CITY OF BEND BASELINE GREENHOUSE GAS EMISSIONS INVENTORY REPORT: FY 2019

October 2020

CITY OF BEND

Contents

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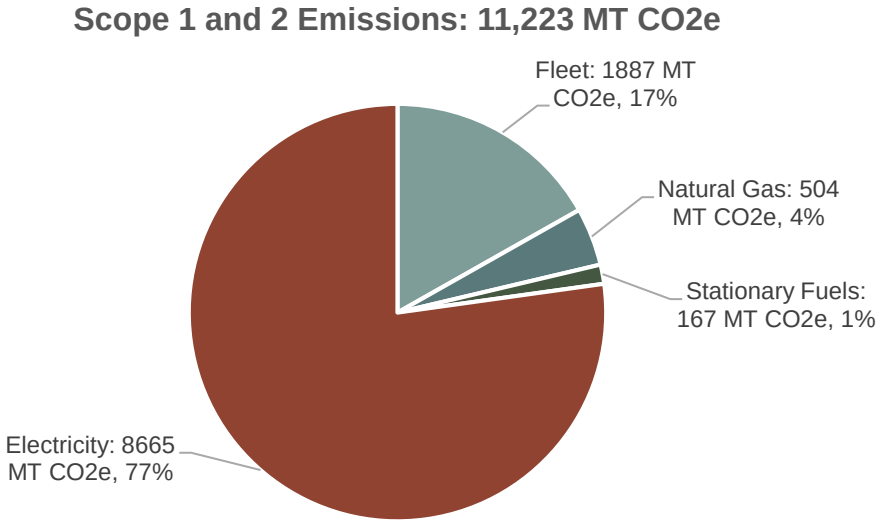
Executive Summary

The City of Bend conducted a greenhouse gas (GHG) emissions inventory to better understand the sources and quantity of emissions from its City operations and facilities to inform its Strategic Energy Management Plan. The inventory follows the internationally recognized Local Government Operations Protocol with an additional supply chain emission analysis. The findings in this report will serve as the baseline for measuring the City's climate action goals. Key findings include:

- City of Bend operations generated **11,223 MT CO_2e** from sources from Scope 1 and 2 sources.
- Purchased electricity contributing **8,665 MT CO_2e** to the total emissions and represents the largest category of emissions, at 77% of the total, among Scope 1 and 2 emissions.
- City owned vehicles and mobile equipment contribute **1,887 MT CO_2e** and is the second largest category of emissions among Scope 1 and 2 emissions.
- Supply chain emissions are **24,384 CO_2e.** While these emissions are not included in the City's climate action goals, the large relative magnitude of this category demonstrates the more accurate and holistic impact that the City has on climate. It is important that the City works to address supply chain impacts, despite not being a part of their formal goals.



Based on this data, the City's priority for reducing GHGs should be to address electricity consumption and fleet vehicles. The majority of the City's electricity consumption occurs in its water and water reclamation infrastructure.

This inventory was produced in tandem with the City of Bend Strategic Energy Management (SEM) Plan. The SEM Plan identifies five year strategies and actions that reduce GHG emissions to achieve the City's adopted climate action goals. This inventory can help to prioritize the projects in the SEM Plan.

1. Introduction

The City of Bend believes that meaningful action is needed at all levels of government to mitigate and adapt to climate change, protect the public trust, ensure a resilient community, and leave a healthy environment and atmosphere for future generations. To this end, the City is committed to regularly monitoring and reporting on progress toward meeting prescribed climate action goals, adopted by the Bend City Council in 2016. This greenhouse gas emissions (GHG) inventory is the first inventory for the City of Bend's facilities and operations. This inventory will serve as the baseline for measuring progress towards achieving Bend's climate goals moving forward.

City of Bend Climate Action Goals

In September 2016, the City Council adopted Resolution 3044 which established climate action goals for the City and the Community as well as fossil fuel and greenhouse gas reduction targets for City facilities and operations. The resolution stated the City's intent to seek to reduce:

1. Its carbon dioxide emissions in its own facilities and operations to achieve carbon neutrality by the year 2030.
2. Its fossil fuel use by 40% by 2030 and by 70% by 2050, from a baseline year of 2010 or later.

Resolution 3044 also directed staff to create a climate action plan to identify short and long term strategies to reduce GHG emissions from the City's operations and facilities. That plan, called the Strategic Energy Management (SEM) Plan, has been developed in tandem with this baseline GHG emissions inventory. This greenhouse gas emissions inventory can help determine which projects from the SEM plan should be prioritized and which actions may yield the greatest results.

2. Methods: Boundaries, Data, Protocols, and Sensitivity Analysis

Inventory Boundaries

In many GHG inventory protocols, emissions sources and activities are classified as either producing direct or indirect GHG emissions. Direct emissions are those that stem from sources owned or controlled by a particular organization. Indirect emissions occur because of the organization's actions, but the direct source of emissions is controlled by a separate entity.

