CITY OF BEND

Community Climate Action Plan

Bend Community Climate Action Plan

Climate Mitigation Strategies and Actions: 2020-2025

Acknowledgements

The City of Bend thanks the following community members, organizations, and staff for contributing to the development of this Community Climate Action Plan through the technical working groups, stakeholder input, or providing data for modeling and analysis.

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Project Funders

The Oregon Community Foundation Donor Advised Funds

Partners for Places, a joint project of the Funder's Network for Smart Growth and Livable Communities and The Urban Sustainability Network

The Environmental Center and its individual and business donors.

Technical Analysis and Public Engagement Support

EnviroIssues
Good Company
HIP Investor
Stanton Global Communications

City of Bend

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See Appendix H for complete list of other advisory committee and stakeholder participants.

Roadmap to the Community Climate Action Plan

The Bend community has made itself clear – it is time to take action against climate change. Climate change directly impacts Bend residents and the natural environment that makes this area so special. In response to community interest, the City Council adopted Resolution 3044 in September 2016 that established climate action goals to reduce community fossil fuel use by 40% by 2030 and by 70% by 2050.

The Bend community is committed to doing its part to mitigate the most severe impacts of climate change. The Community Climate Action Plan lays out a pathway to reduce our fossil fuel use and demonstrate the will of our community to stand together to protect the environment for generations to come.

The vision for the Community Climate Action Plan is to have neighbors, businesses, and community leaders work together to preserve our natural environment while promoting economic opportunity and resilience for current and future generations.

Terms you should know

This Plan is divided into the four **"climate sectors"** that make up the bulk of Bend's emissions. These are:

Energy Supply

Transportation

Energy in Buildings

Waste and Materials

Within each sector is a list of **"climate strategies"** – higher-level objectives that the community needs to achieve to reduce its fossil fuel use.

Each climate strategy is then broken down into **"climate actions"** – specific policies, programs, or projects that can be implemented to help reach those objectives.

See other terms you don't recognize? Take a look in the glossary on page 40.

How to read the Community Climate Action Plan

Chapters 1-3 provide the context for this Plan by describing the process used to develop it, the impacts of climate change in Bend and how Bend contributes to climate change.

Chapter 4 provides the Vision, Goals, and Guiding Principles for this Plan.

Chapter 5 describes how this Plan proposes to achieve the Vision and Goals.

Chapter 6 details the specific climate strategies and actions the City and the community have developed to help Bend reduce its fossil fuel use and meet its emissions reduction targets.

Chapter 7 describes how the City and community will coordinate to implement and evaluate this Plan going forward.

Contents

1. Background

In 2016, Bend residents made themselves clear – the Bend community wants local, community action to address climate change. Bend is a community that is deeply connected to its natural resources. Situated in beautiful Central Oregon, where the Cascade mountains meet the high desert, abundant natural beauty is one of the reasons residents love to call Bend home. The natural resources surrounding Bend have also long been vital to the Bend economy. From its timber industry roots to its present-day support from the outdoor recreation industry, healthy ecosystems surrounding the community benefit all who live here.

In response to the community's push for local climate action, the Bend City Council set climate action goals **to reduce fossil fuel use community wide by 40% by 2030 and by 70% by 2050.** These goals are documented in Bend City Council Resolution 3044, which states:

"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. The City and community of Bend also recognize that energy conservation and other actions to address climate change can complement economic development and contribute to a thriving and livable community."

The term "fossil fuels" describes energy sources that come from ancient organisms and plant matter. Examples of fossil fuels include coal, oil, and natural gas.

What is the Bend Community Climate Action Plan?

The Bend Community Climate Action Plan is a set of strategies that will guide the City and community as we work together to reduce our fossil fuel usage. The City and the Climate Action Steering Committee have developed this Plan with extensive participation by the Bend community.

The strategies consist of new and expanded programs, policies, and systems that the community proposed and vetted. They are meant to encourage and support residents, businesses and other agencies to reduce the community's fossil fuel use and help mitigate climate change. When the climate resolution was passed, the community and the City decided to focus the Plan on mitigation strategies, which directly reduce the amount of emissions that Bend contributes to the atmosphere, rather than adaptation strategies. The strategies in this Plan are near-term activities that can be initiated or complete in three to five years. The goal is to implement this Plan from 2020 through 2025, and then update this Plan on a regular basis as we continue working towards the 2050 goal.

Every day, we make decisions about what to build, invest in, and buy. The climate impact of those decisions will play a role in what Bend looks like for today's children, their children and beyond. This Plan is a roadmap that will guide our community in making decisions that support a sustainable, healthy future for all.

A Community Effort

The Bend community collectively possesses the skills, knowledge, and resources that can be harnessed to create solutions to mitigate Bend's climate impact. Success depends on bringing these skills and resources together, jointly assuming responsibility, and developing collaborative solutions. In this spirit, the City worked with the community through extensive public and stakeholder outreach to co-create this Plan.

Grants and local fundraising, including the Oregon Community Foundation, donor-advised funds, and a local campaign coordinated by The Environmental Center provided the majority of the financial support for the project.

The City of Bend appointed a 13-person Climate Action Steering Committee to develop the strategies and actions in this Plan. The Committee represented diverse interests and stakeholders across the community, including the business community, environmental organizations, government agencies and institutions, youth, subject matter experts, and at-large community members.

They conducted workshops with subject matter experts, interested community members, and relevant stakeholders to solicit their ideas and expertise about potential solutions the community could implement to achieve the climate action goals.

The committee solicited feedback on these ideas from the general public at two points during the plan development – first through a community survey in January 2019 and again in July 2019 through an online open house. Additionally, City staff worked with technical consultants to conduct dozens of stakeholder interviews about specific strategies to gather local, Bend-specific data to inform greenhouse gas modeling efforts. For more detail about the plan development, including community engagement efforts, see Appendix A.

Project Timeline

Spring 2018
City hires a Sustainability Coordinator to staff the planning effort and the City Council appoints the 13-person Climate Action Steering Committee.

Summer 2018
The Climate Action Steering Committee develops a vision for the Community Climate Action Plan and creates objectives for different sectors.

Fall 2018
The Committee hosts working group meetings with stakeholders (both community members and experts) to brainstorm potential climate actions for further consideration. These actions describe ways citizens, businesses, and institutions in Bend can reduce their fossil fuel use.

Winter 2019
Members of the general community share feedback on the working groups' proposed action ideas through an online survey.

Spring 2019
The Committee and the City work with partners and technical experts to identify and quantify the impact of 15 specific strategies and actions to include in this Plan.

Summer 2019
The City hosts an online open house to collect a final round of feedback and ideas for additional strategies to include in the Plan. The Committee takes the comments into account, makes final adjustments to the recommendations, and incorporates five additional strategies.

Fall 2019
Committee and City staff meet with the City Council Stewardship Subcommittee to solicit feedback and receive policy guidance on certain elements of this Plan. The Committee then presents the full Plan to City Council for deliberation.

Striving for Equity

The Community Climate Action Plan should aim to improve equity by providing programs that benefit historically disadvantaged and underrepresented community members. These community members, which include low-income residents, communities of color, and other groups who are typically underrepresented in city and community planning efforts, are more vulnerable in the face of a changing climate. According to the U.S. Global Change Research Program's Fourth National Climate Assessment, low-income and other marginalized communities are more likely to suffer more significant impacts from climate change, such as adverse health impacts from poor air quality.

The Climate Action Steering Committee and the City worked to keep equity at the forefront of the climate action plan by getting direct feedback from community organizations that serve disadvantaged populations in Bend and Central Oregon. These conversations sought to obtain feedback on equity issues related to each climate action sector, and potential solutions to make the climate actions more equitable. City staff also had conversations about equity with subject matter experts, stakeholders, and community members who participated in the planning process, including the Climate Action Steering Committee.

Several climate action strategies have specific equity actions intended to make the climate actions more accessible and increase benefits to traditionally underserved populations. These equity actions are further described in Chapter 6 of this Plan. Equity is also used as one of the evaluation criteria for the climate strategies. For a detailed description of the activities completed to prioritize equity while developing this Plan, see Appendix B.

The key takeaway from the equity work completed for this Plan is that the community has more work to do to ensure that this and other planning efforts include representative input from all of Bend's community members and achieve equity goals. In order to do this, the City must invest long term in establishing and maintaining trust and relationships with those community members. How we implement this Plan will determine whether it will benefit the most vulnerable in our community. Evaluating the success of these strategies in achieving equity goals over the next few years will be essential. The City intends to continue to engage with the community organizations serving disadvantaged populations while this Plan is being implemented to evaluate each strategy's equity outcomes. As needed, the City will adapt actions to better meet these equity goals.

2. What are the Impacts of Climate Change in Bend?

Climate Change in Central Oregon – What's Coming?

The Third National Climate Assessment reveals that the Northwest (Washington, Oregon and Idaho) may increase in temperature by 3.3°F to 9.7°F by 2070, when compared to the 1970-1999 period.[1] Warmer average temperatures will cause dry seasons to last longer and become more extreme. Summer, in particular, is expected to be unusually hot with low rainfall. Simultaneously, winter will arrive earlier in the year, and have more precipitation in a shorter time frame. The precipitation will gradually become rain instead of snow, which will decrease snowpack and water supply for streams and rivers during the hotter months of the year.

According to the Deschutes County Natural Hazard Mitigation Plan, the natural hazards that Bend is most vulnerable to are catastrophic wildfires, extreme winter storms, decreased snowpack and drought.[2] The effects of climate change make these natural hazards more likely to occur. Other hazards, such as windstorms and floods also pose serious risk for Bend. The increasing prevalence of these events has negative consequences for human health, poses safety risks and deteriorates quality of life. Additionally, events like catastrophic wildfire in the summer and decreased snowpack in the winter have direct economic detriment to the Bend community, which realizes a significant economic benefit from outdoor recreation activities. A more detailed analysis of climate change in Bend and Central Oregon is provided in Appendix C.

As articulated in the Bend Community Greenhouse Gas Emissions Inventory (Appendix D):

"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 greenhouse gas emissions (GHG) must be reduced significantly – perhaps more than 50% globally, and by 90% in wealthier nations that are the largest emitters – by mid-century in order to avoid the worst potential climate impacts on human economies and societies that have been projected. The common international goal often referenced to mitigate the worst climate impacts is to limit global average temperature increases to no more than 2°C relative to temperatures at the start of the industrial revolution. As of 2018 – we've already passed the halfway point – average temperatures have increased by more than 1°C since the industrial revolution" (Good Company, 2018).

To prevent the worst impacts from climate change, dramatic changes are needed that will require action at all levels, from international cooperation, through all levels of government, down to the household and individual level.

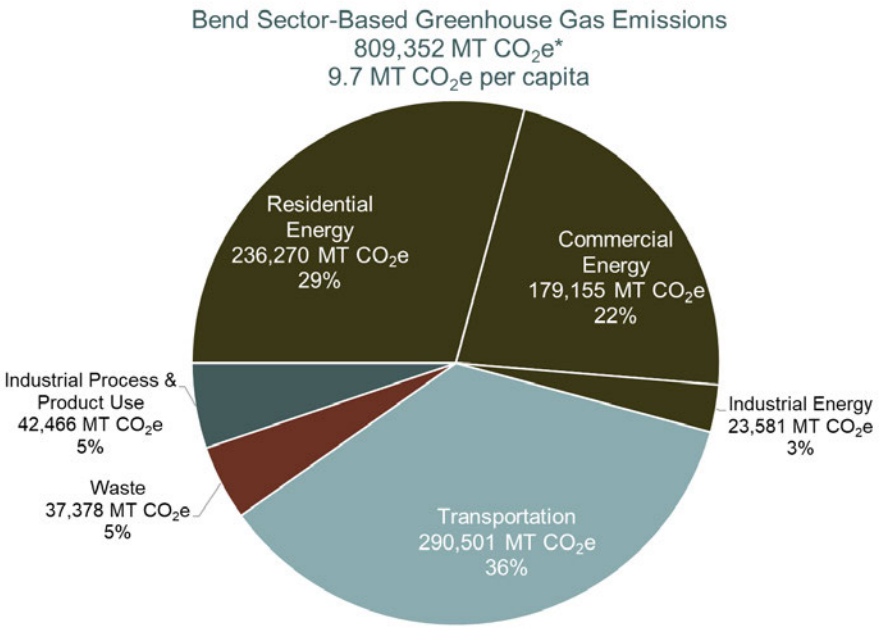
[1] Mote, Philip et al, Northwest: *Climate Change Impacts in the United States: The Third National Climate Assessment*, U.S. Global Change Research Program, (2014): Ch. 21: 489.
[2] *Deschutes County Natural Hazards Mitigation Plan*, Oregon Partnership for Disaster Resilience, May 2015.

3. Bend's Climate Impact

Greenhouse gas emissions are gases released into the atmosphere that trap heat and cause the Earth's temperature to rise. They are emitted into the atmosphere by both human activities and natural processes. The increase in greenhouse gasses in Earth's atmosphere from the combustion of fossil fuels is the main driver behind climate change.

To figure out how to achieve Bend's climate action goals, the City first conducted a community greenhouse gas emissions inventory to understand our baseline. Greenhouse gas emissions can be used as a measurement for fossil fuel use, as the fossil fuel combustion releases greenhouse gas emissions. To learn more about this inventory, see Appendix D. The results of the Community Greenhouse Gas Emissions Inventory tell us that "the Bend community generated 809,352 Metric Tons (MT) CO2e of local, sector-based emissions in 2016. For sense of scale, this quantity of emissions is equivalent to the carbon sequestered annually by over 1 million acres of average U.S. forest – a land area about 50 times the size of the City of Bend." Bend's sector-based emissions[3] are similar in many ways to other communities around Oregon. These emissions are shown in Figure 1, and primarily include emissions from:

Figure 1: Bend's FY16 Sector-Based GHG Emissions



- Combustion of natural gas and electricity use in buildings (green segments)
- Gasoline and diesel combustion in vehicles to transport people and goods (light blue segment)
- Waste, including landfill disposal of community solid waste and wastewater treatment (red segment)
- Local industrial process and product use, including refrigerant gas loss (leaks) from buildings and vehicles, and natural gas loss from the local distribution system (dark blue segment) (Good Company 2018)

[3] Sector-based emissions inventories (or in-geographic boundary inventories) include local emissions, within the City's boundaries, from energy use by homes, businesses, and vehicles as well as emissions from landfilling solid waste and wastewater treatment.

Of Bend's 809,352 MTs of sector-based emissions, 729,508 MT CO2e come from fossil fuel sources, which includes the emissions in the residential, commercial and industrial energy sectors and the transportation sector.[4] The remaining 79,844 MT CO2e come from other greenhouse gases from waste and industrial processes, such as methane. These sectors are not included in Bend's fossil fuel reduction goals, but are an important part of Bend's total climate impact and are therefore addressed in this Plan. When using market-based calculations, these emissions increase to 977,725 MT CO2e total, with 897,881 MT CO2e of the total from fossil fuel sources.[5] Because Bend's Community Climate Action Plan strategies include directly addressing PacifiCorp's resource portfolio, market-based electricity emissions are used as the basis for the calculations in the Plan forecast. Figure 2 shows the different types of emissions sources (fossil fuel, sector-based, and consumption-based) in relation to each other.

