EUGENE CITY COUNCIL
AGENDA ITEM SUMMARY

Work Session: Eugene Community Climate and Energy Action Plan – Update

Meeting Date: September 15, 2010
Department: City Manager's office
www.eugene-or.gov

Agenda Item Number: B
Staff Contact: Matt McRae
Contact Telephone Number: 541-682-5864

ISSUE STATEMENT
In early 2009, the council directed creation of a Community Climate and Energy Action Plan (CEAP) to address climate change and energy volatility. The plan is complete, and this work session provides an opportunity to discuss adoption and next steps for implementation.

BACKGROUND
The council has adopted several recommendations made by the Sustainability Commission, with two recommendations combined into a single planning effort:

A. Develop a community climate action plan that will: (1) set a carbon emissions reduction goal and establish targets for achieving that goal; (2) identify strategies to achieve those targets; (3) identify necessary adaptations; (4) develop measures for tracking success; and, (5) include periodic progress reports back to the community with annual reports of progress to the Sustainability Commission.

B. Develop a community action plan that aims to reduce total, current, community-wide fossil fuel consumption 50 percent by 2030 (as an absolute, not a per capita reduction) by: (1) establishing targets for achieving that goal; (2) identifying strategies to achieve those targets; (3) identifying necessary adaptations; (4) developing measures for tracking success; (5) identifying financial impacts; and, (6) including periodic progress reports back to the community with annual reports of progress to the Sustainability Commission.

Staffing and other resources were identified to lead and support the project. An ad hoc community advisory team was formed in June 2009, to support successful planning and public outreach. Seven public forums were held between September 2009, and March 2010, to aid in plan development. During this process, more than 70 topic specialists and 500 community members provided input. Through this process of engagement with partners and the community, a broad set of potential actions has been honed down to those that are believed to be the most effective in meeting the City's targets for fossil fuel reductions, greenhouse gas emissions reductions, and climate adaptation. Staff from the Oregon Department of Environmental Quality (DEQ) also participated in this process. As the lead agency for the State's climate action policy, DEQ was represented in the community forums and provided feedback and guidance on the actions and targets contained in the plan.

The emission reduction targets contained in the plan reflect the most current methodology for measuring sources of emissions (i.e. emissions inventory) and are designed to:
1) Meet the corresponding proposed State emission reduction targets.
2) Meet the City's goal for reduced fossil fuel consumption.

Since the council work session discussing the draft CEAP in May 2010, staff met with more than a dozen community partners to share the draft plan, incorporated input from those discussions, and researched relative costs and benefits of actions. Highlighted changes to draft:

- Added recommendation: Establish a permitted facility within Eugene/Springfield area that can accept and compost (or anaerobically digest) all organic materials, including food wastes.
- Added recommendation: Assess and reduce barriers to solar energy use and balance priorities for solar access.
- Revised targets: Proposed Oregon greenhouse gas (GHG) emissions targets are incorporated.

In keeping with the Triple Bottom Line (TBL) framework, this plan addresses economic and social impacts in addition to environmental concerns. Some examples include:

- Provide for building efficiency retrofits for low-income populations.
- Diversify funding for the Lane Transit District (LTD) – to provide vulnerable populations with transportation options now and as fuel prices increase.
- Mitigate impacts of climate change and rising energy prices to bolster resilience of our local economy.

In creating an implementation plan, staff will give priority to those action items that: 1) have potential for significant emissions reduction; 2) have a demonstrated high level of community support; 3) are relatively easy or straightforward to implement; 4) are time sensitive; 5) have high leverage opportunity (with partners, grant funding, etc.) or, 6) are candidates for early success and likely to inspire additional investments and support.

RELATED CITY POLICIES

On February 28, 2000, the council adopted Resolution No. 4618, which outlines a definition and statement of intent regarding the application of sustainability principles to the City of Eugene, and affirms the commitment of City elected officials and staff to uphold these principles.

In November 2006, Resolution No. 4893 was adopted, committing the City to sustainable practices and to businesses that produce sustainable products and services.

In October 2008, the council adopted the recommendation from the Sustainability Commission that all City-owned facilities and City operations be "carbon neutral" by 2020.

COUNCIL OPTIONS

The City Council has the following options:

1. Direct the City Manager to implement actions that support the Community Climate and Energy Action Plan goals and objectives, subject to best practices, resources, collaboration with community partners, and approval by council of future policy changes.
2. Direct the City Manager to revise the plan or expand the planning process.
3. Take no action.

CITY MANAGER'S RECOMMENDATION

The City Manager recommends Option 1.

SUGGESTED MOTION

Move to adopt the Climate and Energy Action Plan.

ATTACHMENTS

A. Community Climate and Energy Action Plan

FOR MORE INFORMATION

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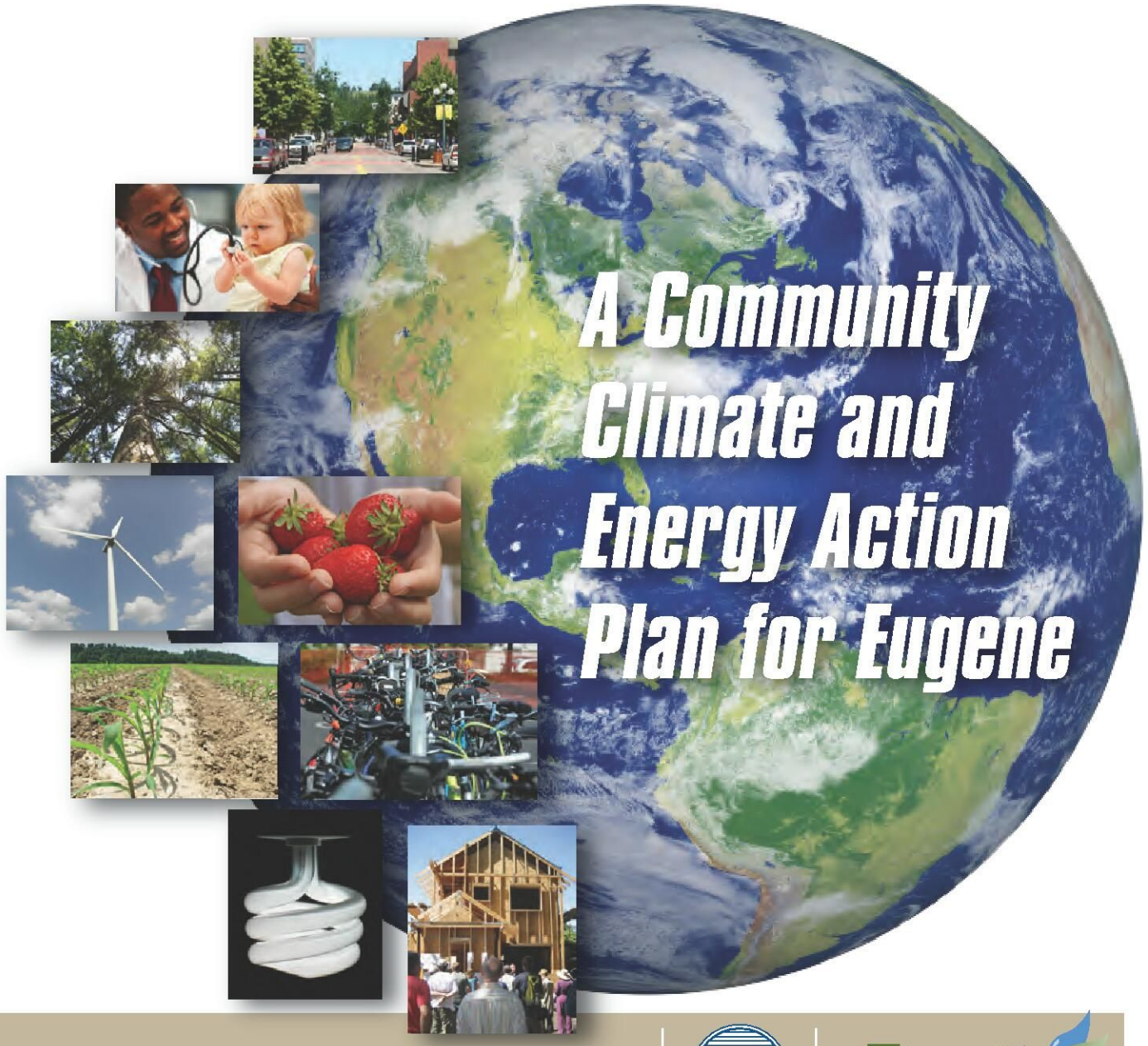

A Community Climate and Energy Action Plan for Eugene

September 2010

EUGENE

CLIMATE&ENERGY Eugene action plan

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Executive Summary

The decade from 2000 to 2009 was the warmest ever recorded.[1] Over the last three decades, each has been warmer than the one before and science is telling us that this trend will continue.[2] In addition, the inexpensive fossil fuels that our community and country depend on for transportation, food production, and industry are projected to become increasingly expensive.[3] Eugene is joining a growing list of cities around the world that are addressing these climate change and energy concerns with a plan to meet the challenges with vision and creativity. In developing this local plan, community leaders and citizens have clearly recognized the need to re-imagine how we live, eat, travel, and play. As we work to adapt to the uncertainties ahead, we can be sure that the boldness of our actions today will determine the quality of life in Eugene now and into the future.

Eugene's first Climate and Energy Action Plan:

In 2008, in response to increasing concern about global climate change and the potential for volatile and rising fuel prices, Eugene's City Council asked staff to develop Eugene's first Community Climate and Energy Action Plan.

The Community Climate and Energy Action Plan goals:

1. Reduce community-wide greenhouse gas emissions 10 percent below 1990 levels by 2020.
2. Reduce community-wide fossil fuel use 50 percent by 2030.
3. Identify strategies that will help the community adapt to a changing climate and increasing fossil fuel prices.

The Six Action Areas:

Buildings and Energy looks at energy used in residential, commercial, and industrial buildings in Eugene. This section includes recommendations to reduce energy use in existing buildings and new construction, expand use of renewable energy, and prepare buildings for climate change.

Food and Agriculture includes everything related to our food production, delivery, distribution, and waste disposal. This section includes recommendations to reduce consumption of meat and dairy foods, reduce greenhouse gas emissions associated with agriculture and food waste, protect regional farmland, increase home- and locally-grown foods, and prepare our food systems for an uncertain future.

[1] "State of the Climate Global Analysis," National Oceanic and Atmospheric Administration, June 2010.

*[2] "**IPCC** Fourth Assessment Report: Climate Change 2007," Intergovernmental Panel on Climate Change, 2007.*

[3] "Peaking of World Oil Production: Recent Forecasts," US Department of Energy, 2007.

Land Use and Transportation considers the use of land and the transportation of people and goods. This section includes recommendations to increase urban density and mixes of land use and a focus on improving systems for bike, pedestrian, transit, and electric vehicles.

Consumption and Waste looks at everything in the lifecycle of consumer goods from extraction of raw materials to manufacturing, packaging, distribution, product use and finally, disposal. This section includes recommendations to reduce greenhouse gas emissions associated with consumption of goods, improve recycling and composting, improve municipal purchasing practices, and adapt consumption strategies based on new findings.

Health and Social Services addresses mental and physical health care and assistance programs for disadvantaged populations. This section contains recommendations to prepare health and social systems for a different future and reduce the impacts of ***climate***-related disasters.

Urban Natural Resources considers the soil, air, water, plants, and animals of our city. This section contains recommendations to manage land, trees, and water for multiple benefits, update resource management plans, improve access to natural resource data, and expand drinking water and stormwater management programs.

From the Mayor

Mayor Kitty Piercy

The City of Eugene has a long history of environmental stewardship. It is a legacy to be proud of. Our planet faces both finite resources and ***climate change***, and the Eugene City Council has committed to an entire new level of local action.

The impacts of climate change and increased energy costs affect all of us, regardless of politics, background, or socioeconomic status. These are not simply environmental issues. They are health, economic, social equity and environmental issues.

We have learned that climate change is affected by carbon emissions, and that carbon footprints are linked to the food and goods we purchase. All of us need to rethink our consumption of goods, we consume too much and at an unsustainable rate.

Our city is part of a broader community, we are part of a world that requires each of us to make significant changes in our lives as governments, businesses, and social service agencies and as individuals - we must all work together more effectively to meet these challenges and to mitigate negative impacts.

"These are not simply environmental issues. They are health, economic, social equity and environmental issues."

Four years ago we began this journey with the Sustainable Business Initiative to foster our city's leadership in sustainable practices, the triple bottom line of environmental stewardship, economic success and social equity. The Sustainability Commission was formed. Innovative policies and practices moved forward throughout the city, but none more ambitious than the Climate and Energy Plan.

The steps outlined in this plan will not only help us reduce our contribution to climate change and improve community resilience, they will also save taxpayer dollars through improved energy efficiency and less expensive transportation options. They will help build the local economy, provide jobs, improve air quality and public health, and community livability.

This plan is a true collaborative endeavor and the result of many hours of hard work. I am very appreciative of the remarkable efforts of everyone involved in its creation. Thank you all for this investment in our community.

We join over 100 cities in developing emissions reduction targets and creating climate action plans. Together we are a powerful force. Each city, small and large must do its part. Eugene, though modest in size is large in its commitment to the future. We move forward with optimism and a commitment to do our part to ensure a quality future for our city, our country, and our planet.

Kitty Piercy

September 2010

Timeline and Goals

1989 Oregon legislature first establishes carbon-reduction goal

1992 Rio Earth Summit *(United Nations framework convention on climate change)*

1997 Kyoto protocol

2005
- Eugene Mayor signs the US conference of Mayors "US mayor's climate protection agreement", striving locally to meet or beat the Kyoto protocol targets
- City of Eugene creates a greenhouse gas inventory for internal municipal operations
- Oregon strategy for Greenhouse Gas Reductions completed

2006 Eugene Sustainable Business Initiative recommends creation of 1) sustainability commission and 2) metropolitan climate action plan

2007
- Eugene sustainability commission is established
- "City of Portland Descending the Oil Peak" report highlights challenges of fossil fuel depletion
- City of Eugene completes a community greenhouse gas inventory

2009
- Climate Leadership Initiative, et.al. creates report: "Preparing for Climate Change in the Upper Willamette Basin of Western Oregon" – highlighting impacts of climate change to Eugene and surrounding area
- Eugene City Council instructs staff to create a Community Climate and Energy Action Plan
- City of Eugene creates the first Internal (city operations) Climate Action Plan

2010 City of Eugene works with community partners to create Eugene's first Community Climate and Energy Action Plan

2020 State of Oregon Goal: Reduce greenhouse gas emissions 10% below 1990 levels

2030 City of Eugene Goal: Reduce overall community fossil fuel use 50% below 2005 levels

2050 State of Oregon Goal: Reduce greenhouse gas emissions 75% below 1990 levels

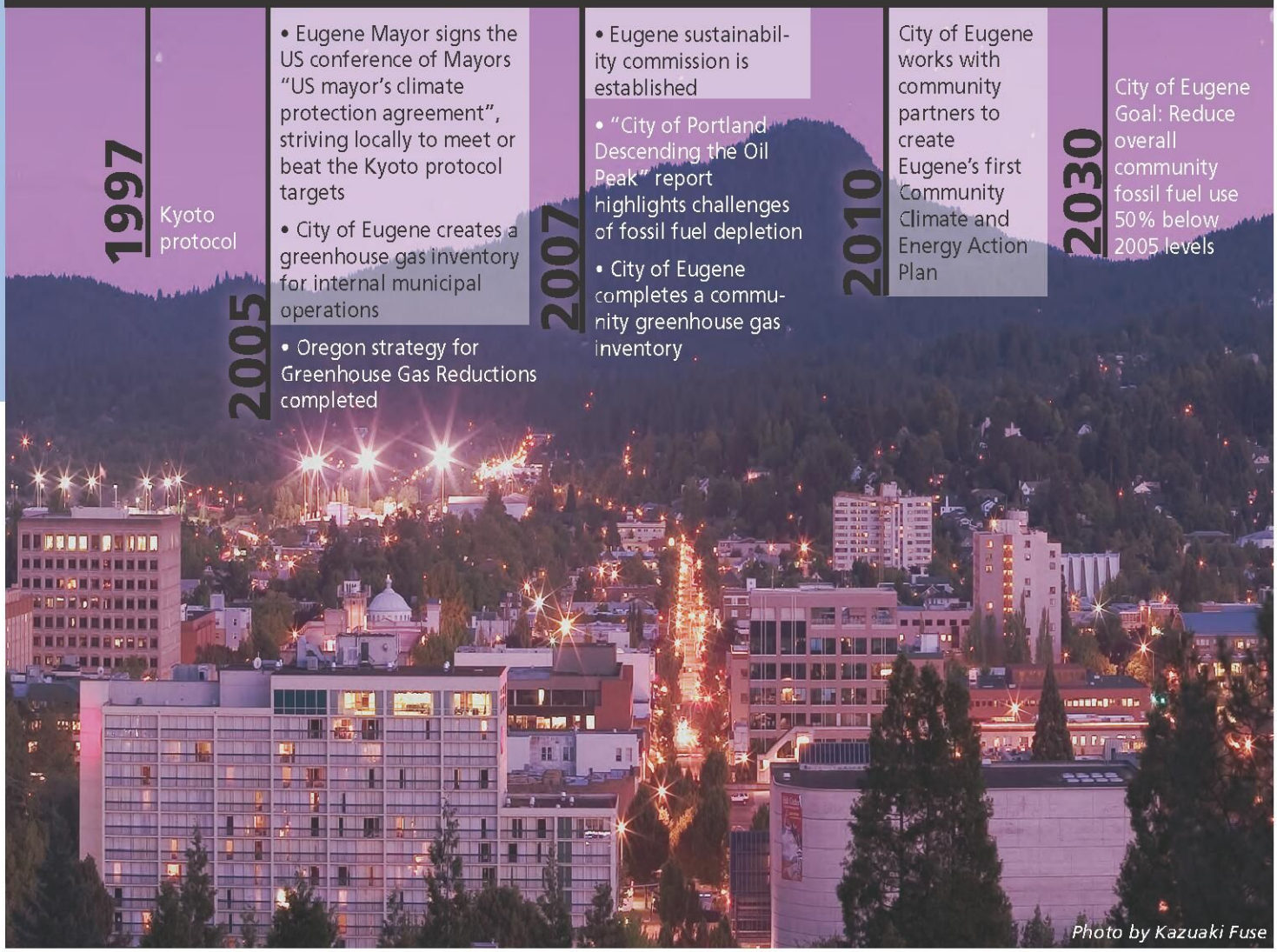


Photo by Kazuaki Fuse

Introduction

Preparing For Change

In the winter of 2008/2009, Eugene's City Council unanimously directed staff to develop a Community Climate and Energy Action Plan (CEAP).[4] All City operations and City-owned facilities were to be carbon-neutral by 2020. During the same year, the Council committed the City to work with its partners to develop a plan to set carbon emission goals, to suggest effective emission reduction strategies, and to identify ways in which the community can adapt to the anticipated changes. Four months later, the Council expanded the action plan to include steps for achieving a 50 percent reduction in community-wide ***fossil fuel*** consumption by 2030. This plan is the product of those efforts to understand what climate change and fuel cost increases could mean for Eugene, and to find ways that lessen the expected impacts and meet the goals for reducing emissions and fossil fuel consumption.

While there is considerable discussion and some debate on the issues of climate change in the community and beyond, this plan was undertaken in response to Council direction and is informed by the scientific evidence available at the time of its publishing.

The Community Climate and Energy Action Plan (CEAP)

Goals

1. Reduce community-wide ***greenhouse gas*** emissions to 10 percent less than 1990 levels by 2020 and 75 percent below 1990 levels by 2050.[5]
2. Reduce community-wide fossil fuel use 50 percent by 2030.[6]
3. Identify strategies that will help the community adapt to a changing climate and increasing fossil fuel prices.[7]

Geographic Scope and Timeline

Citizens, topic experts and partners from inside and outside of the City of Eugene were invited to develop a plan for the broader community. This public engagement process identified challenges and opportunities and presented options and action items that will require partnerships and joint efforts across the community.

The CEAP establishes general directions and offers specific actions over the next three to five years; however, the scientific and general community's understanding of climate and energy challenges are evolving rapidly and Eugene's direction and goals will likely need to be updated.

[4] More policy detail and background can be found in Appendix 9.

[5] This goal matches Oregon's stated GHG reduction targets from House Bill 3543. While this target is not equivalent to the fossil fuel reduction target, it reflects the degree of GHG reductions that are necessary, according to scientific research. Additional discussion of relative greenhouse gas targets begins on page 14 of Appendix 8.

[6] This goal, unanimously adopted by Eugene City Council February 2009, will use the base year 2005, the year of data used for the 2007 community greenhouse gas inventory.

[7] The full text of the City Council directives related to the CEAP can be found in Appendix 9.

How was the plan developed?

The Climate and Energy Action Plan Advisory Team

The CEAP advisory team was assembled in May 2009 and was composed of 11 community members and representatives of partner agencies. In June 2009, the team began providing input on the public outreach and general planning processes. The group brought expertise to the public meetings, observed and participated in topic discussions, provided feedback on the development of the plan and the plan document, and provided background data.

Team Member	Partner Agency/Group
Chuck Gottfried	City of Springfield
Sarah Mazze	Resource Innovation Group and The UO Climate Leadership Initiative
Joshua Proudfoot	Eugene Area Chamber of Commerce
Jason Heuser	Eugene Water and Electric Board
David Hinkley	Friends of Eugene
Lorraine Kerwood/Twila Souers	Eugene Human Rights Commission
Joe McCormack	Lane Transit District
Mike McKenzie-Bahr	Lane County
Jan Wostmann	Neighborhood Leaders Council
Heidi Beierle/Bill Randall	City of Eugene Planning Commission
Shawn Boles	City of Eugene Sustainability Commission

The Public Engagement Process

News releases, print and online calendars, website announcements, and emails invited members of the public to participate in seven public forums. A kickoff event was held in September 2009 and one public forum was held on each of the six topics between October 2009 and March 2010. More than 500 members of the public participated, sharing concerns about climate uncertainty and fuel price volatility, and weighing in on what should be the community's highest priorities. Below are the six topics or action areas:

- Buildings and Energy
- Food and Agriculture
- Land Use and Transportation
- Consumption and Waste
- Health and Social Services
- Urban Natural Resources

The process for identifying action items for each of the six topic areas was as follows:

1. A strategy list was compiled using information submitted by regional experts and gleaned from municipal- and state-level climate and energy plans from across the nation. The list was reviewed by the topic specialists, refined, and then used as a starting place for the public forums.
2. Topic specialists were identified from across the community. Eight to twelve expert community members with broad knowledge of the topic and the ability to bring a variety of perspectives to the public forums were invited to assist with the plan. The topic specialists contributed to the development of the strategy lists, provided technical information support at the public forums, and assisted with the prioritization of strategies. A complete list of Topic Specialists can be found in Appendix 3.
3. Public forums were held to engage members of the community who are interested in climate and energy challenges as they relate to each of the six topics. Each of the forums were attended by 50 to 120 community members, including topic specialists, CEAP advisory team members, neighborhood leaders, and Sustainability Commissioners. Forum participants reviewed the strategy list for the subject topic, provided perspectives on which actions should be given the highest priority, identified missing actions or strategies, and provided detail on how individual actions could be implemented.
4. Topic specialists reviewed proposed actions in greater detail, provided input on priorities, clarified ideas, identified opportunities and challenges, and helped to ground the process in Eugene's unique economic, social, and environmental conditions.
5. Advisory team members weighed information from background documents, input from the public forums and the topic specialist meetings, and offered their varied perspectives on each topic area. The team completed a final review of the strategies and reviewed and commented on the draft Community Climate and Energy Action Plan.
6. Additional Research was conducted after the draft was released to clarify some of the relative costs and benefits of actions. This adds confidence that the priorities included in the plan are the best places for our community to take action. Targets and measures were also added.[8] This information is compiled in the attached spreadsheet, Appendix 1.

The Outcomes

Of the several hundred possible action items suggested, reviewed, and discussed in the public engagement process, the plan only includes those that are expected to best reduce fossil fuel consumption and GHG emissions, and to prepare Eugene for the impacts of energy price volatility and climate uncertainty. A strict cost-benefit analysis wasn't feasible, but the project team designed a process that weighs the relative importance of potential actions in the context of the three stated goals.

[8] The targets associated with objectives and actions in the Plan reflect best estimates of the reductions necessary. Creating targets that are carefully calibrated to the overall GHG and fossil fuel reduction goals will require additional research.

What Happens Next?

Funding: In the 2011 fiscal year budget, $200,000 of one-time funding was earmarked for use in implementing both the Community Climate and Energy Action Plan and the City's Diversity and Equity Strategic Plan. These funds are in addition to the work already underway across the City organization in Solid Waste management, the Green Building program, Stormwater Management, Urban Forestry, and many other existing City programs.

Reporting back: The City Council will receive annual reports assessing the progress being made on each of the multiple objectives included in the plan.

Updating the plan: Our understanding of the complex issues around climate change and greenhouse gas ***sources*** is continually improving, and as our community moves forward on the priorities included in this plan, it will be important to revisit, revise, and update Eugene's Community Climate and Energy Action Plan every three to five years.

How is the Community Climate and Energy Action Plan Organized?

The strategies are divided into six action areas. The first four are the primary targets for greenhouse gas emissions and fossil fuel reductions, and the last two focus on actions necessary to adapt to climate change and rising fuel prices.

- Buildings and Energy
- Food and Agriculture
- Land Use and Transportation
- Consumption and Waste
- Health and Social Services
- Urban Natural Resources

Please note that the actions in each area are not organized by priority. The first action in each section is not necessarily the most important, nor is the last the least important.

A table containing all of the actions and associated targets, measures, estimated financial impacts, and estimated greenhouse gas reductions data is available in the Compiled Priority Action Items Tables in Appendix 1.

Terms in *italics* are defined in the glossary located in Appendix 2.

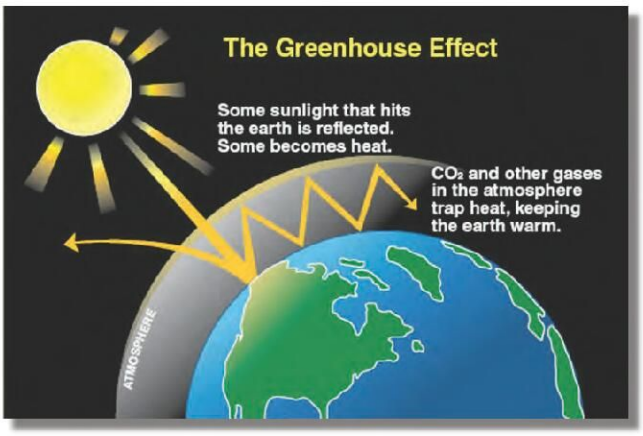


Figure 1 - Source: State of Washington Department of Ecology

How will Climate Change and Volatile, Rising Fuel Prices Affect Eugene?

How Do Greenhouse Gases Contribute to Climate Change?

The earth receives radiant energy from the sun—part of which is reflected back to space. Greenhouse gases, including ***carbon dioxide***, ***methane***, and ***nitrous oxide***, surround the earth and trap some of this energy—keeping the surface warm and making life on earth possible (see Figure 1). Since the start of the Industrial Revolution we have been burning fossil fuels such as oil, coal, and ***natural gas*** to heat and light our homes and businesses, create electricity, and provide transportation. By burning fossil fuels and releasing carbon dioxide, these activities have increased the amount of greenhouse gases in the ***atmosphere***, causing more of the sun's energy to be trapped. The trapped energy warms the earth and changes our climate. Climate scientists have been telling us if we are to avoid further intensifying the ***greenhouse effect*** and its impact on our climate, we will need to reduce our greenhouse gas emissions. Nations, states, and communities must work to decrease greenhouse gas emissions and plan for climate change.

How Will Our Climate Change?

Carbon dioxide and other greenhouse gases produced today will remain in the atmosphere and continue to affect the climate for decades to come. However, reducing greenhouse gas emissions now is expected to decrease the magnitude of climate change over time. "Preparing for Climate Change in the Upper Willamette River Basin of Western Oregon: Co-Beneficial Planning for Communities and Ecosystems,"[9] published in 2009, identifies several important changes expected to affect our community:

- Average annual temperatures increase by 8 to 12° F by around 2080.
- Reduced ***snowpack*** and resultant lower stream flows in summer
- Increased demand for water for agricultural uses.
- Reduced summer hydroelectric power ***generation*** capacity (due to lower stream flows in summer) and increased summer demand for electricity.
- Increased storm intensity, flooding, and wildfires.
- Higher rates of heat-related illness , exhaustion, asthma, and respiratory diseases.

In addition to these physical impacts, climate change is expected to have significant financial impacts, particularly if it accelerates and if we don't prepare our systems for the impacts just outlined. The report, "An

[9] *"Preparing for Climate Change in the Upper Willamette River Basin of Western Oregon: Co-Beneficial Planning for Communities and Ecosystems," US Department of Agriculture, Climate Leadership Initiative, and National Center for Conservation Science and Policy, 2009.*

Overview of Potential Economic Costs to Oregon of a Business-As-Usual Approach to Climate Change,"[10] makes several important observations, including the following: "If spread evenly, Oregon's households, on average, could incur annual costs of $1,930 per year by 2020. Of this amount, $830 relate to expenditures on energy, $460 relate to health-related costs, and $370 to the adverse effects of climate change on salmon populations. These costs are not negligible. The 2020 average of $1,930 represents more than 4 percent of the current median household income in Oregon." The report continues by listing many of the costs that haven't yet been calculated, and states that, "Far greater costs might materialize elsewhere or in future centuries, the result of a business-as-usual approach to climate change over the next few decades. If temperatures rise to the maximum levels predicted under the business-as-usual scenario, billions of people in less-developed countries likely would endure increased thirst and starvation, thousands of species would face extinction, sea levels would rise several meters, and vast areas of the oceans could become essentially barren. To the extent that these distant effects matter to today's Oregonians, the potential costs would be far greater than we indicate."

"Continued dependence on coal, oil, and natural gas affects not only our climate, it influences the stability of our local and national economy"

In contrast to these costs, several reports suggest that taking action now will result in significant savings. "Washington Western Climate Initiative Economic Impact Analysis"[11] and "Pathways to a Low-Carbon Economy,"[12] suggest that reducing energy use and preparing for climate change will quickly save citizens, businesses, and governments millions of dollars by reducing energy costs and creating sorely needed jobs.

How Will a Rise in Fuel Prices Affect Eugene?

Continued dependence on coal, oil, and natural gas affects not only our climate, it influences the stability of our local and national economy. Global demand for oil and natural gas has increased rapidly over the last 30 years. The supply of these non-renewable resources is limited, and over the last decade, concern about the shrinking supply and rising demand has increased. Many credible sources project that global oil supply will go into irreversible decline within the next five to ten years.[13]

Gas prices over $4 per gallon during the summer of 2008 reminded consumers of how dependent Eugene's economy is on these fuels for

[10] *"An Overview of Potential Economic Costs to Oregon of a Business-As-Usual Approach to Climate Change," CLI Et. al. 2009*

[11] *"Washington Western Climate Initiative Economic Impact Analysis," ECONorthwest, 2010*

[12] *"Pathways to a Low-Carbon Economy: Version 2 of the Global Greenhouse Gas Abatement Cost Curve," McKinsey and Company, 2009*

[13] *"Peaking of World Oil Production: Recent Forecasts," US Department of Energy, 2007*

our daily activities. The increased costs of fuel, transportation, food, and consumer goods had a significant impact on many consumers and businesses, and hit small businesses and lower- and fixed-income households the hardest.

The City of Portland Peak Oil Task Force studied the likely impacts of rising fuel prices and in 2007, published their findings in "Descending the Oil Peak: Navigating the Transition from Oil and Natural Gas."[14] The report identifies a number of ways in which northwest communities such as Eugene are vulnerable to changes in global energy markets. For example, transportation of freight via air and truck is expected to become more costly and to cause food prices to rise. Increased costs for fertilizer, animal feed, and processing will also put upward pressure on food costs. Likewise, heating and cooling buildings will become significantly more expensive. Rising costs and shrinking disposable incomes will result in economic weakness, increased unemployment, and higher demand for social services. As is the case with the effects of climate change, the impacts of rising costs and a weakening economy will be felt broadly across the region and those hardest hit by the changes will be the most vulnerable—children, the elderly, and those with lower or fixed incomes.

While there is clearly a need to transition away from dependence on oil, coal, and natural gas, there aren't always easy substitutes. That is in part because these fossil fuels provide a huge amount of energy in a very small volume that can be easily transported, stored, and used by just about anyone. Just one gallon of gasoline, currently sold for about $3, is roughly equivalent to three weeks of labor for one person.[15] Our economic systems have become very reliant on this incredibly cheap and convenient source of "labor" and when the cost of this "labor" goes up, so do the prices of goods and food that depend on this energy for production and distribution.

In contrast to convenient and energy-dense oil, most of the available renewable substitutes like wind, solar and wave energy all generate electricity that requires heavy and expensive batteries to store. The energy transmission and storage systems that will be required for widespread use of these alternatives will take 10 to 20 years and significant investment to develop.[16] In order to reduce the impacts of high fossil fuel prices, these investments must be made soon. Heavy investments in ***renewable energy*** sources will only help replace part of our current energy need, so reduced energy use overall is essential.

[14] *"Descending the Oil Peak: Navigating the Transition from Oil and Natural Gas," City of Portland Peak Oil Task Force, 2007.*

[15] *"The Tightening Conflict: Population, Energy Use, and the Ecology of Agriculture," M. Giampietro, D. Pimentel, 1994.*

[16] *"Peaking of World Oil Production: Impacts, Mitigation,& Risk Management," Hirsch et. al. 2005.*

What has Eugene Done to Prepare for Climate Change and Rising Fuel Prices?

Internal Climate Action Plan: In 2009, at the direction of City Council, the City of Eugene created an Internal Climate Action Plan[17] that describes how the organization will reduce energy use in internal operations with the goal to be ***climate neutral*** by 2020. This will be done by increasing ***energy efficiency***, increasing waste prevention, improving purchasing methods, and offsetting any remaining energy use by purchasing quality carbon offsets.

Waste reduction plan: The City of Eugene is currently creating an internal waste reduction plan with the goal to reduce waste 90 percent by 2030. This will also reduce greenhouse gas emissions from City operations.

Food Scope document: In early 2010 staff completed a scoping and resource plan for development of a food security plan in conjunction with community partners.[18] This work is a positive step toward improving food security in Eugene, and an important part of preparing for climate change.

The Community Greenhouse Gas Emissions Inventory for Eugene

In 2007, as a first step toward creating a climate and energy action plan, City staff and community partners compiled an inventory of the community's greenhouse gas (GHG) emissions. The Eugene Community Greenhouse Gas Emissions Inventory Report[19] provides useful detail about the community's emissions related to buildings, energy use, and transportation.

This report, however, does not account for the energy and associated emissions, that are "embodied" in consumer goods, energy and services. ***Embodied energy*** is all of the energy—including electricity, oil and natural gas—used in making, transporting, storing, distributing and disposing of the consumer goods we use—from drinking cups and lawn furniture, to refrigerators and cars. It is the energy used to mine the metal, harvest the wood, grow the cotton, extract the oil to make the plastic, as well as to manufacture, distribute, and finally to dispose of these items. Many products today are made of components which come from several places and have been shipped around the world before we encounter them. For this reason, calculating the amount of energy in any one item is very difficult; the data and methodology for this type of analysis have been developed only recently.

[17] The City of Eugene Internal Climate Action Plan can be found in Appendix 4 and on the City's website.

[18] "City of Eugene Food Security Scoping and Resource Plan," City of Eugene, April 2010.

[19] See Appendix 8 for the full text of the "Eugene Community Greenhouse Gas Emissions Inventory Report," July 2007.

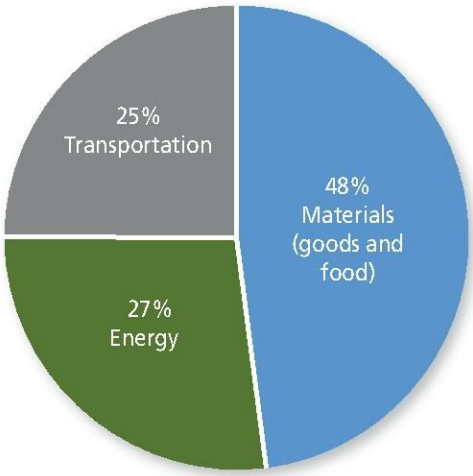


Figure 2 - Greenhouse gas emissions by system. Source: Metro regional greenhouse gas inventory.

A Greenhouse Gas Inventory for the Metro Portland Region

In April 2010, Metro, the regional government for the metropolitan Portland area published "Regional Greenhouse Gas Inventory; The Carbon Footprint of Residents and Businesses Inside the Portland Metropolitan Region." The report, the first of its kind in the nation, is based on analysis which considered the embodied energy of all the goods, services, transportation modes, and energy consumed in the metro area.

Metro's GHG inventory reveals additional information that, along with the Eugene GHG Report, provides a more complete picture of the community's greenhouse gas emissions. For example, Metro's study revealed that 48 percent of greenhouse gas emissions are related to the production, manufacture and disposal of materials, goods and food. (Note that many of these emissions were not estimated in Eugene's GHG Report.) Also, 25 percent of emissions are associated with transportation, which includes the use of passenger vehicles, light trucks, and mass transit services. The final 27 percent are produced by residential, commercial, and industrial consumption of natural gas and electricity.

This new analysis provides valuable information about the real emissions impacts of particular choices and strategies; businesses and residents now have even greater control over their greenhouse gas footprint.

A Greenhouse Gas Inventory for the Eugene/Springfield Metro Area

Lane Council of Governments is conducting a community greenhouse gas inventory for the Eugene/Springfield metropolitan area using the same methodology employed to generate the Portland Metro inventory outlined above. This inventory will be available in the fall of 2010 and the findings will be compared with the Portland Metro inventory to further inform this plan.

Buildings and Energy

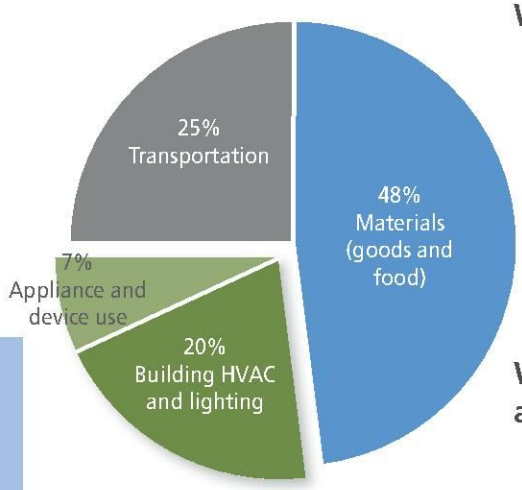


Figure 3 - Greenhouse gas emissions by system. Source: Metro Regional GHG Inventory

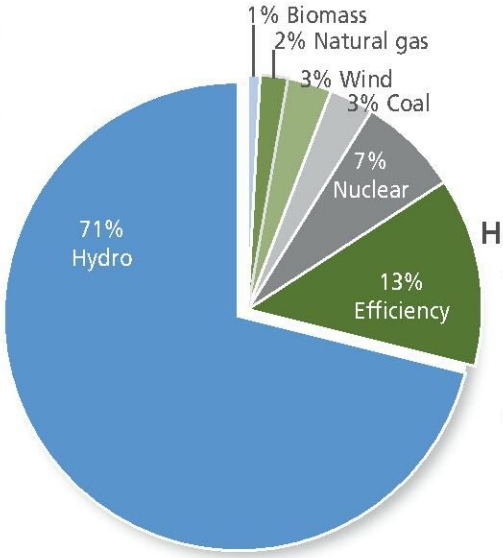


Figure 4 - EWEB power source by type. From EWEB data.

What is the Buildings and Energy Action Area?

This section focuses on all the energy used to provide heating, cooling, light, and power in residential, commercial and industrial buildings in Eugene and on the resulting GHG emissions. The emissions from this sector come from a wide variety of power uses such as operating a commercial businesses (e.g., supermarkets), producing industrial products (e.g., operating sawmill equipment), to powering events (e.g., lighting at Autzen Stadium), as well as the traditional heating/cooling/power needs of homes, apartments, office buildings, manufacturing facilities, etc.

What Part of Eugene's GHG Footprint Comes from Buildings and Energy?

The GHG inventory created by Metro[20] shows that emissions from energy use in buildings accounts for roughly 27 percent of that community's GHG emissions (see Figure 3). This plan assumes that those numbers are generally true for Eugene. The community GHG inventory created by the City of Eugene[21] shows the bulk of emissions associated with building energy use comes from burning natural gas to heat water and buildings, and not from electricity use. There is still need to pay close attention to electricity use, however, because any increases in electricity use, whether from growing population or increased overall demand, is likely to be met by burning coal or natural gas to generate electricity. Therefore, ongoing efforts at electricity conservation are essential to avoiding increased GHG emissions.

How Do Buildings and Energy Contribute to GHG Emissions?

The primary utilities for Eugene are the Eugene Water and Electric Board (***EWEB***), a publicly-owned utility, and the NW Natural Gas Company, an investor-owned utility. Though natural gas is cleaner than coal or oil combustion, it still produces significant amounts of greenhouse gases. The 2007 community GHG inventory projects that by the year 2020 the community will produce more emissions by burning natural gas than by burning gasoline for transportation.

Compared to other communities, a small amount of Eugene's GHG emissions result from electricity generation and use; largely because EWEB sources most of its electricity from hydroelectric dams and other low-GHG-emitting energy sources (see Figure 4). In addition, over the past several decades, EWEB has met much of the increased demand for electricity in Eugene through "efficiency". Instead of additional power plants to meet increasing demand EWEB funds energy conservation programs to reduce demand. This has reduced the amount of electricity that EWEB needs to generate or purchase on behalf of customers by 13 percent. Continuing to reduce the GHG emissions from the local electricity mix by increasing conservation and including more renewable energy sources will ensure a low-carbon electricity mix well into the future. Note that even renewable

[20] *"Regional Greenhouse Gas Inventory; The Carbon Footprint of Residents and Businesses Inside the Portland Metropolitan Region" Metro, April 2010.*

[21] *For more detail on greenhouse gas emissions from buildings and energy use in Eugene, see Appendix 8 "Eugene Greenhouse Gas Emissions Inventory Report" City of Eugene, July 2007.*

energy sources, such as wind and solar power, have some associated GHGs—primarily from construction of the required infrastructure; however, the amounts are minimal compared to burning fossil fuels to generate electricity.

The big opportunities to reduce GHG emissions are increasing the percentage of energy that is renewable, retrofitting existing buildings and equipment, and maximizing efficiency in new buildings. The Northwest Power and Conservation Council[22], EWEB[23] and the ***Energy Trust of Oregon***[24] all call for increased conservation and use of renewable energy sources correlating directly with the recommendations outlined in this plan.

How Will Rising Fuel Prices Impact Buildings and Energy?

In order to significantly reduce fossil fuel use and GHG emissions in the buildings and energy sector, the community must make structural and behavioral changes. The increase in fuel costs associated with the projected increase in demand and decreased supply of oil will have considerable impacts on the ability of residents and business owners to heat and power their homes and businesses. Because they are less energy efficient, many older homes and non-residential structures will become increasingly expensive to heat, light, and operate. Rising fuel prices will also increase the cost of constructing new buildings and retrofitting existing ones, especially as the costs to extract and process raw materials and transport goods increases. This increase is likely to encourage the reuse of buildings and building materials.

How Can We Prepare the Buildings and Energy Sector for Climate Change?

While Eugene takes steps to reduce the community's GHG emissions, we must also prepare for the projected impacts of climate change. More intense storms, reduced snowpack, lower summertime stream flow, and more extreme summertime heat events, will have tangible impacts on buildings and energy resources. Some of the changes can be mitigated through the application of the following ***adaptation*** strategies:

- Maximizing energy and water efficiency in buildings.
- Designing buildings, and locating them in ways that take advantage of the sun and natural ventilation.
- Using landscaping to increase summer shading and minimize air conditioning use.
- Reducing the ***urban heat island*** effect by planting trees and incorporating reflective roofs and light-colored pavement.
- Designing buildings to be more durable and to withstand more intense storm events.
- Incorporating ***stormwater*** management strategies such as green roofs, ***bioswales*** and raingardens.

[22] The Northwest Power and Conservation Council's 6th Plan calls for all new electricity load growth in the region to be met through conservation (over 5,800 average megawatts-aMW) or renewables.

[23] EWEB's "2008-2027 Energy Conservation Resource Strategy 2008-2027" identifies the acquisition of over 54 aMW in conservation measures over the next 20 years at a cost of less than $0.055/kWh.

[24] Energy Trust of Oregon's current 5-year Strategic Plan includes the goal of saving over 22.5 million annual therms of natural gas through efficiency and conservation. "Strategic Plan 2009-2014," Energy Trust of Oregon. 2009. ***http://energytrust.org/About/policy-and-reports/Plans.aspx***

EWEB Greenpower

In 1999 EWEB became the first public utility in Oregon to build and own a wind farm. Today, Adams Elementary School and Northwest Youth Corps are both preparing to mount solar panels on their roofs. And if you charge your electric car at Lane Community College, that power too, will be coming from the sun.

Projects like these, funded by EWEB Greenpower, help meet the goal to increase the amount of energy that comes from renewable sources. If Eugene is to experience a dramatic shift away from fossil fuels, investments will need to be made at many levels and fortunately for businesses and residents, supporting this transition to renewable energy has become very easy and affordable.

EWEB Greenpower is a voluntary program for customers who can pay as little as $1.50 per month to support the program. These Greenpower funds, collected from neighbors and local businesses, are then combined to support renewable energy projects right here in the Northwest. To learn more, visit **www.eweb.org/greenpower.**

Fortunately, many adaptation strategies will help the community reduce both energy use and GHG emissions.

Efforts Underway

Several organizations are working to increase energy efficiency and reduce GHG emissions in Eugene. Local utilities have effective conservation programs that have had a very significant impact on energy consumption. For example, EWEB has offered energy conservation programs for its customers for over 30 years for an annual energy savings that exceeds 500 million ***KWh*** per year—more than the combined output of the utility's six hydroelectric projects.[25] Other efforts underway:

- The City of Eugene offers assistance for energy-efficiency through housing rehabilitation loans, business loans, and the Green Building Incentive Program.
- The Climate Master™ program created by the Climate Leadership Initiative.
- Housing and Community Services Agency (HACSA) offers energy efficiency incentives.
- The Energy Trust of Oregon offers incentives.
- BRING Recycling offers the ReThink Business program.
- The City of Eugene is implementing its Internal Climate Action Plan to reduce GHG emissions from City-owned buildings and City operations.

[25] *"2008 Facts & Figures," Eugene Water and Electric Board. 2009.*

Objectives and Actions for Buildings and Energy

Objective 1:
Reduce total GHG emissions from existing buildings by 50 percent by 2030.

According to the Metro Regional Greenhouse Gas Inventory, residential, commercial and industrial energy use in existing buildings accounts for about 27 percent of all GHG emissions. Sixty-six percent of Eugene's housing stock was built before 1980 when efficiency standards were much lower, signifying a substantial opportunity to increase energy-efficiency in existing buildings. Their retrofitting will be accelerated by expanding the successful programs offered by EWEB, Energy Trust of Oregon, and other partners. Educational and outreach programs will continue to be an important tool to reduce energy use by changing the behavior of building occupants. For example, requiring that information about a building's energy use is made available at the time of sale will empower builders, building owners, renters and buyers to make informed choices and will increase market demand for more energy-efficient buildings.

High-Priority Actions

1.1. Identify the most ***cost-effective*** opportunities for increasing efficiency in existing buildings. Support the existing efforts of local utilities to find these opportunities.

1.2. Expand assistance and incentive programs for building retrofits that increase energy efficiency and reduce the carbon footprint of existing buildings.

1.2a) Work with Energy Trust of Oregon to focus on improving efficiency in buildings that are heated with natural gas.

1.2b) Target sectors with high-efficiency potential including rental buildings, multifamily housing, remodels, and commercial tenant infill.

1.3. Establish a project fund to complement existing loan and incentive programs by focusing on long-term, low-interest financing mechanisms for residential and commercial energy efficiency and/or renewable energy system installations.

1.4. Target ***occupant behavior*** in order to reduce energy use in all types of buildings.

1.4a) Strategies include Advanced Meter Infrastructure (already planned for by EWEB), real-time energy consumption information and community-based social marketing programs.

1.5. Adopt an ***energy performance score*** program or similar tool to disclose total energy use in existing and new buildings for use by builders, realtors, owners, and renters.

District Energy

In a district energy system, steam, or hot or chilled water is produced in a central plant and distributed to multiple buildings in a defined area through underground pipes. These systems eliminate the need for heating or cooling equipment in each building, reducing upfront costs and saving energy. Also, district energy systems may offer more flexibility in the type of fuel used resulting in an easier transition from fossil fuel. An additional value of district systems is the distribution of expenses across all users for operations, maintenance and/or retrofitting, thereby reducing costs to customers. District energy systems, especially those that use renewable fuel sources, can play an important role in reducing the carbon footprint of Eugene's buildings.

Objective 2:
Reduce GHG emissions from new construction by 50 percent by 2030.

Advances in technology and emphasis on ***whole building design*** and ***integrated design*** are enabling construction of buildings that can achieve far greater energy efficiency than previously imagined. New construction also provides an opportunity to incorporate adaptation strategies that allow buildings to work effectively in a changing climate. Facilitating construction of high-performing new buildings can play a significant role in reducing GHG emissions. The actions listed below aim to improve efficiency standards and increase assistance for energy efficiency and climate adaptation strategies in new buildings.

High-Priority Actions

2.1. Lobby for adoption and actively participate in development of building code amendments that meet the ***Architecture 2030*** standards for energy efficiency (standards outlined in Appendix 11).

2.2. Increase incentives for highly energy-efficient new buildings aiming toward ***zero net energy*** and ***carbon neutral*** buildings.

2.2a) Revise or expand incentives to encourage smaller homes that require less energy to operate and fewer building materials to construct.

Objective 3:
Expand Development of Renewable and District Energy Systems.

Renewable energy comes from resources that can be naturally replenished such as wind, hydroelectric, and solar—in contrast to fossil fuels like coal and oil that cannot. Renewable energy sources also produce much fewer GHG emissions than fossil fuels. Increasing use of renewable energy will reduce our use of fossil fuels, decrease GHG emissions, generate green jobs and increase local energy self-sufficiency.

High Priority Actions:

3.1. Increase the use of on-site renewable energy systems, such as solar hot water, ***photovoltaic***, and ground-source heat pumps, by removing financial, infrastructural, regulatory, and perceptual ***barriers***.

3.1a) Invest in EWEB's downtown network to allow surplus energy from photovoltaics on downtown buildings to be integrated into the electricity grid.