To distinguish direct from indirect emissions sources, three "scopes" are defined for traditional GHG accounting and reporting purposes (WRI, The Greenhouse Gas Protocol, p. 25).

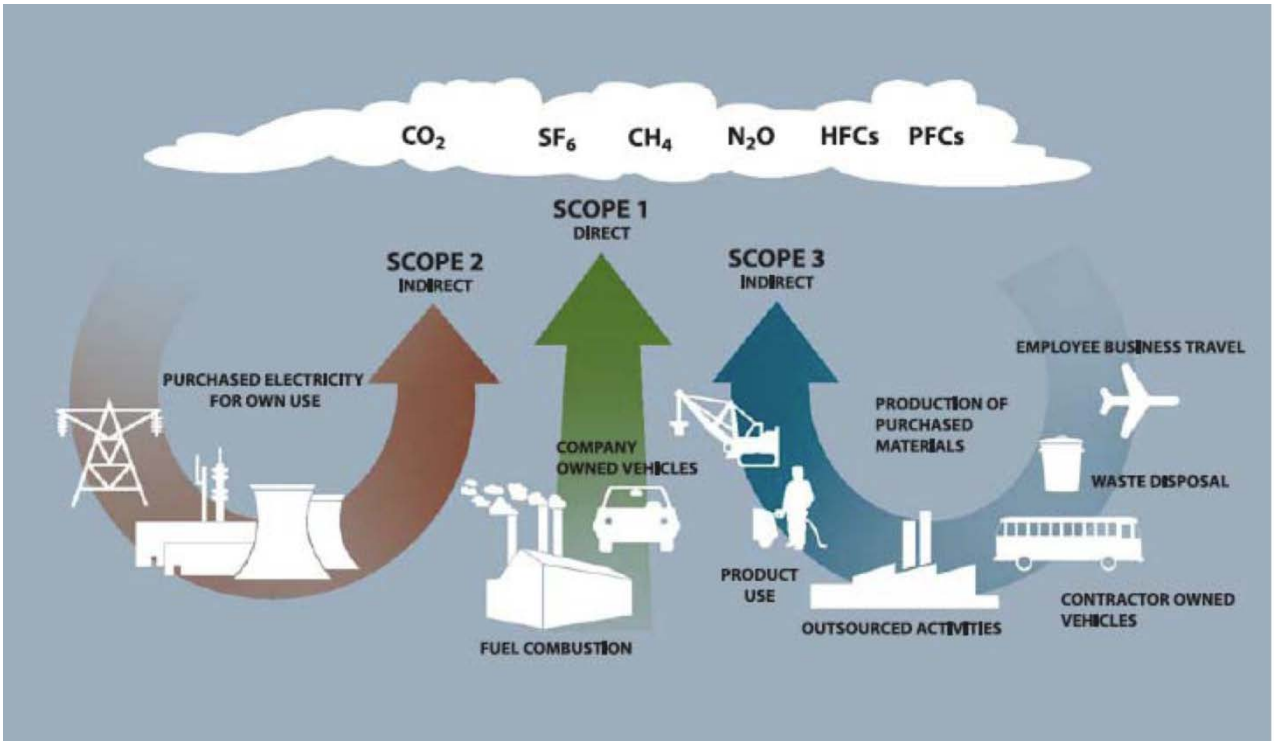
Scope 1 – Direct sources of GHG emissions that originate from equipment and facilities owned or operated by the City of Bend

Scope 2 – Indirect GHG emissions from purchased electricity, heat or steam.

Scope 3 – All other indirect sources of GHG emissions that may result from the activities of the City of Bend but occur from sources owned or controlled by another company or entity, such

as: business air travel, embodied emissions in material goods purchased by the City, outsourced activities, emissions from landfilled solid waste and the commuting habits of City employees.

Figure 1: Greenhouse Gases and Accounting and Reporting Scopes



Source: WRI/WBCSD Greenhouse Gas Protocol, Corporate Accounting and Reporting Standard (Revised Edition), Chapter 4.

Scope 1 (direct) and Scope 2 (indirect) emissions must be reported for most protocols and registries. Scope 3 emissions are indirect and usually considered optional when reporting emissions, but serve to clarify an organization's entire carbon footprint and illuminate the potential regulatory and financial risks an institution may face due to its carbon footprint. The City of Bend, aligned with the majority of municipalities, has goals focused on Scope 1 and 2 emissions. However, the inventory was completed to also include Scope 3 emissions in order to understand the scale of these emissions as the City may want to address them in the future. Figure 1 illustrates the three scopes of emissions. When a municipality decides to conduct a greenhouse gas inventory, there are two different types of inventories to consider: a local government operations inventory (such as this one) or a community inventory.

A *local government operations inventory* draws its boundaries around activities necessary for the city government to fulfill its mission, even though all those activities are on behalf of the citizens and businesses that live and work in the community. This inventory is a local government operations inventory and helps us to understand the greenhouse gas footprint of the City's operations and facilities, which will allow us to develop strategies to reduce those emissions.