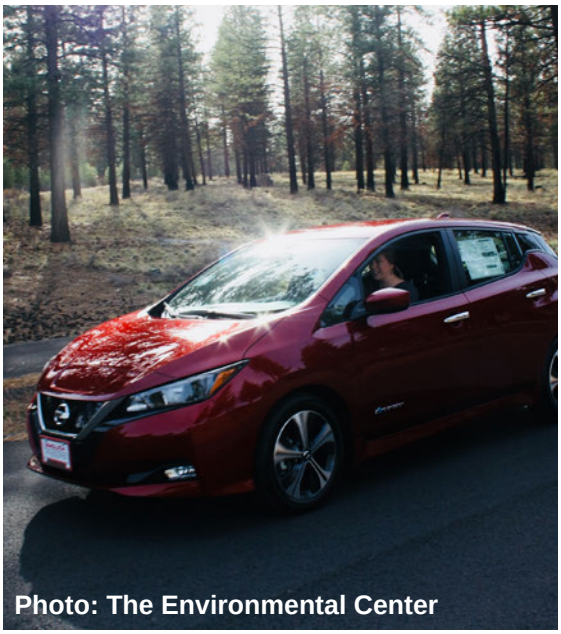
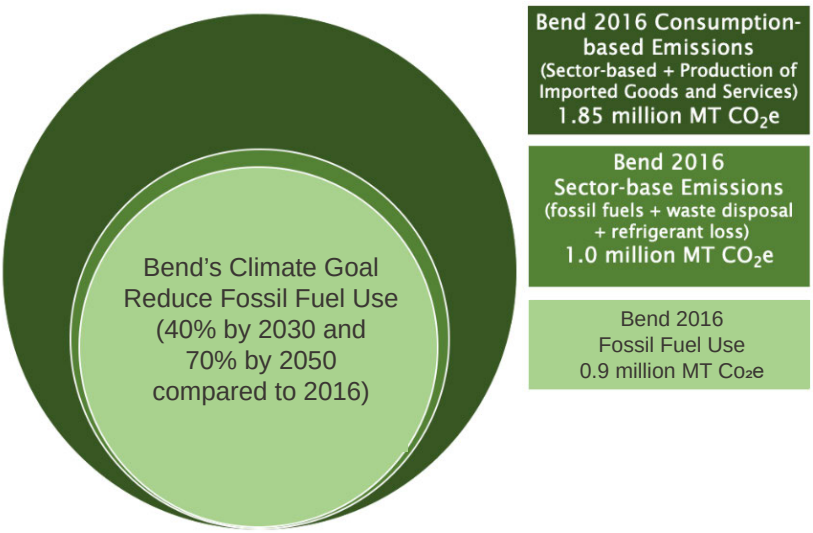


Photo: The Environmental Center

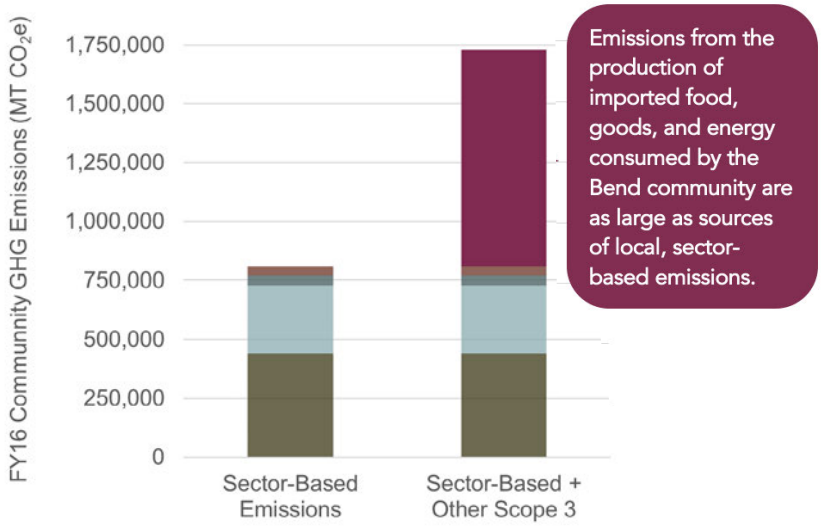
Figure 2: Relative quantities of fossil fuel, sector-based and consumption-based emissions.



Household Consumption and Upstream Energy Emissions

In addition to accounting for sector-based emissions, Bend's Community Greenhouse Gas Inventory also considered emissions that are generated outside of the community during the production of goods, food and services that are consumed in Bend. These emissions total 871,543 MT CO2e. Figure 3 compares the scale of sector-based emissions versus emissions from household consumption and upstream fuel production.[6]

Figure 3: Comparison of sector-based emissions to consumption



[4] Electricity emissions here are calculated using regional average factors or location-based factors.

[5] Electricity emissions here are calculated using PacifiCorp-specific factors or market-based factors.

[6] Sector-based emissions account for "tailpipe" emissions from the combustion of fuels. There are also "upstream" emissions that account for the energy and process emissions during extraction and refinement of fuels.

The scale of the emissions from household consumption is almost equal to sector-based emissions generated locally, which supports the need to address these emissions during the community climate action planning process.

However, because the emissions from household consumption are generated outside of Bend, the community has less control over the energy sources used and the efficiency of production. What the community does have control over is our choice of what kinds of products and services to buy. For example, consumers can choose to buy goods and services from companies that work to lower their carbon emissions. They can also be mindful of their consumption and choose to buy less and reuse what they do buy, rather than constantly buying and disposing of new products.

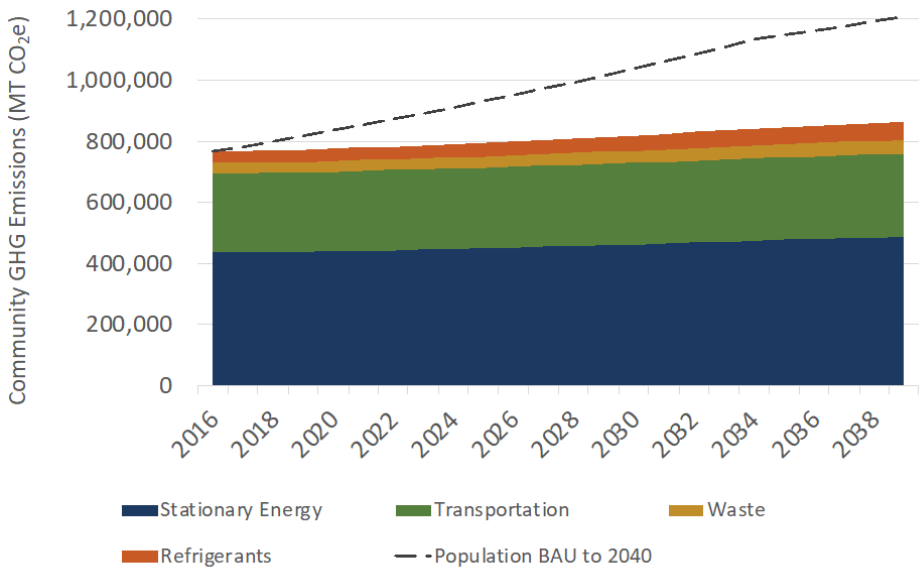
The emissions from non-fossil fuel sources and the emission from household consumption and upstream energy emissions are not included in Bend's fossil fuel reduction goals, since they do not come from direct fossil fuel consumption within the Bend community. However, they are a significant and meaningful part of Bend's climate impact, so there are strategies in this plan that address them.


Photo: Elemental Energy

What happens if we do not change?

In Oregon, we are fortunate to have state policy that drives significant emission reductions in the electricity supply, transportation and building sectors. This allows communities to realize greenhouse gas reductions in absence of additional city or community level action. However, Bend is growing at a dramatic rate. Based on available data, the increased number of people driving, using energy in buildings, and consuming materials in Bend increases the amount of greenhouse gases that Bend is responsible for at a faster rate than the reductions from Oregon's related policies. The community greenhouse gas emissions inventory found that Bend's total greenhouse gas emissions will rise by 13% by 2040 without additional community-level action to mitigate emissions, due to population growth. Figure 4 shows this **"business as usual"** (BAU) emissions scenario. Given this, the Bend community must work to develop local strategies to reduce emissions. State and other government level policy alone will not allow Bend to achieve its greenhouse gas reduction goals.

Figure 4: Greenhouse gas emissions projection for the Bend community in absence of local climate action



"Business as usual" refers to a scenario where we continue to do things as we do currently, without new programs, laws or technologies that reduce our emissions.

4. Climate Action Vision and Principles

Climate Action Vision

The vision for the Community Climate Action Plan is to have neighbors, businesses, and community leaders work together to preserve our natural environment while promoting economic opportunity and resilience for current and future generations.

The goals of this Plan are to:

- Achieve a 40% decrease in fossil fuel use emissions by 2030 and a 70% decrease by 2050 (from a baseline year of 2016).
- Develop and implement a plan that serves as a road map to a sustainable future for our community.
- Harness the resources and talents within Bend's community to take practical action across a wide range of sectors and activities.
- Develop and implement a plan that serves as a road map to a sustainable future for our community.

In order to achieve these goals, this Plan needs to address the following climate action sectors. These four sectors represent the major sources of emissions, based on the baseline greenhouse gas inventory**:**

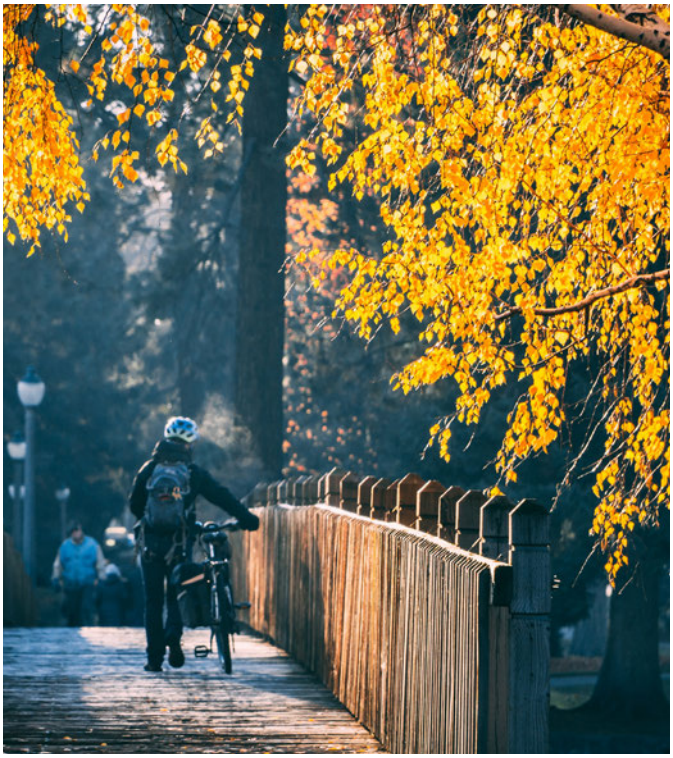
- **Energy Supply:** the source of energy used for transportation, buildings, waste and materials.
- **Energy in Buildings:** the energy used in residential, commercial and industrial buildings.
- **Transportation:** emissions from vehicles.
- **Waste and Materials:** emissions from the production and disposal of materials.

Energy Supply Goals:

1. Demonstrate leadership in the state in accelerating the transition to renewable energy.
2. Identify options, develop projects, and grow a market-driven, renewable energy economy in Bend.
3. Improve access to renewable energy for all Bend residents.
4. Optimize the energy portfolio in Bend to balance carbon intensity, cost and reliability.
5. Invest in local infrastructure and technology to meet energy supply goals.

Energy in Buildings Goals:

1. Increase the energy efficiency of all buildings in Bend.
2. Increase equitable access to energy efficiency programs and benefits for all residents.
3. Increase equitable access to reliable information and education about energy in buildings.
4. Enhance and diversify a skilled building trades work force.
5. Demonstrate leadership in energy efficiency and green buildings in Bend's public agencies.



Transportation Goals:

1. Encourage residents and tourists to change their behavior and use lower carbon transportation options.
2. Decrease total per capita vehicle miles traveled.
3. Improve urban infrastructure to enable more active transportation options.
4. Support innovative forms of low carbon transportation.
5. Pursue opportunities to make Bend's existing transportation system more efficient.

Waste and Materials Goals:

1. Adopt a holistic management approach toward waste and materials usage in Bend.
2. Reduce the upstream impact of waste and materials consumed in Bend.
3. Support the development of waste reduction programs for high-impact waste streams.
4. Expand and improve education programs for waste and materials.
5. Demonstrate leadership in the public sector for developing a progressive materials management culture.

Guiding Principles

How we get there matters. Effective collaboration is vital to achieving the climate action vision and sector goals. Therefore, the plan calls on the community of Bend to lead on climate action through the following principles:

Reflect Local Values

Develop a plan that fits the unique challenges, opportunities and priorities of the Bend community.

Smart about Energy

Reduce our fossil fuel use by promoting efficient and renewable energy consumption. Ensure energy supply reliability and affordability while protecting the natural environment.

Practical, Achievable, Flexible

Create pathways to achieving measurable goals that allow the community to adapt to Bend's needs, capacities and opportunities over time.

Act Inclusively and Respectfully

Consider diverse perspectives and ensure that all viewpoints are considered. Prioritize climate actions that will benefit individuals who have been historically underserved and will be most impacted by climate change.

Promote Economic Wellbeing

Ensure climate actions are well-researched and can have positive outcomes. Build economic resources and resiliency for generations to come.

Create Alliances

Collaborate as a community to build partnerships and find common ground as we develop and implement the Community Climate Action Plan.

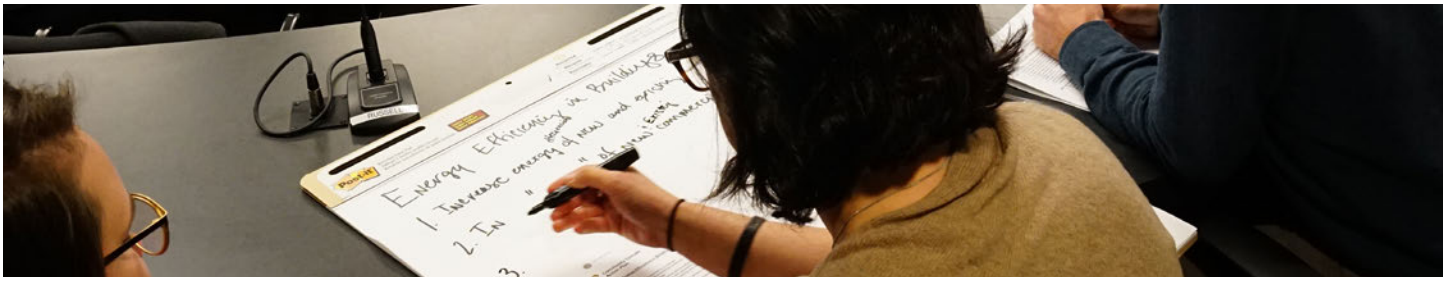
Focus on the Triple Bottom Line

Consider the economic, equity, and environmental impacts of all our decisions.

Keep Eyes on the Horizon

Explore new technologies and approaches. Recognize the long-term nature of some climate actions. Commit to regular evaluation, refinement and collaboration to ensure lasting success.

5. How Will We Get There? Four Areas of Focus



The Climate Action Steering Committee defined the strategies and actions in this Plan through a public engagement process and they describe the ways the community will achieve its climate acton goals. This Plan is organized into four distinct sectors that drive emissions in different ways:

- **Energy supply**
- **Transportation**
- **Energy in buildings**
- **Waste and materials**

Strategies are higher-level objectives that the community needs to achieve to reduce its fossil fuel use.

Actions are specific policies, programs or projects that can be implemented to help reach these objectives.

Evaluation

Working toward fossil fuel reduction does much more than mitigate Bend's contribution toward climate change. Climate action programs and policies can have triple bottom line benefits, meaning they can provide **social** and **economic** benefits, in addition to **environmental** benefits. This Plan recognizes that the strategies pursued for fossil fuel use reduction should provide economic and social benefits to Bend. With this lens, this Plan brings net benefits for Bend across the community's interests.

The climate action strategies were evaluated with a triple bottom line analysis, which included social, economic and environmental criteria. The results of that analysis are shown in the climate action strategy and implementation tables in Chapter 6 (tables 1-4). The specific evaluation criteria as part of triple bottom line analysis included:

- The technical potential of the strategy to mitigate greenhouse gas emissions, measured in the degree to which the strategy conserves or restores natural resources.[7]
- The cost to mitigate greenhouse gas emissions with the strategy, on a per metric ton (or 2,200 lbs) basis, measured in dollars per metric ton of greenhouse gas emissions reduced.[8]
- Six co-benefits selected by the Committee, which are further described in the following section.[9]

[7] The technical analysis focused on the technical potential to reduce greenhouse gasses and the estimated cost per tonne, as this is the focus of this Plan. To calculate these values, data specific to Bend was collected from the community through a series of stakeholder calls with other government agencies, utilities, and local community organizations and businesses.

[8] The cost to mitigate a metric ton of carbon dioxide equivalent is shown in life cycle costs. It takes into account the return on investment to the community per metric ton of carbon dioxide.

[9] The co-benefits were evaluated on a qualitative scale as a means to characterize the benefits of the strategies and to evaluate the strategies' total benefit in relation to each other.

Co-benefits

The co-benefits of each strategy are the positive impacts the strategy will create beyond its effect on reducing greenhouse gas emissions. Describing the co-benefits of each strategy shows us that investing in greenhouse gas reduction is beneficial not just for the environment but for our health, the economy, and equity. The co-benefits evaluated for this Plan are:

Economic vitality

Measured in job creation.

Affordability

Measured in the relative cost and benefit to the person or entity bearing the cost.

Supports the natural environment

Measured in the degree to which the strategy conserves or restores natural resources.

