Source

Knowing the specific sources and activities related to GHG emissions, the City can identify emissions reduction strategies. Looking at the City's operational GHG emissions by both activity sectors and sources of energy can help identify inter-relationships that could be useful in developing emissions reduction strategies. (Figure 14 below) Understanding how the activity sectors and energy sources interact will help in prioritizing actions and developing targeted programs. For example, the building sector produces the largest amount of GHG emissions from City operations and is composed of three very distinct energy sources. Similarly, the combined emissions from electricity used by the streetlight/signals and the sewage systems are roughly equal to emissions from electricity used in City buildings. The strategies targeting the more dispersed uses of electricity may be different than programs addressing building electricity use.

Figure 14



5. Results by Department

This section reviews the relative GHG emissions by department and major divisions within the City organization.

5.1 Overview of Emissions by Department

To help identify reduction strategies, each department's contribution to total emissions is identified. Factors underlying departmental emission changes are also outlined.

The Public Works Department (PW) has the highest percentage of GHG emissions related to the City's operations in both 2000 and 2005 (Figures 15 & 16). The PW emissions include all streetlight and signal systems, the wastewater collection and treatment system, and the majority of the operation of the Eugene Airport, as well as emissions from the use of City buildings and fleet vehicles by PW staff. PW emissions remained stable between 2000 and 2005, but since the total City-wide emissions decreased slightly over this time, the PW share of total emissions increased slightly by 1% from 34% to 35% (Figure 17).

Figure 15

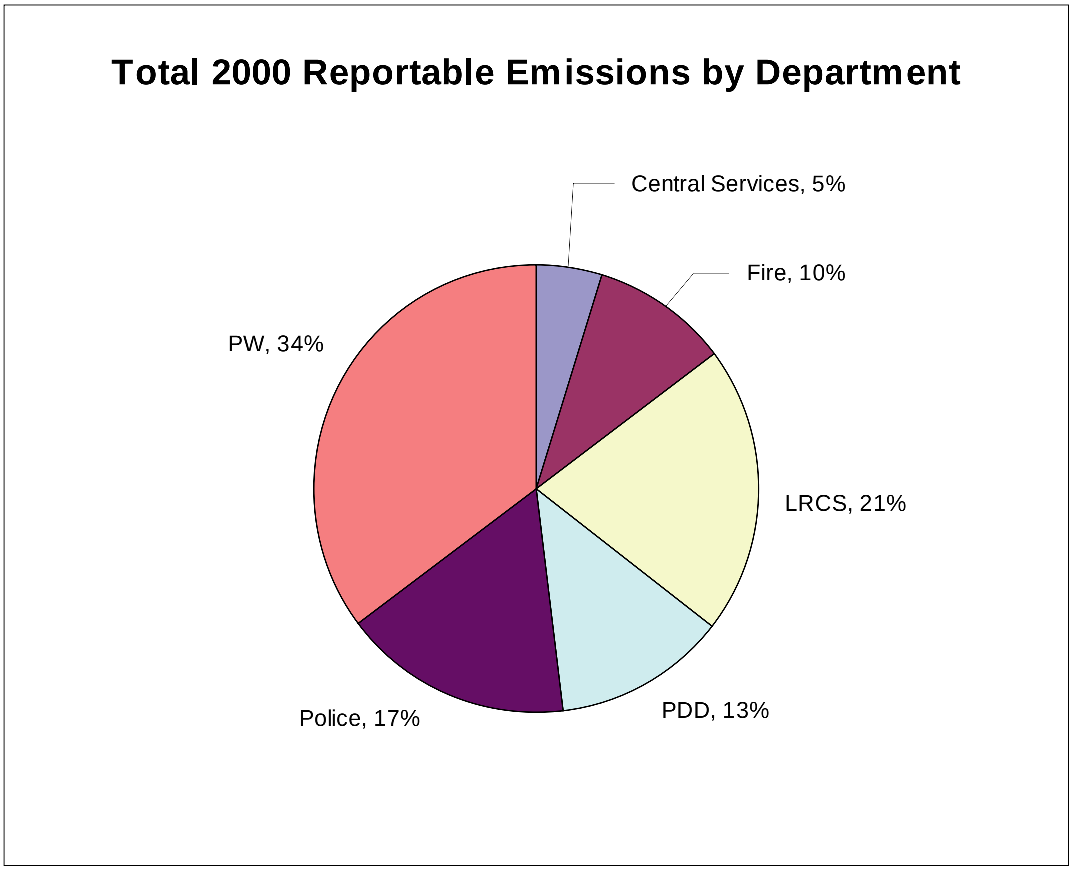
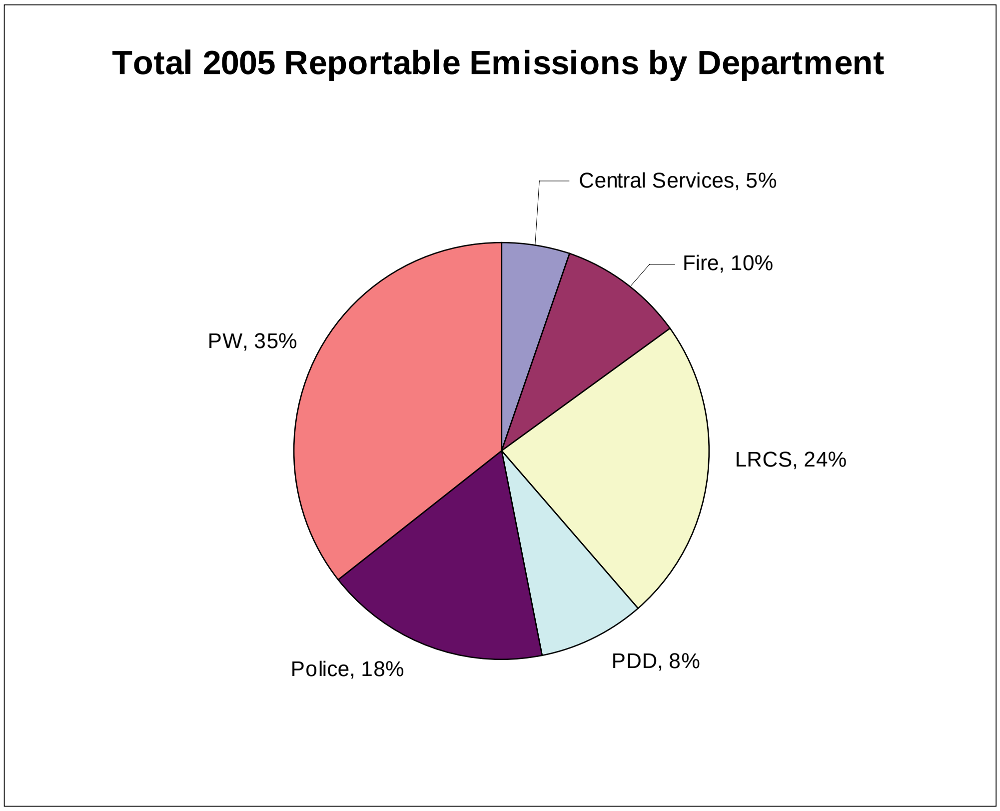
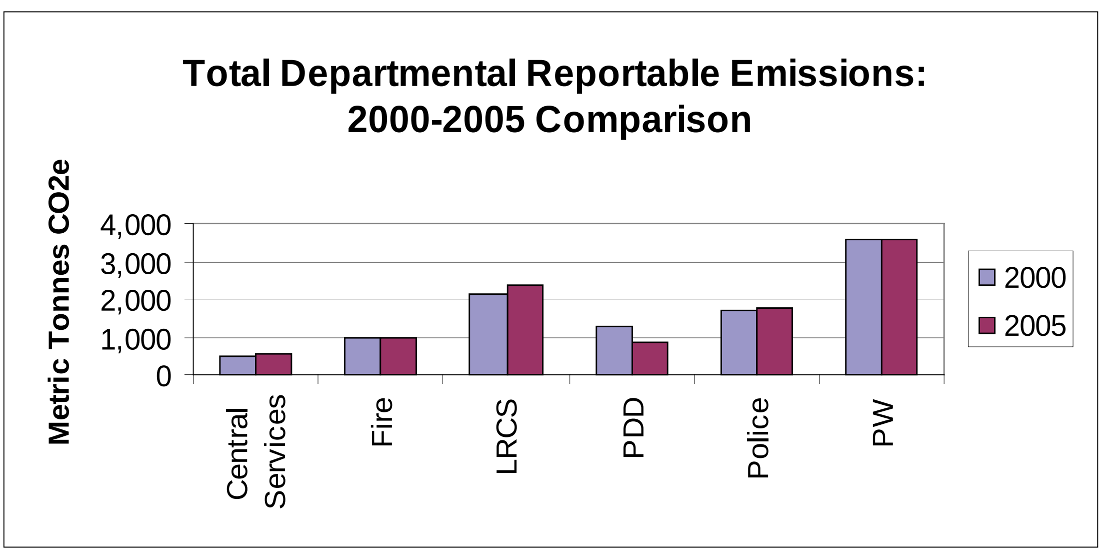


Figure 16



The Library, Recreation and Cultural Services Department (LRCS) has the next highest carbon footprint in the City. LRCS' emissions are predominately related to building energy, especially swimming pools. The LRCS' share of emissions increased from 21% to 24% over the study period. Actual emissions from LRCS activities increased 10% due primarily to the expansion of Amazon pool.