A *community inventory* has a broader scope and draws its boundaries around a geographic location and includes all the activities and emissions sources needed to serve that area including government, citizen and business activities. Therefore, a local government operations inventory would be one component of a greater community-wide inventory. The City of Bend conducted a community inventory with a baseline year of 2016 during the development of the Community Climate Action Plan.

Protocol and Tools

This inventory follows the Local Government Operations Protocol (LGOP), which provides the highest-consensus guidelines for minimum reporting scope and was developed jointly by The Climate Registry and other organizations[1]. However, the protocol only requires the reporting of emissions in Scopes 1 and 2 as defined by the World Resources Institute. Therefore, this inventory has gone further to include several shared emissions categories from Scope 3. The use of additional high-quality public-domain tools to estimate Scope 3 emissions makes this inventory more robust than inventories focused only on mandatory or bare-minimum boundaries. This more integrated and holistic approach paints a more accurate portrait of total emissions associated with the City of Bend's operations. The City utilized Good Company's Carbon Calculator (G3C) to calculate all GHG emissions for City operations. G3C follows the standards set by the LGOP protocol in its methodology and calculation of emissions. Calculations in G3C are fully transparent and include an audit trail that includes all data and resources used in the inventory.

All emissions are reported in metric tons of carbon-dioxide equivalent (MT CO_2e). The reporting year for the baseline was selected as Fiscal Year 2019(July 1, 2018-June 30, 2019). The analysis attempts to cover all six "Kyoto gases" including: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6) and the groups of high global warming potential (GWP) gases, perfluorocarbons (PFCs) and hydrofluorocarbons (HFCs). Because the City does not use PFCs or SF_6, these gases are not included. Overwhelmingly, the direct and indirect CO_2-equivalent emissions are CO_2 from the combustion of fossil fuels.

Description of Data and Assumptions Used

This section is designed to describe where the data was collected and the basic methodology, assumptions and level of estimation/accuracy for each emissions source. The analysis drew on high-consensus public-domain tools for emissions factors and methods. Emissions from some sources (such as natural gas and electricity consumption) were based on highly accurate data and accepted emissions factors. Emissions from other sources (such as employee commute) were estimated by combining available data with industry-specific

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

assumptions and sensitivity analyses. Still others (such as embodied emissions in purchased goods and services) were calculated using estimated data and emissions factors based on averages for the U.S. economy as a whole.

Table 1 describes the data and assumptions used for each emissions category.

Table 1

Emissions Category	Description, Data and Assumptions Used
SCOPE 1: *Direct sources of GHG emissions that originate from equipment and facilities owned or operated by the City of Bend*	
Fleet	Fleet fuel includes mobile combustion emissions from the City's fleet of light and heavy-duty vehicles. Fleet fuel data also includes fuel used in generators and some stationary construction and maintenance equipment. It was assumed that all fuel meets the state guidelines for biofuel blends (E10 for gasoline and B5 for on-road diesel). For fleet vehicles, exact consumption data in gallons was provided. For some bulk purchases, expenditures were available and total gallons purchased was calculated through historical fuel price data.
Natural Gas	The City consumes natural gas for space and water heating. Natural gas is also consumed at pump stations in the wastewater system. Exact consumption at City facilities in gallons was available for the reporting period.
Stationary Fuels	Stationary fuels includes diesel and propane used in generators at the Water Reclamation Facility and the Water Filtration Facility. Exact consumption data in gallons was available.

SCOPE 2: *Indirect GHG emissions from purchased electricity, heat or steam*	
Purchased electricity	Electricity emissions were calculated from all electricity consumption at all City owned and leased facilities, streetlights, traffic signals, and throughout the water and wastewater system (i.e. pump stations, lift stations, wells, reservoirs). Exact consumption data was available for the reporting period. Emissions were calculated using the market-based emissions factor, which is utility-specific, as opposed to a regional average. The City's purchase of renewable energy credits (RECs), was also included for a portion of the electricity consumption.
SCOPE 3: *All other indirect sources of GHG emissions that may result from the activities of the City of Bend but occur from sources owned or controlled by another company or entity*	
Business Travel	Business travel includes employees' flights, use of rentals cars and other travel expenditures for conferences, trainings, and meetings. Emissions were estimated based on business travel expenditures and average emission factors for those activities.
Solid Waste	Total pounds of solid waste sent to landfill was estimated based on the size and frequency of dumpster pick-ups by the City's waste haulers. Both waste haulers for the City provided the location, size, and pick-up schedule for the City's dumpsters. Emissions from the landfill is estimated using the estimate volume of the City's waste and calculating through the EPA's Waste Reduction Model (WARM).
Upstream Energy Production	Emissions from upstream energy production account for the energy and process emissions during extraction and refinement of fuels. These emissions are calculated based on the consumption of electricity, natural gas, and fuel.
Employee Commute	Mode split for employee commutes were based on the average for Deschutes County residents as reported in the American Community Survey. The average commute distance was estimated based on data from the 2019 City of Bend Commuting Factors report by Commute Options.
Supply Chain	For estimating the embodied emissions associated with producing the goods and services purchased by the City, this analysis relied on Economic Input-Output Life-Cycle Analysis (EIOLCA), a public-domain tool developed by Carnegie Mellon University.[2] The EIOLCA estimates emissions based on expenditures in different categories. Complete expenditure data was provided for FY19 and then roughly categorized into sectors defined by the EIOLCA tool.