Social equity

Measured in the degree to which the strategy equitably distributes benefits to historically underserved community members.

Community health and safety

Measured in the degree to which the strategy provides health and safety benefits to the community.

Adaptation and resilience

Measured in the degree to which the strategy helps the community prepare for and recover from stressors such as drought and wildfire.

Many of the strategies in this Plan have net positive returns to the community through cost savings from using less energy and materials over time. For detail on calculations, data, methodology and assumptions, see Appendix F.

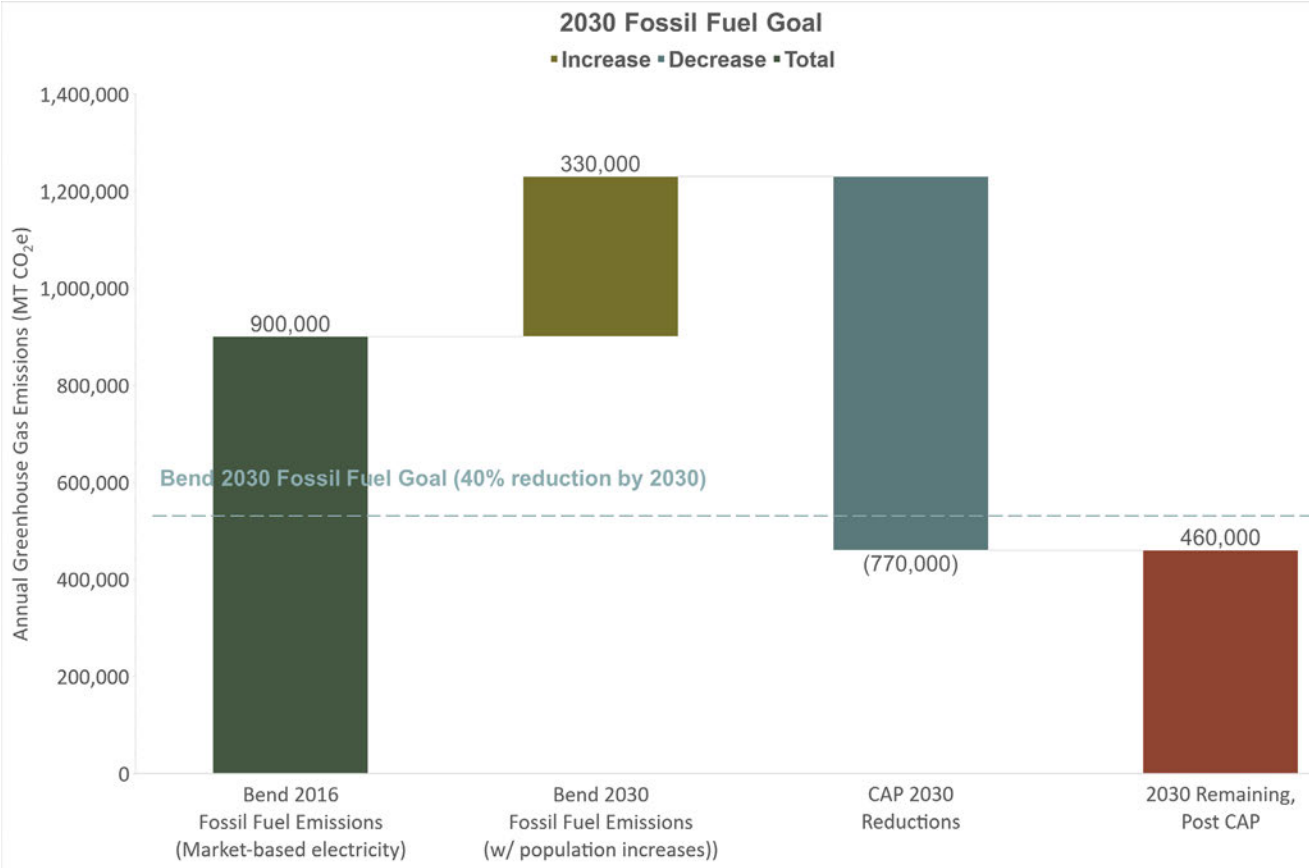
The Impact of Bend's Community Climate Action Plan

Bend's current climate goal is focused on local sources of fossil fuel emissions. Specifically, the Bend City Council set climate action goals to **reduce fossil fuel use community wide by 40% by 2030 and by 70% by 2050.** Bend's goal is focused on the largest local sources of emissions under direct community control.

Not all sources of emissions included in Bend's 2016 Greenhouse Gas emissions Inventory are covered by the goal (something that is common for many communities) as these sources can be located outside the community and can be more difficult to control. Based on the fossil fuel goals, Bend's target is to decrease its generation of market-based fossil fuel emissions to 540,000 metric tons of market-based fossil fuel emissions by 2030, and to 270,000 metric tons of emissions by 2050.

If the Bend community does not take action on climate change, Bend will generate roughly 1,230,000 metric tons of market-based greenhouse gas emissions from fossil fuel sources in 2030, with expected population growth. If Bend's Plan is implemented as planned and the intended outcomes are achieved, the community is forecasted to reduce its fossil fuel use by 770,000 metric tons annually of emissions by 2030. This represents a 49% reduction from 2016 baseline emissions, surpassing Bend's 2030 climate goal.

Figure 5: Bend Community Climate Action Plan progress towards 2030 climate action goal



By 2050, if this Plan is implemented as planned and the intended outcomes are achieved, Bend is forecasted to reduce its fossil fuel use by 1,300,000 metric tons of market-based fossil fuel emissions and generate 460,000 metric tons of emissions. Unfortunately, with expected population increases, this represents a 49% reduction from the 2016 baseline emissions as well, falling short of the 70% fossil fuel reduction goal. This is partly because a statewide policy requiring the electricity supply to phase out coal will be implemented by 2030, and emissions reductions realized by this state policy will decrease on an annual basis after 2030.

Bend's climate action strategies proposed in this Plan continue to reduce fossil fuel use through 2050, but roughly at a pace that just offsets the increased population growth. Falling short of the 2050 reduction goal incites a need for the Community to remain committed to climate action over the long term. Bend must update this Plan regularly and identify more climate strategies over time. With improvements in technology, data, and forecasting, updating this Plan in future years should provide opportunities for the Community to achieve the ultimate reduction goals.

Several of the strategies in this plan reduce greenhouse gas emissions that do not come from fossil fuel sources, but do generate local greenhouse gas emissions. These additional local emissions include emissions from waste and from refrigerant loss in industrial processes. Figure 6 shows the forecast emission reduction contributions from local sector-based sources if this Plan is fully implemented.

When considering all of the sector-based emissions, the majority of the emissions reductions are driven by decarbonizing the energy supply. A full 67% of the forecast emissions come from the energy supply sector, with 51% of that driven by existing Oregon electricity policy and the remaining 16% coming from other energy supply related strategies detailed in Chapter 6. Another 12% of the total forecast reductions come from strategies that improve the energy efficiency of buildings. 20% come from reducing fuel use in the transportation sector, and 1% come from improving waste recovery. Figure 7 shows how much each category of emissions contributes to the overall forecast reductions.

Figure 6: Bend Community Climate Action Plan progress towards Bend's 2050 climate action goal. This plan achieves a 49% reduction in fossil fuel consumption compared to the 2016 baseline.

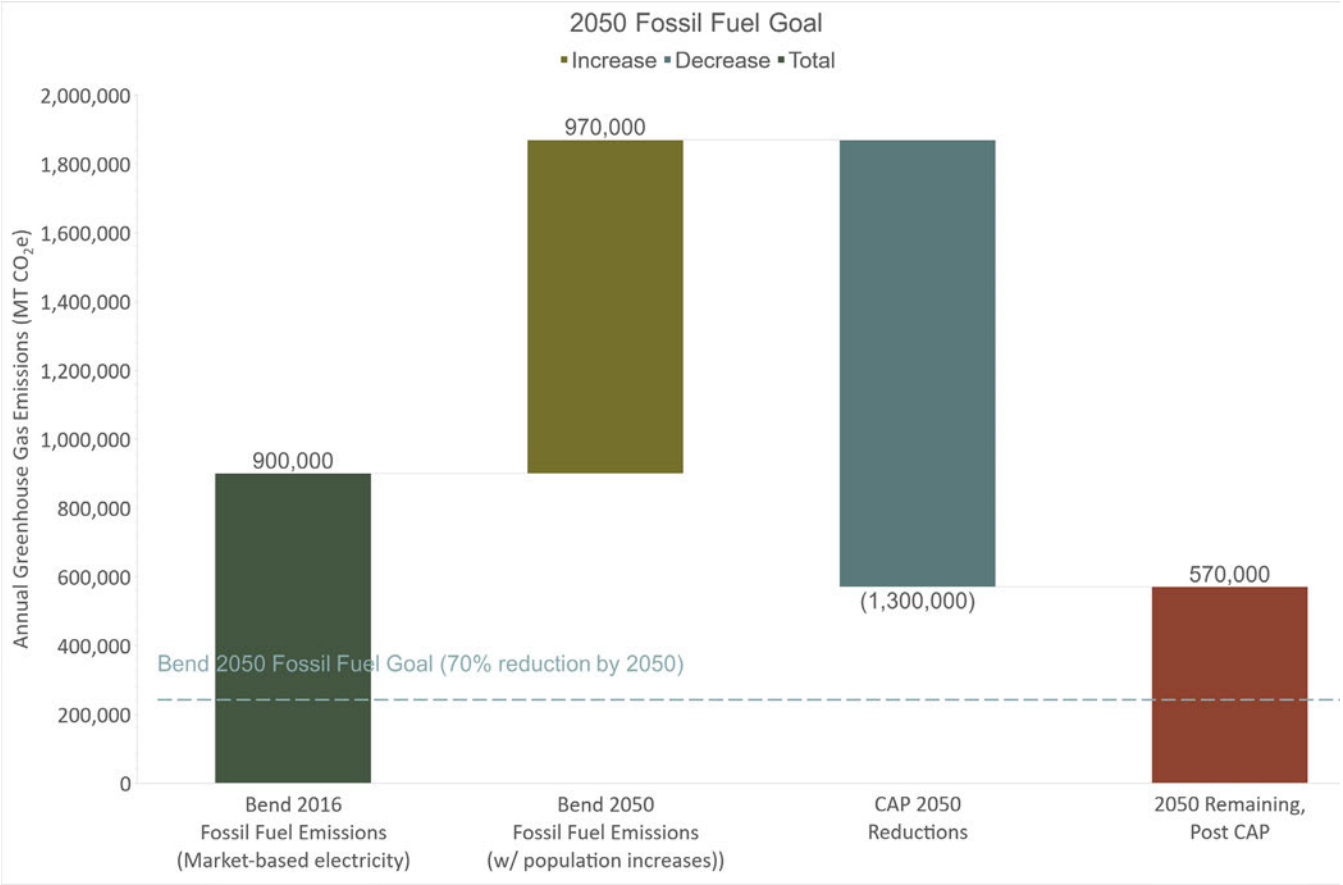
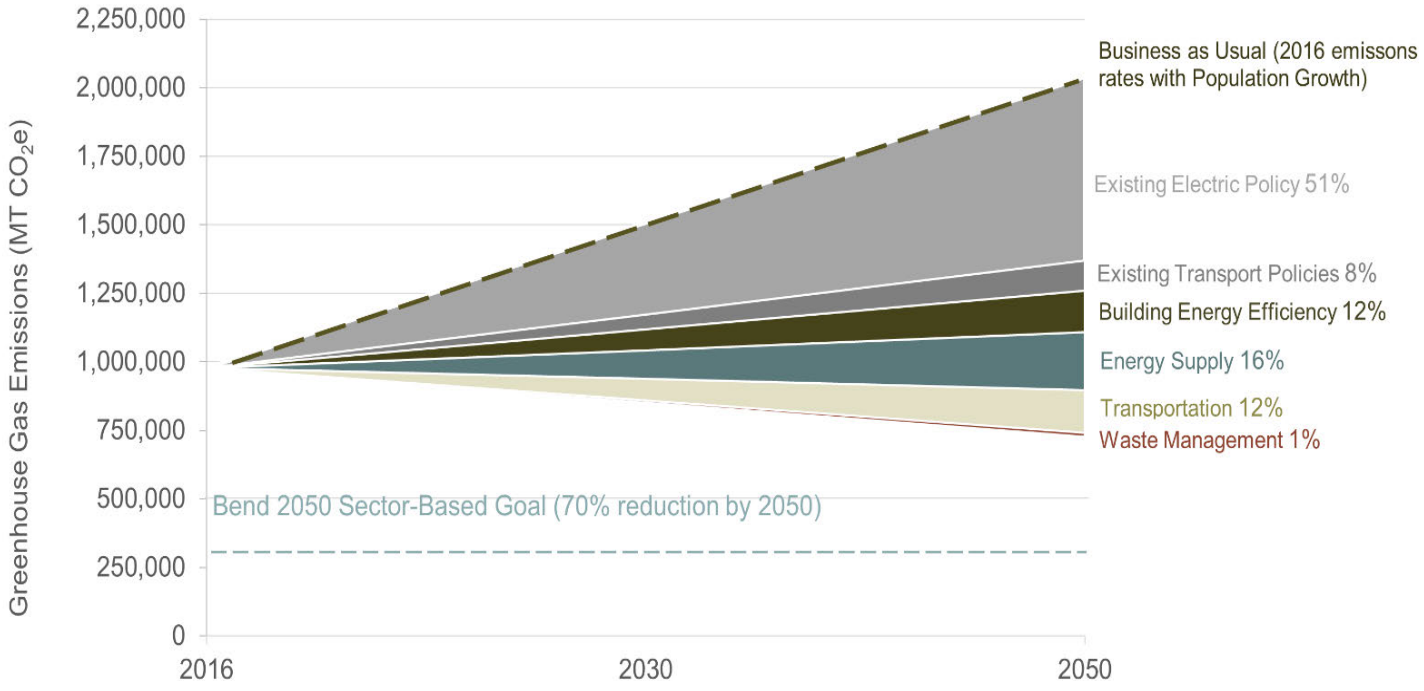


Figure 7: Forecast emission reduction contributions from sector-based emissions.



6. Strategy and Action Implementation Details

Fully implementing all of the Community Climate Action Plan strategies goes beyond the authority of any individual entity or person. The City of Bend intends to take a leadership role. It has the authority and takes responsibility for many of the specific climate actions but cannot take action on all of them. Many of the strategies require other public agencies, community organizations, and city franchisees to take the lead on implementation. Successfully reaching the maximum technical potential of each strategy will also require that individual residents and businesses in the community participate in new programs or systems that are offered by the implementing partners.

The following sections describe how the climate action strategies will be implemented and who is responsible for each.

These sections also provide other details on the strategies, including:

- Specific implementation actions
- The technical potential for each strategy to reduce emissions, assuming the strategy target is achieved
- The life cycle savings or expenditures that will be incurred by implementing each strategy
- Progress metrics that provide ways of evaluating movement toward reaching these goals
- Strategy targets that quantify specific goals for each strategy
- Co-benefits of each strategy

For each sector, there is also a description of relevant equity actions and equity outcomes. **Equity actions** are actions that the City or other implementation leads will take to make it easier for traditionally underserved populations to implement the climate strategies. **Equity outcomes** describe how the implementation of a climate strategy will lead to a more equitable system.

Key to the Implementation Details Tables

Implementation Responsibilities

- City of Bend
- Deschutes County
- Public Agencies
- Lending Agencies
- Community Partners
- Businesses
- Private Developers
- City and State Partners
- Utility
- Cascades East Transit
- Oregon Department of Energy
- Energy Trust of Oregon
- Workforce Development Agencies
- Waste Haulers
- Tourism Agencies
- Oregon Department of Environmental Quality

Cumulative Emission Reductions Potential (in metric tons of emissions)

200,000

Savings or Expenditure Range (per metric ton of emissions reduced)

- Savings
- Expenditures

Co-benefits

- Economic Vitality
- Affordability
- Supports the Natural Environment
- Community Health and Safety
- Adaptation and Resilience
- Social Equity

Energy Supply

Energy supply refers to the sources of the energy we use to power and heat our buildings, power our modes of transportation, and produce the materials we use and foods we consume. Different energy sources have different levels of greenhouse gas emissions. Switching from a carbon-intensive source of energy, such as coal or oil, to lower-carbon sources, such as renewable wind and solar energy, will reduce our greenhouse gas emissions.