Figure 17



The Police Department has the third largest portion of departmental GHG emissions - 17% in 2000 and 18% in 2005. Police Department emissions are primarily from vehicle use to provide Police services. About 73% of the Police Department's total carbon footprint is from the vehicle fleet.

The Fire Department's GHG emissions represent about 10% of City departmental GHG emissions in both 2000 and 2005 with actual emissions also remaining stable. Emissions from Fire Department operations are split between buildings and fleet. While the use of vehicle fuels account for the majority of Fire's carbon footprint, the building energy used at the 2nd and Chambers headquarters and training complex as well as 10 fire stations also contribute a large proportion of Fire's total GHG emissions.

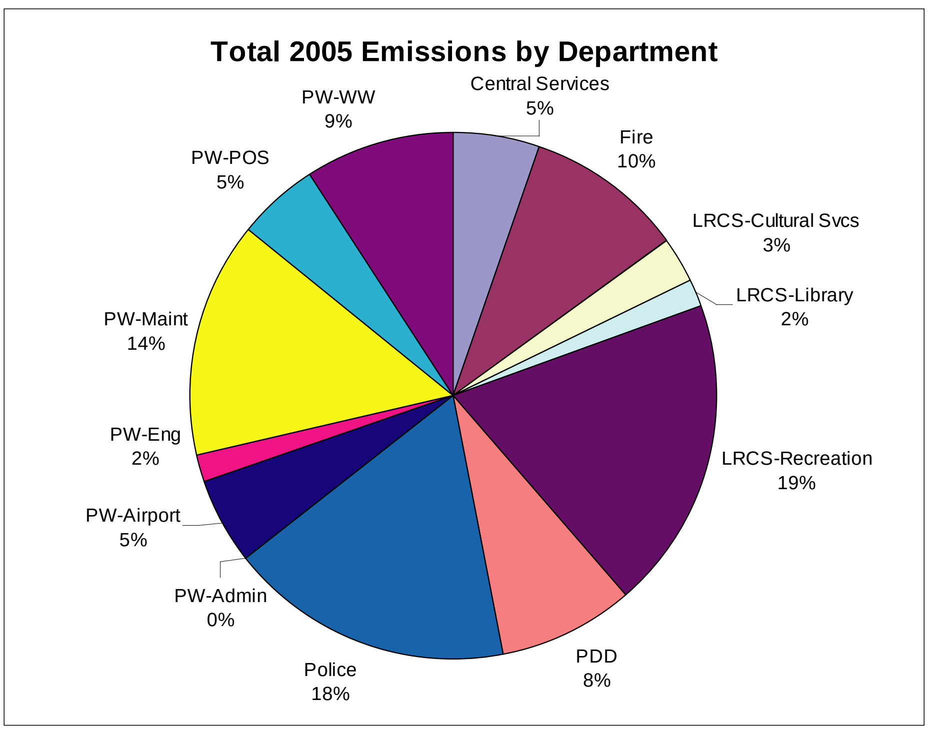
The Planning and Development Department (PDD) showed a significant decrease in their share of City-wide GHG emissions, from 13% in 2000 to 8% in 2005. This change was primarily a result of a "whole building" energy retrofit at the Atrium, which halved the Atrium's demand for energy.

The Central Services (CS) Department was responsible for 5% of total City emissions in both 2000 and 2005. Central Services' emissions increased less than 1%, between 2000 and 2005. The majority of CS emissions come from energy use in buildings.

5.2 Analysis by Department and Division

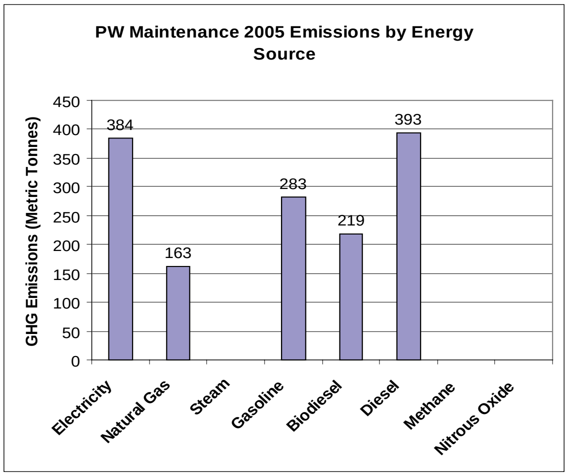
Knowing the origin of 2005 emissions at the departmental level and the two departments with the largest emissions at the division level (Figure 18), can be helpful in developing emissions reduction strategies specific to those workgroups.

Figure 18

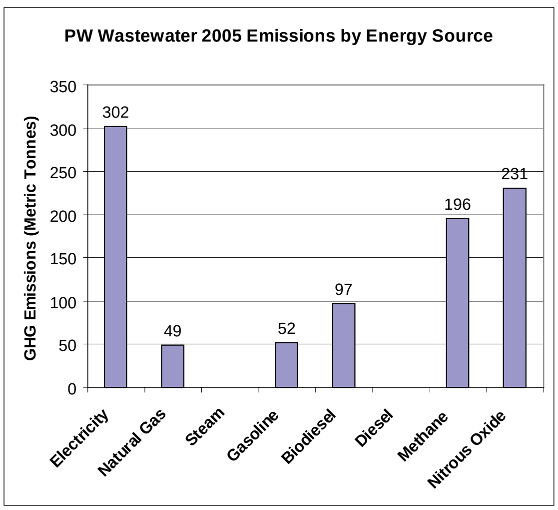


5.2.1 Public Works Department

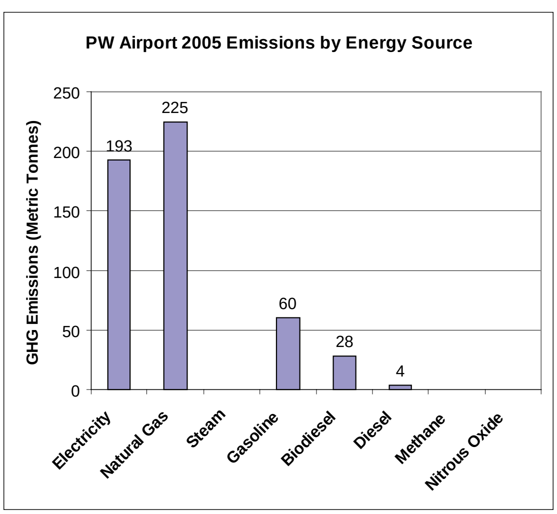
The Public Works Department is the largest City department and encompasses five divisions with varied missions and equally varied emissions signatures.



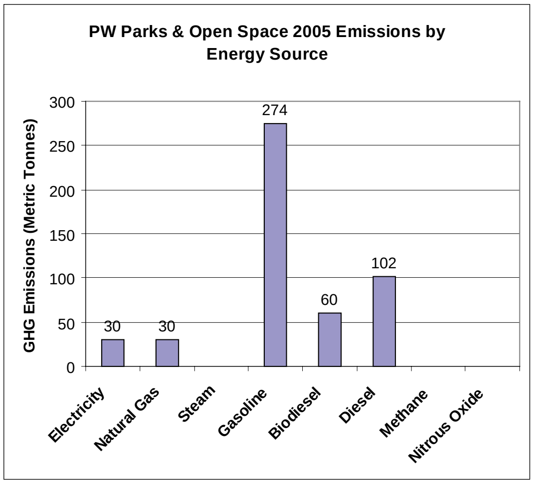
a. Public Works Maintenance (PWM) is the largest emitter of the departments, with 14% of the City's overall emissions. Emissions from vehicles needed for street, sewer and stormwater system maintenance are the source of most of PWM's emissions, followed by the electricity used by streetlights and signal operations. Natural gas for heating PWM's Fleet Maintenance shop, offices and other facilities is the final segment of PWM emissions.



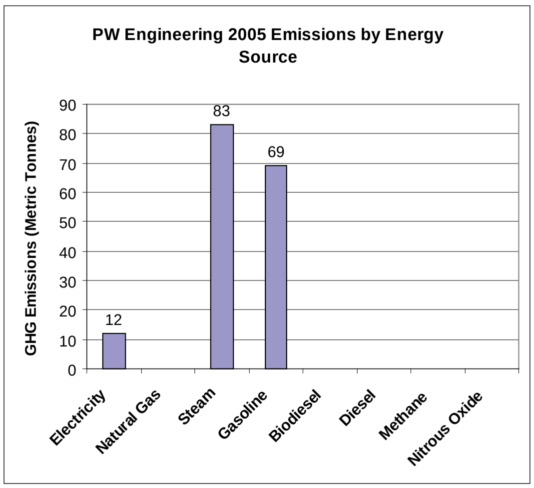
b. The Wastewater Division (PWW), the next largest source of emissions within Public Works, comprises 9% of total City emissions. Electricity to power the industrial equipment and, to a lesser extent, buildings at the plant, is the largest source of emissions for PWW. Direct emissions of air-borne nitrous oxide and methane, from wastewater processing are also significant emissions sources. Transportation fuels and natural gas for buildings and a small amount of process heat are the three smaller sources of PWW emissions.



