Appendix 8

City of Eugene Community GHG Inventory

CITY OF EUGENE

Eugene Community Greenhouse Gas Emissions Inventory Report

July 2007

City of Eugene Central Services
Facility Management Division
210 Cheshire Avenue
Eugene, OR 97401

Prepared by
Lynne Eichner-Kelley
Glen Svendsen

Community Greenhouse Gas Emission Inventory
Prepared by the City of Eugene
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Eugene's Community Greenhouse Gas Emission Inventory

1. Introduction

The community of Eugene has a long history of environmental stewardship. The City organization has historically implemented programs which have had the consequence of reducing greenhouse gas emissions in addition to their intended goal, such as the Transportation Options program, solid waste reduction and recycling or the energy management program. The City of Eugene completed a preliminary inventory of the City's own operational greenhouse gas emissions in April 2005, with the assistance of graduate students from the U of O Planning, Public Policy and Management Program.

The issues surrounding global warming have provided the impetus for broadening the City's internal efforts to look at the community-wide issue of climate change. In March 2006, the City of Eugene joined over 200 U.S. cities in becoming a member of the International Council for Local Environmental Initiatives, or ICLEI. Membership in ICLEI affords local governments a cost-effective way to build internal expertise for continuing climate change work. This community greenhouse gas inventory was initiated in August 2006 based on experience gained from the City's of Eugene's internal inventory and with the training, technical assistance and software available to ICLEI members.

The inventory of community-wide greenhouse gas emissions is the first step in developing Eugene's climate action plan. This inventory provides the basis for completing other elements of a climate action plan, including the selection of an emissions reduction target and development of specific strategies to achieve emissions reductions. When completed, the climate action plan will serve as the foundation for Eugene's ongoing efforts to reduce emissions, and provide the basis for measuring progress and improving reduction strategies in the future.

This inventory presents a picture of Eugene's current greenhouse gas emissions, and is not intended to introduce the issue of climate change. Some references to general information on global warming and climate change are included at the end of this report. A more complete discussion of the impact of global warming on Eugene, and individual measures to respond to climate change, will be included in the final climate action plan.

2. Executive Summary

Eugene's 2005 community-wide greenhouse gas (GHG) emissions are estimated at approximately 1.25 million metric tonnes, or 8.6 metric tonnes per capita. (A metric "tonne", which is approximately 2,200 pounds, is used in this inventory to be consistent with standard practice.) This total is projected to increase to 1.5 million metric tonnes by 2020. This closely matches population growth, and annual per capita emissions are projected to reach 8.8 metric tonnes in 2020. Eugene has a relatively low level of per capita emissions compared to Oregon and the nation. Eugene's 2005 per capita emissions are one-half of the statewide average per capita emissions, and about two-fifths of the national per capita emissions. Eugene's relatively low level of GHG emissions, due primarily to our "clean" electrical energy, will influence the future selection of GHG reduction strategies. Many approaches considered in other communities are focused on their source of electrical energy, and may not be the best measures for Eugene.

Over half of the community's current GHG emissions are related to the use of gasoline (41% of total emissions) and diesel fuel (11%). The next largest source of GHG emissions is from the use of natural gas, which accounts for 37% of total emissions. Electrical energy contributes 11% of community-wide GHG emissions. Remaining GHG sources are less than 1% of the total.

Combined residential, commercial and industrial transportation activities within Eugene create over half of total community emissions. Residential activities are the next largest source of GHG emissions at 22% of total emissions, due primarily to the use of natural gas as a source for heating and water heating. Commercial activities account for 17% of total GHG emissions, again related primarily to the use of natural gas. Industrial activities contribute only 10% of the community's GHG emissions, again related to natural gas usage in industrial processes and space heating.

Understanding the overall mix of Eugene's greenhouse gas emissions provides information on the relative importance of different activities as sources of greenhouse gas emissions. Knowing the specific sources and activities related to GHG emissions in the community will establish a basis for selecting emissions reduction strategies.

3. Methodology Overview

Eugene's community-wide inventory followed the protocol developed by ICLEI and the authors of the Clean Air and Climate Protection (CACP) software. Data was gathered from five sectors that produce the majority of community-level emissions: residential energy, commercial energy, industrial energy, transportation and waste. Utility level energy data and community wide figures for transportation and solid waste disposal were collected from numerous sources (see Appendix 1). Where necessary, data was either projected back in time (a method called backcasting) or estimated using the best available information. The CACP software converts all data to the equivalent value in CO2 (eCO2) in order to compile the information.

The focus of the inventory of community greenhouse gas emissions is on activities that directly produce greenhouse gas emissions, or on the direct consumption of energy. It is these types of local activities that can most effectively be addressed by community-level emissions reductions strategies, and progress toward reduction targets most directly measured. As a result, the methodology used for this inventory does not currently include energy embedded in consumer goods from outside the community, nor does it include the potential for capture and storage of carbon by living plants (called biomass sequestration). In the transportation sector, through-trips, such as on I-5, and local trips without an origin or destination in Eugene are also not included in the inventory. Two small emissions sources, wood burning and fuel oil, were included because of significant issues with particulate pollution and significant change in use, respectively.

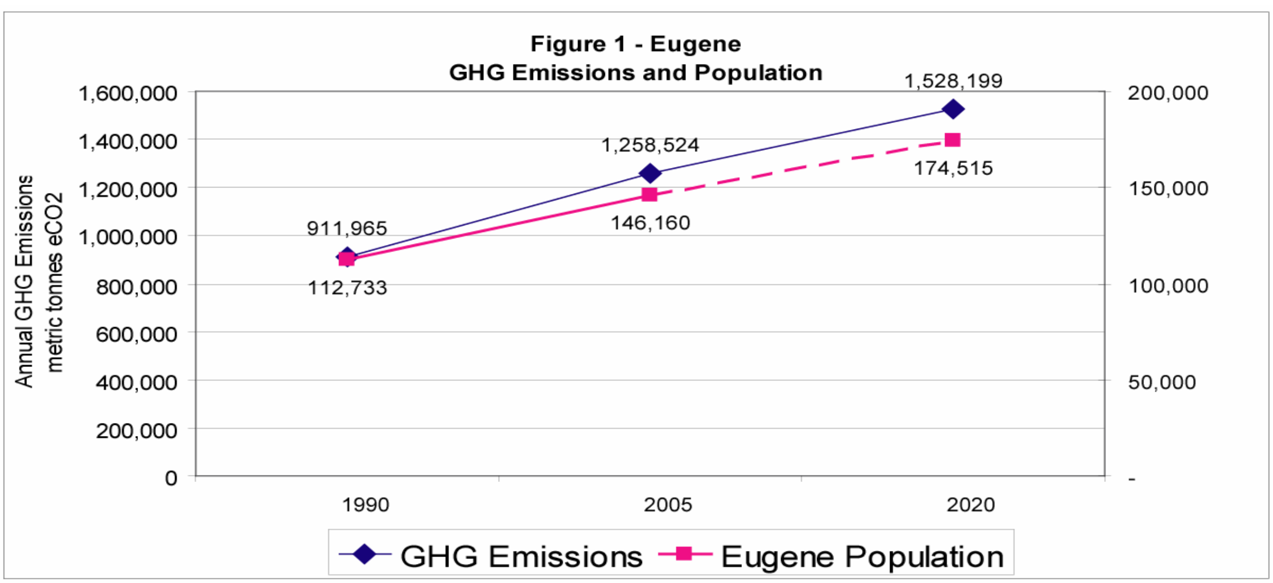
Boundaries for the inventory were chosen to correspond, for the most part, to the boundaries of Eugene Water and Electric Board's (EWEB) territory. EWEB's service area roughly matches the Eugene portion of the Metro Plan boundaries. River Road/Santa Clara and the Blachly Lane service territory along Hwy 99, south of Awbrey Lane, were also included.

The year 1990 was chosen as a baseline year in order to be consistent with the climate goals of the State of Oregon and many other US cities. This also allows us to comply with the spirit of the Kyoto Protocol, as recommended by the US Mayor's Climate Protection Agreement. Mayor Kitty Piercy is a signatory of the Agreement. An interim year, 2005, was chosen to provide a snapshot of the current emissions situation and allow quantification of reduction measures undertaken after 1990. The target year of 2020 for this inventory is within the planning horizon of most local agencies. This enables the model to use reasonable and existing growth projections, yet still allows sufficient time to implement significant emissions reductions measures.

The projections for 2020 were done with a "business-as-usual" scenario. Any emissions reduction measures or programs that are currently in existence or are already included in agencies' growth projections are therefore included in the base case 2020 scenario. For instance, nodal development and continued expansion of the bus rapid transit system are included in the community vehicle-miles-traveled "business as usual" projections for 2020.