In Bend, our energy supply is provided to us by our franchised utilities. We have two electricity utilities, Pacific Power and Central Electric Cooperative. We have one gas utility, Cascade Natural Gas. The greenhouse gas emissions that come from electricity are driven by what sources the utility uses to generate electricity, which change over time. A significant portion of Pacific Power's electricity grid today is supplied by coal resources, which have a high emissions factor. Pacific Power is required to eliminate coal resources in Oregon by 2035 and to supply the grid with 50% renewable resources by 2040 as a result of Oregon's Clean Energy and Coal Transition Act. Central Electric Cooperative procures most of its electricity from Bonneville Power Administration which generates mostly hydroelectric and nuclear power, which are low in greenhouse gas emissions.

Energy Supply Strategies

Strategies that decarbonize Bend's energy supply will contribute the most of all the strategies in this Plan to Bend's forecast emissions reductions. These strategies reduce emissions by 880,000 MT CO_2e, which represents a 67% reduction from the total sector-based emissions in 2050 (and a 69% reduction in emissions from buildings). This Plan reduces emissions from the energy supply by committing to providing 100% renewable electricity to the Bend community, expanding distributed renewable energy resources, establishing a natural gas offset program, and investing in capturing renewable natural gas through a biodigester project at the wastewater treatment facility. Additionally, the Bend community will greatly benefit from the Clean Energy and Coal Transition Act. This law contributes 51% of Bend's forecast reductions. Table 1 shows the strategies that the Bend community will take to reduce greenhouse gas emissions from its energy supply.

Energy Supply

Table 1. Energy Supply - Climate Action Strategies

Implementation Actions	Implementation Responsibilities	Progress Metric	Target	Cumulative Emission Reductions Potential* (each circle below represents 200,000 metric tons of emissions)	Savings or Expenditure Range (per metric ton of emissions reduced)	Co-benefits
STRATEGY: *ES1- Provide 100% renewable electricity supply to the community*						
ES1A – Develop a roadmap to **achieve a 100% renewable electricity supply** for the community.	Lead: City of Bend Partners: Utility	• Percent of community subscribed to renewable power. • Total load and percentage of total load served by renewables.	100% renewable energy procured by 2025.	4,410,000 ●●●●● x4.4	$10 to $35	10 / 7.5 / 5 / 2.5
STRATEGY*: ES2 - Contract for a natural gas offset program for community gas use*						
ES2A – **Develop a program that allows residential and commercial customers to offset their natural gas use.**	Lead: Utility Partners: Not yet identified	• Percentage of the community households and organizations subscribed to gas that have offset emissions. • Total number and percentage of therms offset.	25% of customer participation in the program.	1,860,000 ●●●●● x1.8	$20 to $45	10 / 7.5 / 5 / 2.5
STRATEGY*: ES3 - Expand distributed commercial and residential solar photovoltaics (PV)*						
ES3A – **Increase community education on renewable energy and available incentives** by developing and delivering educational programs.	Lead: Community Partners Partners: Energy Trust of Oregon, Utility	• Number and percentage of households educated.	32 Added MW of solar PV by 2036. 1.6 MW of solar PV added annually.	200,000 ●○○○○	$75 to $50	10 / 7.5 / 5 / 2.5
ES3B – **Promote renewable energy incentives offered by utilities** by providing information about these incentives to individuals and companies applying for building permits.	Lead: City of Bend Partners: Energy Trust of Oregon, Utility	• Number and percentage of permit applicants that have been reached.				
ES3C – **Create new incentive packages that increase the installation of renewable energy systems on residential and commercial buildings**	Lead: City of Bend Partners: Energy Trust of Oregon, Private Developers, Utility	• Number and percentage of new buildings with installations. • Number and percentage of existing buildings with installations. • Total generation capacity of installed systems.				

Note:
This Target, Cumulative Emission Reductions Potential, Savings or Expenditure Range, and Co-benefit data is based on all eight actions in ES3.

City of Bend · Community Partners · Utility · Energy Trust of Oregon · Private Developers · Lending Agencies · Deschutes County · Public Agencies

Savings · Expenditures · Economic Vitality · Affordability · Supports the Natural Environment · Community Health and Safety · Adaptation and Resilience · Social Equity · Workforce Development Agencies

**Emissions reduction potential assumes stated strategy target is achieved. For more details on methodology and calculations, see Appendix D.*

Energy Supply

Table 1. Energy Supply - Climate Action Strategies

Implementation Actions	Implementation Responsibilities	Progress Metric	Target	Cumulative Emission Reductions Potential* (each circle below represents 200,000 metric tons of emissions)	Savings or Expenditure Range (per metric ton of emissions reduced)	Co-benefits
STRATEGY*: ES3 (cont.) - Expand distributed commercial and residential solar photovoltaics (PV)*						
ES3D – **Create revolving loan funds to finance renewable energy projects.** These funds will be more accessible than current loan options to low- and moderate-income residents. The City will investigate different options for fund administration.	Lead: City of Bend Partners: Private Developers	• Total dollars distributed through fund annually. • Number and percentage of buildings using loan program.	32 Added MW of solar PV by 2036. 1.6 MW of solar PV added annually.	200,000	$75 to $50	10 7.5 5 2.5
ES3E – **Develop community solar projects that residents can subscribe to for access to offsite solar energy.**	Lead: Community Partners Partners: Utility, City of Bend	• Number and total generation capacity of projects. Total number of subscribers for each project.				
ES3F – **Pilot microgrid and battery storage projects** powered by renewable energy that can operate independently of the energy grid.	Lead: City of Bend, Community Partners Partners: Utility	• Number of microgrids in total. • Total installed renewable generation capacity inside of microgrids. • Percentage of local load served by microgrids.				
ES3G – **Support and expand workforce development programs in renewable energy trades** that are delivered by community organizations.	Lead: Community Partners, Workforce Development Agencies Partners: Not yet identified	• Number of people trained per year. • Number and percentage of those trained that are fully employed in this profession.				
ES3H – **Create a commercial, property-assessed clean energy program** that allows renewable energy projects to be financed through property tax assessment.	Lead: Deschutes County Partners: Not yet identified	• Total installed generation capacity as percentage of total commercial load. • Number of participants in program.				

Note: *This Target, Cumulative Emission Reductions Potential, Savings or Expenditure Range, and Co-benefit data is based on all eight actions in ES3.*

City of Bend · Community Partners · Utility · Energy Trust of Oregon · Private Developers · Lending Agencies · Deschutes County · Public Agencies

Savings · Expenditures · Economic Vitality · Affordability · Supports the Natural Environment · Community Health and Safety · Adaptation and Resilience · Social Equity · Workforce Development Agencies

**Emissions reduction potential assumes stated strategy target is achieved. For more details on methodology and calculations, see Appendix D.*

Energy Supply

Table 1. Energy Supply - Climate Action Strategies

Implementation Actions	Implementation Responsibilities	Progress Metric	Target	Cumulative Emission Reductions Potential* (each circle below represents 200,000 metric tons of emissions)	Savings or Expenditure Range (per metric ton of emissions reduced)	Co-benefits
STRATEGY*: ES4 - Build/explore a biodigester at the wastewater treatment facility*						
ES4A – Build a biodigester at the wastewater treatment facility, after confirming feasibility of the project.	Lead: City of Bend Partners: Not yet identified	• Percent of onsite load served by the digester, • Gallon equivalents of fossil fuel displaced in transportation or electricity produced.	72,000 therms annual production.	140,000	$10	10 / 7.5 / 5 / 2.5
STRATEGY*: ES5 - Install solar panels on public buildings*						
ES5A – Install solar panels on public buildings to demonstrate public sector leadership.	Lead: City of Bend, Public Agencies Partners: Not yet identified	• Number and percentage of buildings with rooftop solar. • Total installed capacity of renewables. • Percentage of total load that is served by rooftop solar.	1.2 MW of additional capacity on schools. 0.710 MW of additional capacity on City buildings.	20,000	$50	10 / 7.5 / 5 / 2.5

City of Bend · Community Partners · Utility · Energy Trust of Oregon · Private Developers · Lending Agencies · Deschutes County · Public Agencies

Savings · Expenditures · Economic Vitality · Affordability · Supports the Natural Environment · Community Health and Safety · Adaptation and Resilience · Social Equity · Workforce Development Agencies

**Emissions reduction potential assumes stated strategy target is achieved. For more details on methodology and calculations, see Appendix D.*

Equity Actions and Outcomes

The following equity actions will be taken to make strategies and actions in this sector more accessible and equitable:

- Build a community solar project so renters and those without solar access can access renewable energy, and ensure a rate structure that is accessible for low- and moderate-income households.
- Promote existing utility incentives for landlords to add renewable energy to their properties.
- Promote renewable energy incentives that benefit for low- and moderate-income residents.
- Engage in outreach campaigns in multiple languages that inform communities not reached by traditional methods about ways they can implement these strategies. For example, conducting an outreach campaign to inform communities of incentives for energy-efficient building upgrades that benefit residents with low- and moderate-incomes.

The strategies and actions in this sector will lead to the following equity outcomes:

- Job training for underemployed individuals in renewable energy trades.
- More accessible loans for residents with low- and moderate-incomes to make improvements to their energy supply.

Energy in Buildings

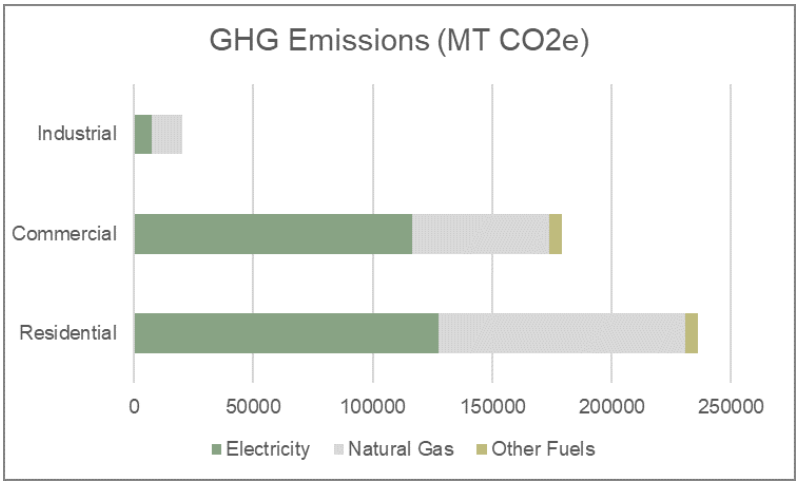
The energy we use in our buildings makes up 54% of Bend's local (sector-based) fossil fuel use, making it the largest contributor to greenhouse gas emissions in the community. Residential buildings produce 29% of overall emissions. Commercial buildings produce 22% of overall emissions, and industrial buildings are relatively low at 3% overall emissions.

Almost everything we do and use in buildings consumes energy – from our lights, heating and cooling systems, to our appliances and electronics. In Bend, we primarily use natural gas and electricity as the energy sources for our buildings. Electricity represents 58% of the greenhouse gas emissions in this sector, while natural gas represents 40%. The remaining 2% comes from other fuels like propane (Good Company, 2018).

Additionally, Bend is growing quickly and adding many new homes and commercial buildings over the next several years. Because of this, Bend must also focus on implementing methods to reduce the impact of new buildings, in addition to existing buildings.

We can reduce our greenhouse gas emissions in this sector by improving our buildings so they use less energy to meet our needs and by switching to renewable energy like wind, solar, and renewable fuels. Figure 8 shows the breakdown of energy consumption in the residential, commercial, and industrial sectors. Industrial energy use in Bend is relatively low compared to energy use in residential and commercial buildings, which means that individuals have a large opportunity to make an impact in their homes and businesses. The strategies in this Plan are primarily focused on commercial and residential building strategies to take advantage of these opportunities.

Figure 8: Electricity and natural gas consumption by building type in Bend community.



Energy in Buildings Strategies

Increasing the energy efficiency of Bend's new and existing buildings is forecast to reduce emissions by roughly 150,000 MT CO2e by 2050. These strategies contribute 12% of forecasted sector-based emissions. Efficiency is a particularly cost-effective climate action in the near-term as PacifiCorp works to decarbonize its grid. Building energy efficiency is also one of the only components of the plan that reduces emissions from community combustion of natural gas.

The Bend community will reduce emissions through energy efficiency by expanding voluntary uptake of energy efficiency upgrades, implementing voluntary and mandatory benchmarking programs for commercial and residential buildings, supporting the advancement of a higher-performing building energy code, and promoting smaller home sizes. While energy efficiency strategies represent a reduction of roughly 12% of total emissions from buildings in Bend, strategies to decrease emissions from the energy supply also decrease emissions from buildings in Bend. As a result, the total amount of forecasted emission reductions from buildings includes reductions from both sectors. Table 2 describes the strategies that the Bend community will take to reduce emissions in its buildings.

Energy in Buildings

Table 2. Energy in Buildings - Climate Action Strategies

Implementation Actions	Implementation Responsibilities	Progress Metric	Target	Cumulative Emission Reductions Potential* (each circle below represents 200,000 metric tons of emissions)	Savings or Expenditure Range (per metric ton of emissions reduced)	Co-benefits
STRATEGY*: EB1 - Support policies that increase energy efficiency of buildings*						
EB1A – Participate in code update processes and vote for advancing energy efficiency in codes to help achieve the State's goal of having a net zero ready building code by 2023.	Lead: City of Bend Partners: Not yet identified	• Number of new buildings that are net zero ready. • Percentage of building stock that is net zero ready.	Annual reduction of 6,000 MWh and 275,000 therms.	1,320,000	Not available	
EB1B – Develop and deliver outreach and education campaigns to promote net zero ready building standards.	Lead: Community Partners Partners: Not yet identified	• Number of households and organizations reached with the message. • Number of developers and builders reached with the message. • Number and percentage of new building starts that are net zero ready before the new code is implemented.				
STRATEGY*: EB2 - Improve uptake of voluntary energy efficiency projects in buildings*						
EB2A – Increase community education on energy efficiency and available energy efficiency incentives by developing and delivering educational programs.	Lead: Community Partners Partners: Energy Trust of Oregon, Utility	• Number and percentage of residents that have engaged in outreach and education programs.	Annual reduction of 6,000 MWh and 125,000 therms.	1,180,000	$50 to $0	
EB2B – Promote energy efficiency incentives offered by utilities by providing information about these incentives to individuals and companies applying for building permits.	Lead: City of Bend Partners: Energy Trust of Oregon, Utility	• Number and percentage of residents that have received the information.				

***Note:** This Target, Cumulative Emission Reductions Potential, Savings or Expenditure Range, and Co-benefit data is based on all six actions in EB2.*

City of Bend · Community Partners · Utility · Energy Trust of Oregon · Private Developers · Technical Experts · Lending Agencies · Workforce Development Agencies · Oregon Department of Energy

Savings · Expenditures · Economic Vitality · Affordability · Supports the Natural Environment · Community Health and Safety · Adaptation and Resilience · Social Equity

**Emissions reduction potential assumes stated strategy target is achieved. For more details on methodology and calculations, see Appendix D.*

Energy in Buildings

Table 2. Energy in Buildings - Climate Action Strategies

Implementation Actions	Implementation Responsibilities	Progress Metric	Target	Cumulative Emission Reductions Potential* (each circle below represents 200,000 metric tons of emissions)	Savings or Expenditure Range (per metric ton of emissions reduced)	Co-benefits
STRATEGY*: EB2 (cont.) - Improve uptake of voluntary energy efficiency projects in buildings*						
EB2C – The City will work with private developers and technical experts to **create new incentives and programs to expand energy efficiency projects in residential and commercial buildings.**	Lead: City of Bend Partners: Energy Trust of Oregon, Private Developers, Utility	• Number and percentage of building projects that have utilized incentives.	Annual reduction of 6,000 MWh and 125,000 therms.	1,180,000	$50 to $0	10 7.5 5 2.5
EB2D – Create revolving loan funds to finance energy efficiency projects. These funds will be more accessible than current loan options to residents with low or moderate incomes and the City will investigate different options for fund administration.	Lead: City of Bend Partners: Lending Agencies	• Total dollars distributed through fund annually. • Number and percentage of buildings using loan program.				
EB2E – Support workforce development programs in energy efficiency trades that are delivered by community organizations.	Lead: Community Partners, Workforce Development Agencies Partners: Not yet identified	• Number of people trained per year. • Number and percentage of trained people fully employed in Bend.				
EB2F – Explore options for demand response programs, which encourage consumers to adjust their energy use during peak energy hours.	Lead: Utility Partners: Not yet identified	• Number and percentage of buildings using the demand-side management strategies.				