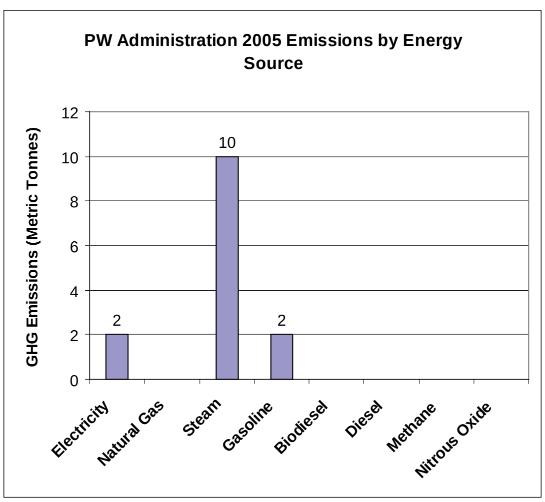
c. The Eugene Airport is another division of Public Works. Just over 5% of the City's emissions come from Airport operation. This includes only City operations, and not the impact of airplanes flying into and out of Eugene. The largest portion of the Airport's emissions is from the use of natural gas to heat the terminal and other buildings. Electricity used for taxiway and parking lot lighting and building operation contributes the second largest portion of the Airport's emissions. Vehicle fuel use is a relatively minor contributor of emissions.



d. The Parks and Open Spaces Division (PW-POS) also contributes about 5% of the emissions of City operations. PW-POS is the workgroup with the largest portion of their emissions coming from vehicle fuels, especially gasoline. Electricity for park lighting and natural gas for office heating produces small amounts of emissions, in almost equal portions.



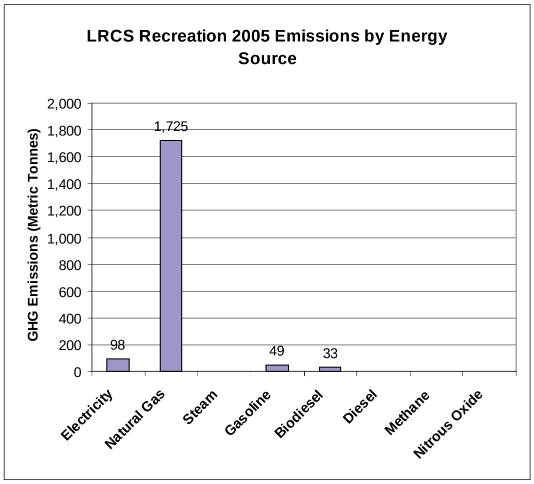
e. Public Works Engineering's (PWE) share of City emissions is 2% for 2005. PWE's impact comes from two primary sources, steam for space and water heat in office space and gasoline for vehicle use. This includes only emissions from PWE's operations. An indication of the GHG emissions embodied in contracted construction work managed by PWE is discussed in Section 6.



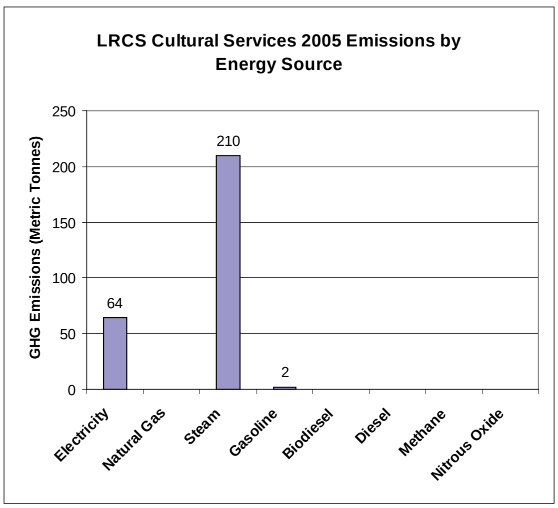
f. Public Works Administration, has an emissions share of less than 1% (and is thus barely noticeable on the charts). The work of this division is mostly office-based. The footprint is from the steam and electricity needed to operate the buildings, and a small amount of transportation fuel.

5.2.2 Library Recreation and Cultural Services

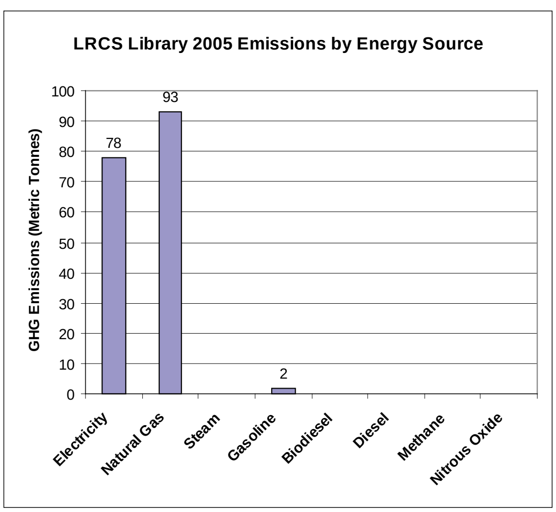
The Library, Recreation and Cultural Services (LRCS) Department produces about one quarter (24%) of the City's operational emissions. Of the three LRCS Divisions, as noted in the department's name, the Recreation Division is responsible for the majority of the department's emissions. The Recreation Division's GHG emissions increased significantly between 2000 and 2005, in part due to the renovation/expansion of the Amazon Pool.



a. The Recreation Division within LRCS has the largest GHG emission of any division of the City - 19% of total City GHG emissions. This is due primarily to heating the City's three pools, which consume 61% of the natural gas used by the City. Even after a series of energy conservation projects, the pools account for almost one-quarter of the City's total building energy costs. Electricity and vehicle fuels are minimal contributors by comparison.

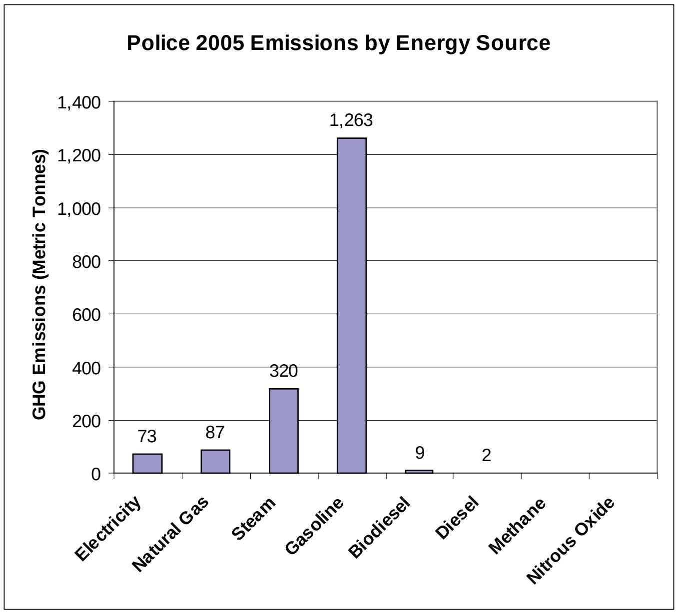


b. Cultural Services' (CS) emissions are 3% of Citywide emissions. The operation of the Hult Center is responsible for the majority of the CS emissions, with a small contribution from electrical use at the Cuthbert. The Hult is heated by steam, which is the primary emission source there. It is likely that efficiency upgrades put in place since 2005 have already reduced the Hult's footprint to some extent. The future replacement of steam energy is likely to help further.



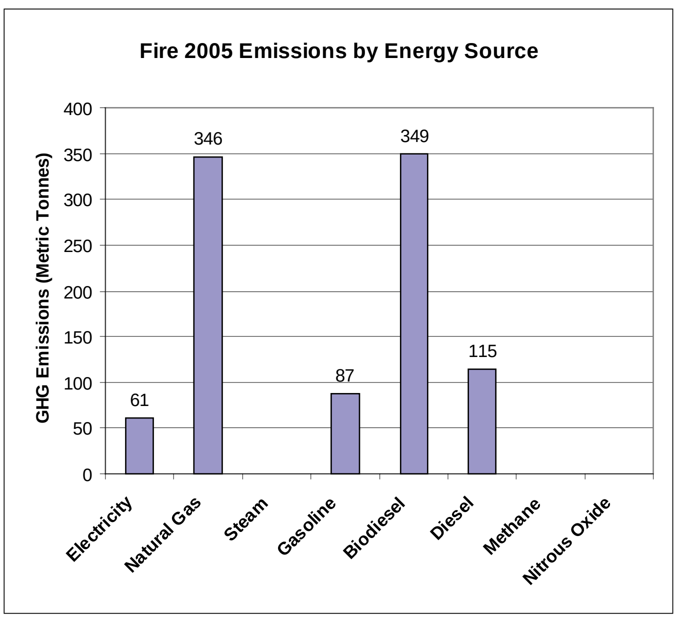
c. The Library has the lowest GHG emissions of all the LRCS Divisions, with only 2% of total City emissions. The Library's impact comes, almost entirely, from operating the three library branches, Downtown, Sheldon and Bethel. All three use natural gas for space and water heating, and electricity for ventilation, cooling, lighting and equipment. A very small amount of emissions come from vehicle use. (LRCS Administration is included in the Library figures.)