4. Key Findings

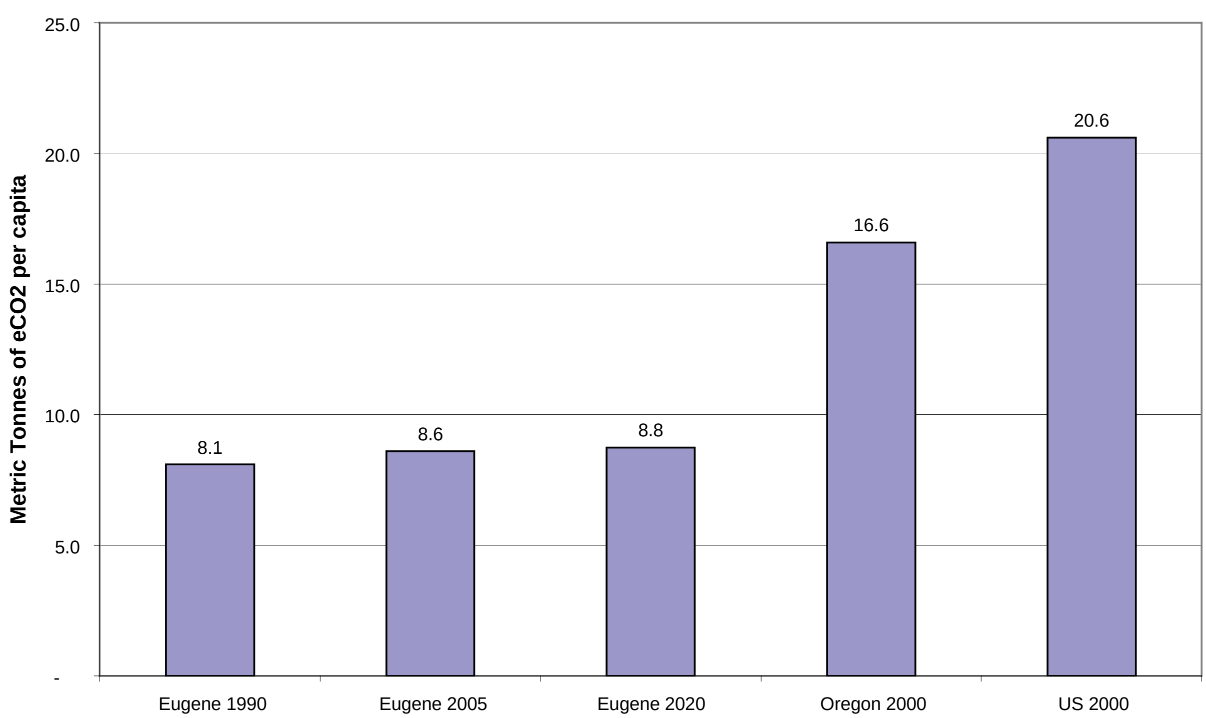
The growth in GHG emissions from 1990 levels to 2005 was approximately 38%. Projected growth of GHG from 2005 to 2020 is estimated at 21.4%. Total growth in emissions from the base year of 1990 to the target year of 2020 is projected to be two-thirds higher than total 1990 emissions. It's important to note that any goal to go below 1990 levels must not only reduce current emissions, but avoid all additional GHG emissions resulting from population growth. Figure 1 below shows the growth in total GHG emissions and population for Eugene from 1990 to 2005 and projected to 2020.



While overall emissions increased 38% from 1990 to 2005, per capita GHG emissions in Eugene have increased only 6% between 1990 and 2005. This means that the rate of growth in total emissions has been primarily due to the growth in total population from 1990 to 2005. However, per capita GHG emissions are projected to rise at about the same rate through 2020, based primarily on the increased use of natural gas as an energy source.

Eugene's 2005 per capita emissions are one-half of the statewide 2000 average per capita emissions, and about two-fifths of the national 2000 per capita emissions, as shown in Figure 2 below. This difference may be due to a combination of EWEB's comparatively clean power mix, which emits about one-tenth of the greenhouse gas per megawatt hour of the Oregon power grid average emissions, and the limited scope of economic activity covered in the community greenhouse gas inventory. As the community greenhouse gas inventory focuses primarily on emissions generated within Eugene, the "embedded" green house gas emissions of imported goods and materials are not included in Eugene's inventory. (Theoretically, the emissions related to imported goods would be counted in those communities where the manufacturing takes place.) The Oregon and United States GHG emissions estimates encompass a broader range of economic activities, including manufacture and transport of goods across the State and the nation. More analysis of the comparison of the GHG emissions in goods exported from and imported to Eugene is needed to determine what adjustment, if any, should be made to Eugene's per capita GHG estimate. City staff has recommended to Oregon Department of Energy and ICLEI researchers that this is an area needing an accepted protocol.

Figure 2 - Per Capita Emissions
Eugene, State of Oregon and US



(Source of Oregon and US data: Oregon Strategy for Greenhouse Gas Reductions, December, 2004)

5. Analysis of Inventory Findings

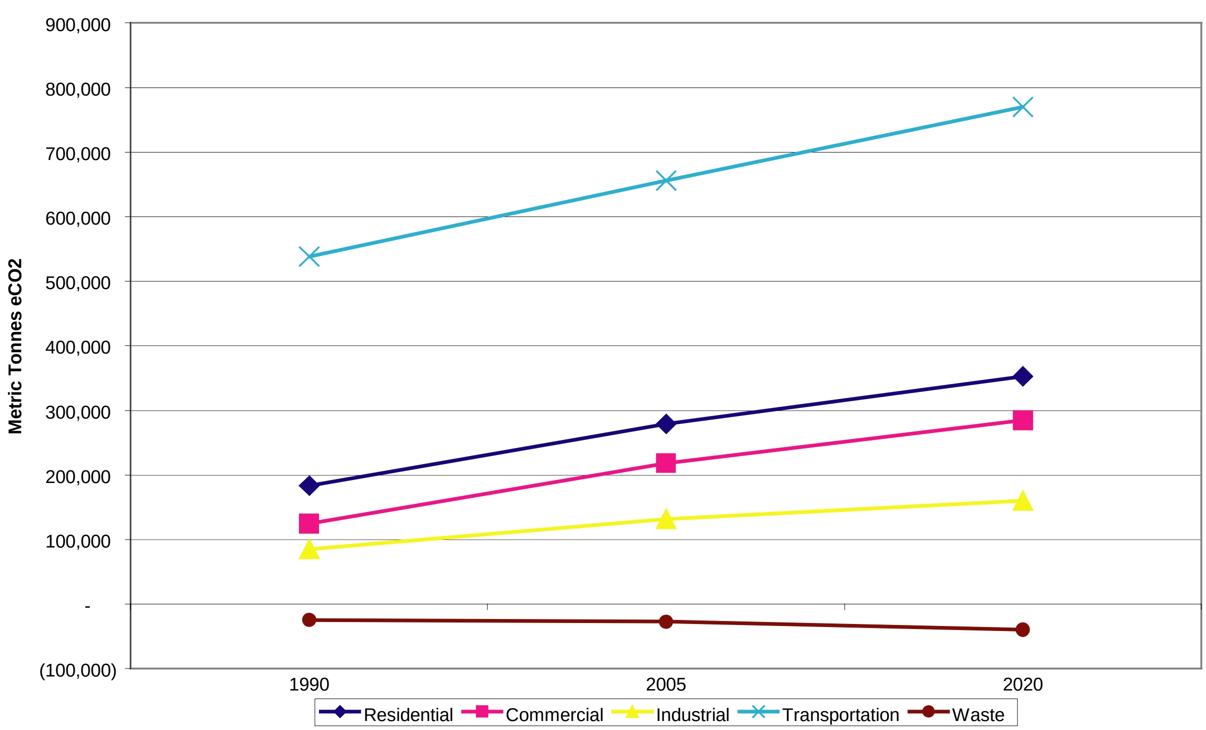
The results of the community GHG emissions inventory can be analyzed by the type of activity contributing to greenhouse gases, and by the energy source that creates those emissions. Both types of analysis can be used in the development of GHG reduction strategies. The next sections provide a more detailed view of Eugene GHG emissions data by activity, by fuel source, and finally by fuel source within each activity sector

5.1 Results by Sector

All economic sectors show growth in the total amount of greenhouse gas emissions from 1990 through 2020, with the exception of solid waste. As noted above, this growth parallels the growth in Eugene's population. The following charts show the relative impact of the five economic sectors over the period included in the model.