***Note:** This Target, Cumulative Emission Reductions Potential, Savings or Expenditure Range, and Co-benefit data is based on all six actions in EB2.*

City of Bend · Community Partners · Utility · Energy Trust of Oregon · Private Developers · Technical Experts · Lending Agencies · Workforce Development Agencies · Oregon Department of Energy

Savings · Expenditures · Economic Vitality · Affordability · Supports the Natural Environment · Community Health and Safety · Adaptation and Resilience · Social Equity

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Energy in Buildings

Table 2. Energy in Buildings - Climate Action Strategies

Implementation Actions	Implementation Responsibilities	Progress Metric	Target	Cumulative Emission Reductions Potential* (each circle below represents 200,000 metric tons of emissions)	Savings or Expenditure Range (per metric ton of emissions reduced)	Co-benefits
STRATEGY*: EB3 - Implement benchmarking and disclosure programs for energy performance*						
EB3A – Develop a home energy score program that allows homes to be compared based on their energy use and energy efficiency, leveraging industry stakeholders, the U.S. Department of Energy standard home energy scoring tools, and industry best practice.	Lead: City of Bend Partners: Oregon Department of Energy	• Number and percentage of housing units with energy scores available. • Trend of average Home Energy Score.				
EB3B – Develop voluntary disclosure and benchmarking programs for public and commercial buildings that allow them to track, report, and make their energy use public. Develop rules and requirements with input from industry stakeholders and community.	Lead: City of Bend Partners: Oregon Department of Energy	• Number and percentage of buildings participating in the program. • Average energy trends of buildings participating in the program.	Annual reduction of 3,000 MWh and 200,000 therms.	1,000,000	$50 to $50	10 / 7.5 / 5 / 2.5
EB3C – Support and expand low cost energy audit programs. Identify barriers to utilizing existing programs and ways to address them.	Lead: Community Partners Partners: Not yet identified	• Baseline number of audits per year. • Number and percent growth in baseline number of audits delivered.				
STRATEGY*: EB4 - Promote smaller homes and denser housing options through incentives*						
EB4A – Develop incentives that encourage private developers to build smaller housing options.	Lead: City of Bend Partners: Private Developers	• Number and percentage of new dwellings that are accessory dwelling units. • Average square footage of dwelling units by year.	Average home size is 1,600 square feet.	410,000	$700	10 / 7.5 / 5 / 2.5

City of Bend · Community Partners · Utility · Energy Trust of Oregon · Private Developers · Technical Experts · Lending Agencies · Workforce Development Agencies · Oregon Department of Energy

Savings · Expenditures · Economic Vitality · Affordability · Supports the Natural Environment · Community Health and Safety · Adaptation and Resilience · Social Equity

**Emissions reduction potential assumes stated strategy target is achieved. For more details on methodology and calculations, see Appendix D.*

Equity Actions and Outcomes

The following equity actions will be taken to make strategies and actions in this sector more accessible:

- Engage in intentional outreach campaigns in multiple languages that inform communities not reached by traditional methods about ways they can implement these strategies. For example, conducting an outreach campaign to inform communities of incentives for energy-efficient building upgrades that benefit residents with low- and moderate-incomes.
- Promote existing utility incentives for landlords to improve the energy efficiency of rental properties.
- Promote incentives for manufactured homes.
- Encourage lower costs of homes by creating incentives to promote smaller homes.

The strategies and actions in this sector will lead to the following equity outcomes:

- Job training for underemployed individuals.
- More accessible and affordable energy audits.
- Transparency in the relative energy consumption of different homes. This is because low- and moderate-income residents face a larger energy burden and are disproportionately impacted by inefficient homes.
- More accessible loans for residents with low- and moderate-incomes to undertake energy efficiency upgrades to their homes.
- Encourage lower costs of homes by creating incentives to promote smaller homes.

Transportation emissions make up 36% of local greenhouse gas emissions in Bend. These emissions come from the tailpipes of passenger vehicles, commercial service vehicles, freight vehicles, and transit vehicles, and include both Bend residents and visitors. Most emissions from transportation are from passenger cars and trucks owned by Bend residents. Roughly 66% of the greenhouse gas emissions from passenger transportation are trips that take place entirely within the City's boundary, while about 33% of the emissions come from trips that either start or end outside of the boundary. Total transportation emissions are increasing as the Bend community continues to grow.

Transportation Strategies

This Plan will reduce emissions from the transportation sector by 270,000 MT CO2e in 2050, which contributes 20% of the total forecast emissions reductions. Within the transportation sector, these strategies lead to a 44% decrease in emissions compared to a business as usual scenario. Existing Federal and Oregon transportation policies will reduce emissions by increasing the fuel economy of vehicles (Federal Fuel Economy Requirements) and reducing the carbon intensity of fuels used in Oregon (Oregon Clean Fuels Program). Existing transportation policies represent 8% of Bend's total sector-based forecast reductions. The community will reduce local emissions further by encouraging more trips on foot, bike, transit, electric vehicles, and carpooling or vanpooling. Local climate action policies represent the remaining 12% of Bend's sector-based forecast reductions.

Figure 9: This plan is forecast to reduce transportation emissions by 270,000 metric tons annually in 2050.

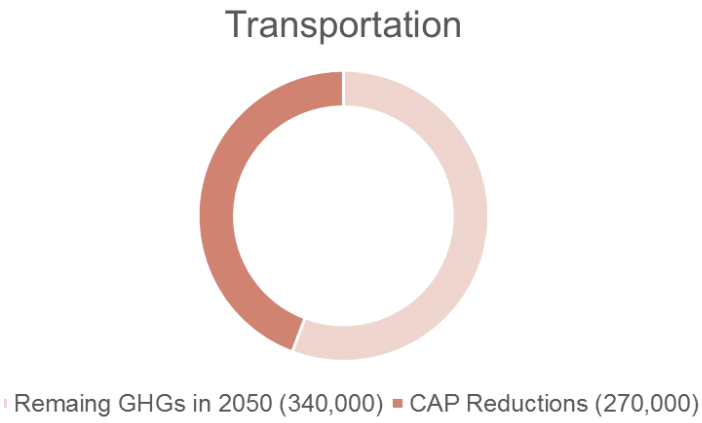
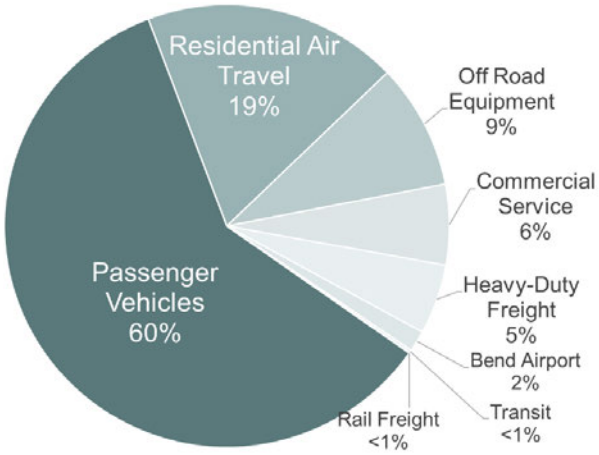


Figure 10: Breakdown of greenhouse gas emissions in the transportation sector by type of vehicle.



Transportation

Table 3. Transportation - Climate Action Strategies

Implementation Actions	Implementation Responsibilities	Progress Metric	Target	Cumulative Emission Reductions Potential* (each circle below represents 200,000 metric tons of emissions)	Savings or Expenditure Range (per metric ton of emissions reduced)	Co-benefits
STRATEGY*: T1 - Support the transition to electric vehicles (EVs) with an EV Readiness Plan*						
T1A – Develop a plan that anticipates EV growth, determines necessary charging infrastructure to accommodate this growth, and defines mechanisms to encourage the expansion of public and private charging infrastructure. Update code, standards, and specifications to achieve necessary infrastructure.	Lead: City of Bend Partners: Not yet identified	• Number and percentage of total vehicles registered in Bend that are EVs. • Annual vehicle registrations and number and percentage that are EVs.	25% of vehicle miles travelled (VMT) are with electric vehicles.	1,160,000	$200 to $50	10, 7.5, 5, 2.5
STRATEGY*: T2 - Increase bike and pedestrian trips*						
T2A – Prioritize Bend's Bike, Pedestrian, and Complete Streets Policies in the Transportation System Plan. These policies include expanding bike and pedestrian infrastructure, especially in historically underserved neighborhoods.	Lead: City of Bend Partners: Not yet identified	• Based on TSP metrics for each related policy.	10% of VMT are by biking and walking. 15% of trips taken are by bicycle and 15% of trips taken are by walking.	690,000	$60	10, 7.5, 5, 2.5

City of Bend · Public Agencies · Community Partners · Cascades East Transit

Savings · Expenditures · Economic Vitality · Affordability · Supports the Natural Environment · Community Health and Safety · Adaptation and Resilience · Social Equity

**Emissions reduction potential assumes stated strategy target is achieved. For more details on methodology and calculations, see Appendix D.*

Transportation

Table 3. Transportation - Climate Action Strategies

Implementation Actions	Implementation Responsibilities	Progress Metric	Target	Cumulative Emission Reductions Potential* (each circle below represents 200,000 metric tons of emissions)	Savings or Expenditure Range (per metric ton of emissions reduced)	Co-benefits
STRATEGY*: T3 - Increase transit ridership*						
T3A – Create a Mobility Hub program to improve access to a wide range of travel options and support multimodal lifestyles. These hubs combine multiple modes of transportation together in one physical location, often clustered around a high-frequency public transit stop. Typical components include carshare stations, bike parking, wayfinding elements and universal fare payment via a single smartcard or mobile app.	Lead: City of Bend, Cascades East Transit Partners: Not yet identified	• Number and percentage of Mobility Hubs planned. • Number and percentage of Mobility Hubs developed.				
T3B – Create high capacity transit corridors that increase frequency of service on major routes**.**	Lead: Cascades East Transit Partners: Not yet identified	• Based on TSP metrics.	Transit makes up 2% of VMT.	490,000	$50	
T3C – Expand transit service coverage consistent with the regional transportation master plan.	Lead: Cascades East Transit Partners: Not yet identified	• Based on regional transportation master plan metrics.				
T3D – Coordinate with school district to encourage use of public transit for getting to school.	Lead: Public Agencies Partners: Community Partners	• Percent mode share of children riding public transit to school.				

City of Bend · Public Agencies · Community Partners · Cascades East Transit

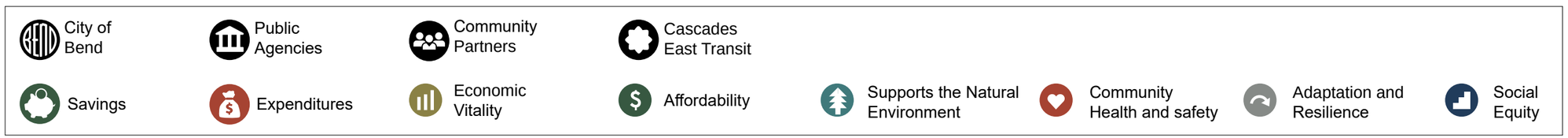
Savings · Expenditures · Economic Vitality · Affordability · Supports the Natural Environment · Community Health and Safety · Adaptation and Resilience · Social Equity

**Emissions reduction potential assumes stated strategy target is achieved. For more details on methodology and calculations, see Appendix D.*

Transportation

Table 3. Transportation - Climate Action Strategies

Implementation Actions	Implementation Responsibilities	Progress Metric	Target	Cumulative Emission Reductions Potential* (each circle below represents 200,000 metric tons of emissions)	Savings or Expenditure Range (per metric ton of emissions reduced)	Co-benefits
STRATEGY*: T4 - Promote ride sharing*						
T4A – Encourage the use of carpooling, vanpooling, and other modes of ride sharing.	Lead:  Partners: Not yet identified	• Annual number of carpools, vanpools, or other shared trips taken.	6% of VMT are shared trips.	140,000 	 $140	
STRATEGY*: T5 - Convert City and other public agency fleets to electric vehicles and alternative fuels*						
T5A – Public agencies will convert fleets to electric and alternative fuel vehicles as total cost of ownership allows.	Lead:  Partners: Not yet identified	• Number and percentage of sedans converted to EVs. • Carbon intensity of heavy duty fuel that are low carbon. • Total annual emissions from vehicle fuels.	100% of gas use is substituted with electric. 100% of diesel is substituted with renewable diesel.	50,000 	 $200 to $75	



**Emissions reduction potential assumes stated strategy target is achieved. For more details on methodology and calculations, see Appendix D.*

Equity Actions and Outcomes

The following equity actions will be taken to make strategies and actions in this sector more accessible:

- While implementing transportation improvements, follow the set of equity policies developed in Bend's Transportation System Plan to ensure that these improvements promote equity in the community.
- Prioritize complete streets – or streets that support all modes of transportation – and active transportation projects in neighborhoods that have higher proportions of low-income residents and residents of color.
- Create programs that improve access to transit for low-income residents (i.e. transit passes).
- Promote affordable and accessible housing development along transit routes.

The strategies and actions in this sector will lead to the following equity outcomes:

- Improved access and safety for transportation choices beyond private cars, including transit, walking, biking and others.

Waste and Materials

The goods and services we use in our daily lives have a huge effect on the environment and generates large amounts of greenhouse gas emissions. This includes the food we eat, clothes we wear, electronics we use, furniture we own, and materials we use to build our houses. Most of what we use eventually ends up in the landfill, where it breaks down and releases greenhouse gas emissions. Emissions from the landfill make up 5% of the total greenhouse gases emitted in the Bend community. Recovering or diverting materials from the landfill can help reduce the emissions associated with waste.

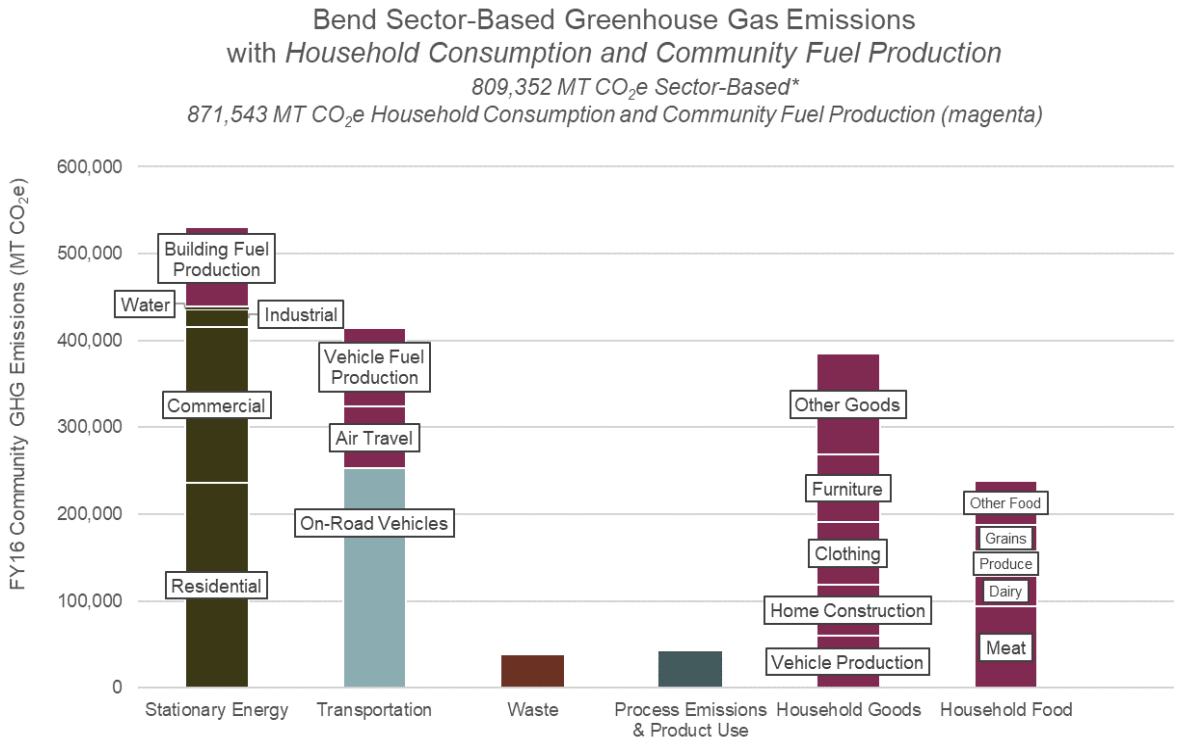
Emissions from the production of imported food, furniture, clothing, vehicles, fuel and home-building materials that are bought and used in Bend, but produced outside of the community, generate substantial emissions. The emissions add up to 871,543 MT CO2e, which is actually more than the emissions that occur within the community. Emissions that occur outside of the community boundaries are more difficult to manage because the community has less control over the associated production activities, but Bend residents can mitigate these emissions in part by consuming less of these things or consuming things that have a lower impact.