5.2.3 Police Department



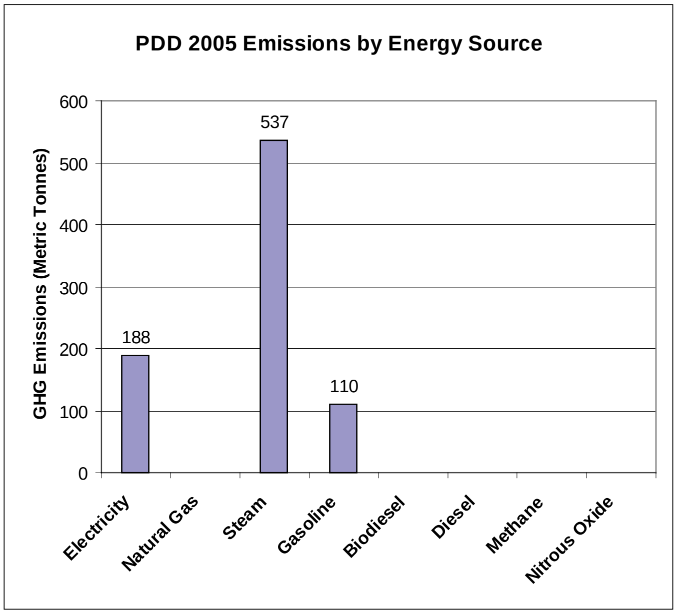
Police Department (EPD) accounts for 18% of total 2005 City GHG emissions. Although the EPD emissions information is not broken down by division, the majority (73%) of Police GHG emissions originate from gasoline use in Police vehicles. The impacts of buildings account for the remainder of the emissions profile for EPD, with steam use being the largest of those factors, followed by small electricity and natural gas components.

5.2.4 Fire Department



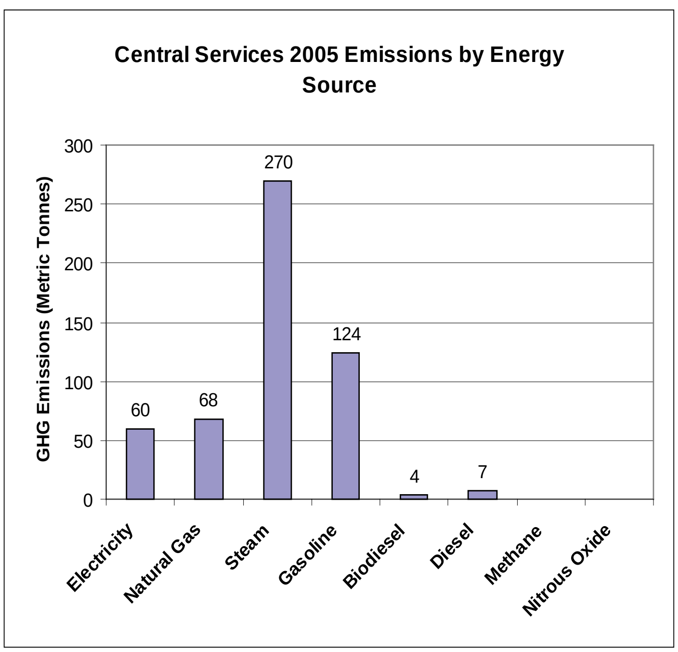
The Fire Department's GHG emissions, which represent about 10% of City Departmental GHG emissions, are split between buildings and fleet. While the extensive use of vehicle fuels account for a majority of Fire's carbon footprint, the building energy related to the 2nd and Chambers headquarters and training complex as well as 10 fire stations also contribute a large proportion of Fire's total GHG emissions.

5.2.5 Planning and Development Department



The Planning and Development Department (PDD) is responsible for 8% of the City's total 2005 emissions. Efficiency upgrades at the Atrium Building, completed since 2000, helped reduce PDD's footprint by 35% from 2000 levels. PDD emissions come from building operations at the Atrium and the parking structures, including some of the tenant spaces. Steam heating is the primary contributor, with a significant share also coming from electricity needed to light the six garages.

5.2.6 Central Services Department



Central Services (CS) Department has the smallest emissions signature of the six departments at 5% of 2005 totals. Its activities are primarily internal support and more office-based than some of the other departments. The impacts of building use results in a similar signature to that of PDD, but with a slightly higher vehicle fuel component through vehicle use for courier, facility maintenance and information services equipment maintenance. Steam is the primary source of emissions, with gasoline next in line. Electricity and natural gas are significant but smaller sources of emissions for CS.

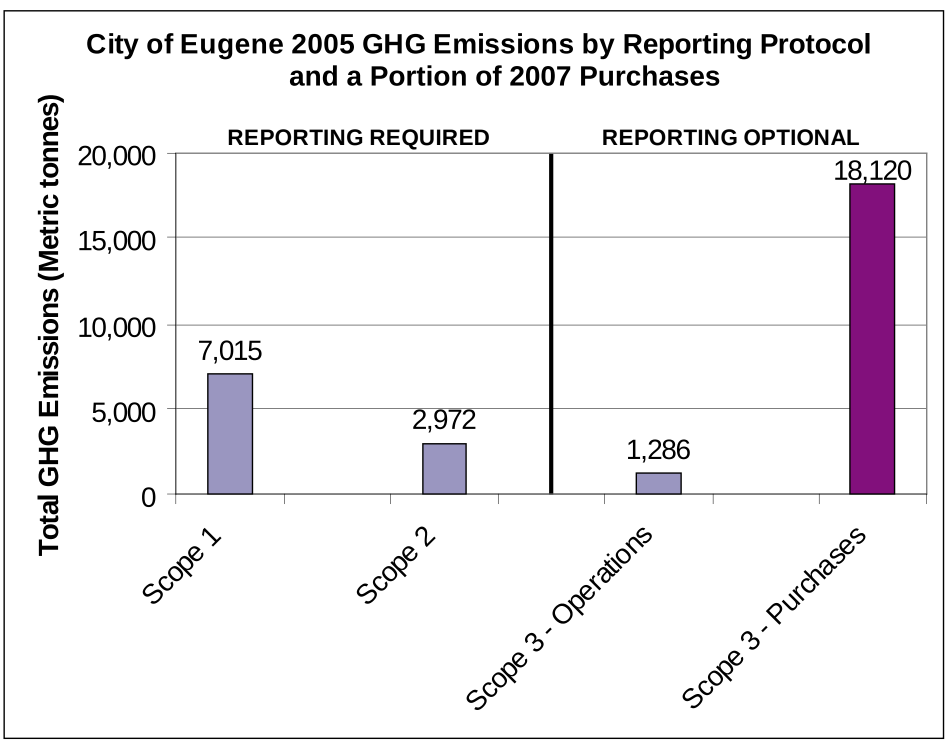
6. City Scope 3 Emissions

Under the reporting protocol adopted by the Western Regional Climate Registry and used in the ICLEI model for estimating GHG emissions, Scope 3 emissions result from activities for which direct and indirect energy consumption is not under the City's management control. Scope 3 emissions are difficult to quantify and are not currently addressed in GHG quantification protocols. In addition to being outside the ability of City operations to control, it is not clear who is responsible for the emissions; there is a high potential for double-counting; an absence of relevant data; and lack of consensus within the GHG quantification community. A consistent protocol for the measurement and quantification of Scope 3 emissions has not been widely accepted.

For the City of Eugene, Scope 3 emissions include employee commute, handling of waste disposed by the City, and the use of energy embodied in the goods and services purchased by the City. The definition of Scope 3 emissions includes the GHG impact of the "upstream" extraction, manufacturing and transport of materials purchased and used by the City, and the "downstream" impacts of materials disposal and reuse. The City is not able to assess the full GHG impacts of City purchasing and disposal activities. The estimates of Scope 3 emissions contained in this report can not be compared directly with the measurement of Scope 1 and 2 GHG emissions. The issues around measurement of these "external" GHG impacts will continue to receive attention as the methodology for this type of analysis evolves.

Figure 4, repeated below as Figure 19, shows the relative magnitude of a portion of the City of Eugene 2005 Scope 3 emissions.