3.1b) Address the financial barriers to onsite renewable energy by expanding financing options like long-term loans and property-assessed clean energy bonds.

3.1c) Assess and reduce barriers to solar energy use and balance priorities for solar access.

3.3. Develop at least one ***community scale renewable energy*** pilot project by 2015.

3.4. Develop ***district energy*** systems in Eugene.

3.4a) Remove legal, technical, policy, governance, and financial barriers to district energy systems.

3.2b) Complete the viability study for a district energy system for the EWEB Riverfront Master Plan.

3.2c) Develop at least one clean district energy, or shared energy, system pilot project by 2015 by working with property owners and local utilities.

Objective 4:
Increase the implementation of climate change preparation strategies for the built environment.

While Eugene takes steps to lower greenhouse gas emissions, the community must also prepare for the inevitable impacts of climate change. Since buildings constructed today will likely be in use for decades, state building codes must facilitate climate preparation strategies. These strategies that improve energy efficiency will also help the community adapt to the effects of climate change. Increasing efforts to conserve water will also help reduce the amount of energy used to treat and distribute water, and will improve Eugene's ability to adapt to the projected reductions in water supply.

High Priority Actions:

4.1. Encourage the use of passive systems in buildings for heating, cooling, ventilation, water delivery, and incorporate climate change preparation strategies into building design and construction.

4.4a) Lobby to improve state building codes.

4.4b) Develop incentives to encourage the use of passive heating and cooling systems, lighting, ventilation, and other strategies that reduce energy demand and better adapt buildings for a changing climate.

4.2. Provide education, assistance and incentives to reduce potable water use in new and existing buildings and landscaping.

4.2a) For example: low-flow fixtures, appropriate (xeriscape) landscaping, use of ***greywater*** and onsite rainwater catchment systems, behavior change, etc.

City of Eugene Green Building Program

The goal of the City's Waste Prevention and Green Building Program is to make sustainable waste prevention and green building practices the norm in Eugene, through the guide2Green Program. Priority goals for the program are to reduce GHG emissions, promote sustainable economic development and support local self-sufficiency activities. To achieve these goals, the Program provides technical assistance, education and training, and grants and incentives to the Eugene community. In September 2009, the City implemented a Green Building Incentive Program. To be eligible, projects must seek green building certification through either ***Earth Advantage*** or Leadership in Energy and Environmental Design (***LEED***) programs. Incentives include priority plan review and inspections, same-day permits, reduced systems development charges, technical assistance, and recognition and publicity benefits. Residential projects that meet high standards for energy efficiency and waste reduction are also eligible for rebates on permit fees, which are partially funded by the American Recovery and Reinvestment Act through the Energy Efficiency and Conservation Block Grant Program.

Food and Agriculture

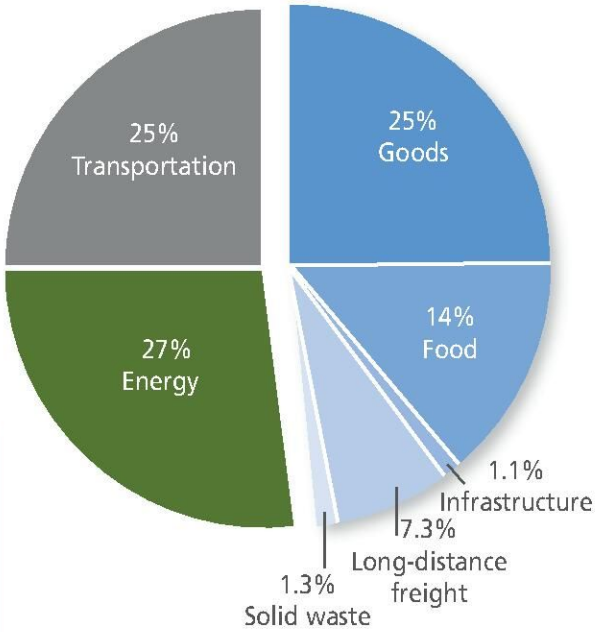


Figure 5: Greenhouse gas emissions by system. Source: Metro Regional GHG Inventory

What is the Food and Agriculture Action Area?

In this Plan, the food and agriculture sector includes everything related to food production and delivery, from the agricultural field to grocery store shelves. This includes the systems, infrastructure and activities which produce and process food, the systems used to transport and distribute food, and the systems that dispose of waste from food production, processing and consumption.

What Part of Eugene's GHG Footprint Comes From Food and Agriculture?

Eugene's 2007 greenhouse gas inventory does not specifically identify greenhouse gas associated with food production and distribution. However, Metro's regional greenhouse gas inventory[26] indicates that food provision accounts for roughly 14 percent of total greenhouse gas emissions for the Portland Metro area (see Figure 5) and this plan will assume that the findings for Eugene would be similar. This figure does not include GHG emissions associated with transportation of food or disposal of solid waste generated by food production.

How Do Food and Agriculture Systems Contribute to GHG Emissions?

A popular misconception is that transportation is the largest source of GHGs associated with our food supply. In fact, GHG emissions associated with our food come primarily from the food production phase[27]—a result of energy use by farming and processing equipment, manufacture of fertilizers and other agricultural chemicals, production of animal feed, provision of irrigation water, etc. In addition, a very significant amount of GHGs, largely in the form of methane, are generated by livestock animals and management of their wastes.

While there is growing national interest in buying locally-produced foods and there are many good reasons to support local growers, when it comes to reducing GHG emissions associated with food, the most effective approach is to reduce the consumption of carbon-intensive foods such as dairy products and red meat. It turns out that the methods used to grow our food, and the amount of meat and dairy products that we eat, have a much more significant impact on total GHG emissions than do typical transportation methods or distances.

[26] *"Regional Greenhouse Gas Inventory; The Carbon Footprint of Residents and Businesses Inside the Portland Metropolitan Region," Metro Regional Government, April 2010. See Appendix 7 of this document.*

[27] *"Food Miles and the Relative Climate Impact of Food Choices in the United States," Weber and Matthews. 2008.*

How Will Rising Fossil Fuel Prices Impact Food and Agriculture Systems?

Fossil fuels are used extensively in most food and agriculture systems for powering agricultural, processing and refrigeration machinery; manufacturing fertilizers, pesticides, and other agricultural chemicals; transporting and distributing products; and producing agricultural equipment and materials. Increasing costs for fuel, including diesel, gas and natural gas, will impact food and agricultural systems at all of these points and are expected to have a significant impact on the price of food.

How Can We Prepare Our Food and Agriculture Systems for Climate Change?

While steps must be taken to reduce the carbon footprint of food and agriculture systems, the systems must also be prepared for the projected impacts of climate change. "Preparing for Climate Change in the Upper Willamette River Basin of Western Oregon,"[28] identifies several likely climatic changes expected in the Eugene area. The area will likely experience warmer, wetter winters and warmer, drier summers, factors that will undoubtedly affect the agricultural productivity of the valley. Here are a few adaptive strategies that will enable the food and agriculture systems to maintain productivity in the face of climate change:

- Growing a wider diversity of food crops.
- Growing food with fewer fossil fuel inputs.
- Developing drought-tolerant food crops for this region.
- Reducing the agricultural consumption of freshwater, and using greywater where appropriate.

Efforts Currently Underway

Many organizations and members of the Eugene community are working to improve access to locally-grown foods and to raise awareness about the importance of food security for the community. Willamette Food and Farm Coalition, the Farm to School program, Lane Food Policy Council, Food for Lane County, the Extension Service, neighborhood sustainability and farming groups, and many others are working to strengthen supplies, improve storage capacity, encourage local agriculture, facilitate home gardening and otherwise improve resiliency of the local food systems.

[28] *"Preparing for Climate Change in the Upper Willamette River Basin of Western Oregon: Co-Beneficial Planning for Communities and Ecosystems," US Department of Agriculture, Climate Leadership Initiative, and National Center for Conservation Science and Policy, 2009.*

Objectives and Actions for Food and Agriculture:

Objective 5:
Reduce consumption of carbon-intensive foods.

Growing evidence shows that the kind of food we eat makes a significant difference in the associated GHG emissions. The facts and choices are not always intuitive and it is important that education and outreach programs are developed to inform the community about the importance of food choice as a strategy to reduce GHG emissions.

High Priority Actions:

5.1. Begin a community campaign to educate the public about food choice as part of a climate-friendly lifestyle.

5.1a) Specifically encourage reduced consumption of red meat and dairy products and other carbon-intensive foods.

5.2. Implement a "Buy climate-friendly first" food purchasing policy for public institutions including city and county governments, schools, and hospitals.

Objective 6:
Reduce GHG emissions associated with agriculture and food waste.

While most agricultural production occurs outside Eugene's urban areas, local governments and citizens can encourage growers and state leaders to reduce the GHGs associated with agriculture. A waste-digesting system for the community would provide methane from decomposing food waste for use as a locally-generated fuel source.

High Priority Actions:

6.1. Transition to agricultural methods that reduce GHGs. Support efforts of Oregon Department of Agriculture, Oregon Tilth, Oregon State University, Willamette Farm and Food Coalition, and other partners.

6.2. Conduct a pilot project at the River Avenue Wastewater Treatment Plant to determine the system's ability for co-digestion of food waste and biosolids as detailed in the Consumption and Waste section.

Objective 7:
Increase food security by preserving the productive capacity of the local and regional *foodsheds*.

In order to increase the ***resilience*** of Eugene's food supply, local and regional agriculture systems must maintain the capacity to grow a significant percentage of the community's food.

High Priority Actions:

7.1. Strengthen land use regulations which protect farm lands, particularly those on high-value agricultural soils.

7.1.a) Strengthen City and County land use protections to prevent urban growth onto prime farmlands.

7.2. Strengthen current farmland protections at state levels.

7.2.a) Lobby state agencies to strengthen protections for high-value farmlands.

Objective 8:
Prepare our food systems for the uncertainties created by climate change and rising energy prices.

Eugene can take action now to ensure that the community's food supply is resilient to the system-destabilizing effects of climate change. In addition, by reducing the energy inputs required by the food supply system, the community can reduce impacts that increasing energy costs will have on the cost of food.

High Priority Actions:

8.1. Implement the following recommendations from Eugene's Food Security Scoping and Resource Plan.[29]

8.1.a) Identify a City of Eugene liaison for food-system related programming.

8.1.b) Develop a comprehensive Community Food Security Assessment and implement changes to improve food security.

8.2. Develop an updated regional emergency food distribution plan that accounts for climate- and energy-based disruptions. The level of need for such a plan will be made clear by conducting a ***vulnerability*** assessment as outlined in the Health and Social Services section.

8.3. Increase the diversity and drought resistance of food crops grown in the upper Willamette Valley.

8.3a) Support efforts of food-advocacy organizations, food growers, and state agencies to develop appropriate crops.

8.3b) Prioritize development of vegetable protein crops such as beans and grains that are suited to the Willamette Valley.

8.4. Remove barriers to using greywater in agriculture. Work with state lawmakers to find solutions for greywater re-use.

[29] *"City of Eugene Food Security Scoping and Resource Plan." City of Eugene Planning and Development Department, April, 2010.*

Common Ground Garden

The first crop of onions and garlic were planted in October; and by mid March, leafy greens were planted in protected cloches, followed by kale, chard, lettuce, cauliflower, broccoli, kohlrabi, snap peas and snow peas. In June, tomatoes, peppers, summer squash, cucumbers, herbs, bush and pole beans, beets, ground cherries, and leeks were all put into the ground. Over the course of a year, this group of neighborhood gardeners hopes to produce 1600 pounds of food.

Nearby residents in the Friendly Neighborhood, had been thinking about starting a garden on the unimproved city street for years, and in September 2009, a small group formed around the vision of a shared, open, neighborhood garden. During a neighborhood meeting, the group decided how to organize the garden, name the garden, and how to form work parties to build beds, plant seeds and starts, and make use of free city leaves and free arborist wood chips.

The Common Ground Garden exemplifies community based action and serves as a model for others across the community. In addition to growing bountiful fruits and vegetables, this garden grows social capital, neighborhood empowerment, better nutrition, neighborhood resilience, and a feeling of community well being and belonging.

Interested in trying this out in your neighborhood? In early 2011, look for the City's "Urban Gardening Manual," a resource guide that shares best practices for how to start a neighborhood garden, access financial and organic resources, and clear guidance on using public lands. For more information, contact City of Eugene Compost and Urban Ag Specialist Anne Donahue at 541-682-5542.

Objective 9:
Increase availability of home-grown and locally-sourced food in Eugene

Many Eugene community members are interested in growing their own food to reduce the ***energy intensity*** of their food, gain new skills, enjoy the recreational benefits of growing food, and reduce the cost of their household's food. Food gardening can also be an important community-building activity, strengthening neighborhoods and social groups. The increased social cohesion it encourages can improve the community's resilience in times of change and challenge. Home-grown and locally-grown food can provide security and resilience during short- and longer-term emergencies by reducing reliance on food imported from long distances.

High Priority Actions:

9.1. Expand community gardens on public and private lands including school campuses, City lands, and church properties.

9.1a) Conduct an assessment of opportunities for community garden locations within the city.

9.2. Encourage planting of non-invasive food-bearing trees and shrubs on public and private lands. Support urban tree food programs of such advocates as Tree by Tree, and the Eugene Tree Foundation.

9.3. Reevaluate limitations on numbers and types of animals permitted under Eugene's code to allow, where appropriate, an increase in the number and variety of food-producing animals that can be kept by urban residents.

Land Use and Transportation

Land Use and Transportation

What is the Land Use and Transportation Action Area?

This section of the Community Climate and Energy Action Plan considers how the community is spatially organized, and how that organization affects transportation needs. The transportation systems in this section are those that move people and local freight: passenger vehicles, bicycles, mass transit systems, air transport and local freight distribution systems, and the roads and other infrastructure required for these systems. Transportation of goods is discussed in Chapter 4: Consumption and Waste section.

Although a particular land use may directly impact consumption of fossil fuels and emission of greenhouse gases, in most cases, the more important impacts of land uses are on the demand for transportation systems. Land use directly impacts transportation system needs and transportation systems contribute significantly to fossil fuel consumption and GHG emissions. As the two are so connected, this plan will consider them together and outline action items for each that will affect the other.

What Part of Eugene's GHG Footprint Comes From Land Use and Transportation?

According to the analysis completed for the Metro Regional Greenhouse Gas Inventory,[30] about 25 percent of the Portland area's greenhouse gas emissions are associated with local transportation systems. This plan will assume that GHG impacts for Eugene are similar. The majority of emissions come from on-road commercial vehicles, private cars and air travel, with rail, marine and mass transit contributing smaller amounts of greenhouse gases (see Figure 6).

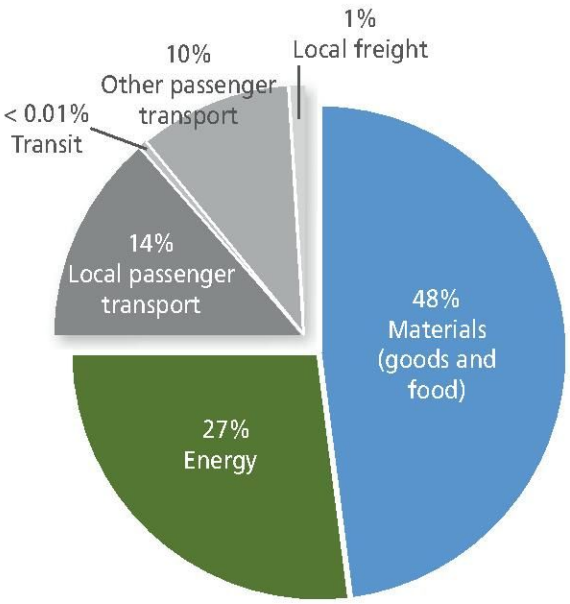


Figure 6: Greenhouse gas emissions by system. Source: Metro Regional GHG Inventory

[30] *"Regional Greenhouse Gas Inventory; The Carbon Footprint of Residents and Businesses Inside the Portland Metropolitan Region," Metro Regional Government, April 2010.*

How Do Land Use and Transportation Contribute to Greenhouse Gas Emissions?

Land use decisions influence where people live and do business, and where the schools, services and industry are located. Distances and available transportation modes between home, stores, work and school have a significant impact on transportation needs and are a major driver of a community's greenhouse gas outputs.

Metro's study found that local passenger transportation accounts for 14 percent of greenhouse gas emissions in the region. Other passenger transport, primarily long distance ground transportation and air travel, accounts for 10 percent,and mass transit for less than 0.01 percent, of total regional GHG emissions. As stated above, emissions from long distance freight are associated with transporting goods rather than people, and their scope, impacts, and reduction strategies are discussed in Chapter 5: Consumption and Waste.

How Will Rising Fuel Prices Impact Land Use and Transportation?

Increases in fuel prices will discourage the use of less fuel-efficient transportation modes such as the single-occupancy vehicle. As operating a private vehicle becomes more expensive, Eugene will likely see an increase in demand for mass transit and other transportation options, and for housing nearer to employment, which could lead to denser land use patterns.

How Can Eugene Prepare Land Use and Transportation Systems for Rising Fuel Prices?

Fuel prices and demand for transportation alternatives can rise more quickly, as in 2008, than transportation systems can adapt. If investments are made in alternatives to the single-occupant vehicle, the community will be better prepared for increases in the price of fuel and subsequent shifts in transportation demand. With alternatives in place, such as improved mass transit, bicycling, and electric vehicle infrastructure, the community can shift more easily away from expensive transportation. Alternative transportation will be particularly important for community members who cannot afford to purchase newer, more fuel-efficient or electric-powered automobiles.

Another proactive measure that will reduce transportation-related GHG emissions is making fuel-wise land use decisions that reduce dependence on single-occupant vehicles, such as facilitating infill development and developing walkable neighborhoods.

Preparing Eugene's Land Use and Transportation Systems for Climate Change.

A recent study of potential climate change scenarios for the Eugene area concluded that the community may experience more severe storm events and resultant flooding, as well as an increase in forest fires.[31] This analysis suggests that transportation systems will be impacted, especially roads and railroads, and those along rivers and streams, or on unstable slopes, will be especially vulnerable. Increased storms and wildfire smoke may also impact air travel and transport of goods. In order to minimize the impacts to the transportation system, planning and design efforts must consider these scenarios.

In addition to impacts on the transportation system, the same study suggests that the Eugene area could experience an influx of ***climate refugees***, people moving away from areas that have become less livable due to a rise in sea level, severe storms, or prolonged drought. Land use and transportation planning processes must consider possible impacts on the community.

Efforts Underway

A number of government agencies, business, and non-profit organizations are working to reduce the community's dependency on fossil fuels for transportation. For years Eugene has developed and implemented land use regulations, such as the state required Urban Growth Boundary, that facilitate compact growth and reduce transportation demand. The community has nationally-recognized mass transit, and bicycle infrastructure systems that decrease dependence on single-occupant vehicles. Likewise, alternate modes advocacy, undertaken by City staff along with partners such as point2point solutions, Lane Coalition for Healthy Active Youth, Bike Lane Coalition, Greater Eugene Area Riders, and many others, continues to press for more non-vehicle transportation infrastructure. However, the community must do even more to meet the Eugene City Council's goal of reducing fossil fuel use 50 percent by 2030. Below is a list of objectives and related action items that will help Eugene reach this goal.

[31] *"Preparing for Climate Change in the Upper Willamette River Basin of Western Oregon: Co-Beneficial Planning for Communities and Ecosystems," US Department of Agriculture, Climate Leadership Initiative, and National Center for Conservation Science and Policy, 2009.*

ENVISION EUGENE in the year 2030. Envision your neighborhood, home, job, school, and your favorite parks and shops – and how you will get there. In the spring of 2010, Eugene's Planning Division started a community conversation, called Envision Eugene, to think about how Eugene will grow and change over the next 20 years. The plan will help answer the questions of how and where we will accommodate a population of nearly 200,000 people; and where's the balance between increasing density and preserving what's important to us about our neighborhoods, city, and area?

Envision Eugene has been collecting community input through workshops, websites, and surveys to help inform the creation of our community plan. People are being asked to think about ways to grow inside the existing urban growth boundary (UGB), and if necessary, where and how might the boundary be expanded. Concepts from the Climate and Energy Action Plan like 20 minute neighborhoods, increasing reliance on buses, bikes and walking, and special setbacks for Bus Rapid Transit, are key components of the Envision Eugene discussion.

In the fall of 2010, Envision Eugene will ask community members to help select a preferred growth scenario that meets the city's land needs and promotes the most sustainable, livable, prosperous city possible. To learn more about Envision Eugene and how you can be involved, visit our website at: **www.EnvisionEugene.org.**

OBJECTIVES AND ACTIONS FOR LAND USE AND TRANSPORTATION:

Objective 10:

Create 20-minute neighborhoods, where 90 percent of Eugene residents can safely walk or bicycle to meet most basic, daily, non-work needs, and have safe pedestrian and bicycle routes that connect to mass transit.

"Twenty-minute neighborhoods" are those in which a significant number of regular trips can be made in 20 minutes without using a personal automobile. A resident might walk to the grocery store or school and meet many of their recreational and social needs without using a car. Creating these neighborhoods is an important step toward meeting our greenhouse gas and fossil fuel reduction goals. This objective cannot be achieved by local government alone; success will depend on partnerships with neighborhoods, businesses, Lane Transit District, school districts, and others.

Implementing the 20-minute neighborhoods action will ultimately increase the mix of land uses (residential next to commercial, near schools, near parks) in the urban area, and increase connectivity of alternative transportation systems such as bike paths, pedestrian paths, and the bus system. Recent research suggests that accessibility of destinations is strongly associated with ***vehicle miles traveled (VMT)***, and "walking is most strongly related to measures of land use diversity, intersection density, and the number of destinations within walking distance."[32] Work is underway at the state and regional levels to create the models that can predict how much greenhouse gas reductions can really be achieved by making these changes. In the absence of those tools, there is broad agreement that these changes can and will have a significant and lasting reduction in the use of gasoline and diesel fuel in our urban areas.

High Priority Actions:

10.1. Make the creation of 20-minute neighborhoods a core component of the Eugene Plan and the Eugene Bicycle and Pedestrian Master Plan.

10. 2. By 2013, complete and implement a 20-minute neighborhoods plan:

10.2a) Identify funding for necessary planning effort.

10.2b) Identify key accessibility components for 20-minute neighborhoods: e.g., schools, parks, grocery store, retail services, etc.

10.2c) Conduct a network gap analysis to determine needs.

10.2d) Identify steps to improve the number and distribution of 20-minute neighborhoods.

10.2e) Coordinate with ***opportunity siting*** and ***infill compatibility standards*** planning.

[32] *"Travel and the Built Environment: A Meta-Analysis," Ewing et. al. 2010.*

Objective 11:
Increase density around the urban core and along high-capacity transit corridors:

Growing evidence indicates that increasing the density of development around the urban center and transit corridors is an effective strategy for reducing fossil fuel use and greenhouse gas emissions. This type of development increases access to services, increases bikeability and walkability, reduces single occupant auto trips, and makes transit more effective.[33],[34],[35] In addition to reducing fossil fuel use by curbing single-occupant vehicle trips, preventing sprawling land use appears to help communities adapt to climate change by reducing the number of extreme heat events.[36]

High Priority Actions:

11.1. Zone future commercial and high-density residential uses in and around the urban core, and along EmX and other high-capacity transit corridors to accommodate urban growth.

11.1a) Coordinate with opportunity siting and infill compatibility standards planning efforts.

Objective 12:
Include the potential for climate refugees when conducting land use planning.

The negative impacts of climate change in the Pacific Northwest may be low relative to impacts in other regions of the US and globally. This could bring about rapid movements of climate refugees—people leaving unlivable locations seeking less-impacted areas. In order to prepare for these possible impacts, city and community planning activities must be increasingly flexible and broad-thinking.[37]

High Priority Actions:

12.1. Closely monitor the community's population growth rate to gauge whether population projections are accurate.

12.1a) Set population thresholds that will trigger review of community growth plans; for example, if growth rates are significantly different than projections for several years in a row.

12.1b) If trends show a significantly higher rate of population increase than was assumed in the planning process, Eugene should update its planning model sooner than legally required.

[33] *"Cost-Effective GHG Reductions through Smart Growth & Improved Transportation Choices: An economic case for investment of cap-and-trade revenues," Center for Clean Air Policy, July 2009.*

[34] *"Moving Cooler: An analysis of transportation strategies for reducing greenhouse gas emissions," Urban Land Institute, 2009.*

[35] *"Travel and the Built Environment: A Meta-Analysis," Ewing et. al. 2010.*

[36] *"Urban Form and Extreme Heat Events: Are Sprawling Cities more Vulnerable to Climate Change than Compact Cities?" Stone, et. al., 2010.*

[37] *The City of Eugene is currently undergoing a land use planning process, Envision Eugene, to be completed in early 2011, that will determine how the next 20 years of population growth will be accommodated.*

Objective 13:
Continue to expand and improve Eugene's bicycle and pedestrian infrastructure and connectivity to increase the percentage of trips made by bike and on foot.

In order to increase the number of trips taken by bike or on foot, gaps in bicycle and pedestrian transportation systems must be identified and necessary improvements must be made. In May 2010, the City of Eugene will begin work on a Eugene Pedestrian and Bicycle Master Plan. This project will identify gaps in the bike and pedestrian networks and enable the community to focus resources for infrastructure where most needed. A systematic approach to improving bike and pedestrian transportation networks, will advance Eugene toward meeting community fossil fuel and greenhouse gas reduction targets.

High Priority Actions:

13.1. Create a pedestrian and bicycle master plan that will accomplish the following:

13.1a) Identify mobility gaps in the bicycle and pedestrian transportation system.

13.1b) Recommend improvements to increase safety (real and perceived), comfort, speed, and convenience for users of all ages and skill levels.

13.1c) Create a plan for implementing the necessary system improvements.

13.1d) Identify funding sources for ***implementation***.

13.2. Increase the mileage and connectivity of bicycle boulevards and shared-use paths to encourage biking by cyclists of various skill levels.

13.3. Create a "Complete Streets" policy that requires all subsequent transportation and rehabilitation projects to incorporate infrastructure for bicycles, pedestrians, and mass transit service.

Objective 14:
Increase the supply of integrated, convenient, efficient, and cost-effective public transit:

Mass transit is one of the more effective strategies to reduce transportation reliance on single-occupant vehicles. Not only does increased use of transit reduce GHGs,[38] but it can provide a lower-cost, accessible transportation alternative.

High Priority Actions:

14.1. Diversify funding sources for Lane Transit District (*LTD*) to increase the long-term reliability of mass transit service while maintaining cost effective and fuel efficient transit service.

14.2. Align City of Eugene Transportation System Plan and LTD's long-range transit plan to integrate bus routes into the broader alternative transportation system.

14.2a) Partner with LTD to help inform service changes and improvements.

14.2b) Create special ***setbacks*** along future ***Bus Rapid Transit (BRT)*** or other mass transit corridors to accommodate future right-of-way expansion.

14.2c) Determine the role of mass transit in accomplishing greenhouse gas emission reduction goals by working with LTD in developing the Long Range Transit Plan.

14.3. Invest in transit infrastructure that meets future access and mobility needs while consuming less fossil fuel.

14.3a) Maximize electrification of the regional mass transit systems.

14.3b) Increase use of hybrid vehicles including buses and other heavy vehicles.

Health Impacts of Climate Action

Many of the actions contained in this plan will have positive impacts that go beyond saving energy and fossil fuel. With help from Upstream Public Health, a non-profit health advocacy organization, an effort was made to assess some of the possible health-related impacts—and the product is the first ever Health Impact Assessment (HIA) conducted on a local climate action plan.

Similar to environmental impact assessments that require federal agencies to consider the environmental impact of their proposed actions, HIAs are used to evaluate the potential health effects of a project or policy before it is implemented. The assessments are voluntary and typically focus on health outcomes such as obesity, physical inactivity, asthma, injuries, and social equity.

The HIA found that many of the transportation-related objectives in the Plan are likely to positively affect the public's health. Several policies aimed at reducing greenhouse gas emissions also result in increased physical activity, better air quality, and fewer vehicle crashes. These changes lead to reduced rates of chronic disease and mortality, reduced respiratory illness, and fewer injuries and fatalities from vehicle collisions. The full report is available as appendix 5 of this report and more information is available online at: **www.upstreampublichealth.org**.

[38] *"Moving Cooler: An Analysis of Transportation Strategies for Reducing GHGs," The Urban Land Institute, 2009.*

Objective 15:
Expand outreach, marketing and education about climate-friendly transportation alternatives.

In order to be motivated to change their behavior, community members must understand the effects of their transportation choices on overall greenhouse gas emissions and the available alternatives to the single-occupant vehicle. Emissions reductions can be realized by reducing the number of people who drive in single-occupant vehicles and by educating the community about how to be more fuel-efficient when they do drive their automobiles.

High Priority Actions:

15.1. Increase promotion of bicycling, walking, mass transit, car-pooling, telecommuting, high-occupancy vehicles, and emergency ride home programs as attractive alternatives to driving.

15.2. Increase the community's understanding of fuel-efficient driving techniques.

Objective 16:
Ensure maximum efficiency in current and future freight systems.

Movement of goods is important for the community's economy; however, it typically produces significant greenhouse gas emissions.[39] As Eugene makes changes to transportation systems to decrease reliance on fossil fuels, efficient delivery of food, consumer goods, and other materials must be maintained.

High Priority Actions:

16.1. Plan for efficient freight transportation that minimizes greenhouse gas emissions and fossil fuel consumption, and accomplishes the following:

16.1a) Connects multiple modes—train, truck, van, car, bicycle.

16.1b) Accommodates upper Willamette Valley commercial, industrial and agricultural freight needs.

16.1c) Facilitates efficient local deliveries.

[39] *"Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions," Urban Land Institute, July 2009.*

Objective 17:
Increase the use of low-carbon vehicles and fuels to improve overall fuel-efficiency and reduce vulnerability to fluctuating oil prices.

In order to meet the stated fossil fuel reduction target (reduced 50 percent by 2030), some of the current automobile transportation must be transitioned from fossil fuels to electricity. This will require considerable new infrastucture, some of which is now in the planning phase. According to the Oregon Department of Transportation, "Reducing on-road vehicle GHG emissions by 75 percent from 1990 levels would be equivalent to reducing Oregonian's per capita annual consumption of petroleum fuels from 567 gallons to 68 gallons. This will not be achievable without transformative changes in vehicle fleets and fuels such as electrification of the light vehicle fleet."[40]

High Priority Actions:

17.1. Accelerate the transition to plug-in hybrids and electric vehicles. Partner with Lane County, EWEB, auto retailers, electrical contractors, UO, LCC, and others.

17.1a) Support the installation of a network of electric car charging stations.

17.1b) Require installation of electric car charging stations in new multifamily housing.

17.1c) Use guidance provided by the University of Oregon Electric Vehicle strategy.

17.2. Conduct research to understand what role biofuels can play in decreasing Eugene's vulnerability to energy markets. Work with partners at LTD, the Oregon Department of Energy, etc.

17.2a) Complete research by 2013 so that outcomes can inform the next CEAP.

[40] *"Background Report:The Status of Oregon Greenhouse Gas Emissions and Analysis," Oregon Department of Transportation, October 2009.*

Consumption and Waste

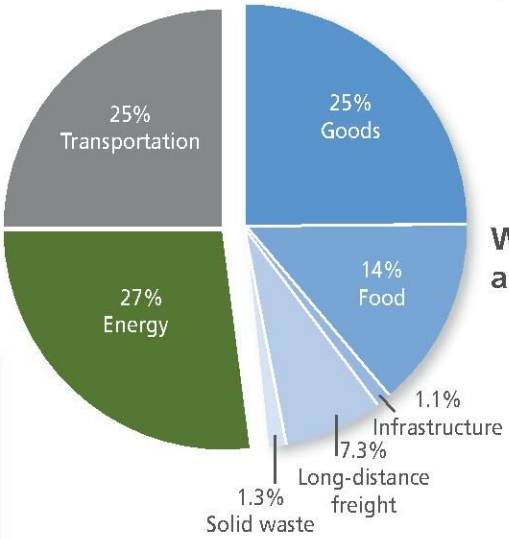


Figure 7: Greenhouse gas sources by system. Source: Metro Regional GHG Inventory

What is the Consumption and Waste Action Area?

For the purposes of this plan, consumption and waste includes everything in the ***lifecycle*** of consumer goods; the embodied energy in everything from chairs to cars, from building materials to strollers. The lifecycle of these goods begins with mining or extraction of raw materials, and includes their manufacturing, packaging, distribution, use and finally, their disposal.

What Part of Eugene's GHG Footprint Comes from Consumption and Waste?

Until very recently, many inventories of GHG emissions, including the City of Eugene's, focused on the direct emissions that come from the use of fossil fuels. Using this methodology, these analyses have consistently shown that transportation and energy systems are the major contributors to GHG emissions; however, a number of recent consumption-based analyses measure what the fossil fuels are ultimately used for. This new evaluation method is the basis of leading research on US GHG emissions and includes an inventory completed in the fall of 2009 by the Environmental Protection Agency (***EPA***).[41] Consumption or "systems-based" inventories show roughly 42 percent of US emissions come from the provision of food and goods—roughly equaling the combined emissions from the transportation and energy systems.

The GHG inventory recently completed by Metro[42] also considered lifecycle emissions and developed estimates for the metropolitan Portland region's total GHG emissions using regionally adjusted consumption and transportation data. Metro's report estimates that the provision of goods (excluding food) accounts for 25 percent of GHG emissions in the region. However, when the emissions from provision of food and solid waste disposal are included, the total GHG emissions comprise roughly 40 percent of the region's total emissions (see Figure 7). According to the inventory, consumption and waste in the Portland Metro region have a greater share of total emissions than either transportation or energy use in buildings. For the purposes of this Action Plan, we will assume that the Eugene area's profile is within the bounds of the two studies and that consumption and waste comprises roughly 40 - 42 percent of the total GHG emission profile.

How Do Consumption and Waste Contribute to Greenhouse Gas Emissions?

Conventional sector profile GHG inventories consider GHG emissions from solid waste management. This includes carbon dioxide from collection, transportation and processing of waste with the majority of emissions coming from the decomposition process in landfills where methane is released. Systems GHG inventories, such as that created by Metro, consider resource extraction activities such as mining and logging; transporting and processing of raw materials; and manufacturing, and packaging and distribution of consumer goods, which all consume large amounts of coal, oil, and natural gas.

[41] *"Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices." US EPA, September 2009.*

[42] *"Regional Greenhouse Gas Inventory; The Carbon Footprint of Residents and Businesses Inside the Portland Metropolitan Region," Metro Regional Government, April 2010.*

How Will Rising Fossil Fuel Prices Impact Consumption and Waste Systems?

Due to the large amounts of coal, oil, and natural gas used during production and distribution of goods and food, a small increase in fossil fuel prices will likely be magnified in the cost of goods. As prices of products increase (and incomes stay flat), more people may chose to repair and reuse consumer goods, expanding the usable life of products resulting in a decrease in new consumer purchases. Rising food costs will mean that food will likely become a larger portion of a household's budget and may shift more families into a position of ***food insecurity***. This decrease in purchasing of consumer goods and food will likely create downward pressure on the local, regional and national economy.

How Can We Prepare Consumption and Waste Systems for Climate Change?

While climate change will likely have some impact on consumption and waste systems, they are not expected to be as significant as the impact forecasted for other systems and sectors. Therefore, this plan does not focus on adaptation or preparation strategies for consumption and waste systems.

Efforts Currently Underway

Eugene has a strong history of implementing reduce, reuse, and recycle programs. Currently, over 95 percent of Eugene households participate in recycling services and roughly 53 percent of the waste produced in the area is diverted from the landfill. In 1994, the City of Eugene began using a rate structure for home solid waste collection that charges homeowners more money if they throw away a larger volume of waste. This has had the effect of reducing the volume of waste going to the landfill. The majority of solid waste from Eugene is taken to Lane County's Short Mountain Landfill, where an estimated 75 percent of the methane released from decomposing waste is captured and used to generate electricity.

In addition, the community supports and benefits from local recycling, reuse, and composting businesses ranging from industrial recycling at Schnitzer Steel to home scale re-use at St. Vincent de Paul and Goodwill Industries. BRING Recycling has been a leader in the community for the reuse of building materials for over 30 years and NextStep Recycling has provided electronics reuse and recycling for over 10 years. Organizations such as MECCA (Materials Exchange Center for Community Arts) and the Resurrected Refuse Action Team also help community members find creative new ways to re-use materials. Large-scale commercial composting facilities operated by Lane Forest Products and Rexius Sustainable Solutions help keep organic wastes out of the local landfill. All of these local businesses create jobs, reduce waste, and several provide service and education to disadvantaged populations, further building the capacity of our community.

Objectives and Actions for Consumption and Waste:

Objective 18:
Reduce greenhouse gas emissions by addressing purchasing habits.

The actions in this objective are aimed at working with community partners to change consumer behavior to reduce the impact that our purchasing habits have in creating greenhouse gases. Consumption is not only being addressed at the grassroots and household levels, but through international business organizations such as the World Business Council for Sustainable Development.[43] Major corporations are also beginning to recognize the need to decrease emissions related to product development.

High Priority Actions:

18.1. Educate businesses and residents about the important role of consumption in creating greenhouse gas emissions. Focus on encouraging the purchase of durable, repairable and reusable goods; reducing the amount of materials that go to waste (including food); reducing consumption of carbon-intensive consumer goods and services.

18.2. Lobby at the state level for better product labeling that includes information about greenhouse gas emissions associated with products.

18.3. Provide information for the public on when to replace high energy-use appliances such as refrigerators, dishwashers, and water heaters. Where this information is already available, increase its distribution and accessibility.

18.4. Actively support new state and national *product stewardship* legislation that requires producers to be involved in end-of-product-life management, either through product design changes (e.g. compostable snack bags), investing in take back programs (e.g. Oregon E-cycles), or placing a fee on the sale of products to support diversion (e.g. Oregon Bottle Bill).

[43] *"Sustainable Consumption Facts and Trends: From a Business Perspective," The World Business Council for Sustainable Development, 2009.*

Objective 19:
Increase waste diversion by improving recycling.

Recycling, reusing, and repurposing materials can reduce greenhouse gas emissions by reducing the energy used to mine or harvest virgin materials. There is a significant opportunity to increase recycling of waste from building construction and demolition, activities that currently generate roughly 30 percent of the total waste generated in Oregon.

High Priority Actions:

19.1. Target expanded recycling outreach and services to commercial and multi-family residential building owners and occupants, including local businesses, apartment buildings, and student and cooperative housing.

19.2. Enact a local ordinance to increase waste recovery rates from commercial and multi-family buildings.

19.3. Assist businesses in improving paper, metal and glass recycling with a goal of supporting 5 percent of the community's businesses each year. Aid partners by promoting events or trainings, providing space for trainings, assisting with funding, etc.

19.4. Enact an ordinance that requires all construction and demolition waste materials to be sorted for reusable or recyclable materials.

Objective 20:
Increase waste diversion rate for organic wastes

The 2002 Waste Composition Study by the Oregon Department of Environmental Quality (DEQ) found that 34 percent of total waste being disposed at Short Mountain Landfill from the city of Eugene was compostable organic waste. The majority of methane emissions generated in a landfill system come from the decomposition of organic materials, and methane is a potent greenhouse gas with more than 21 times the *global warming* potential of carbon dioxide. Although an estimated 75 percent of methane generated from the landfill gas system is recovered, the remainder is emitted into the atmosphere.

High Priority Actions:

20.1. Establish a permitted facility within the Eugene/Springfield area that can accept and compost (or anerobically digest) all organic materials including food wastes.

20.1a) Develop a collection program and rate structure to support food waste collection.

20.2. Conduct a pilot project at the River Avenue Waste Water Treatment Plant to determine the system ability to co-digest food waste and biosolids to generate electricity.

Objective 21:
Conduct research to determine the most effective next steps in the area of consumption and waste.

There are many actions that may have significant benefits but the scale of benefits is largely unknown at present. Below are two actions that were identified as potential solutions, but further research is needed. These research efforts must be completed by 2013 so that findings can be used to inform the next Climate and Energy Action Plan.

High Priority Actions:

21.1. Follow research being conducted by 1) the EPA's West Coast Forum on Climate Change and Materials Management, 2) Action Item recommendations from the Materials Management subcommittee of the Oregon Governor's Global Warming Committee's Roadmap 2020 plan, and 3) Oregon Department of Environmental Quality systems-based GHG inventory, to determine highest priority and most cost effective measures to address GHG production in the materials management sector.

21.2. Determine the greenhouse gas emissions profile from the current solid waste collection system and provide recommendations on how to reduce carbon emissions within the system.

Objective 22:
Reduce greenhouse gases in municipal operations by changing purchasing practices and reducing waste.

It is important that local governments lead by example. In 2009, in response to direction from Eugene's City Council, City staff prepared an Internal Climate Action Plan[44] to make City operations ***climate neutral*** by the year 2020. In order to accomplish this goal, the City's purchasing practices must be changed to reflect the current understanding of greenhouse gas sources. Additionally, City staff are creating an internal waste prevention plan to reduce waste production, increase diversion of waste, and reduce greenhouse gases associated with purchasing decisions.

High Priority Actions:

22.1. Increase the effectiveness of current City of Eugene purchasing policies that prioritize: 1) Reuse of products and materials, 2) purchasing durable goods, and 3) avoiding disposable goods whenever possible. Implement the following steps:

22.1a) Set targets for these procurement policies.

22.1b) Identify measurements to monitor the impacts of these procurement policies.

22.1c) Increase efforts to implement these purchasing policies throughout the organization.

[44] *The City of Eugene Internal Climate Action Plan is available as Appendix 4*

22.2. Encourage other local public agencies to prioritize: Reuse of products and materials, purchasing durable goods, and avoiding disposable goods whenever possible.

22.3. Reduce public agency purchase of greenhouse gas-intensive goods by 2014.

22.3a) Identify City-purchased goods (either directly or through contracts) with the highest associated life cycle greenhouse gas emissions by 2012.

22.3b) Create a plan to reduce purchase of the 5 goods that have both the most greenhouse gas intensive life cycles, and the highest rates of purchase.

22.3c) Annually report the quantity of these goods being purchased.

22.4. Implement steps outlined in the City waste reduction plan to reduce waste at City buildings, events, and ongoing operations.

22.4a) Continue to monitor the waste stream from internal operations in order to measure progress.

Health and Social Services

What is the Health and Social Services System?

The Health and Social Services system includes public, private and not-for-profit service agencies that provide a broad spectrum of support programs in the community including mental and physical health care, assistance for low-income community members, addiction prevention and treatment programs, and child abuse prevention programs. These services are included in the Community Climate and Energy Action Plan, not because they are significant sources of greenhouse gases, but because they are an important safety net for our community and very vulnerable to the impacts of climate change and rising fuel costs. Likewise, to a large extent, the populations that are assisted by the services are themselves very vulnerable to the effects of climate change and fuel price volatility.

What Part of Eugene's GHG Footprint Comes From Health and Social Services?

The provision of health and social services involves transportation of people and goods, and consumption of materials and energy; therefore, the services are associated with some greenhouse gas emissions. However, in this plan GHG emissions, and the methods to reduce them, are discussed in earlier chapters on buildings and energy, food and agriculture, *land use* and transportation, and consumption and waste. The focus of the Health and Social Services chapter is on adapting to changing climate and rising fuel prices—not specifically on reducing greenhouse gases.

How Will Increasing Fuel Prices Impact Health and Social Services?

Increasing global demand for a finite amount of oil and natural gas has led to rising fuel prices and will likely continue to do so. As the cost of fossil fuels rise, low-income and other disadvantaged community members will be most affected by the changes. With less financial resiliency, these vulnerable populations will have the most difficulty adapting to rising costs, and as impacts of the rising fuel costs spread throughout the economy, the number of economically disadvantaged in Eugene will likely grow.

Photo by Denise Wendt, FOOD for Lane County

Existing income and housing conditions in Eugene are already challenging. According to the Eugene-Springfield 2010 Consolidated Plan, "Poverty rates in the cities of Eugene and Springfield have climbed over the past 40 years, rising from 10.9 percent of the total population in 1969 to 19.3 percent in 2007"; "The 2009 One-Night Homeless Count identified 2,232 homeless persons"; "more than one-quarter (26.1 percent) of all homeowners and nearly half (47 percent) of all renters have a housing cost burden," where more than 30 percent of household income is paid for housing costs, including utilities. These challenging conditions mean that health and social services, such as hunger relief and the provision of affordable housing, are already stressed.

Other challenges resulting from increasing fuel prices:

- Increasing costs of fuel for transportation and home heating.
- Rising food prices.
- Higher costs for medical services and public health services.
- Increasing demand for social services.
- Increasing demand for public school services with increased costs of maintaining school facilities.
- Growing vulnerable and marginalized populations.

In order to avoid the most severe impacts of rising fuel prices, Eugene must prepare local and regional health and social service systems for these changes, and create systems that can adapt to a different energy and climate future.

How will climate change affect our health and social services?

In the Eugene/Springfield area, climate change is expected to cause warmer, drier summers and wetter, stormier winters.[45] Other potential challenges posed by climate change:

- Increased risks of flooding and consequent impacts on transportation infrastructure, housing stock, etc.
- Increased wildfire resulting in reduced air quality.
- Higher rates of asthma and other respiratory diseases.
- Disruption to transportation systems due to severe storms.
- Negative impacts on the drinking water supply.
- Increased energy prices.
- Increased incidence of heat-related illness.

[45] *"Preparing for Climate Change in the Upper Willamette River Basin of Western Oregon: Co-Beneficial Planning for Communities and Ecosystems," US Department of Agriculture, Climate Leadership Initiative, and National Center for Conservation Science and Policy, 2009.*

These impacts could result in more displaced and homeless community members; economic strains for vulnerable populations; and resultant food emergencies; and increased demand for public health and other social, services by a community strained by social, economic and environmental changes.

Efforts Currently Underway

The University of Oregon Climate Leadership Initiative, in coordination with the Oregon Coalition of Local Health Officials (CLHO), is coordinating a statewide response to health issues related to climate change. Lane County Public Health actively addresses health concerns likely to be exacerbated by climate change, including ***vector-borne diseases*** and heat-related illnesses. Many public, private and not-for-profit social service agencies are providing support for members of the community who are vulnerable to economic change, loss of housing, food insecurity, health crises, and other conditions that challenge the resiliency of their families and households. The major challenge for this sector, as outlined above, is the expected increase in demand for health and social services as climate change and rising fuel prices exceed many individuals' and households' ability to adapt.

Photo by Denise Wendt, FOOD for Lane County

Photo by Denise Wendt, FOOD for Lane County

Objectives and Actions for Health and social services:

Objective 23:
Prepare community systems for longer-term climate and energy challenges including fuel shortages, increased summer drought and increased storm intensity.

The community's local emergency management programs are well-prepared to manage unexpected and relatively short-term emergencies such as urban forest fires, heat waves, and localized flooding. There is need to assess the vulnerability of the water supply and health systems to longer-term emergencies.

High Priority Actions:

23.1. Conduct a climate and energy vulnerability assessment that assesses the mid-term, and longer-term climate and energy vulnerabilities of essential services – specifically energy, water, food, health, housing, and sanitation.

23.1a) Build on existing emergency management efforts.

23.1b) Identify viable local solutions and estimate costs of reducing vulnerabilities.

23.1c) Estimate capacity needs and costs for implementing preparation and adaptation strategies.

23.1d) Continue to monitor emerging data on climate-change-related health risks and revise adaptation plans as necessary.

23.2. Strengthen current hunger relief systems to handle increased short-term and long-term demand.

23.2a) Conduct analysis to project future demand for hunger relief services. This could be conducted as part of the vulnerability assessment (above).

23.2b) If analysis (a) suggests need, develop plans to prepare for increased food demand from a higher percentage of the population by partnering with the local food bank.

23.2c) Identify and remove barriers to, and encourage, development of homegrown food sources such as backyard and community gardens, urban food orchards, etc. This action item is also identified in the Food and Agriculture section.

23.3. Increase financial assistance for low-income populations to support energy efficiency home retrofits that reduce the costs for utility service.

23.3a) Target rental properties and property managers.

23.4. Conduct a food security assessment, as outlined in the Food and Agriculture section and take action to increase security of the community's food supply.

Food for Lane County

Hunger is not new to Oregon, a state that ranked 15th in the nation for food insecurity and 3rd for very low food security in 2008, and where requests for food boxes went up 20 percent from 2008 to 2009. The two leading reasons people in Lane County seek assistance from a food bank are the high costs of food and energy; two concerning costs discussed in detail throughout this plan.

For 25 years, the nonprofit food bank FOOD for Lane County (FFLC) has been dedicated to alleviating hunger by creating access to food in our community. FFLC programs are designed to help low-income individuals and families obtain nutritious food when they cannot afford to buy it. This is accomplished by soliciting, collecting, rescuing, growing, preparing and packaging food for distribution to food pantries, meal sites, shelters, affordable housing sites, and non-emergency programs. In the last year alone, FFLC distributed 6.5 million pounds of food, resulting in over five million meals for those in need. In addition to distributing this much-needed food, FFLC fights the root causes of hunger through public awareness, education and community advocacy.

FFLC serves the emergency food needs for a population base of 338,000 people living in the 4,620 square miles comprising both urban and rural Lane County, and depends on volunteers and the local community to help meet this need. Find out more by visiting **www.foodforlanecounty.org**

Objective 24:
Reduce *exposure* of human populations to climate-related disasters.

The frequency of forest fires and flooding are expected to increase in the upper Willamette Valley as a result of higher summertime temperatures and changes in precipitation patterns.[46] Existing local emergency plans contain provisions for managing the impacts of both these emergencies at their present scale and frequency; however, Eugene must develop expanded strategies to reduce the negative impacts of increased flooding and wildfires.

High Priority Actions:

24.1. Reduce risk of home fires due to wildfires in and around the urban area.

24.1a) Increase efforts to educate homeowners about creating defensible space around their homes.

24.2. Ensure essential services are not located within the 100-year flood zone.

24.2a) Identify essential emergency and non-emergency services that are located in flood zones or that could be isolated by flooding.

24.2b) Develop a plan to move essential services out of the flood zone and/or decrease their vulnerability to flood damage and flood isolation.

Objective 25:
Increase the capacity of Eugene's health sector, and the community at large, to meet the health-related challenges of climate change and rising fuel prices by fostering greater involvement of the public health system in climate change and energy planning.

Public health professionals are already working to address many of the challenges that climate change and increasing energy prices are likely to exacerbate. As the professionals who are most directly involved with this work, they are a critical part of raising community awareness. Public health professionals will play an essential role in planning adaptation strategies for mitigating the impacts of climate change and energy cost volatility.

High Priority Actions:

25.1. Educate the public and health professionals about health risks posed by climate change.

25.2. Prioritize local public health resources to emphasize educating the public, staff, and administration about climate change, energy price volatility and the related system impacts and health risks.