The transportation sector is the largest component of Eugene's greenhouse gas emissions, projected to increase to almost 800,000 metric tonnes by 2020 (Figure 3). The transportation sector includes the greenhouse gas emissions due to the residential, commercial and industrial vehicle use within Eugene, based on computer modeling of vehicle miles traveled by each type of activity. Emissions related to residential and commercial structures are the next largest contributors to Eugene's greenhouse gas emissions, projected to reach about 350,000 metric tonnes and nearly 300,000 metric tonnes respectively by 2020. The industrial sector produces the least greenhouse gas emissions, projected at about 170,000 metric tonnes in 2020.

Figure 3 - Eugene Community Greenhouse Gas Emissions by Sector

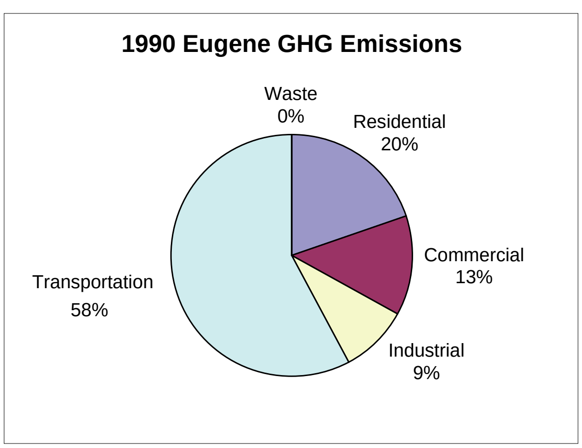


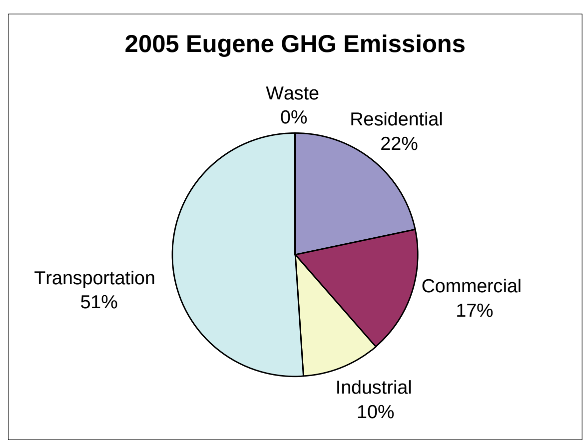
The waste sector is considered in the model as providing carbon storage. This phenomenon is explained by the multiplication effect of methane and the long-term capture and storage, or sequestration, of a portion of the total waste. Organic matter that decomposes without oxygen, or anaerobically, will 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 OR DEQ figures) of the methane formed at the Short Mountain site is captured and burned to produce energy, which converts it back to the less potent CO_2. The net result is that a little bit more carbon equivalent is buried and trapped in the landfill than is added to the atmosphere.

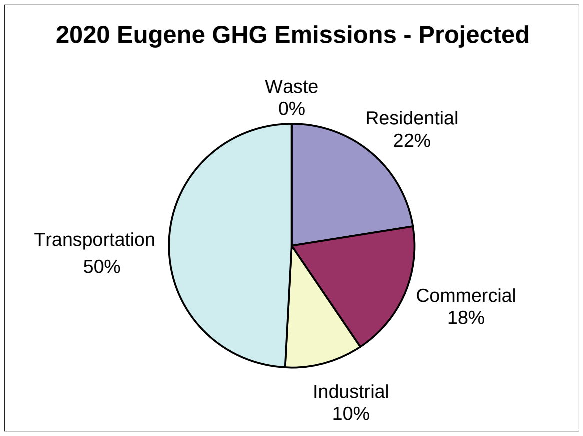
This does not mean that creating additional garbage is part of the solution. It does underscore the fact that the capture and use of methane is a very effective strategy that is already in place, and needs to be maintained or expanded. Also, this model of estimating greenhouse gas emissions does not recognize the benefits of recycling. Recycling both reduces the total amount of solid waste and reduces the "upstream" production of greenhouse gas emissions related to goods and materials manufactured outside of Eugene. As this inventory captures only energy generated or consumed directly by the community, the role of recycling as an emissions reduction strategy needs to be evaluated in other ways.

While total GHG emissions are projected to increase, the emissions from some activity sectors will increase faster than others. The relative impact of the transportation sector has decreased from 1990 to 2005 in spite of continued growth in vehicle miles traveled (VMT). This trend is expected to continue through 2020. Residential and commercial sector emissions impacts have increased, in relation to those from transportation, primarily due to the continued fuel-switching from electric to natural gas for heating. The following graphs (Figure 4) show the relative contribution of the five economic sectors to community greenhouse gas emissions over the thirty-year period.

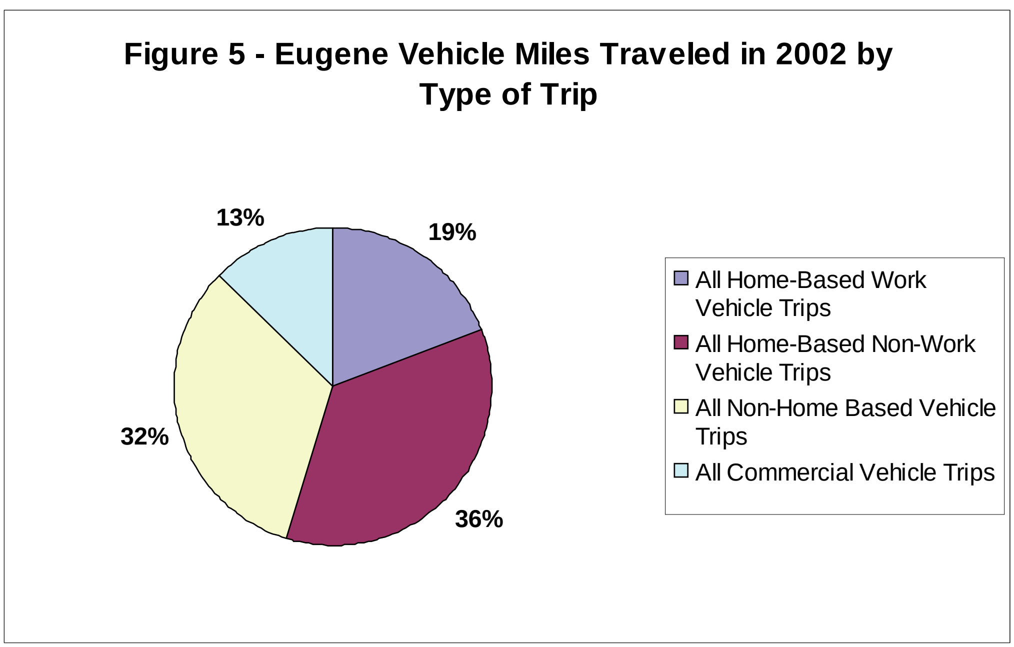
Figure 4 – Eugene Community Greenhouse Gas Emissions, 1990, 2005 and Projected 2020





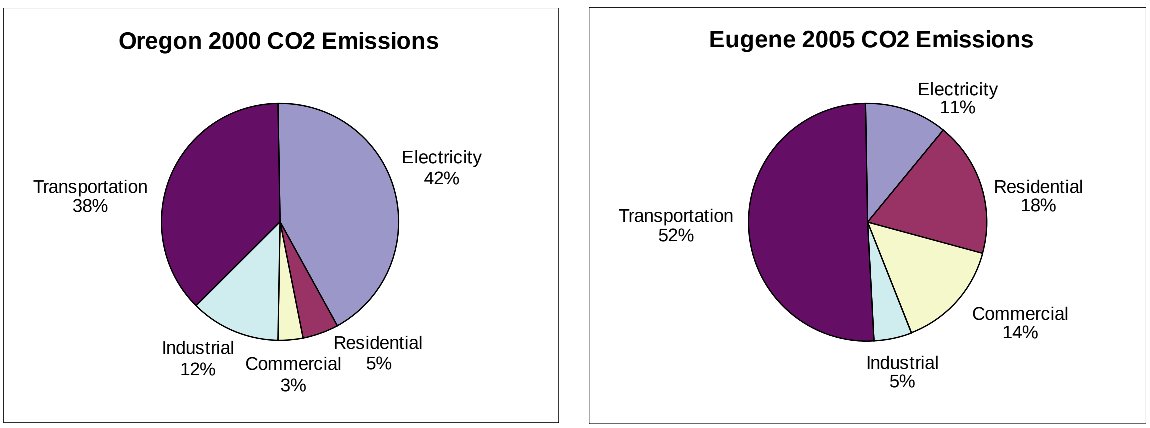


Within the transportation sector, residential trips make up the majority of emissions related to vehicle travel. (Figure 5) Using the Lane Council of Government's regional transportation model of vehicle travel miles, Figure 5 was derived from the estimated average school-in-session weekday trips that originate from a Eugene residence, as well as from trips that are not based on household activity but that have a Eugene origin or destination including commercial vehicle trips. Of these trips, home to work trips account for about 19% of Eugene-related vehicle miles traveled (VMT). Home based non-work trips make up 36% of VMT, and includes trips made for home to school, home to shopping, home to college, and home to recreation, sports and other purposes. Non-home based trips account for about 32% of the vehicle miles traveled. These are trips initiated by drivers from a Eugene origin and by trips ending at a Eugene destination and include service trips such as mail deliveries, garbage pickup, meter reading, as well as work to shop, work to meals, and college to work trips. Commercial trucking accounts for the remaining 13% of vehicle miles traveled from or to a Eugene location.