Figure 19

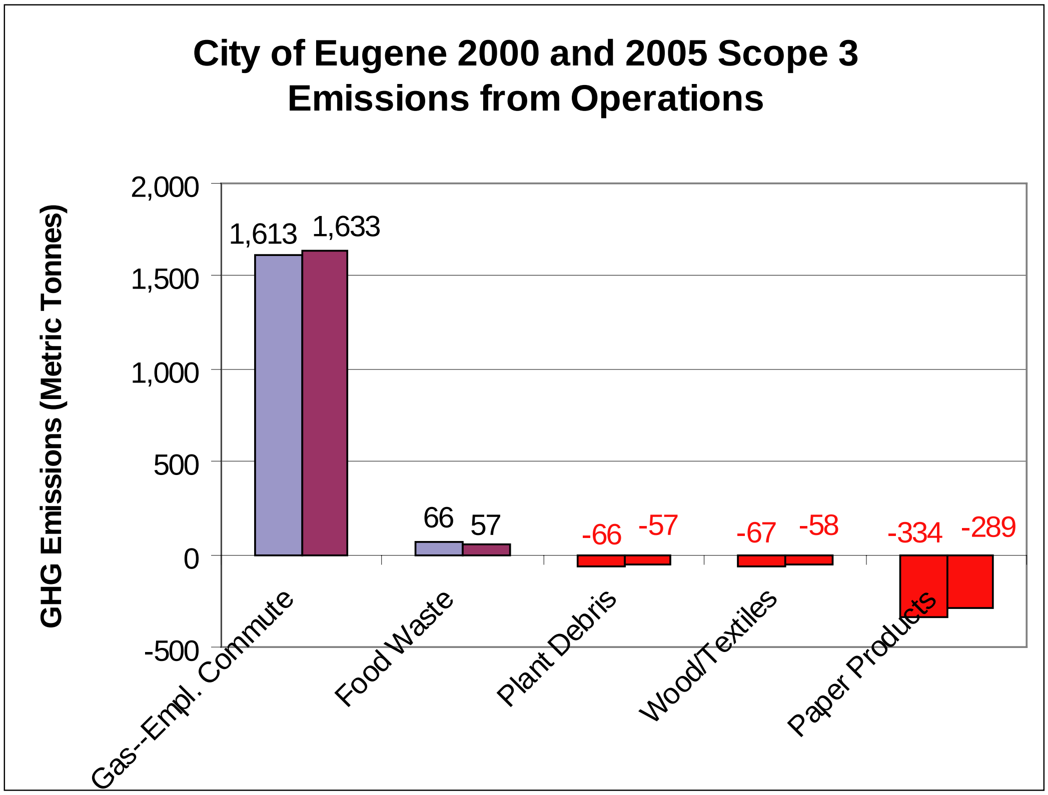


The City's goal to achieve carbon neutrality by 2020 focuses on the reduction of Scope 1 and 2 GHG emissions, but also including efforts to reduce Scope 3 emissions. A closer look at the nature and scale of the City's Scope 3 emissions provides some direction for developing strategies to reduce overall GHG emissions from City operations. Even if it is not possible to track exact changes in Scope 3 emissions through accepted protocols, there may be actions that the City can take to reduce overall GHG impacts.

6.1 Scope 3 - Operations

In this inventory, the internal City Scope 3 emissions sources have been divided into two groups - operational and purchases. Scope 3 emissions related to City operations, as shown in Figure 20 below, include vehicle fuels and emissions from disposal of solid waste.

Figure 20



Scope 3 emissions from operations increased slightly by about 74 MT, from a net of 1,212 MT of GHG emissions in 2000 to 1,286 MT in 2005. This was mainly due to emissions from employee commuting increasing slightly.

In the ICLEI model, the waste sector for the City of Eugene is considered to decrease carbon emissions. The amount of carbon "captured" in the waste stream decreased between 2000 and 2005. The underlying reduction in office-related waste also means that the City avoided GHG emissions related to the manufacture and distribution of materials that would otherwise have ended up in the waste stream.

The waste sector is shown as reducing GHG emissions for two principle reasons: the reduction of methane typically produced in a landfill and the long-term capture and storage, or sequestration, of a portion of the total waste. Organic matter – primarily food waste - that decomposes without oxygen (i.e. – anaerobically) will form methane, a greenhouse gas 21 times more potent than CO^2. If the methane is not captured or burned, landfills are net *sources* of greenhouse gas emissions. However, up to 80% (based on Oregon Department of Environmental Quality figures) of the methane produced at Lane County's Short Mountain landfill is captured and burned to produce energy, which converts methane back to the less potent CO^2. As the CO^2 emissions associated with landfills is assumed to originally be from plant sources, or "biogenic", it is not considered to contribute to GHG emissions, and is not included in the inventory. The net result is that more carbon equivalent is buried and trapped in the landfill than is added to the atmosphere, resulting in a decrease to total GHG emissions. The waste sector offset total GHG emissions from internal City operations by -348 MT in 2005 and -401 MT in 2000.

While creating additional garbage is not a viable emissions reduction strategy, it does highlight that the capture and use of methane is a very effective strategy that is already in place, and needs to be maintained or expanded. The ICLEI model for estimating greenhouse gas emissions does not recognize the benefits of recycling and total waste reduction. Recycling both reduces the total amount of solid waste and reduces the "upstream" production of greenhouse gas emissions related to the extraction and processing of raw materials and the manufacture of goods and materials purchased by the City of Eugene. As there is currently no generally accepted methodology for estimating the "upstream" GHG impacts of waste and waste reduction, this inventory captures only the direct impact of waste deposited in the landfill.

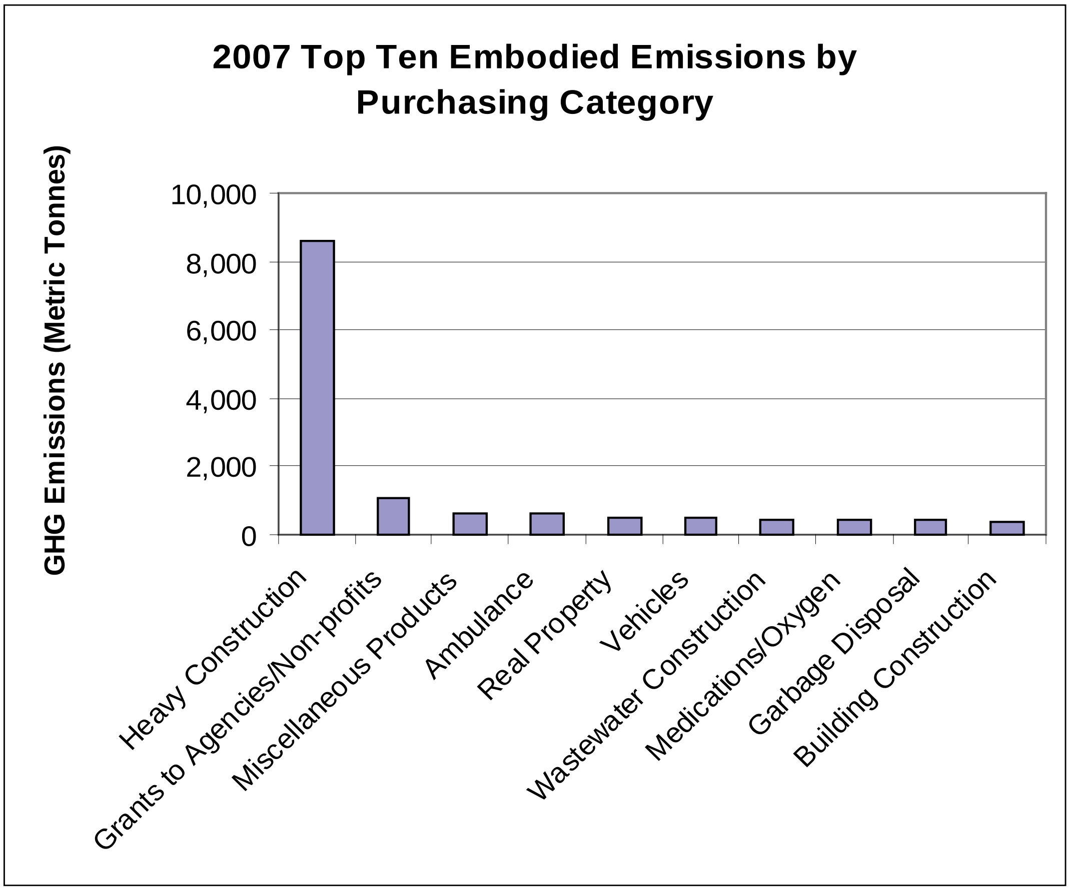
6.2 Scope 3 - Purchasing

An estimate of the emissions from a portion of goods and services purchased by the City of Eugene was provided by the Good Company. Good Company used a model developed by Carnegie Mellon University to provide a greenhouse gas estimate of a portion of the City's local purchases, equivalent to about 20% of total 2007 purchases. The estimate was included in the inventory to provide an indication of the scale of the potential GHG impact of the City's purchase of goods and services.

The estimate was derived from a national model of the GHG emissions embodied in different types of purchases. As a national model, the estimate may not accurately reflect the actual impact of locally-purchased goods and services, especially those that use local electrical energy in their production. However, it does highlight the importance of sustainable purchasing practices overall, and may help identify the types of purchases that have the most potential for decreasing the City's GHG emissions.

Good Company estimated that approximately 18,120 metric tonnes of GHG emissions was attributable to $40 million in purchases of local goods and services. As this reflects about 20% of total City purchasing expenditures in 2007, the actual GHG emissions related to purchasing would be significantly higher. As shown in Figure 21 below, the ten purchasing categories (out of 118) with the highest GHG emissions impacts totaled 13,572 metric tonnes, or about 75% of the estimated purchasing impacts.