25.3. Develop a climate change preparation strategy for the public health system.

[46] *"Preparing for Climate Change in the Upper Willamette River Basin of Western Oregon: Co-Beneficial Planning for Communities and Ecosystems," US Department of Agriculture, Climate Leadership Initiative, and National Center for Conservation Science and Policy, 2009.*

Urban Natural Resources

What is the Urban Natural Resources Action Area?

Urban Natural Resources, as the term is used in this plan, comprises the soil, air, water, plants, and animals in the suburban and urbanized areas of the community. These resources include stormwater, drinking water, and all the trees, shrubs, grasses and other plants that are scattered across the community on public and private lands.

What Part of Eugene's GHG Footprint Comes from Urban Natural Resources?

Maintenance activities, which are necessary to protect and manage urban natural resources, produce some greenhouse gases; for example, when fossil fuels are used to power machinery and maintenance vehicles. However, the amount of GHG produced is a minute percentage of the total produced in the community. In fact, most inventories do not include natural resources as a source of greenhouse gas emissions, and many describe plants and soils as ***carbon sinks***, a place where greenhouse gases, such as carbon dioxide, are taken out of the atmosphere by trees and other plants and stored in their leaves, stems and roots.

How Will Rising Fuel Prices Impact Urban Natural Resources?

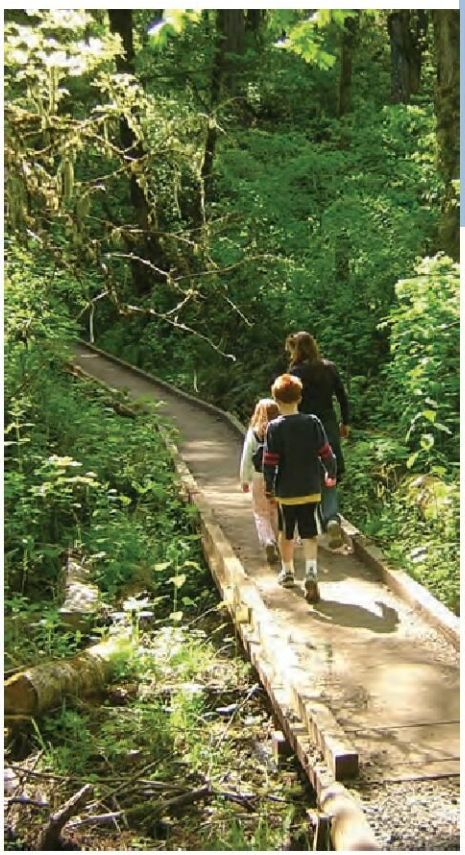
Increasing fuel prices are expected to encourage community members to seek more recreational opportunities closer to home. This may increase the use of neighborhood parks, the Ridgeline Trail, the West Eugene Wetlands, and Riverfront paths, as well as other facilities such as the Howard Buford Recreation Area and the waters of the Willamette River in and around Eugene. At the same time, increased fuel prices are likely to drive up the cost of park maintenance, tree care, riparian restoration, and weed control. These challenges may be compounded as services compete for resources when home, business, and local government budgets are under the economic pressure of increasing energy prices.

How Can We Prepare Our Urban Natural Resources for Climate Change?

Probable outcomes of climate change on the community's urban natural resources:

- Lower summer stream flows.
- Increased stream temperatures.
- Warmer terrestrial temperatures.
- Increased summer drought and risk of wildfire.
- Increased number and scale of problems caused by ***invasive species***.

The projected changes in temperatures, rainfall patterns, stream flow and wildfire incidence will likely result in shifts in hydrology and in habitat types. As the region gets hotter and drier in summer, native plants and



The Wildland-Urban

INTERFACE is that area where human development mixes with forested lands. The trend of people building homes on previously uninhabited forest land is expected to continue, thereby exposing greater numbers of people and property to the hazards of a wildfire.

Wildfires are a natural process that cycles nutrients, maintains forest health, and creates wildlife habitat, but the probability of wildfires in Oregon is expected to increase due to warmer temperatures and increased drought associated with climate change. Reducing the overall fire risk in Eugene's wildland-urban interface will take time, energy, and resources.

Fortunately, simple tools are available to help with this task. Creating and maintaining defensible space (see image above) around homes is the first step in surviving a wildfire and reducing the risk of damage to structures. This is done by removing flammable vegetation, trimming trees, planting fire resistant plants, utilizing non-combustible roofing material and providing clear emergency exits.

More help is available by contacting the Eugene Fire and EMS Department, or visiting **www.firefree.org**.

animals that are well adapted to current conditions may become less competitive than other species. Some plants and animals will likely disappear altogether and others will relocate.

The way that the community's land is developed affects the resiliency of Eugene's infrastructure. Low Impact Development (LID) is a design approach that strives to maintain and enhance natural water movement, both within a developing site and more broadly throughout urban areas. Some LID strategies include preventing unnecessary soil compaction, retaining rainwater (also known as stormwater) on-site, and designing stormwater systems to put water back into the soil instead of into the storm drain. LID strategies protect soil and increase the resiliency of stormwater systems.

To increase the adaptability of Eugene's natural resource systems, management approaches must consider the variety of natural resources—soil, trees, wildlife, and water—and manage them together across the urban landscape.[47],[48] Similarly, natural resource planning must be flexible, holistic, and considerate of the dynamic biological systems and potential impacts that climate change can bring.

Efforts Underway

Eugene residents value their parks, rivers, forests, and wetlands. Several natural resource area plans, including the Ridgeline Vision and Action Plan, the Willamette River Vision Plan, and the Metro Waterways Plan, have been developed to preserve the quality of these resources. Local utilities that manage the community's drinking water supply are planning for the potential impacts of climate change. In addition, the Eugene Fire Department and Parks and Open Space staff are managing City lands near residential areas to reduce fuels and minimize wildfire risks.

[47] *"Preparing for Climate Change in the Upper Willamette River Basin of Western Oregon," Climate Leadership Initiative, USDA Forest Service, National Center for Conservation Science and Policy, 2009.*

[48] *"A New Era for Conservation: Review of Climate Change Adaptation," National Wildlife Federation, 2009.*

Objectives and Actions for Urban Natural Resources:

Objective 26:

Protect sensitive urban natural areas including riparian areas, wetlands, and floodplains, for multiple benefits including improved water and air quality, reduced water and air temperatures, and reduced flooding.

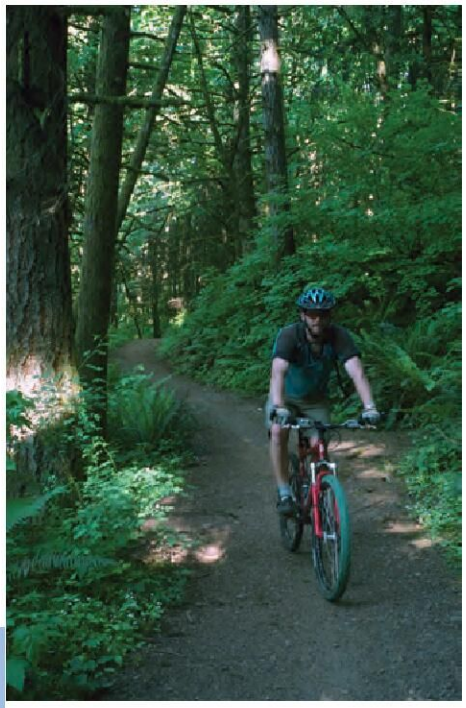
Many of the adaptation goals of this section, including increased shading, decreased flooding, and improved wildlife habitat, can be met by managing for multiple benefits. These natural resources are interdependent; success with one goal can mean success with multiple goals. In areas where soils are protected from compaction, for example, trees that provide shade grow healthier and are more resilient, and stormwater can better infiltrate the soil, thus reducing flooding. When streamside flood zones are protected from development, buildings are less likely to flood, and stream banks can support shade trees that cool the stream and provide maximum wildlife habitat value.

High Priority Actions:

26.1. Increase funding for public acquisitions of property to facilitate the combined goals of stormwater management, flood abatement, stream shading, headwaters protection, and increased connectivity between wildlife corridors. Some priorities for property acquisition are outlined in the Ridgeline Vision and Action Plan, the Willamette River Vision Plan, and the Metro Waterways Plan.

26.2. Update urban forestry management plans to promote urban forest management on a city-wide scale, expanding beyond individual lots or streets.

26.3. Identify and remove barriers, including City code, that may discourage or prevent use of Low Impact Development (LID) practices during construction on public and private property.



Objective 27:
Manage and update urban natural resource information, and make data available to public and policy-makers.

Information on climate change and fuel price volatility is evolving rapidly and relevant, up-to-date information about urban natural resources must be centralized and easily accessible so that planners, managers, policy-makers, and the public are able to respond to changes with well-informed decisions. This information will also assist in setting future targets and measuring success among a variety of natural resource goals.

High Priority Actions:

27.1. Compile and maintain an inventory of urban natural resources that is current and accessible to the public and policy-makers.

27.1a) Create a list of climate-sensitive urban natural resources that should be tracked: inventories of City-managed trees, stormwater resources, riparian buffers, opportunities for food production, solar resources, soil classifications, publicly-owned land, etc.

27.1b) Identify a central coordinator of information, such as Lane Council of Governments (*LCOG*).

27.1c) Utilize existing inventories.

27.1d) By 2013, identify any information gaps and create a plan to fill them.

27.1e) Fill any information gaps by 2015.

Objective 28:
Update vegetation management plans.

High Priority Actions:

28 .1. Plan for increased fires in the forests surrounding the urban area.

28.1a) Re-examine urban forest management policies to ensure that focus is placed on reducing susceptibility to the likely increase in wildfires.

Objective 29:
Educate community members about the importance of urban natural resources.

It is important that community members remain informed about the importance of stormwater, urban trees, watershed health, and water quality as these resources relate to a changing climate.

High Priority Actions:

29.1. Provide educational resources to students, teachers, residents, and businesses about the benefits of trees, watershed health, and water quality.

29.1a) Build on existing community efforts.

Objective 30:
Manage stormwater to reduce flooding, recharge groundwater, and improve water quality.

Climate change is expected to increase downpours, and cause more intense winter storm events. In order to minimize local flooding during these events, stormwater must be slowed and allowed to infiltrate the soil. This type of stormwater management, although not actively encouraged for existing buildings, is required by City policy on new or redeveloped sites,[49] and includes the use of tools such as bioswales, *pervious pavement*, and *rain gardens*. Because the majority of the buildings that will be standing in Eugene in 2020 already exist, making stormwater retrofits is an important strategy for improving the resiliency of the community's stormwater system.

High Priority Actions:

30.1. Manage stormwater and riparian areas to meet multiple goals: improved water quality, lowered stream temperatures, increased infiltration, increased capacity, and improved native plant and wildlife habitat.

30.2. Develop a program to encourage onsite treatment of stormwater from existing buildings and facilities.

30.2a) Identify incentives to encourage property owners to retrofit existing structures and facilities.

CLIMATE CHANGE is predicted to reduce summer stream flows, increase drought, and put stress on plants and animals alike. In order to adapt, many animals will need space to move away from stresses and into areas that are more livable. And as fuel prices increase, residents of Eugene may seek recreational opportunities closer to home. Eugene is fortunate to have a Parks and Open Space system that not only provides outstanding recreational opportunities, but preserves an incredible array of habitats in several large and varied natural areas. In west Eugene, over 3,000 acres of protected wetlands form a well connected, integrated system of prairies, creeks, pond areas and seasonal pools. The Ridgeline system to the south contains over 1,900 acres of protected upland prairies, oak dominated communities and conifer forests. Along the valley floor, the Willamette river flows through several parks, providing habitat for fish, beaver, herons, and bald eagles. Together these areas support a diverse group of animals and plants including several listed as rare and endangered.

Wildlife corridors such as Amazon Creek, help connect large wetland, upland, and river habitats. This connectivity facilitates the migration of wildlife, seeds, and genes that help plant and animal populations be resilient.

In addition to supporting plants and wildlife, the trails and paths that weave through these extensive natural areas provide valuable opportunities for our community to experience, explore, and learn firsthand the value of nature.

[49] *"Stormwater Management Manual," City of Eugene, 2008.*

TREES are an integral part of Eugene's health. They cool our community by providing shade; they provide wildlife habitat, improve air and water quality, raise property values; and, when properly sited, reduce energy costs year-round.

Recognizing this community value, volunteers with the non-profit Eugene Tree Foundation (ETF) have helped plant nearly 1,400 street and yard trees, as well as hundreds more in Eugene's natural areas and along roads and bike paths.

Since 1997, ETF members have created a healthier urban forest and strengthened community bonds through tree planting, stewardship, education and advocacy. ETF organizes monthly volunteer work parties to plant, inspect, prune, water, and care for trees—often collaborating with the City of Eugene's NeighborWoods, Stream Team, and Volunteers in Parks programs.

Beginning in late 2010, ETF will pilot a new neighborhood-based planting program in several neighborhoods in coordination with the Portland nonprofit Friends of Trees. This work will plant the next generation of trees in Eugene and create a network of volunteers to help care for trees and natural areas throughout the community. Learn more by visiting **www.eugenetreefoundation.org**.

Objective 31:
Expand public and private programs to manage, and invest in, trees to cool buildings, pavement, and waterways.

Mature trees can help meet several natural resource goals by reducing flooding, improving air quality, cooling streams and cooling the urban heat island, a condition that occurs when the urban area is warmed by dark pavement, roof shingles, and buildings. The temperature of hard surfaces shaded by a tree may be up to 35° F lower than in full summer sun.[50] Tree shade also reduces energy needed to heat and cool buildings.[51] The greatest benefits will come from shading roadways, buildings (the south and west sides), and streams. Trees frequently take ten to twenty years before they provide a significant amount of shade; however tree planting is an inexpensive investment in the future livability of our community that can be taken on by just about anyone.

High Priority Actions:

31.1. Increase planting, preservation, and maintenance of trees and shrubs.

- **31.**1a) Build on existing initiatives and partnerships.
- **31.**1b) Seek additional financial and volunteer resources.
- **31.**1c) Plant a diversity of species, including species native to the Willamette Valley, to increase the percentage of survivors under changing conditions.

31.2. Control invasive species, such as English ivy, on City and County parks in order to maintain the health of existing urban area native habitats.

31.3. Create incentives to encourage residents and businesses to plant trees.

[50] *"The Benefits of Urban Trees," Chris Hastie, July 2003.*

[51] *"Urban Forest Values: Economic Benefits of Trees in Cities," Kathleen L. Wolf, Ph.D., 1998.*

Objective 32:
Encourage ongoing water conservation.

High Priority Actions:

32.1. Increase existing water conservation education and water quality initiatives as outlined in the Buildings and Energy section.

Objective 33:
Strengthen protections of drinking water sources.

When considering the impacts of climate change, water quantity and quality will continue to be critically important to the livability of Eugene. Fortunately, the McKenzie River provides Eugene residents with a seasonally stable, ample, high-quality water supply.[52] Continued protection of the quality and availability of this resource is essential.

High Priority Actions:

33.1. Strengthen and expand protections to maintain surface water quality and prevent the contamination of shallow wells.

[52] *"Deep Groundwater Mediates Streamflow Response to Climate Warming in the Oregon Cascades," Tague, C. et. al., 2008.*

Appendix 1

Compiled Priority Action Items

APPENDIX 1: COMPILED PRIORITY ACTION ITEMS

	High Priority Action Areas	Relative GHG Reduction	Fossil Fuel Reduction	Adaptation Value*	Cost	Savings	Leader (L) / Partners (x): City of Eugene	Utilities	Business Sector	Residents	Neighborhoods	School Districts	Lane County	U of O	Lane CC	State of Oregon	Lane Transit Dist	Non-Profits	Other	Timing: Ongoing	2011	2012	2013	Future	Suggested Measures	Suggested Targets	Adaptation Explanation
	Buildings & Energy Use																										
	Objective 1: Reduce total green house gas emissions from existing buildings by 50 percent by 2030.																								Natural gas use and electricity use total and per capita; greenhouse gas intensity of electricity.	Reduce greenhouse gas emissions from existing buildings by 50 percent by 2030	
	1.1 Identify the most cost-effective opportunities for increasing efficiency in existing buildings.	H	H	CC/FF	$		x	L	x			x	x	x	x	x					x			EWEB completes conservation potential assessment (CPA) - analysis of efficiency opportunities.	Complete by summer 2010	(FF)Reduces reliance on natural gas to generate electricity. (CC)Increased efficiency can reduce energy demand (and cost) during extreme summertime heat events.
	1.2 Expand assistance programs for retrofits that increase energy efficiency and reduce the carbon footprint of existing buildings.	H	H	CC/FF	$$$	$$	x	L								x				x					Dollars spent annually by EWEB and City of Eugene on efficiency grants and incentives; Number of residents/ businesses/ customers participating; percent of residents/ businesses/ customers participating.	Increase participation 5 percent annually	(FF)Reduces reliance on natural gas to generate electricity. (CC)Increased efficiency can reduce energy demand (and cost) during extreme summertime heat events.
Buildings & Energy Use	1.3 Establish a project fund to expand financing mechanisms for residential energy efficiency and/ or renewable energy system installations.	M	M	CC/FF	$$$	$$$	x	L								x		x			x				Fund created; dollars available annually.	Establish fund by 2013	(FF)Reduces reliance on natural gas to generate electricity. (CC)Increased efficiency can reduce energy demand (and cost) during extreme summertime heat events.
	1.4 Target occupant behavior in order to reduce energy use in all types of buildings.	M	M	CC/FF	$$	$$	x	L	x	x		x	x	x	x	x		x		x					Number of customers reached; estimated GHG reductions for targeted occupants.		(FF)Reduces reliance on natural gas to generate electricity. (CC)Increased efficiency can reduce energy demand (and cost) during extreme summertime heat events.
	1.5 Adopt an energy performance score program or similar tools, to disclose total energy use including natural gas and electricity in existing and new buildings, for use by builders, realtors, owners, and renters.	L	L	N	$		L	x	x							x		x			x				Energy Performance Score adopted or available for use.	Create Energy Performance Score system by 2015	
	Objective 2: Reduce greenhouse gas emissions from new construction 50 percent by 2030.																									Reduce greenhouse gas emissions from new construction by 50 percent by 2030	
	2.1 Lobby for adoption, and actively participate in development, of building code amendments that meet the Architecture 2030 standards for energy efficiency.	L	L	CC/FF	$		L	x	x	x			x					x					x		Adoption of Architecture 2030 standards as state building code.	Adoption of standards by 2018	(FF)Reduces reliance on natural gas to generate electricity. (CC)Increased efficiency can reduce energy demand (and cost) during extreme summertime heat events.
	2.2 Increase incentives for highly energy-efficient new buildings, aiming toward zero net energy and carbon neutral buildings.	L/M	L/M	CC/FF	$$-$$$	$	L	x	x							x				x					Incentives offered by City of Eugene and EWEB	Revise and expand incentives by 2012	(FF)Reduces reliance on natural gas to generate electricity. (CC)Increased efficiency can reduce energy demand (and cost) during extreme summertime heat events.
	2.2a Revise or expand incentives to encourage smaller homes that use less energy to operate and fewer building materials to construct.	L	L	CC/FF	$	$$	L	x								x					x	x			Incentives offered by City of Eugene and EWEB	Revise and expand incentives by 2012	(FF)Reduces reliance on natural gas to generate electricity. (CC)Increased efficiency can reduce energy demand (and cost) during extreme summertime heat events.

$ = $0 - $99,999 $$ = $100k - $999k $$$ = $1 million +

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	Objective 3: Expand use of Renewable and District Energy Systems.																										
	3.1 Increase the use of on-site renewable energy systems, such as solar hot water, photovoltaic, and ground-source heat pumps, by removing barriers to such systems.	L/M	L/M	CC/FF	$$$		x	L	x	x		x	x	x	x	x				x					Identification and reduction of barriers; annual use of on-site renewables.		(FF)Reduces reliance on natural gas to generate electricity. (CC)Increased efficiency can reduce energy demand (and cost) during extreme summertime heat events.
Buildings and Energy Use	**3.1a** Invest in EWEB's downtown network to facilitate net metering, a program which would allow connection to photovoltaic systems on downtown buildings.	L	L	CC/FF	$$$		x	L	x				x		x	x						x	x		Downtown net metering available.	Net metering available by 2016	(FF)Reduces reliance on natural gas to generate electricity. (CC)Increased efficiency can reduce energy demand (and cost) during extreme summertime heat events.
	3.1b Address the financial barriers to onsite renewable energy by expanding financing options such as long-term loans and property-assessed clean energy bonds.	L	L	CC/FF	$$$	$$	x	L								x			Banks				x	x	Financing options available.		
	3.1c Assess and reduce barriers to solar energy use and balance priorities for solar access.	n/a	n/a	FF	$		L	x	x	x	x	x	x	x	x	x		x						x	Code updated	Update code by 2013	(FF)Aids in investment in onsite renewables reducing reliance on natural gas to generate electricity.
	3.2 Develop at least one community scale renewable energy pilot by 2015.	L	L	CC/FF	$$$		x	L	x	x		x	x			x		x				x	x	x	Number of projects completed.	At least one project complete by 2015	(FF)Reduces reliance on natural gas to generate electricity. (CC)Increased efficiency can reduce energy demand (and cost) during extreme summertime heat events.
	3.3 Develop district energy systems in Eugene.	L	L	CC/FF	$$$		x	L	x	x		x	x			x		x				x	x	x	Number of projects developed.	At least one developed by 2015	(FF)Reduces reliance on natural gas to generate electricity. (CC)Increased efficiency can reduce energy demand (and cost) during extreme summertime heat events.
	3.3a Develop at least one clean district energy, or shared energy, system pilot project by 2015 by working with property owners and EWEB.	M	M	FF	$$$	$$	x	L	x	x	x	x	x	x	x												
	Objective 4: Increase the implementation of climate change preparation strategies for the built environment.																										
	4.1 Encourage the use of passive systems in buildings for heating, cooling, ventilation, water delivery, and incorporate climate change preparation strategies into building design and construction.	M	M	CC/FF	$	$$	L									x				x					Incentives or other encouragement available		Improves livability of homes during extreme weather events. Reduces cost of home operation when fossil fuel prices rise.
	4.1a Lobby for state building code amendments.	L	L	CC	$		L	x		x						x		x		x					Adopted COE legislative policies include climate change/building code elements.		
	4.1b Develop incentives to encourage the use of passive heating and cooling systems and other strategies that reduce energy demand and better adapt buildings for a changing climate.	L	L	CC/FF	$-$$	$$	L	x													x						(FF)Reduces reliance on natural gas to generate electricity. (CC)Increased efficiency can reduce energy demand (and cost) during extreme summertime heat events.
	4.2 Provide education, assistance and incentives to reduce potable water use in new and existing buildings and landscaping.	L	L	CC	$$	$$	x	L	x			x		x	x	x		x		x					Dollars spent for water conservation education. Numbers of customers reached. Water use per capita.		reduces demand on freshwater resources, that are expected to decline during summer drought under climate change conditions.

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							City of Eugene	Utilities	Business Sector	Residents	Neighborhoods	School Districts	Lane County	U of O	Lane CC	State of Oregon	Lane Transit Dist	Non-Profits	Other		Ongoing	2011	2012	2013	Future			
	Food and Agriculture																											
	Objective 5: Reduce consumption of carbon-intensive foods.																										Develop official target and measurement by December 2011.	
	5.1 Begin a community campaign to educate the public about food choice as part of a climate-friendly lifestyle.	M	M	n	$	$	x		x	x	x	x	x	x	x	x			L	OSU	x	x				Number of consumers aware of campaign.	Create and begin campaign in 2011.	Increased demand for foods that require fewer fossil fuels is likely to dampen inflationary affect on food of rising fuel prices
Food and Agriculture	**5.1a** Specifically encourage reduced consumption of carbon intensive foods including red meat and dairy.	M	M	n	$	$	x		x	x		x		x	x	x			L	OSU	x							
	5.2 Implement a "Buy climate-friendly first" food purchasing policy for public institutions - schools, hospitals, city and county governments.	M	M	n	$	$-$$	x	x	x			x	x	x	x	x			L			x				"Climate Friendly" defined; number of institutions with "buy climate friendly first" purchasing policy.	Create policy for City of Eugene by December 2011.	Increased demand for foods that require fewer fossil fuels is likely to dampen inflationary affect on food of rising fuel prices
	Objective 6: Reduce the greenhouse gas emissions associated with agriculture and food waste.																										Develop official target and measurement by December 2011.	
	6.1 Transition to agriculture methods that reduce greenhouse gas emissions.	M	L	FF	$$-$$$								x		FBMP		L		Oregon Tilth	OSU, ODA	x							Likely to reduce dependence on fossil fuels in agricultural systems
	6.2 Conduct a pilot project for co-digestion of food waste and biosolids. See Consumption and Waste section.	M	M	CC/FF	$$$	$$	L	x	x			x		x									x	x	x	Progress toward, or implementation of, pilot project (public or private).	Create pilot project by 2015.	If implemented long term, additional energy supply will help reduce dependence on fossil fuel and hydro power for electricity generation
	Objective 7: Preserve the productive capacity of the local and regional foodshed.																											
	7.1 Strengthen current farmland protections, particularly around high-value agriculture soils.	n/a	n/a	CC/FF	$$		x			x			L			x			Land Watch OSU		x							Retaining prime farmland will help increase resilience of local food systems
	7.1a Strengthen City and County land use protections to prevent urban growth onto prime farmlands.	n/a	n/a	CC/FF	$		L			x			x								x					Assessment of existing land use code protections; strategies for increased protections.		Retaining prime farmland will help increase resilience of local food systems
	7.2 Strengthen current farmland protections at state levels.	n/a	n/a	CC/FF	$$		x			x			x				L		x		x							Retaining prime farmland will help increase resilience of local food systems
	7.2a Lobby state agencies to strengthen protections for high-value farmlands.	n/a	n/a	CC/FF	$		x		x	x			L			x			x		x					Adopted COE legislative policies include farmland protections.		Retaining prime farmland will help increase resilience of local food systems

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	Objective 8: Prepare our food systems for the uncertainties created by climate change and rising energy prices.																										
	8.1 Implement the following recommendations from Eugene's Food Security Scoping and Resource Plan:	L	L	CC/FF																							
	8.1a Identify City of Eugene liaison for food system related programming.	L	L	CC/FF	$		L													x					This action was completed in Spring 2010; liaison has been identified and retained.		Helps to increases home-based food production and resilience
	8.1b Develop a comprehensive Community Food Security Assessment.	n/a	n/a	CC/FF	$		x	x					x	x				L	OSU		x				Progress toward, or completion of, assessment.	Complete assessment by 2013.	Identifies the next steps needed to increase relilience in local food systems.
Food and Agriculture	**8.2** Develop an updated a regional emergency food distribution plan that accounts for climate and energy based disruptions.	n/a	n/a	CC/FF	$		L		x				x	x				x			x	x			Progress toward, or completion of, updated plan.	By August 2011, coordinate with City of Eugene Risk Services to set formal target date for this action.	
	8.3 Increase the diversity and drought resistance of food crops grown in the upper Willamette Valley.	n/a	n/a	CC/FF	$$				L							x		x	OSU	x					New drought tolerant crops planted ; seed available to local growers.	Ongoing	Increases the odds that some crops will survive extreme weather events and adds to the available food should a food shortage take place.
	8.4 Support the efforts of non-profits, food growers, and state agencies to increase the diversity and drought resistance of food crops.	n/a	n/a	CC	$		x	x	x	x		x	x	x	x	x		x	(L) OSU	x					Methods of support and support provided		
	8.4a Prioritize development of vegetable protein crops such as beans and grains.	L	n/a	CC/FF	$				L									x		x							Likely to increase resilience in local food systems.
	8.5 Remove barriers to using greywater in agriculture. Work with state lawmakers to find solutions for greywater re-use.	L	L	CC/FF	$	$$			x				x		x	L		x	OSU						Barriers identified and reduced. Strategies for working with state.		Reduces use of freshwater, a resource likely to be diminished with climate change.
	Objective 9: Increase availability of home-grown, and locally sourced food in Eugene.																										
	9.1 Expand Community gardens on public, private, and community lands including City land, school campuses, and church properties.	L	L	CC/FF	$	$	x	x	x		x	x	x	x	x			L	Churches	x					Barriers identified & reduced; acreage of community gardens reported through self-reporting residents, non-profit activities, and City programs		Done at a large scale, this could reduce reliance on imported food crops and provide inexpensive food reserves.
	9.1a Assess opportunities for community garden locations within the city.	n/a	n/a		$		L				x			x				x			x				Completion of assessment.		
	9.2 Encourage planting of non-invasive food-bearing trees and shrubs on public and private lands. Support urban tree food programs of such advocates as Tree by Tree, and the Eugene Tree Foundation.	L	L	CC/FF	$	$	L	x	x	L	x	x	x	x				L		x						Numbers of new food-bearing trees planted on public and private land through self-reporting residents and non-profit activities and City programs.		Done at a large scale, this could reduce reliance on imported food crops and provide inexpensive food reserves.
	9.3 Reevaluate limitations on numbers and types of animals permitted under Eugene's code to allow, where appropriate, an increase in the number and variety of food-producing animals that can be kept by urban residents.	L	L	CC/FF	$	$	L		x	x			x					x			x				Code review completion; recommendations and revisions complete.	Initial work session with Eugene City Council: 9/8/10.	Done at a large scale, this could reduce reliance on imported food crops and provide inexpensive food reserves.

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APPENDIX 1: COMPILED PRIORITY ACTION ITEMS

	High Priority Action Areas	Relative GHG Reduction	Fossil Fuel Reduction	Adaptation Value*	Cost	Savings	Leader (L) / Partners (x): City of Eugene	Utilities	Business Sector	Residents	Neighborhoods	School Districts	Lane County	U of O	Lane CC	State of Oregon	Lane Transit Dist	Non-Profits	Other	Timing: Ongoing	2011	2012	2013	Future	Suggested Measures	Suggested Targets	Adaptation Explanation
	Land Use and Transportation																								Gasoline and Diesel fuel consumed total and per capita.	Target set: Reduce community wide fossil fuel use 50 percent by 2030.	
	Objective 10: Create 20-minute neighborhoods, where 90 percent of Eugene residents can safely walk or bicycle to meet most basic daily, non-work needs, and also have safe pedestrian and bicycle routes that connect to mass transit.																										
Land Use and Transportation	**10.1** Make the creation of 20-minute neighborhoods a core component of the EugenePlan and the Eugene Bicycle Pedestrian Master Plan.	H	H	FF	$		L							x				x	LCOG	x					Concept incorporation into plans.	Incorporate into plans during planning processes in 2010 and 2011.	20 minute neighborhoods would reduce reliance on fossil fuels - increasing community resilience when fuel prices rise.
	10.2 By 2013, complete and implement a 20-minute neighborhoods plan	H	H	FF	$$		L														x	x	x		Completion of plan.	Complete by 2013.	20 minute neighborhoods would reduce reliance on fossil fuels - increasing community resilience when fuel prices rise.
	10.2a Estimate cost and identify funding for planning	n/a	n/a	n/a	$		L														x				Funding identified.	Complete by 2013.	20 minute neighborhoods would reduce reliance on fossil fuels - increasing community resilience when fuel prices rise.
	10.2b Identify key components for 20 minute neighborhoods (i.e. schools, parks, grocery store, retail services)	n/a	n/a	n/a	$		L														x				Key components listed.	Complete by 2013.	20 minute neighborhoods would reduce reliance on fossil fuels - increasing community resilience when fuel prices rise.
	10.2c Conduct a network gap analysis to determine needs (coordinated with Opportunity Siting)	n/a	n/a	n/a	$		L												LCOG		x	x			Gap analysis completion.	Complete by 2013.	20 minute neighborhoods would reduce reliance on fossil fuels - increasing community resilience when fuel prices rise.
	Objective 11: Increase density around the urban core and along transit corridors.																										
	11.1 Zone future commercial and high residential densities in and around the urban core, and along EMX and other high-capacity transit corridors to accommodate future urban growth.	H	H	CC/FF	$$	$$	L		x	x	x	x	x				x			x	x				To be identified in Envision Eugene process.	Create regular benchmarks through the Envision Eugene process that will determine if density goals are being met.	Aids in adapting to high fuel prices by reducing dependance on fossil fuel for transportation. Reducing sprawl also appears to reduce extreme heat events.
	Objective 12: Consider the potential for climate refuges when conducting land use planning activities.																										
	12.1 Closely monitor the community's population growth rate to gauge whether population projections are accurate.	n/a	n/a	CC	$		L												LCOG	x	x				Targets are set and annual monitoring is in place.	Targets set by December 2011.	Aids in anticipating community changes and needs due to climate refugees.

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	Objective 13: Continue to expand and improve Eugene's bicycle and pedestrian infrastructure and connectivity to increase the percentage of trips made by bike and on foot.																										
	13.1 Create a pedestrian and bicycle master plan	n/a	n/a	FF	$$		L		x	x	x	x	x	x	x	x	x	x			x				Plan underway summer 2010; completion of plan.	Complete by June 2011.	Aids in adapting to high fuel prices by reducing dependance on fossil fuel for transportation. Reducing sprawl also appears to reduce extreme heat events.
	13.1a Identify mobility gaps in the bicycle and pedestrian transportation system.	n/a	n/a				L		x	x	x	x					x	x	BPAC		x				Included in plan.	Complete by June 2011.	
	13.1b Recommend needed improvements to bicycle and pedestrian infrastructure.	n/a	n/a				L		x	x	x	x					x	x			x				Included in plan.	Complete by June 2011.	
	13.1c Create an implementation plan.	n/a	n/a				L														x				Included in plan.	Complete by June 2011.	
	13.1d Identify funding sources for implementation.	n/a	n/a				L									x	x	x		x	x				Included in plan.	Complete by June 2011.	
Land Use and Transportation	**13.2** Increase the connectivity of bicycle boulevards and shared-use paths to encourage bicyclists of varying abilities to travel by bike.	M	M	FF	$$$	$$	L													x					Miles of bike boulevards and shared-use paths; number of intersections in system of shared use paths and bike boulevards.	Improve connectivity as detailed in the 2011 Pedestrian and Bicycle Master Plan.	Reduces dependance on fossil fuel for transportation.
	13.3 Create a complete streets policy that requires all subsequent transportation projects and rehabilitation projects to accommodate bicycles, pedestrians, and transit service.	L	L	FF	$		L														x				Transportation System Plan contains complete streets policy.	Incorporate into Transportation System Plan during update beginning 2010.	Reduces dependance on fossil fuel for transportation.
	Objective 14: Increase the supply of integrated, convenient, efficient, and cost effective public transit.																									Increase number of choice riders by 2 percent per year (from The LTD road map).	
	14.1 Diversify funding sources for Lane Transit District (LTD) to increase the long-term reliability of mass transit service while maintaining cost effective and fuel efficient transit service.	M	H	FF	$	$$			x				x				L		Springfield		x	x	x		Sources of funding; percent of operating costs covered by payroll tax; stability of operational funding.	By 2012 set an official target to shift the percentage of operating funds away from payroll taxes by x amount by x year. Coordinate target development with LTD.	Reduces dependance on fossil fuel for transportation
	14.2 Align City of Eugene Transportation System Plan and LTD long-range transit plan to integrate bus routes into the broader alternative transportation system.	M	M	FF	$	$$$	x										L			x	x	x				Align during Transportation System Plan update beginning 2010, and LTD planning, when it takes place.	Reduces dependance on fossil fuel for transportation
	14.2a Create special setbacks along future Bus Rapid Transit (BRT) or other mass transit corridors to accommodate future right-of-way expansion.	n/a	n/a	FF	$	$$$	L									x	x			x					Locations identified; setbacks created; incorporation into Transportation System Plan.	Incorporate in Transportation System Plan update beginning Summer, 2010.	Reduces dependance on fossil fuel for transportation
	14.2b Determine the role of mass transit in accomplishing greenhouse gas emission reduction goals by working with LTD in developing the Long Range Transit Plan.	n/a	n/a	FF	$		L										x			x	x	x			GHG reduction potential determined	Determine GHG reductions possible by 2012.	Reduces dependance on fossil fuel for transportation
	14.3 Invest in transit infrastructure that meets future access and mobility needs while consuming less fossil fuel.	M	M	FF	$-$$$	$$	x		x	x		x	x			x	L										Reduces dependance on fossil fuel for transportation.
	14.3a Electrification of transit system	M	M	FF	$$$	$$	x	x	x	x						x	L							x		By August 2011. partner with LTD to set a formal target and measures.	Reduces dependance on fossil fuel for transportation.
	14.3b Increase use of hybrid vehicles, including buses and other heavy vehicles				$$	$														x					Percent of City of Eugene and LTD fleets propelled by internal combusion, hybrid, electricity, or other alternative.	Reduce the number vehicles propelled strictly by internal combustion 20 percent by 2020.	Reduces dependance on fossil fuel for transportation.

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	Objective 15: Expand outreach, marketing and education regarding climate-friendly transportation alternatives.																										
15.1	Increase promotion of bicycling, walking, transit, car-pooling, telecommuting, high occupancy vehicles, and emergency ride home as attractive alternatives to driving in order to increase the mode share alternatives to the single occupancy vehicle.	H	H	FF	$$	$$	x		x	x	x	x	x	x	x	x	x	x	(L) point2point	x					Percent of trips taken using each mode; number of residents or businesses reached; VMT avoided; dollars spent on Transportation Demand Management.	Increase rideshare in community by 3 percent per year (from LTD roadmap).	Reduces dependance on fossil fuel for transportation.
15.2	Increase promotion of fuel-efficient driving techniques.	M	M	FF	$$	$$	x		x	x	x	x	x	x	x	x	x	x	(L) point2point	x					Dollars spent to promote fuel-efficient driving; number of residents of businesses reached.		Reduces amount of fossil fuel needed transportation.
	Objective 16: Ensure maximum efficiency in current and future freight systems.																										
16.1	Plan for efficient freight transportation that minimizes greenhouse gas emissions and fossil fuel consumption, and:	M	M	FF	$$	$	L		x							x				x	x				Incorporation of freight efficiency into transportation planning efforts.	Incorporate during relevant planning efforts including the Transportation System Plan update beginning in 2010.	
16.1a	Connects multiple modes (train, truck, van, car, bicycle); Accommodates regional (upper Willamette Valley) commercial, industrial and agricultural freight needs; and facilitates efficient local deliveries.						L																		Connectivity of freight routes; efficiency measures included.	Incorporate during relevant planning efforts including the Transportation System Plan update beginning in 2010.	
	Objective 17: Increase the use of low-carbon vehicles and fuels to improve overall fuel efficiency and reduce vulnerability to fluctuating oil prices.																										
17.1	Accelerate the transition to plug in hybrids and electric vehicles	M	M	FF	$$	$	x	L	x	x	x	x	x	x	x	x				x					Number of electric vehicles purchased for municipal fleets.		
17.1a	Support the installation of a network of electric car charging stations.	n/a	n/a	FF	$$	$	L	L						x							x	x			Number of public charging stations installed in homes and in public spaces.	As part of USDOE grant, complete first round of installations in Eugene and Springfield by March, 2011.	
17.1b	Require installation of conduit to support electric car charging stations in new multifamily housing	n/a	n/a	FF	$	$$	L	x	x	x															Requirement adopted.		
17.2	Conduct research to understand what role biofuels can play in decreasing Eugene's vulnerability to energy markets. Use outcomes of research to inform the next CEAP and appropriately promote local use and production of biofuels.	n/a	n/a	FF	$		x		x						L		x					x	x	x	Research conducted.	Complete research by 2013.	

Land Use and Transportation

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Consumption and Waste																											
	Objective 18: Reduce greenhouse gas emissions by addressing purchasing habits.																								DEQ Material Recovery and Waste Generation Survey	By 2020, reduce per capita solid waste generated by 25 percent from 2008 level of 2,709 lbs. per person.	
	18.1 Educate businesses and residents about the role of consumption in GHG emissions.	H	n/a	N	$$		x		x	x	x	x	x	x	x	x		L		x					Number of residents reached with campaign; tons of solid waste produced per capita (a surrogate for consumption rate).	By August, 2011, set a target for numbers of homes to reach each year.	
	18.1a Encourage businesses and residents to: purchase durable, repairable and reusable goods; reduce the amount of materials that go to waste, including food; Reduce consumption of carbon-intensive consumer goods and services.	H	L	N	$	$$-$$$	x		x	x	x	x			x	x			L	x					Number of residents reached with campaign; tons of solid waste produced per capita (a surrogate for consumption rate); numbers of self-reporting organizations who have changed practices.	By August, 2011, set a target for numbers of homes to reach each year.	
	18.2 Lobby at state level for better product labeling that includes information about greenhouse gas emissions associated with products.	n/a	n/a	N	$		L		x	x															Adopted COE legislative policies include product labeling elements.	Include in legislative priorities as soon as there is a potential for legislative success.	
	18.3 Provide information for the public on when to replace high energy-use appliances. Where/ If this information is already available, increase the distribution and accessibility.	M	L	Y	$		x	L	x							x		x		x					Locations where information is available; numbers of residents reached.		Reduced electricity use reduces demand on hydroelectric generation.
	18.4 Participate actively in the process to develop local, state, and federal product stewardship legislation.	n/a	n/a	N	$		L		x	x						x		x		x					Adopted COE legislative policies include product stewardship elements.	Include in legislative priorities as soon as there is a potential for legislative success.	
	Objective 19: Increase waste recovery rate by improving recycling and composting.																								DEQ Material Recovery and Waste Generation Survey.	**Target set:** By 2020, recover 75 percent of all solid waste generated.	
	19.1 Target expanded recycling outreach and services to commercial and multi-family residential buildings, including local businesses, apartment buildings, student and cooperative housing.	L	L	N	$		L		x	x	x		x	x	x			x		x					Number of residents and businesses reached.		
	19.2 Enact a local ordinance to increase waste recovery rates from commercial and multi-family buildings.	L	L	N	$		L			x												x	x		Ordinance in place; waste recovery rate from commercial and multi-family buildings.	By 2020, recover 75 percent of all solid waste generated.	
	19.3 Assist businesses in improving paper, metal and glass recycling with a goal of supporting 5 percent of businesses each year.	M	M	N	$$		x						x		x	x			(L) BRING	x					Number of businesses being assisted	Five percent of businesses each year.	
	19.4 Enact an ordinance that requires all construction and demolition waste materials to be sorted for reusable or recyclable materials.	M	M	N	$$		L						x					x				x	x		Ordinance enacted	Create a formal completion target by December 2010.	
	Objective 20: Increase the waste diversion rate for organic wastes.																									Decrease total amount of organic material being disposed in landfill by 50 percent by 2020	
	20.1 Establish a permitted facility within Eugene/Springfield area that can accept and compost all organic materials (including food wastes).	M	L	FF	$	$	L	x	x	x									waste haulers		x				Tons of organic material disposed in landfill from waste composition study.		
	20.1a Develop a collection program and rate structure to support food waste collection.	n/a	n/a	FF	$		L																		Collection program developed		
	20.2 Conduct a pilot project at the River Avenue Waste Water Treatment Plant to determine the system ability for co-digestion of food waste and biosolids.	M	M	CC/FF	$$$	$$	L	x	x	x									waste haulers		x				Pilot project conducted	Conduct pilot by 2020.	Provides a locally sourced, clean burning renewable energy supply - reducing vulnerability to volatile fuel prices

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	Objective 21: Conduct research to determine next steps.																											
Consumption and Waste	**21.1**	Follow research being conducted by the EPA's West Coast Forum on Climate Change, Waste Prevention, Recovery and Disposal, to determine highest priority and most cost effective measures to address GHG production in the waste management sector.	n/a	n/a	N	$		L														x				Identified priority measures		
	21.2	Determine the greenhouse gas emissions profile from the current solid waste collection system and provide recommendations on how to reduce carbon emissions.	n/a	n/a	N	$		L							x							x				Completion of study	Complete study by 2013.	
	Objective 22: Reduce GHGs in municipal operations by improving purchasing practice and reducing waste.																											
	22.1	Increase the effectiveness of current City of Eugene purchasing policies that prioritize: 1) Reuse of products and materials, 2) purchasing durable goods, and 3)avoiding disposable goods whenever possible. Implement the following steps:	L	L	N	$	$	L	x					x	x	x	x	x				x				Identify measures as part of this action (b, below)	Set targets as part of this action (a, below).	
	22.1a	Set targets for procurement policies	L	L	N	$		L	x					x	x	x	x	x			x							
	22.1b	Identify measurements to monitor the impacts of procurement policies			N	$		L	x					x	x	x	x	x			x							
	22.1c	Increase efforts to implement these purchasing policies throughout the organization.			N	$		L	x					x	x	x	x	x			x							
	22.2	Encourage other local public agencies to prioritize: Reuse of products and materials, purchasing durable goods, and avoiding disposable goods whenever possible.			N	$	$	x	x	x	L		x	x	x	x	x	x	x		x							
	22.3	Reduce public agency purchase of GHG-intensive goods by 2014	M	M	FF	$		L													x					Quantity purchased (directly or through contracts) of goods identified in step b.	Show annual decrease in purchase of identified goods by 2014.	The price of high-GHG materials such as asphalt, concrete, and steel fluxuate with the price of oil. Reducing the demand for these items reduces budgetary impacts of rising fuel prices.
	22.3a	Identify city-purchased goods with the highest associated GHG emissions by 2012	n/a	n/a		$		L														x						
	22.3b	Create a plan to reduce the purchase of the 5 most GHG intensive goods (through substitutions, efficiencies, etc.)	M	M	FF	$		L														x						The price of high-GHG materials such as asphalt, concrete, and steel fluxuate with the price of oil. Reducing the demand for these items reduces budgetary impacts of rising fuel prices.
	22.3c	Annually repot the quantity of these goods (from step b) being purchased.	n/a	n/a	N	$		L													x							
	22.4	Implement the steps in the City waste reduction plan to reduce waste at City buildings, events, and ongoing operations	L	L	N	$	$	L													x					Tons of City waste avoided; tons of waste diverted from the landfill.	**Target set**: increase volume of waste diverted from landfill from internal operations to 75 percent by 2014 and 90 percent by 2020.	

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Health and Social Services																											
	Objective 23: Prepare community systems for longer-term climate and energy challenges including fuel shortages, increased summer drought and increased storm intensity.																										
	23.1 Conduct a climate and energy vulnerability assessment that identifies the mid- term, and longer-term climate and energy vulnerabilities of the community – specifically regarding: energy, water, food, health, housing, and sanitation.	n/a	n/a	CC/FF	$$		L	x	x	x	x	x		x		x	x	x			x				Completion of assessment	Conduct assessment by the end of 2012.	Aids in understanding vulnerabilities to climate change and increasing fuel prices so vulnerabilities can be addressed.
	23.1a Build on existing emergency management efforts.	n/a	n/a																		x						
	23.1b Estimate costs of mitigating the identified vulnerabilities.	n/a	n/a		$		L	x	x			x	x	x	x	x	x				x				Completion of cost estimate/analysis		
	23.1c Estimate capacity needs and costs for implementing preparation and adaptation strategies.	n/a	n/a																		x				Completion of needs assesment		
	23.1d Continue to monitor emerging data on climate change related health risks and revise adaption plans when necessary.	n/a	n/a		$															x					Records of plan revisions		
	23.2 Strengthen current hunger relief systems to handle increased short-term and long-term demand.	n/a	n/a	CC/FF	$$				x	x		x	x					x		x					Capacity, extent of network, and funding of local hunger relief systems.		Increases resilience to food shortages due to climate- or energy-related disruptions to food supply.
	23.2a Conduct analysis to project future demand for hunger relief services;– this could be conducted as part of the vulnerability assessment (above).	n/a	n/a	CC/FF	$		L																				
	23.2b If analysis (a) suggests need, develop plans to prepare for increased food demand from a higher percentage of the population.	n/a	n/a	CC/FF	$		x											(L)FFLC							Development of plan.		
	23.2c Identify and remove barriers to, and encourage, development of home-grown food sources such as backyard and community gardens, urban food orchards, etc. This action item is also identified in Food and Agriculture section.	n/a	n/a	CC/FF	$	$	x		x	L		x	x			x		x		x					Plans reviewed; revisions made		
	23.3 Increase financial assistance for low income populations to support energy efficiency retrofits so that low income populations can see reduced costs for utility service and avoid interruptions in utility service.	M	M	CC/FF	$$	$$$		L	x	x							x	x		x					Incentives or funding available; incentives or funding provided		Reduces exposure of low income populations to spikes in natural gas prices.
	23.3a Target rental properties/landlords.	n/a	n/a	FF	$$	$$																						
	23.4 Conduct a food security assessment, as outlined in the Food and Agriculture section, and take action to increase the security of the community's food supply.	n/a	n/a	CC/FF	$		x	x					x	x				L	OSU								

Health and Social Services

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	Objective 24: Reduce the exposure of human populations to climate related disasters.																										
	24.1 Reduce risk of home fires due to wildfires in and around the urban area.	n/a	n/a	CC	$	$$$	x	x		L	x	x	x							x							Reduces risk of structural fires when climate change produces increased risk of wildland fires.
	24.1a Increase efforts to educate homeowners about creating defensible space around their homes	n/a	n/a	CC	$		L	x	x	x	x	x	x	x	x	x			CERT	x					Dollars or other resources spent locally to educate homeowners about creating defensible space; numbers of residents reached.		
Health and Social Services	**24.2** Ensure no essential services are located within the 100 year flood zone.	n/a	n/a	CC	$	$$$	L	x	x				x			x	x		Hospitals	x					Number of essential service facilities removed from 100 year flood zone.		Helps maintain essential emergency, health, and social services during flooding events that are expected to increase with climate change.
	24.2a Identify essential emergency and non-emergency services	n/a	n/a	CC	$		L														x				Services identified	By 2012	
	24.2b Create a plan to move essential services out of the flood zone over time.	n/a	n/a	CC	$		L	x	x				x					x		x					Plan completion	Ongoing	
	Objective 25: Increase the capacity of Eugene's health and social services sectors, and the community at large, to meet the health-related challenges of climate change and peak oil by fostering greater public health involvement in climate change and energy planning.																										
	25.1 Educating the public and health professionals about the health risks posed by climate change.	n/a	n/a	CC	$		x		x	x	x	x	L	x	x	x		x	CLI	x							Increases community awareness of risks allowing residents to be better prepared.
	25.1a Prioritize local public health resources to emphasize educating the public, staff, and administration about climate change, energy price volatility and the related system impacts and health risks.	n/a	n/a	CC/FF	$		x					x	L			x			CLI	x							
	25.1b Pursue funding for development of a climate change preparation strategy for the public health system.	n/a	n/a	CC	$		x					x	L			x		x	CLI		x						Helps health systems to be better prepared for changes due to climate and rising fuel prices.