[2] Carnegie Mellon University Green Design Institute. (2008) Economic Input-Output Life Cycle Assessment (EIO-LCA), US 1997 Industry Benchmark model [Internet], Available from:<http://www.eiolca.net> Accessed 1 January, 2008.

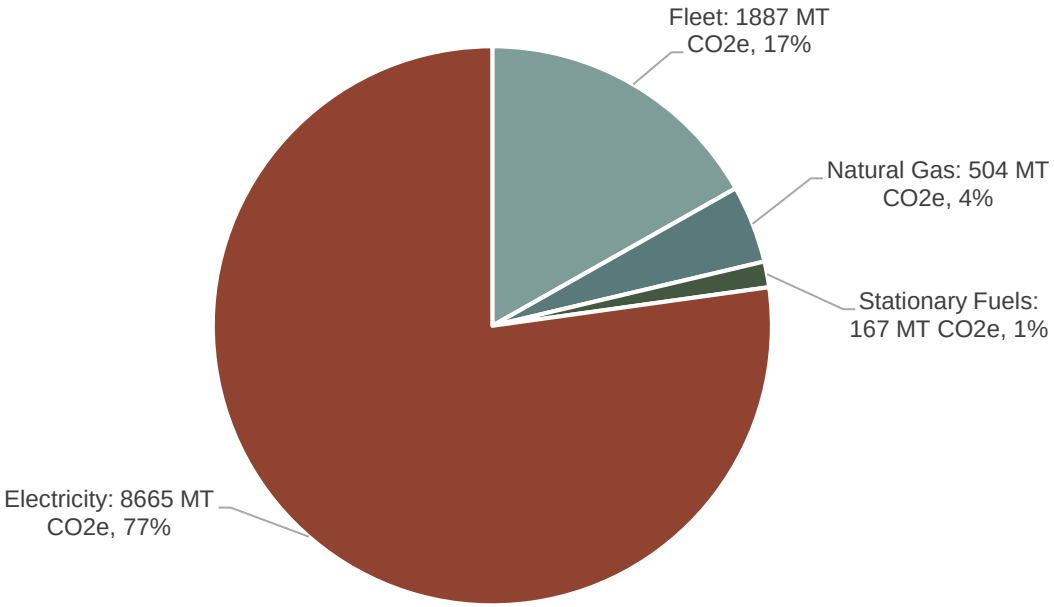
	The EIOLCA tool helps estimate emissions by providing average emissions intensities for different purchasing categories.
Wastewater Process	Emissions from wastewater come from the flaring of biogas generated at the plant. Calculations were based on the quantity composition of biogas produced.

3. Inventory Results

Agency Wide Summary

In FY19, City of Bend operations generated **11,223 MT CO2e** from sources from Scope 1 and 2 sources, which are the primary areas included in the City's climate action goals. The largest source within the goal is purchased electricity, contributing 8,665 MT CO2e, and therefore represents the biggest opportunity for reductions. The other primary area within the goal comes from City owned vehicles and mobile equipment, which contributes 1,887 MT CO2e.

Figure 2. Scope 1 and 2 Emissions: 11,223 MT CO2e



When including scope 3 emissions, such as supply chain, commuting, business travel, wastewater, and upstream energy production, the City's emissions footprint is significantly larger, at **40,636 MT CO2e**. The vast majority of scope 3 emissions come from supply chain, which generate 24,384 MT CO2e. Supply chain emissions were dominated by construction and maintenance expenditures. Another major area of scope 3 emissions is upstream energy production, which is linked to the amount of electricity the City purchases.