Waste and Materials Strategies

Emissions from waste and materials are not fossil fuel-based emissions, so the strategies in this Plan that reduce waste and material consumption do not contribute to the fossil fuel reduction goals. However, there are other greenhouse gas emissions from waste and materials that are produced locally when our waste breaks down in the landfill. These emissions are considered local, sector-based emissions. Waste and material reductions from this Plan contribute 1% or 15,000 MT, of the forecast reductions for local sector-based emissions. However, the small scale of the waste and materials strategies do not tell the whole story. The bulk of emissions generated to produce imported goods, food, and services (like air travel) happen outside of Bend's geographic boundaries.

This Plan includes a variety of actions to address these "consumption-based emissions" such as reducing edible food waste, implementing curbside composting and construction and demolition material recycling programs, encouraging the repair and reuse of consumer goods, and increasing community use of low-carbon concrete. These strategies will reduce consumption-based emissions by 90,000 MT CO2e in 2050. It is challenging to set goals around these strategies because it is difficult to accurately track the progress of these strategies within a greenhouse gas inventory, but we think it is important to do so and will continue to work on appropriate tracking mechanisms. Table 4 describes the strategies that the Community will take to reduce emissions from waste and materials.

Figure 11: Bend sector-based emissions with household consumption emissions.



Waste and Materials

Table 4. Waste and Materials - Climate Action Strategies

Implementation Actions	Implementation Responsibilities	Progress Metric	Target	Cumulative Emission Reductions Potential* (each circle below represents 200,000 metric tons of emissions)	Savings or Expenditure Range (per metric ton of emissions reduced)	Co-benefits
STRATEGY*: W1 - Improve non-food waste recovery*						
W1A – Improve recycling at multifamily residences. Create codes, standards, and specifications to ensure multifamily developments optimize for recycling infrastructure. Conduct outreach and education to improve recycling in multifamily housing. Coordinate with Deschutes County and waste haulers to ensure that the programs developed can be standardized across the region.	Lead: City of Bend Partners: Deschutes County, Waste Haulers	• Number and percentage of multifamily units served with recycling.	45% non-food material recovery by 2025.	800,000	Not available	
W1B – Develop a recycling and waste reduction program targeting tourists, including hotels and resort communities.	Lead: Community Partners Partners: Tourism Agencies, Businesses	• Number and percentage of organizations participating. • Number of tons and percentage of total waste recovered.				
W1C – Investigate and invest in facility and infrastructure upgrades to meet long term needs of solid waste system. Expand infrastructure to accommodate higher levels of waste recovery.	Lead: Deschutes County, Waste Haulers Partners: Not yet identified	• Dollars invested. • Expected diversion per dollar of capital and expected operations and maintenance.				
STRATEGY*: W2 - Expand use of low-carbon concrete in City projects and new development*						
W2A – Utilize low-carbon concrete mixes in City projects and create incentives to encourage developers to utilize low-carbon concrete.	Lead: City of Bend Partners: Oregon Department of Environmental Quality	• Number of tons and percentage of tons or square yards of concrete with low-carbon concrete substitute compared to conventional concrete.	30% low-carbon materials used in 50% of community concrete consumption.	240,000	$200 to $0	

City of Bend · Public Agencies · Community Partners · Utility · City and State Partners · Deschutes County · Waste Haulers · Tourism Agencies · Businesses

Savings · Expenditures · Economic Vitality · Affordability · Supports the Natural Environment · Community Health and Safety · Adaptation and Resilience · Social Equity · Oregon Department of Environmental Quality

**Emissions reduction potential assumes stated strategy target is achieved. For more details on methodology and calculations, see Appendix D.*

Waste and Materials

Table 4. Waste and Materials - Climate Action Strategies

Implementation Actions	Implementation Responsibilities	Progress Metric	Target	Cumulative Emission Reductions Potential* (each circle below represents 200,000 metric tons of emissions)	Savings or Expenditure Range (per metric ton of emissions reduced)	Co-benefits
STRATEGY*: W3 - Improve food waste recovery*						
W3A – Expand curbside composting program by accepting more materials and increasing participation.	Lead: City of Bend Partners: Deschutes County, City and State Partners	• Number of tons of curbside compost collected. • Percentage of total waste recovered as compost per year.	25% food waste recovery by 2025. 50% food waste recovery by 2050.	210,000	$0	10, 7.5, 5, 2.5
W3B – Develop and deliver educational programs that teach and encourage residents to compost their food waste.	Lead: Community Partners, Waste Haulers Partners: Not yet identified	• Number and percentage of households reached with the message. • Number of times each household has been delivered the message.				
STRATEGY*: W4 - Improve construction and demolition waste recovery*						
W4A – Expand and develop new programs to increase recovery of construction and demolition materials. Identify barriers to recovering materials and use these programs to help overcome these barriers.	Lead: City of Bend, Deschutes County Partners: Not yet identified	• Tons and percentage of construction and demolition waste that is recovered.	Target not identified.	150,000	Not available	10, 7.5, 5, 2.5

City of Bend · Public Agencies · Community Partners · Utility · City and State Partners · Deschutes County · Waste Haulers · Tourism Agencies · Businesses

Savings · Expenditures · Economic Vitality · Affordability · Supports the Natural Environment · Community Health and Safety · Adaptation and Resilience · Social Equity · Oregon Department of Environmental Quality

**Emissions reduction potential assumes stated strategy target is achieved. For more details on methodology and calculations, see Appendix D.*

Waste and Materials

Table 4. Waste and Materials - Climate Action Strategies

Implementation Actions	Implementation Responsibilities	Progress Metric	Target	Cumulative Emission Reductions Potential* (each circle below represents 200,000 metric tons of emissions)	Savings or Expenditure Range (per metric ton of emissions reduced)	Co-benefits
STRATEGY*: W5 - Develop outreach and education materials for upstream consumption reduction*						
W5A – Conduct outreach campaigns that promote waste prevention and reducing consumption. Connect residents and businesses to local resources like repair cafes that help reduce waste.	Lead: Partners: Not yet identified	• Diverted tons or dollars of resold goods. • Number of attendees at repair fairs.	Target not identified.	100,000	$270	
W5B – Implement training programs for specific industries to prevent waste. Identify these industries based on waste characterization data from the Knott landfill (once available). Examples include the building and construction industry and the food and restaurant industry.	Lead: Partners: Not yet identified	• Number of participants in training programs.				
STRATEGY*: W6 - Develop programs that encourage food waste prevention*						
W6A – Conduct outreach campaigns that promote food waste prevention.	Lead: Partners: Not yet identified	• Quantity of avoided food waste through food donation programs. • Number and percentage of households reached with message. • Number of times each household has been delivered the message.	Reduce edible food waste by 5%.	100,000	$1,200	

City of Bend · Public Agencies · Community Partners · Utility · City and State Partners · Deschutes County · Waste Haulers · Tourism Agencies · Businesses

Savings · Expenditures · Economic Vitality · Affordability · Supports the Natural Environment · Community Health and Safety · Adaptation and Resilience · Social Equity · Oregon Department of Environmental Quality

**Emissions reduction potential assumes stated strategy target is achieved. For more details on methodology and calculations, see Appendix D.*

Equity Actions and Outcomes

The following equity actions will be taken to make strategies and actions in this sector more accessible:

- Engage in intentional outreach campaigns in multiple languages that inform communities not reached by traditional methods about ways they can implement these strategies.
- Encourage multifamily property owners to include space for recycling and composting at new developments either through incentives or requirements.

The strategies and actions in this sector will lead to the following equity outcomes:

- Develop internship and training opportunities in repair and reuse fields to develop workforce skills in these trades.

7. Community Climate Action Plan Implementation

Ongoing oversight and coordination of the Community Climate Action Plan will require a creative and collaborative approach that is different than many other plans overseen by the City of Bend. The City will need to continue to coordinate with the various implementation partners, and continue to engage with residents, businesses and public agencies.

City Staffing for Coordination and Project Management

The City of Bend will provide staff and be accountable for overseeing the coordination of this Plan. This includes coordinating with departments of the City that will be executing certain elements of this Plan, and also with external entities who are key implementation partners. Staff will meet with implementation partners throughout the year to check progress of plan elements, provide technical assistance, and ensure strategies are moving forward. The City will be accountable for ongoing monitoring, tracking and reporting of progress, including coordinating updating the greenhouse gas emissions inventory and this Plan every three to five years.

Community Governance and Coordination

Successfully implementing this Plan requires a collaborative approach to governance and coordination. The City will work with other public agencies and community partners to define a governance structure that facilitates ownership, decision making and strategy execution in partnership with many other entities. The City will be the primary implementer for many strategies in this Plan, but just as many must be implemented by community partners and other public agencies. The governance model for this plan should also create opportunities for key stakeholders, subject matter experts, and members of the public to provide input and recommendations on program and policy development for the strategies, such as through an advisory committee, technical advisory group, or similar.

Funding and Financing this Plan

This Plan will only be successful if the City and community dedicate necessary resources to the initiatives described in the climate action strategies. Funding and financing to implement this Plan fully will need to come from a variety of sources and will include both public and private funds. As programs are developed and funding needs are determined more definitively, the City and the Committee will work together to identify and leverage appropriate grants, public financing mechanisms, private investment and public-private partnerships to fund the climate action strategies. Appendix G maps out potential funding and financing pathways that can be used for each specific strategy.

The City of Bend and the community are committed to climate action for the long term. The strategies in this Plan are meant to be short- to medium-term activities that are actionable and can be initiated or complete in the next three to five years. Each strategy described will require different sets of stakeholders to be engaged to define specific programs, identify resources needed, set action-specific targets, and develop more specific implementation plans with assigned roles and responsibilities. The development of this Plan is the just the beginning of meaningful work to reduce our community's greenhouse gas emissions. This Plan is to be referenced as a living document and updated as the community evolves, technologies improve and understanding progresses about what is needed for meaningful climate action.

Climate Plan Update in Three to Five Years

The City will formally update this Plan in three to five years. The next iteration of this Plan should address the following recommendations:

- **Focus on adaptation strategies and tie into the community's resiliency plans:** This Plan is focused specifically on climate mitigation, or reducing the greenhouse gas emissions from the community. However, communities around the world, including Central Oregon, are already feeling the effects of climate change in the form of extreme weather events, heat, catastrophic wildfires, drought and more. These climate-related impacts are expected to persist and get more intense, and it is vital the community is prepared to handle these events.

> **The next phase of climate action planning for the Bend community should include adaptation strategies to acknowledge and address how Bend can adapt to future climate-related events, while still working to mitigate future impacts.**

- **Greater focus on consumption**: The Bend Community Greenhouse Gas Inventory found that the impact of the goods, food, and fuel we consume that occurs outside of the community boundaries is greater than the emissions that occur within our City. The Climate Action Goals established in Resolution 3044 were centered on fossil fuel use within the City boundaries, so the goals and analysis were completed without including the impact of the consumption-based emissions. With an understanding of how significant the impact is from consumption, the next Plan should focus more on this topic and include consumption emissions in its stated goals.
- **Focus on water conservation and the water-energy nexus:** Water treatment, conveyance, and heating are energy intensive activities that contribute to greenhouse gas emissions. As we live in a high-desert ecosystem, water conservation is extremely important and activities to save water should be an important component of our community's efforts to reduce emissions. Due to focusing on the four primary emission sectors (energy supply, buildings, transportation, waste and materials), this Plan does not explicitly address water use and conservation. The next plan should include strategies that address emissions from water use and encourage water conservation.

Glossary

Term	Definition
Biodigester	A technology in which organic waste material is decomposed by microbial action and typically produces biogas, which can then be used as a renewable fuel or converted to renewable electricity to offset fossil fuel use
Business as usual	A scenario assuming no actions are taken to reduce greenhouse gas emissions
Carbon dioxide equivalent (CO_2e)	A measurement that describes how much global warming potential a given type and amount of greenhouse gas may cause using the functionally equivalent amount or concentration of carbon dioxide as the reference
Climate strategy/strategies	The higher-level objective(s) that the community needs to reduce its fossil fuel consumption
Climate action(s)	Specific programs, policies or initiatives that the community can take to make progress in its climate strategy to reduce greenhouse gas emissions
Consumption-based emissions	Emissions from the production of goods, materials and services that are consumed by residents of a certain geographic area but are produced outside of the geographic area. The emissions come from activities such as raw material extraction, production, and transport of materials and goods
Co-benefit	Additional positive benefit from implementing a strategy other than solely greenhouse gas reduction
Climate change adaptation	Actions to adjust to actual or expected climate and its effects, which seek to lower the risks posed by the consequences of climatic changes
Climate change mitigation	Actions to limit the magnitude or rate of climatic changes and their related effects by reducing greenhouse gas emissions
Demand response program	Programs that encourage utility customers to change their power consumption or use of a resource to better match the demand for power with the supply

Glossary

Term	Definition
Energy audit	An assessment and analysis of energy flows for energy conservation in a building. Energy audits help to identify and prioritize possible upgrades to improve energy efficiency in buildings, such as increasing insulation or using different HVAC systems
Energy benchmarking	The practice of comparing the measured energy performance of a facility to itself, other facilities or established norms, with the goal of informing or motivating improved performance
Emission intensity	The emission rate of a given pollutant relative to the intensity of a specific activity
Equity action	Specific programs, policies or initiatives that make the climate actions more accessible and/or less harmful to underserved community members and increase benefits to traditionally underserved populations
Equity outcome	A resulting effect that supports equity through increasing benefits or mitigating harmful impacts to traditionally underserved populations or by making programs more accessible to underserved populations
Fossil fuel	Fuel formed from the remains of living organisms through natural processes that occur in the earth
Greenhouse gas	Gas that traps heat in the atmosphere by absorbing infrared radiation
Greenhouse gas emissions inventory	A study that quantifies the greenhouse gas emissions that are generated within a specific boundary. The boundary can be geographic, such as the City of Bend, or it can be defined by operational or financial control
Location-based emissions	Emissions calculated using the regional electricity grid greenhouse gas intensity. These represent the average impacts of electricity use and efficiency efforts across a large geographic area
Market-based emissions	Emissions calculated using the greenhouse gas intensity of electricity contracts with local utilities

Glossary

Term	Definition
Metric ton (MT)	A unit used to measure greenhouse gas emissions, equal to 1,000 kilograms or approximately 2,204.6 pounds
Microgrid	A small network of electricity users with a local source of supply that is usually attached to a centralized grid but can function independently
Revolving loan fund	A self-replenishing pool of money that utilizes interest and principal payments on old loans to issue new ones
Sector-based emissions	Emissions that come from sources located within a geographic boundary and emissions that occur as a consequence of the use of grid-supplied energy within the geographic boundary
Technical potential	The maximum achievable emissions reduction of a specific strategy or action
Triple bottom line	A framework that assesses actions with a three-part lens that includes environmental, social and economic impacts

Appendix A. Plan Development Process

Overview

The Bend Community Climate Action Plan is a plan that is "by Bend and for Bend." For this reason, community members were involved at every step of this Plan's development, and they will continue to be involved during implementation. This appendix further describes the process for developing this Plan and how the City and the Climate Action Steering Committee engaged the community and other stakeholders throughout the process.

Stakeholder Engagement

General Engagement Approach

The Plan development process utilized a grassroots approach to community engagement and communication, supplemented with formal city communication channels. The Climate Action Steering Committee members distributed information through their personal and organizational networks. For example, they shared information about this Plan in newsletters for organizations they were affiliated with.

The Committee also distributed information about this Plan through grassroots channels, such as posters on bulletin boards and "pop up" tabling at community gathering spaces like churches and food courts. The intent of this approach was to meet people where they were to share information with them and get their input. The Committee also used online public survey tools to increase the accessibility of surveys and attract the largest number of respondents.

To supplement these grassroots outreach efforts, City staff provided information through the City's formal communication channels, including the City newsletter, the City's social media channels, a "City Edition" short video, neighborhood association newsletters and press releases. Press releases were followed up with interviews with local radio and TV news stations. City staff and some committee members also delivered presentations to different organizations throughout the planning process. These organizations included neighborhood associations, rotary clubs, non-profit organizations, and other clubs, boards and agencies.