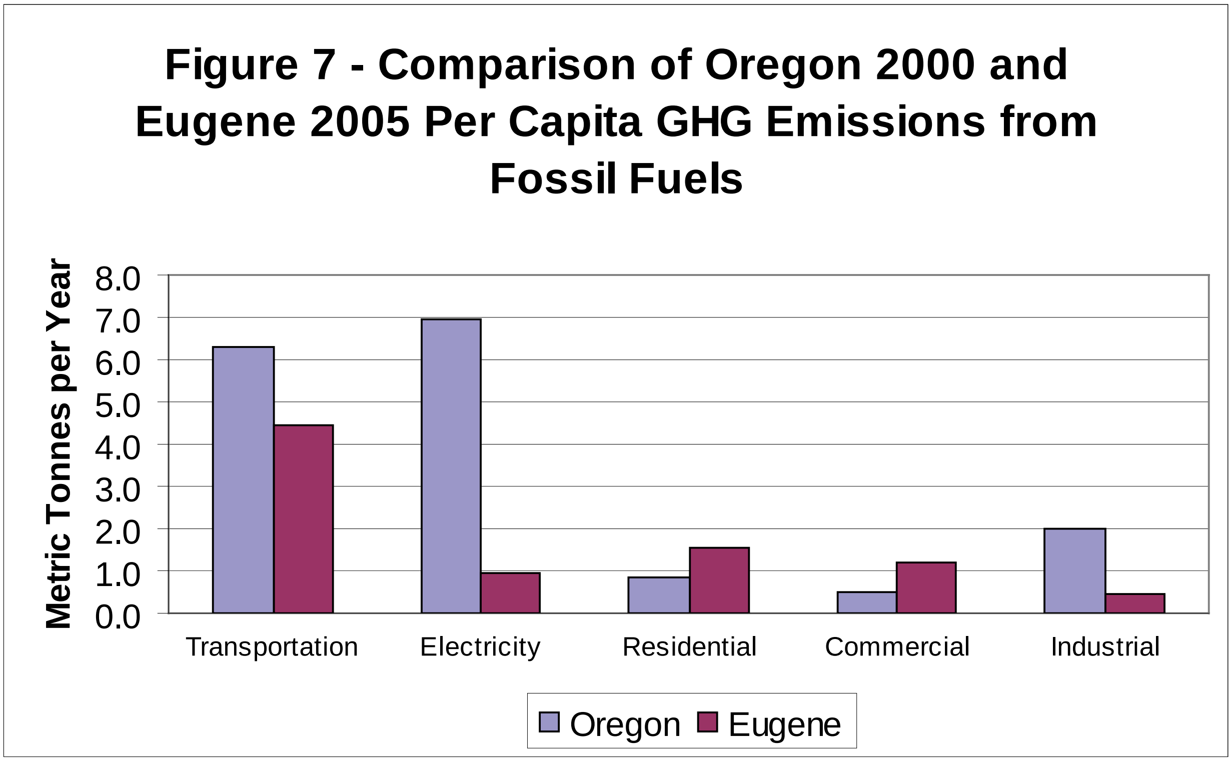
Eugene's pattern of emissions due to fossil fuels is significantly different from the State of Oregon as a whole, as shown in Figure 6. This may mean that the most effective strategies for reducing greenhouse gas emissions related to fossil fuels are different for Eugene than those being developed for Oregon or the nation. As noted earlier, Eugene's pattern of emissions from fossil fuel, dominated by vehicle transportation emissions, reflects this community's relatively clean electrical power. The transportation sector's share of GHG emissions in Eugene is quite large at 51% in 2005 compared to 38% for Oregon overall. This is due to the relative lack of GHG emissions from electrical generation in Eugene with the exceptionally clean power that EWEB delivers. As shown later, the higher representation of the residential and commercial sectors is due predominately to use of natural gas.

Figure 6 – Fossil Fuel Equivalent C02 Emissions by Sector in Oregon and Eugene



Source of Oregon data: Oregon Strategy for Greenhouse Gas Reductions, December, 2004

Comparing Eugene's 2005 per capita emission levels by sector with the 2000 statewide per capita emissions highlights key differences (Figure 7). This view shows Eugene's overall lower level of GHG emissions from fossil fuels, and Eugene's dramatically lower level of GHG emissions related to electrical energy. While transportation accounts for the largest proportion of Eugene GHG emissions, the per capita level of GHG emissions of transportation fuels is significantly lower than the statewide average. Since Eugene's community inventory only counts travel with an origin or destination within Eugene, the statewide emissions figures may be more comprehensive, as the state includes more inter-city and through traffic, especially within the I-5 corridor.



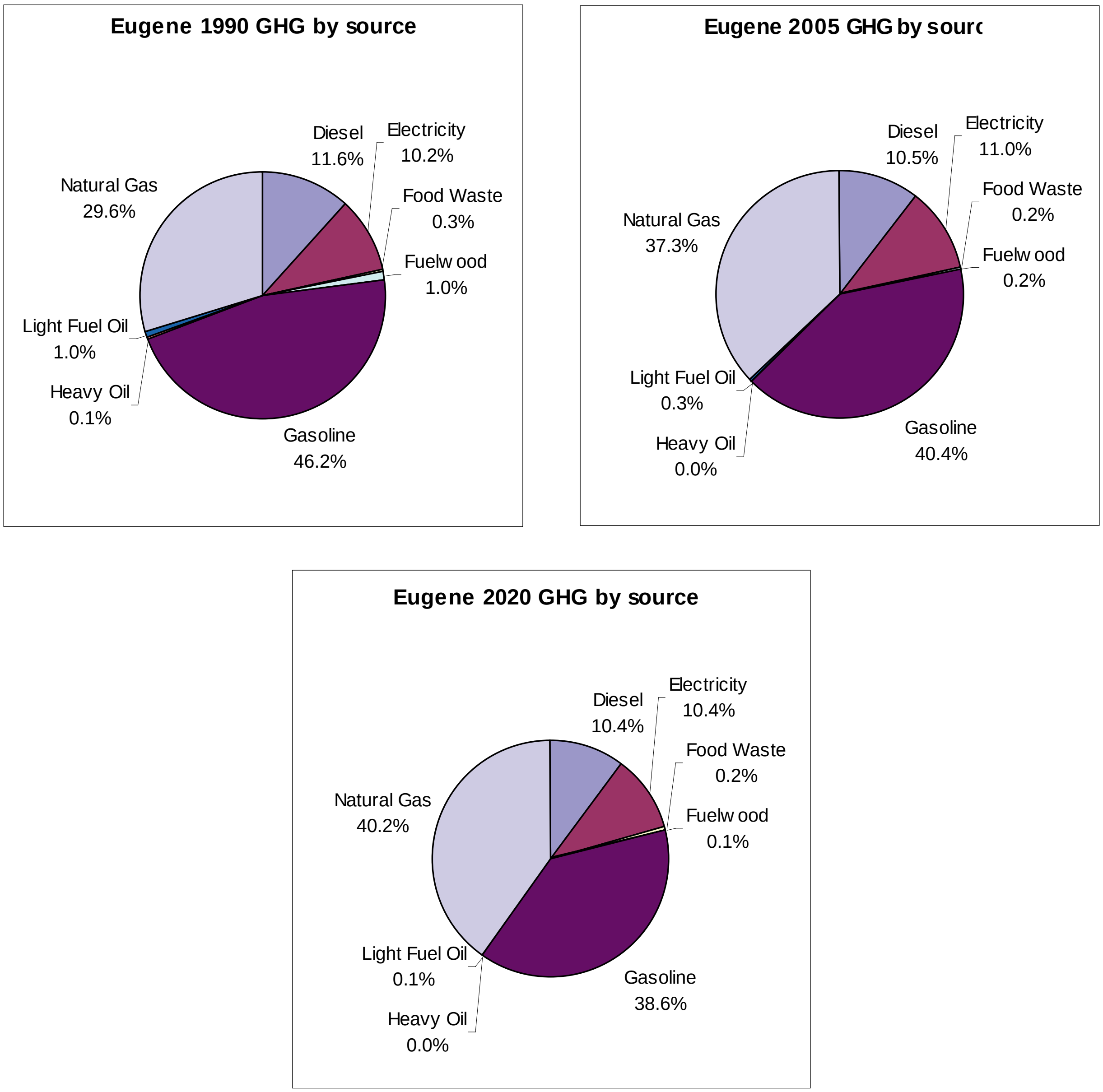
Eugene's low level of emissions due to electrical generation reflects EWEB's predominant use of hydroelectric power, compared to the state as a whole, and EWEB's long-term emphasis on conservation, with an aggressive conservation program in place since 1976. EWEB has stated that growth in electrical demand has been met through a combination of clean energy and conservation for the past decade, limiting the need to purchase electrical power generated from fossil fuel sources. Conservation can play an important role in reducing the per capita level of greenhouse gas emissions, and can help offset overall emissions that are expected to increase with population.