Figure 3
Greenhouse Gas Emissions: Scope 1, 2 & 3

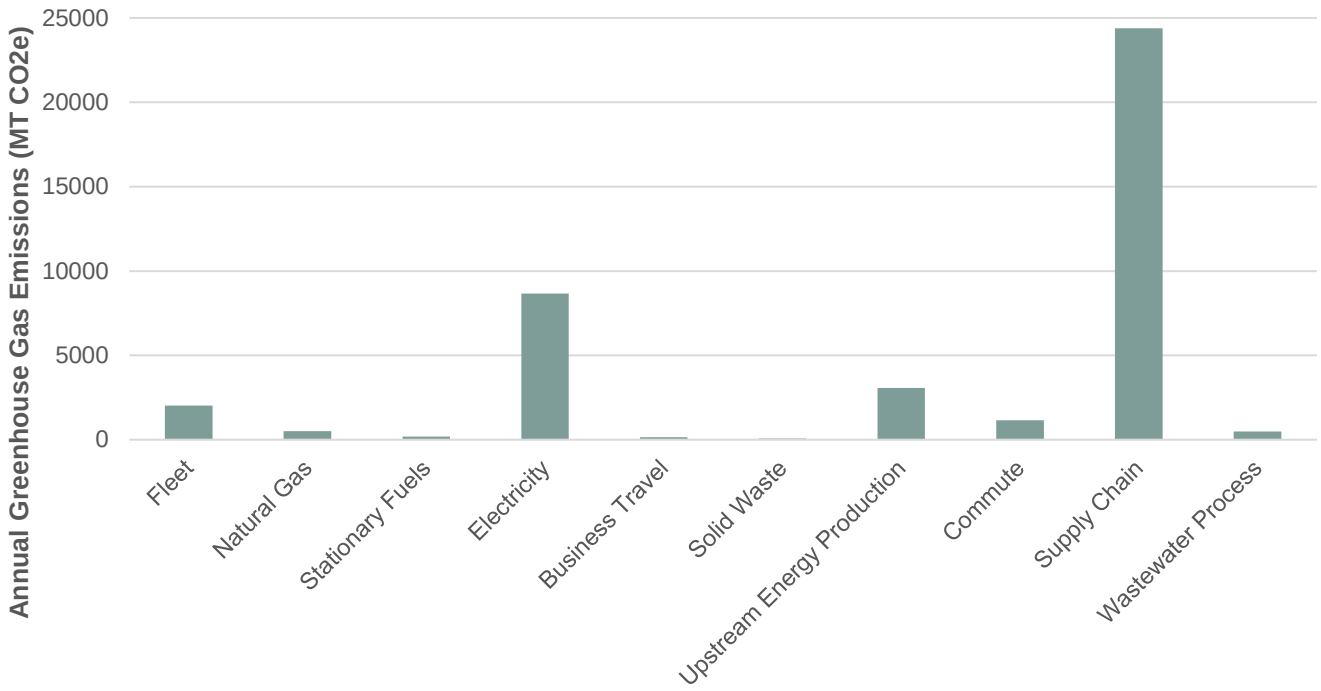


Table 2 summarizes the total quantity of emissions by each category, also refected in Figure 3.

Table 2

Emissions Category	FY19 Emissions (MT CO2e)
Scope 1	
Fleet	1,887
Natural Gas	504
Stationary Fuels	167
Scope 2	
Purchased electricity	8,665
Scope 3	
Business Travel	139
Solid Waste	75
Upstream Energy Production	3,174
Employee Commute	1,159
Supply Chain	24,384
Wastewater Process	482

Inventory Highlights

The following inventory areas are further explored in order to understand how different departments are contributing to each of these areas: building energy, fleet and supply chain.

Other areas are not included if the total category was very small and therefore not a priority, or if the data is not separated into multiple departments (i.e. business travel, employee commute, wastewater processes).

