

**GREENHOUSE GAS INVENTORY
FOR
MUNICIPAL GOVERNMENT OPERATIONS**



City of Corvallis
Oregon

PREPARED BY THE CITY OF CORVALLIS
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EXECUTIVE SUMMARY

The Intergovernmental Panel on Climate Change (IPCC), the United Nations body that regularly convenes climate scientists, has identified human activity as the primary cause of the climate change that has occurred over the past few decades and quickened in recent years. Consensus statements from the IPCC suggest that human-caused emissions must be reduced significantly—perhaps by more than 50% globally, and by 80% in wealthier nations that are the largest emitters—by mid-century in order to avoid the worst potential climate impacts.

Emissions from city government operations can be significant. By measuring its emissions, the City of Corvallis is better prepared to take action, manage risk, and lead climate mitigation efforts in the community and beyond. The City's greenhouse gas (GHG) inventory for municipal operations was conducted by following the Local Government Operations protocol, which is in accordance with Oregon Department of Environmental Quality (DEQ) guidelines.

The City's GHG inventory for calendar year 2008 quantified emissions of 15,411 metric tons (MT) CO₂ equivalent (CO₂e)—an approximate 2% increase over emissions in the baseline year 2004. Emissions of 15,411 MT CO₂e are equivalent to the annual emissions from 2,947 passenger vehicles or the energy consumption of 1,312 homes (based on US averages).

GHG emissions included in the inventory are categorized as Scope 1—vehicle fleet fuel and natural gas usage—or Scope 2, indirect emissions from electric use. Scope 1 emissions across all sectors of City operations are 3,598 MT CO₂e (23%). Natural gas and electric power used to operate the City's buildings and facilities account for about one-third of total GHG emissions. Energy used for water delivery contributes about 23% of total GHG emissions, while wastewater treatment contributes about 21%. The inventory also included an estimate of emissions embodied in the City's purchases in 2008, which constituted 27% of the total Scope 1 and Scope 2 emissions.

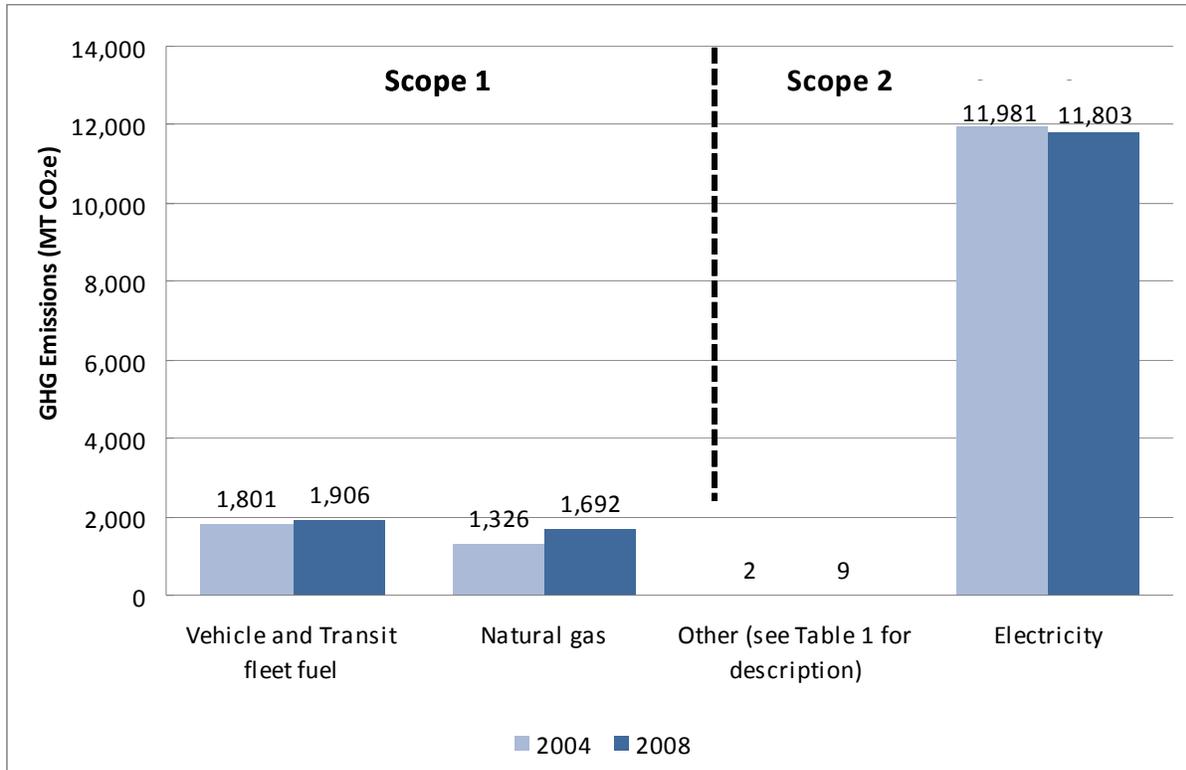
The information gathered in the City's GHG emissions inventory can be used:

- To educate and engage employees and citizens on topics related to the City's GHG emissions and climate disruption.
- To measure the effectiveness of the City's efforts to reduce its GHG emissions.
- As an additional source of information when evaluating alternatives to reduce energy consumption and expenses.
- As an additional source of information when making power and fuel choices, and when making procurement decisions.

OVERVIEW OF RESULTS

During 2008, City of Corvallis emissions from fuel and power use by buildings and vehicles (Scopes 1 and 2) were 15,411 MT CO₂e. This represents a 2-percent increase since the baseline year of 2004,¹ when emissions totaled 15,111 MT CO₂e.

Figure 1: City of Corvallis Greenhouse Gas Emissions from Local Government Operations



For a sense of scale, the City's emissions yield of 15,411 MT CO₂e for 2008 is equivalent to:

- Annual emissions from 2,947 passenger vehicles.
- Annual emissions from the energy consumed by 1,312 homes.²

¹ 2004 is the earliest year for which the City could obtain data for all of the required sectors.

² Equivalency data based on US averages. Source: <http://www.epa.gov/cleanenergy/energy-resources/calculator.html>

Figure 2: City of Corvallis Greenhouse Gas Emissions by Sector

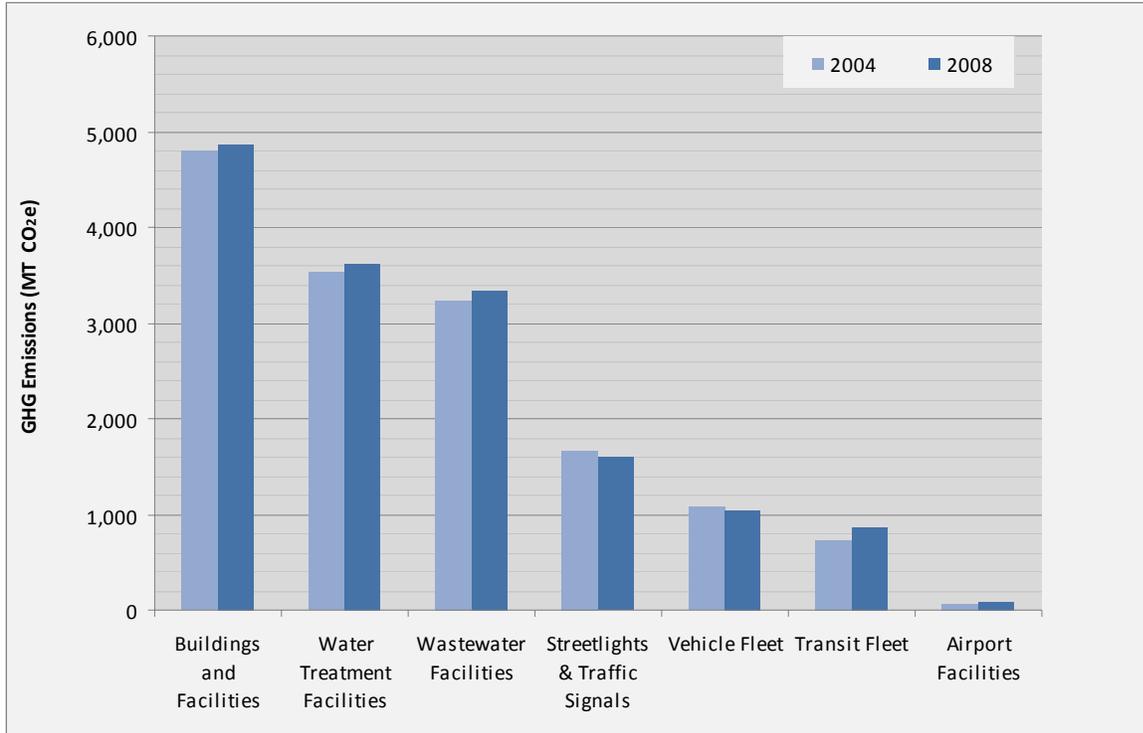
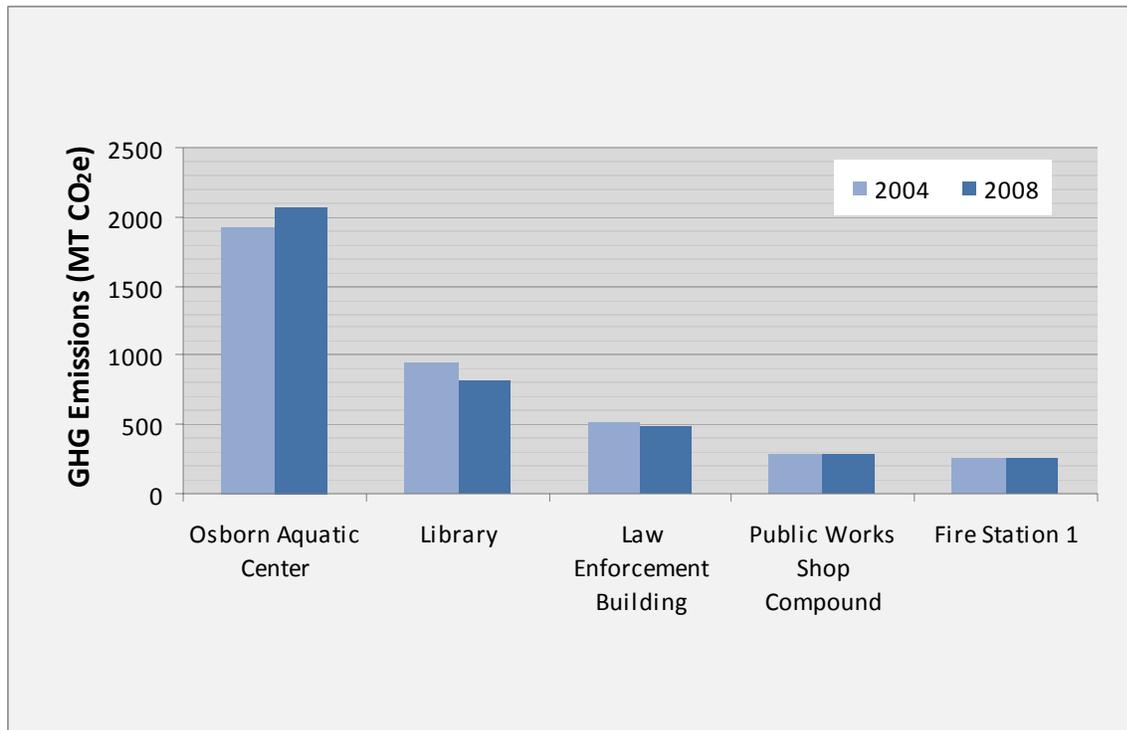


Figure 3: City of Corvallis Facilities with Highest Emissions



METHODS: DATA, PROTOCOLS, AND SENSITIVITY ANALYSIS

In accordance with Oregon Department of Environmental Quality guidelines, this inventory follows the Local Government Operations (LGO) Protocol, which provides the highest-consensus guidelines for minimum reporting scope. The LGO Protocol was developed as a collaboration of The Climate Registry (TCR), the California Air Resources Board (CARB), the California Climate Action Registry (CCAR, now the Climate Action Reserve), and ICLEI—Local Governments for Sustainability. The LGO Protocol follows the same format as The Climate Registry’s General Reporting Protocol (GRP).