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APPENDIX 1: COMPILED PRIORITY ACTION ITEMS

	High Priority Action Areas	Relative GHG Reduction	Fossil Fuel Reduction	Adaptation Value*	Cost	Savings	Leader (L) / Partners (x): City of Eugene	Utilities	Business Sector	Residents	Neighborhoods	School Districts	Lane County	U of O	Lane CC	State of Oregon	Lane Transit Dist	Non-Profits	Other	Timing: Ongoing	2011	2012	2013	Future	Suggested Measures	Suggested Targets	Adaptation Explanation
	Urban Natural Resources																										
	Objective 26: Protect sensitive urban natural areas including riparian areas, wetlands, and floodplains for multiple benefits including improved water and air quality, reduced water and air temperatures, and reduced flooding.																										
	26.1 Increase funding for public acquisitions of property to facilitate the combined goals of stormwater management, flood abatement, stream shading, headwaters protection, and increased connectivity between wildlife corridors.	n/a	n/a	CC	$$-$$$		L	x				x	x	x	x	x		x		x					Dollars or other resources used to purchase land or otherwise protect water resources		Increases resilience of urban natural systems by reducing flooding, improving water quality, and increasing or improving wildlife habitat
	26.2 Update urban forestry management plans to promote urban forest management on a city-wide scale, expanding beyond individual lots or streets.	n/a	n/a	CC	$		L	x	x	x	x	x	x	x	x	x	x	x					x			Municipal urban forestry management plans updated and accomodating new elements.		Increases the resilience of urban trees by proactively planning for the more broadly defined urban forest.
	26.3 Identify and remove barriers that may discourage or prevent use of Low Impact Development (LID) practices during construction on public and private property.	L	n/a	CC	$		L	x					x			x					x					Barriers to LID identified and removed		Increases resilience of urban vegetation by protecting soils and protecting natural site hydrology. Reduces urban local flooding.
	Objective 27: Manage and update urban natural resource information to reflect current knowledge. Make data available to public and policy-makers.																										
	27.1 Compile and maintain an inventory of urban natural resources that is current and accessible to the public and policy-makers.	n/a	n/a	Y	$		L	x	x			x	x	x	x	x	x	x	LCOG						Completion of inventory and accessibility of information.		Provides tools for quicker response and informed decision making to increase adaptability of natural systems and resource management programs
	Objective 28: Update vegetation management plans to prepare for changes in climate.																										
	28.1 Plan for increased fires in forests surrounding the urban area.	n/a	n/a	CC	$	$$$	L	x	x	x	x	x	x					x							Vegetation management plans updated.		Reduces risks presented by forest fires - a risk expected to increase with climate change
	Objective 29: Educate community about the importance of urban natural resources.																										
	29.1 Provide educational resources to students, teachers, residents, and businesses about the benefits of trees, watershed health, and water quality.	n/a	n/a	CC	$		x	x				x						x		x					Dollars and other resources spent to provide educational resources to students, teachers, residents, and businesses.		Increases community value of natural resources that important to community resilience.

Urban Natural Resources

$ = $0 - $99,999 $$ = $100k - $999k $$$ = $1 million +

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APPENDIX 1: COMPILED PRIORITY ACTION ITEMS

	High Priority Action Areas	Relative GHG Reduction	Fossil Fuel Reduction	Adaptation Value*	Cost	Savings	Leader (L) / Partners (x): City of Eugene	Utilities	Business Sector	Residents	Neighborhoods	School Districts	Lane County	U of O	Lane CC	State of Oregon	Lane Transit Dist	Non-Profits	Other	Timing: Ongoing	2011	2012	2013	Future	Suggested Measures	Suggested Targets	Adaptation Explanation
	Objective 30: Manage rainfall (stormwater) to reduce flooding, recharge groundwater, and improve water quality.																										
	30.1 Manage stormwater and riparian areas to meet multiple goals: improved water quality, lowered stream temperatures, increased infiltration, increased capacity, and improved plant and wildlife habitat.	n/a	n/a	CC	$	$$-$$$	L	x	x	x	x	x	x	x	x	x	x	x	x	x					Water quality measures collected by Oregon Department of Environmental Quality and the City of Eugene.	Avoid degredation of water quality across the urban area.	Managing for this broad variety of objectives increases the resiliency of natural systems by cleaning stormwater, reducing local flooding, and improving wildlife habitat
	30.2 Develop a program to encourage onsite treatment of stormwater from existing buildings and facilities.	n/a	n/a	CC	$	$$	L		x	x	x	x		x	x					x	x				Complete when a program is established and operational resources are identified.	Develop and begin program by 2015.	Reduces peak stream flows and localized flooding -which are expected to increase with climate change
Urban Natural Resources	**Objective 31: Expand public and private programs to manage, and invest in, trees to cool buildings, pavement, and waterways.**																										
	31.1 Increase planting, preservation, and maintenance of trees and shrubs.	L	L	CC	$$		L	x	x	x	x	x		x	x	x		x		x					Dollars spent by municipalities and non-profits on tree preservation and maintenance. Number of trees planted annually by municipalities and non-profits.		New and existing trees cool the urban area (streets, waterways, buildings) - reducing urban summertime peak temperatures. Trees reduce local flooding during rain events by intercepting rainfall. Trees sequester carbon from the atmosphere.
	31.2 Control invasive species on public lands including City and County parks in order to maintain the health of existing urban area habitats.	L	L	CC	$$	$$	L	x	x	x	x	x		x	x	x		x		x					Dollars spent on invasive weed control; acres treated.		Existing trees cool the urban area (streets, waterways, buildings) - reducing urban summertime peak temperatures. Trees reduce local flooding during rain events by intercepting rainfall. Trees sequester carbon from the atmosphere.
	31.3 Create incentives to encourage residents and businesses to plant trees.	L	L	CC	$	$	x	x	x	x	x	x	x	x	x			L		x					Incentives to plant trees available to residents, businesses, and others	Identify and implement incentives by 2013	New trees cool the urban area (streets, waterways, buildings) - reducing urban summertime peak temperatures. Trees reduce local flooding during rain events by intercepting rainfall. Trees sequester carbon from the atmosphere.
	Objective 32: Encourage ongoing water conservation.																										
	32.1 Increase existing water conservation education and water quality initiatives as outlined in the Buildings and Energy section.	L	L	CC	$$	$$	x	L	x	x	x	x	x		x			x		x					See buildings and energy section		Reduces demand for fresh water, the availability of which is expected to decrease with climate change
	Objective 33: Strengthen protections of drinking water sources.																										
	33.1 Strengthen and expand water quality protections to protect surface water quality and prevent the contamination of shallow wells.	n/a	n/a	CC	$$	$$	x	L	x	x	x		x			x				x							Protects fresh water supply - the availability of which is expected to decrease with climate change

$ = $0 - $99,999 $$ = $100k - $999k $$$ = $1 million +

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Appendix 2

Eugene Climate and Energy Action Plan Glossary

Adaptation: An adjustment in natural or human systems to a new or changing environment. Adaptation to ***climate change*** refers to adjustments in response to actual or expected climatic stimuli or their effects, which lessens harm or exploits beneficial opportunities. Various types of adaptation include anticipatory and reactive, private and public, and autonomous and planned.

Albedo: The amount of solar ***radiation*** reflected by a surface or object. Snow-covered surfaces have a high albedo; the albedo of soils ranges from high to low; and vegetation- covered surfaces and oceans have a low albedo.

Architecture 2030: A non-profit, non-partisan and independent organization established in response to the ***global-warming*** crisis by architect Edward Mazria in 2002. The mission is to rapidly transform the US and global Building Sector from the major contributor of ***greenhouse gas*** emissions to a central part of the solution to the global-warming crisis. (Description from website: ***www.architecture2030.org***). Find more detail about Architecture 2030 and proposed targets in Appendix 11

Atmosphere: The gaseous envelope surrounding the Earth. The dry atmosphere consists almost entirely of nitrogen (78.1 percent volume mixing ratio) and oxygen (20.9 percent volume mixing ratio) together with a number of trace gases, such as argon (0.93 percent volume mixing ratio), helium, radiatively active ***greenhouse gases*** such as carbon dioxide (0.035 percent volume mixing ratio), and ozone.

Barrier: Any obstacle to reaching a potential that can be overcome by a policy, program, or measure.

Biofuel: A fuel produced from dry organic matter or from combustible oils produced by plants. Examples include alcohol from fermented sugar, black liquor from the paper manufacturing process, wood, and soybean oil.

Biomass: When referring to fuel, biomass is a plant-derived fuel from clean and untreated wood such as brush, stumps, lumber ends and trimmings, wood pallets, bark, wood chips or pellets, shavings, sawdust and slash, agricultural crops, biogas, or liquid ***biofuels***, but excludes materials derived in whole or part from construction and demolition debris.

Bioswale: A vegetated depression that can temporarily store ***stormwater***, reduce flooding, cleaning water, and encourage infiltration.

Bus Rapid Transit (BRT): A system that emulates the efficiencies and operations of light-rail at a fraction of the costs. Attributes of a BRT system:

Exclusive right-of-way—guarantees travel time, Signal priority—gives buses priority through intersections, Level boarding—makes boarding easier and quicker, Off-Board Fare Collection—negates fumbling with change and allows boarding at all doors, Less frequent stops—improves travel time, Improved stations—offers station amenities for passenger comfort, and Park & Ride connections – improves Vehicle Image (Source: Lane Transit District)

Capacity (energy): The maximum power capability of a system.

Carbon dioxide (CO2): The major heat-trapping gas whose atmospheric *concentration* is being increased by human activities. It also serves as the yardstick for all other *greenhouse gases*. The major source of CO2 emissions is fuel combustion, but they also result from clearing forests and burning *biomass*. Atmospheric concentrations of CO2 have been increasing at a rate of about 0.5 percent a year, and are now more than 30 percent above pre-industrial levels.

Carbon neutral (also climate neutral): When *greenhouse gas* emissions are net zero. A building is carbon neutral when it doesn't generate more *greenhouse gas* emissions than it sequesters. This can also be accomplished by "offsetting" *emissions* with "carbon credits."

Carbon sequestration: The uptake and storage of carbon. Trees and other plants, for example, absorb *CO2*, then release the oxygen while storing the carbon.

Carbon sinks: The processes or ecological systems that take in and store more carbon than they release. This process is called *carbon sequestration*. Forests and oceans are large carbon sinks.

Climate: The average state of the *atmosphere* including typical weather patterns for a particular region and time period (usually 30 years). Climate is the average, long-term weather pattern for a particular region, while weather describes the short-term state of the atmosphere. Climate measures average precipitation, temperature, wind, and seasonal phenomena such as length of the growing season.

Climate change: A significant change from one climatic condition to another, often used in reference to climate changes caused by the increase in heat-trapping gases since the end of the 19th century.

Climate feedback: An interaction mechanism between processes in the *climate system* that happens when an initial process triggers changes in a second process that in turn influences the initial one. A positive feedback intensifies the original process, and a negative feedback reduces it.

Climate neutral: See carbon neutral.

Climate refugees: People displaced from their homes or lands by significant changes in climate such as increased drought, sea level rise, or increased storm intensity.

Climate system: A complex system consisting of five major components: the *atmosphere*, the hydrosphere, the cryosphere, the land surface and the biosphere, and the interactions between them. The climate system evolves in time under the influence of its own internal dynamics and because of external forcings such as volcanic eruptions, solar variations, and human-induced forcings such as the changing composition of the *atmosphere* and *land-use change*.

Climate variability: Climate variability refers to changes in the average state and other aspects of the climate over space and time beyond that of individual weather events. Variability can be due to natural climate processes (internal variability), or natural or human-induced external changes (external variability). See also *climate change*.

Concentration: Amount of a chemical in a particular volume or weight of air, water, soil, or other medium. See also *PPM* (parts per million).

Cost-effective: A criterion that specifies that a technology or measure delivers a good or service at equal or lower cost than current practice, or the least-cost alternative for reaching a given target.

Community scale renewable energy: A renewable energy system, *photovoltaic* for example, installed at a large scale: for example, over the roof of a large commercial building. Often this will include multiple investors paying for a single, large installation that will benefit many homes or businesses.

District energy: In this system, steam, hot water or chilled water is produced in a central plant and distributed to multiple buildings in a defined area through underground pipes.

Earth Advantage: A third party, green building certification program for new homes, multi-family buildings, and neighborhoods. Pilot programs are also available for remodels and small commercial projects. Key areas addressed include *energy efficiency*, indoor air quality, environmental responsibility, and resource efficiency. For more information: *www.earthadvantage.com*

Ecosystem: Any natural unit of living and non-living parts that interact to produce a stable system through cyclic exchange of materials.

Embodied energy: The total expenditure of energy involved in the creation of a product. This includes the energy to extract raw materials (lumber, iron, etc.), process, package, transport, install, and recycle or dispose of products.

Emissions: The release of a substance (usually a gas when referring to the subject of climate change) into the ***atmosphere***.

Energy efficiency: Ratio of energy output of a conversion process or of a system to its energy input.

Energy intensity: Energy consumption per unit of output (e.g., food, materials, goods) or per measure of demand for services: (e.g., number of buildings, total floorspace, floorspace-hours, number of employees).

Energy Performance Score: A home energy rating system similar to the miles-per-gallon (MPG) rating for the auto industry that enables homebuyers to directly compare energy consumption between homes while offering a natural market incentive to upgrade their homes as much as possible.

Energy Trust of Oregon (ETO): A nonprofit organization that helps certain utility customers in the Pacific Northwest improve their *energy efficiency* and tap renewable sources. ETO was set up to administer public purpose funds that are collected from customers for new cost-effective conservation, new market transformation, and the above-market costs of new ***renewable energy*** resources. For more information: ***http://energytrust.org***

EWEB: Eugene Water and Electric Board—Eugene's largest utility.

EPA: The United States Environmental Protection Agency.

Exposure: The nature and degree to which a system is exposed to significant *climatic variations*.

Food insecurity: When people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development, and for an active and healthy life. It may be caused by the unavailability of food, insufficient purchasing power, inappropriate distribution, or inadequate use of food at the household level and can be chronic, seasonal, or transitory.

Foodshed: The area where food is grown, processed, delivered and consumed. A foodshed may be global or may be local—defined by a specific distance for example.

Fossil fuel: A general term for combustible geologic deposits of carbon in reduced (organic) form. Fossil fuels are of biological origin and include coal, oil, natural gas, oil shales and tar sands. A major concern is that they emit *CO2* when burned, significantly enhancing the ***greenhouse effect***.

Generation: The process of making electricity. The term may also refer to energy supply.

Global warming: An average increase in the temperature of the Earth's *atmosphere*, which can contribute to changes in global climate patterns. Global warming can occur from a variety of causes, both natural and human induced. In common usage, "global warming" often refers to the warming that can occur as a result of increased emissions of *greenhouse gases* from human activities. See *climate change*, *greenhouse effect*.

Greenhouse effect: The thermal effect that results from heat-trapping gases allowing incoming *solar radiation* to pass through the Earth's atmosphere, but preventing most of the outgoing infrared radiation from the surface and lower atmosphere from escaping into outer space.

Greenhouse gas (GHG): Commonly abbreviated GHG, a term used for gases that trap heat in the *atmosphere*. The principal greenhouse gases that enter the atmosphere as a result of human activity are *carbon dioxide*, *methane*, and *nitrous oxide*. Others include, but are not limited to, water vapor, chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), ozone (O3), hydrofluorocarbons (*HFC*s), perfluorocarbons (*PFCs*), and sulfur hexafluoride (SF6).

Greywater: Under Oregon law, greywater means *wastewater* from showers, baths, bathroom and kitchen sinks, and laundry. If handled properly, greywater can safely be reused for flushing toilets and urinals as well as for irrigation. Reuse of greywater reduces the demand on other sources of water, such as potable water, surface water, and groundwater.

HFC: Hydrofluorocarbon compounds: a human-made greenhouse gas generated by industrial processes.

IPCC: Intergovernmental Panel on Climate Change. Established in 1988, the IPCC assesses information in the scientific and technical literature related to all significant components of the issue of *climate change*. It draws on hundreds of the world's leading scientists to serve as authors, and thousands as reviewers. Key experts on *climate change* and the environmental, social and economic sciences from some 60 nations have helped the IPCC prepare periodic assessments of the scientific underpinnings of global *climate change* and its consequences. The IPCC is also looked to as the official advisory body to the world's governments on the state of the science of the climate change issue.

Implementation: The realization of an idea, or execution of a plan, by groups or individuals, public or private.

Infill compatibility standards: A City of Eugene planning effort with a stated goal to create and adopt land use code standards and processes that (a) Prevent residential infill that would significantly threaten or diminish the stability, quality, positive character, livability or natural resources of residential neighborhoods; and (b) Encourage residential infill that would enhance the stability, quality, positive character, livability or natural resources of residential neighborhoods; and (c) if the goal stated in (a) is met, allow for increased density, a variety of housing types, affordable housing, and mixed-use development; and (d) Improve the appearance of buildings and landscapes.

Integrated design: a collaborative and holistic approach to building through which multiple disciplines and aspects of design—including architecture, lighting and electrical, HVAC, interior design, and landscape design—are considered together in the planning of a new structure or renovation to achieve a cost-effective, resource-efficient, and comfortable result. (Source: BetterBricks and the National Institute of Building Sciences)

Invasive species: An introduced species that invades natural habitats.

KWh: Kilowatt-hour.

LCOG: Lane Council of Governments, a voluntary association of local governments in Lane County, Oregon. The agency is a regional planning, coordination, program-development, and service-delivery organization that helps area cities, Lane County, educational districts, and special-purpose districts reach their common goals.

LTD: Lane Transit District

Land use: Human-determined arrangements, activities, and inputs undertaken in a certain land type, the social and economic purposes for which land is managed (e.g., grazing, timber extraction, and conservation).

Land-use change: A change in the use or management of land by humans, which may lead to a change in land cover. Land cover and land-use change may have an impact on the ***albedo***, evapotranspiration, sources, and ***sinks*** of ***greenhouse gases***, or other properties of the ***climate system***, and may thus have an impact on climate, locally or globally.

Lifecycle (of goods): The complete life (of goods)—the mining or extraction of raw materials, the manufacturing processes, transportation, packaging, retail, the use of goods, and finally their disposal.

LEED: Leadership in Energy and Environmental Design, a program of the United States Green Building Council and a commonly used green building standard.

Methane (CH4): A hydrocarbon that is a heat-trapping gas carrying a *global warming* potential recently estimated at 24.5. Methane is produced through anaerobic (without oxygen) decomposition of waste in landfills, animal digestion, decomposition of animal wastes, production and distribution of natural gas and oil, coal production and incomplete combustion of fossil fuels.

Metric ton (Mt): Common measurement for the quantity of *greenhouse gas* emissions. A metric ton is equal to 2205 lbs or 1.1 short tons.

Mitigation: An intervention to reduce the sources or enhance the *sinks* of *greenhouse gases*.

Natural gas: A fossil fuel that occurs as underground deposits of gases consisting of 50 to 90 percent *methane* (CH4) and small amounts of heavier gaseous hydrocarbon compounds like propane (C3H8) and butane (C4H10).

Nitrous oxide (N2O): A powerful *greenhouse gas*. Major sources include soil cultivation—especially from use of commercial and organic fertilizers—fossil fuel combustion in vehicles, nitric acid production and the combustion of *biomass*.

Non-point-source pollution: Pollution from sources such as areas of crop production, timber, surface mining, disposal of refuse, and construction, which cannot be defined as discrete source points. See also *point-source pollution*.

NWN: Northwest Natural Gas.

Occupant behavior: The behavior of building occupants such as residents and employees. Relevant occupant behaviors include how occupants operate thermostats, open and close windows, and use water and electricity.

ODOT: Oregon Department of Transportation.

Oregon DEQ: Oregon Department of Environmental Quality.

Opportunity siting: A City of Eugene planning effort with the stated goals of 1) Creating a planning process for finding specific sites that can feasibly accommodate high-density residential development that is compatible with and has the support of nearby residents and 2) Facilitating development on those sites.

Pervious pavement: Pavement (asphalt or concrete) that is designed so that water can move through the pavement and infiltrate into the ground.

PFCs: Perfluorocarbons; a human-made *greenhouse gas* generated by industrial processes.

PPM: Parts per million.

Photovoltaic (PV): A solar power technology that converts sunlight into electricity.

Peak Oil: A term used to describe the transition from many decades in which the available supply of oil grew each year to a period in which the rate of oil production enters it terminal decline.

Point-source pollution: Pollution resulting from any confined, discrete source, such as a pipe, ditch, tunnel, well, container, concentrated animal-feeding operation, or floating craft. See also ***non-point-source pollution***.

Product stewardship: Calls on those in the product lifecycle—manufacturers, retailers, users, and disposers—to share responsibility for reducing the environmental impacts (definition from EPA website). Ideally, this would result in changes in design so that products create less waste, can be re-used or disassembled for easier recycling, or are otherwise redesigned.

Rain gardens: *Stormwater* management structures designed to slow runoff, clean water, and increase soil infiltration.

Radiation: Energy transfer in the form of electromagnetic waves or particles that release energy when absorbed by an object.

Renewable energy: Energy sources that are, within a short time frame relative to the Earth's natural cycles and sustainable. They include non-carbon technologies such as solar energy, hydropower, and ***carbon-neutral*** technologies such as ***biomass***.

Resilience: Amount of change a system can undergo without altering state.

Setbacks: Land use code that requires buildings or facilities to be a certain distance back from a roadway or other defined object. A building must be "set back" xx feet from the street, for example.

Sink: A natural or artificial reservoir like soil, a forest, a landfill, a wood structure or other ***biomass***-related product that stores carbon from the *atmosphere*.

Snowpack: A seasonal accumulation of slow-melting snow.

Solar radiation: *Radiation* emitted by the sun.

Source (greenhouse gas): Any process or activity that releases into the ***atmosphere*** a ***greenhouse gas***, an aerosol or a precursor to a *greenhouse gas*.

Stakeholder: A person or entity that would be affected by a particular action or policy.

Stormwater: Rain, snow, and other precipitation that falls onto buildings, streets, and the ground. Stormwater is managed within the stormwater system of downspouts, gutters, underground pipes, and streams.

Streamflow: Water within a river channel usually expressed in cubic meters per second.

Urban heat island: The increased temperatures experienced in urban areas due to dark-colored pavement, roofs, buildings, etc.

Vector: An organism, such as an insect, that transmits a pathogen from one host to another. See also ***vector-borne disease***s.

Vector-borne disease: Disease transmitted between hosts by a vector organism such as a mosquito or tick.

Vehicle-miles traveled (VMT): A measurement to determine the amount of automobile traffic—can also be used to calculate greenhouse gas emissions.

Vulnerability: The degree to which a system is susceptible to, or unable to cope with, adverse effects of ***climate variability*** and extremes.

Wastewater: Used water that contains dissolved or suspended waste materials.

Weather: Atmospheric condition at any given time or place measured in terms of wind, temperature, humidity, atmospheric pressure, cloudiness, and precipitation. In most places, weather can change from hour to hour, day to day, and season to season. Climate is usually defined as the "average weather."

Whole building design: See *Integrated design*.

Zero net energy: A net zero energy building annually produces as much energy through on-site renewable systems as it uses.

Appendix 3

Topic Specialist List

Building and Energy

Name	Representing	Organization
John Rowell	architecture	Rowell Brokaw Architects
Bill Welch	energy	EWEB
Rudy Berg	architecture	Common Practice Building Design
Mike Hatten	architecture	Solarc
Kip Much	natural gas	Northwest Natural Gas (*NWN*)
Dean Foor	renewable energy	Essential Consulting Oregon
Brian McCarthy	landscape architecture	CMGS Landscape Architects
Anne Delaney	architecture/affordable housing	Bergsund Delaney Architects
Mark Miksis	development	Arlie & Co.
Larry Banks	architecture	Pivot Architecture
Eric Nill	solar energy	Advanced Energy Systems
Marcus Kauffman	energy	Resource Innovations

Food and Agriculture

Name	Representing	Organization
Deb Johnson-Shelton	Food Policy Council	Lane County Food Policy Council
Megan Kemple	Farmers Coalitions	Willamette Farm and Food Coalition
Ross Penhallegon	Agricultural Extension Service	OSU Extension Service - Lane County
Jean-Paul Cunningham	Local Farmers Market	Lane County Farmer's Market
Karl Morgenstern	Drinking water/watershed protections	Eugene Water and Electric Board
Jan Spencer	Neighborhoods/Permaculture	River Road Neighborhood Snap Program
Sarah Cantril	Latino Support/Gardening advocacy	Heurto de la Familia
Will Shaver	Commercial food processing	Sustainability Commission/Grain Millers
Rick Wright/Michael Scott	Retail (Supermarkets)	Market of Choice
Mary Wood	Law	UO Environmental Law
Natalie Reitman-White	Food Wholesaler	Organically Grown Company
Kelly Hoell	Climate and energy consulting firm	Good Company
Sarah Mazze	Climate change research	Climate Leadership Initiative
Stephanie Page	State government agriculture dept.	Oregon Department of Agriculture

Land Use and Transportation

Name	Representing	Organization
Rob Zako	biking/walking	transportation consultant
Josh Skov	sustainability consultant	sustainability commissioner
Andrea Riner	Regional transportation planner	LCOG
Steve Nystrom	Land Use policy	City Land Use
Lisa Gardner	Land Use policy	City Land Use
David Roth	Transportation policy	City Transportation
Jon Lauch	Schools	4J school district (facilities)
Heidi Beierly	Citizen planning commission	Planning Commissioner
Tom Schwetz	Transit Lane	Transit District
shane rhodes	bike ped	Safe Routes to School/ 4J
Kevin Matthews	environmental group	Friends of Eugene
Ian Hill	biofuel/transportation	Sequential Biofuels
Rusty Rexius	Business/local trucking	Rexius Sustainable Solutions
Sally Markos	air quality	Lane Regional Air Protections Agenecy -LRAPA

Consumption and Waste

Name	Representing	Organization
David Allaway	State of Oregon	Government Oregon Dept. of Environmental Quality
Sarah Grimm	County Waste Management/Recycling	Lane County Solid Waste Management
Julie Daniel	Local Reuse Non-Profit	Bring Recycling
Ethan Nelson	City of Eugene	Solid Waste Program City of Eugene
Rick Wichmann	Largest City of Eugene licensed Hauler	Sanipac
Lorena Young	Regional expert on recycling markets	International Paper
Lorraine Kerwood	Recycling Industry	NextStep Recycling
Tom Bowerman	Durable consumption	The Green Store
Ian Hill	Biofuels	SeQuential Biofuels
Richie Weinman	Social Justice Issues	City of Eugene

Health and Social Services

Name	Representing	Organization
Karen Edmonds	Local Food Bank	FOOD for Lane County
Sally Markos	Air Quality Monitoring	Lane Regional Air Protection Agency (LRAPA)
Stacy Vynne	Climate Change Research	Climate Leadership Initiative
Laurie Trieger	Community Health Non-Profit	Lane Coalition for Healthy Active Youth
Phil Farrington	Health Care	Peace Health
Brian Johnson	Emergency Preparedness	Lane County Public Health
Richie Weinman	City Development	City of Eugene
Jennifer Jordan	Chronic Disease Prevention	Lane County Public Health
Al Levine	Mental Health	Lane County Health and Human Services
Juan Carlos Valle	Latino support	Centro Latino Americano/Police commission
Kari Lyons	Public Health	Portland/Metro Public Health
Donna Butera	School district	Bethel School District

Urban Natural Resources

Name	Representing	Organization
Pat Boylen	Wildlife Biology	Lane Community College
Trevor Taylor	Urban parks natural area mgmt.	City of Eugene Parks and Open Space
Amy Linder	Fire safety	Eugene Fire
Lori Hennings	Urban Natural Resources mgmt.	Metro (Portland) - natural resources
Billy Curtis	Stormwater management	City of Eugene Stormwater Management
Therese Walch	Stormwater management	City of Eugene Stormwater Management
Nancy Toth	Utility water management.	EWEB
Craig Smith	City Recreation Department	City of Eugene recreation
Erik Burke	Urban Forestry - non-profit	Eugene Tree Foundation
Larry Six	Watershed council - non-profit	McKenzie Watershed Council
Mark Snyder	Urban Forestry - local government	City of Eugene Urban Forestry
Scott Altenhoff	Urban Forestry - local government	City of Eugene Urban Forestry
Jason Stein	Urban Forestry - business Private	Urban Forestry Business
Kristin Ramstad	Community Assistance Forester	Oregon Dept. of Forestry
Nathaniel Sperry	Urban Forestry - business	Sperry Tree Care
Bill Hatton	Federal Land Management Agency	US Bureau of Land Mgmt

Appendix 4

City of Eugene Internal Climate Action Plan

City of Eugene

Internal Climate Action Plan for City Operations

Table of Contents

*Plan adopted as a framework; subject to additional edits. Plan may be modified pending implementation.

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Acknowledgements

Members of the Internal Climate Action Planning Team

- Matt Rodrigues, Phase 1 project manager, Civil Engineer, Public Works Engineering
- Lynne Eichner-Kelley, Phase 2 project manager, Sustainable Operations Analyst, Facility Management
- Felicity Fahy, Sustainability Manager (former), City Manager's Office
- Rich Fay, Aquatics Manager, Library Recreation and Cultural Services
- Jeff Narin, Logistics Manager, Fire
- Keith Nicolson, Fleet/Radio Technical Supervisor, Public Works Maintenance
- Sharon Olson, Technical Services Analyst, Wastewater
- Rick Siel, Advanced Professional, Police
- Ron Sutton, Operation and Maintenance Manager, Facility Management

Special Thanks to:

- Kandy Hanes, Fleet Services, Public Works Maintenance
- Denise Villanova, Fleet Services, Public Works Maintenance
- Lindsay Selser, Transportation Team, Public Works Engineering
- Gavin Carpenter, Sequential Biofuels

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CITY OF EUGENE – INTERNAL CLIMATE ACTION PLAN*

Executive Summary

Climate change poses present and growing risks to Eugene. These fundamental changes to the climate have the potential to impact all facets of life in our community. Action to reduce operational emissions will reduce the future impact on our community, our local economy and the natural beauty of Eugene.

Upon the recommendation of the City of Eugene Sustainability Commission, the City Council directed that all City-owned facilities and City operations be "carbon neutral". This Action Plan presents steps which can be taken to help reach that goal the course of the next 10 years and prepare the organization to seize opportunities. This plan is intended to be the first in a series of action plans as we continually adjust to the changing realities of economics, technology, government policies and our ecosystems.

The City of Eugene completed an inventory of operational greenhouse gas emissions (GHG) in January 2009 and found that there has already been a decrease in operational GHG emissions between 2000 and 2005. This plan builds on those early successes.

Figure 1 outlines projected emissions reductions from 2005 levels. Operational emissions are projected to reach pre-1990 levels, in keeping with the Kyoto Protocol just after 2016. Total forecasted reductions of the plan are 55% of 2005 emissions by 2020.

Percent Reduction from 2005 Emissions Scope 1 and 2 Operational Emissions		
	By Timeframe	Cumulative
before 2012	8%	8%
by 2012	12%	20%
by 2016	14%	34%
by 2020	21%	**55%**

Figure 1

Climate change is already affecting our lives in Eugene. In addition to reducing our emissions to prevent more dire consequences in the future, it is necessary to adapt to those changes that are happening now.

There is another concern with the use of fossil fuel—that of future supply. Fossil fuel extraction may be at or near its peak and could soon begin to slow, causing higher prices and economic disruption. Included in this plan are fossil fuel use reductions that could be expected to result from full implementation.

In order to form this plan, GHG reductions concepts were gathered from staff, departments and the ICAP (Internal Climate Action Plan) team. Estimates for ongoing savings (or costs) were calculated for 32 specific actions and prioritized into three timeframes; present to 2012, 2012 to 2016 and 2016 to 2020 based on availability of technology and funding. High level assumptions concerning the factors

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outside our control were incorporated into the prioritization of actions. These actions form the basis for this Internal Climate Action Plan.

The actions in the plan have been also categorized into three strategies; conservation, efficiency and renewables, to address different facets of emissions reduction. Underlying all three strategies is the need for comprehensive effort to shift the culture of the organization toward a common understanding of the issues, goals and strategies to achieve them.

The vast majority of the actions identified in this plan would be expected to return operational savings to the organization. The exceptions are some of those actions which depend on renewable energy. Several of the actions for the near-term (2012) of the plan are co-funded by EECBG, City CIP and utility incentives. It is recommended that the organization consider financing for later term efforts (2016 and 2020), if other options are not available. Financing could allow immediate emissions reductions and eventual cost savings which may not occur without the initial investment.

The purchase of GHG offsets will be needed to reach the final carbon neutral goal. The ICAP team determined that the purchase of offsets would be used only in the end-term (2020) of the Action Plan. The cost of offsets can be reduced by expanding our emissions reduction efforts.

Expected 2020 Emissions after Operational Emissions Reductions	Annual Cost from 2020 forward to offset remaining Emissions
4,005 metric tonnes CO2	$122,000

Successful implementation of the plan will require ongoing oversight. It is recommended that a staff member be assigned to coordinate overall progress on the Action Plan. Regular progress reviews are recommended in the form of updates to the inventory and review of progress on individual actions.

The community looks to municipal leadership to show commitment and demonstrate workable strategies in GHG emissions reduction. Without significant action, the well-being of our community, in economic, personal and ecological terms, are all at risk.

This Action Plan is the roadmap, an interactive and ongoing commitment to move toward the maximum possible emissions reductions, rather than a fixed set of instructions. Energy use and the resultant emissions are a part of almost every facet of modern life, and so changes will need to be made on every front. While there can be no guarantee that all of our assumptions will continue to hold true and thus any one specific action will come to pass, we can commit to pursuing continued and expanded emission reduction action.

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CITY OF EUGENE – INTERNAL CLIMATE ACTION PLAN*

Introduction

a. Climate Change and a Plan for Action

The Intergovernmental Panel on Climate Change (IPCC) was established in 1989 by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO). In 2007 the IPCC published a report pointing to human activities as the primary contributor to climate change. Climate change poses present and growing risks to Eugene and the world from increasingly extreme weather events, changing precipitation patterns, shifts in plant and animal populations and, especially here in the hydro-dependent Northwest, increasing energy prices. These fundamental changes have the potential to impact all facets of life in our community, but there are many options to mitigate their effects. Planning to adapt to the impacts of existing climate change effects can help reduce near-term consequences. Action to reduce our emissions will reduce the future impact on our community, our local economy and the natural beauty of Eugene.

Upon the recommendation of the City of Eugene Sustainability Commission, the City Council directed that all City-owned facilities and City operations be "carbon neutral" (i.e., 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.

This Action Plan presents steps which can be taken to help reach that goal. An inventory was completed in order to understand the source and quantity of our operational emissions and guide development of this plan. Based on the completed inventory, the Internal Climate Action Plan team worked over the course of eight months to gather, quantify and prioritize actions to reduce greenhouse gas emissions resulting from the daily operations of the City of Eugene.

This plan outlines actions suggested for implementation over the course of the next 10 years. These actions are prioritized into three timeframes: near-term, (present to 2012), mid-term (2012 to 2016) and far-term (2016 to 2020) based primarily on our assumptions about the availability of technology and funding. The interim emissions reductions goals for each timeframe are based on the expected emissions reductions for that set of actions and the best assumptions we can make about other factors that may affect our progress.

This plan is intended to guide continued climate action to reduce GHG emissions and fossil fuel use in our internal operations. It is also intended to help prepare the organization to seize opportunities, whether in funding or advancing technology, when they arise.

Since no plan can foresee all eventualities in a rapidly changing world, the recommended actions included are not set in stone. This plan is intended to be the first in a series of action plans as we continually update and adjust to the changing realities of economics, technology, government policies and our ecosystems.

This Internal Climate Action Plan outlines a set of workable strategies and demonstrates the commitment to climate action within city operations. Robust climate action at the operational level can

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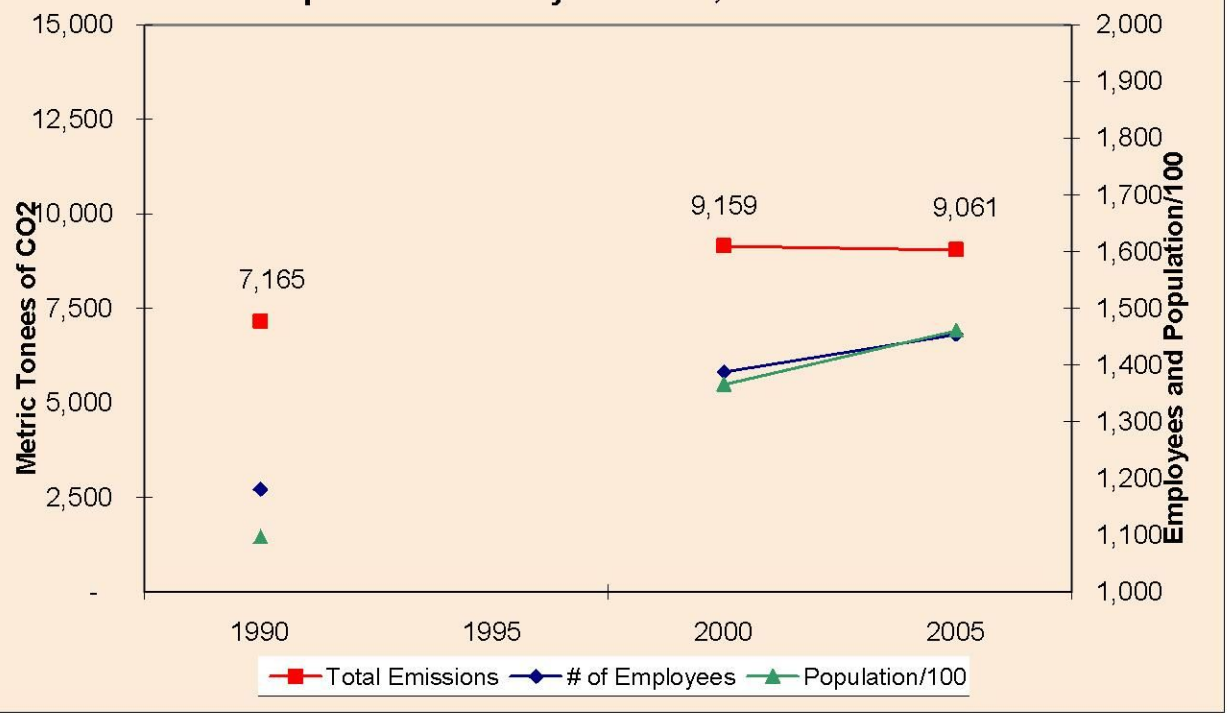
help the organization and the community, not simply cope with climate change but thrive in a changing world.

b. Summary of the 2005 Internal GHG Emissions Inventory

The City of Eugene completed an inventory of operational greenhouse gas emissions (GHG) in January 2009. The inventory gathered data for the years 2000 and 2005, and estimated emissions totals for 1990 (Figure 2).

The most striking finding of the analysis is that there has already been a decrease in operational GHG emissions[1] between 2000 and 2005. This comes after GHG emissions increased about one-third between 1990 and 2000. By 2005, City operations had successfully arrested and reversed growth of GHG emissions. This is significant due to the continued growth of City staff and services—that is, 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 the use of bio-based fuels. There are three methods that were used in the inventory to analyze the impacts of GHG emissions; activity sector, energy source and scope.

Figure 2: Total Reported Emissions, Employees and Population/100 for years 1990, 2000 & 2005



[1] *All GHG emissions in this plan are "equivalent CO2" units in metric tonnes. This plan will refer to them as simply CO2*

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The analysis addressed GHG emissions by activity sectors within City operations (Figure 3).[2] For both the 2000 and 2005 years, the activity sector with the largest emissions impact has been building use (51% of emissions in 2005, down from 52% in 2000). The City's vehicle fleet sector had 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.

GHG emissions can also be considered in terms of the underlying energy source (Figure 4). The energy source with the largest footprint in 2000 was gasoline used by the City's vehicle fleet, which amounted to 23% of reportable emissions, increasing slightly to 24% of emissions in 2005. However, the City's use of natural gas was the largest source of reportable GHG emissions in 2005, increasing to 28% of reportable emissions since 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.

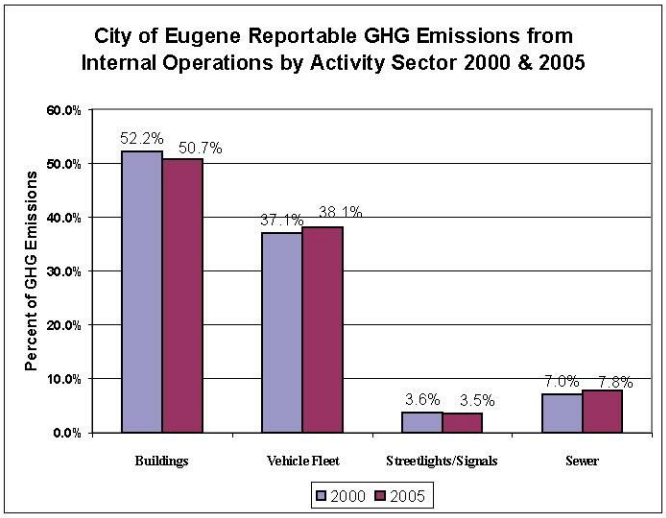

Figure 3

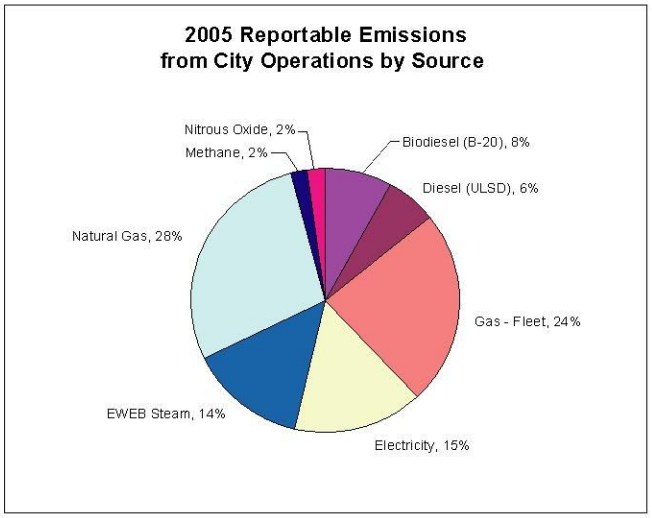

Figure 4

Diesel fuel, which was the fifth largest source of GHG emissions in 2000, was replaced by the use of ultra-low sulfur diesel and biodiesel 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.

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[2] *An error was discovered in the Internal GHG Emissions Inventory report during the summer of 2009. As a result of additional review during the development of the Internal Climate Action Plan, it was learned that the emissions figures in the report are incorrectly labeled as metric tonnes, when they have actually been calculated in short tons. Relationships between the fuel types, scopes, sectors, departments, etc are not affected by this error. However, those referring to the Inventory Report should be aware that the emissions figures in the body of that document are 9.1% higher than the correct figures due to the difference between metric tonnes and short tons. Figure xx shown above cites the corrected summary information which should be used for total emissions.*

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A third way to evaluate GHG emissions is by their "scope." According to the ICLEI-Local Governments for Sustainability, Local Government Operations Protocol,

- Scope 1 includes all *direct* GHG emissions from energy consumption, such as vehicle fuels and natural gas in buildings, excluding CO2 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, for instance employee commuting and GHG emissions embedded in materials and services purchased by the City.

The Council's adopted goal of carbon neutrality for City operations by 2020 focuses on Scope 1 and 2 emissions only. Scope 3 emissions are not currently included in the Council's goal, due to the lack of accepted protocol for quantifying these emissions. However, the inventory does include some preliminary estimates of GHG emissions from Scope 3 activities - including employee commuting, waste disposal and a portion of the City's purchasing activity. Scope 3 emissions appear to be much larger than Scope 1 and 2 emissions combined, if embedded emissions in goods and services purchased by the City are included.

The full Inventory Report can be accessed on the web at the following address:

http://www.eugene-or.gov/portal/server.pt/gateway/PTARGS_0_2_308202_0_0_18/City_Operations_GHG_Inventory.pdf

2. Adaptation to Climate Change

The focus of this Action Plan is mitigation of greenhouse gas emissions to avoid future climate impacts, yet climate change is already affecting our lives in Eugene. For example, EWEB has reduced predictions for their own hydroelectric generation based on reduced stream flow and local vineyards are finding that their vines are no longer as suitable for local growing conditions. Even if CO2 emissions were to stabilize immediately, high CO2 concentrations already in the atmosphere will persist for years. In addition to reducing our emissions to prevent more dire consequences in the future, then, it is necessary to adapt to those changes that are happening now.

In early March 2009 Resource Innovations, a sustainability-focused research organization at the University of Oregon, in collaboration with the US Forest Service and the National Center for Conservation Science & Policy, released a report titled *Preparing for Climate Change in the Upper Willamette River Basin of Western Oregon.* This report highlights the likely impacts of climate change on the Upper Willamette River Basin based on models used by the IPCC adjusted for local conditions. While no models can predict exactly how climatic conditions may change, these recent findings suggest the following potential impacts here in the Upper Willamette Basin:

- Increased annual average temperatures of 2 to 4° F and increased average summer temperatures of 4 to 6° F by around 2040;

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- Slightly less precipitation during spring, summer, and fall, and up to a 60% decrease in snowpack in the Pacific Northwest by 2040;
- Warmer ocean temperatures provide more moisture in the atmosphere that in turn can lead to more severe storm events and increased flooding;
- Changes in plant and wildlife communities as they adjust to new conditions. This could include pests and disease bearing species.

Some potential operational impacts of such changes might be:

- Increased energy and water costs
- Need to respond to more frequent and severe weather or fire emergencies
- Extended season for mowing and irrigation in the parks
- Increased damage to buildings due to high heat, flooding or increased incidence of pest insect species.
- Increased damage to streets due to high heat or flooding
- A need to provide shelter during heat emergencies or more frequent flooding
- Potential need to modify recreational activities (e.g. outdoor concerts during heat emergencies)
- Impacts on natural areas maintained by the City
- Building cooling systems no longer adequate for increased temperatures
- A future influx of "climate refugees" from areas more hard-hit by climate change.

The Sustainability Board will be addressing the issue of adaptation and the organizational impact of climate change that is already underway. The next step of the group will be to formulate recommendations for the organization.

Reduction Goals

a. Operational Emissions Reduction Goals—Scope 1 and 2

The emissions reduction goal presented here comprises the broad range of greenhouse gas reduction actions currently available to us and those anticipated to become available within the timeframe of the Action Plan. Actions included in the plan encompass all scope 1 and 2 sectors, strategies and energy

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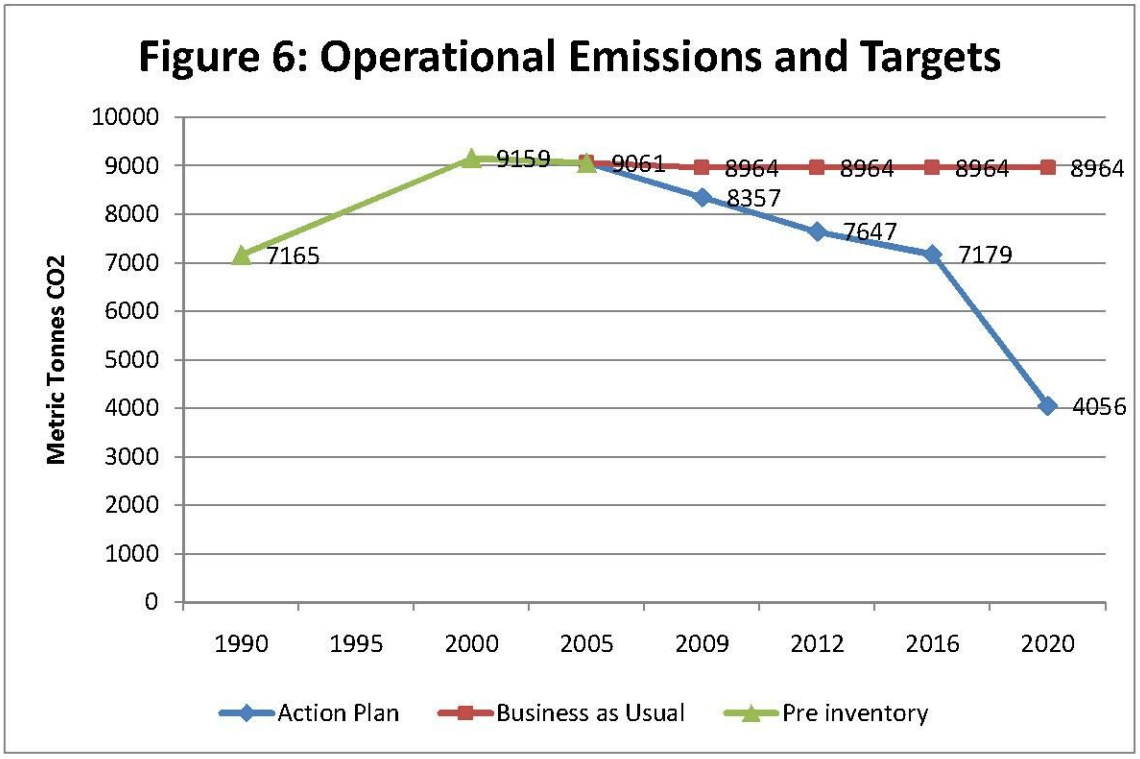
types. These actions taken together form a path to reduce emissions across the organization over the course the Action Plan.

Figure 5: Percent Reduction from 2005 Emissions
Scope 1 and 2 Operational Emissions

	By Timeframe	Cumulative
before 2012	8%	8%
by 2012	12%	20%
by 2016	14%	34%
by 2020	21%	**55%**

Figure 5 outlines projected emissions reductions from 2005 levels. Actions which have been put in place since 2005 have been accounted for in the "before 2012" timeframe. It should be noted that cumulative reductions expected by 2016 are projected to meet estimated 1990 levels of operational emissions. Operational emissions are projected to reach pre-1990 levels, in keeping with the Kyoto Protocol, early in the final timeframe. Total forecasted reductions of the plan are 55% of 2005 emissions by 2020 (Figure 6).



This goal represents

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the maximum potential for operational GHG reduction given the assumptions we have made and the best information available to date.

Figure 7 outlines some of the operational goals for other municipalities compared with the City of Eugene's goal. Though some care should be taken in making direct comparisons due to differing baselines or measurement protocols, it is clear that the goal of this action plan compares with those of regional leaders in climate action.

City	Operational Goal	Timeframe
Portland/ Multnomah County	50% of 1990 levels	2030
Bellingham	70% of 2000 levels	2020
Eugene	55% of 2005 levels	2020
Eugene—Final Goal with offsets	Net Zero Emissions	2020

Figure 7

Fossil Fuel Use Reduction

This plan is focused on operational reduction in GHG and fossil fuel is the primary contributor to the city's emissions. Yet there is another concern with the use of fossil fuel—that of future supply. It is estimated that fossil fuel extraction is at or near its peak and may soon begin to slow, causing higher prices and economic disruption.