5.2 Results by Source

To be most effective, greenhouse gas reduction strategies need to reflect the major energy sources producing emissions, and identify those energy sources that are most likely to respond to change strategies. Figure 8 below shows the relative change in the source of GHG emissions in Eugene over the inventory period.

An important finding from this analysis of the source data is the shifting role of natural gas. In 1990, natural gas is responsible for less than a third of Eugene's emissions. By 2005, emissions from natural gas are nearly equal to those of gasoline. Projected emissions for 2020 show that natural gas will be the largest share of Eugene's eC02 emissions given a "business-as-usual" scenario. As previously noted, unlike other areas of Oregon or the nation, electricity is a relatively minor source of greenhouse gas emissions in Eugene.

Figure 8 – Eugene Community Greenhouse Gas Emissions by Energy Source, 1990, 2005 and Projected 2020



While natural gas is projected to take the lead in eCO2 emissions in Eugene by 2020, gasoline has been and will remain a consistently large emissions source. Emissions from gasoline are currently the leading source of CO2 in the community. Emissions reduction strategies that target either overall quantity of gasoline used, or the type of vehicle fuels, will likely figure prominently in a Eugene climate action plan.

Woodburning contributes very minimally to the GHG emissions of the community of Eugene. The CO2 coefficient for burning fuelwood is generally considered to be zero. Carbon released from burning wood cycles in and out of the atmosphere very quickly when viewed on the geologic time-scale of the carbon contained in fossil fuel. It is generally thought that the equivalent amount of carbon released by burning is entirely re-sequestered in growing plant material, assuming that the ability of vegetation to perform this task is remaining stable. Though there is ongoing debate about the sequestration ability given the changing nature of forest and vegetation, for this inventory we have accepted the assumption in the ICLEI model of a net zero GHG impact of woodburning. It is recommended that future updates of this inventory investigate the role that significant changes in the area or quality of mature vegetated landscapes may play in overall atmospheric GHG levels.

Although woodburning is not a significant contributor to CO2 in the atmosphere, it does contribute substantially to other forms of pollution in Eugene. While this report does not address the relative criteria air pollutants (CAP's) of fuel sources, they should be considered an important factor in the step of choosing GHG reduction strategies. Overall health of the environment may not be improved by simply trading one impact for another. Future updates of the inventory will include CAP information in an appendix.

5.3 Results Combined by Sector and Source

The following figures show the source of GHG emissions by the four primary activity sectors for 2005. Understanding the relationship between different economic sectors and their individual sources of GHG emissions will help in developing emissions reduction strategies. The following figures show the source of GHG emissions by economic sectors for 2005. (Solid waste was treated in the ICLEI model as a separate GHG emissions source, and is not included below as it was shown as reducing overall Community GHG emissions.)

In the residential sector, natural gas is the predominant GHG source, accounting for 83% of residential GHG emissions. (Figure 9a) Electricity is a distant second, at only 15% of residential emissions. (Note that the total energy consumed is different from the GHG emissions due to these energy sources. Natural gas accounts for just under 60% of residential energy consumption, while electricity amounts to about 40% of total residential energy consumption.) The relatively low amount of residential GHG emissions from reflects EWEB's relatively clean power sources. Light fuel oil and wood are minor sources of residential GHG emissions. Residential light fuel oil use has decreased since 1990 due to switching to electricity or natural gas, and the proportion of GHG due to fuel oil is expected to decline further in the future.

The source of GHG emissions for the commercial sector is very similar to the residential sector, with natural gas at 83% of total commercial GHG emissions. (Figure 9b) Electrical consumption accounts for 17% of GHG emissions, and fuel oil less than 1% of commercial emissions.

Fig. 9a - Residential sector 2005

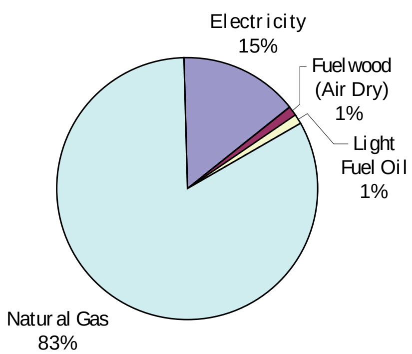
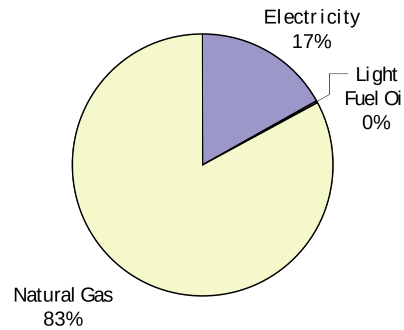


Fig. 9b - Commercial Sector 2005



The emissions profile of the industrial sector is almost evenly split between natural gas and electricity. (Figure 9c) Since electricity has a much lower level of emissions per unit, this means that the predominant source of energy for the industrial sector is electricity. Electrical use in the industrial sector is almost twice the use of natural gas, which helps keep the GHG emissions from the industrial sector relatively low.

In the transportation sector, the sources of GHG emissions are gasoline and diesel fuel, with gasoline accounting for about 80% of the transportation sector's total GHG emissions. (Figure 9d)

Fig. 9c - Industrial Sector 2005

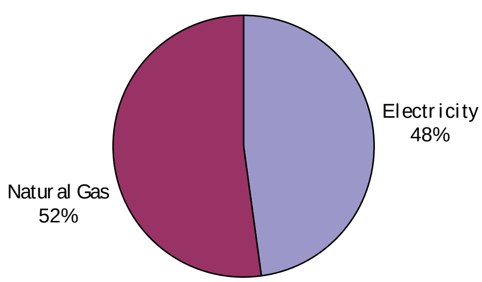
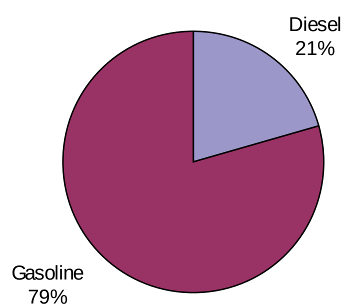