Business Engagement

In addition to general public engagement activities, the City made extra efforts to engage the business community, which was identified as a primary stakeholder in the City Council's climate action resolution. The Bend Economic Development Advisory Board, a board appointed by the City Council that advises the Council on matters related to economic development in Bend, had a designated seat on the Climate Action Steering Committee. This representative was responsible for expressing the viewpoints of the Board and the business community during the development of this Plan. City staff also gave several presentations to the Board to get their direct input and feedback on the recommendations included in this Plan.

Equity Engagement

The Climate Action Steering Committee and the City had a goal of centering equity in the Community Climate Action Plan. The City does not currently have an equity committee or many established channels for bringing the perspectives of underserved populations into planning processes. In response to this gap, the Committee established an equity subcommittee charged with guiding the Committee in its goal of centering equity. The equity subcommittee used several tactics to achieve this goal including:

- Identifying individuals and organizations in the

community that could share the perspective of underrepresented populations (including residents with low incomes, communities of color, people with disabilities and seniors) and building relationships with them.

- Developing specific climate strategies and actions that they felt would achieve equity goals.
- Getting feedback from the individuals and organizations on these strategies and actions.

For more information on the equity work done during the development of this Plan, see Appendix B.

Timeline

Spring 2018

The City Council appoints a 13-person Climate Action Steering Committee. The members of the Committee are tasked with serving as the City's primary advisors during this Plan's creation. They help guide the engagement process for this Plan and develop the strategies and actions in this Plan. The Committee represents diverse interests and stakeholders across the community, and has the following representation:

- Three business community representatives, including one member of the Bend Economic Development Advisory Board
- Two environmental community representatives
- Two government agencies or public institution representatives
- Two youth representatives (under age 18 at time of appointment)
- Two subject matter experts
- Two at-large community members

Committee members are responsible for:

- Representing their stakeholder group's perspective in discussions and decision-making processes
- Communicating progress on this Plan back to their respective constituencies
- Distributing information about this Plan through their networks
- Soliciting participation in the public input events

The City hires a technical consultant to provide a Community Greenhouse Gas Emissions Inventory. This inventory identifies the quantity and source of Bend's greenhouse gas emissions. This allows City staff and the Committee to understand the quantity of emissions reductions needed to achieve their goals, and in what sectors these reductions could be most readily achieved.

Summer 2018

Committee sets a vision, goals, and guiding principles for this Plan. Committee identifies key resources and stakeholders in the community.

Fall 2018

The City convenes multiple technical working groups to work with the Committee members to identify the potential policies, programs and actions that could help the community reach its climate action goals. A separate technical working group is convened for each emission sector area:

- Energy supply
- Energy in buildings
- Transportation
- Waste and materials

Committee members solicit working group participants by identifying and inviting key subject matter experts and sector-relevant stakeholders in the community. The working group meetings were also open to the public. A total of 8 working groups are held with almost 100 individuals participating.

Winter 2018/2019

The Committee consolidates and reviews ideas from technical working groups.

The City and Committee use an online survey to solicit public input on the ideas proposed by technical working groups. The survey shows all the potential ideas under consideration and asks the public to share to what degree they think each strategy is the right direction or the wrong direction for this Plan. The survey also gives respondents the chance to provide open-ended comments related to this Plan. *The community survey garners almost 1,600 responses.*

The Committee takes the results of this survey into consideration when they determine which strategies to ultimately recommend for this Plan. The results of the survey can be found on the City's website.

City staff solicit input from the business community through meeting with the Bend Economic Development Advisory Board and with other businesses.

Committee selects 15 strategies to be included in a climate action modeling scenario. In selecting these strategies, the Committee takes into account input from community survey, business feedback, and climate action goals.

Spring 2019

Committee identifies evaluation criteria by selecting and weighting the following co-benefits:

- Economic vitality
- Affordability
- Supports the natural environment
- Social equity
- Adaptation and resilience
- Public health and safety

Note: Co-benefits are further described on page 12 of this Plan.

Technical consultant conducts a triple bottom line analysis of the strategies that the Committee recommended for this Plan. The analysis includes:

- Quantifying the technical potential of each strategy to reduce greenhouse gas emissions
- The life-cycle costs associated with removing emissions from the atmosphere through each strategy
- Evaluating each strategy's impact on the six co-benefits

To gather the data needed for the analysis, the City and consultant conduct interviews with primary implementation partners and key stakeholders in the community. During these interviews, the City and consultant gather information to understand how specific programs might be structured, what barriers exist to implementing programs, and what resources are needed to overcome the identified barriers. These interviews also help the City identify what programs other organizations and agencies are planning that could help the community reach its greenhouse gas reduction goals. They also identify which of those activities were directly aligned with the recommended climate action strategies.

The results of this analysis reveal that the selected strategies are not sufficient to achieve the emissions reduction goals set by the City.

Summer 2019

The Committee reviews results of data analysis and selects five additional strategies to recommend for this Plan that help achieve the additional emissions reductions needed to reach the City's goals.

City staff solicit additional input from business community through another meeting with the Bend Economic Development Advisory Board after key decisions have been made and preliminary data analysis results are in.

The proposed climate action strategies and a summary of the data analysis are publicized in an online open house in July 2019. The purpose of the online open house is to provide the public a summary of the recommended programs and policies in this Plan. It also provides a final opportunity for the public to share general comments on this Plan and the specific strategies. The Committee takes the comments into account when selecting additional strategies to include in this Plan and when making their final adjustments to the recommendations.

The Committee and City staff meet with City Council Stewardship subcommittee to solicit feedback and receive policy guidance on certain elements of this Plan.

The Committee receives and considers public comments from online open house. The Committee approves final list of recommended strategies for this Plan.

Fall 2019

The Committee and City staff meet with City Council Stewardship subcommittee again to solicit more feedback and receive policy guidance on certain elements of this Plan.

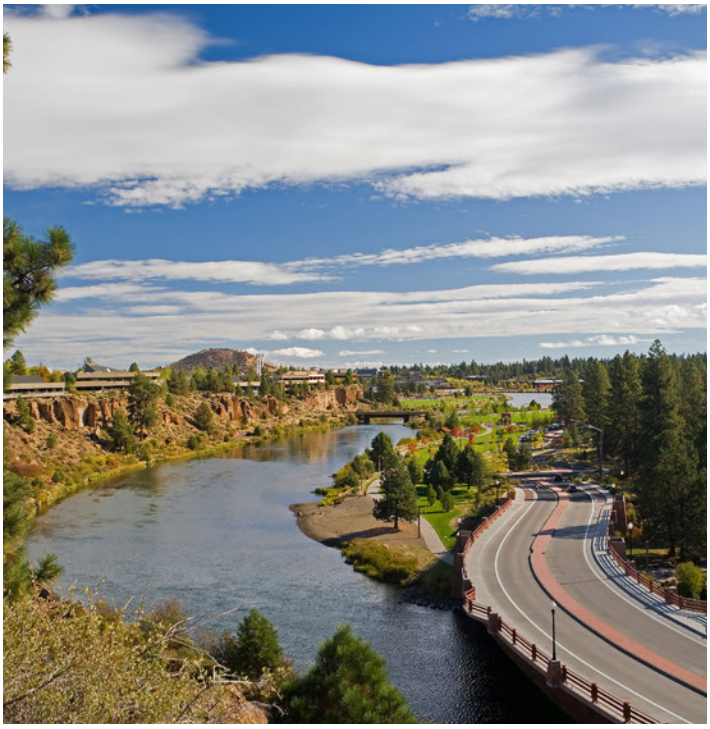
The Committee presents full Plan to City Council for deliberation.

Appendix B. Equity Background

The City of Bend has identified equity as a central goal and focus of the Community Climate Action Plan (CCAP). The purpose of this appendix is to explain how the City of Bend and Climate Action Steering Committee integrated equity into its planning efforts.

In the early phases of the planning effort, the City centered equity in the development of the Plan through a variety of efforts, including:

- **Partnering with the Civic Equity Project in the early project phases.** This is a branch of a local civic engagement non-profit focused specifically on connecting historically underrepresented communities to public processes. City staff participated in a panel and have had several meetings with this group.
- **Participating in an Equity Leaders Training through the Urban Sustainability Directors Network (USDN).** City staff participated in a peer learning group about incorporating equity in climate action plans. Staff received training from USDN's equity coach specific to the Bend Community Climate Action Plan project. Staff have applied strategies learned at these trainings to equity activities conducted to date. Climate Action Steering Committee Members watched USDN's publicly available equity training videos.
- **Establishing authentic relationships with social service providers and community-based organizations.** City staff have been working to establish relationships with social service providers and other organizations that serve historically underrepresented communities. Staff will continue to build on relationships already established and will aim to create additional relationships as the project moves forward.



- **Climate Action Steering Committee Equity Subcommittee.** The Committee formed an equity subcommittee, with the objective of centering equity in this Plan. The subcommittee helped evaluate the strategies proposed in this Plan for equity actions and outcomes intended to make the climate strategies more accessible and increase benefits to historically underrepresented communities.
- **Equity considerations in technical working groups.** Technical working groups were consulted in the middle of the plan development and were asked to brainstorm potential equity issues or considerations to be aware of with respect to proposed strategies.
- **Co-benefit analysis.** Climate action strategies were evaluated against a set of criteria called co-benefits. Social equity was one of the co-benefits that was evaluated. For more information on co-benefits, see Chapter 5 of this Plan.

Tactics for Receiving and Incorporating Feedback into the Community Climate Action Plan Strategies

Once the climate action strategies were defined, the City conducted focused outreach to disadvantaged/historically underrepresented groups. Goals of this outreach effort were to:

- Encourage their involvement during the planning process.
- Educate these stakeholders about this Plan and the work done to date.
- Collect their feedback on the identified equity actions, including potential barriers in implementing these actions.
- Build relationships with these stakeholders in order to develop trust and encourage future participation with the Community Climate Action Plan.

Staff and the Equity Subcommittee worked together to help reach these audiences. These audiences include:

- Residents with low to moderate income
- People of color
- People with disabilities
- Seniors

Key Community Groups

Identified below are community organizations that the City connected with to learn how to better engage their members and contacts and to get their feedback on the climate action strategies.

Organization	Audience	Contact
Neighbor Impact	People with low income	Christina Zamora
Housing Works	People with low income	Keith Wooden
Central Oregon Coalition for Access	People with disabilities	Carol Fulkerson
Council on Aging	Seniors	Denise LaBouda
Latino Outdoors	Latino Community	Zavier Borja
East Cascade Works	Workforce Development	Heather Ficht

Equity Tools

The City and the consultant team developed the following tools to be used during focused equity outreach. These tools were intended to help stakeholders learn how the City evaluated equity in this Plan. They also provided an opportunity for disadvantaged audiences to provide feedback on this analysis and state if they support the findings and/or see something in need of further evaluation.

- **Equity fact sheet:** The fact sheet provided information on this Plan, how the City has analyzed equity issues related to this Plan, and proposed strategies for how this Plan can serve to improve (or at least not negatively contribute to) equity. These strategies, or "equity actions" were developed with the Climate Action Steering Committee's equity subcommittee.
- **Equity survey/input form**: This tool was used in conjunction with the equity fact sheet and is intended to collect feedback on the equity actions. Goals for collecting this feedback are to determine if these actions will help disadvantaged/ historically underrepresented communities implement the actions in this Plan, and if there are any gaps in this Plan.

City staff and Committee members used the equity tools to conduct a series of meetings with staff from the organizations listed above. During the meetings, City staff interviewed the organizations' staff to get their feedback on how effective the proposed strategies were for their constituents.

Key Takeaways from Equity Meetings

Below is a summary of feedback City and Committee staff heard while meeting with equity stakeholders.

- On-bill repayment programs are confusing in general, so it may be hard to make them accessible.
- On-bill repayment programs are inaccessible if the additional payment is more than whatever savings are realized.
- There was support for community solar to provide renters with access to solar. This would need to be accompanied with focused outreach.
- Energy efficiency and renewable energy incentives that are directed towards landlords are only effective as equity strategies if the landlord is required to pass the benefit on to the tenant.
- There was support for programs that increase energy efficiency incentives for residents with low incomes, but these need to be accompanied with focused outreach on the benefits.
- There was strong support for workforce development programs, particularly in energy efficiency and renewable energy fields.
- There was support for incentivizing energy efficiency in manufactured homes. Stakeholders thought there were many opportunities here.
- There was strong support for incentives that promote smaller housing types.

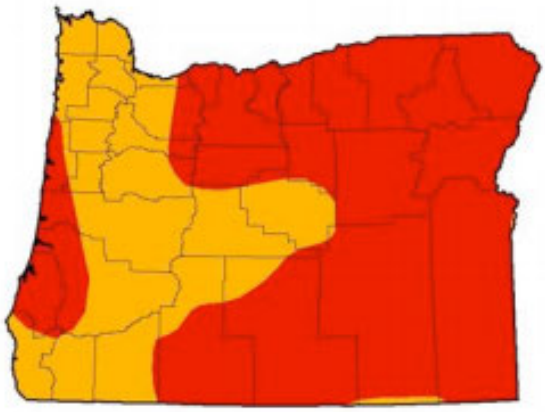
Appendix C. Climate Risk and Vulnerability Assessment

Bend's unique natural environment is a part of all our lives, whether we hike, ski, or simply appreciate its beauty. The outdoors attracts tourism, provides us with valuable resources, and is an integral part to our economy. Our community and environment are at serious risk due to climate change. Over the past century, the average temperature of the Northwest has increased 1.3°F.[1] As temperatures rise, the probability and severity of natural disasters also increases.

Central Oregon is at risk for many natural disasters, some of which are directly caused by climate change. According to the Deschutes County Natural Hazard Mitigation Plan Bend is most vulnerable to wildfires, winter storms, and drought.[2] These hazards also have a high probability of occurring, making them the most threatening natural disasters with a direct correlation to climate change. Other hazards, such as windstorms and floods also pose serious risk for Bend.

Currently, the projected future climate predictions indicate that the average temperature for the northwest will continue to increase. The Third National Climate Assessment reveals that the Northwest may increase in temperature by 3.3°F to 9.7°F by 2070, when compared to the 1970-1999 period.[3] Warmer average temperatures will cause dry seasons to last longer, and become more extreme. Summer in particular, will be unusually hot with low rainfall. Simultaneously, winter will arrive earlier in the year, and have more precipitation in a shorter time frame. The precipitation will gradually become rain instead of snow, which will decrease snowpack and water supply for streams and rivers during the hotter months of the year.

Figure 1: Retrieved from US Drought Monitor



US Drought Monitor for August 25th, 2015. All of Oregon was severe (orange) or extreme (red).

Warming Temperatures/Drought

Bend has abundant surface and underground water resources, which reduces vulnerability from drought and low precipitation. However, drought and low rainfall will increase the aridity of soil around Central Oregon, which increases the probability of other natural hazards occurring. A study by the Ecological Society of America found that forests around Central Oregon will be at greater risk for wildfires due to low moisture

levels in the soil and warmer climate. Over the past few decades, the area burned by wildfires has increased with warmer temperatures and longer snow-free periods.

The past few years have seen the hottest temperatures on record. In 2015, winter temperatures were 5–6°F above average. This caused precipitation to fall as rain instead of snow, resulting in low snowpack. As shown in Figure 1, all of Oregon was in severe or extreme drought.

[1] Kenneth E. Kunkel, et al, "Regional Climate Trends and Scenarios for the U.S. National Climate Assessment: Part 6. Climate of the Northwest U.S.," National Oceanic and Atmospheric Administration, (January 2013): 29.
[2] Deschutes County Natural Hazards Mitigation Plan, Oregon Partnership for Disaster Resilience, May 2015.
[3] Mote, Philip et al, Northwest: Climate Change Impacts in the United States: The Third National Climate Assessment, U.S. Global Change Research Program, (2014): Ch. 21: 489.