The City of Corvallis used ICLEI’s Clean Air and Climate Protection (CACP) 2009 software program to collate and compute emissions data. The analysis also draws on high-consensus public-domain tools for emissions factors and methods.

Emissions data is reported for a calendar year and in metric tons of carbon-dioxide equivalent (MT CO_{2e}). The analysis covers six gases: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), sulfur hexafluoride (SF₆) and the groups of high-global-warming-potential (GWP) gases, perfluorocarbons (PFCs) and hydrofluorocarbons (HFCs). Overwhelmingly, the direct and indirect CO₂-equivalent emissions are CO₂ from combustion of fossil fuels.

The protocol requires the reporting only of emissions in Scopes 1 (direct emissions) and 2 (indirect emissions), as defined by the World Resources Institute (see Table 1). Scope 3 emissions are those that come from critical activities related to an organization’s operations but are outside of its direct control (see Appendix A for more on the City’s Scope 3 emissions).

Table 1: Description of City of Corvallis Greenhouse Gas Emissions Categories

WRI Scope	Emissions Category	MT CO _{2e}	Description
Scope 1 (Direct Emissions)	Vehicle and Transit fleet fuel	1,906	This category includes the following sources: <ul style="list-style-type: none"> • City fleet of automobiles • Public works equipment, including trucks and maintenance vehicles • Parks and Recreation, Police, and Fire vehicles • Transit fleet (860 MT CO_{2e} of the total)
	Natural gas	1,692	The City uses natural gas in 11 facilities for space and water heating. It also uses natural gas in wastewater treatment.
	Other	9	About 2 MT CO _{2e} are “fugitive” emissions from wastewater treatment, for example, those resulting from incomplete combustion of digester gas.
	Refrigerants	< 1	Refrigerants used in building cooling systems and fire extinguishers created less than 1 MT of emissions in 2008.

Scope 2 (Indirect Emissions)	Electricity	11,803	<p>Electricity is used at 15 major buildings as well as for:</p> <ul style="list-style-type: none"> • Traffic lights, street lights and parking lot lighting • Lighting at the airport • Water and wastewater treatment plant operations • Pump stations in the water delivery and wastewater collections systems
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Vehicle Fleet

Data about City and transit fleet fuel usage is collected from the Public Works, Fire, and Parks and Recreation Departments. Information about vehicle type, vehicle age, fuel type and gallons of fuel used was the basis for computing estimated emissions from operation of the City’s vehicle fleet.

Natural Gas

City staff extracts data about natural gas usage from statements generated by the gas company and collates that data in detailed spreadsheets. Data is tracked by building or other facility by month.

Refrigerants

Information about the refrigerants used by the City of Corvallis was collected from the accounts payable system. The City used 20 pounds of CO₂ to recharge fire extinguishers in 2008.³