Figure 21



Heavy construction accounted for 8,606 metric tonnes of embodied emissions, or 47% of the total. When combined with building and wastewater construction, the embodied GHG emissions for construction as a whole total 9,433 metric tonnes, or over one-half of the estimated emissions. Conversely, the other 108 categories of City purchases accounted for 25% of total estimated emissions, or an average of 42 metric tonnes each.

One overall finding is that, in addition to managing the amount and sustainable qualities of purchasing in general, it may be effective to focus on purchases with the highest GHG emissions impacts. Some analysis of purchasing not included in this initial review may be needed to identify any City purchases from regional or national sources with large embodied GHG impacts. (See Appendix 2 for a more complete discussion of upstream impacts of City-purchased materials and services.)

7. Putting it All Together: Context for Setting Strategies

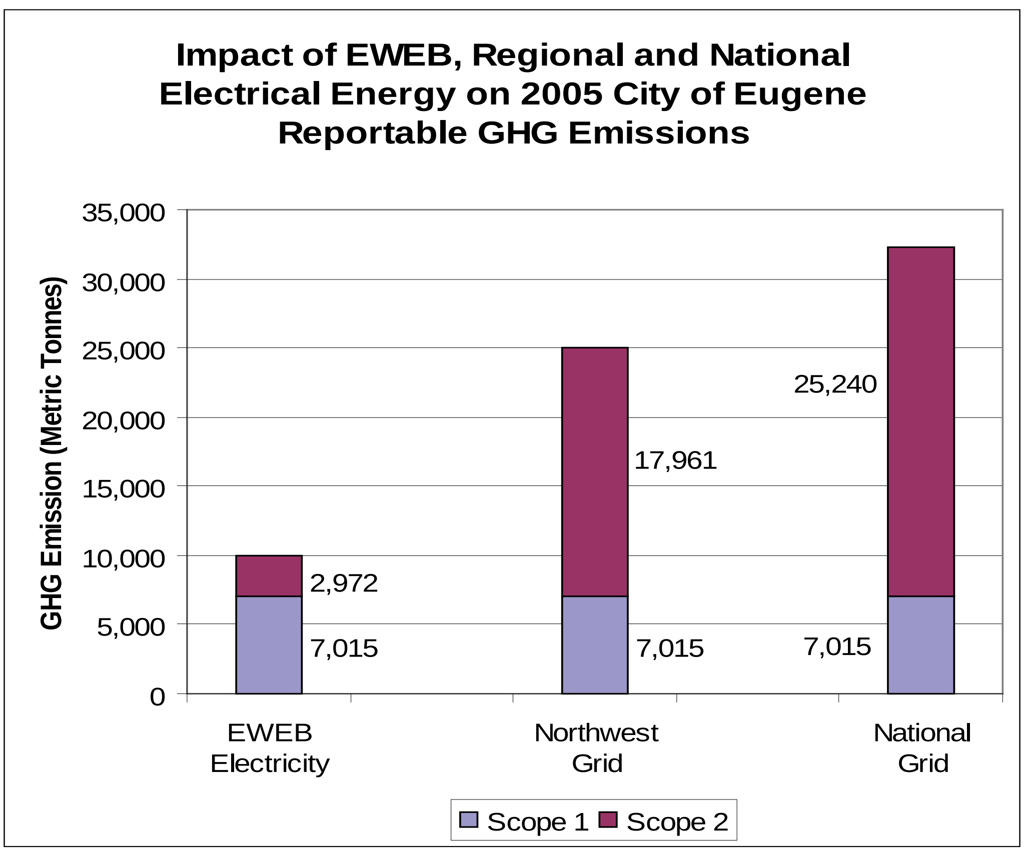
A brief overview of the major results of the City's operational GHG emissions will help outline the context for developing emissions reduction strategies.

7.1 Electrical Energy

Electricity use accounts for a smaller proportion of GHG emissions in the City of Eugene than many other comparably sized municipalities, due to the relatively clean energy mix provided by EWEB. However, there are still opportunities for reduction of electricity-related emissions.

It will continue to be important to conserve electrical energy or use alternative electrical energy sources, in order to stay within EWEB's generation capacity and not increase the City's carbon footprint. The carbon emissions of electricity on the regional grid are about 10 times the level of EWEB electricity on a British Thermal Unit (BTU) basis, due to the inclusion of electricity from natural gas and coal-fired generation facilities. Figure 22 shows what the impact would be if the City used electrical energy from the regional or national grid. As a Scope 2 source of carbon emissions, the City's total 2005 GHG emissions from internal operations would have increased from 9,988 metric tonnes to about 25,000 metric tonnes if the City was on the regional electrical grid, and to a total of 32,000 metric tonnes for the national electrical grid.

Figure 22

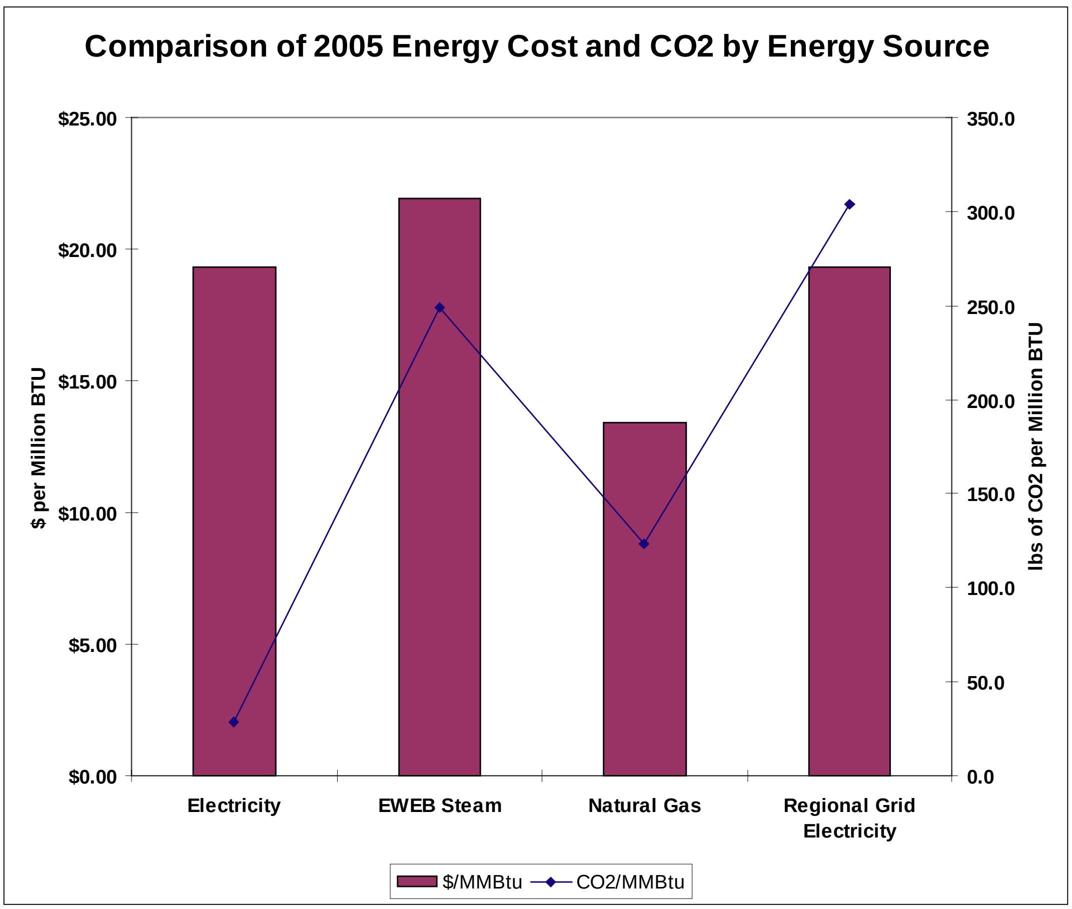


7.2 Steam Energy

EWEB is planning to de-commission the steam utility in the next two to five years, so the City will have to find an alternative energy source for several downtown properties. Steam currently has the highest cost per unit of energy of the three fuel energy sources in City buildings. (See Figure 23 below) Steam is also the largest contributor of GHG emissions per unit of energy of the City's three building-energy sources. The steam system produces almost 10 times the amount of GHG emissions per BTU than EWEB electricity, and roughly twice the amount from heating with natural gas.

However, there are "cost versus carbon" trade-offs in moving from steam to another energy source. EWEB electricity has a low carbon footprint, but costs significantly more than natural gas on a BTU basis. Natural gas has about four times the GHG emission as EWEB electricity on a per BTU basis, but costs less (although the cost advantage is decreasing as natural gas rates increase). One goal of strategies could be to avoid using additional electricity from the regional grid, which has much higher GHG emissions on a per BTU basis than either EWEB electricity or natural gas, and is also more expensive than natural gas on a per BTU basis.

Figure 23



7.3 Vehicle fuels

The City's use of gasoline and diesel fuels continues to be a significant source of GHG emissions. The City is committed to hybrid vehicles and use of biofuels for the general sedan fleet. However, there are economic and operational challenges to increased use of diesel biofuels and adoption of alternative fuel vehicles for some City functions, such as Police patrol vehicles. The City faces a challenge in decreasing fossil fuel use and will need to develop creative methods to address fleet vehicle usage and emissions levels.