Figure 8: Projected Fossil Fuel Use Reduction

Fuel type/units	Percent reduction
Unleaded/E10-gallons	90%
B20-gallons	28%
Natural Gas-therms	28%
EWEB Steam-klbs	60%
Total Fossil energy use reduction (MMbtu)	41%

Figure 8 shows the goals for reduction in fossil fuel that could be expected if the current plan can be fully implemented of this plan. Since different types of energy are measured with different units the impacts as percentages of their native units and then as a combined percentage of common unit of Btu's (British Thermal Units). It should be noted that the very small percentage of EWEB electricity that is derived from fossil fuel was not included in the figures below.

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Implementation Plan—2009 to 2020

b. Overview

i. Methodology

In September 2008, a staff team was assembled to formulate a plan to guide GHG reduction work within the City organization. Over the following eight months, the team solicited input on ways to reduce emissions and fossil fuel use from all City departments through departmental meetings and through a *Think Tank* intranet discussion. Over a hundred ideas, concepts and suggestions for action were received.

Beginning in May 2009, the ideas were refined and combined into larger concepts. Over the next four months the estimated GHG reductions and financial impacts were calculated for 32 specific actions using information and assumptions compiled with the help of staff around the organization. (See Action Plan charts for detail of calculation assumptions). These actions were prioritized first by timeframe based on availability of technology and funding, then by GHG reduction potential, strategy and cost to form the basis for this Internal Climate Action Plan.

ii. Assumptions and Uncertainty

The Internal Climate Action Plan team established guidelines concerning the factors outside our control that may influence our ability to make progress toward our goal. Both funding and timing for measures may be affected by these factors, and a process has been established to re-evaluate actions should these underlying assumptions change. The following are high level assumptions incorporated into the priorities:

- Energy cost increases would remain moderate for several years, due to economic conditions, and then return to a more volatile state with the trend being a higher inflation rate than the general economy.
- Federal funding for efficiency, conservation and GHG reduction, whether through the stimulus effort or other mechanisms, would continue at higher levels than in the recent past for 3-4 years, with moderate decreases. The City would continue to pursue all forms of funding at a higher level than in the recent past.
- Advances in technology in electric vehicles, particularly plug-in hybrids, would be available for our use within 2-3 years. These are likely to be adopted relatively slowly at first due to capital costs.
- Other technological advances, in areas such as renewable vehicle fuels, photovoltaic manufacturing or food waste recycling are likely within the decade covered by the plan. The group agreed that, given the aggressive nature of the Council goal, technological advances of a large magnitude will be required within 5-7 years.

iii. Operational Emissions Reductions by Timeframe-Scope 1 and 2

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Timeframes in this report are represented by the year in which the Action is fully implemented and actively reducing emissions.

iv. Actions taken Prior to 2005

The City of Eugene has been actively taking steps to reduce energy use, cost and emissions for nearly two decades. There are two categories of such "historical" actions outlined below.

Actions implemented between 1990 and 2000, the baseline for the internal inventory, are shown in figure 9 below. Though that period shows growth in emissions, the impact of these efforts should not be underestimated. These are the projects and programs that helped to slow the growth in our operational emissions and set the stage for the decreases that occurred between 2000 and 2005. It's important that these projects and programs be kept in place as we pursue greater reductions in emissions.

• Installed LED traffic lights to replace incandescent
• Installed LED lighting for Airport taxiway
• Installed energy-efficient high pressure sodium street lighting
• Generated electricity from methane recovery at wastewater treatment plant
• Implemented an energy tracking and management program
• Conducted energy audits of all major municipal facilities
• Installed energy-efficient exit sign lighting
• Performed energy-efficient lighting retrofits
• Program to swap out space heaters and incandescent desk lamps
• Installed ***Energy Star*** roofing when roof needs replacement
• Installed energy-efficient vending machines

Figure 9

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Figure 10 Action	Action in place
Whole building energy efficiency projects	2000
Use of biodiesel (B20) in City fleet	2003
Fleet advice to insure appropriate vehicle for needs.	2004
Reduce travel for sweepers by providing closer drops for material	2004

The actions outlined in figure 10 were responsible for reductions below 2005 emissions levels. This stabilization, and then decrease, of operational emissions is an excellent result for which many municipalities will continue to strive, but the City of Eugene has already achieved.

2005-2009: Actions underway during Action Plan process

Figure 11	Action in place	GHG Reduction	Percent of Total
Use of E10	2006	241	2.66%
Additional Hybrid vehicles	2005	34	0.38%
Current purchase GreenPower--6% of total City use	2007	100	1.10%
Suspend take-home vehicles for Police command staff	2009	19	0.21%
Implement no-idling policy	2009	155	1.71%
POS Fuel Conservation Program	2009	15	0.17%
Effects of Building Efficiency Admin Order	2009	100	1.10%
Reconfigure Library lighting and HVAC controls	2009	40	0.44%
	Total	704	7.77%

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The Internal Greenhouse Gas Inventory was completed in 2005. Actions that have been put in place since that time are not reflected in the 2005 emissions figures, the starting point for our emissions reduction goal. The actions outlined in figure 11 have enabled emissions reductions from 2005 levels and are considered part of the plan. Assuming that these actions, and those put in place before 2000, remain in place, a new inventory conducted today would be expected to show a nearly 8% reduction in city operational emissions since 2005.

Action Plan for 2012

The near-term of the Action Plan includes measures recommended for implementation by 2012. Measures are prioritized for this timeframe due to the relative ease of completion within less than three years.

Four of these actions are underway, or soon will be. The High Efficiency Gas Conversion and Upgrade Small HVAC actions are included in a formal agreement to fund under the Energy Efficiency and Conservation Block Grant. Actions Fine Tune Pool Schedules and Upgrade Remaining Inefficient Lighting fall under the existing Energy Management program and will be folded into that work plan over the timeframe.

However, staff time and some level of funding will need to be identified for the remaining four actions identified in the near-term plan; City Operations Transportation Policy, Expanded Purchase of GreenPower, Fitness Equipment Generates Power, Expanded Energy Education.

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CITY OF EUGENE – INTERNAL CLIMATE ACTION PLAN*

Action Plan for 2012						
	GHG Reduction				Funded	Source
ActionTitle/ *Description*	Metric Tonnes	Percent of Total	Initial cost	Ongoing Savings	*Calculation Assumptions*	
High efficiency gas conversion for 4 steam heated buildings	786	8.67%	$$$$	Yes	Yes	EECBG/CIP/Incentives
The Hult Center, Parcade, Overpark and Atrium buildings must be converted to an alternate heat source from steam. High efficiency gas is a cost-effective choice that gives us significant savings in energy use and cost and emissions.				*Figures are from the Systems West analysis*		
Expanded purchase of GreenPower--additional 6%	100	1.10%	$	No	No	not identified
An additional purchase of Greenpower would be a quick way to gain emissions reductions and would support the continued improvement of EWEB's power resources				*Current city purchase of 2,277,600 Kwh multiplied by EWEB specific CO2 Coefficient*		
Upgrade Small HVAC units	97	1.07%	$$$	Yes	Yes	EECBG/CIP/Incentives
Efficiency upgrades have not yet been focused on smaller buildings. This action will survey all the small HVAC units and determine whether to replace, upgrade or simply tune them up.				*Figures are from the EECBG analysis, based on per ft2 cost and savings averages for HVAC retrofits per EWEB energy management*		
Fine-tune Pools' schedules to better match needs with temperatures	76	0.84%	$	Yes	Yes	staff time as part of Energy Management Program
Pool patrons have varied needs and prefer different water temperatures. This action looks at allowing water temperature to drift downward and scheduling activities accordingly.				*Based on a 5% savings from allowing temps to drift and scheduling classes to take advantage of lower temps*		
City Operations Transportation Policy--alt modes-bike, bus, train, walk, add'l time, carpool, telemeetings, route planning, shuttle use.	24	0.26%	$	Yes	No	staff time--not identified
Many suggestions were received about reducing emissions from on-the-job transportation. This action proposes wrapping them into a comprehensive policy around workplace transport.				*Discussion with PWE staff yielded conservative estimate of 5% reduction in fuel use in the City's passenger fleet. This was converted to CO2 based on emissions from E10*		
Audit and upgrade remaining inefficient lighting in City facilities	19	0.21%	$$	Yes	No	Staff time, CIP/Incentives
Much work has been done to upgrade lighting in City buildings, but there are still some opportunities to explore.				*Assumes that percent of lighting electrical use by most City Dpts is 25% This is a conservative estimate based on 3 energy analyses of City bldgs and a PGE study. Percent applied to total electrical use in buildings. Assumed 10% of lighting energy savings may be available, even after most areas have been upgraded to T8.*		
Hook up fitness equipment to generate electricity			$	Min	No	not identified
This action can make energy and conservation issues tangible to City staff. Ongoing education is important to support overall efforts.				*Direct savings are minimal . No calculations done*		
Expand education component of Energy Management Program			$	Yes	No	staff time Energy Management Program--not allocated
Many actions revolve around energy savings in buildings. Feedback and general education, as well as training on specific changes to system will need to increase as actions begin to change the culture of the organization.				*No calculations done*		
TOTAL	**1102**	**12.16%**				
$ < $50,000 $$-$50,000 to $100,000 $$$ $100,000 to 400,000 $$$$ > $400,000						

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Action Plan for 2016

The period between 2012 and 2016 is the mid-term of this Action Plan. Actions in this timeframe are considered more difficult to accomplish than those of the previous term, due to infrastructure, funding or technology issues. These actions are presented as doable given current information and are generally extensions of existing efforts. They are the preferred direction of the workgroups that would be responsible for implementation. However, these are not presented as confirmed or funded projects. Ongoing work remains in completing a full-scale cost/benefit analysis, identifying resources and overcoming existing challenges in order to bring these ideas to fruition. Inclusion of an action in this timeframe signifies that workgroups have committed to pursuing these objectives.

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CITY OF EUGENE – INTERNAL CLIMATE ACTION PLAN*

Action Plan for 2016						
	GHG Reduction		Initial	Ongoing	Funded	Potential Source
Action Title/Description	Metric Tonnes	Percent of Total	Cost	Savings	Calculation Assumptions	
Conversion 50% of gasoline sedan vehicles to E85	595	6.57%	$$$	Yes	No	Grants, BETC, Fleet Fund
The City has a significant number of flexfuel vehicles in the fleet, and E85 is readily available. This action would continue the expansion of biofuels use, but requires an additional storage tank during the transition.				*Usage of E10 in 2008 was assumed to be replaced by E85. Adjusted to account for lower BTU/gal of E85.*		
Convert City non-emergency diesel fleet from B20 to B50	179	1.98%	$$$	No	No	Grants, BETC, Fleet Fund
Biofuels in place of fossil fuel can significantly reduce emissions. Many of the diesels in the City fleet can use higher bio-blends seasonally. The issue is the storage of multiple fuels and higher price of biodiesel.				*2008 fuel use for non-EMS and police diesel vehicles times CO2 per gal, adjusted for BTU difference. Assumes B50 would cost 10% more than B20 and that B20 avg cost for 2008 is $3.11*		
Study and upgrade indoor pool heating and ventilation equipment	260	2.87%	$$$	Yes	No	Grants, BETC, CIP, Incentives, Loans
Pools use a lot of energy in the form of natural gas and thus have a lot of opportunity for efficiency and emissions reduction. This action proposes to upgrade, if determined to be cost-effective, to a radiant heat system and recommission the ventilation controls.				*Based on end-use from analysis done prior to upgrades in 2000. Assumed 10-20% pool water heat energy savings, 20% savings in space heat energy from radiant heat and retrocommissioning controls, 30% savings on domestic hot water energy from adding solar, 10% reduction in energy use by motors.*		
Replace police patrol vehicles with a more efficient choice**	210	2.32%	$$$?	Yes	No	Grants, BETC, Fleet Fund
The current model of police patrol vehicle used by the City will no longer be manufactured as of 2012. This action is based on choosing a more efficient vehicle when replacement is needed.				*Assumption is that replacement vehicle will use 50% less fuel than the Crown Victoria. Current average is 9.2 mpg, assumption implies 18.4 mpg on avg.*		
Purchase plug-in hybrid or all electric vehicles to replace sedan fleet	50	0.55%	$$$	Yes	No	Grants, BETC, Fleet Fund
Supplementing or replacing fossil fuel with electricity in vehicles greatly reduces emissions. This action assumes that a suitable vehicle will be available when sedans over 12 years old need replacement.				*Assumes that any sedans 12 yrs or older will be gradually replaced with plug-in or electric vehicles. 2008 use of E10 for these vehicles was reduced 75%*		
Solar Domestic or Tankless Water Heating at multiple Fire Stations	17	0.19%	$$$	Yes	No	EECBG or other grants/CIP/Incentives
Hot water use at Fire Station is high due to the need to shower after calls. Several stations have solar hot water, and this action would add them at all stations where solar access exists. Stations not suitable for solar, would upgrade to a more efficient tankless heater.						
Use laptops instead of desktop computers where needed, complete change from CRT to LCD monitors**	4	0.04%	SOP	Yes	No	Gradual replacement already funded
Just over 100 CRT monitors are still in use. This action looks at the results from the gradual replacment of these units, and from the use of a laptop in place of a desktop in cases where mobility is needed.				*Assumes 75% of Exempts would have a business need for laptop. Existing CPU's 190 avg watts vs laptops at 95 watts. Avg CRTuses 80 Watt, LCD is 35 watts for common sizes. Assumes 9hrs/day, 48 weeks per year times the number of CRT's still in use.*		
Solar Domestic Water Heating at Police and PW	2	0.02%	$	Yes	No	EECBG or other grants/CIP/Incentives
Police and the crew rooms at Public Works Maintenance were found to have a high number of daily showers. This is a good opportunity to directly replace energy use with renewables.				# of showers per day from Dept contacts. Assumed solar could provide 60% of hot water annually. Assumed $17,000 average design and installation cost, before utility incentives		
TOTAL	1317	14.53%				
$ < $50,000 $$-$50,000 to $100,000 $$$ $100,000 to 400,000 $$$$ > $400,000						
**Emissions reductions are not the primary focus of this action, but present an opportunity for a more efficient choice. Costs represented are the additional cost for a more efficient choice.						

*Plan ad

Action Plan for 2020

The end-term of this Action Plan runs from 2016 to 2020. Efforts included in this final phase of the Action Plan are primarily those that have significant challenges, but are deemed possible with expected improvements in technology or initial cost. The specific action Retro Commissioning for Major Facilities is intended to be a long term effort beginning in 2012 and finishing by 2020.

Like the mid-term of the Plan, actions included continue or expand efforts that have been undertaken in the past. Workgroups have committed to including these concepts in their decision-making and to positioning themselves for future implementation. Changes in conditions affecting the implementation of these actions are difficult to predict. It's recommended that these factors be monitored on an ongoing basis in order to adjust the plan, or implement an action as soon as it is feasible.

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CITY OF EUGENE – INTERNAL CLIMATE ACTION PLAN*

Action Plan for 2020						
	GHG Reduction				Funded	Potential Source
Action Title/ *Description*	Metric Tonnes	Percent of Total	Initial Cost	Ongoing Savings	*Calculation Assumptions*	
Conversion of remaining 50% of gasoline sedan vehicles to E85	595	6.57%	$$	Yes	n/a	n/a
This is a continuation of the related action from 2016 timeframe--see previous chart for more detail						
Ongoing retro-commissioning for Major City facilities	395	4.36%	$$$	Yes	No	CIP+Incentives
Retro-commissioning is an in-depth tune up of building mechanical systems to insure that they are functioning as efficiently as possible. Two larger buildings would be tuned up each year to reach all of them by 2020.				*Occupied buildings over 10,000ft2 were studied. Per Ft2 Cost and energy savings ranges were used from "Retro Commissioning Fact Sheet" CA Dpt of General Services. Buildings were classifed as "high", "med" or "low" within the two ranges depending on complexity and history of upgrades. Amount of energy and GHG savings per $ of energy cost savings estimated and applied for emissions savings estimates.*		
Install additional generation capacity to utilize methane now being flared.	320	3.53%	$$$	Yes	No	CIP+Incentives,SELP or CREB financing
Though all methane is flared to prevent escape into the atmosphere, not all of it currently produces electricity. This actions would expand generating capacity to use all available methane to produce power.				*Assumes that 15% additional generation can be added*		
Upgrade Street Lighting Technology to next generation--induction or LED	230	2.54%	$$$$	Yes	No	CIP+Incentives,SELP or CREB financing
Lighting technology is advancing rapidly and may soon offer cost-effective choices that improve levels of efficiency and lower maintenance costs. At that point this action would begin to retrofit a portion of the system each year.				*Assumes that 10% of the system would be retrofit each year beginning in 2016 with a source that has efficiency 15% better than existing. This is cumulative annual savings as of 2020, when system is 50% retrofitted..*		
Install photovoltaic (PV) solar cells on City buildings	160	1.77%	$$$$	Yes	No	CIP+Incentives,SELP or CREB financing
The price of solar cells is projected to drop over the next few years. When the cost of systems comes within range, we will be poised to install on City buildings.				*Bldgs not included <1000 ft2, historic structures, in shade, w/o power, bldgs, fire training structures, parking garages. Buildings in the downtown network included with the assumption that EWEB will overcome technical issues. Total roof area was reduced by 30% to account for other uses of roof, 30% again for potential shading. Remaining area multiplied by 1100 KWH per ft2 to get power potential. Cost of $8.00 pr ft2 installed were used. EWEB and ODOE BETC pass-through was applied for final cost.*		
Replace inefficient unit heaters with gas radiant heat	151	1.67%	$$$	Yes	No	CIP+Incentives,SELP or CREB financing
Radiant heat is up to 30% more efficient than heating and circulating air. Replacing the existing heaters will help reduce our largest single fossil fuel use--natural gas.				*From EECBG analysis. Cost, incentive and percent efficiency improvement from case study of Tualatin Fire Station*		
Replace lift trucks with hybrid version**	31	0.34%	$$$	Yes	No	CIP+Incentives,SELP or CREB financing
Nine lift trucks would gradually be replaced by hybrid versions as they needed replacement.				*Assumes B20 @$3.11 per gallon. Hybrid would be 40% more efficient than existing.*		
Facility booking program tied to HVAC Control			$	Yes	No	CIP+Incentives,SELP or CREB financing
This action would allow users to both reserve a meeting room and schedule the heating and cooling. Rooms could be left at unoccupied temperatures when not in use.				*no calculations done*		
TOTAL	**1882**	**20.77%**				
$ < $50,000 $$-$50,000 to $100,000 $$$ $100,000 to 400,000 $$$$ > $400,000						
**Emissions reductions are not the primary focus of this action, but present an opportunity for a more efficient choice. Costs represented are the additional cost for a more efficient choice.						

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Scope 3 and other Concepts

Scope 3 emissions are defined as those indirect emissions that are not covered under scopes 1 and 2. More specifically, scope 3 emissions are upstream impacts of purchased goods, materials and services, or transport in non-city owned vehicles (such as employee commute or business travel). Emissions in this category are not included in the Net-Zero Council Goal and thus are not a focus in this Action Plan. However, there are several efforts underway in the organization that address scope 3 issues.

- A study is currently in progress that will quantify all operational solid waste produced by the organization and formulate a plan to reduce this waste by 90%. A reduction of this magnitude will require significant changes in the organization's purchasing and recycling procedures. Such changes will have the additional benefit of reducing the GHG impact of the materials used by the organization.

- The City maintains an active employee commute reduction program as a participant in the regional "Commuter Solutions" program and provides staff with bus passes, an emergency ride home program and reduced parking rates for car pools. Staff commute choices are not under the operational control of the organization and thus are considered scope 3 relative to City operations. However, relative to the community's emissions the vehicle miles traveled (VMT) by City staff traveling to work are scope 1.

- Work is ongoing to reduce the nitrous oxide (NOx) released by the wastewater treatment plant (WWTP) NOx emissions that are known to be released to the air from WWTP have been included in the inventory. Other NOx released from the plant is water-borne. It is currently unclear if these emissions can eventually enter they atmosphere and impact climate change.

- Warm mix asphalt was used with good results in selected road construction projects during the 2009 construction season. Warm mix is made at a lower temperature than the traditional mix and thus reduces the amount of energy and emissions from asphalt production.

Other concepts

- A full-scale energy audit is underway at the Wastewater treatment plant. Once defined, the GHG emissions reductions from efficiency upgrades for the treatment process and the plant buildings can be included in the next update of the plan.

- Clean fuel specifications are being considered for capital road construction contracts. The use of bio-fuels by contractors hired by the City could reduce indirect emissions.

- An innovative idea has been put forward to study potential for installing piping under roads when major construction is undertaken. The piping could provide access to ground-source heating and cooling for nearby homes or businesses.

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Emissions Reductions by Strategy

Review of strategies

It's important to look at the plan in terms of not only the timeline, but in terms of the types of strategies which can be employed to reach our goal. The actions in the plan have been categorized into three strategies, each addressing a different facet of emissions reduction.

Implement Conservation: This strategy is based on specific changes in staff practices and procedures without any change in equipment. These types of actions can be accomplished initially with little or no cost and can be implemented relatively quickly. However, these types of actions are limited by existing technology and must be carefully implemented to avoid impact on staff productivity. Savings from these measures tend to decrease over time without centralized support from the organization in the form of policy, follow-up, training and feedback on their effectiveness. These types of strategies, combined with efforts to institutionalize the changes, are an excellent and cost-effective foundation for emissions reduction.

Efficient Technology: Upgrades to high efficiency equipment are the foundation of this plan. Replacement or retrofit of outdated equipment not only provides reliable emissions reduction and energy cost savings, but can improve reliability and comfort, and decrease maintenance cost. This strategy is maximized by combining efficiency improvements with conservation efforts. This can often help reduce the first cost by reducing overall equipment needs. Efficiency upgrades can be limited by availability and cost of equipment or existing conditions (for instance the orientation or structure of a building). They also must be balanced with the cost of maintenance and any issues around the maturity of the technology, since equipment that fails to function as intended will not achieve desired emissions reductions. Although not as dependent as conservation, these types of actions also require some support as there may be different expectations or operating procedures.

Renewable Energy: Renewable energy produces fewer greenhouse gas emissions and has less impact on the environment. This strategy uses alternative energy sources, such as bio-fuels, EWEB Greenpower or solar energy to meet operational needs. This strategy can provide rapid emissions reductions, often without significant initial investment. Connecting the use of renewable energy to conservation and efficiency efforts will amplify their effectiveness.

These three strategies present complementary approaches to meeting the challenge of emissions reduction. However, each type of action, and effective climate action in general, also requires comprehensive efforts to shift the culture of the organization. While action promoting culture change serves to support and "cement" the savings of other actions, and may be considered to be a part of those actions. The success of the overall plan will, to some extent, be dependent on the ability of the organization to internalize the concepts in the plan.

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Action Cost and Funding Recommendations

The majority of the actions identified in this plan are expected to return operational savings to the organization. At the time of this report, the only exceptions are some of those actions which depend on renewable energy. Of the broad range of actions put forward only the use of biodiesel and the purchase of Greenpower are not currently expected to provide savings. Additionally, the final step of purchasing offsets, to be considered at the end-term of this plan, would add operating cost. Other renewable energy actions, photovoltaic electrical generation in particular, are not currently cost-effective but were included in the end-term of the plan with the expectation that improved technology will soon reduce initial costs.

Considered on a purely economic basis, these actions make sense and potentially for reasons beyond ongoing savings. While not yet quantifiable beyond the cost benefits of reducing energy use, the investment in GHG reduction may buffer the organization against financial risk. It appears likely that the regulatory environment could shift toward a concrete and down-trending cap on emissions. Those entities producing emissions beyond the cap could incur financial consequences. Conversely, emissions levels below a cap may allow trading and reinvestment in GHG reduction. City staff will need to track these developments on federal, regional and state levels to determine potential impacts on the organization.

Several of the actions for the near-term (2012) of the plan are co-funded by EECBG, City Capital Improvement Projects(CIP) and utility incentives. It's not known if the EECBG funding will continue; however, several actions are outlined and studies will soon begin on several others in order to prepare for potential future EECBG funding opportunities.

In order to fund continuing progress toward GHG reduction and operational savings, it's recommended that the organization consider financing for mid-term efforts (2016). Those measures that are not eligible for EECBG funding or are beyond the capacity of the CIP to undertake, may qualify for low-cost financing through the Oregon Dept of Energy's SELP (Small-scale Energy Loan Program), CREBs (Clean Renewable Energy Bonds) or QECBs (Qualified Energy Conservation Bonds). Performance contracting may offer another avenue to explore. An agreement is crafted which sets a repayment schedule based on guaranteed energy savings from a specified efficiency upgrade project. Public agencies in Oregon have begun to use this mechanism.

The downside of financing initial investment is the impact of interest and the delay in realizing direct cost savings. However, if other options are not available to implement GHG reduction actions, financing allows immediate emissions reductions and eventual cost savings which may not have occurred at all.

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Use of emissions offsets to reach the Net-Zero Goal

According to the Climate Trust "A greenhouse gas (GHG) offset is generated by the reduction, avoidance, or sequestration of GHG emissions from a specific project. Offsets are so named because they counteract or offset greenhouse gases that would have been emitted into the atmosphere; they are a compensating equivalent for reductions made at a specific source of emissions." [3]

It is clear from the council goal that the purchase of offsets is to be considered a secondary strategy to be used only after all practicable operational reductions have been made. The ICAP team recommends that the purchase of offsets be used only in the end-term (2020) of the action plan when the full impacts of previous actions have been determined.

Cost for offsets are calculated based on the current price of Bonneville Environmental Foundation (BEF) offsets per metric tonne. BEF figures were used for this discussion because of the regional nature of their investment and third-party certification of offset quality.

Expected 2020 Emissions after Operational Emissions Reductions	Annual Cost from 2020 forward to offset remaining Emissions (present value)
4,005 metric tonnes CO2	$122,000

The cost of offsets can be reduced by expanding our emissions reduction efforts. We run the risk of committing financial resources to offsets that may not be needed to reach our goal if we begin those purchases before we have exhausted the potential of direct reductions.

Initial discussions have been held with the University of Oregon and EWEB concerning the feasibility of developing a local offset mechanism in order to benefit the local economy. Although there does not currently appear to be sufficient demand for a local offset, the concept should be revisited in the second or third timeframe of the plan.

Emissions offsets provide a method to quickly stimulate climate action, and the resulting economic activity. Use of offsets allows us to take the final step in achieving our Net-Zero goal within the timeframe of this action plan.

Plan Progress Review

It is recommended that a staff member be assigned to coordinate overall progress on the Internal Action Plan. Staff will be needed to:

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[3] Climate Trust: *About Offsets* at http://www.climatetrust.org/about_offsets.php

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- Insure that plan is being implemented and report on progress
- Update the inventory on a regular basis
- Review and update the plan regularly, and as needed to respond to changes in conditions

Regular progress reviews are recommended at varying intervals, shown below in figure 12. Additionally, conditions affecting the GHG reduction potential of actions, cost savings, cost and availability of technology, and availability of funding should be monitored. Changes in these areas can quickly make an action more or less feasible.

Figure 12: Recommended Progress Review

Activity	Frequency
Information update to designated plan coordinator for actions in progress	Quarterly
Execs approval of work plan strategies and costs	At plan implementation; annually, as part of budget process; and explicitly every four years
Progress reports to Sustainability Board Progress reports to Sustainability Commission and City Council	Annually, with updates to Execs and others as needed At plan implementation and at least every 4 years
Update to Inventory	Every 4 years, beginning in 2012
Update to Action Plan	Every 4 years, beginning in 2012 with addendums when needed to respond to conditions

Conclusion

The problem

The City of Eugene organization is faced with a momentous challenge in responding to the issue of climate change. The community looks to municipal leadership to show commitment and demonstrate workable strategies. Without significant action the economic, personal and ecological well-being of our community are all at risk.

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The solutions

This Action Plan is the roadmap, an interactive and ongoing commitment to move toward the maximum possible internal emissions reductions, rather than a fixed set of instructions. It is a set of tools that we understand and some guidelines for using them. As we work to extend many of our existing efforts, find ways to fund investment, prepare to take action when conditions change and inform and educate our staff, we must keep in mind that there is no single solution, no silver bullet. Energy use and the resultant emissions are a part of almost every facet of modern life, and so changes will need to be made on every front. There are a thousand solutions, a thousand silver BB's, if you will. Our task is to understand which way they need to go and corral them accordingly.

While there can be no guarantee that all of our assumptions will continue to hold true and thus any one specific action will come to pass, we can commit to pursuing continued and expanded emission reduction action. Keeping the goal in mind, with a blueprint and a set of tools will help us overcome obstacles and carry the commitment to climate action forward.

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Appendix A: Link to related documents

City of Eugene No-Idle Policy

http://www.eugene-or.gov/portal/server.pt/gateway/PTARGS_0_2_317789_0_0_18/noidling%20policy.pdf

Energy Conservation Administrative Order

http://www.eugene-or.gov/portal/server.pt/gateway/PTARGS_0_2_354232_0_0_18/Admin_Order_44-09-06.pdf

Appendix B

Staff Suggestions for Internal Climate Actions

Presented By	Suggestion	Source
Fire/EMS	Retrofit stations not suitable for solar with tankless water heaters.	Multiple building energy sources
Fire/EMS	Develop multiple City owned fueling locations to reduce VMT	Multiple vehicle fuel sources
LRCS: Library	Implement point of use photovoltaic solar cells to power street lighting, parking meters, irrigation equipment, etc.	Electricity
LRCS: Library	Capture heat generated by the library and use to heat other City buildings	Multiple building energy sources
LRCS: Library	For the Library Building can we draw cool air from the stairwells to help cool the building?	Natural Gas
LRCS: Library	Reduce packaging for shipment of purchased media and books	
LRCS: Recreation	Add more manual lighting controls at the library so large banks don't stay on	Electricity
LRCS: Recreation	Hook up fitness equipment to generate electricity at fitness centers similar to the Olympic Trials	Electricity
LRCS: Recreation	Implement facility booking program tied to automated public meeting room thermostats	Multiple building energy sources
LRCS: Recreation	Implement more zones in buildings to allow more efficient climate control	Multiple building energy sources
LRCS: Recreation	Give staff limited control over on-site climate adjustments to adjust automated thermostats that are too hot or cold	Multiple building energy sources
LRCS: Recreation	Move Sheldon Community Center to a separate thermostat than the pool area.	Natural Gas
LRCS: Recreation	Replace light switches with motion sensors	Electricity
PDD	Turn off second computer monitor when not in use	Electricity
PDD	Install photovoltaic (PV) solar cells on City buildings	Electricity
PDD	Reduce office space by efficiently locating staff	Multiple building energy

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		sources
PDD	Stop offering flexible spending accounts for parking to City staff	Multiple vehicle fuel sources
PDD	Add batteries to PDD inspector vehicles to reduce idle time during inspections	Gasoline
PDD	Promote/support use of alternate modes for City business	Gasoline
PDD	Implement tele/video conferencing for City training	Gasoline
PDD	Improve quality, quantity, and accessibility of City bikes	Gasoline
PDD	Implement downtown City vehicle pool	Gasoline
PDD	Licensing incentives for clean taxi fleets	Gasoline
PDD	Create system master planning for solid waste haulers	Multiple vehicle fuel sources
PDD	Education on leaf pick-up to encourage on-site use and less PWM pickup	B20
PDD	PIC electronic submission and review of development plans	
Police	Add extra batteries to patrol vehicles to power electronic equipment while stopped to reduce idling	Gasoline
Police	Purchase fuel more efficient patrol vehicles in 2011 when Crown Victoria is retired	Gasoline
PW: Engineering	Install ground source geothermal when reconstructing streets, become heating/cooling provider	Multiple building energy sources
PW: Engineering	Allow use of fleet bikes for personal use	Gasoline
PW: Engineering	Use of Warm Mix Asphalt for capitol construction contracts	
PW: Engineering	Implement clean fuels specification for capitol construction projects	
PW: Engineering	Create employee shuttle service (Business use) to reduce VMT	Gasoline
PW: Engineering	Carpooling requirements for out of City training	Gasoline
PW: Engineering	Count tree planting as internal offset credit	
PW: Engineering	Change to four day work week for in full or in part.	Multiple vehicle fuel sources
PW: Engineering	City Fleet Bicycles (Training in use, gear, adequate bikes)	Gasoline
PW: Engineering	Develop an internal employee transportation options/choice plan	Gasoline
PW: Engineering	Enhance City Meeting Invitation Procedures	Gasoline
PW: Engineering	Enhance Vehicle checkout system	Gasoline
PW: Engineering	Create a quarterly Transportation Options Newsletter distributed to all City Employees	Gasoline
PW: Engineering	Employee Transportation Coordinator (ETC) in each Division	Gasoline

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PW: Engineering	Expand City Participation in the Business Energy Tax Credit (BETC) program	Gasoline
PW: Engineering	Employee Transportation Fairs (Educate employees on alt-transportation options)	Gasoline
PW: Engineering	Incorporate education on alt-modes use for City business during new city employee orientation	Gasoline
PW: Engineering	Electronic bidding for Capital Projects	
PW: Engineering	Specify and design projects for minimal virgin material use and maximum recycling	
PW: Maintenance	Convert City diesel fleet to minimum B50	B20
PW: Maintenance	Conversion of sedan fleet to use E85	Gasoline
PW: Maintenance	Purchase electric vehicles to replace sedan fleet	Gasoline
PW: Maintenance	Purchase hybrid lift trucks for street light and traffic signal maintenance	B20
PW: Maintenance	Purchase hybrid TV trucks for Storm and wastewater investigation	B20
PW: Maintenance	Implement strict standards on right sizing of fleet vehicles	Multiple vehicle fuel sources
PW: Maintenance	Increase drop box locations for sweepers	B20
PW: Maintenance	Implement fuel delivery truck for fire vehicle support	B20
PW: Maintenance	Implement tele/video conferencing for City meetings	Gasoline
PW: Maintenance	Meeting locations determined by location of greatest number of participants	Gasoline
PW: Maintenance	Route planning for maintenance vehicles	Multiple vehicle fuel sources
PW: Maintenance	Purchase smaller more fuel efficient sweepers	B20
PW: Maintenance	Infiltration and inflow projects to reduced amount of WWTP wet weather flow	Multiple building energy sources
PW: Maintenance	Publish quarterly fuel usage and VMT report to divisions	Multiple vehicle fuel sources
PW: Parks/Open Space	Install separate meters for different divisions occupying the same building or complex	Multiple building energy sources
PW: Parks/Open Space	Count removal of buildings and other impervious area as a credit.	
PW: Parks/Open Space	For general funded vehicles need to have incentive back to division for choosing the economic vehicles in a class	Multiple vehicle fuel sources
PW: Parks/Open Space	For general funded vehicles need to have incentive back to division for fuel savings	Multiple vehicle fuel sources
PW: Parks/Open Space	Use small solar installations for vehicles needing to power equipment while turned off	Gasoline
PW: Parks/Open Space	Improve bus shelters near City offices	Multiple vehicle fuel sources
PW: Parks/Open Space	Schedule non-emergency maintenance responses geographically to reduce VMT	Gasoline

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PW: Parks/Open Space	Assign vehicles a job description use appropriate vehicles for task.	Gasoline
PW: Parks/Open Space	Change the budgeting system to reward conservation.	
PW: Parks/Open Space	Utilize bike trailers for maintenance activities when possible	Multiple vehicle fuel sources
PW: Parks/Open Space	Set reduction goal for fuel usage to 5% by the end of 2009	Multiple vehicle fuel sources
PW: Parks/Open Space	Hold competition between workgroups on reduction of GHGs	
Think Tank	Power source cost equalizer: reserve difference b/w Nat Gas & Electric - "Charge" ourselves elect. rate for cheaper natural gas, the reserve the difference for green retrofits	Multiple building energy sources
Think Tank	Adjust timers on lighting	Electricity
Think Tank	Reduce to 4-day work week	Multiple building energy sources
Think Tank	Reduce number of servers in data center	Electricity
Think Tank	Lower building temperature	Multiple building energy sources
Think Tank	Install clear panels on equipment sheds at PW yard	Multiple building energy sources
Think Tank	Install motion detection lights (in all break rooms, bathrooms, low-occupancy rooms in particular)	Electricity
Think Tank	Program City computers to use energy saving settings	Electricity
Think Tank	Provide an on-screen reminder to turn off monitor on shut-down	Electricity
Think Tank	Unplug equipment when not in use - When printers off, it may signal a repair alert to ISD	Electricity
Think Tank	Pools - shut off water/air boilers & furnaces when facility not in use	Multiple building energy sources
Think Tank	Reduce lights in areas that don't really need them - bright day hallways and day-lit areas	Electricity
Think Tank	Solar thermal for city facilities - find ways to fund solar H2O on city facilities	Multiple building energy sources
Think Tank	Do more to encourage alternative modes of commuting (Incentives)	Multiple vehicle fuel sources
Think Tank	Charge for parking at all City facilities - Simultaneously provide better bike parking and some incentive for using it-$20/month, time off, etc.	Multiple vehicle fuel sources
Think Tank	Establish policy to discontinue use of disposable cups-Lug your own mug (to meetings, events, etc.)	
Think Tank	Use laptops instead of desktop computers	Electricity
Think Tank	Reduce the use of small motors	Multiple building energy sources

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Think Tank	Reduce maintenance fleet size - replace older vehicles; staff in 2-person teams	Multiple vehicle fuel sources
Think Tank	Make bikes available at all work locations for staff	Multiple vehicle fuel sources
Think Tank	Methane reduction - Have we reached potential for methane reduction at wastewater or can more be done?	Multiple building energy sources
Think Tank	Replace thermal paper used in printers - non-recyclable; NOTE-I've called BRING and tried reaching someone at Weyerhaeuser and it appears this paper may in fact be recyclable, I've been doing so thinking it was for years.	
Think Tank	A6 money to redesign maintenance intensive landscape in parks	
Think Tank	Go solar	Electricity
Think Tank	City-wide energy audit	Multiple building energy sources
Think Tank	Investigate and apply for EWEB Grant opportunity	Multiple building energy sources
Think Tank	Steam Decommission: Ask EWEB to help fund building retrofits; (Lane County has under-utilized Bond authority available-could we create a County-City partnership to accomplish this?)	Steam
Think Tank	Add solar panels to City buildings	Electricity
Think Tank	Return to 4-day workweek	Multiple building energy sources
Think Tank	Encourage Teleconferencing instead of meetings	Multiple vehicle fuel sources
Think Tank	Build travel time for Alt Modes into meeting schedules	Multiple vehicle fuel sources
Think Tank	Get rid of the driving incentives - and could incentivize alt modes (discussed elsewhere)	Multiple vehicle fuel sources
Think Tank	Develop an energy budget as if we're living on a fixed-income	Multiple building energy sources
Think Tank	Synchronize stop lights - (more of a community level action)	Multiple vehicle fuel sources
Think Tank	Use efficient travel routes	Multiple vehicle fuel sources
Think Tank	Buy a mobile fire engine fueling truck	Multiple vehicle fuel sources
Think Tank	More pervious surface - this could be more community or sustainability focused	
Think Tank	To change behavior… reward good behavior, disincentivize "bad" behavior; personalize consequences	
Think Tank	Street lighting, path lighting - find more info in Think Tank	Electricity
Think Tank	Look for intersections to replace signals w/roundabouts - more community GHG reduction based (RN)	

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Think Tank	Timed stop lights - more community GHG reduction based	
Think Tank	Inform broader organization of availability of free bus passes	Multiple vehicle fuel sources
Think Tank	Education (at the source, e.g. sign of alt modes avail. near car keys)	
Think Tank	Motivating folks to change behavior - Inform folks what can be "saved" through behavior change	
Think Tank	Staff training - Concerted training effort to highlight individual actions & responsibilities and collective impacts and actions	
Think Tank	Reinforce existing policies - use different media and forums to communicate existing policies like no-idling, computer turn-off, etc	
Think Tank	Performance data - Provide ongoing feedback on performance and consequences	
Think Tank	Bike locker facilities - more & better bike locker facils. where staff is concentrated	Multiple vehicle fuel sources
Think Tank	Encourage telecommuting	Multiple vehicle fuel sources
Think Tank	Vendor & contract relationships: Emphasize 3 legs of sustainability with all vendors & contractors - travel routes for waste collection, travel mode for consultants, use local consultants	
Think Tank	Develop plan to swap out less efficient street/path lighting - could reduce number of; light alt mode paths better to encourage use (community focus?)	Electricity
Think Tank	Create a carpooling resource for employees - (NOTE: Exists through LTD Commuter Solutions; add link to City inter- and intra-net)	

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Appendix 5

CEAP Health Impact Assessment

HEALTH IMPACT ASSESSMENT ON TRANSPORTATION POLICIES IN THE EUGENE CLIMATE AND ENERGY ACTION PLAN

A collaborative project of Upstream Public Health, the City of Eugene Office of Sustainability, Community Health Partnership: Oregon's Public Health Institute, and Lane County Public Health.

August 2010

PHOTO: DON HANKINS

PHOTO: RFDUCK ON FLICKR.COM

ABOUT THIS PROJECT

This project examines the health benefits and negative impacts of transportation recommendations within the Eugene Climate and Energy Action Plan (CEAP). It examines seven objectives within the CEAP and summarizes the scientific evidence that links those policies to health issues in Eugene. Those health issues include injuries and chronic cardiovascular and respiratory diseases and will be impacted by the CEAP objectives through changes in collision rates, physical activity, and air pollution.

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EXECUTIVE SUMMARY

Eugene's Climate and Energy Action Plan and Health

In the fall of 2010, the Eugene City Council will vote on whether or not to adopt the Eugene Climate and Energy Action Plan (CEAP). The goals of the plan are to: reduce greenhouse gas emissions, reduce fossil fuel use, and adapt to climate change and rising fuel prices. The plan includes over 30 objectives to meet these goals, along with the estimated costs of and estimated greenhouse gas reductions for many of the objectives.

In addition to reducing greenhouse gas emissions, many objectives of the CEAP will impact the public's health. Research has shown that policies aimed at reducing greenhouse gas emissions can result in increased physical activity, better air quality, and fewer vehicle collisions as people drive less and increasingly walk, bike, or take public transit for transportation. These changes, in turn, can improve the health of Eugene residents by reducing the burden of chronic diseases (such as diabetes and heart disease), improving cardiovascular and respiratory health, and reducing injuries.

Upstream Public Health received funding from Community Health Partnership: Oregon's Public Health Institute (CHP:OPHI) to examine the health benefits and costs associated with the transportation recommendations in the CEAP. Upstream worked collaboratively with the City of Eugene Office of Sustainability, CHP:OPHI, Lane County Public Health, and others to conduct this analysis. The goal of this HIA is to inform the Eugene City Council's decision to approve, modify, or reject the CEAP by examining how the CEAP will impact public health and by suggesting strategies to best improve the health of Eugene residents while decreasing greenhouse gas emissions in Eugene and the surrounding area.

Methodology of the Study

A health impact assessment (HIA) is a tool used to inform policy debates and promote decisions that are the most beneficial to health. HIAs typically consist of six stages as recommended by the Centers for Disease Control and Prevention: screening, scoping, assessing, developing recommendations, reporting, and evaluating.[1]

In the screening stage, it was determined that the HIA had the potential to inform the debate about the CEAP and could influence the decision to approve, modify, or reject the plan. In the scoping stage, it was decided to limit the analysis to the transportation recommendations in the CEAP and to focus on health impacts related to physical activity, air pollution, and collisions, especially as these impacts related to vulnerable populations.

The assessment phase included data collection for existing conditions in Eugene and a literature review to examine the scientific evidence of the potential impact of the CEAP objectives. For each of the selected objectives, this report includes information about current conditions in Eugene and a description of how the CEAP objective will impact health. The report will be disseminated to policymakers and key community stakeholders in Eugene, as well as to state and national partners.

Recommended Policies for Health

Recommendations highlighted in this report include: (1) the Transportation and Land Use objectives of the CEAP have broad benefits for health and should be approved, (2) strategies to decrease greenhouse gas emissions through active transportation have greater health benefits than strategies to increase the use of low-emissions vehicles, and planning agencies should set active transportation targets that are linked to greenhouse gas emission reductions, (3) increased urban density can improve health, but strategies should be put in place to prevent the negative health impacts that can accompany density, (4) investments in complete streets, safety improvements, and in increasing the connectivity of pedestrian and bicycle infrastructure should be a high priority, (5) public transit investments should be prioritized to benefit low-income and other vulnerable population centers, (6) integrate health impact assessment practice into current land use and transportation planning at the state and local level, and (7) develop a system to track injuries and fatalities by transportation mode, to evaluate plan implementation and systematically improve bicycle and pedestrian outcomes.

Introduction

A health impact assessment (HIA) is a tool used to inform policy decisions and promote decisions that are the most beneficial for health. The purpose of this HIA is to address the health impacts of the Transportation and Land Use objectives of the Eugene Climate and Energy Action Plan (CEAP). These objectives are designed to reduce greenhouse gas emissions. While a reduction in these emissions will have direct impacts on health, an examination of those impacts is outside of the scope of this analysis. Instead, this report focuses on the health impacts that the CEAP objectives will have, independent of greenhouse gas reductions.

CLIMATE CHANGE POLICIES AND PUBLIC HEALTH

Government policies to mitigate and to adapt to the effects of climate change have the potential to benefit health in many ways. The aim of these policies is to directly reduce greenhouse gas levels through changes in the way we transport people and goods, the way we build and power our homes and other buildings, and the way we design our cities. Climate change-related transportation policies often aim to reduce motor vehicle use, support alternative modes of transportation, and lower emissions through use of alternative fuels.

In reducing greenhouse gas emissions, these transportation policies may mitigate some of the effects that climate change will have on public health. Climate change will cause increases in: heat stress; vector-borne diseases (carried by insects and animals); malnutrition and other health problems related to drought; respiratory and allergic disease; and developmental effects such as preterm birth and perinatal mortality.[2] [3] [4] [5] As the likelihood of natural disasters increases, affected populations will experience higher rates of injury, illness, and death that accompany disaster. Additionally, environmental refugees fleeing unsafe regions may speed the spread of disease and cause overcrowding in their new areas.[6] [7]

Those likely to be most impacted by these health issues include the young, the elderly, low-income households, those with pre-existing health conditions, and those with inadequate access to health care.[8] The homeless population, which often includes members of the before-mentioned groups, will also disproportionately suffer from the effects of climate change.[9]

Co-Benefits of Climate Change Policy

Climate change policies will benefit public health in ways that are not directly related to decreased greenhouse gas emissions – these benefits are known as co-benefits. Climate change policies focused on transportation offer a number of co-benefits. Reduced motor vehicle usage will lead to a reduction in air pollution caused by auto emissions. This will benefit air quality overall, leading to reduced rates of asthma, respiratory irritation, irregular heartbeats, and heart attacks. A reduction in air pollution will also lead to lower mortality rates, especially cardiopulmonary and lung cancer mortality.[10] [11]

Reduced motor vehicle usage will also result in a decrease in injuries and fatalities due to motor vehicle collisions. As people spend more time walking and biking instead of driving, physical

activity rates will increase. Increased physical activity will lead to a reduction in obesity and a reduction in chronic disease rates. Specifically, rates of colon and breast cancer, diabetes, stroke, and heart disease will decrease.[12] [13] Mortality rates will decrease as well, especially cancer and cardiovascular mortality rates.[14] [15] [16] [17] Moderate exercise, such as walking and cycling, reduces cigarette cravings," too; reduced smoking rates will have many health benefits for smokers and non-smokers alike.[18]

There are many reasons for policy-makers to carefully consider the health co-benefits of climate change mitigation and adaptation policies. Although there is general scientific consensus that human-caused climate change is happening, the possible outcomes of climate change (especially at the local level) are difficult to predict with accuracy. At the same time, the financial costs of many climate change mitigation and adaptation policies are easier to predict (and can be very high). This combination of high costs and unclear climate change benefits can stymie the development of innovative climate change policies.

Increasingly, though, communities are starting to examine the costs of not adopting adaptation and mitigation policies. A recent report by the Climate Leadership Initiative at the University of Oregon estimates that, if no action is taken in Oregon to adapt to or to mitigate climate change, resulting costs would reach $3.3 billion by 2020 and $9.8 billion by 2080. Health-related costs alone account for $764 million of the costs by 2020 and $2.6 billion of the costs by 2080, and these estimated health-related costs do not even include those related to "expanded range of tropical and sub-tropical diseases" or "increased incidence of water- and food-borne diseases".[19]

Even when the precise climate change benefits of a mitigation or adaptation policy are unclear, research and recent evidence predicts that many policies will have a positive effect on the health of the community. When these health benefits are taken into consideration, the cost/benefit comparison of climate change policy is likely to be significantly improved. In many instances, considering health benefits during policy development will provide decision-makers with more options and will encourage more innovative solutions. Considering health impacts before policy adoption may also save resources (time, money, and human lives) compared to addressing health consequences that stem from the policy at a later time.

Examining the Health Impacts of Climate Change Policies – Examples

There is a large and growing body of research examining the health impacts of climate change, but there are only a few examples of analysis of the health impacts of climate change *policy*. This HIA is the first completed on a local Climate Action Plan.

California

In California, researchers are working on a health impact assessment of the state's greenhouse gas cap and trade program.[i] In particular, the HIA will focus on air pollutant emissions, consumer economic impacts, employment, and land use and transportation.[20] The HIA will use statewide,

[i] Generally, cap and trade programs (also called emissions trading) set a mandatory cap on emissions in a region and then allow businesses to purchase credits or permits to emit greenhouse gases. Businesses can sell credits to or purchase credits from other businesses to change their allowed emissions.

regional, and community case studies and will be completed before the adoption of the rule. The purpose of the HIA is to "assess the potential impact of the cap-and-trade program on health including local impacts and strategies to maximize criteria and toxic pollutant reduction as well as other public health benefits to the extent feasible".[21]

Additionally, by fall of 2010, the California Department of Public Health plans to develop and distribute a health impact assessment guide to local health agencies. The department will also provide technical assistance in using HIAs "to assess land use, housing, and transportation activities and policies that could impact/influence community sustainability, public health, GHG emissions and community resilience for climate change".[22]

Oregon

In May of 2009, Upstream Public Health completed an HIA on policies to reduce vehicle miles traveled in Oregon metropolitan areas.[23] This was the first HIA that was completed on a climate change policy in the U.S. It examined local policies to reduce overall driving by: (1) increasing the cost of driving, (2) investing in public transit, or (3) modifying land use planning. The HIA examined impacts on health through changes in air pollution, physical activity, and collisions. Recommendations resulting from the analysis emphasized the need for a combination of the three types of policies but also highlighted the effectiveness of requiring businesses to charge a fee for employee parking. Recommendations also included: maximize the density of neighborhoods already within the urban growth boundary, require new developments to be mixed-use and high-density with good connectivity, improve the pedestrian infrastructure of neighborhoods, and increase the coverage area for public transportation across all of the metropolitan regions.