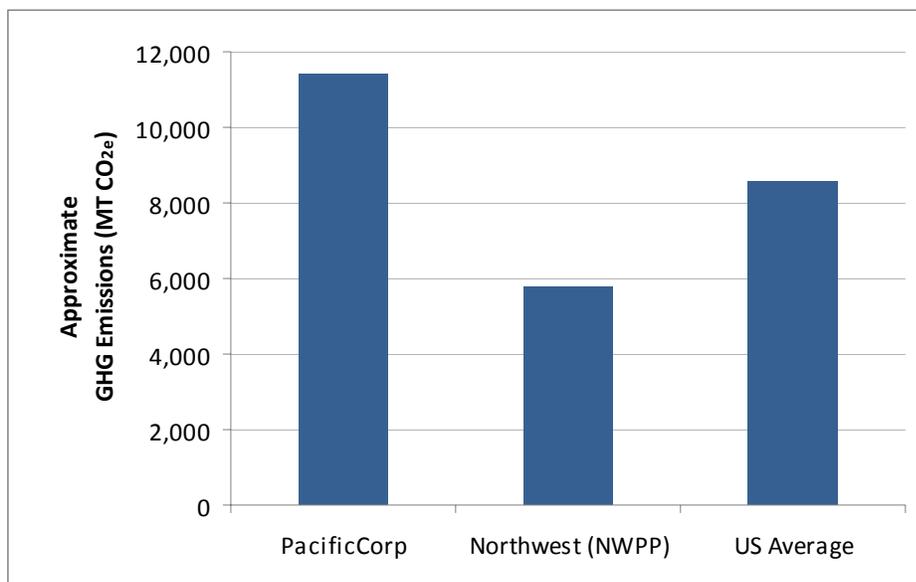
Electricity

City staff extracts data about electric usage from statements generated by electric utilities and collates that data in detailed spreadsheets. Electric use is tracked for buildings, streetlights, traffic lights, parking lot lights, and airport lighting. Electricity use is pro-rated based on square feet occupied in the case of the Law Enforcement Building, where the City shares the space with the County. A significant portion of the City’s electric usage is devoted to treating and delivering potable water to customers, as well as for wastewater facility operation.

Pacific Power, a subsidiary of PacifiCorp, provides nearly all of the power for operations in the City of Corvallis. The electric power emissions factors used for the 2008 inventory are for PacifiCorp for 2006, the latest year for which emissions factors were available. Figure 4 provides additional perspective on the emissions associated with electricity consumption by comparing emissions if alternate emissions factors were used. The emissions factors used in Figure 4 are from the year 2004, but actual emissions data are from the 2008 inventory for City operations.

³ The City used 17 pounds of the refrigerant R-22 for HVAC system maintenance in 2008. It is not included in this inventory because R-22 is governed under the Montreal Protocol and is not considered a greenhouse gas.

Figure 4: Electricity Emissions Scenarios for City of Corvallis using Local, Regional, and National Emissions Factors (2008 emissions, 2004 emissions factors)



Informational Items to Accompany the Inventory

In 2008, the City of Corvallis purchased 900 MWh (megawatt hours) of Blue Sky renewable energy certificates (RECs). According to Pacific Power, purchase of the RECs avoids about 497 MT of CO₂ emissions. The City does not use its purchase of RECs to offset the emissions from electric energy usage that is itemized in this inventory. However, purchasing renewable energy credits helps influence future energy production and encourages the development of clean energy facilities.

In 2008 the City avoided releasing 209 metric tons of CO₂ by using biodiesel in its fleet and transit vehicles. Because the carbon released by combustion of biodiesel is of biogenic origin and would have been emitted to the atmosphere through natural processes of decay, it is not included in the definition of greenhouse gas emissions as defined by the Local Government Operations Protocol.

CITY OF CORVALLIS SUSTAINABILITY EFFORTS AND CLIMATE ACTION

The City has demonstrated a commitment to energy efficiency in its operations and in the community to reduce costs and environmental impacts, including greenhouse gas emissions.

- 2000 – The City Council adopted a resolution committing to participation in the Cities for Climate Protection Campaign.
- 2001 – Corvallis became one of the first municipalities to purchase renewable energy, eventually increasing its commitment to 7% of electricity usage.
- 2005 – The City Council passed a resolution urging residents and businesses to purchase renewable power.
- 2005 – Mayor Helen Berg signed the US Mayors Climate Protection Agreement. Current Mayor Charles Tomlinson also is a signatory.
- 2006 – Corvallis became the first city on the West Coast to be named an EPA “Green Power Community.” By 2009, Corvallis was number one in the nation (it currently ranks third), and in 2010 won the EPA’s first Green Power Community of the Year award.
- 2006 – The City hired a full-time employee to develop a comprehensive sustainability program, which includes gathering baseline data for internal operations, forming City-wide sustainability teams, and coordinating sustainability projects across all departments.
- 2008 – The City joined ICLEI—Local Governments for Sustainability, an association committed to advancing climate protection and sustainable development.
- 2008 – The City of Corvallis partnered with the grassroots Corvallis Sustainability Coalition to develop and implement selected items from a Community Sustainability Action Plan, of which energy is one of 12 topic areas.⁴
- 2008 – City staff facilitated the partnership between the Energy Trust of Oregon and the Corvallis Sustainability Coalition to launch Oregon’s first community energy project. The year-long Corvallis Energy Challenge resulted in an increase in residential energy audits of 335 percent over the previous year.
- 2009 – The City Council chose to use the bulk of Corvallis’s \$511,600 federal energy block grant allocation to build on the Corvallis Energy Challenge by providing outreach, incentives, and demonstration projects.
- 2009 – A City Council Energy Strategy Committee developed the *Community Energy Strategy: A 2020 Framework*, which was adopted by the full Council in January 2010.⁵

City staff has taken many actions to reduce greenhouse emissions and investigate climate action opportunities on an ongoing basis. The following table provides some examples; more detailed information about these projects can be found in the City’s annual sustainability reports, available at <http://www.ci.corvallis.or.us/sustainability>.