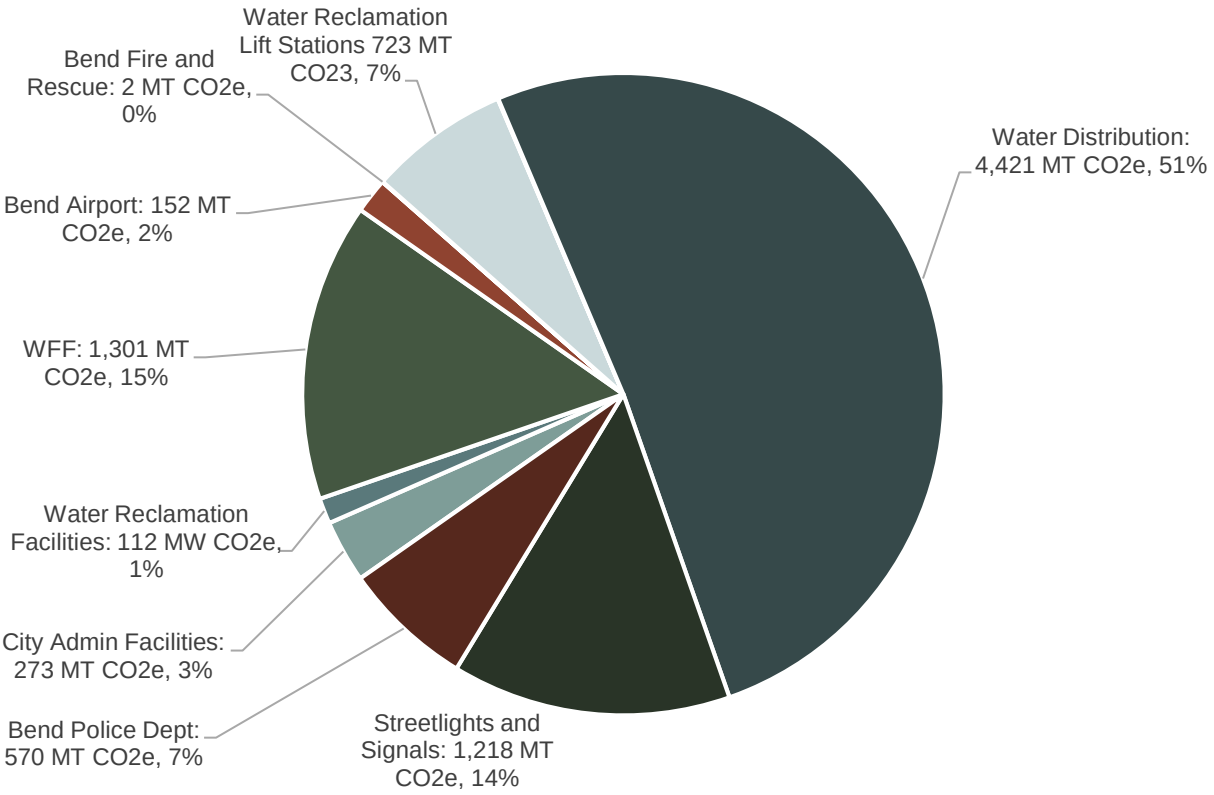
Building Energy

Electricity

Building energy, especially electricity consumption, is the largest share of Scope 1 and 2 emissions for the City of Bend, at 9,336 MT CO2e and represents the biggest opportunity for Bend to make greenhouse gas reductions. Building energy consists of purchased electricity, natural gas combustion, and a small amount of additional fuel used in on-site generators and stationary equipment. Of the 9,336 MT of CO2e contributed by building energy, 8,665 MT CO2e comes from electricity purchased by Bend's utility providers Pacific Power and Central Electric Cooperative.

Figure 4 shows how different operational departments contribute to the overall electricity-related emissions.

Figure 4. Emissions from Electricity: 8,665 MT CO_2e



The largest GHG impact from electricity occurs in the water distribution system, through the pumps, wells, reservoirs and pressure reducing valves. This represents over half of the City's electricity-related GHGs, even when excluding the Water Filtration Facility (WFF) and intake facility. When including the WFF and intake facility, the water distribution system represents

66% of the City's GHG footprint associated with electricity. After the water distribution system, the next largest areas of opportunity include streetlights and traffic signals (14% of electricity-related emissions) and wastewater lift stations (7% of electricity related emissions).

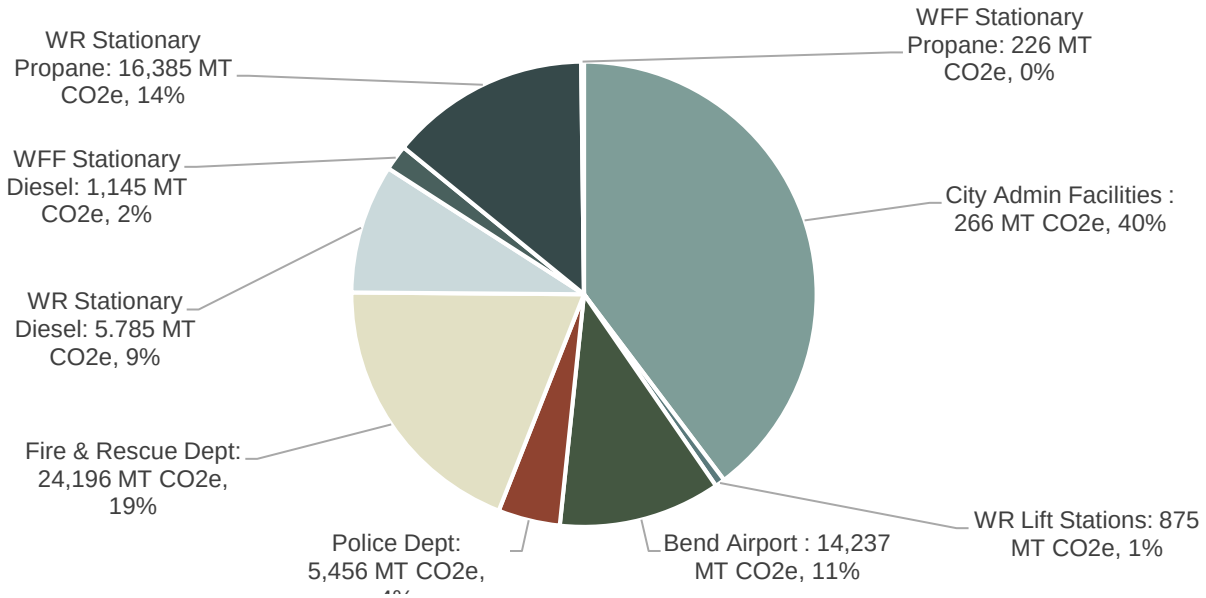
The particular utility territory that each facility is located within has an enormous impact its associated emissions. Pacific Power's electricity is generated primarily by fossil fuels such as coal and natural gas, while Central Electric Cooperative's (CEC) electricity is provided by large-scale hydropower from Bonneville Power Administration, which has a low greenhouse gas impact. Therefore, facilities in Pacific Power territories have a dramatically larger emissions impact than any located in CEC territory. Due to this, the City's largest single electricity consumer, the Water Reclamation Facility (WRF), has a low emissions profile as it is located within CEC territory.