London and Delhi

An inter-disciplinary team of researchers examined the health benefits of climate change policies in London and Delhi.[24] They used a comparative risk assessment[ii] approach to estimate the impacts of the policies on physical activity, air pollution, and traffic injuries. They concluded that a combination of strategies to reduce driving rates and to improve fuel efficiency together had the largest benefit for health, because they measurably reduced both respiratory illnesses and heart disease.

Maryland

The state of Maryland's Climate Action plan is made up of 61 policies, one of which is to conduct HIAs on climate change policies. This policy is a key recommendation in the final plan: "Conduct health impact assessments to evaluate the public health consequences of climate change and projects and/or policies related to sea-level rise".[25] The plan notes that assessing the health benefits of climate change policies helps create a more collaborative working environment and involves more policy implementers from the very beginning.

[ii] Comparative risk assessment uses information about population demographics and the hazards of pollutants and exposure levels to predict impacts on health.

China

Researchers in China have examined recent policies aimed at reducing greenhouse gas emissions (in part for the 2008 Summer Olympics), in order to predict how an expansion of those policies would affect health in other areas of China. They examined household energy efficiency, industrial energy efficiency, building energy efficiency, and vehicle energy efficiency.[26] The authors concluded that full implementation of the climate change policies "could prevent 20,311 cardiopulmonary related premature deaths nationwide annually by 2020 and 29,239 by 2030" and could prevent "6,000 respiratory hospital emissions by 2020" and approximately 9,000 in 2030.[27] Just these two effects of the climate change policies could save more than $4 billion in costs.

POPULATION DEMOGRAPHICS

The previous examples highlight some of the ways that communities are considering the health benefits of climate change policies. In considering the health benefits of the CEAP transportation objectives, it is important to understand the characteristics of the population in Eugene and the existing conditions of the built environment that will be affected.

Eugene, with a 2008 population of 154,620, is the second most populous city in Oregon, after Portland. According to the Population Research Center at Portland State University, Eugene's population is likely to grow to 202,565 by 2035.[28] As the population grows, the share of the ethnic minority population (especially the Latino population) in Eugene is also likely to grow, following a trend that started in the 1990s. The share of the population that is 65 years and older is expected to increase from 12.1% in 2010 to 20.8% by 2035[29].

Overall, the population in Eugene is fairly similar to the population in Oregon as a whole, with two exceptions. Both the poverty rate and educational attainment level of Eugene residents are markedly higher than in Oregon as a whole. More demographic tables can be found in the Appendix.

Age

Children make up a smaller portion of Eugene's population, compared to Salem, Portland, or Oregon as a whole. Older adults make up a greater share of the population than in Portland or Oregon as a whole (**Table 1**).

Table 1: Percent Population by Age, 2008

Population	Eugene	Salem	Portland	Oregon
Under 18 Years Old	17.7	24.0	21.2	22.9
65 Years or Older	13.8	13.9	10.4	13.3

Data from the American Community Survey, 2008.[30]

Race and Ethnicity

The population in Eugene is 86.5% White, which is slightly higher than in Oregon as a whole (**Table 2**). The 14.5% non-White population and the Hispanic portion of the White population (4.3% of the White population) may experience some of the greatest benefits of climate change policies, because they are at greater risk of experiencing the negative health impacts of climate change. This disparity is due in part to the fact that these populations, on average, may have access to fewer resources to help them address rising fuel costs, heat waves, and other climate change impacts. For

example, for 2006-2008 the median income for Latino and Hispanic households in Eugene was $26,477 compared to $43,720 for White, non-Hispanic or Latino households.[31]

Table 2: Race and Ethnicity, 2006-2008 (Percent Population)

Race and Ethnicity	Eugene	Salem	Portland	Oregon
White	86.5	84.7	78.6	86.2
Black or African American	1.5	1.4	6.4	1.7
American Indian and Alaskan Native	1.4	3.0	1.4	1.8
Asian	5.0	2.6	6.5	3.5
Native Hawaiian and Other Pacific Islander	0.1	0.7	0.5	0.3
Some other race alone	1.8	4.3	2.9	3.2
Two or more races	3.6	3.3	3.7	3.3
Hispanic or Latino	6.7	17.9	8.8	10.6

Data from the American Community Survey 3 year estimates, 2006-2008

Income and Employment

The median household income in Eugene is $42,398. This is 85.0% of the median Oregon household income ($49,863). In comparison, median household incomes in Portland and Salem are 98.3% and 86.4% of the Oregon median household income, respectively.

In Eugene, 19.7% of people had an income in the past 12 months below the poverty level, while in Oregon as a whole 13.4% of the population had an income in the past 12 months below the poverty level. Eugene's poverty rate is also higher than Portland's and Salem's (15.2% and 16.4%, respectively). Non-white populations in Eugene had a higher rate of poverty than the White population for 2006-2008 (**Table 3**).

Table 3: Below Poverty Level in Eugene in the Past 12 Months, 2006-2008 (Percent Population)

Race and Ethnicity	Percent Population
White	18.5
Black or African American	N
American Indian and Alaskan Native	N
Asian	28.5
Native Hawaiian and Other Pacific Islander	N
Some other race alone	45.5
Two or more races	20.2
Hispanic or Latino	34.1

N "indicates that data…cannot be displayed because the number of sample cases is too small."
Data from the American Community Survey 3 year estimates, 2006-2008

The unemployment rate for Lane County in June 2010 was 10.6% when seasonally adjusted, compared to 10.5% in Oregon as a whole.[32] Historically, nationwide, "the jobless rate for blacks generally has been at least twice that for whites, whereas the unemployment rate for Hispanics has hovered between the rates for whites and blacks".[33] As mentioned above, low-income and racial and ethnic minority populations may reap a significant proportion of the benefits of climate change

policies, in part because they are at greater risk of experiencing the negative health impacts of climate change. These groups are also likely to experience greater health co-benefits of climate transportation policies, for reasons that will be explored in this report.

Educational Attainment

The population in Eugene has higher educational attainment levels than the population of Oregon as a whole and the population of the capital city of Salem (**Table 4**). The percentage of Eugene's population with a bachelor's degree or higher education is just below Portland's, and the percentage of Eugene's population that finished high school or more is slightly higher than in Portland.

Table 4: Educational Attainment, 2006-2008 (Percent Population 25 Years and Older)

Educational Attainment	Eugene	Salem	Portland	Oregon
High School Graduate or Higher	92.1	84.7	89.4	88.0
Bachelor's Degree or Higher	39.5	25.0	39.6	27.9

Data from the American Community Survey 3 year estimates, 2006-2008

COMMUNITY HEALTH

Health-related data is most often collected at the county level by the public health department. As a result, it can be difficult to disaggregate data down to the city or neighborhood level. Because the Eugene-Springfield population makes up such a large share of the population of Lane County (about 70%), county-level data can still be very valuable when considering the health impacts of climate change policy.

In Oregon, Lane County is ranked as the 17th healthiest county, where 1 represents the county with the best health, and 33 represents the county with the poorest health (three counties were not ranked). Lane is also ranked 17th for health factors, which include health behaviors, clinical care, social and economic factors, and the physical environment.[34] Multnomah County (including Portland) ranked 21st, and Marion County (including Salem) ranked 10th. In 2008, 13% of the population in Eugene had a disability, similar to 13.3% of the population of Oregon as a whole.[35]

Pediatric asthma hospital admission rates in Lane County in 2007 were considerably higher than in Oregon as a whole – 51.8 per 100,000 population compared to 41.3 in Oregon.[36] The percentage of residents in Lane that are overweight or obese is the same as in Oregon as a whole. Overweight, obese, and the diseases listed in **Table 5** are some of the primary health outcomes that are related to air quality and physical activity.

Table 5: Age-Adjusted Prevalence of Selected Chronic Diseases and Factors, 2007 (Percent Population)

Diseases and Factors	Lane	Marion	Multnomah	Oregon
Asthma	11	9	9	9
Diabetes	6	7	7	6
Coronary Heart Disease	3	4	4	4
Overweight	36	39	35*	37
Obesity	23	25	20*	22

*Statistically significant difference from statewide rate.
Data from BRFSS, Keeping Oregonians Healthy, 2007.[37]

While a smaller percentage of 8th graders in Lane County are overweight and at risk of overweight than in Marion County, Multnomah County, or Oregon as a whole, by the time youth reach 11th grade in Lane County, they are about as likely or slightly more likely to be overweight or at risk of overweight than 11th graders in Multnomah County or in Oregon as a whole (**Table 6**).

Table 6: Modifiable Risk Factors Among 8th & 11th Graders, 2005-2006 (Percent Population)

Grade	Risk Factor	Lane	Marion	Multnomah	Oregon
8th	At risk of overweight	14.8	16.0	15.3	15.3
	Overweight	9.3	13.3*	10.7	10.5
	Met physical activity recommendations	60.7	62.3*	55.1*	58.9
11th	At risk of overweight	13.1	13.9	13.2	13.0
	Overweight	10.6	12.0	10.2	10.7
	Met physical activity recommendations	52.1	51.7	40.4*	49.2

*Statistically significant difference from statewide rate.
Data from BRFSS, Keeping Oregonians Healthy, 2007.

Other important health outcomes affected by climate change policy include fatalities and injuries from collisions. Data examining fatalities and injuries by population that uses each mode is unavailable, but **Table 11** on page 26 includes information about injuries and fatalities from motor vehicle collisions in Eugene. This data does not include fatalities and injuries to bicyclists and pedestrians that occurred outside of motor vehicle collisions.

TRANSPORTATION BEHAVIORS AND INFRASTRUCTURE

In Lane County in 2004, 14.82% of all trips were less than one mile, and 14.77% of all trips were made without an automobile.[38] As seen in **Table 7**, non-auto modes make up over 30% of work commute trips in Eugene.

Table 7: Means of Transportation to Work, 2006-2008 (Percent Workers 16 Years and Over)

Means of Transportation	Eugene	Salem	Portland	Oregon
Drove alone	66.1	73.0	61.5	72.1
Carpooled	9.1	14.0	9.5	11.3
Public transit (not taxicabs)	6.8	3.2	12.2	4.2
Taxicab, Motorcycle, or Other means	0.6	0.7	1.7	1.3
Bicycle	7.1	1.9	4.7	1.6
Walked	6.4	3.6	4.9	3.8
Worked at home	4.0	4.0	6.3	5.8

Data from 2006-2008 American Community Survey 3-year estimates.

Bicycle rates vary significantly by city throughout Oregon. In the Lane metropolitan area, the ratio of bikeway miles (both on- and off-street) to arterial and collector[iii] miles (excluding freeways) was 59% in 2004.[39] As of February 2010, Eugene had a total of 41 miles of off-street paths, 33 miles of bike routes, and 81 miles of bike lanes. Compared to Salem, Portland, and Oregon as a whole, in Eugene, walking and bicycling make up a higher share of work commute mode.

Public transit rates also vary significantly by city. The average annual weekday transit trips per person in the Eugene metropolitan area in 2007 was 37, compared to 25 for Cherriots (Salem area) and 53 trips for TriMet (Portland area).[40] Many factors affect public transit use, including distance to stops, reliability of transit, and accessibility of destinations. Lane Transit District operates 42 bus routes in Lane County, a rapid transit bus between Eugene and Springfield, the RideSource service for individuals who cannot use the bus, and other services. Children under 5 and adults over 65 ride free.[41] In Lane County, 83% of households are within ¼ mile of a transit stop.[42]

OTHER BUILT AND NATURAL ENVIRONMENT FACTORS

The population density in 2000 in Eugene was 3,403 persons/square mile, compared to 2,994 persons/square mile in Salem and 3,939 in Portland.[43] Food access in Lane County is comparable to Marion County, but there are fewer zip codes with access to healthy food than in Multnomah County and in Oregon as a whole (**Table 8**).

Table 8: Physical Environment Health Factors, 2010

Health Factors	Lane	Marion	Multnomah	Oregon
Zip codes with access to healthy food*	38%	36%	45%	47%
Liquor store density**	0.4	0.4	0.7	0.5

* Healthy food outlets include grocery stores with more than four employees, produce stands, and farmer's markets.
** The number of liquor stores per 10,000 population (MATCH, 2010).

In 2009, the Eugene-Springfield area had eight days when the air quality was unhealthy for sensitive populations[iv] and one day when the air quality was unhealthy for the general public (**Table 9**). During days with air quality that is unhealthy for sensitive populations, these groups

[iii] A collector street moves traffic from residential streets into the arterial street system.
[iv] Sensitive populations include children, older adults, and other "groups of people who are particularly sensitive to the harmful effects of certain pollutants," such as those with lung or heart disease (Lane Regional Air Protection Agency, 2009).

may experience adverse health effects. In the Lane County Metropolitan area, there are 172.3 tons of carbon monoxide emissions each week.[44]

Table 9: Air Quality Index Summary, 2009 (Number of Days in Eugene-Springfield)

Year	Good	Moderate	Unhealthy (Sensitive)	Unhealthy
2009	321	35	8	1
2008	325	40	1	0
2007	321	40	4	0
2006	339	25	1	0
2005	294	69	2	0

Totals include Carbon Monoxide, Particulate Matter$_{2.5}$, and Ozone data
Data from Lane Regional Air Protection Agency, 2009.[45]

METHODOLOGY

Health impact assessments (HIAs) are used to evaluate the positive and negative impacts policies have on health. HIAs typically include the following six steps:

1) *Screening* – Determining the need and value of a HIA for a project or proposal.
2) *Scoping* – Determining which health impacts to evaluate, the methods for analysis, and the plan to complete the assessment.
3) *Assessing* – Using data, research, expertise, and experience to judge the magnitude and direction of potential health impacts on affected populations.
4) *Developing Recommendations* – Suggesting changes to the project or proposal to promote positive health impacts or to mitigate negative health impacts.
5) *Reporting* – Communicating the results to stakeholders and decision-makers.
6) *Evaluating* – Tracking the effects of the HIA on the decision and the impacts of the decision on health.[46]

Screening

In the screening stage, a potential HIA is evaluated to determine whether the analysis is feasible, timely, and would add value to the decision-making process, and a decision is made on whether to move forward with the analysis. The idea for an HIA on the transportation policies in the CEAP was brought up during a presentation in Eugene in October of 2009 and was initiated jointly by Upstream Public Health and the City of Eugene Office of Sustainability. Upstream Public Health with input from key stakeholders screened the project between October 2009 and January 2010.

In June of 2009, Community Health Partnership: Oregon's Public Health Institute (CHP: OPHI) was selected as a recipient of an award by the Centers for Disease Control and Prevention and the National Network of Public Health Institutes to conduct a series of HIAs on climate change, transportation and health policies, and to distribute lessons learned to national partners. CHP: OPHI chose to contract with Upstream Public Health in April of 2010 to conduct this project as one of the pilot HIAs on climate change, transportation, and health.

Feasibility

The HIA was screened to determine if adequate scientific evidence and sufficient resources were available to conduct the HIA. The City of Eugene identified key partners that could contribute to the analysis, including staff from Lane County Public Health, Lane Transit District, Lane Regional Air Protection Agency, Lane Coalition for Healthy Active Youth, and others. It was determined that there was significant interest among local agencies and community organizations to conduct the HIA.

Ideally, an HIA would be conducted on the entire CEAP, because policies from each section of the CEAP will have important health impacts. "Buildings and Energy" objectives have the potential to impact health through reduced greenhouse gas emissions and decreased home energy costs (leaving a larger share of household budgets for other needs). "Food and Agriculture" objectives will impact public health by supporting access to affordable, healthy food that is locally produced.

"Consumption and Waste" objectives will affect public health by reducing air pollution emissions related to waste disposal. "Health and Social Services" objectives will directly impact health, in part through increased emergency preparedness of public health and emergency response workers and residents themselves. "Urban Natural Resources" objectives will impact public health through the protection of trees, water quality, and air quality – all of which affect health.

Due to limited resources, though, this assessment focuses solely on the objectives in the "Transportation and Land Use" section. Upstream Public Health previously coordinated an HIA on policies to reduce vehicle miles traveled. This HIA of the CEAP transportation and land use policies benefits from Upstream's expertise and collection of relevant data to inform this project, which made the analysis of many of the CEAP recommendations feasible.

Timeliness

This project was designed to inform the decision by the Eugene City Council to approve, modify, or reject a draft Climate and Energy Action Plan in late 2010. It was determined that the HIA could be conducted in early and mid 2010 in order to inform this decision.

Relevance to Political Discussion

It was determined that an informed discussion about the health impacts, and in particular the health benefits, would be a valuable addition to the political discussion at the city council. In fact, because many of the environmental benefits of reduced greenhouse gas emissions in Eugene do not measurably benefit Eugene residents, the discussion of the immediate health benefits to local residents is very important. It was determined that an HIA could help to demonstrate local benefits to instituting the Eugene CEAP, independent of the impact on the global climate.

Additionally, this project represents the first HIA conducted on a local Climate Action Plan in the U.S. Therefore, it was determined that this project could serve as a model for other HIAs of climate change policies, and in particular HIAs on local and state Climate Action Plans.

Scoping

The geographic area of interest for this HIA was the City of Eugene in Oregon.

The Eugene Office of Sustainability and Upstream Public Health jointly coordinated the scope definition process. The scope of analysis was discussed with stakeholders in November of 2009. Key stakeholder organizations included the Lane Regional Air Protection Agency, Eugene Public Works Administration, Lane Coalition for Healthy Active Youth, and Lane County Public Health. The resources available to do the analysis and the short timeline to influence the city council limited the scope of the analysis.

This HIA focused on a subset of policies from the "Land Use and Transportation" section of the Climate and Energy Action Plan (CEAP) that were likely to affect health. The objectives and priority actions selected from the CEAP are listed in **Table 10**. Similar priority actions from certain objectives were grouped together for analysis: 1 and 2; 5 and 6; 8, 9, and 10; 11 and 12. The remaining priority actions were analyzed individually: 3; 7; 13; 14; and 15. This HIA does not examine "Objective 3: Consider the potential for climate refugees when doing land use planning."

There is little literature on the health impacts of Objective 3, and projecting the impacts of future refugee issues was too complicated to undertake within the scope of this HIA.

Table 10: Objectives and Priority Actions Included in the HIA

Objectives	Priority Actions	
Objective 1: Create 20-minute neighborhoods, where 90% of Eugene residents can safely walk or bicycle to meet most basic daily, non-work needs, and also have safe pedestrian or bicycle routes which connect to mass transit	1	Make the creation of 20-minute neighborhoods a core component of the Eugene Plan and the Eugene Bicycle Pedestrian Master Plan.
	2	By 2013, complete a 20-minute neighborhoods plan: a. Identify funding for necessary planning effort. b. Identify key accessibility components for 20 minute neighborhoods, e.g. schools, parks, grocery store, retail services, etc. c. Conduct a network gap analysis to determine needs. d. Coordinate with *opportunity siting and infill compatibility standards* planning.
Objective 2: Increase density around the urban core and along transit corridors	3	Zone future commercial and high-density residential uses in and around the urban core, and along EmX and other high-capacity transit corridors to accommodate future urban growth. a. Coordinate with *opportunity siting* and *infill compatibility standards* planning efforts.
Objective 4: Continue to expand and improve Eugene's bicycle and pedestrian infrastructure and connectivity to increase the percentage of trips made by bike and on foot.	5	Create a pedestrian and bicycle master plan that will: a. Identify mobility gaps in the bicycle and pedestrian transportation system. b. Recommend improvements to increase safety (both real and perceived), comfort, speed, and convenience for users of all ages and skill levels. c. Create a plan for implementing the necessary system improvements. d. Identify funding sources for implementation
	6	Increase the mileage and connectivity of bicycle boulevards and shared-use paths to encourage cyclists of various skill levels to commute by bike.
	7	Create a "Complete Streets" policy that requires all new transportation projects and rehabilitation projects to incorporate bicycles, pedestrians, and mass transit service.
Objective 5: Increase the supply of frequent, reliable, integrated and convenient public transit	8	Diversify funding sources for Lane Transit District (LTD) to increase the long-term reliability of mass transit service. a. Partner with Springfield, Lane County, LTD, and businesses to develop strategies for providing mass transit for the Eugene community.
	9	Align City of Eugene Transportation System Plan and LTD Long Range Transit Plan to integrate bus routes into the broader alternative transportation system. a. Partner with LTD to help inform service changes and improvements. b. Create special *setbacks* along future *Bus Rapid Transit (BRT)* or other mass transit corridors to accommodate future right-of-way expansion. c. Work with LTD in developing the Long Range Transit Plan to determine the role of mass transit in accomplishing greenhouse gas emission reduction goals.
	10	Invest in transit infrastructure that meets future access and mobility needs while consuming less fossil fuel. Recommended actions include: a. Maximize electrification of the regional transportation systems. b. Increase use of hybrid vehicles, including buses and other heavy vehicles.
Objective 6: Expand outreach, marketing and	11	Increase promotion of bicycling, walking, mass transit, car-pooling, telecommuting, high-occupancy vehicles, and emergency ride home

education regarding climate-friendly transportation alternatives	11	programs as attractive alternatives to driving, in order to increase the mode share of alternatives to the single-occupant vehicle. Partner with Point 2 Point Solutions, Lane Transit District, Greater Eugene Area RiderS (GEARS), BikeLane Coalition, local businesses, the City of Eugene Smart Trips program, Safe Routes to School, Lane Coalition for Healthy Active Youth, Lane County Public Health, Climate Masters at Home™, and others.
	12	Increase the community's understanding of fuel-efficient driving techniques.
Objective 7: Ensure maximum efficiency in current and future freight systems	13	Plan for efficient freight transportation that minimizes greenhouse gas emissions and fossil fuel consumption, and: a. Connects multiple modes (train, truck, van, car, bicycle); b. Accommodates regional (upper Willamette Valley) commercial, industrial and agricultural freight needs; and c. Facilitates efficient local deliveries.
Objective 8: Increase the use of low-carbon vehicles and fuels to improve overall fuel efficiency and reduce vulnerability to fluctuating oil prices	14	Accelerate the transition to plug-in hybrids and electric vehicles. Partner with Lane County, EWEB, auto retailers, electrical contractors, UO, LCC, and others. a. Support the installation of a network of electric car charging stations. b. Require installation of electric car charging stations in new multifamily housing.
	15	Conduct research to understand what role biofuels can play in decreasing Eugene's vulnerability to energy markets. Work with partners at LTD, the Oregon Department of Energy, etc. a. Complete research by 2013 so that outcomes can inform the next CEAP.

The HIA focused on the impact the objectives and policy actions would have on health through changes in air pollution, physical activity, and collisions. Changes in noise levels, stress, household budgets and access to healthy food, goods, and services will also have important health impacts, but analyzing those impacts was outside of the scope of this HIA.

Assessment

Although assessment often includes the magnitude and the direction of health effects, this analysis describes the types of health impacts but does not assess the magnitude of those impacts, due to a lack of clear prospective data.

Data Collection

If available, existing conditions data for the city of Eugene was the first choice, followed by the metropolitan area of Eugene-Springfield, and lastly by Lane County. Data on existing conditions were collected from a variety of sources: US Census, US Environmental Protection Agency, National Transit Database, Department of Transportation, Oregon Department of Environmental Quality, Oregon Department of Administrative Services, and Oregon Department of Human Services.

Literature Review

For each set of policy actions, a literature review was carried out to find current research on the topic. Several policy actions have overlapping topics, thus they did not all have separate search strategies. The following searches were carried out during the review: built environment and physical activity; built environment and air pollution; built environment and collisions; public transit and physical activity; promotion and active transportation; plug-in vehicles and air pollution; and biofuels and air pollution. Less intensive searches were carried out for the impact

the policies would have on vulnerable populations and the relationship between diesel fuel and air pollution.

The Built Environment and Physical Activity

Due to the large body of literature, the search on the built environment and physical activity was restricted to reviews. Ovid Medline was searched with the following search terms: "exercise (exploded)"[v] or "bicycling (exploded)" or "walking (exploded)" and "social planning (exploded)" or "environment design (exploded)" or "built environment (keyword)." After examining abstracts, full articles, and reference lists of relevant reviews, 11 review articles formed the literature base for the built environment and physical activity sections.

The Built Environment and Air Pollution

Two searches were conducted in Pubmed Medline with the keywords "built environment air pollution" and "air pollution road proximity." An additional search was performed in Transportation Research Information Services (TRIS) with the following keywords: "air pollution road proximity" and "air pollution and built environment." After examining abstracts, full articles, and reference lists of relevant articles, 20 articles formed the literature base for the built environment and air pollution. These articles were further restricted to those that addressed the characteristics typical of 20-minute neighborhoods (see page 22 for a description of a 20-minute neighborhood) and the bicycle and pedestrian infrastructure, leaving six articles for the final literature base.

The Built Environment and Collisions

Ovid Medline was searched with the following terms: "accidents, traffic" and "social planning" or "environment design" (all exploded) or "built environment" (keyword). An additional Ovid Medline search was conducted with "accidents, traffic" (exploded) and "sprawl" (keyword). The Human Impact Partners evidence base (http://www.humanimpact.org/EvidenceBase) was also searched, and one report from its reference list was used.[47] The search resulted in 19 articles. After the topic was restricted to 20-minute neighborhoods and bicycle and pedestrian infrastructure topics, nine articles remained.

Public Transit and Physical Activity

The reference lists from the "Built Environment and Physical Activity" reviews were used to find articles on public transit and physical activity. A search was also completed using Google Scholar with search terms "public transit physical activity." One article from the Google Scholar search was particularly relevant,[48] and this article was used in PubMed Medline to extract other articles that were related. Fourteen articles formed the final literature base for public transit and physical activity.

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v When a search term is "exploded," the search will include terms that are related to the original search term. For example, "exercise (exploded)" would also return articles that included "physical activity" as a key term.

Promotion of Active Transportation

Google Scholar was searched with "promotion active transportation." A relevant review on promoting active transportation[49] was used in Pubmed to find related articles. Pubmed Medline was also searched with "promotion active transportation." A particularly relevant American Journal of Preventive Medicine supplement was reviewed (Volume 37, 6S2). Six articles formed the final evidence base for promotion.

Plug-in Vehicles and Air Pollution

A search of Pubmed Medline using the keywords "plug in vehicle air pollution" yielded one article.[50] A related citations search was used to find additional articles in Pubmed Medline. Reference lists were also reviewed for relevant articles. An Ovid Medline search was also conducted with the keywords "electric vehicle." The final evidence base for plug-in vehicles and air pollution included two articles and one technical report.

Biofuels and Air Pollution

A search of Ovid Medline using the exploded terms "bio fuels" and "air pollution" yielded one article.[51] Ovid Medline was also searched with "air pollution" exploded and "biodiesel" as a keyword. A review of biodiesel emissions published by EPA was also used. The final evidence base for biodiesel and air pollution includes four articles. Ovid Medline was also searched using the exploded terms "ethanol" and "air pollution." The final evidence base for ethanol and air pollution included three articles.

Recommendations

Recommendations based on the assessment of the selected objectives can be found at the end of this report. The recommendations are designed to maximize health benefits while decreasing greenhouse gas emissions and were revised to reflect feedback received at a community forum in July 2010, and from input on the draft HIA report. At the July Forum, approximately 30 participants representing transportation, public health, environment and architecture expertise as well as unaffiliated concerned citizens heard a presentation on the draft proposal and provisional recommendations and had an opportunity to provide oral and written feedback to inform the recommendations.

Reporting

The results of the report are organized as in **Table 10**; certain priority actions are grouped together, and some are analyzed individually. For each objective, the report explains how changes stemming from the objective will ultimately affect community health. In the figures that show the pathways from CEAP objectives to community health, the solid lines mean that there is a consistent evidence base for the association. The dashed lines mean that the association is speculative or that there is not enough evidence to strongly support the association. Where the data is available, the report explores related existing conditions in Eugene or in Lane County.

Throughout the report, where "good land use mix" is mentioned, it refers to a mix that generally includes destinations of interest to residents, like grocery stores, restaurants, entertainment, etc. "Higher residential density" does not refer to a specific density; generally, increasing residential

density is associated with more walking. "Accessibility" and "accessible" refer to features and environments that are safe and convenient to use because they offer several mobility options, have a well-connected street and/or sidewalk network, and are close to destinations. These terms do not refer to the Americans with Disability Act accessibility standards.

The report will be disseminated to the Eugene City Council, interested citizens and activists, and national, state, and local groups with an interest in examining the health impacts of transportation policies related to climate change. The report will be included as an appendix in the CEAP, and electronic copies will be available on Upstream Public Health's website: http://upstreampublichealth.org.

The City of Eugene Office of Sustainability plans to coordinate the release of a media advisory. In addition, the results will be submitted in the future to a scientific journal article and relevant regional magazines.

Evaluating

A limited evaluation of the HIA will be conducted after the Eugene City Council's final decision regarding the CEAP. This evaluation will examine the impact of the HIA on the CEAP decision-making process and the relevance of the HIA to area transportation planners. A set of evaluation questions will be developed with input from the key participants in the HIA and distributed to planning, health and environmental stakeholders in Lane County.

RESULTS

Objective 1: Create 20-minute neighborhoods, where 90% of Eugene residents can safely walk or bicycle to meet most basic daily, non-work needs, and also have safe pedestrian or bicycle routes which connect to mass transit

Priority Action 1: Make the creation of 20-minute neighborhoods a core component of the Eugene Plan and the Eugene Bicycle Pedestrian Master Plan.

Priority Action 2: By 2013, complete and implement a 20-minute neighborhoods plan:

a. *Identify funding for necessary planning effort.*
b. *Identify key components for 20 minute neighborhoods, e.g. schools, parks, grocery store, retail services, etc.*
c. *Conduct a network gap analysis to determine needs.*
d. *Coordinate with opportunity siting and infill compatibility standards planning.*

The 20-Minute Neighborhood

Cities across the country are using the 20-minute neighborhood concept as one way to think about neighborhood livability and future sustainability. Definitions vary but often include: walkable destinations that meet everyday needs (e.g. grocery store, school, park, bank, library, doctor's office); other retail destinations; and a well-connected, pleasant, and safe pedestrian and bicycling environment that offers several mobility options. The CEAP defines 20-minute neighborhoods as "those in which a significant number of regular trips can be made in 20 minutes, without using a personal automobile."

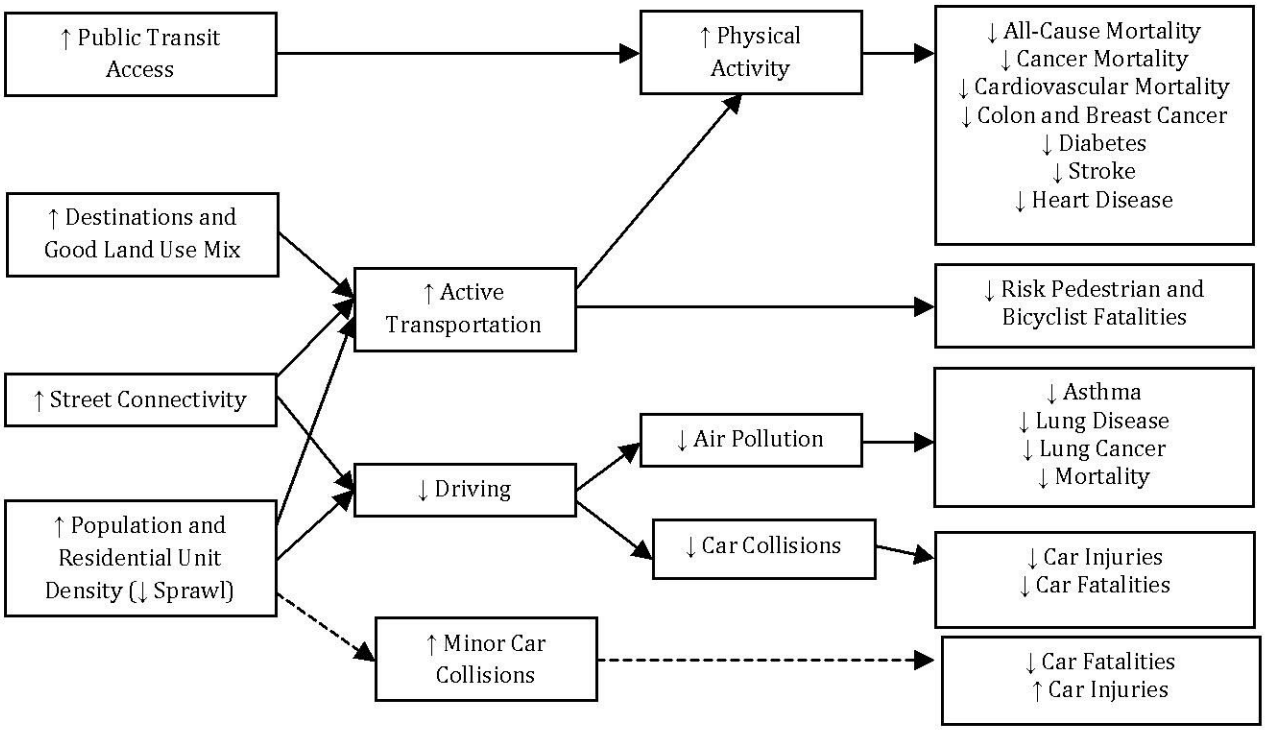
While the 20-minute neighborhood may be easy to visualize, it can be very difficult to measure whether or not a neighborhood is a 20-minute neighborhood. "Conventional wisdom among planners has been that pedestrians in the United States will only walk a quarter to a third of a mile for any reason," but a recent study that examined how far pedestrians would walk to access rail transit in Portland and in San Francisco found that the median trip was 0.47 miles.[52] Individuals walk and cycle at different rates and are comfortable with different environments – where one neighbor feels safe, another may not. Also, just because a destination is nearby does not mean that it is affordable or culturally appropriate. As a result of these factors, a 20-minute neighborhood will not look the same for everyone.

To measure destinations and sidewalk and bike routes in a neighborhood, planners often look within a ¼-mile, ½-mile, and/or 1-mile radius from a home or center of a neighborhood or district. This data is used as a proxy for measuring if a neighborhood is a 20-minute neighborhood, and although it is an imperfect measurement for all of the reasons listed above, it can be a good starting point. Planners can use these measurements to compare different areas of the city and explore why some areas might be missing certain amenities near residences.

The characteristics of a 20-minute neighborhood are associated with increased physical activity, decreased collision fatalities, and lower levels of air pollution. These factors contribute to positive

health outcomes and are discussed in detail below. **Figure 1** shows the relationship between these policy actions and health. Depending on the design of the 20-minute neighborhood, there may be more or less vehicle collisions, but *fatality rates* from collisions decrease as "sprawl" decreases.[vi]

Figure 1: Pathway Between the Characteristics of 20-minute Neighborhoods and Health



Physical Activity

Nearby destinations and a good land use mix are both associated with higher levels of walking for transportation.[53 54 55 56 57 58] Even subjective[vii] accounts of these amenities are associated with higher levels of walking for transportation.[59]

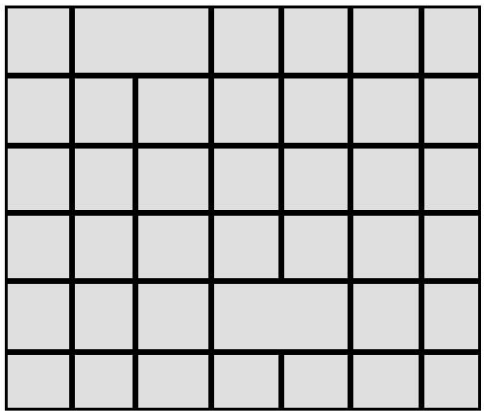
Nearby destinations may not be easy to walk to if they are not supported by good network connectivity – "the directness and availability of alternative routes from one point to another" – which could be achieved by street with sidewalks or pedestrian/multi-use paths that are separate from cars.[60] Residents need to be able to access nearby amenities easily, and having multiple pathways to get from one point to another increases the amount of walking.[61 62] In Lane County, the median block length of the census tracts within the county ranges from 1,206 feet to 20,813 feet (data from the RAND Center for Population Health and Health Disparities).[63] A typical block length in a compact, downtown urban area is 200-300 feet.[64] For more detailed information on street connectivity, see **Figure 2** and the Appendix.

[vi] See the "Collisions" section on page 25 for a definition of "sprawl".

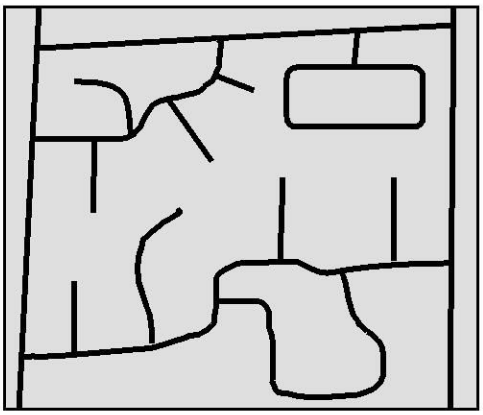
[vii] A subjective account or report is data collected from personal accounts, as compared to an objective report that relies on observed and measurable data (such as distance to a bus stop).

Figure 2: Examples of high and low street connectivity.

Highly Connected Street Network:



Poorly Connected Street Network:



Increasing access to public transit, through increased density of transit stops, closer proximity to stops, and ease of access to transit stations, benefits health in several ways. Increased density of stops was related to meeting physical activity recommendations in a study of 50-75 year olds in Portland, OR.[65] Increased public transit accessibility is also associated with more walking for transportation and less motorized trips, indicating that the development of a dense, well-connected transit network will benefit those who use transit and those who do not.[66] [67] [68]

Additionally, transit use is associated with walking, often enough to meet public health recommendations for physical activity of thirty minutes or more of moderate activity five days per week.[69] [70] [71] [72] [73]

Overall, there is sufficient evidence that the characteristics of 20-minute neighborhoods are associated with higher levels of physical activity. Higher residential density, good land use mix, distance to nonresidential destinations, and access to public transit are characteristics consistently positively associated with physical activity.

According to data collected in 2002-2005, only 58.8% of adults in Lane County met the public health recommendation to achieve 30 minutes or more of moderate activity at least 5 days per week or 20 minutes or more of vigorous activity at least 3 days per week, and 58.7% of adults were either overweight or obese.[74] Making changes to the built environment that will encourage physical activity among Eugene residents will be an important policy action in the upcoming years.

Increasing levels of physical activity is associated with reduced all-cause mortality.[75] [76] [77] [78] In addition, studies have found that physical activity is associated with reduced cause-specific mortality, including deaths from cardiovascular disease[79] and cancer.[80] Physical activity is also associated with lowered risk of colon cancer and breast cancer in women,[81] diabetes,[82] heart disease, and stroke.[83]

Vulnerable Populations

The characteristics of 20-minute neighborhoods can also be important for vulnerable populations, such as children and older adults. Access to destinations (including schools) has been found to be positively associated with physical activity levels in children.[84] In Lane County in 2005-2006, only 60.7% of 8th graders and 52.1% of 11th graders met physical activity recommendations.

Additionally, for older adults, more accessible neighborhood design supports greater levels of walking.[85] In a study of adults 50-75 years old in Portland, OR, an increase in land-use mix was associated with a reduction in overweight and obesity prevalence; in the same study, high street connectivity was related to meeting physical activity recommendations.[86] With a projected increase in the proportion of older adults and a nationwide childhood obesity epidemic, 20-minute neighborhood characteristics will be especially valuable to these populations.

Collisions

Areas typically considered "suburban" or "sprawl" are often lacking many of the characteristics of 20-minute neighborhoods and have higher traffic fatality rates compared with more compact areas, even after accounting for exposure[viii].[87] [88] Characteristics of sprawl include: "a population widely dispersed in low-density residential development; rigid separation of homes, shops, and workplaces; a lack of distinct, thriving activity centers, such as strong downtown or suburban town centers; and a network of roads marked by very large block size and poor access from one place to another".[89]

Neighborhoods that are more walkable can provide alternative forms of transportation, which can limit the amount of collisions simply through the fact that when people drive less, they are less likely to be involved in a collision.[90] Increased congestion can impact collisions through increasing the frequency of collisions, but due to slow speeds, the fatalities will be limited. However, reduced density of cars will allow them to travel faster, and could increase the number of fatal collisions.[91]

Pedestrians are more likely to be involved in a collision with increased vehicle flow.[92] [93] Risk of injury for child pedestrians is strongly associated with vehicle volume.[94] However, increased pedestrian and bicyclist flow is associated with decreased risk to pedestrians and bicyclists,[95] [96] possibly due to altered driver behavior when pedestrians and bicyclists are more common.[97] [98]

However, it has been noted that residential unit density and population density are associated with increased collisions[99] and increased pedestrian-vehicle collisions.[100]

In 2008, there were five fatalities from motor vehicle collisions in Eugene - one bicyclist, one pedestrian, and three motor vehicle occupants (**Table 11**). Because the number of bicycle and pedestrian trips would increase with the development of 20-minute neighborhoods and the investment in more and better bicycle and pedestrian infrastructure, it is possible that these factors would lead to an increase in the number of pedestrian- and bicycle-vehicle collisions. However, the overall risk of collisions for bicyclists and pedestrians would decline, so it would be safer for each

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[viii] "Because pedestrian fatality rates depend on the amount of walking," the authors adjusted for exposure from walking.

individual bicyclist and pedestrian than it was before. Current trends in Portland, OR and in New York City, NY indicate that as bicycle ridership increases, the number of collisions (in addition to the rate) may be holding steady or decreasing.[101] [102]

Table 11: Fatalities and Injuries from Motor Vehicle Collisions in Eugene, 2004-2008

Year	Bicyclists		Pedestrians		Motor Vehicle Occupants	
	Injuries	Fatalities	Injuries	Fatalities	Injuries	Fatalities
2008	70	1	25	1	978	3
2007	56	2	23	2	1014	1
2006	60	0	29	1	911	4
2005	86	1	36	5	740	2
2004	53	2	19	0	428	1

Data from Oregon Department of Transportation Traffic Crash Summaries 2004-2008.[103]

Air Pollution

In a study of King County, Washington, researchers found that a 5% increase in walkability (based on mixed use, connected streets, high residential density, and pedestrian-oriented retail) was associated with a per capita 6.5% fewer vehicle miles traveled (VMT), 5.6% fewer grams of nitrogen oxides emitted, and 5.5% fewer grams of volatile organic compounds emitted.[104] People living in more walkable neighborhoods drove less and produced less air pollution than people living in less walkable neighborhoods.[105]

With increasing population density, diversity (here used as a measure of population/employment mix), and accessibility, VMT decreases.[106] A significant inverse relationship exists between vehicle emissions and household density and street connectivity.[107] By reducing VMT and vehicle emissions, these 20-minute neighborhood characteristics also reduce air pollution.

Increases in pollutants such as nitrogen dioxide (NO_2) and fine particulate matter (PM) have been associated with cardiopulmonary mortality.[108] [109] NO_2 has been linked to increased risk of lung cancer and non-accidental mortality,[110] and fine PM has been linked to all-cause and lung cancer mortality.[111] Decreases in fine PM are associated with increased life expectancy[112] and decreases in chronic coughing and phlegm, wheezing, and dyspnea.[113] See "Biodiesel" on pages 45-46 for more information about the effects of particulate matter on health.

In 2002, 62% of nitrogen oxides and 5% of particulate matter was attributable to on-road vehicles in Lane County (**Table 12**). Increasing the amount people walk and bike while simultaneously decreasing the amount they drive through the development of 20-minute neighborhoods will lower the current levels of these detrimental pollutants. Reducing pollution levels will become increasingly important to Eugene as new air quality standards are introduced.

Table 12: Percent of Selected Air Emissions that Come from On-Road Vehicles in Lane County, 2002

Emissions	Percent
Carbon Monoxide	68
Nitrogen Oxides	62
Volatile Organic Compounds	27
Particulate Matter	5
Sulfur Dioxide	19

Data from US Environmental Protection Agency, 2002.

Other Considerations

Building connected street networks requires the use of more concrete, asphalt, and other building materials. Although some of the negative impacts of increasing paved surfaces may be offset by the use of pervious paving materials, the production of both pervious and impervious materials is accompanied by greenhouse gas emissions. An increase in the use of these materials will result in negative health effects somewhere in the world, if not in Eugene.

While a connected street network designed for all users may support increases in pedestrian and bicycle trips, a network of pedestrian and bicycle infrastructure could also be developed separate from a network that accommodates cars. In this case, it may be possible to use fewer materials and still create a supportive environment for active transportation.

Urban design is a critically important factor in whether or not a 20-minute neighborhood is truly supportive of pedestrians and bicyclists. The Task Force on Community Preventive Services systematically reviewed and evaluated studies that "assessed the relationship between the perceived environment and physical activity practices, or effectiveness in providing a more inviting and safer outdoor environment for activity".[114] From the six studies ultimately assessed, the "median improvement in some aspect of physical activity (e.g., number of walkers or percent of active individuals) was 35%." Community-scale and street-scale urban design and land use policies were both found to affect physical activity. Effective design features include: improved street lighting; infrastructure projects to increase safety of street crossing; use of traffic calming approaches (e.g., speed bumps, traffic circles); enhancing street landscaping".[115]

Objective 2: Increase density around the urban core and along transit corridors

Priority Action 3: Zone future commercial and high-density residential uses in and around the urban core, and along EmX and other high-capacity transit corridors to accommodate future urban growth.

a. *Coordinate with opportunity siting and infill compatibility standards planning efforts.*

The policy actions included in Objective 2 address characteristics of the built environment, such as population and residential density, mixed-use neighborhoods, and public transit. The health benefits of these types of changes to Eugene neighborhoods are discussed in Objectives 1, 4 and 5 and include increased physical activity, decreased air pollution, and decreased collisions.

Other Considerations

While all residents in Eugene will likely benefit from changes that encourage urban density, a mix of affordable housing, retail services and employment centers, and access to public transit, vulnerable populations,[ix] such as older adults and low-income residents, will especially benefit from these changes. However, increased density may also affect health through an increase in the urban heat island effect.[x] Older adults are especially vulnerable during heat waves, so there is a chance that increasing density may adversely impact them and other vulnerable populations if accompanying measures to reduce the heat island effect are not taken.[116] These measures may include increasing tree, vegetation, and green space coverage and green roofs as well as the use of permeable pavement materials where possible.

Vulnerable Populations

Improving access to public transit can have a positive impact on low-income residents in Eugene, especially if transit access is linked to affordable housing. Low-income families in the United States spend a disproportionate amount of their income on transportation. In a recent study of working families (with a yearly income of $20,000-$50,000) in 28 metropolitan areas, the families spent 57.3% of their income on housing and transportation. This is nearly 10 points higher than the 47.6% of yearly income that all households in the study areas spent on transportation and housing combined.[117] If affordable housing were linked to better public transit, low-income residents would not need to spend as much on transportation.

A national survey found that African Americans and Hispanics use public transit or walk to travel to the doctor more than Whites do (16.5%, 24.0%, and 3.5% of respondents, respectively).[118] With a better mix of services near affordable housing, low-income residents and transit-dependent populations would not need to travel as far to reach services they need, further reducing the burden of transportation expenses. Given Eugene's relatively high level of poverty and the relatively low

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[ix] "The Agency for Health Care Research and Quality defines vulnerable populations as those who are made vulnerable by their financial circumstances or place of residence, health, age, personal characteristics, functional or developmental status, ability to communicate effectively, and presence of chronic illness or disability" (Dorsey, C. and Murd, C. (2003). The theory of self-care management for vulnerable populations. *Journal of Theory Construction and Testing*, 7(2), 43-49.)

[x] As an area develops and vegetation is replaced by impervious surfaces, such as buildings and driveways, these areas become warmer than surrounding areas that are less developed.

median incomes of Eugene's Hispanic and Black and African American households, it is important that any policy to increase density also promotes affordable housing and density in the right places to ensure low-income households are not priced out of the most livable neighborhoods.

Over the next 30 years, the population in Lane County will include an increasing percentage of older adults. The number of adults 65 years and older is expected to increase by 133% between 2000 and 2040. During that same time period, the population of 0-19 year olds is expected to increase by 19%, and the population of 20-64 year olds is expected to increase by 38%. Lane County is projected to have over 100,000 residents who are 65 years or older by 2040. In 2000, adults 65 years and older were 13% of the population, and by 2040 they will represent 21% of the population.[119]

A report that looked at the transportation patterns of older adults (age 65 and older) found that more than one in five older adults in America do not drive personal vehicles for reasons including declining health, concern over safety, and lack of a car. Additionally, over 50% of older adults who do not drive stay home simply because they do not have transportation, this is especially true of residents of sprawling or rural communities, households without a car, and persons of color. Compared with older adults who do drive, older adults who do not drive make 15% fewer trips to the doctor, 59% fewer shopping trips, and 65% fewer trips for social, family, and religious activities.[120] This can have a large impact on the social support older adults have available to them, their nutrition, and how they maintain their health.

Increasing density around the urban core and along transit corridors may benefit the health of Eugene residents, particularly those who are part of a vulnerable population. Measures to mitigate possible negative effects of density should be put in place in order to maximize health benefits.

Objective 4: Continue to expand and improve Eugene's bicycle and pedestrian infrastructure and connectivity to increase the percentage of trips made by bike and on foot.

Priority Action 5: Create a pedestrian and bicycle master plan that will:

a. *Identify the mobility gaps in the bicycle and pedestrian transportation system.*
b. *Recommend improvements to increase safety (both real and perceived), comfort, speed, and convenience for users of all ages and skill levels.*
c. *Create a plan for implementing the necessary system improvements.*
d. *Identify funding sources for implementation*

Priority Action 6: Increase the mileage and connectivity of bicycle boulevards and shared-use paths to encourage cyclists of various skill levels to commute by bike.