⁴ Corvallis Sustainability Coalition, “Community Sustainability Action Plan,” <http://www.sustainablecorvallis.org/actionplan>, 2008.

⁵ City of Corvallis Ad-hoc Energy Strategy Committee, “Community Energy Strategy: A 2020 Framework,” <http://archive.ci.corvallis.or.us/ElectronicFile.aspx?docid=264104>, 2009.

Table 2: Selected Climate Actions of the City of Corvallis

Category	Actions
Transportation	<ul style="list-style-type: none"> • Purchase alternative fuel and fuel-efficient vehicles • Installing electric vehicle charging stations • Enacted “no-idling” policy for City fleet and contractors • Time street signals to reduce vehicle idling • Promote bicycle lanes and facilities, commute trip reduction programs, incentives for car pooling and public transit
Buildings and Energy	<ul style="list-style-type: none"> • Purchase renewable energy • Conduct energy audits and retrofits for City facilities • Converted five City buildings to solar hot water; have grant funding to install a photovoltaic system on one • Upgraded HVAC systems with high-efficiency boilers and energy management systems in three buildings, with more to follow
Solid Waste and Recycling	<ul style="list-style-type: none"> • Collect food debris and staff-generated paper towel waste in yard waste carts for composting • Use compostable products at events • Found outlets to recycle items not collected by solid waste company, such as plastic film, hard plastics, and Styrofoam • Use electronic solutions to reduce paper consumption
Purchasing / Procurement	<ul style="list-style-type: none"> • Encourage or require selection of more sustainable products (e.g., recycled content, ENERGY STAR equipment) for City use • Encourage vendors to recycle and use sustainable materials • Include sustainability requirements in RFPs and contracts • Began inventory of emissions associated with purchased goods and services (see Appendix A on Scope 3 emissions)
Water / wastewater	<ul style="list-style-type: none"> • Capture wastewater treatment methane for energy production • Comprehensive water conservation program provides education, outreach, and incentives to reduce water use and associated energy use • Installing water-wise landscapes and irrigation control systems in parks • Use variable speed drives on pumps to optimize water and energy use
Infrastructure construction / development	<ul style="list-style-type: none"> • Converted traffic signals to efficient light emitting diode (LED) bulbs • Replaced mercury vapor streetlights with high-pressure sodium lights • Use alternative paving options (e.g., porous concrete) • Reuse soil and concrete debris from street reconstruction in other projects • Reuse and recycle materials from building renovations (Majestic Theater) and demolition (Moose Lodge)
Business-related travel	<ul style="list-style-type: none"> • Use City-owned alternative fuel vehicles for local travel • Encourage employees to use their own or City-owned bicycles for transportation when conducting City business • Investigating video- and teleconferencing for meetings and training

CLIMATE ACTION OPPORTUNITIES

A greenhouse gas inventory is the first step toward fulfilling the City's commitments under the US Mayors Climate Protection Agreement and as a member of ICLEI—Local Governments for Sustainability.⁶ Next steps include setting reduction targets and creating a climate action plan that identifies cost-effective opportunities to reduce emissions from City operations.

The City has in progress or has investigated a number of projects that, should they come to fruition, could significantly reduce municipal greenhouse gas emissions. Most of the projects have been made possible by or are dependent on grant funding:

- The City is using \$120,000 of its federal energy block grant allocation to retrofit the Senior Center with a geothermal heat pump. Annual energy savings are projected to be 4,700 kWh of electricity and 6,000 therms of natural gas, the equivalent of 33 metric tons of CO₂.
- The City will continue to build its electric vehicle infrastructure as a participant in the EV Project, a \$230 million initiative to deploy nearly 15,000 charging stations in six states.
- In 2008, the City contracted with SunEnergy Power Corporation to build a 13-acre (2MW) solar array at the wastewater treatment plant. SunEnergy will build the array at its own expense, and then sell the electricity to the City at competitive rates. The project has been stalled because of the economic downturn.
- Parks and Recreation has a Capital Improvement Program (CIP) project for a feasibility study, engineering, and design for solar hot water at the Osborn Aquatic Center.
- Public Works is looking at using excess methane from wastewater treatment to generate electricity or to heat additional buildings.
- Public Works has evaluated using small-scale hydropower to generate electricity for the Rock Creek Water Treatment Plant and is seeking grant funding for the project.
- Public Works and Fire Department staff assisted an OSU Wood Science student investigating the feasibility of using woody biomass to generate heat at Fire Station 5.

In addition to reducing its greenhouse gas emissions, the City of Corvallis is committed to maintaining healthy forests within its urban boundaries and on its 2,352-acre watershed property. Recent discussions of cap-and-trade programs (see Appendix B) have highlighted the importance of forests in reducing atmospheric carbon concentrations. An American Forests study estimated that the Corvallis urban forest stores more than 100,000 tons of carbon at a sequestration rate of about 830 tons per year. Moreover, urban trees provide a secondary carbon reduction benefit by shading buildings and pavement, and reducing the heat island effect, thereby decreasing the demand for electricity. City staff will consider carbon storage benefits in management decisions about the urban and watershed forests and will stay apprised of new policies, scientific research, and financial incentives related to forest carbon storage.

⁶ For more information on the City's commitments, see ICLEI's Five Milestones for Climate Mitigation at <http://www.iclei.org/action-center/getting-started/iclei2019s-five-milestones-for-climate-protection> and the U.S. Mayors Climate Protection Agreement at <http://www.usmayors.org/climateprotection/documents/mcpAgreement.pdf>.

APPENDIX A: SCOPE 3 EMISSIONS

Scope 3 emissions are those that come from critical activities related to the City's operations but that are outside of its direct control. Scope 3 emissions include the following sources.

Business Travel

The City was unable to estimate the emissions related to employee business travel in 2008 because expense records detailing travel costs and method of travel were not available, particularly for shorter-distance trips.

Solid Waste

The City generated an estimated 350 tons of garbage in 2008. The emissions associated with 350 tons of garbage going to a landfill that does methane (CH₄) recovery and generates electricity, such as the Coffin Butte Landfill, is about 47 MT CO_{2e}.

Employee Commutes

Though precise data about the number, length and mode of employee trips to and from work is not available, it is possible to estimate the total commuting miles traveled using some basic assumptions about work schedules, work location, mode of travel and vehicle mileage.

Reasonable estimates for greenhouse gas emissions due to employee commutes range from 596 MT CO_{2e} to 656 MT CO_{2e}.

The City could develop a more refined estimate of emissions from employee commutes if it:

- used additional information from City computer systems to confirm the number of trips each employee makes per year (that is, how many shifts they work per week);
- conducted a survey or used other method to derive a better estimate of the number of employees using some means other than a single-occupancy vehicle to get to work.

Embodied Emissions in Purchased Goods and Services

The City used its purchasing records and the Economic Input-Output Life-Cycle Analysis, (EIO-LCA), a public-domain tool developed by Carnegie Mellon University,⁷ to estimate the emissions associated with producing the goods and services purchased by the City. This estimate can be used to inform future guidelines for purchasing behavior.

Embodied emissions in purchased goods and services for the City of Corvallis are estimated to be 4,144 MT CO_{2e} for 2008. Estimated embodied emissions (which are Scope 3 emissions) represent about 27% of the City's total Scope 1 and 2 emissions from operations for 2008. More than one-half of the estimated embodied emissions came from two categories of expenses: 1) maintenance and operating supplies (excluding fuel); and 2) purchasing professional and technical services. Purchasing vehicles accounts for 12% of estimated embodied emissions.

⁷ Carnegie Mellon University Green Design Institute (2008), Economic Input-Output Life Cycle Assessment (EIO-LCA), US 1997 Industry Benchmark model, <http://www.eiolca.net>.

APPENDIX B: POLICY AND REGULATORY CONTEXT

Beyond Corvallis, regulatory action regarding greenhouse gas emissions, as well as energy- and transportation-related legislation and policy, is taking place at the international, national, regional, and state levels.