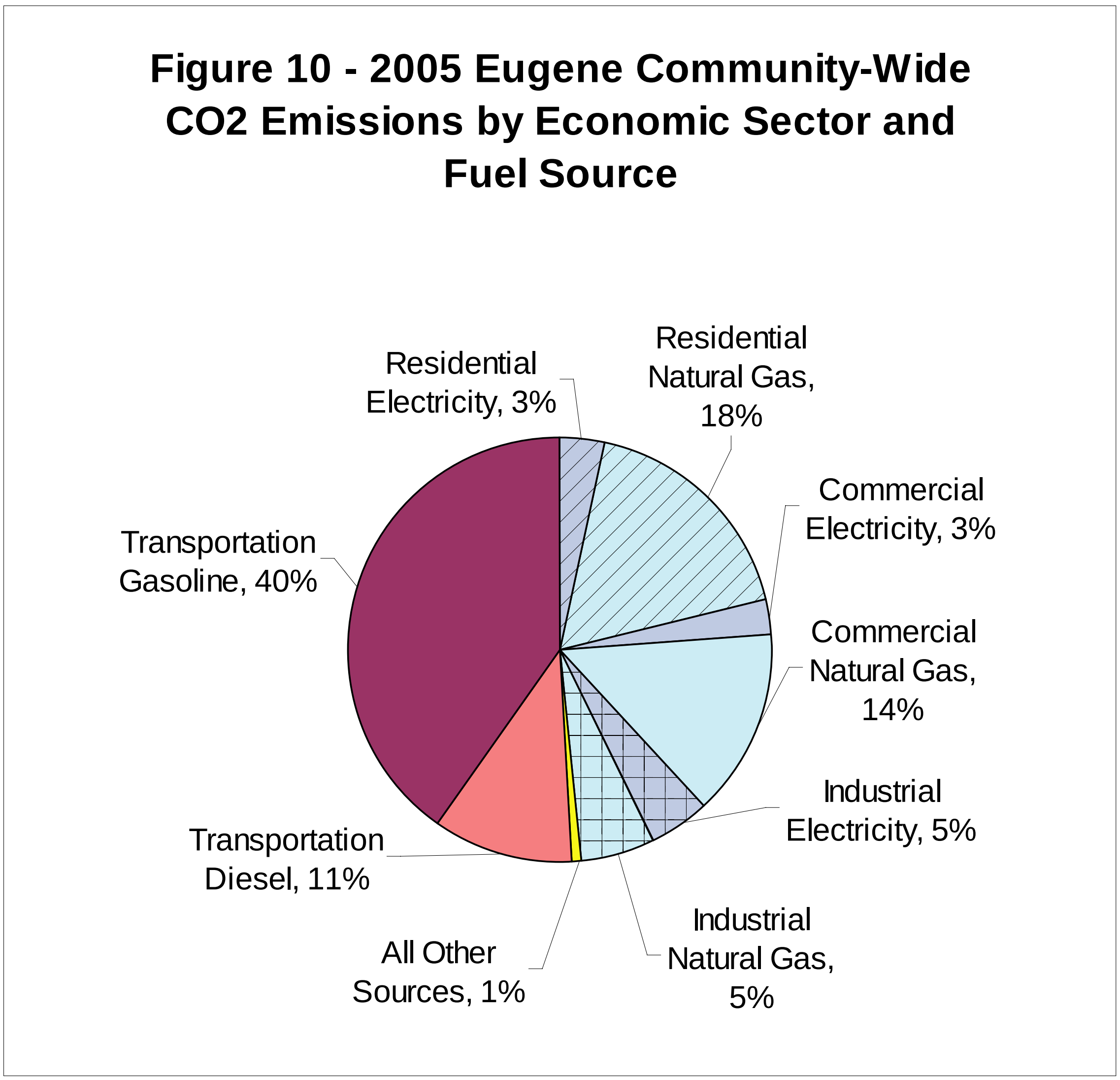
Fig. 9d - Transportation Sector 2005



6. Putting it All Together

Understanding the overall mix of Eugene's greenhouse gas emissions provides information on the relative importance of different activities as sources of greenhouse gas emissions. Knowing the specific sources and activities related to GHG emissions in the community will establish a basis for selecting emissions reduction strategies. Figure 10 below shows the composition of Eugene's greenhouse gas emissions by activity sector and energy source.

The transportation sector's use of gasoline and diesel fuels dominates the current GHG emissions signature of Eugene. The next highest contributions to Eugene's emissions are the residential and commercial use of natural gas. These four components will need to be a major focus of GHG reduction strategies for significant reduction to occur in the overall level of GHG emissions in Eugene. Given the extremely low impact of electricity on Eugene's GHG footprint, it will be challenging, but important, to maintain the low emissions levels related to electrical generation as demand for electricity increases or if use of electrical energy instead of other forms of energy is encouraged as a strategy.



7. Context for Setting Targets

Targets for reductions in greenhouse gas emissions typically include both a timeline and a volume goal. This analysis has assumed a target year of 2020. Setting the target for a reduction in the volume of greenhouse gas emissions will be the next step in Eugene's Climate Action Plan. The following table shows three possible targets, the level of GHG emissions required to meet each level and the impact on annual per capita tons of CO2 emissions.

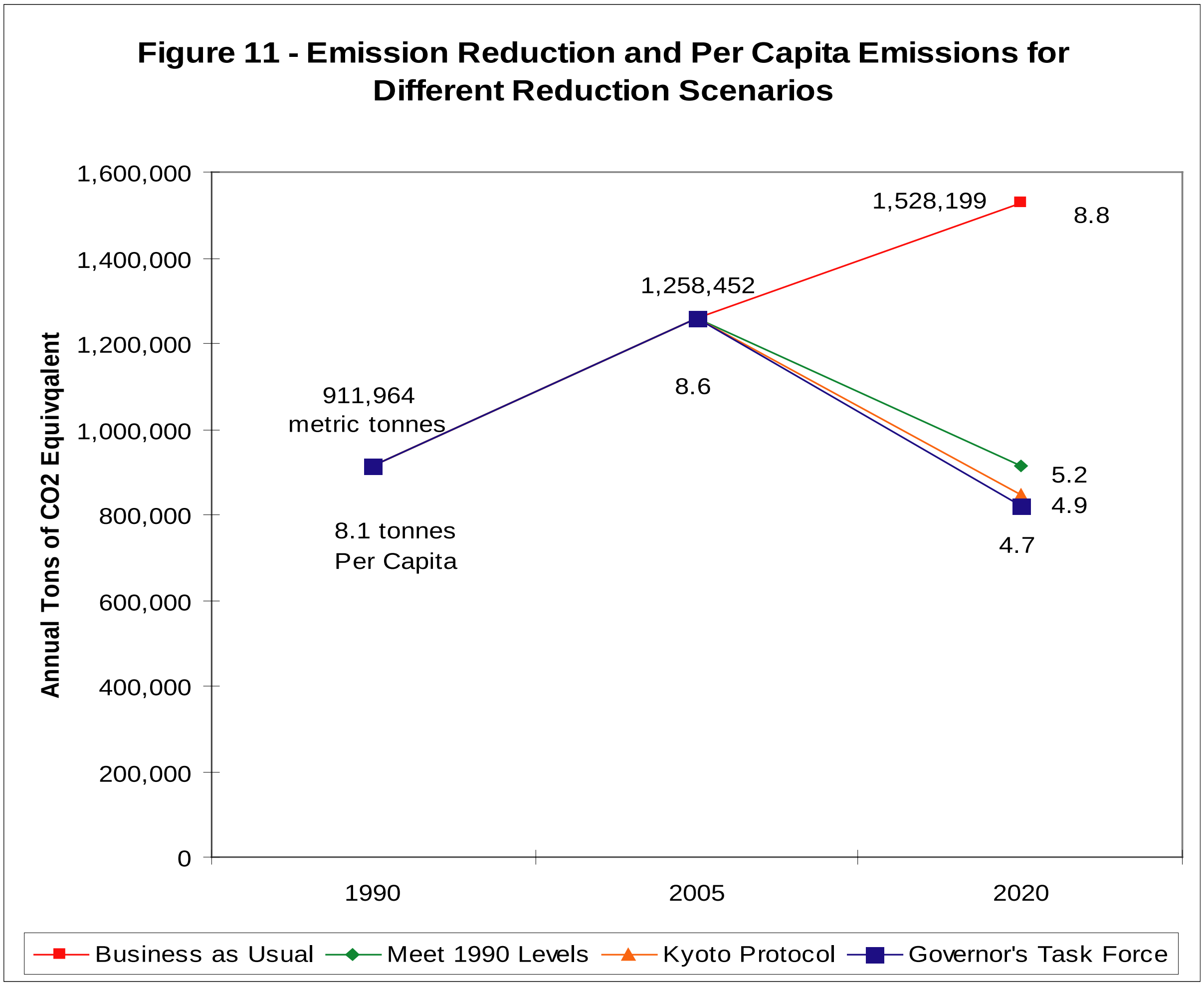
Table 1 – Potential 2020 Greenhouse Gas Reduction Targets for Eugene

Target	Total Eugene GHG tonnes/yr	% Reduction in total GHG emissions	Per Capita CO2 tonnes/year
Business as Usual	1,528,199	No reduction	8.8
Meet 1990 Levels	911,964	40%	5.2
Kyoto Protocol (7%<1990)	848,127	45%	4.9
Governor's Task force (10% < 1990)	820,768	46%	4.7

As noted earlier, any goal to reduce GHG emissions below 1990 levels must not only reduce current emissions, but avoid all additional GHG emissions resulting from population growth. Due to the cumulative impact of population growth on total emissions, reducing total emissions from current levels will require a large change in per capita emissions in the future. For example, reducing total community emissions to 1990 levels would require a reduction in per capita emission of 40% by 2020. Meeting the Governor's Advisory Group on Global Warming target of 10% below 1990 levels by 2020 would result in cutting per capita emissions by nearly 50%.