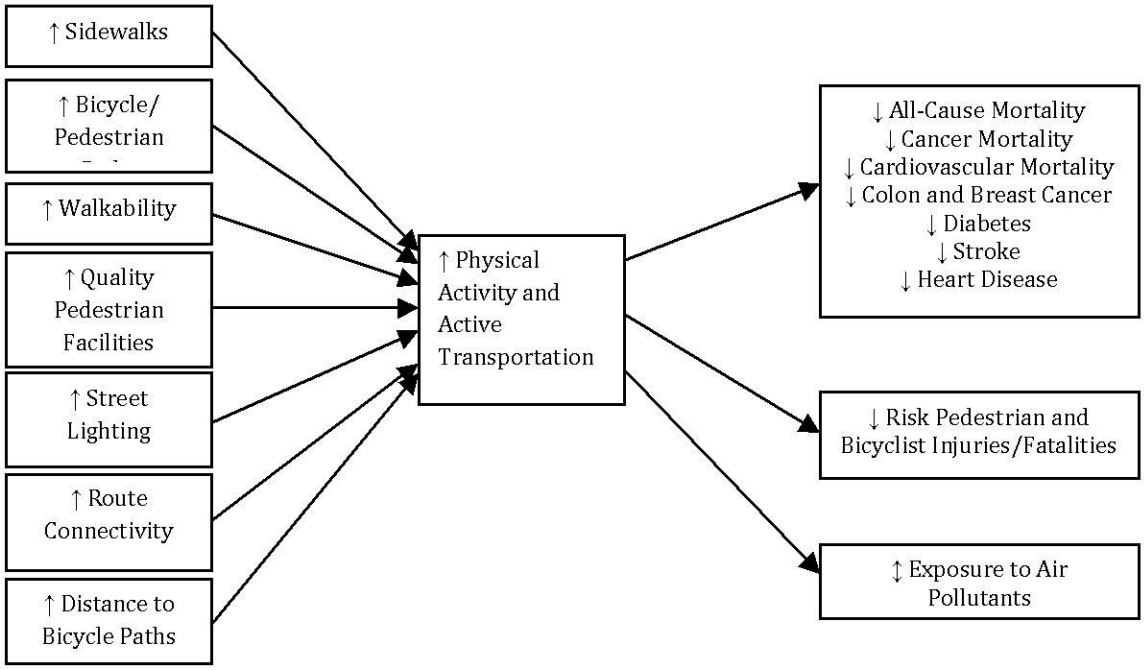
Although many daily trips are within walking and biking distance, most Americans prefer to use their personal vehicles to reach destinations. According to data collected in Eugene from 2006-2008, 7.1% of adults rode their bike to work, and 6.4% walked to work; the vast majority of adults traveled to work in a car.[121] Work commute data is often used as a proxy to represent overall pedestrian and bicyclist transportation choices. While distance is an important factor in determining whether an individual will use an active form of transportation or drive a car, another very important factor is the type of environment that they must ride their bike or walk through. Roads without sidewalks or wide shoulders are prohibitive to walkers and bicyclists. Busy roads can be discouraging, especially if crossing signals are not frequent. Large highways and freeways can make it very difficult, if not impossible, for pedestrian and bicyclist traffic to cross from one area to another.

Other countries have been successful in achieving high rates of walking and bicycling, largely due to policy changes similar to those associated with Objective 4 (Priority Actions 5 and 6). The Netherlands and Germany have both worked to improve infrastructure for pedestrians and bicyclists. For pedestrians, that has included: extensive auto-free zones that cover much of the city center; wide well-lit sidewalks on both sides of every street; pedestrian refuge islands for crossing wide streets; clearly marked crosswalks, often raised and with special lighting for visibility; and pedestrian activated crossing signals. For bicyclists the network of bike paths and lanes has been greatly expanded; a truly coordinated network of bicycle paths, lanes, and streets for both rural and urban areas has been developed; bike paths serve practical as well as recreational destinations; special bike turn lanes lead directly to intersections. Bicycle infrastructure also includes: separate bike signals with advance green lights for cyclists; bicycle activated traffic signals; modified street networks that create deliberate dead ends and slow, circuitous routing for cars but direct, fast routing for bikes. As a result, compared to the United States, Germany and The Netherlands have reduced collisions and have higher rates of walking and cycling, especially among older adults.[122]

In the Lane metropolitan area in 2004 the ratio of bikeway miles (both off and on street) to arterial and collector miles (excluding freeways) was 59%.[123] The 2002 Regional Transportation Plan reported that 58% of roadway miles had sidewalks, but this figure was not updated for the 2007 Regional Transportation Plan. These ratios suggest that there is an opportunity for Eugene to

greatly improve its bicycle and pedestrian infrastructure. Roads without sidewalks will be prohibitive to pedestrian travel, and the low ratio of bike miles to street miles means that bicyclists may have a difficult time choosing a route that feels safe. **Figure 3** summarizes the effect that good pedestrian and bicycle infrastructure will have on health. These pathways are discussed in greater detail below.

Figure 3: Pathway Between Pedestrian and Bicycle Infrastructure and Health



Physical Activity

Evidence suggests that sidewalks and bicycle paths increase the number of walking and cycling trips. When sidewalk continuity is used as one of the criteria for determining neighborhood walkability, highly walkable neighborhoods have higher rates of walking and cycling. In one study, better pedestrian facilities were related to higher pedestrian rates at commercial centers, even when other environmental characteristics were constant. Another study found that better pedestrian infrastructure, including sidewalks and street lighting, was related to greater non-automobile travel.[124]

The existence of sidewalks and the strong connectivity of routes/network are positively correlated with walking for transportation. Greater street connectivity generally means more direct routes and thus shorter distances from home to potential destinations. Street connectivity might also affect walking by expanding the choice of routes, providing variety in routes within the neighborhood or to destinations.[125] See page 24 and the Appendix for more discussion of street connectivity.

The perceived presence of sidewalks has been associated with participating in sufficient levels of physical activity among women, mixed samples, and older adults. The perceived presence of footpaths has also been found to be the most important neighborhood correlate of meeting

recommended levels of physical activity among higher income earners.[126] Presence of sidewalks has been found to be associated with walking for transport.[127] An accessible bike path is positively associated with physical activity, distance to a bikeway is negatively associated with physical activity, and safe footpaths are positively associated with physical activity.[128]

The Community Guide from the Task Force on Community Preventive Services determined that there was sufficient evidence that street-scale and community-scale urban design, such as safe and attractive pathways to reach destinations, bike lanes, and traffic calming, can be effective in increasing walking and bicycling.[129] See "Other Considerations" on page 27 for more information on community design and health.

Vulnerable Populations

Safe and accessible pedestrian and bicycle infrastructure can be important for vulnerable populations. Older adults, children and disabled persons are often dependent on forms of transportation other than a personal vehicle. Due to our automobile-dominated transportation system, these groups face a disproportionate burden of limited access to places in the community.[130] However, in other countries, older adults are much more likely to use active transportation for their travels; among Dutch older adults, bicycling accounts for 25% of all trips made.[131]

Low-income populations are also more dependent on other forms of transportation besides a personal vehicle. One in ten residents of Eugene does not own a car[132] and would greatly benefit from enhanced pedestrian and bicycle infrastructure.

In general, the literature supports a positive association between the presence and condition of sidewalks and children's physical activity. The literature does not provide strong evidence for bike paths and children's activity levels.[133]

Collisions

Increased pedestrian and bicyclist flow is associated with decreased risk to pedestrians and bicyclists,[134] [135] possibly due to altered driver behavior when pedestrians and bicyclists are more common.[136] [137] A study conducted by Jacobsen utilizing data from California, Denmark, The Netherlands, the United Kingdom, and several other European countries showed that the risk per bicyclist and pedestrian decreased with increasing numbers of bicyclists and pedestrians, and bicyclists and pedestrians were safer in towns where bicycling and walking were more common.[138] A study from Australia showed that when bicycling doubled, the risk of fatality and injury per kilometer fell by 34%, and when bicycling decreased by 50%, the risk per kilometer was 52% higher.[139]

A study conducted in Canada found that pedestrian risk decreased with increasing pedestrian flow, but the study cautioned that if promotion of walking is not accompanied by infrastructure that creates a safe environment for walking, increasing pedestrian flow could lead to more collisions involving pedestrians.[140] However, as mentioned in the "Collisions" section of the analysis of Objective 1, recent reports from Portland, OR and New York City, NY indicate that the increasing

number of cyclists in the last several years has not generated the expected increase in the number of collisions.[141] [142]

Air Pollution

Although it is possible that bicyclists and walkers could be exposed to higher levels of pollution in compact urban areas due to the high volume of vehicle traffic,[143] it is still possible that people choosing active transportation are not exposed to higher levels of pollutants compared to people in cars. A study conducted in Copenhagen, Denmark found that car drivers were exposed to higher levels of benzene, toluene, ethylbenzene, and xylene compared to bicyclists during morning hours.[144] Another study conducted in Amsterdam found that the uptake of carbon monoxide, benzene, toluene, and xylene was roughly the same for drivers as it was for bicyclists, although the uptake of nitrogen oxides was higher for bicyclists.[145]

Recently, researchers in the Netherlands modeled the effects of a shift of 500,000 people from making short trips by car to making those trips by bike instead. They found the reductions in all-cause mortality for those who "shift from car to bicycle use for short trips" to be substantially larger than the "potential mortality effect of increased inhaled air pollution doses" and the "effect on traffic accidents".[146]

Researchers at Portland State University are currently examining how roadway barriers (including sound walls) between motor vehicle and bicycle traffic affect cyclists' exposure to ultra-fine particulate matter.[147]

A reduction in all travelers' intake of air pollutants is important, regardless of the mode of transportation. Promoting the use of active transportation instead of personal vehicles should lower the vehicle volume and lower the levels of air pollution for everyone.

Other Considerations

Increasing the connectivity of pedestrian and bicycle networks in Eugene is also likely to increase residents' connection to transit, the benefits of which are discussed in Objective 5.

As with several other objectives, urban design will play an important role in how well new bicycle and pedestrian infrastructure investments will support increased physical activity. See page 27 for information about "The Community Guide to Preventive Service" – a review of evidence-based urban design features that have been proven to support physical activity.

Even as more climate change mitigation and adaptation strategies are implemented locally and across the world, temperature increases already underway will still affect pollution levels and water levels. Therefore, investments in pedestrian and bicycle infrastructure should be carefully located to avoid likely areas of flooding and should be supported by landscaping and other features that may limit pollution exposure.

Priority Action 7: Create a "Complete Streets" policy that requires all new transportation projects and rehabilitation projects to incorporate bicycles, pedestrians, and mass transit service.

Implementing a complete streets policy means that streets will be designed with all users – such as pedestrians, bicyclists, vehicles, public transit riders, children, older adults, and disabled people – in mind. Although there is no single standard set of criteria defining a complete street, many of them will share common elements, such as sidewalks, bike lanes, bus lanes, multiple crossing areas, and audible pedestrian signals.[148] Streets that are designed only for vehicles are often not friendly to other users and can limit the movement of vulnerable populations, such as children, older adults, and disabled persons.

Physical Activity

Benefits to health will be similar to those discussed for Priority Actions 5 and 6, but a complete streets policy is also likely to benefit vulnerable populations especially.

Vulnerable Populations

Children are most likely to have the opportunity for active transportation when going to and from school. However, parents report that traffic danger is the factor that mostly often prohibits their children from walking or biking to school; long distances is the second most common reason reported by parents.[149] Streets without sidewalks or with heavy traffic can be significant barriers to children's active transportation, leading children instead to ride a bus or get a ride from their parents, despite walkable or bikeable distances. Children that walk to school are more physically active overall compared to those who travel to school by car.[150] In Australia, parental concerns about walking and biking safety were negatively associated with 10-12 year old children walking or biking to nearby destinations.[151]

Collisions

As with physical activity, health benefits from reduced collisions will be similar to those discussed for Priority Actions 5 and 6, with extra benefits for vulnerable populations.

Vulnerable Populations

Parental concern about the safety of children as pedestrians is not unfounded; in 2007, 20% of children 9 years or younger and 15% of children 10-15 years who were killed in traffic collisions were pedestrians.[152] Further, children that report having difficulty with traffic (e.g., missing sidewalk/path, do not know when it's safe to cross, insensitive/unaware drivers) have a higher risk of collisions than those who do not report difficulties.[153]

Older adults also share an excess burden of pedestrian-related collision fatalities. Adults aged 70 years and older accounted for 16% of all pedestrian fatalities. For pedestrians 70 years and older, the fatality rate is higher than any other age group: 2.66 per 100,000 population.[154] Designing streets with all users in mind will positively impact older adults, since they have different needs compared to other groups.

Risk of pedestrian-vehicle collisions are higher for older adults at crosswalks that are marked but do not include a traffic signal or stop sign than those that have a signal or sign.[155] Older adults in

Connecticut who had difficulty crossing the street reported that they had insufficient time to cross and difficulty with right-turning vehicles. In addition, less than 1% of older adults 72 years and older had a walking speed of at least 4 feet/second, the speed usually used to determine crossing times at intersections.[156] Older adults may take longer to cross streets; therefore very wide streets are less accessible and may not provide enough crossing time. Often, public transit stops do not provide a place to rest while waiting.

Not having an accessible built environment can limit the mobility of older adults and confine many of them to their homes. Focus groups conducted in Portland, Oregon indicated that traffic and pedestrian infrastructure and neighborhood attractiveness influenced the physical activity of older adults.[157] Slow traffic and good pedestrian infrastructure were important for older adults to feel walking was a safe activity in their neighborhoods.

Even with pedestrian infrastructure provided, the streets may still not be accessible for people with disabilities. People with physical disabilities have been found to be more likely to participate in leisure time physical activity if they live in areas with features that support active living, including activity-friendliness (e.g., street connectivity, park benches, and walking paths), density of destinations, and safety.[158] However, even when neighborhoods are accessible for the general population, there might still be barriers for people with visual or motor impairments. Disabled populations have reported problematic sidewalk pavement and puddles or poor drainage as barriers to physical activity in their otherwise accessible environment.[159]

Air Pollution

Here again, Priority Action 7's air pollution-related health benefits will be similar to those of Priority Actions 5 and 6.

Objective 5: Increase the supply of frequent, reliable, integrated and convenient public transit

Priority Action 8: Diversify funding sources for Lane Transit District (LTD) to increase the long-term reliability of service.

a. *Partner with Springfield, Lane County, LTD, and businesses to develop strategies for providing mass transit for the Eugene community.*

Priority Action 9: Align City of Eugene Transportation System Plan and LTD Long Range Transit Plan to integrate bus routes into the broader alternative transportation system.

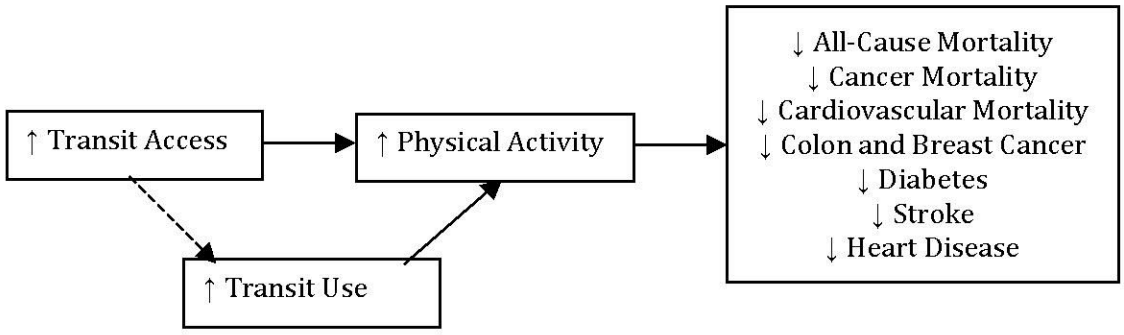
a. *Partner with LTD to help inform service changes and improvements.*
b. *Create special setbacks along future Bus Rapid Transit (BRT) or other mass transit corridors to accommodate future right-of-way expansion.*
c. *Work with LTD in developing the Long Range Transit Plan to determine the role of mass transit in accomplishing greenhouse gas emission reduction goals.*

Policy Action 10: Invest in transit infrastructure that meets future access and mobility needs while consuming less fossil fuel. Recommended actions include:

a. *Maximize electrification of the regional transportation system.*
b. *Increase use of hybrid vehicles, including buses and other heavy vehicles.*

In Eugene, data from 2006-2008 showed that only 6.8% of workers 16 years and older used public transit to commute to work (US Census Bureau, 2006-2008). On average in 2008, each resident of the Eugene metropolitan area used public transit 43 times per year.[160] Increasing the number of Eugene residents that use public transit can have a positive impact on health. **Figure 4** shows the relationship between public transit and health and is discussed in detail below.

Figure 4: Pathway Between Transit Access and Health



Physical Activity

As mentioned earlier in the "Physical Activity" portion of the Objective 1 analysis, transit use is associated with walking, often enough to meet public health recommendations for physical

activity.[161] [162] [163] [164] [165] [166] In a study examining individuals' body mass index (BMI)[xi] and physical activity before and after the completion of a light rail transit (LRT) system in Charlotte, NC, researchers found that those using the LRT to commute to work experienced, on average, a 1.18 decline in BMI. LRT commuters also reduced their odds of becoming obese over time by 81%.[167]

Increasing access to public transit may not be enough for the community to realize the most health benefits. Individual perception of transit access often does not correspond with measured objective access; simply increasing public transit access to Eugene neighborhoods will not increase physical activity if the perception of low access remains. If residents believe that public transit is not an option because it is not "accessible," they will not use the services provided. Positive perception of good transit access has also been found to be directly associated with physical activity.[168] [169] [170] [171] [172]

In 2002, 88% of households in the Eugene metropolitan area lived within ¼ mile of a public transit stop,[173] but a low proportion of the Eugene population takes advantage of public transit. The relatively low use of public transit could be related to residents perceiving they have little access to public transit or it could reflect infrequent, less dependable service that is less useful for residents to use, regardless of their proximity to a transit stop.

Vulnerable Populations

Public transit can be very important for vulnerable populations, such as older adults, children, low-income residents, and people with disabilities. In general, these groups are less independent and have limited individual transportation options. Older adults may feel unsafe driving at certain times of the day, or they may no longer operate a vehicle. Children are restricted to receiving rides from others or using active forms of transportation to reach destinations of interest. Low-income residents may not have the resources to pay for a personal vehicle and the costs associated with individual driving, and people with disabilities are more likely to be restricted in their use of personal vehicles as well. All of these groups would benefit from increased access to public transit and improved transit service; these changes would provide them with more options for traveling within and remaining connected to their neighborhood and community.

Collisions

Compared to driving, taking transit is generally safer.[174] Nationally, "the fatality rate (standardized by passenger miles) for bus riders in 2003-2005 was only 2.8% of the fatality rate for automobile drivers".[175] However, non-collision injuries on transit can have important health effects and are discussed in more detail in "Other Considerations."

Air Pollution

See Objective 8 for a discussion of the health benefits of electric, hybrid, and alternative fuel vehicles.

[xi] Body mass index is a measure of weight that takes a person's height into account. BMI is calculated by dividing a person's weight in kilograms by his or her height in meters squared. Obesity is defined as a BMI of 30 or greater, and overweight is defined as 27.3 or 27.8 for women and men, respectively.

Other Considerations

For many households, increased reliability of transit service would also decrease transportation expenditures, as more trips are made convenient via bus. As less of the household budget is spent on transportation, these households may experience less stress and have more resources to meet their daily needs.

Non-collision injuries and fatalities are more prevalent with transit use than with other modes. Injuries are most likely to occur during boarding or when the bus accelerates or decelerates.[176]

Vulnerable Populations

A recent analysis of bus collisions using data from Portland, OR, found "a positive association between lift usage and the expected frequency of non-collision incidents, suggesting that customers with disabilities face a relatively greater safety risk".[177] Improvements in lift mechanisms and securement devices should be considered in order to limit the risk of injury to vulnerable populations.

Objective 6: Expand outreach, marketing and education regarding climate-friendly transportation alternatives

Priority Action 11: Increase promotion of bicycling, walking, mass transit, car-pooling, telecommuting, high-occupancy vehicles, and emergency ride home as attractive alternatives to driving in order to increase the mode share of alternatives to the single-occupant vehicle. Partner with Point 2 Point Solutions, Lane Transit District, Greater Eugene Area RiderS (GEARS), BikeLane Coalition, local businesses, the City of Eugene Smart Trips program, Safe Routes to School, Lane Coalition for Healthy Active Youth, Lane County Public Health, Climate Masters at Home™, and others.

Priority Action 12: Increase the community's understanding of fuel-efficient driving techniques.

Changes made to Eugene neighborhoods, such as designs that support the creation of 20-minute neighborhoods and increased access to public transit, will be valuable alterations to the community and benefit the health of Eugene residents. However, as mentioned in the discussion of Objective 5, it is possible that making these changes alone will not be enough to encourage Eugene residents to use the new amenities or services. It might be necessary to promote changes, such as new bicycle routes or increased public transit service, to inform Eugene residents of the available transportation options beyond the personal vehicle.

Physical Activity

Often, policy changes that are supported by programs and promotion of these changes can increase the use of alternative forms of transportation. A project to increase active transportation in Jackson, Michigan used active living promotion and programs. Promotion techniques included a website and quarterly newsletter, use of billboards, press releases, and events like "Smart Commute Day" and "Walk to School Day." The project generated more walking and biking trips and increased the number of students walking to school.[178] Another promotion project in Omaha using marketing campaigns, community-wide media campaigns, and a social marketing toolkit for businesses resulted in more residents having explored parts of Omaha on foot as well as an increase in participation in the Bicycle Commuter Challenge.[179]

A Bike to Work Week was initiated in Victoria, British Columbia in 1995. Despite having about 500 participants, the event failed to motivate potential bicyclists who were the true target of the event. Organizers worked on recruiting bicycling team captains from individual workplaces to help promote bicycling. The result was that Bike to Work Week grew from 1075 participants in 1998 to 6446 participants in 2008.[180]

A UK intervention promoting active transportation to work titled "Walk In to Work Out" was successful in increasing the amount of commute-related walking but not in increasing the amount of cycling. The intervention included a booklet with information on choosing routes, maintaining personal safety, shower and safe cycle storage information, and useful contacts. Additionally, an activity diary, workplace map, distances from local stations, local cycle retailers and outdoor shops, contacts for relevant organizations, local maps, and reflective safety accessories were included. Participants increased their amount of walking through various means, like getting off the bus a stop early, using public transit more, and parking further away from destinations.[181]

In 2007, the Oregon Department of Transportation used individual marketing to promote environmentally friendly modes of travel in Eugene. Households received tote bags containing information materials, such as bus schedules specific to each household. An increase in walking, bicycling, and public transit was seen, and a simultaneous decrease was seen in car trips. Mobility did not decrease as a result of the transportation mode shift; cars were used for fewer trips, while active transportation trips increased.[182]

A review of four interventions that targeted travel behavior, in a motivated subsample of the population or by using tailored information, showed that the interventions were successful in increasing the amount of active commuting. For example, the "Walk In to Walk Out" materials were used in Scotland and resulted in more time spent walking to work among participants. Another program called "TravelSmart" targeted households interested in changing their behavior and provided tailored resources. Results from England and Australia showed that households shifted between 3.6%-5.5% of trips towards active transportation.[183]

It remains to be seen whether the behavior changes resulting from promotion are long lasting. However, if changes are made but not promoted to residents in Eugene, it is unlikely that many of the changes would be discovered on their own.

Other Considerations

Fuel-efficient driving techniques vary with technology. Currently, electric and hybrid vehicles are most efficient at slower speeds, while gas cars peak around 35-45 mph. As a result, the promotion of electric and hybrid vehicles (along with fuel-efficient driving techniques) may benefit motor vehicle, bicycle, and pedestrian traffic patterns by reducing overall vehicle traffic speeds, and thereby reducing fatalities.

Programs such as bike sharing, and facilities such as covered bike parking and end-of-trip showers will also make it easier for individuals to use bicycles for commuting and other trips. While some end-of-trip facilities will make it more convenient for individuals to continue to use active transportation methods even in inclement weather, education programs about how to safely and comfortably bike or walk in such weather should support these facilities.

Objective 7: Ensure maximum efficiency in current and future freight systems

Priority Action 13: Plan for efficient freight transportation that minimizes greenhouse gas emissions and fossil fuel consumption, and:

a. *Connects multiple modes (train, truck, van, car, bicycle);*
b. *Accommodates regional (upper Willamette Valley) commercial, industrial and agricultural freight needs; and*
c. *Facilitates efficient local deliveries.*

Freight movement in the United States, whether by trucks, trains, or ships, is largely powered by diesel fuel, a major source of particulate matter and nitrogen oxides, which combine with volatile organic compounds to form ozone.[184] Over the past 10 years, Lane County has exceeded the NAAQS threshold for particulate matter ($PM_{2.5}$) more than other counties in Oregon. Due to the land patterns in Lane County, the air pollutants frequently remain trapped in the Willamette Valley, especially in colder months due to more frequent temperature inversions.[185] Since the land topography traps pollutants in the valley, it becomes even more important to control the emissions from freight diesel in Eugene.

Table 13: Percentage of Monitored Days and Number of Person-days (in Thousands) During Which the Measured PM (2.5) Concentration Exceeded the NAAQS of 35 mcg/m³ in Lane County

	1999	2000	2001	2002	2003	2004	2005	2006	2007
Percent	5.0	7.9	9.6	7.1	5.5	4.7	10.1	4.8	7.4
Person-days	5792	9381	11359	8502	6598	5632	8028	2027	3092

Source: http://www.oregon.gov/DHS/ph/epht/docs/airrep.pdf

The air quality of the Eugene-Springfield area differs significantly from the measurements for all of Lane County, though. In 2009, the Environmental Protection Agency designated Oakridge a non-attainment area for the national standards for 24-hour $PM_{2.5}$.[186] Because Oakridge's $PM_{2.5}$ concentrations are included in the general county figures in **Table 13**, the table is valuable primarily as a comparison to Eugene (see **Table 14** for Eugene-Springfield measurements).

Table 14: Percentage of Monitored Days and Number of Person-days (in Thousands) During Which the Measured PM (2.5) Concentration Exceeded the NAAQS of 35 mcg/m³ or Measured Ozone Concentration Exceeded the 2008 NAAQS of 75 ppb Willamette Valley Portion of Lane County*

		2001	2002	2003	2004	2005	2006	2007	2008	2009
Particulate Matter	Percent	1.9	1.9	0.8	0.8	2.5	1.6	2.5	0.3	3.0
	Person-days	2195	2209	950	962	2609	1959	2968	331	3663
Ozone	Percent	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0
	Person-days	0	0	988	0	0	0	0	0	0

*Includes Eugene-Springfield area.
Source: www.lrapa.org [Lane Regional Air Protection Agency]

Air Pollution

Currently, Eugene meets the Environmental Protection Agency standards for particulate matter$_{2.5}$ and ozone. Using particulate matter$_{2.5}$, ozone, and carbon monoxide data, in 2009 the Eugene-Springfield area had eight days when the air quality was unhealthy for sensitive populations and

one day when the air quality was unhealthy for the general public. The current goal is to lower diesel emissions to 50% of 2010 levels by 2030, partially through improvements in freight efficiency. This will have a profound impact on the health of Eugene residents.

Ground-level ozone is also known as smog and can cause respiratory irritation, compromised respiratory function, aggravated asthma, increased susceptibility to respiratory illness (e.g., bronchitis and pneumonia), and permanent lung damage with prolonged exposure.

A study conducted by Bell and Dominici found that a 10 ppb increase in daily average ozone was associated with a 0.52% increase in mortality.[187] If current freight ozone levels are reduced, one can expect a corresponding increase in life expectancy.

Particulate matter causes respiratory health effects similar to those caused by ozone, and particulate matter also contributes to irregular heartbeat, nonfatal heart attacks, and premature death for people with heart or lung disease. Particles under 10 μm in diameter are the most problematic, because they can enter lung tissue and possibly even the blood stream.[188]

A recent analysis found that a decrease of 10 $\mu g/m^3$ of $PM_{2.5}$ was associated with an increase in life expectancy by 0.61 years. If current freight $PM_{2.5}$ levels are reduced, one can expect a corresponding increase in life expectancy.[189]

Vulnerable Populations

Populations at highest risk for the adverse effects of ozone include children, adults with lung diseases (e.g., asthma), and those working or spending leisure time outdoors.[190] Particulate matter and Ozone exposure is related to the development of asthma in children as well as children's hospitalization for asthma and other respiratory emergencies.[191] Exposure to particulate matter has been linked to increases in pre-term birth and increases in infant mortality.[192] [193]

Objective 8: Increase the use of low-carbon vehicles and fuels to improve overall fuel-efficiency and reduce vulnerability to fluctuating oil prices.

Priority Action 14: Accelerate the transition to plug-in hybrids and electric vehicles. Partner with Lane County, EWEB, auto retailers, electrical contractors, UO, LCC, and others.

a. *Support the installation of a network of electric car charging stations.*
b. *Require installation of electric car charging stations in new multifamily housing.*
c. *Use guidance provided by the University of Oregon Electric Vehicle strategy.*

Altering the built environment (by, for example, creating 20-minute neighborhoods or enhancing the bicycle infrastructure) can help reduce air pollution and time spent driving. Changing the vehicles that people drive can also reduce air pollution, by replacing gasoline-powered vehicles (with their attendant emissions) with electric vehicles. Installing electric car charging stations could increase the feasibility of using electric vehicles in Eugene, and an increased use could have positive effects on the health of residents.

The potential for plug-in hybrid electric vehicles and battery electric vehicles to achieve large-scale greenhouse gas (GHG) emission reductions is highly dependent on the energy source of electricity production. For example, battery electric vehicles eliminate local air pollution, but this pollution may just be displaced to another area. Therefore, it's important to consider simultaneous policies that encourage charging with low-carbon electricity. For example, although 3% of the resources used by the Eugene Water and Electric Board to supply electricity come from coal, 24% of the resources used by Portland General Electric to supply electricity come from coal.[194] [195]

Although the power source is important, often the source of electricity is a cleaner source than gasoline. Therefore, compared with conventional vehicles, plug-in electric hybrid vehicles can reduce GHG emissions by 32%, but the reductions are small compared with traditional hybrid vehicles.[196][xii] A study focusing on carbon dioxide (CO_2) emissions alone found that plug-in electric hybrid vehicles have lower emission rates than conventional vehicles and hybrid electric vehicles. Replacing inefficient coal plants with facilities that have lower emissions of CO_2 would also result in CO_2 reduction.[197]

Assuming a 40% market penetration and 50% of new car sales of plug-in hybrid electric vehicles by 2030 in the United States, a report compiled by Electric Power Research Institute showed that plug-in hybrid electric vehicles would lead to small improvements in air quality. When considering the electric and vehicle emissions together, volatile organic compounds (VOC), nitrogen oxides (NOx), and sulfur dioxides (SO_2) all decrease. While ozone also decreased for most areas in the country, 1% of the population was expected to see an increase in ozone levels. Particulate matter (PM) levels will increase, primarily through increased coal generation that was assumed for the electric sector. However, secondary PM is expected to decrease due to lower VOC and NOx emissions.[198]

[xii] A hybrid electric vehicle uses an internal combustion engine and an electric propulsion system. The electric system can be recharged through the combustion engine or through regenerative breaking technology. A plug-in hybrid electric vehicle's electric system can be recharged by plugging into the electric grid.

Air Pollution

It is likely that the air quality will improve in Eugene due to the use of plug-in electric hybrid vehicles, although further research should be conducted to ensure that pollution is not displaced to the areas with the power source.

Other Considerations

Although the increased use of plug-in hybrid electric vehicles and battery electric vehicles is likely to have health benefits in the Eugene area, adoption of these vehicles may be cost-prohibitive for many households. Programs to assist low-income households may be necessary to make it possible for these residents to consider transitioning to plug-in hybrid electric vehicles and battery electric vehicles.

Priority Action 15: Conduct research to understand what role biofuels can play in decreasing Eugene's vulnerability to energy markets. Work with partners at LTD, the Oregon Department of Energy, etc.

a. *Complete research by 2013 so that outcomes can inform the next CEAP.*

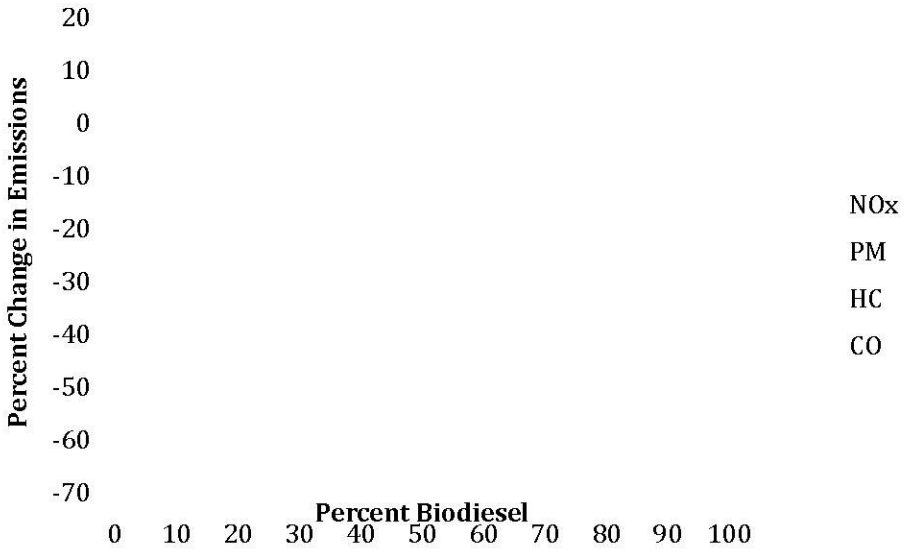
As natural resources become more difficult to obtain, ensuring that Eugene has renewable options for fuel sources is important. Biodiesel and ethanol are both viable options as renewable fuels and have the potential to impact the health of Eugene residents as well as decrease the dependency on foreign resources.

Biodiesel

From mobile sources, diesel-powered vehicles and equipment are important contributors to particulate matter and nitrogen oxides emissions.[199] [200] Biodiesel can be locally produced in Oregon from renewable sources, like oilseed crops, animal fats, and waste cooking oils.[201] Further, biodiesel has the potential to lower emissions when compared with conventional diesel.

A review conducted by the EPA found that particulate matter (PM) dropped by almost half when using 100% biodiesel (B100) and by 12% when using a diesel mix with 20% biodiesel (B20) (**Figure 5**). However, nitrogen oxides (NOx) increased by 2-4% with B20 and by 10% with B100.[202]

Figure 5: Change in Emissions from 20% Biodiesel Blend or 100% Biodiesel when Compared with Conventional Diesel.



NOx = Nitrogen oxides
PM = particulate matter
HC = hydrocarbons
CO = carbon monoxide
Source: US EPA, 2002

Results published after the EPA study (2002) showed that NOx change for B20 ranged from -10% to +6% and the average change was -0.6% (+/-2.0% 95% CI). NOx emissions appear to vary widely depending on the engine manufacturer and design. PM decreased by 14.1% in recent studies.[203] B20 likely has a negligible impact on NOx levels. However, the impact on PM, carbon dioxide (CO),

and total hydrocarbon (THC) is larger and B20 shows consistent reductions in these emissions for essentially all engines tested.[204]

Submicron particulates (particulates less than 1 um in diameter) are important to consider for health because smaller particulates can lodge deeper in lung tissue. Although both diesel and biodiesel were shown to emit the same size of particles, it has been shown that in comparison with petroleum-based diesel, biodiesel can reduce total number concentration of submicron particles by 24-42%.[205]

Particulate matter leads to respiratory problems, like irritation and coughing, compromises respiratory function, aggravates asthma, and leads to bronchitis, irregular heartbeat, nonfatal heart attacks, and premature death for people with heart or lung disease.[206] In addition, particulate matter has been associated with cardiopulmonary mortality,[207] [208] and fine particulate matter has been linked to all-cause and lung cancer mortality.[209] Decreases in fine particulate matter are associated with increased life expectancy[210] and decreases in chronic coughing and phlegm, wheezing, and dyspnea.[211] Decreasing the exposure of Eugene residents to particulate matter would positively impact their health through decreased respiratory problems.

Other Considerations

However, biodiesel is lower in energy concentration compared to conventional diesel. Animal-based biodiesel has 10.6% less energy content and plant-based biodiesel has 7.9% less energy content compared to conventional diesel. Energy content of fuel is a good predictor of relative fuel economy. Using biodiesel will reduce fuel economy, most likely within the ranges listed in **Table 15**.[212]

Table 15: Percent Reduction in Miles/Gallon

Fuel	Percent Reduction in Miles/Gallon
20% Biodiesel	0.9-2.1
100% Biodiesel	4.6-10.6

Source: US EPA, 2002

Ethanol

Ethanol or ethanol-blend fuels are also alternative options to conventional petroleum gasoline. Replacing conventional gasoline with a blend of 85% ethanol by volume and 15% gasoline may reduce tailpipe emissions of carbon monoxide and nitrogen oxides but may increase hydrocarbon emissions.[213] Blends with less ethanol by volume (3, 6, and 9%) emit less carbon monoxide, hydrocarbons, and nitrogen oxides (**Table 16**).[214]

Table 16: Change in Emissions from 3, 6, 9, and 85% Ethanol Blend, Compared with Conventional Gasoline

Fuel	Percent Change from Conventional Gasoline			
	E3	E6	E9	E85
Carbon Monoxide	-42	-86	-83	-22
Nitrogen Oxides	-35	-86	-77	-8
Hydrocarbons	-79	-98	-90	+12

Source: Lin, Chang, & Hsieh, 2010 and Zhai, Frey, Rouphail, Concalves, & Farias, 2009

However, an analysis on carcinogens emitted from both gasoline and ethanol fuels cautioned against replacing gasoline completely with ethanol fuel. Ozone-related mortality, hospitalizations, and asthma-related emergency room visits were all expected to increase with the use of E85.[215]

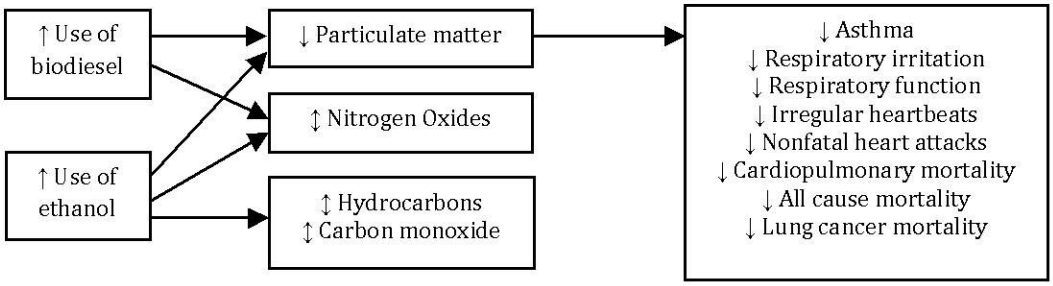
Ethanol-diesel blends offer another alternative to conventional diesel. Emissions tests with ethanol-diesel blends show fairly consistent results for reducing particulate matter emissions, although the impacts on carbon monoxide, nitrogen oxides, and total hydrocarbons are less conclusive and depend on the blends.[216] [217]

Vulnerable Populations

Low-income populations are more likely to live and go to school in places with higher traffic exposure. Lower-income neighborhoods have higher exposure to particulates than higher-income areas. Additionally, low-income neighborhoods with high particulate exposure were associated with an increased risk of death from non-accidental causes compared to high-income neighborhoods with low particulate exposure.[218] It is likely that low-income populations have higher exposure to diesel pollution in Eugene and will be more positively affected by any reductions in diesel pollution.

Overall, biodiesel is a promising alternative to petroleum diesel and may have positive impacts on the health of Eugene residents (**Figure 6**), primarily through the reduction of particulate matter. Ethanol fuel is more controversial but would likely lower levels of particulate matter as well.

Figure 6: Pathway Between Increased Use of Biofuels and Health



Other Considerations

Although the impact on air pollution is important, especially for populations that are exposed to high amounts of diesel exhaust (such as people living by freight corridors or near transit centers), it is also important to consider the other impacts of using fuels produced from food crops. If the entire corn and soybean crops in the US were devoted to the production of biofuels, their use would offset 12% of the gasoline and 6% of the diesel demand. However, these crops are major contributors to the food supply in the United States, and it is unlikely that the food supply would be unaffected if a large amount of these crops were devoted to producing biofuels.[219] Using an alternative to produce biofuels, such as agricultural residue like corn stover, might be a better option, since it will have less of an impact on the food supply.

Further considerations include whether the resources used to produce the materials for biofuels create more environmental problems, such as increased use of pesticides and fertilizers to grow the

crops needed for fuel production[220] and which biofuel is the most cost-effective to reduce emissions in Oregon.[221]

RECOMMENDATIONS

These recommendations suggest strategies to best improve the health of Eugene residents while decreasing greenhouse gas emissions in Eugene and the surrounding area.

Recommendation #1: Approve the Transportation and Land Use section of the Climate and Energy Action Plan in order to improve the health of Eugene residents.

This analysis shows that the Transportation and Land Use objectives in the draft CEAP have benefits for the public's health, and several of the objectives and priority actions are consistent with the Centers for Disease Control and Prevention's recommendations for improving health through transportation policy.[222] Key benefits include improved air quality, increased physical activity, and reduced injuries. An estimate of the magnitude of these benefits was outside of the scope of this study. However, these positive benefits, together, are likely to significantly increase lifespans and reduce healthcare costs in Eugene and the surrounding region.

Recommendation #2: To ensure maximum benefits to human health, make sure that active forms of transportation are measurably increased, while meeting greenhouse gas reduction goals.

Although all of the recommendations in the CEAP are likely to improve health, they are not all equal in their benefits. In a study modeling greenhouse gas emission reduction strategies, researchers found that a scenario focused on increased active transportation showed greater health benefits (nearly five times the estimated increase in disability-adjusted life years) than a scenario that focused on lower-carbon-emission vehicles. However, a combination of both strategies showed an even greater positive health impact than either strategy alone.[223] In this study, the active transportation scenario that was modeled included high levels of walking and bicycling for transport (similar to those seen in Copenhagen or Amsterdam, for instance).

The 2007 Regional Transportation Plan for the Lane metropolitan area projected what proportion of trips would, under the plan, be completed by different modes in 2031. The plan indicates that 16.1% of all trips in 2031 would be non-auto trips; 9.76% of trips would be completed by walking, while 3.87% of trips and 2.48% of trips would be complete by biking and public transit, respectively.[224] While these figures are high for Oregon, they are low when compared to the active transportation scenario mentioned above. For example, in 2002, 34% of commute trips and about 20% of all trips in Copenhagen were made by bike.[225]

In order to ensure that reduced greenhouse gas emissions also mean increased active transportation, specific goals for walking, biking and public transit rates should be set to correlate with greenhouse gas goals, and all local, regional and state plans should be consistent with these active transportation goals.

Recommendation #3: Promote urban density while seeking strategies to reduce the potential negative impacts of density.

Increased density has a critical place in reducing greenhouse gas emissions and promoting more vibrant cities. Increased density supports physical activity and promotes better access to healthy food and other goods and services. In the region overall, the total air pollutants are reduced, thereby decreasing respiratory ailments.

However, density also has the potential to increase minor vehicle collisions and to increase bicycle and pedestrian collisions. Increased density may also increase noise, which can lead to stress for residents. Increased density may contribute to pricing low-income populations and communities of color out of the urban center into suburbs, where they are more dependent on sedentary forms of transportation and lack access to healthy food and other goods and services.

Therefore, strategies for increased density should be combined with diverse strategies to increase livability within dense urban areas. Increased investment in infrastructure and safety improvements for bicyclists and pedestrians should accompany the development of increased density, in order to prevent an increase in collisions. Urban design features, such as clearly marked and raised pedestrian paths, improved lighting and landscaping, specialized bike and pedestrian signals, and auto-free zones, can promote physical activity and improve safety even in high-density environments. Integrating transportation and land use planning processes to increase access to parkland (and other health-promoting destinations) may offset some of the stress of living in a dense area by making it easier for residents to access greenspace and physical activity opportunities.

Polices that promote increased density and the development of 20-minute neighborhoods must be accompanied by strategies to ensure that ample affordable housing options will be available in neighborhoods that support active transportation.

These strategies together can help ensure that the negative health impacts of density are avoided or minimized.

Recommendation #4: Invest in a safer and more efficient pedestrian and bicycle infrastructure.

Eugene already has a high rate of bicycle use and walking for transportation, compared to Oregon in general. However, both of these modes are likely to continue to grow if residents perceive bicycling and walking as safer and easier. In order to encourage a higher proportion of trips to be made by walking or by bicycle, Eugene should invest in the development of complete streets that include evidence-based design features and safety improvements.

Investments in the creation of strong pedestrian and bicycle route connectivity will also have a large impact on walking and cycling rates. Connectivity has been shown to increase walking and biking and is an important component of the 20-minute neighborhood concept. Both bicycling and walking have a broad range of health benefits, while also reducing greenhouse gas emissions.

Recommendation #5: Ensure investments in public transit access benefit low-income communities and other vulnerable populations.

Vulnerable populations including low-income, youth, elderly, disabled and people of color often depend more heavily on public transit for commuting and for buying necessary goods and services. It is important that public transit investments should seek to improve overall access to public transit, while reducing greenhouse gas emissions. Attention should be paid not just to how low-income neighborhoods and other communities can connect to worksites, but also to full-service grocery stores, childcare facilities, schools and parkland.

Recommendation #6: Integrate health impact assessment practice into current land use and transportation planning at the state and local level.

A growing body of literature, described in this report and others, shows that transportation and land use planning practices have broad and significant impacts on human health. However, these impacts are not often considered in the planning process. In order to better improve health in transportation planning, it will be necessary to assess the impacts of all transportation and land use plans on health, create recommendations to improve health, implement healthier planning options, and evaluate the health outcomes from previous plans. In the assessment stage, health outcomes can be assessed through formal stand-alone HIAs (as conducted for example for the Humboldt County Comprehensive Plan[226]), or for smaller projects, rapid HIAs or health outcomes checklists can be used. The Healthy Development Measurement Tool[227] can be a useful tool for understanding key health outcomes without necessarily doing a full HIA.

Recommendation #7: Develop a system to track injuries and fatalities by transportation mode, to evaluate plan implementation and systematically improve bicycle and pedestrian outcomes.

Injury and fatality data is currently only available for vehicle collisions (including collisions with bicycles and pedestrians). Without an accurate measurement of all bicycle and pedestrian injuries and fatalities (in relation to the number of trips that each of these modes generate), it is difficult to understand how existing conditions impact safety.

Appendix

Demographic Data

Median Household Income, Percent Households, 2006-2008:

Inco me	Eugene	Salem	Portland	Oregon
Less than $10,000	12.1%	7.5%	8.5%	7.0%
$10,000 to $14,999	6.3%	6.7%	6.1%	5.6%
$15,000 to $24,999	12.8%	13.1%	10.8%	11.1%
$25,000 to $34,999	11.1%	13.3%	11.2%	11.4%
$35,000 to $49,999	14.3%	15.3%	14.3%	15.0%
$50,000 to $74,999	18.5%	20.3%	18.4%	19.9%
$75,000 to $99,999	10.5%	10.4%	11.7%	12.4%
$100,000 to $149,999	9.1%	9.6%	11.0%	11.1%
$150,000 to $199,999	2.7%	2.7%	4.2%	3.4%
$200,000 or more	2.6%	1.2%	3.9%	3.0%

Data from the American Community Survey 3 year estimates, 2006-2008.

Educational Attainment for Percent Population 25 Years and Over, 2006-2008:

Educational Attainment	Eugene	Salem	Portland	Oregon
Less than 9th grade	3.1	6.6	4.4	4.5
9th to 12th grade, no diploma	4.9	8.7	6.4	7.4
High school graduate (includes equivalency)	20.0	26.2	20.6	26.5
Some college, no degree	24.5	24.3	22.9	25.6
Associate's degree	8.1	9.2	6.3	8.0
Bachelor's degree	22.5	16.0	24.1	17.8
Graduate or professional degree	17.0	9.0	15.5	10.1
Percent high school graduate or higher	92.1	84.7	89.4	88.0
Percent bachelor's degree or higher	39.5	25.0	39.6	27.9

Data from the American Community Survey 3 year estimates, 2006-2008

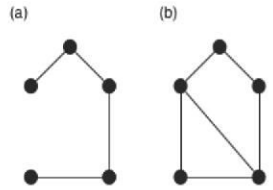
Street Connectivity

Street connectivity can be quantified in a number of ways, including the calculation of Alpha and Gamma indices. The Alpha Index(α) represents the ratio of the actual number of complete loops to the maximum number of possible loops with higher numbers representing a higher level of complexity and connectivity. The Gamma Index (γ) represents the ratio of actual number of street segments to maximum possible, with higher numbers representing areas with more gridded street patterns and lower numbers representing areas with more cul-de-sacs. Both indices can range from 0 to 1, where 0 represents poor connectivity and 1 represents a well-connected street network.

Alpha Connectivity

	Edges	Vertices	α
a	4	5	0
b	6	5	0.4

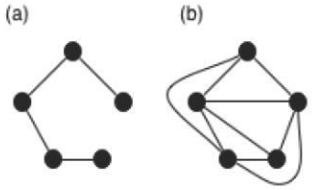
α = (edges-vertices+1)/(2*vertices – 5)



Gamma Connectivity

	Edges	Vertices	γ
a	4	5	0.44
b	9	5	1.0

γ = edges/(3*(vertices-2))



The Lane County census tracts range from an Alpha value of 0.03 (very low connectivity) to 0.39 (higher connectivity). Gamma values range from 0.35 to 0.60 (data from the RAND Center for Population Health and Health Disparities).[xiii]

[xiii] This research used data from the RAND Center for Population Health and Health Disparities, which is funded by grant 1-P50-ES012383 from the National Institute of Environmental Health Sciences. For further information on the CPHHD, go to http://www.rand.org/health/centers/pophealth/index.html.

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Appendix 6

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Appendix 7

Metro Greenhouse Gas Inventory

Spring 2010

www.oregonmetro.gov

Regional greenhouse gas inventory

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

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

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

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

Direct – such as gasoline combustion;

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

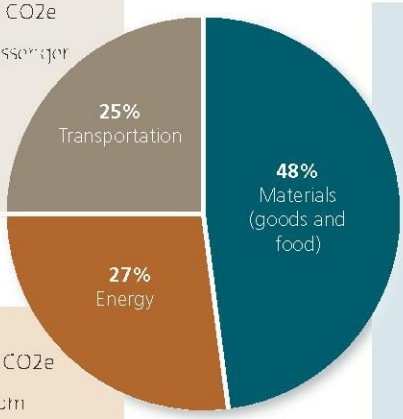
Remote – associated with activities that end with final consumption here in the community, such as the production of many goods and much of our food.

Metro Area Greenhouse Gas Emissions

31 Million Metric Tons Carbon Dioxide Equivalent (MMT CO2e)

Transportation
Estimated emissions: 7.8 MMT CO2e

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



Materials (goods and food)
Emissions related to the production, manufacture and disposal of materials, goods and food
Estimated emissions 14.9 MMT CO2e

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

Energy
Estimated emissions: 8.2 MMT CO2e

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

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

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

Metro

Methodology

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

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

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

1 *"2008 Seattle Community Greenhouse Gas Inventory," City of Seattle, www.seattle.gov/climate/docs/2008-community-summary.pdf or "CO2 Emissions from Fossil Fuels by Sector," Sightline Institute www.sightline.org/maps/charts/Climate-EmBySector.*

2 *"Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices," EPA (2009), www.epa.gov/oswer/docs/ghg_land_and_materials_management.pdf.*

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

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

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

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

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

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

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

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

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

SAFE AND RELIABLE TRANSPORTATION
People have safe and reliable transportation choices that enhance their quality of life.