Scale	Recent activity
International	The non-binding Copenhagen Accord resulted from the UN Copenhagen Climate Conference of December 2009. The Accord calls for developed countries to set targets to reduce emissions by 2020. Developing countries agree to pursue nationally appropriate mitigation strategies to slow the growth of their emissions but are not committed to reducing their carbon output. As of January 2010, 138 countries had signed the agreement.
Federal	The American Clean Energy and Security Act of 2009 (also known as the Waxman-Markey Bill) would establish a cap-and-trade system, under which the government sets a limit on the total amount of greenhouse gases that can be emitted nationally. Companies could then buy or sell permits to emit these gases. The bill was approved by the House of Representatives in June 2009, but in July 2010 the Senate declined to consider climate change legislation before the end of the legislative term. Meanwhile, the US EPA has issued mandatory reporting guidelines for large emitters of greenhouse gases (25,000 tons per year). Other energy and economic stimulus legislation passed by the federal government supports climate-related initiatives.
Regional	Three regional initiatives – Western Climate Initiative (WCI), Midwestern Greenhouse Gas Accord (MGGA), and Regional Greenhouse Gas Initiative (RGGI) – continue to move forward with programs that include carbon emissions limits, offset credits, and complementary policies on energy efficiency, clean car standards, renewable energy, and low carbon fuel standards. RGGI began auctioning emission permits for power plants in late 2008, and the first three-year compliance period began in January 2009. The WCI plans to implement the first phase of its cap-and-trade program in January 2012, and the MGGA has finalized draft recommendations.
State of Oregon	In 2007 the Oregon legislature passed HB 3543, which established goals both to reduce greenhouse gas emissions by targeted dates and to prepare for and adapt to the impacts of climate change. In 2008, Oregon adopted Administrative Rules that require certain entities emitting more than 2,500 tons of greenhouse gases per year to report to the Department of Environmental Quality, beginning in 2010 for the 2009 calendar year. On the incentive side, the Oregon Department of Energy offers the Business Energy Tax Credit to those who invest in energy conservation, recycling, renewable energy resources and less-polluting transportation fuels.

APPENDIX C: COST OF CARBON: QUANTIFICATION AND RISK

Assembling a greenhouse gas inventory is an opportunity to analyze a particular kind of financial risk—the implications of a future “cost of carbon,” a direct or indirect cost associated with greenhouse gas emissions as a result of policies such as those outlined in Appendix B. Many analyses of proposed legislation have indicated a likely range of this cost, and examples exist from countries that have already capped CO₂ emissions.

A 2009 EPA analysis⁸ of proposed climate policy suggests that, within a few years of implementing a cap-and-trade system, the cost of carbon could be around \$15 per MT CO₂e. One proposed “reserve price” (or price floor) is \$10, while short-term “escape hatch” prices (or price ceilings) have been around \$30. This range provides a sense of the City’s total direct and indirect financial exposure related to the cost of carbon. At the City’s 2008 level of emissions of 15,411 MT CO₂e, the cost of carbon could be:

- \$10 per MT CO₂e = \$154,110
- \$15 per MT CO₂e = \$231,165
- \$30 per MT CO₂e = \$462,330

This total financial risk is unlikely to be borne entirely by the City of Corvallis. Indeed, just as part of the carbon footprint is shared with others—from employees who commute to vendors that supply the organization with goods and services—the cost-of-carbon risk will likely be shared. This rough calculation is an approximation of the financial risk that could emerge under likely climate policy scenarios.

⁸ U.S. Environmental Protection Agency Office of Atmospheric Programs, “EPA Analysis of the American Clean Energy and Security Act of 2009 H.R. 2454 in the 111th Congress,” http://www.epa.gov/climatechange/economics/pdfs/HR2454_Analysis.pdf, June 23, 2009.

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Melissa Powel, Public Works
Steve Rogers, Public Works
Adam Steele, Public Works
Mary Steckel, Public Works
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Information about the City's sustainability program is available at <http://www.ci.corvallis.or.us/sustainability> or by contacting Sustainability Supervisor Linda Lovett at 541-766-6916.