Emissions from electricity are also influenced by the purchase of renewable energy credits (RECs), which represent energy generated by renewable energy sources such as solar or wind. The City purchases renewable energy credits through Pacific Power's Blue Sky Program, equivalent to roughly 8% of its total electricity consumption from Pacific Power. In the inventory, these have been distributed to the departments whose account they are associated with. The Bend Fire and Rescue department purchases annually more than the total amount of electricity it consumes. Therefore, Bend Fire and Rescue has zero GHG emissions associated with its electricity consumption. Various City administration buildings also purchase RECs, such as City Hall. The excess RECs that are purchased through Bend Fire and Rescue have been attributed to City administration facilities in this inventory.

Stationary Fuel: Natural Gas, Diesel and Propane

Stationary fuels contribute a relatively lower amount of GHG emissions at 670.5 MT CO2e. However, stationary fuels are a Scope 1 emission and represent an important sector to reduce. Stationary fuels include the natural gas used for heating buildings and the diesel and propane used in stationary equipment such as generators. The largest contributor to natural gas emissions is heating used in the City administrative buildings, fire stations, and the Bend airport. Stationary diesel and propane generators for the water reclamation system are also a significant component of stationary combustion, at 23% of the related emissions. Figure 5 shows how natural gas emissions are distributed among the City of Bend's facilities.

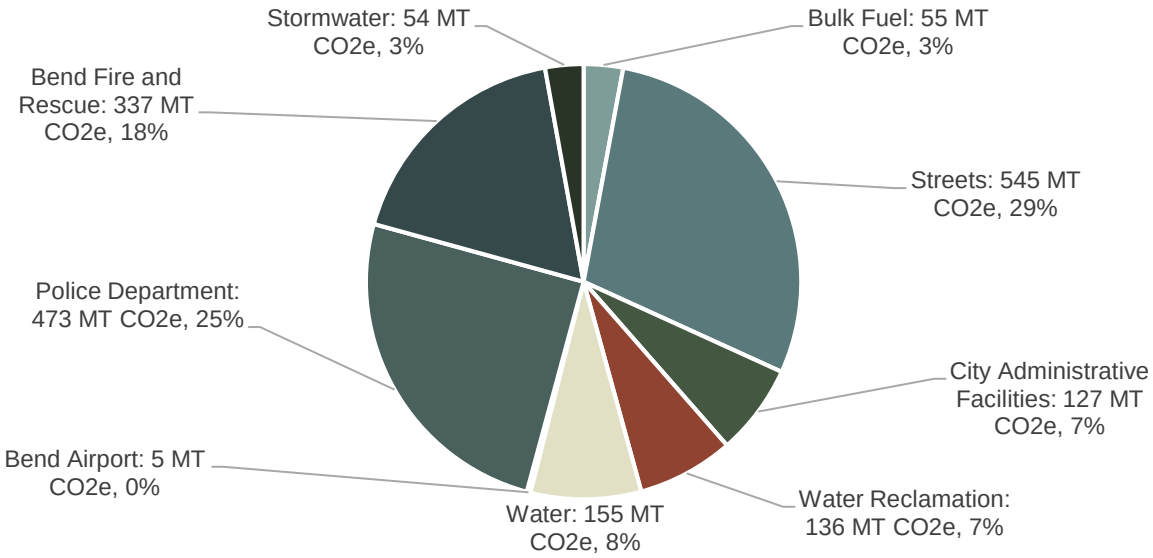
Figure 5.
Emissions from Stationary Fuel: 670.5 MT CO2e



Fleet

Emissions from the City's fleet contributes 1,887 MT CO2e and is a Scope 1 emission. Most of the fuel consumption in the City's fleet comes from the Streets and Operations department (29%), closely by the Bend Police Department (25%) and Bend Fire and Rescue. Figure 6 shows the breakdown of emissions from Fleet.

Figure 6.
Emissions from Fleet: 1,887 MT CO2e



The rest of the emissions come from other City fleet vehicles such as the motor pool vehicles, utility vehicles, and others used for specific department functions. Bulk fuel includes diesels fuel for construction equipment and gasoline for small engines such as weed eaters and chain saws. Emissions can be reduced in fleet by switching to alternative fuels (i.e. renewable biodiesel) and electric vehicles as replacement opportunities occur and technologies improve and become more cost effective.