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

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

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

4 *Oregon House Bill 2001, also known as the Oregon Jobs and Transportation Act, is the transportation funding plan adopted by the 2009 Legislature. www.leg.state.or.us/09reg/measures/hb2000.dir/hb2001.en.html*

SOURCE-BY-SOURCE SUMMARY OF GREENHOUSE GAS EMISSIONS

Energy (natural gas and electricity)

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

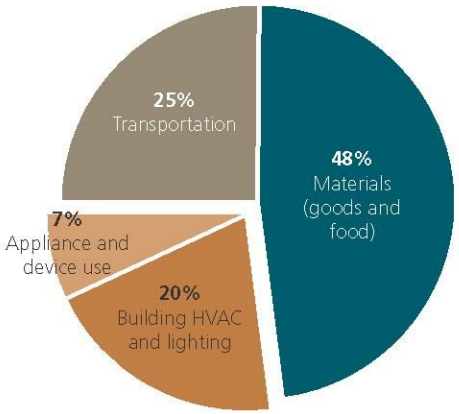
Lighting, heating and cooling buildings and the operation of appliances by residences, commercial establishments, and industrial buildings account for 8.2 million metric tons of carbon dioxide equivalent.

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

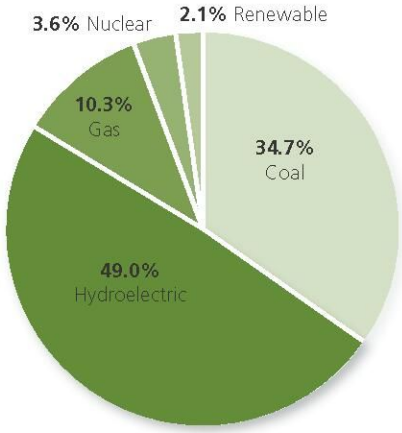
The electric utilities serving the Portland metro area, Portland General Electric (PGE) and Pacific Power, have made investments in renewable energy and energy efficiency. The pie chart below shows the mix of energy for the Northwest Power Pool. A state-mandated Renewable Portfolio Standard (RPS) will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

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

Metropolitan area greenhouse gas emissions with energy split



Regional sources of electricity Northwest Power Pool (NWPP)



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

6 *A Renewable Portfolio Standard for Oregon www.oregon.gov/ENERGY/RENEW/RPS_home.shtml*

Transportation

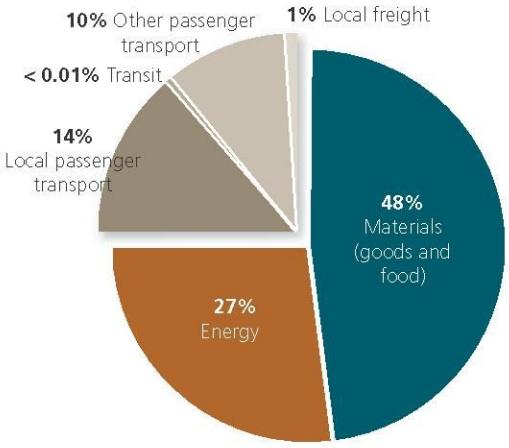
Transportation is responsible for about 25 percent of the region's greenhouse gas emissions. These emissions come mainly from on-road commercial and individual vehicles and air travel, with small shares from rail, marine and transit sources.

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

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

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

Metropolitan area greenhouse gas emissions with transportation split



7 *The legislation specifies that the emissions goal applies to vehicles weighing up to 10,000 pounds.*

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

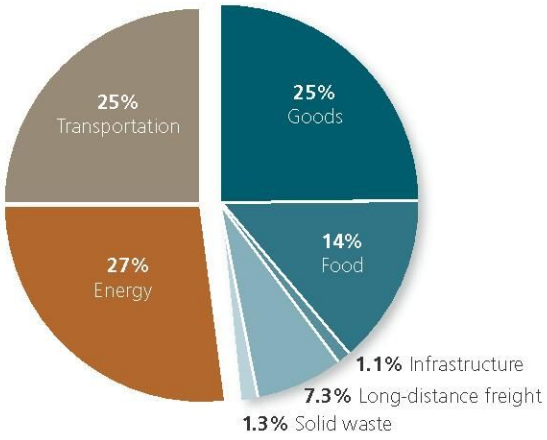
Materials, goods and food (production, movement and disposal)

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

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

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

Metropolitan area greenhouse gas emissions with materials split



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

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

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

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

9 *See "Embodied Environmental Emissions in U.S. International Trade, 1997–2004," Christopher L. Weber and H. Scott Matthews (2007).*

SUMMARY OF CALCULATION ASSUMPTIONS AND METHODS

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

Energy

Assumptions for natural gas emissions:

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

Assumptions for electricity emissions:

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

Other details:

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

Transportation

Method for local passenger transportation:

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

Assumptions for freight:

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

Assumptions for transit:

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

Assumptions for long distance/other:

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

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

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

Assumptions

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

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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
July, 2007

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.

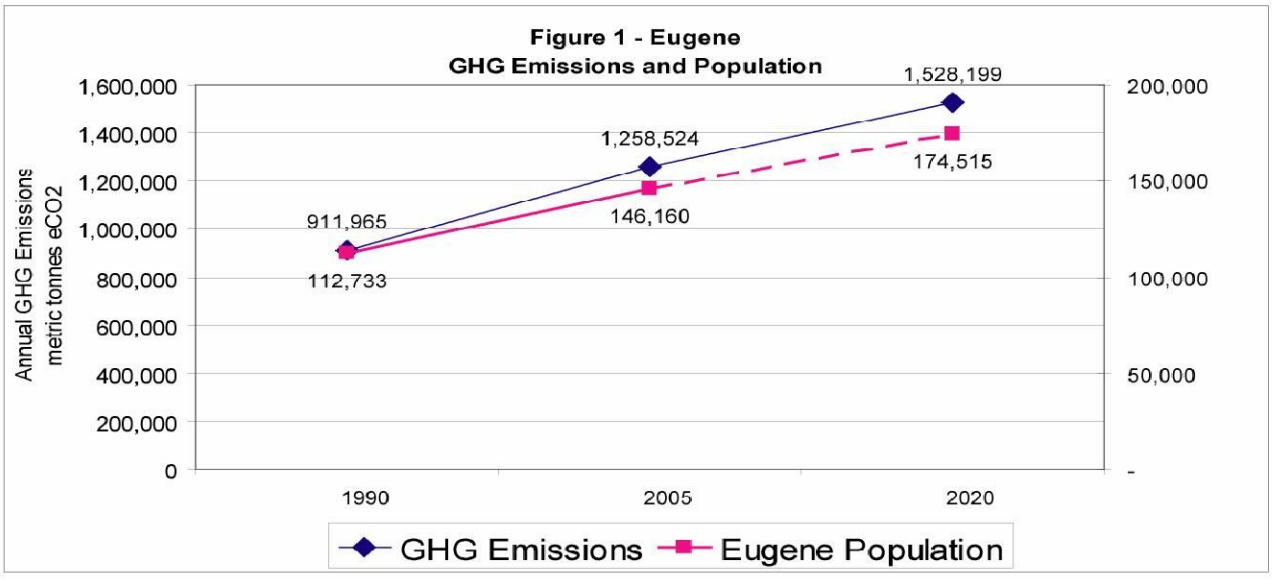
Boundaries for the inventory were chosen to correspond, for the most part, to the boundaries of Eugene Water and Electric Board's (EWEB) territory. EWEB's service area roughly matches the Eugene portion of the Metro Plan boundaries. River Road/Santa Clara and the Blachly Lane service territory along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

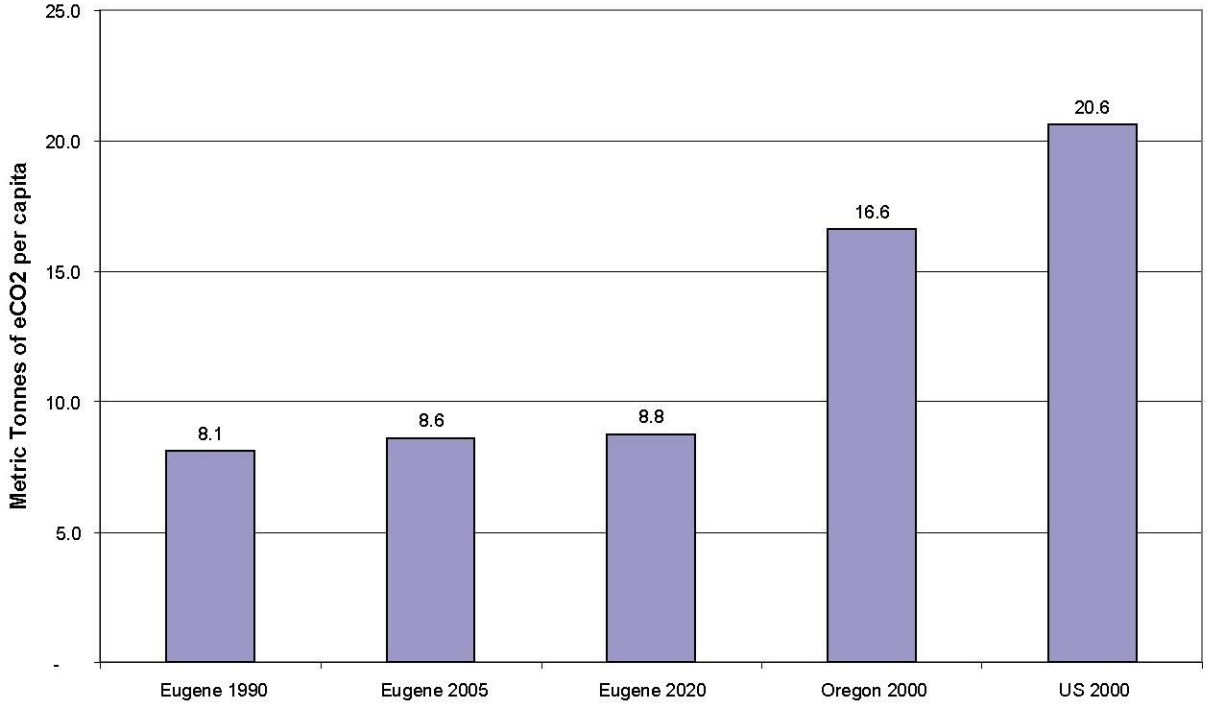
The growth in GHG emissions from 1990 levels to 2005 was approximately 38%. Projected growth of GHG from 2005 to 2020 is estimated at 21.4%. Total growth in emissions from the base year of 1990 to the target year of 2020 is projected to be two-thirds higher than total 1990 emissions. It's important to 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

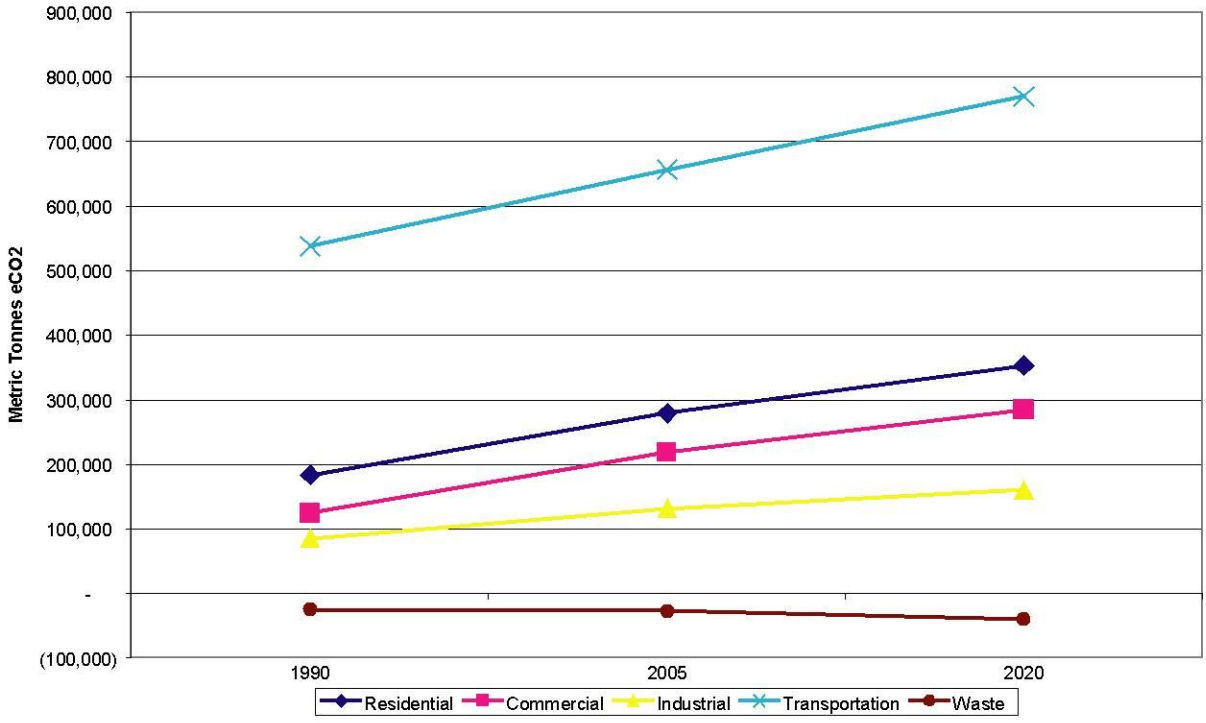
The results of the community GHG emissions inventory can be analyzed by the type of activity contributing to greenhouse gases, and by the energy source that creates those emissions. Both types of analysis can be used in the development of GHG reduction strategies. The next sections provide a more detailed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

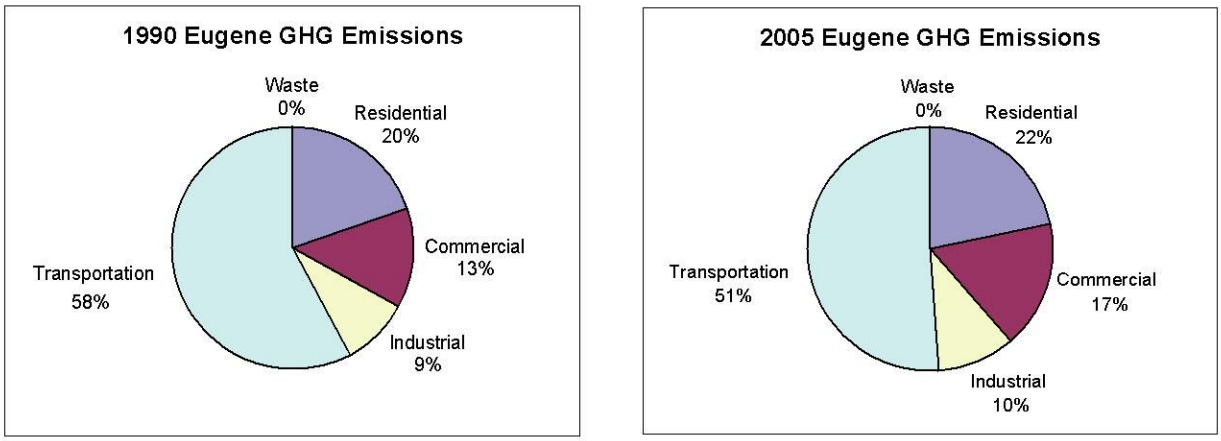


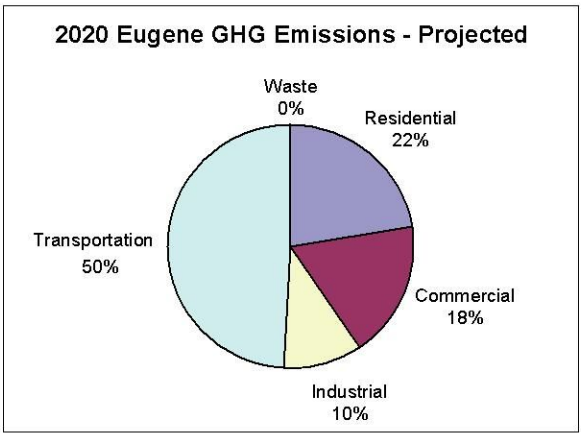
The waste sector is considered in the model as providing carbon storage. This phenomenon is explained by the multiplication effect of methane and the long-term capture and storage, or sequestration, of a portion of the total waste. Organic matter that decomposes without oxygen, or anaerobically, will 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.

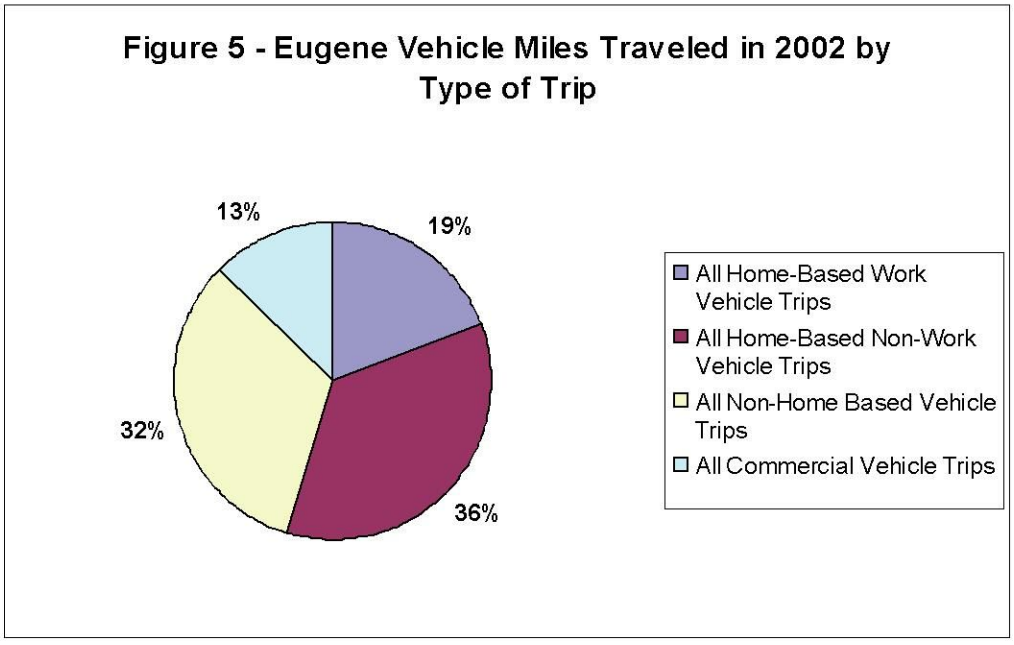
While total GHG emissions are projected to increase, the emissions from some activity sectors will increase faster than others. The relative impact of the transportation sector has decreased from 1990 to 2005 in spite of continued growth in vehicle miles traveled (VMT). This trend is expected to continue 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



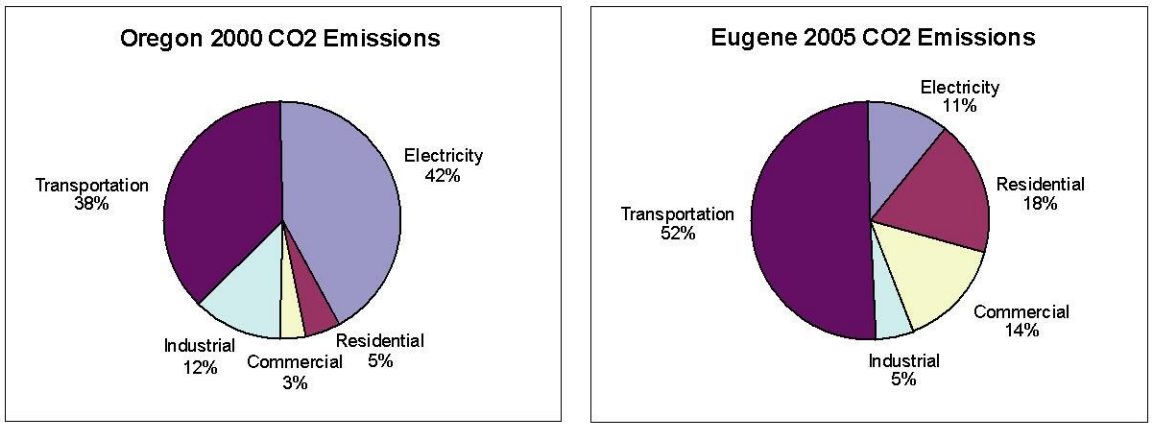


Within the transportation sector, residential trips make up the majority of emissions related to vehicle travel. (Figure 5) Using the Lane Council of Government's regional transportation model of vehicle travel miles, Figure 5 was derived from the estimated average school-in-session weekday trips that 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.



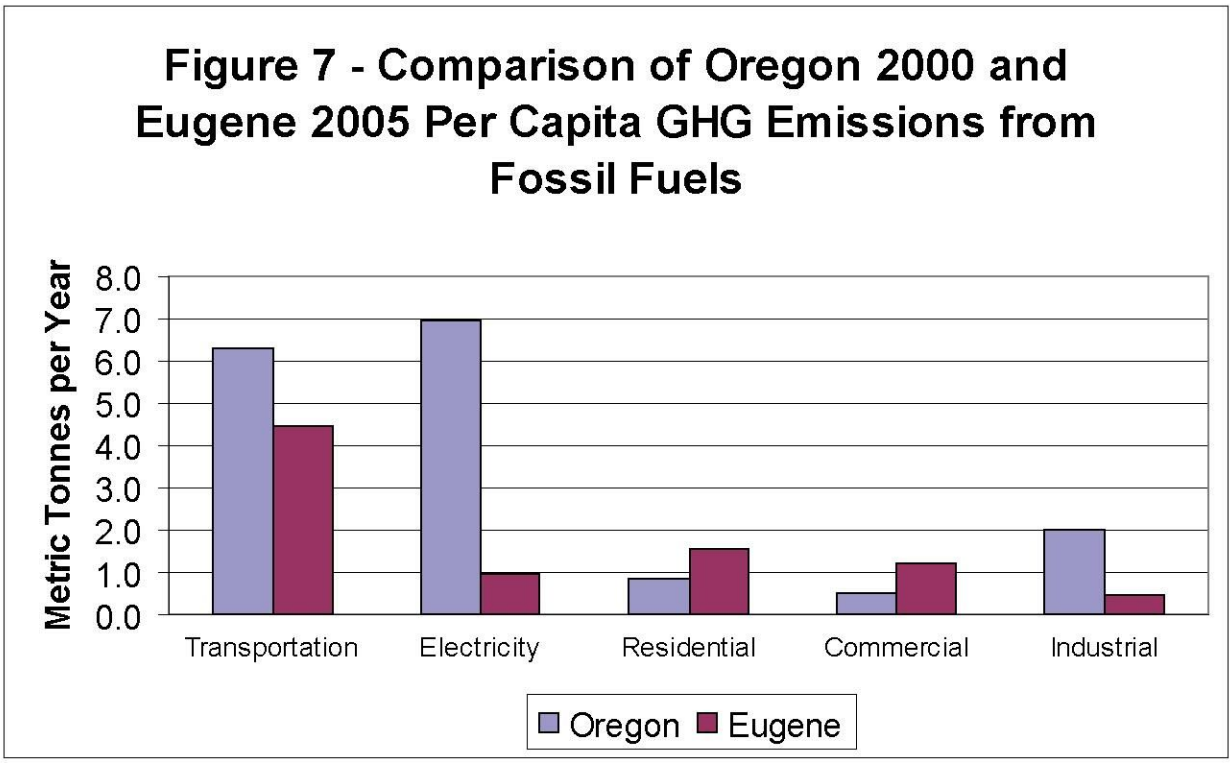
Eugene's pattern of emissions due to fossil fuels is significantly different from the State of Oregon as a whole, as shown in Figure 6. This may mean that the most effective strategies for reducing greenhouse gas emissions related to fossil fuels are different for Eugene than those being developed for 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.



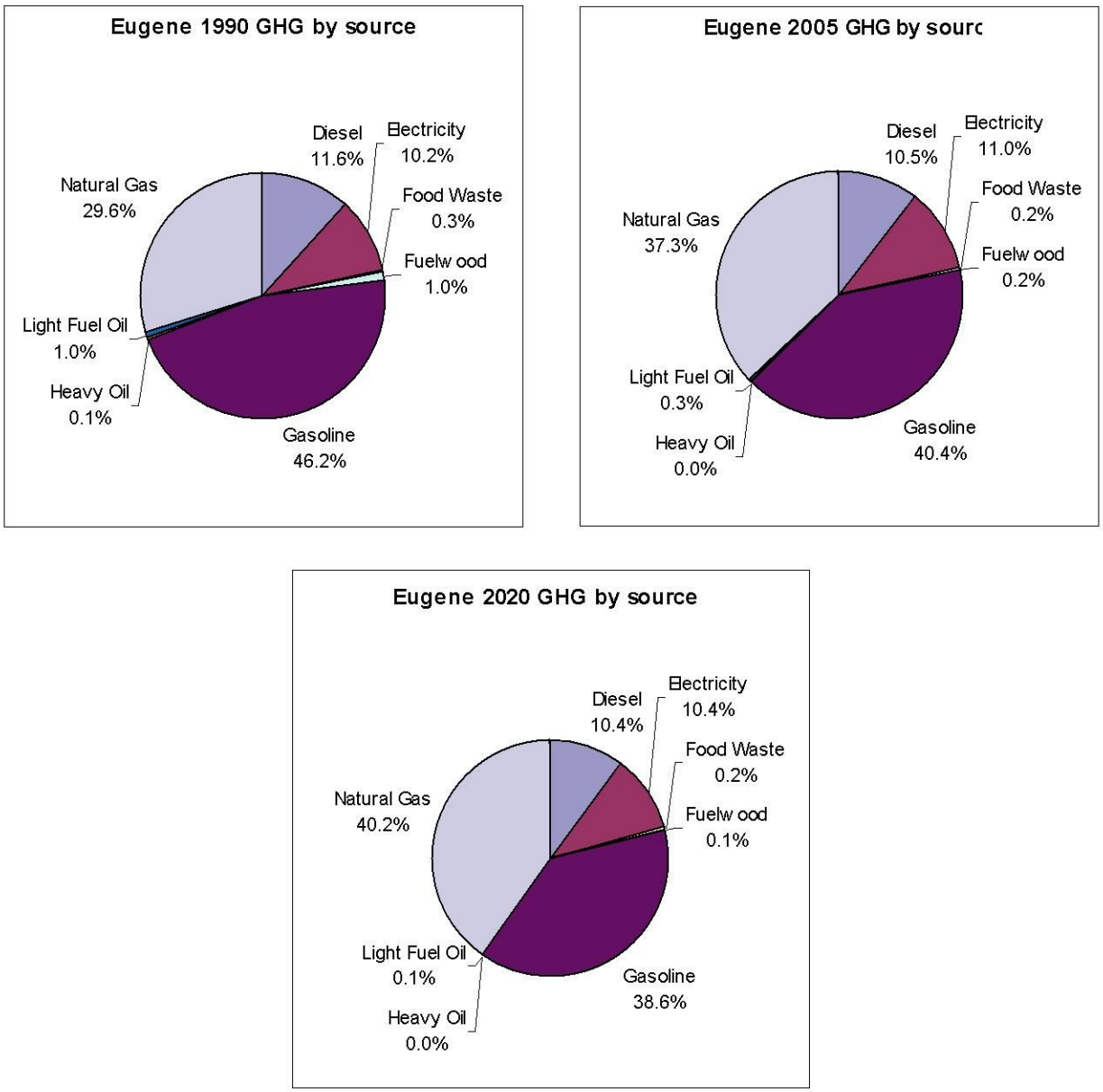
Eugene's low level of emissions due to electrical generation reflects EWEB's predominant use of hydroelectric power, compared to the state as a whole, and EWEB's long-term emphasis on conservation, with an aggressive conservation program in place since 1976. EWEB has stated that growth in electrical 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.

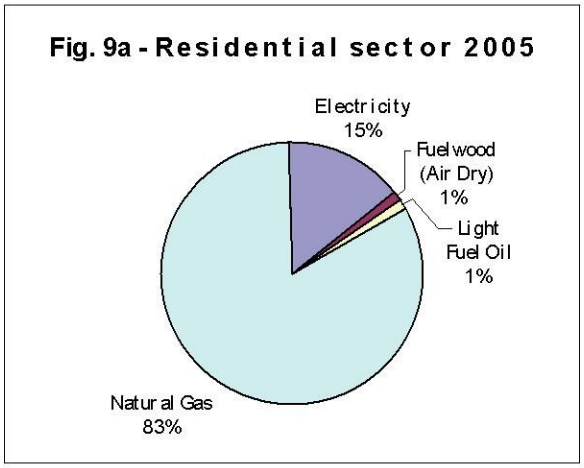
Although woodburning is not a significant contributor to CO2 in the atmosphere, it does contribute substantially to other forms of pollution in Eugene. While this report does not address the relative criteria air pollutants (CAP's) of fuel sources, they should be considered an important factor in the 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.

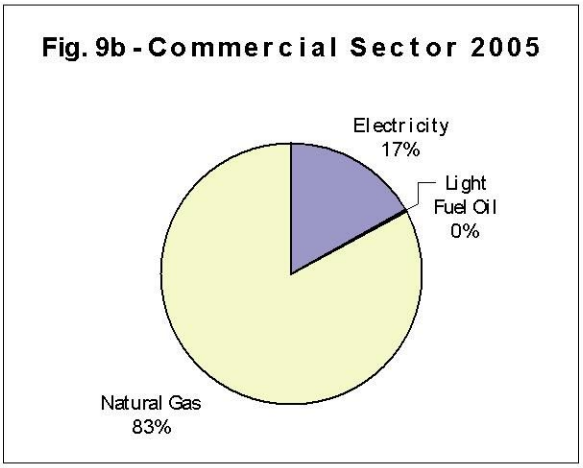
5.3 Results Combined by Sector and Source

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.

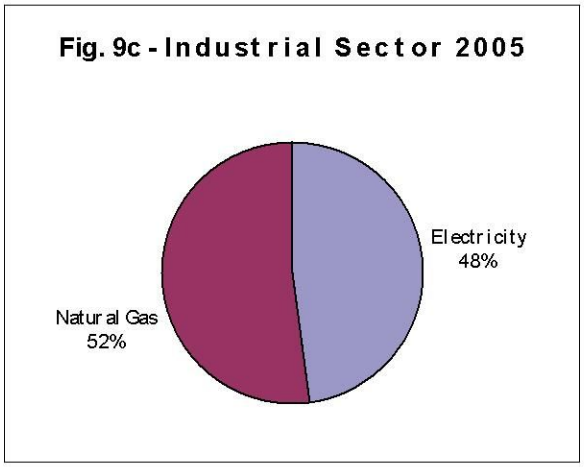
The source of GHG emissions for the commercial sector is very similar to the residential sector, with natural gas at 83% of total commercial GHG emissions. (Figure 9b) Electrical consumption accounts for 17% of GHG emissions, and fuel oil less than 1% of commercial emissions.

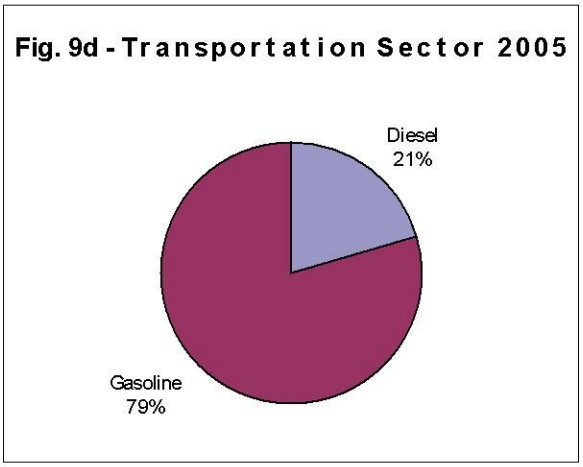




The emissions profile of the industrial sector is almost evenly split between natural gas and electricity. (Figure 9c) Since electricity has a much lower level of emissions per unit, this means that the predominant source of energy for the industrial sector is electricity. Electrical use in the industrial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



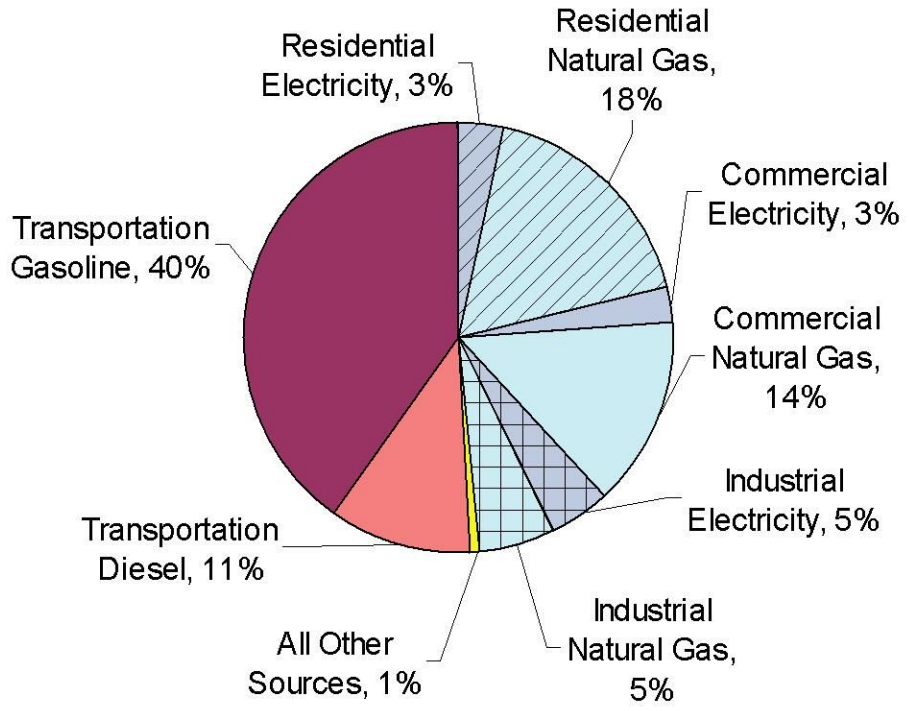


6. Putting it All Together

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.

Figure 10 - 2005 Eugene Community-Wide CO2 Emissions by Economic Sector and Fuel Source



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

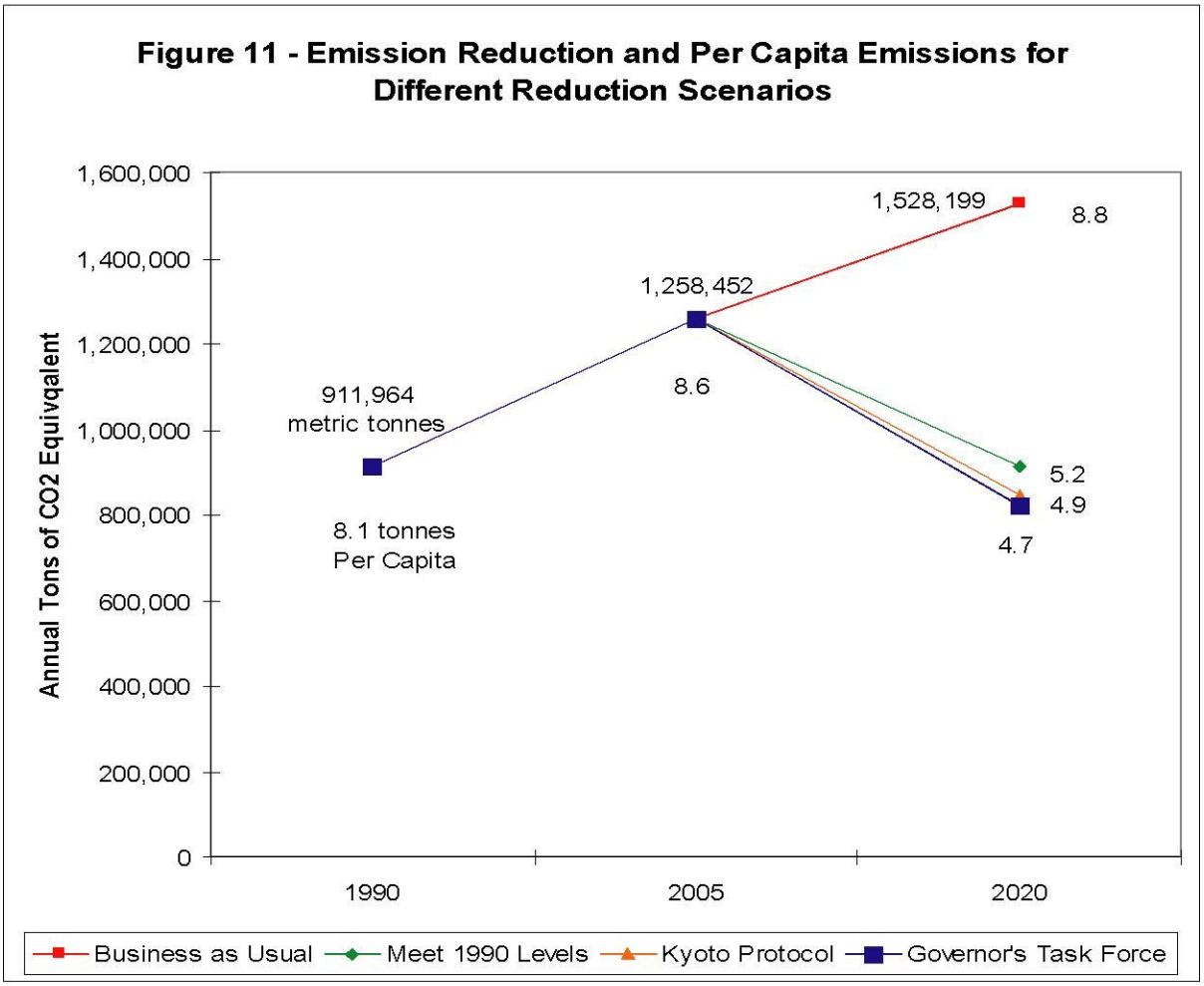
Target	Total Eugene GHG tonnes/yr	% Reduction in total GHG emissions	Per Capita CO2 tonnes/year
Business as Usual	1,528,199	No reduction	8.8
Meet 1990 Levels	911,964	40%	5.2
Kyoto Protocol (7%<1990)	848,127	45%	4.9
Governor's Task force (10% < 1990)	820,768	46%	4.7

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.

Figure 11 - Emission Reduction and Per Capita Emissions for Different Reduction Scenarios



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, CO2 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

					Annual Growth
		1990	2005		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%		

Appendix 9

Policy Background

In the winter of 2008/2009, in response to recommendations from Eugene's Sustainability Commission, the Eugene City Council adopted the following directive:

In conjunction with a wide variety of community partners, by August 2010, develop a community climate and energy action plan that will (1) reduce greenhouse gas emissions and (2) reduce total, current community-wide fossil fuel consumption 50 percent by 2030 (as an absolute not a per capita reduction) by:

- Establishing a greenhouse gas emissions reduction goal;
- Establishing targets for achieving those goals;
- Identifying strategies to achieve those targets;
- Identifying necessary adaptations;
- Developing measures for tracking success;
- Identifying financial impacts, and
- including periodic progress reports back to the community with annual reports of progress to the Sustainability Commission

The language from the Sustainability Commission recommendations is below:

Recommendation 2 from Eugene Sustainability Commission to Eugene City Council. October, 2008

While City facilities and operations contribute to local carbon emissions, their collective impact at the community, metro and regional level is of far greater significance. The City, in conjunction with several community partners, completed a Eugene Community Greenhouse Gas Emissions Inventory Report in July 2007. The "next steps" section of the August 2007 memo to the council noted it was vital to have in-depth discussions with community members and local agencies in order to identify reduction strategies and ways to get there.

While the commission recognizes that the City is limited in its jurisdictional authority to regulate outside its boundary, it also recognizes that Eugene must be a leading participant in moving our region toward carbon neutrality. While Eugene has relatively low carbon emissions compared with many other North American cities, much of that is due to the excellent work of EWEB to provide us with primarily low carbon emission hydro and wind power and their focus on energy conservation since the 1970s. However, based on the review of the SBI report and other relevant information, the commission has determined that immediate action to develop a community climate action plan, including a community carbon emission reduction goal is needed. Therefore the commission recommends the following:

The City of Eugene shall, in conjunction with a wide variety of community partners:

Develop a community climate action plan within 18 months that will (1) set a carbon emission reduction goal and establish targets for achieving that goal; (2) identify strategies to achieve those targets; (3) identify necessary adaptations;, (4) develop measures for tracking success, and (5) include periodic progress reports back to the community with annual reports of progress to the Sustainability Commission.

Recommendation 2 from Eugene Sustainability Commission to Eugene City Council. February, 2009

All eight of the commission's work plan issue areas have direct or indirect ties to energy consumption. The Portland Peak Oil Report, public testimony and other research asserts the world is very near, at or past global "***peak oil***" production. The steep oil price rises last summer and the increasing petroleum demand from the growing economies of China and India suggest the end of the cheap, fossil-fuel based energy age is near. Under even moderate fossil-fuel supply reductions or modest price increases, Eugene can expect a wide variety of negative social, environmental and economic impacts. The commission both acknowledges and appreciates the long standing cooperative partnership forged between the City and EWEB that has resulted in Eugene's comparatively low dependence on fossil-fuel derived electricity. Nonetheless, the commission's review of the literature leads it to conclude that immediate action is necessary. Eugene must prepare to reduce the impacts of fossil fuel price escalation and supply fluctuations. Attachment B outlines additional background and rationale for this recommendation. The commission recommends that:

The City of Eugene, in conjunction with a wide variety of community partners:

By August 2010, develop a community action plan that aims to reduce total, current communitywide fossil fuel consumption 50 percent by 2030 (as an absolute not a per capita reduction) by (1) establishing targets for achieving that goal; (2) identifying strategies to achieve those targets; (3) identifying necessary adaptations; (4) developing measures for tracking success; (5) identifying financial impacts, and (6) including periodic progress reports back to the community with annual reports of progress to the Sustainability Commission.

Note: If this recommendation is adopted by council the commission recommends that development of the plan be undertaken in conjunction with the community climate action plan (one of the first set of commission recommendations adopted by the council). Note that the community climate action plan is also being developed with community partners within the same timeframe. The resulting plan would focus on both climate and energy consumption issues.

Appendix 10

Architecture 2030 Standards

Architecture 2030 has issued ***The 2030 Challenge*** asking the global architecture and building community to adopt the following targets:

- All new buildings, developments and major renovations shall be designed to meet a fossil fuel, GHG-emitting, energy consumption performance standard of 50 percent of the regional (or country) average for that building type.
- At a minimum, an equal amount of existing building area shall be renovated annually to meet a fossil fuel, GHG-emitting, energy consumption performance standard of 50 percent of the regional (or country) average for that building type.
- The fossil fuel reduction standard for all new buildings and major renovations shall be increased to:
  - 60 percent in 2010
  - 70 percent in 2015
  - 80 percent in 2020
  - 90 percent in 2025

Carbon-neutral in 2030 (using no fossil fuel GHG emitting energy to operate).

These targets may be accomplished by implementing innovative sustainable design strategies, generating on-site renewable power and/or purchasing (20 percent maximum) renewable energy and/or certified renewable energy credits.

Resolution brought forward by:

Mayor Daley of Chicago
Mayor Chavez of Albuquerque
Mayor Diaz of Miami
Mayor Nickels of Seattle
The American Institute of Architects (AIA)
US Green Building Council (USGBC)
Leadership in Energy and Environmental Design (LEED)
Royal Architecture Institute of Canada (RAIC)
County of Sarasota, FL
State of New Mexico (Governor Bill Richardson)
City of Santa Fe, NM
Rocky Mountain Institute (RMI)
Environment America
International Council for Local Environmental Initiatives (ICLEI)
World Business Council for Sustainable Development (WBCSD)
Environmental Protection Agency (EPA/Target Finder)
American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
National Wildlife Federation (NWF)
Society of Building Science Educators (SBSE)
AIA Committee on the Environment (AIA/COTE)
Association of Collegiate Schools of Architecture (ACSA)
Union Internationale des Architectes (UIA)
American Solar Energy Society (ASES)
American Society of Interior Designers (ASID)
Cascadia Region Green Building Council
Ontario Association of Architects (OAA)

Source: ***www.architecture2030.org***

Appendix 11

Health Benefits Literature Reviews

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Report prepared by: Claire Otwell and Vanessa Vissar

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Introduction

The City of Eugene Community Climate and Energy Action Plan (CEAP) will foster significant emissions reductions in Eugene by recommending specific actions to mitigate and adapt to climate change. The implementation of certain actions in the CEAP can be linked to health benefits as described in this report.

This report is intended to complement the Health Impact Assessment completed by Upstream Public Health that analyzes health impacts of land use and transportation recommendations included in the CEAP. This report is an effort to demonstrate that there are likely health impacts associated with many of the recommendations in the CEAP.

The literature reviews include information about the health impacts associated with three CEAP actions, one each from the Urban Natural Resources, Food and Agriculture, and Health and Social Services sections. The recommendations that are reviewed are:

1) Increase planting, preservation, and maintenance of trees and shrubs;

2) Educate community members on the importance of food choice as a significant component of a climate-friendly lifestyle (e.g., encourage less consumption of carbon intensive foods such as red meat and dairy);

3) Strengthen current hunger relief systems to handle increased short-term and long-term demand.

Scope

The limited resources available for this report restricted the scope of the literature reviews to three actions from the CEAP. It is likely that additional literature reviews covering other recommendations in the CEAP would be informative.

Methodology

Actions were selected for this literature review based on advice from several experts regarding the extent of existing research relating to each action. The actions selected were those expected to have related peer reviewed research that could demonstrate significant findings.

Once an action was selected, related peer-reviewed research papers were gathered and reviewed for evidence of the possible health impacts. Literature reviews were conducted for one action each of the Urban Natural Resources, Food and Agriculture, and Health and Social Services sections of the CEAP.

Findings

A summary of the literatures reviews of the Urban Natural Resources, Food and Agriculture, and Health and Social Services sections of the CEAP are detailed in this report. Key findings from this review include:

- Eating less meat and dairy products contributes to decreased risk of cardiovascular disease, obesity, type II diabetes, and some cancers.
- Urban trees can reduce extreme heat events and associated heat illness and improve air quality, reducing respiratory illness.
- Personal access to sufficient quantity and quality of foods is likely to prevent some chronic diseases.

Food & Agriculture

What are the health benefits of reducing consumption of carbon intensive foods (those associated with high greenhouse gas emissions, such as red meat and dairy products)?

Research indicates that eating less meat and dairy products contributes to a wide range of health benefits including lowered risk of cardiovascular disease, obesity, type 2 diabetes, and some cancers.[1]

Lowering red meat consumption can decrease the level of total fat and protein intake, which can lead to lower weight, cholesterol levels, and blood pressure.[2] Eating red meat increases the risk for heart related diseases[3], elevated risk of certain cancers, and increased odds of premature death.[4]

Individuals who avoid meat but consume dairy products have lower cholesterol levels than those who consume meat.[5] Additionally, the consumption of dairy products has been linked to certain cancers.[6] For instance, a study indicated that women consuming more than one glass of milk per day have a 73 percent greater chance of ovarian cancer than women who drink less than one glass per day.[7]

Individuals that do not eat food of animal origin consume greater quantities of fruit and vegetables providing a variety of health benefits including lower blood cholesterol concentrations, a lower incidence of stroke, and a lower risk of mortality from stroke and heart disease.[8] Such foods and nutrients can also be protective against certain cancers.[9]

Encouraging reduced consumption of red meat and dairy products will not only have an impact on greenhouse gas emissions but may also improve overall public health.

Urban Natural Resources

What are the health benefits to increasing planting, preservation, and maintenance of trees and shrubs?

Urban trees benefit public health in two key ways by helping to reduce extreme heat events and associated heat-related illness, and by improving air quality and reducing associated respiratory illness.

High temperatures can have negative effects on public health in urban areas. Numerous epidemiological studies of extreme temperatures conducted in Europe and North America have shown a positive association between heat waves and mortality.[10] Vulnerable populations such as senior citizens, women, children, and people with mental illness or physical disabilities are often the most greatly affected.[11] Increasing tree cover in urban areas can help moderate the heat island affect and reduce temperatures.[12] The heat island effect occurs when inner urban environments absorb and retain heat often resulting from a pavement dominated city landscape.

In addition to causing heat related illness, higher temperatures can make air-quality problems more severe and can increase the production of ground-level ozone and smog. Recent studies suggest there are serious risks from long-term ***exposure*** to high levels of ozone. One study found that in urban areas across the United States, the amount of ozone in the air is sufficient to cause measurable changes in lung function, respiratory symptoms, and airway inflammation in healthy people engaged in normal outdoor exercise and recreational activities.[13]

Finally, urban tree plantings have been shown to decrease particulate air pollution. Because small changes in air pollution can have relatively considerable impacts on air quality and human health, the effects of urban forests on air pollution can be significant.[14] The size of particles is directly linked to their potential for causing health problems. Small particles, less than 10 micrometers in diameter, can get deep into lungs and may even enter the bloodstream affecting both the lungs and heart.[15] A nationwide modeling study found that urban trees remove approximately 711,000 ***metric ton***s of air pollution annually in the US.[16] The combined effects of trees on air pollutants are significant enough that increasing urban trees could be a viable means to improving air quality and helping meet clean air standards in the United States.[17]

Because trees improve air quality and reduce exposure to extreme temperatures, there is strong evidence that planting and maintaining urban trees will improve overall public health.

Health & Social Services

What are the health benefits to strengthening current hunger relief systems to handle increased short-term and long-term demand:

Access to appropriate quantities of nutritious food is important for the health of all members of the community. While proper nutrition for adults may improve general health and contribute to the prevention and treatment of chronic diseases, food security is even more critical for children. An inadequate food supply in a child's early years decreases his/her chance of enjoying good health throughout his/her life. According to one study, food-insecure infants and toddlers showed an increased likelihood of fair to poor general health and of experiencing health problems requiring hospitalization. Definitive results from the study suggest that ensuring food security will reduce health problems, including the need for hospitalizations.[18]

The benefits of adequate food intake for school age children have been confirmed by a study investigating relationships between food insufficiency and cognitive, academic, and psychosocial outcomes for US children. The study found that children from 6 to 11 years old, from food-sufficient households, had significantly higher math scores, were less likely to have repeated a grade, seen a psychologist, or had difficulty getting along with other children.

The benefits of secure access to food are relevant in both genders and all age groups as demonstrated in a 2003 study examining the relationship between food insufficiency and physical, mental, and social health in Canada. Individuals from food-sufficient households had significantly lower odds of having poor functional health, restricted activity, beneficial multiple chronic conditions, and of suffering from major depression and distress. Individuals in food-insufficient households were more likely to report heart disease, diabetes, high blood pressure and food allergies, and women in food-insufficient households were and more likely to be obese.[19]

Alleviating hunger and providing more secure access to food at the community level can increase quality of life and decrease the incidence of chronic illness in the community.

Conclusion

Improved public health serves as one of the many co-benefits of implementing selected actions from the Urban Natural Resources, Health and Social Services and Food and Agriculture sections of the CEAP. Current research indicates there are positive health benefits resulting from eating less meat and dairy products, increasing planting, preservation, and maintenance of trees and shrubs, and strengthening current hunger relief systems.

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