7.4 Other Considerations

The nitrous oxide emissions created as part of the Wastewater Treatment Plant's operations are included as Scope 1 emissions. However, there are additional nitrous oxides created in the treatment process that are currently released in the effluent returning to the Willamette River. While some portion of these dissolved nitrous oxides may become airborne at a later time, there is no accepted methodology to measure these potential emissions. The water-borne nitrous oxides have a volume several times larger than the direct emissions included in this inventory, the impact of these "uncounted" nitrous oxides may prove to be a larger issue in the future.

In addition to these issues, there are a number of factors that may need to be considered when setting interim goals and implementation strategies to address the City's GHG emissions, including:

- Local issues
    - Downtown electrical grid limitations in accommodating distributed energy and energy generation projects
    - Potential public or private partnering opportunities in funding, construction, siting and owning alternative energy projects
    - Potential for projects to create local offsets and City-created offsets
- Regional issues
    - Oregon/Western Regional Climate Initiative cap and trade goals
    - Current Oregon grant and tax policy support for energy efficiency projects
    - Proposed changes in Oregon legislation related to climate action goals
- Economic issues
    - Solid waste and recycling markets' relationship to overall economic conditions and demand for recycled materials
    - Federal stimulus funding
    - Changes in federal funding for efficiency and renewable energy projects
    - Local job creation opportunities
    - City budgetary issues including shortfall in the general fund FY2010 and beyond

8. Recommended Next Steps

The inventory of the City's internal GHG emissions provides the foundation for an operational climate action plan. The next steps in the process to achieving the carbon neutral by 2020 reduction goal for City facilities and operations is to define interim emissions reduction targets, review the relative impacts of existing efforts and develop specific strategies to achieve these targets. While the magnitude of the City's operational emissions is small in comparison to the community-wide emissions, it is critical that the City provide leadership by demonstrating both commitment and workable strategies within our own operations. When combined with a climate action plan for the community, the City of Eugene's internal plan will help form a comprehensive strategy for local climate action.

Appendix 1: CO2 Equivalent Conversion Factors

CO2 Equivalent Coefficients for Energy Sources used in City of Eugene Operations		
Energy Type	**Year**	**Metric Tonnes CO2 per MMBTU energy**
EWEB Electricity*	2000	0.0126
EWEB Electricity*	2005	0.0128
Northwest Region*	2000	0.1326
Northwest Region*	2005	0.1376
USA total*	2000	0.1983
USA total*	2005	0.1982
EWEB Steam		0.1130
Natural Gas		0.0560
Gasoline		0.0750
Gasoline-E-10		0.0670
Diesel		0.0780
Biodiesel-B20		0.0620

*CO2 content of electricity varies depending on method of generation
NOTE:1 Metric Tonne is equal to 2204 lbs.

APPENDIX 2: ESTIMATION OF EMBODIED EMISSIONS IN PURCHASED GOODS AND SERVICES

The following analysis was performed by Good Company (www.goodcompany.com), a sustainability research and consulting firm located in Eugene, Oregon that helps clients measure, manage and market their environmental performance. Additional support for this project was provided by Climate Masters (part of University of Oregon's Climate Leadership Initiative), a program that trains individuals to provide climate change education and household consultations to help Eugene residents curb their carbon footprints.

Overview and Summary

This analysis provides an estimate of greenhouse gases (GHGs) embodied in purchases by the City of Eugene in 2007. These embodied GHGs are generated during the "upstream" stages of the life cycles of the City's purchases, including the stages of raw material extraction, production and transportation of all goods and services. The responsibility for embodied emissions in purchases is not equal to those generated directly by City operations and owned equipment, such as the burning fossil fuels in buildings and fleet vehicles. Nonetheless, these emissions, while not *owned* by the City, are *shared* by the City, and they therefore warrant attention in the City's climate action efforts.

While the method used (EIO-LCA) provides only aggregate insights of low precision, there are several take-aways from the analysis. First, the total emissions embodied in purchases are significant in scale relative to other documented emissions, regardless of the precision of the estimate. Second, construction services surfaces as the single largest contributor to embodied emissions (likely due to materials and fuel use). Finally, for climate action, the results suggest opportunities for purchasing policies and specifications to target products and services purchased in the largest volumes, that have a relatively high level of emissions per dollar spent, and for which there are low-embodied-GHG alternatives.

Summary of Data and Methods

Economic Input-Output Life-Cycle Analysis (EIO-LCA), the method used to perform this analysis, requires expenditure data. The City of Eugene Purchasing Office generously provided detailed data for the 2007 fiscal year. The data received was split into three spending categories based on geographic location of purchase including: Eugene-Springfield, local-Oregon, and outside-Oregon. Due to time constraints the following analysis includes only a portion of Eugene-Springfield purchases, which represent 20% of total data by dollars spent. (Still, these purchases total more than $40 million.)

Carnegie Mellon University developed a free online tool (www.eiolca.net), which provides a greenhouse gas estimate for 491 sectors of the US economy based on dollars of output. Each line item purchase was assigned an economic sector, line items were subtotaled and each category total was entered into the online tool, which estimated emissions for each economic sector. Initial emissions estimates were adjusted for inflation to correct for price-level differences between the base year in the EIO-LCA model and the current data year. Figure 1 shows the top twenty (20) categories by total emissions, with corresponding emissions per dollar. For additional information data, process and the EIO-LCA method see the end of the appendix.

Summary of Results

The estimated embodied emissions for purchases in the metropolitan area (category "Eugene-Springfield") equal 18,120 MT CO_2e for the 2007 fiscal year. As can be seen in Figure 1, the largest single category of total estimated emissions is heavy construction services. Indeed, heavy construction is as large as the next nineteen categories combined, and about 48% of emissions of all 118 categories from the full analysis. This category is also the largest in terms of total dollars spent.

Rank, by total emissions	Category Description	Category Expenditure $	Impact per Dollar kg CO_2e per $	Total Estimated Embodied Emissions MT CO_2e
1	CONSTRUCT SVCS, HEAVY: TOTAL	$9,913,494	0.87	8606
2	GRANTS TO AGENCIES & NONPROFIT: TOTAL	$4,325,445	0.24	1045
3	MISCELLANEOUS PRODUCTS: TOTAL	$1,238,645	0.50	617
4	AMBULANCE: TOTAL	$1,081,285	0.56	607
5	REAL PROPERTY: TOTAL	$1,347,022	0.39	523
6	AUTO VEHICLES/TRANSP EQUIP: TOTAL	$986,948	0.52	509
7	BUILDING CONSTRUCTION SVCS: TOTAL	$1,013,429	0.40	402
8	CAPITAL, OTHER, WASTEWATER: TOTAL	$66,426	6.39	425
9	MEDICATIONS/OXYGEN	$53,162	7.88	419
10	GARBAGE/TRASH DISPOSAL: TOTAL	$69,610	6.02	419
11	COMPUTER HARDWARE MAINTENANCE: TOTAL	$1,955,196	0.19	372
12	PROFESSIONAL SVCS, MISC.: TOTAL	$2,922,046	0.11	314
13	HAZARDOUS MATERIAL/WASTE SVCS: TOTAL	$48,992	6.01	295
14	CONTRACTUAL SERVICES: TOTAL	$2,665,982	0.11	286
15	LEGAL SVCS - ATTORNEYS: TOTAL	$2,122,460	0.11	235
16	ROOFING SERVICE: TOTAL	$384,414	0.40	152
17	OIL, LUBRICANTS: TOTAL	$56,959	3.29	188
18	FOOD ITEMS, MEALS, CATERING: TOTAL	$205,461	0.89	183
19	REAL PROPERTY, R-O-W: TOTAL	$413,406	0.39	160
20	HUMAN SVCS: TOTAL	$324,468	0.48	156

Figure 1: Top twenty EIO-LCA categories ranked by total embodied emissions, with CO_2e per dollar. Total estimated emissions for the "Eugene-Springfield" purchasing category are 18,120 MT CO_2e.

Total Emissions Sense-of-Scale

To help the reader understand the significance of 18,120 MT CO_2e, the Environmental Protection Agency's online Greenhouse Gas Equivalencies Calculator (http://www.epa.gov/cleanenergy/energy-resources/calculator.html) was used to provide the following comparisons.

This level of emissions -- 18,120 MT CO_2e – can be expressed with the following equivalencies:

- Annual emissions of 3,300 passenger vehicles
- Emissions from burning three million gallons of gasoline
- Carbon dioxide sequestered by 450,000 tree seedlings growing for 10 years

Figure 2 shows the top five categories by emissions (as previously seen in Figure 1).