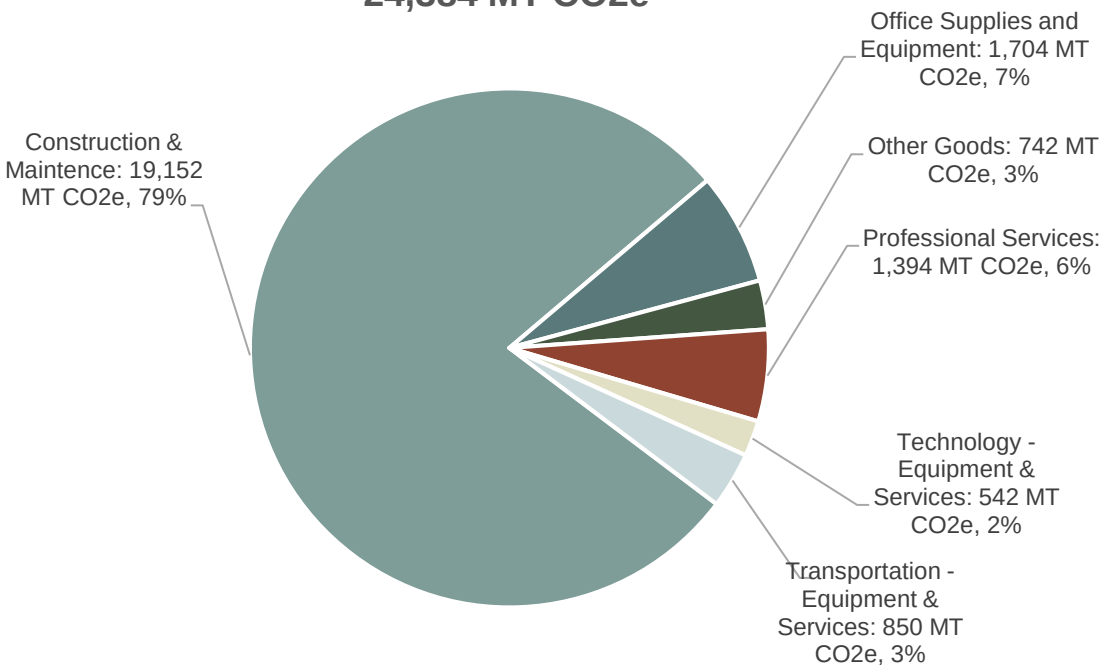
Supply Chain

Emissions from purchased goods and services are estimated based on Economic Input-Output Life-Cycle Analysis (EIOLCA), a public-domain tool developed by Carnegie Mellon University.[3] The EIOLCA calculates emissions based on expenditures in different categories and takes into account the full life cycle impact of a good or service purchased. Supply chain emissions are Scope 3 emissions and not included in the scope of the City's climate action goals. However, the impact associated with purchased goods and services is significantly larger the impact of Scope 1 and 2 emissions for many agencies and organizations. It is therefore best practice to include supply chain analysis in emissions estimating, reporting, and reduction planning when working to address an organizations impact on climate. Greenhouse gas emissions from supply chain are an estimate, as the calculations rely on statewide averages and the expenditure categorization is imperfect. Still, the estimated quantity of Scope 3 emissions is so much larger than the City's Scope 1 and 2 emissions that including this estimate provides a more realistic understanding of the City's impact on climate.

For the City of Bend, Scope 3 emissions are almost three times are large as Scope 1 and 2 emissions combined, and supply chain emissions, at 24,384 MT CO2e, make up the vast majority of the City's scope 3 emissions. Supply chain emissions were summarized into six broad categories for this analysis: construction and maintenance, office supplies and equipment, professional services, technology equipment and services, and transportation equipment and services. Figure 7 shows the breakdown of supply chain emissions by those categories:

[3] Carnegie Mellon University Green Design Institute. (2008) Economic Input-Output Life Cycle Assessment (EIO-LCA), US 1997 Industry Benchmark model [Internet], Available from:<http://www.eiolca.net> Accessed 1 January, 2008.

Figure 7.
Emissions from Purchased Goods and Services:
24,384 MT CO2e



Construction and maintenance contributes the vast majority of supply chain emissions, at 79% of the total. Construction and maintenance expenditures include the City's capital improvement projects. This category of expenditure should be the City's primary focus when addressing supply chain emissions.

Emissions from supply chain can be reduced by implementing green procurement policies and programs that encourage departments to purchase lower-carbon products and higher efficiency equipment. Due to the magnitude of emissions from supply chain, addressing these through such programs is important in reducing the City of Bend's greenhouse gas footprint. However, as these GHG estimates are based on expenditures and average emission facts, reductions from changes in supply chain may be difficult to track on a year-to-year basis. The best way, therefore, to use the supply chain analysis is to identify and address priority areas of largest impact.

4. Next Steps

The City has developed its first Strategic Energy Management Plan in tandem with this report, which describes the actions that the City will take over the next 5 years to begin reducing its emissions. The SEM will require cross departmental collaboration and action to reduce emissions across facilities, fleet, utilities, engineering, operations, and procurement.

Using the baseline inventory established in this report and repeating it every one to two years, the City will be able to track and report on progress made towards accomplishing the climate action goals adopted in Resolution 3044.