Figure 11 below graphically represents the impact of these possible emissions reduction targets on both the total volume of emissions, and on the per capita level of GHG emissions, based on the projected population growth from 2005 to 2020.

The need for a large reduction in personal GHG emissions is not immediately obvious, as the 1990 per capital level of GHG emissions of 8.1 tonnes per capita in only about 6% lower than the actual 2005 level of 8.6 tonnes per capita. However, population growth since 1990 has increased the total volume of greenhouse gases by a much higher proportion. As GHG reduction targets are typically expressed in terms of reductions in total emissions, the per capita impact is magnified.



8. Other Considerations

This analysis is based on the GHG emissions due to activities within the community. As noted earlier, the "upstream" energy required to both manufacture and transport consumer goods made outside the community, but consumed within Eugene, are not included in this inventory. While reductions in consumer goods transported over long distances could reduce GHG emissions elsewhere, this would not be reflected as a reduction of GHG emissions within Eugene in the current inventory methodology. Although reducing consumption of imported goods and increased recycling of consumer waste are not directly measured within this "community" GHG emissions inventory, strategies encouraging purchasing goods with recycled content, buying locally, and reducing packaging in consumer goods still have environmental benefits on a wider scale.

The scope of this inventory focuses on community-wide levels and sources of greenhouse gas emissions from different economic sectors and fuel sources. However, there are a number of other factors that could be considered when establishing greenhouse gas reduction targets and action strategies. For example, fuel sources vary in their emission of other pollutants - such as nitrogen and sulfur compounds - and the release of airborne particulates that have negative environmental impacts. Awareness of these other factors when designing GHG reduction strategies will help avoid unintended environmental consequences.

The broader social and economic, as well as environmental, impacts of GHG reduction strategies need to be considered to develop a truly sustainable climate action plan.

9. Strategic Implications

Determining achievable targets and effective strategies are the next steps in Eugene's Climate Action Plan.

- The task of reducing emissions is made more difficult by the excellent emissions signature of our power.
- It is critical to maintain the benefit of clean power, which has kept total community emissions and per capita emission relatively low.
- Maintaining excellent methane recovery systems is essential to prevent increased GHG emissions.
- Growth in natural gas use is a key issue, in part due to its proportionate increase as an energy source.
- Conservation remains one of the most direct and cost-effective methods to reduce GHG.
- Transportation must be a major focus to accomplish a large-scale reduction in community-wide emissions levels.
- Strategies that address both sectors and sources must be employed.
- Broader environmental, economic and social impacts of strategies, in addition to GHG reduction, should be considered.

10. Recommended Next Steps to Develop a Community Climate Action Plan

- Sign on to the Cities for Climate Protection Resolution
- Define the roles for governing bodies and staff groups
- Set Targets
- Identify balance between mitigation measures and adaptation planning
- Identify strategies and reductions to implement
- Identify and commit financial resources to implement climate change action.

11. References for further information

The Pew Center on Global Climate Change
http://www.pewclimate.org/

Oregon Governor's Initiative on Global Warming
http://www.oregon.gov/ENERGY/GBLWRM/

ICLEI: Local Governments for Sustainability
http://www.iclei.org/index.php?id=391

Appendix 1: Data Sources and Detailed Methodology by Emissions Source

Electricity

Electrical power within the boundaries of this inventory comes from two utilities, Eugene Water and Electric Board (EWEB) and Blachly-Lane Electric Cooperative. The majority of the area is served by EWEB, with the exception of a small wedge bisected by Hwy 99 south of Awbrey Lane. This area is comprised primarily of commercial and industrial enterprises and is served by Blachly-Lane Coop.

Data for total electrical load by sector were obtained for 1990 and 2005. EWEB provided residential, commercial, industrial and water utility data. Blachly-Lane provided commercial and industrial data. Blachly-Lane has no significant residential load within the boundaries of the inventory.

Load growth projections were obtained from each utility to estimate the total use of each sector in the target year. (Listed in summary of data inputs)

CO2 emissions coefficients for EWEB power for 1990, 2005 and projection for 2020 were obtained from Jim Maloney, EWEB. CAP (criteria air pollutant) emissions coefficients were calculated based on the CCAP software coefficients multiplied by percent of the resource in EWEB's mix and projected resource mix for each year.

It should be noted that most community wide inventories use emissions coefficients which are standardized by NERC (North American Electricity Reliability Council) region. Because EWEB power is significantly cleaner than either the US or regional average, custom emissions coefficients were calculated and entered in the software. The table below compares the EWEB coefficients to the regional and national standards.

Comparison of Emissions Coefficients (in lbs/MWh)									
Region	**Year**	**CO2**	**N2O**	**CH4**	**Nox**	**Sox**	**CO**	**VOC**	**PM10**
EWEB Electricity	1990	71.280	0.000	0.003	0.073	0.155	0.004	0.001	0.009
EWEB Electricity	2005	96.600	0.000	0.004	0.095	0.175	0.009	0.002	0.010
EWEB Electricity-projected	2020	96.600	0.000	0.004	0.093	0.169	0.010	0.002	0.010
NW Grid-WSCC/NWP	1990	969.458	0.078	0.059	1.774	1.640	0.575	0.066	0.544
NW Grid-WSCC/NWP	2005	1035.573	0.075	0.058	1.347	1.353	0.599	0.067	0.521
NW Grid-WSCC/NWP--proj	2020	967.464	0.062	0.055	1.078	1.019	0.661	0.072	0.426
USA total	1990	1478.613	0.021	0.020	3.585	8.194	0.216	0.026	0.149
USA total	2005	1491.586	0.021	0.019	2.461	5.486	0.218	0.025	0.144
USA total--projected	2020	1437.720	0.019	0.019	2.015	4.068	0.246	0.027	0.126

Sources for this information:

- Joe McFadden, Manager Member Services, Blachly-Lane Electric
- Tom Williams, Major Accounts, EWEB
- Jim Maloney, Resource Project Manager, EWEB.

Natural Gas

Northwest Natural supplies the Eugene/Springfield area with natural gas through the North and South Eugene gates.   Information for total annual therm use for both gates from 1990 to 2005 was provided. Northwest Natural also provided estimates of the percent of total used by Eugene proper and the percent of use between the three sectors within Eugene, residential, commercial and industrial. Estimates were calculated by first applying the Eugene area percent of use and then the sector split proportions. This information is summarized in the table below.

Eugene UGB Natural Gas Consumption-Annual Therms					
Sector	% split	1990	1990	2005	2005
		Total	Eugene only	Total	Eugene only
		all therms	80%	all therms	80%
		62,000,000	**49,600,000**	103,002,500	**82,402,000**
Residential	50%		**24,800,000**		**41,201,000**
Commercial	35%		**17,360,000**		**28,840,700**
Industrial	15%		**7,440,000**		**12,360,300**

Projected growth in natural gas use in was obtained from the Northwest Natural Gas 2004 Integrated Resource Plan, Volume III, Technical Appendix.   The results of NWN Gas planning process were presented in aggregate for the state of Oregon.   The average of the 10 and 20 year projections for the "medium" growth scenario was 1.75%. This annual growth projection was used in the ICLEI model.

Sources for this information:

- Doug Tilgner, Manager of System Operations, Gas Supply Dept, NW Natural
- Jean-Marc Ohlmann, System Design Engineer, NW Natural.

Steam

EWEB provides district steam to 94 commercial customers, at the time of this report, in the downtown and university areas. Steam is now produced at EWEB's riverfront plant by burning natural gas and occasionally, light fuel oil. In 1990 the fuel for producing steam was hogged wood fuel and heavy fuel oil. Steam is distributed through a network of underground piping. The City of Eugene has 6 buildings in the downtown core that use steam for space and water heating.

EWEB initially furnished information on the total annual measured consumption of the steam system in 1990 and 2005.   However, figures were not available that described the overall emissions signature of EWEB steam, taking into account the mix of fuel and the efficiency of the delivery system. Figures were available, however, for the total fuel input to the steam system.

Since emissions coefficients were available for the fuels used and efficiency was no longer an issue upstream of the production and distribution of the steam, the input fuel was entered directly into the CCAP software for 1990 and 2005.