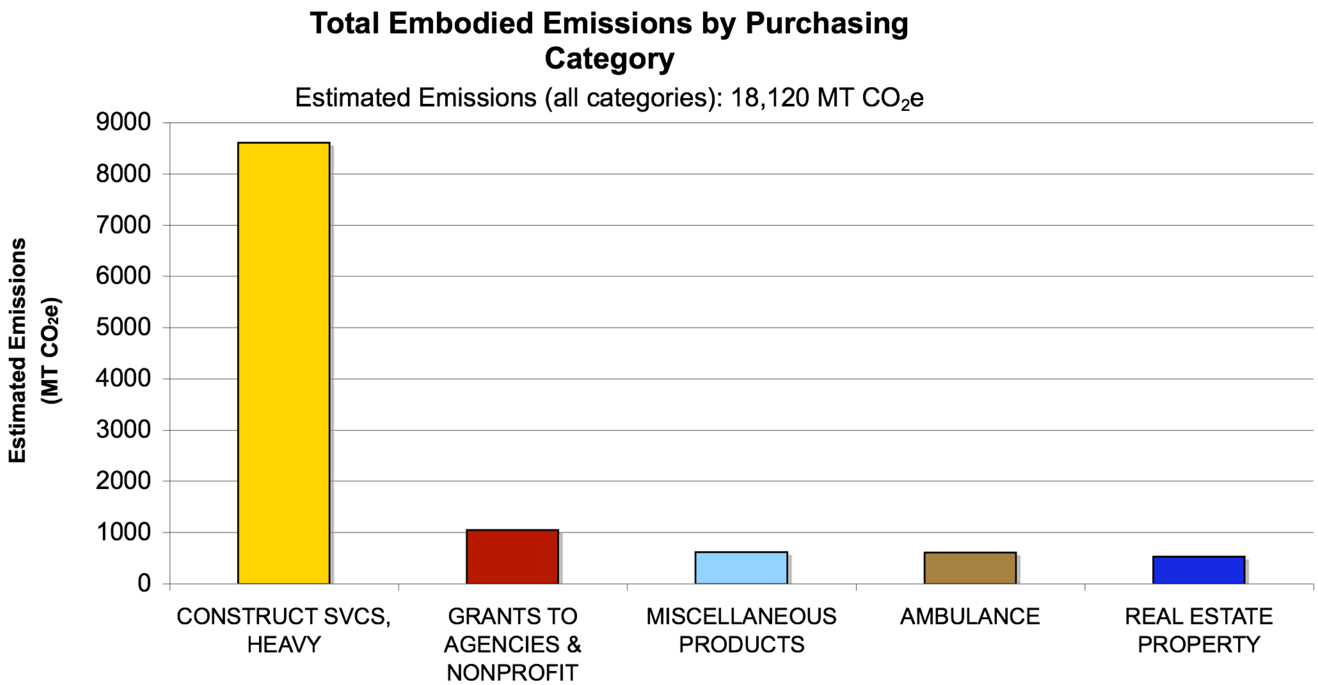


Figure 2: Top five EIO-LCA categories, by total category embodied emissions.

Ultimately, climate action efforts might focus not only on total emissions but those areas with the highest emissions intensity. Figure 3 shows the top ten purchasing categories ranked by CO_2e per dollar spent. It is noteworthy that none of the ten purchasing categories in figure 3 appear in Figure 2. Despite their large emissions per dollar, the total annual purchases for these items are relatively low. In creating purchasing policy, the most productive focus may therefore be on those items purchased in large quantities and requiring large expenditures, rather than those with high impact per dollar spent.

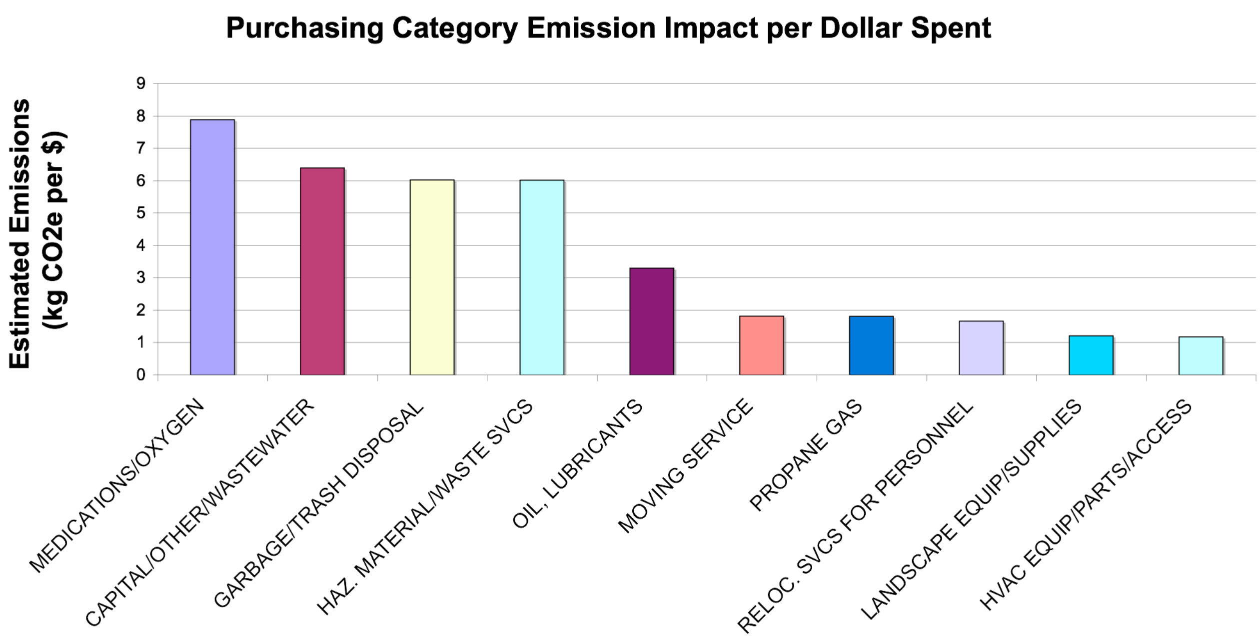


Figure 3: Top ten categories, ranked by emission impact per dollar spent.

DETAILED ANALYSIS INFORMATION

1. Data

- Source: City of Eugene Purchasing Office
- Data Received for fiscal year 2007
  - Local-Eugene/Springfield (~$72 million)
  - Local-Oregon (~$102 million)
  - Outside-Oregon (~$17 million)
- **Local-Eugene/Springfield data set was used for analysis (37% of data by dollars)**
- Data Excluded from analysis: (~$32 million)
  - Total category expenditures <$10K ($320 thousand)
  - Financial items – These items have large dollar values, but the embodied emissions result from administrative work which has low GHG intensity (~$24 million)
  - Miscellaneous items – Black box category with many random items for which analysis is time prohibitive. (~$3.2 million)
  - Fuel ($900 thousand) and power (~$3.6 million) line items were removed because these would be accounted for in scope 1&2 emission categories of the City of Eugene operations greenhouse gas inventory.
- Data Included: All but excluded (~$40 million)

2. Process

- Data is sorted by "Group Description" (118 EIO-LCA economic categories)
- Expenditures are subtotaled for each group description category
- A economic sector is chosen to represent the category and total category expenditures are entered into EIO-LCA model
- The EIO-LCA economic category used and resulting greenhouse gas emissions are recorded in an Excel spreadsheet
- Because the EIO-LCA model uses 1997 data, an inflation correction value is applied to the estimated emissions to deflate the value to the 1997-dollar equivalent. This value is based on the Consumer Price Index (minus food and energy) for all items except construction materials, which uses the Producer Price Index for building materials. The CPI correction value decreases emissions by ~18% and the PPI by ~34%.

3. Method – EIO-LCA Description

Source: Carnegie Mellon University

The method used to generate this estimate is Economic Input-Output Life Cycle Assessment (EIO-LCA). Carnegie Mellon University has developed a free online tool (www.eiolca.net), which provides a greenhouse gas intensity for 491 sectors of the US economy, based on dollars of economic activity.

The model is valuable for simple, cost-effective emission estimates. The strength of the model is its ability to provide comprehensive estimates by using aggregate values for all goods and services in the 491 sectors. Its weakness is that it cannot provide a detailed estimate for specific processes. In order to accurately estimate embodied emissions for a specific good or service that products specific supply chain must be assessed, which can be an extremely time-consuming process that relies on data from many private sources.

In broad terms, this method consists of plugging values into the following equation to estimate total CO2-equivalent emissions for various areas of expenditure:

$$\frac{CO_2e}{\$} \cdot \$ = CO_2e$$

In other words, the estimate stems from the carbon intensity of purchasing (the first term) and the quantity of purchases (the second term). This product is summed across purchasing categories, which differ in both carbon intensity and total spent.

It should be noted the calculator asks for the producer of each item, but the retail price (price paid by the City of Eugene for any given item) was used. It should also be noted that this calculator was last updated in 1997. This fact led us to make some simple refinements in the method.

The initial calculations suffered from the distortions of price level, as described above. While this is rarely a problem over a short period (a year or two), the decade between the EIO-LCA database's creation and this inventory's calculations created an issue. We therefore attempted to correct for this change in price level.

Specifically, we made two corrections. First, for the large bulk of purchases (excluding those related to construction), we adjusted the calculations by the Consumer Price Index, the standard and official measure of retail inflation for the US economy. Second, we adjusted all construction expenditures (one of the largest areas of procurement) by a construction price index that, while not official government data, is well-known and has decades of history.