Projecting the future use of the steam system in Eugene in 2020 proved to be a difficult task. Customers have been dropping off the EWEB steam system causing a cycle of rising cost and further loss of load. EWEB is forecasting a 10% decrease in steam sales over the next 2 years but were not able to forecast beyond. In most cases, customers pulling off the steam system will shift to natural gas for water and space heating needs. For the purposes of this inventory, the decrease in steam was shifted to natural gas use at the rate of 5% per year for the next 2 years, as projected by EWEB, and held steady from 2007 to 2020. Future updates of this inventory will adjust for the status and best known projections of the steam system at that point in time.

Sources for this information:

- Tom Williams, Major Accounts, EWEB.

Household Fuelwood

The quantity of wood burned in Eugene was estimated using data from the US Census Bureau's American Community Survey for 1990 and 2005. The survey provides an estimate for the total number of households using wood as a heating fuel in the metropolitan area. Splitting out the number of households by Eugene's share of the metro area population and multiplying by a statewide average annual household wood use gave us the figures that were used in this inventory. Average annual household wood use was obtained from the Oregon Department of Energy.

Projections for use of household fuelwood were estimated to remain at current levels. While the trend from 1990 to 2005, and anecdotal evidence from new building permits suggests that wood use is declining, increases in the cost of home heating fuel may counteract the trend.

Sources for this information:

- US Census Bureau, 2005 American Community Survey
http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=ACS&_submenuId=&_lang=en&_ts=
- House Heating Fuel by Metropolitan Area: 1990, Congressional Information Service from U of O Knight Library archive
- Oregon Department of Energy, "Residential Biomass" PPT presentation
- Keli Osborne, Permit Review Manager, Planning and Development, City of Eugene.

Fuel Oil

Estimates from US Census Bureau's American Community Survey for 1990 and 2005 were again used to derive the number of Eugene households using fuel oil. Average annual household use in Oregon came from *Oregon Petroleum Association* figure of 290 gallons of heating oil per year. Multiplying the two together gave us the estimate for light fuel oil use in the community.

Additionally, EWEB uses a small amount of fuel oil to generate steam. These figures came directly from EWEB.

Sources for this information:

- US Census Bureau, 2005 American Community Survey http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=ACS&_submenuId=&_lang=en&_ts=
- House Heating Fuel by Metropolitan Area: 1990, Congressional Information Service from U of O Knight Library archive
- Oregon Petroleum Association, quoted in "Winter Forecast Cozy for Home Heating Oil", The Oregonian, October 19, 2006.
- Tom Williams, Major Accounts, EWEB.

Transportation

Information for transportation impacts was gathered from LCOG (Lane Council of Governments). The information does not include the impacts of traffic on I-5, since Eugene can not expect that local policies would have any affect on I-5 traffic. Input into the CACP software required VMT (Vehicle Miles Traveled) and the distribution of those by vehicle type.

VMT was obtained by using the daily VMT as determined by the 2002 Regional Transportation Model completed by LCOG and splitting out the Eugene portion by percent of Eugene/Springfield population. The Eugene-only daily VMT was then backcasted for 1990 and extrapolated for 2005 using the average annual change in VMT from the Urban Mobility report as completed by the Texas Transportation Institute. Estimated 1990 and 2005 daily VMT figures were multiplied by 330, as recommended by the CCP protocol, to account for daily variation in traffic volume on weekend and holidays. This method was suggested and results reviewed by Susan Payne, LCOG.

LCOG projects growth in internal Eugene VMT to be 1.27% per year. Compounded over the next 15 years the total growth in VMT is *expected to be 24%.*

VMT distribution by vehicle types were calculated by LCOG using the EPA Mobile 6 modeling protocol. Unfortunately the Mobile 6 model does not classify passenger vehicles by size. This made it necessary to combine all passenger vehicles, including light duty trucks and SUV's into a single classification for entry into the CCP software. When the combined passenger vehicle category is used, the CCP software uses a passenger vehicle fleet average mpg figure to calculate fuel use and thus, CO_2 emissions. This average increased slightly from 16.1 mpg in 1990 to 17.7mpg in 2005, and is projected, under a business-as-usual scenario to increase to 18.4 mpg by 2020. VMT distribution used for all three years modeled is shown in the chart below. As noted earlier, we are aware that 1990 emissions are most likely overestimated to some extent because they are based on the best available, but limited, VMT distribution data.

VMT Distribution per Mobile6 Model LCOG to CCAP Software Category				
		Mobile6 Category	**CCAP Category**	
LDGV	46.55%	Light Duty Gasoline Vehicles(Psgnr Cars)	Passenger Vehicle-Gas	86.73%
LDGT1-2	29.07%	Light Duty Gasoline Trucks(<6000lbs gvw)	Passenger Vehicle-Gas	
LDGT3-4	11.11%	Light Duty Gasoline Trucks(>6000lbs gvw)	Passenger Vehicle-Gas	
HDGV	4.17%	Heavy Duty Gasoline Vehicles	Heavy Truck-Gas	4.17%
LDDV	0.15%	Light Duty Diesel Vehicles	Passenger Vehicle-Dsl	0.35%
LDDT	0.20%	Light Duty Diesel Trucks	Passenger Vehicle-Dsl	
HDDV	8.23%	Heavy Duty Diesel Vehicles	Heavy Truck-Diesel	8.23%
MC	0.52%	Motorcycles	Motorcycles-Gas	0.52%
	100.00%			100.00%

Sources for this information:

- Susan Payne, Senior Planner, Lane Council of Governments
    - OR DMV fleet composition for Eugene, 2002 Regional Transportation Model, EPA Mobile 6 modeling
- Texas Transportation Institute, Urban Mobility Report 1982-2003.

Solid Waste

Eugene is fortunate to have a community level solid waste and recycling program. Data was available through this program for residential and commercial solid waste in tons for 1990 and 2005. Additionally, solid waste program estimates indicate that there may be from 10 to 20% more solid waste generated by "self-haulers" than is captured in the data. Solid waste volumes were adjusted upwards by 10% to account for this.

The Oregon Department of Environmental Quality regularly conducts Waste Characterization and Composition studies. The most recent report available was done in 2002 and also contains information from previous studies in 1992-93. The 2002 DEQ data was compiled specifically for Eugene and was used in the model for 2005 figures. Earlier data specific to Eugene was not available. Comparison of the DEQ data showed that the 1992-93 data for the "rest of Oregon" showed a similar profile to Eugene data. This data was used for the 1990 inventory. (See appendix #2 for actual figures used in the CACP model).

There is some difference of opinion about methane recovery rates at Oregon landfills. OR DEQ reports that attempts to measure actual methane recovery have reported rates of about 42% at the Short Mountain facility, while professional opinion based on the fact that Short Mountain is a state of the art facility, estimate a recovery rate of 80%. The CACP model was run with both methane recovery rates. In both cases the GHG impact was negative. The 80% recovery rate was used in the model to maintain consistency with the state-level inventory.

Sources for this information:

- Alex Cuyler and Nancy Young, Solid Waste and Recycling Analysts, City of Eugene
- Dave Allaway, OR Dept of Environmental Quality
- Pete Spendelow, OR Dept of Environmental Quality.

Appendix 2: Summary of Data Inputs to CACP software

		1990	2005		Annual Growth Projections to 2020
EWEB (kwh)					
	Residential	958,057,848	960,623,460		1.06%
	Commercial	533,748,372	740,774,729		1.06%
	Industrial	355,832,248	493,849,820		1.06%
Blachly-Lane Coop (kwh)					
	Commercial	7,314,575	8,838,538		1.06%
	Industrial	69,680,949	84,198,701		1.06%
Northwest Natural Gas (therms)					
	Residential	24,800,000	41,201,000		1.75%
	Commercial	17,360,000	28,840,700		1.75%
	Industrial	7,440,000	12,360,300		1.75%
2020 Commercial also includes 10% fuel switch from Steam, with efficiency factor.					
EWEB steam (fuel units)					
	Commercial				
	units hog fuel	41,468	3,479,000	therms	-10%
	gal heavy oil	66,234	22,584	gal light oil	-10%
Household Firewood (cords)					
		20,518	11,292		0%
Household Fuel Oil (gallons)					
		907,475	371,588		-60%
VMT (millions of miles per year)					
		828.46	925.22		1.27%
Waste disposed (tons)					
	Residential	40,700	24,974		2.56%
	Commercial	64,900	80,906		
Waste Composition Estimates		*1992-93*	*2002*		
		"Rest of Oregon"	*Eugene only*		
	Paper	29.51%	21.99%		
	Food Waste	17.55%	15.31%		
	Plant Debris	9.42%	6.02%		
	Wood/Textiles	9.51%	18.10%		
	All other	34.01%	38.58%		