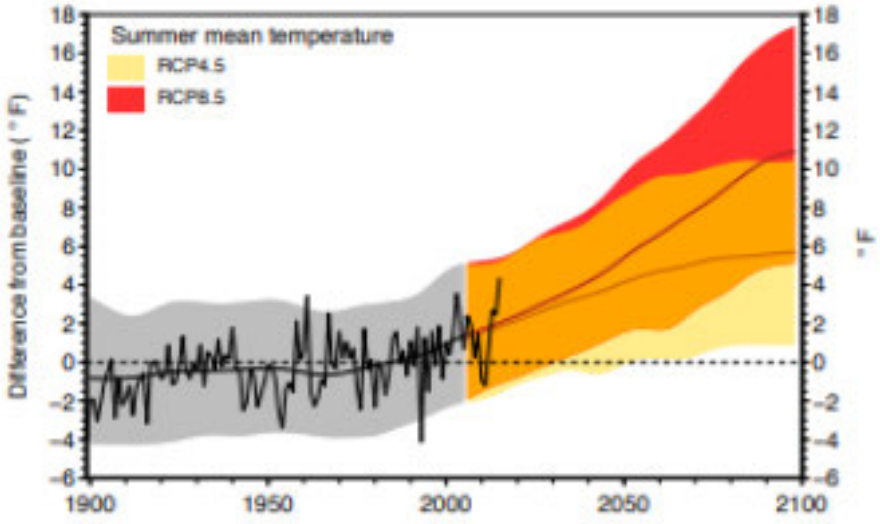
Bend has abundant surface and underground water resources, which reduces vulnerability from drought and low precipitation. However, drought and low rainfall will increase the aridity of soil around Central Oregon, which increases the probability of other natural hazards occurring. A study by the Ecological Society of America found that forests around Central Oregon will be at greater risk for wildfires due to low moisture

levels in the soil and warmer climate.[4] Over the past few decades, the area burned by wildfires has increased with warmer temperatures and longer snow-free periods.

The past few years have seen the hottest temperatures on record. In 2015, winter temperatures were 5–6°F above average.[5] This caused precipitation to fall as rain instead of snow, resulting in low snowpack. As shown in Figure 1, all of Oregon was in severe or extreme drought.

Furthermore, forests around Central Oregon under the classification "moist mixed-conifer forests" are expected to decrease in size by 20% by 2040. Moist mixed-conifer forests are defined as forests at elevations around 3,000-7,000 ft. and populated by Douglas and White Firs, Western Larch, Ponderosa and Lodgepole Pine. These forests, which surround Mt. Bachelor, cannot thrive in an arid environment, with little precipitation during the longer and hotter summers. "Higher temperatures and a lack of water can also make trees more susceptible to pests and disease, and trees damaged or killed burn more readily than living trees."[5]

Figure 3: Retrieved from Oregon Climate Change Research Institute, 2017.



The Third Oregon Climate Assessment Report by the Oregon Climate Change Research Institute, finds that summer temperatures are expected to warm more than other seasons, with projections of 6.5°–13.9°F by the 2080s.[7] More extreme temperatures will also become more common as the average temperatures increase. "In fact, the hottest days in summer are projected to warm by 1°–2°F more than the change in mean summer temperature over the Pacific Northwest." Warming temperatures will greatly affect winter precipitation, which results in high drought probability and vulnerability for Central Oregon.

[4] Joshua S. Halofsky, et al., "Dry forest resilience varies under simulated climate-management scenarios in a central Oregon, USA landscape," Ecological Applications, Vol. 24, No. 8 (December 2014): 1908.
[5] M.M Dalton, et al, The Third Oregon Climate Assessment Report, Oregon Climate Change Research Institute, College of Earth, Ocean and Atmospheric Sciences, Oregon State University, Corvallis, OR. (2017): 13.
[6] United States Environmental Protection Agency, What Climate Change Means for Oregon, (August 2016): 2.
[7] Dalton, The Third Oregon Climate Assessment Report, 6.

\n addition to damaging the environment, warmer temperatures can harm human health. According to the Center for Disease Control (CDC), infants, young children, and the elderly are at higher risk of heat-related health problems due to the lack of ability to regulate internal temperature.[8] Additionally, extreme heat events cause dangerous health problems such as rashes, cramps, heath exhaustion and heat stroke. Extreme heat can also cause existing medical conditions to worsen.

Heat waves can be deadly, and these extreme heat events will become more frequent and severe. A report by the CDC, Climate Change and Extreme Heat Events, states that "From 1999 through 2009, extreme heat exposure caused more than 7,800 deaths in the United States."[9] Heat waves are more prevalent in cities, as cities are hotter than their rural surroundings. This "urban heat island" is caused by pavement and concrete absorbing heat, which can raise temperatures[10] As cities like Bend continue to grow, and as temperatures rise, the amount of people at risk of heat related health problems will increase.

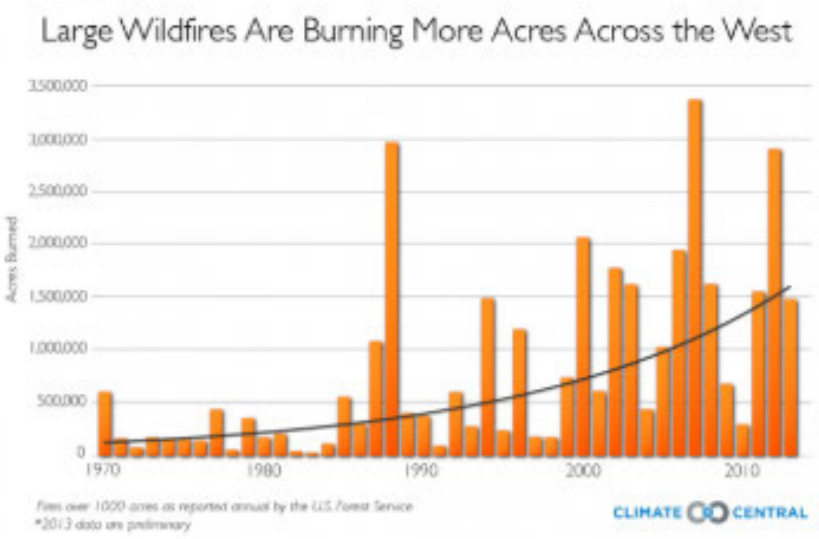
Wildfire

Central Oregon is at higher risk for wildfires than ever before. Due to fire suppression over the last century, forests around Central Oregon are densely packed, and laden with dead or unhealthy flora. Wildfires will take advantage of these dangerous conditions. The United States Department of Agriculture's Forest Service states "the wildfires seen in the 21st century are larger, more severe and more frequent than wildfires seen in the previous century, and they threaten the lives and property of the people living and recreating in the central Oregon area." Over the past 50 years, the fire season has extended from 23 days in the 1970s to 116 days in the 2000s. This is largely due to reduced mountain snowpack and earlier spring snowmelt.

Wildfires in Oregon are natural and inevitable. However, the severity and probability of wildfires increases as Oregon becomes drier and has longer summers. "Unusually dry winter and hot summers increase the likelihood of a wildfire event, and place importance on mitigating the impacts of wildfire before an event takes place."[12]

In 2017, the number of wildfires was slightly above average at 2,042, according to Oregon.gov. "Statewide, a total of 664,842 acres burned - almost 42 percent above the 10-year average." Over the past two decades, the number of wildfires, and acreage burned, has steadily increased. This trend correlates with hotter, drier, and longer summers, and with reduced snowpack during winter.

Figure 4: Retrieved from Climate Central



[8]Center for Disease Control and Prevention Website, Natural Disasters and Severe Weather, Frequently Asked Questions About Extreme Heat.
[9]Centers for Disease Control and Prevention, Climate Change and Extreme Heat Events, 2.
[10]Centers for Disease Control and Prevention, Climate Change and Extreme Heat Events, (October, 2016): 14.
[11]Dalton, The Third Oregon Climate Assessment Report, 6.
[12]Deschutes County Natural Hazards Mitigation Plan, Oregon Partnership for Disaster Resilience, May 2015, 11-87.
[13]Oregon Office of Emergency Management: Hazards in Oregon: Hazards and Preparedness, Wildfire.

Snowpack

Central Oregon depends on snowpack for a steady supply of water through the drier months of the year. Snowpack is the amount or thickness of snow that accumulates on the ground. Precipitation during winter will be expected to fall as rain instead of snow, as the climate warms.[14] The Oregon Basin Outlook Report from the United States Department of Agriculture (USDA) states that "The 2018 snow season brought a well below normal snowpack to most of Oregon's mountains. Most regions barely achieved 70% of normal snowpack levels at the peak of the season. As a result, summer streamflow forecasts are calling for well below average flows and water shortages are likely in some parts of the state."[15]

The red line in Figure 5 shows 2018's snowpack for the Upper Deschutes and Crooked Basins around Central Oregon. Current snowpack is significantly lower than the normal snowpack, as shown with the black dotted line. Low snowpack and a warmer than normal winter will decrease stream and river volume. The Oregon Basin Outlook Report details "Unusually warm temperatures in the month of May led to rapid snowmelt from an already limited snowpack. The low winter snowpack and drier than normal spring conditions are strong indicators of a critically low summer water supply outlook." The consequences of low snowpack and snowmelt will affect reservoir, stream, river, and lake volume. As shown in Figure 6, most of the Northwest has seen large decreases in percent snowpack. The Cascade Mountain Range, which includes Mt. Bachelor, and the Three Sisters, are all seeing reductions in snowpack. [16]

The consequences of low snowpack and snowmelt will affect reservoir, stream, river, and lake volume. As shown in Figure 6, most of the Northwest has seen large decreases in percent snowpack. The Cascade Mountain Range, which includes Mt. Bachelor, and the Three Sisters, are all seeing reductions in snowpack.

Figure 5: Retrieved from Oregon Basin Outlook Report 2018

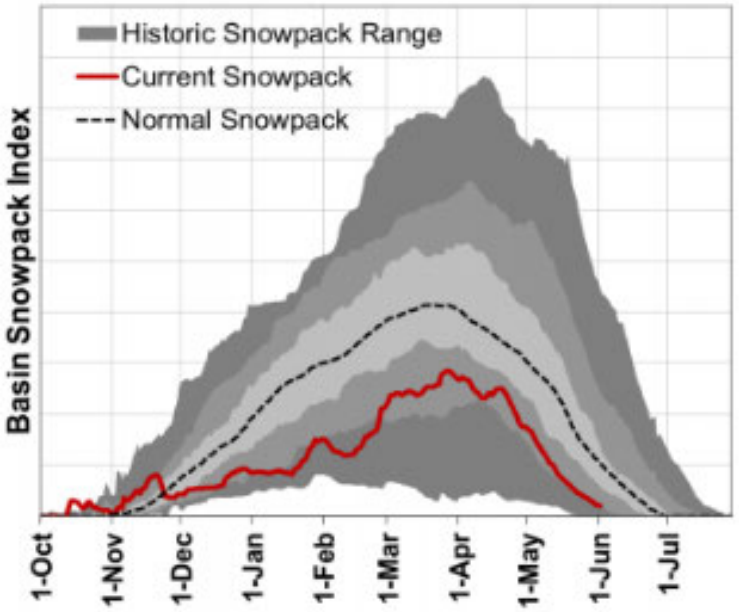
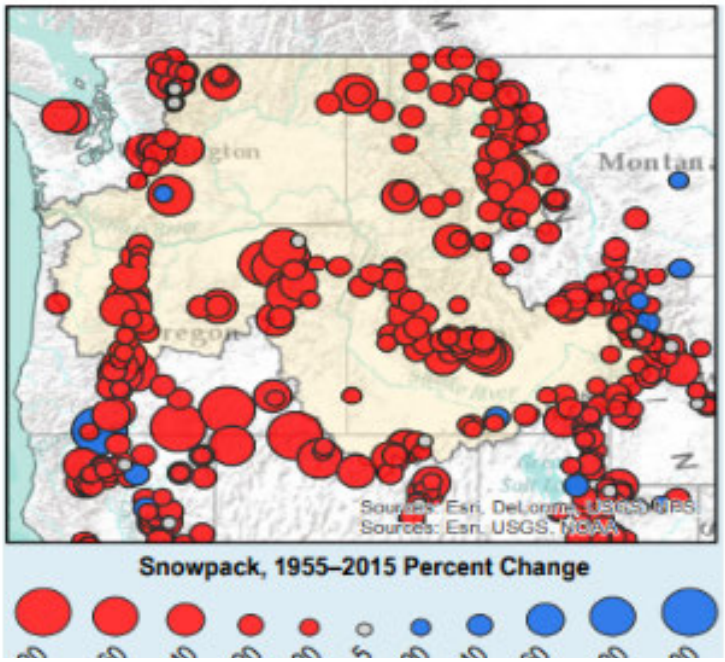


Figure 6: Retrieved from Dalton, 2017



[14]United States Environmental Protection Agency, Climate Change Indicators: Snowpack, (August 2016).
[15]United States Department of Agriculture, Natural Resources Conservation Service, Oregon Basin Outlook Report, (June 1, 2018): 1.
[16]United States Department of Agriculture, Oregon Basin Outlook Report, 3.

Winter Storms and Floods

The Deschutes River bisects Bend, and is most vulnerable to flooding during the winter months. Riverine flooding occurs when the capacity of the river is exceeded due to excessive precipitation or snowmelt. Central Oregon receives most of its precipitation during the winter months as snowfall, however, that is likely to change as winter temperatures rise. Rain and melting snow may overburden stream and rivers, resulting in floods. Floods can be augmented in the winter if the soil is frozen. "If the ground is saturated or frozen, stream flow can be increased even more by the inability of the soil to absorb additional precipitation."[17] Bend is more vulnerable to riverine and urban flooding as winter temperatures increase.

Central Oregon has had a history of harsh winter storms, which have shut down cities and means of travel for days at a time. Severe cold can cause irreversible damage to crops, water pipes, and homes. Residents who are unprepared may face serious health and safety risks as well. As winter temperatures rise, more precipitation will fall as rain instead of snow. The Third Oregon Climate Assessment Report details that "Some of the Pacific Northwest's largest floods occur when copious warm rainfall from atmospheric rivers combine with a strong snowpack, resulting in rain-on-snow flooding events."[18] The rapid shift in temperature can cause water on streets and underpasses to freeze and prevent any new precipitation from draining. These floods are a major hazard, and can shut down transportation routes until the ice melts.[19]

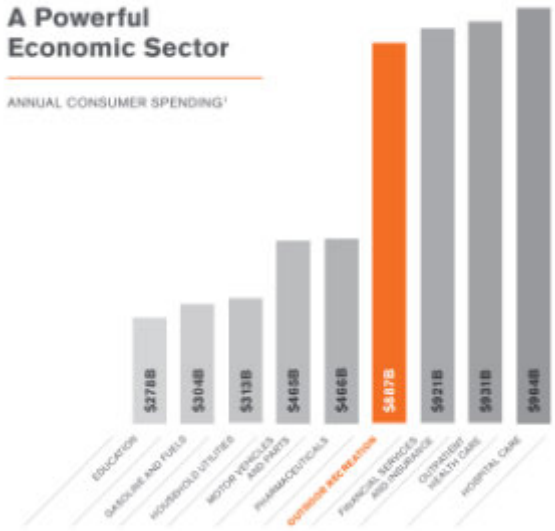
Winter Storms can damage power lines and cause power outages, which shut down homes powered by electric heat. Those without heat, and unable to drive may face serious health and safety risks. An article by Jeffery Berko et al, "Deaths Attributed to Heat, Cold, and Other Weather Events in the United States, 2006-2010," found that from 2006-2010, 10,649 U.S. resident deaths were attributed to weather-related causes. "Exposure to excessive natural cold, hypothermia or both was cited for 6,660 (63%) of deaths."[20] The pattern across age groups was similar for heat and cold related mortality. The death rate increased substantially for persons over the age of 74, and increased even further for persons aged 85 and over.[21] Elderly people are most vulnerable to winter storms as they often live alone, cannot maintain body temperature easily, and can easily become marooned without access to medical care. Deaths indirectly caused by winter storms and flooding are common, as transportation becomes more dangerous, and isolates residents that may be unable to care for themselves.[22]

[17] State of Oregon, "Flood Chapter," in Natural Hazards Mitigation Plan, (February 2012): 3-F-4.
[18] Dalton, The Third Oregon Climate Assessment Report, 23.
[19] State of Oregon, "Winter Storms Chapter," in Natural Hazards Mitigation Plan, (February 2012): 3-WS-10.
[20] Jeffery Berko et al, "Deaths attributed to Heat, Cold and Other Weather Events in the United States, 2006-2010," National Health
[21] Statistics Reports; no. 76. Hyattsville, MD: National Center for Health Statistics, (2014): 4.Berko, "Deaths Attributed to Weather Events," 5.
[22] State of Oregon. "Winter Storms Chapter." in Natural Hazards Mitigation Plan. (February 2012): 3-WS-1 - 3-WS-34.

Economy

Economy

Figure 7: Retrieved from Outdoor Industry Association, 2017



Bend is part of the Mountain Pact, a coalition of cities in the Northwest dependent on their unique climates to support their economies. The "Mountain Pact empowers mountain communities to build resilience in the face of economic and environmental stresses through a shared voice on federal policy related to climate, public lands, and outdoor recreation." [23]

According to the Outdoor Industry Association, outdoor recreation is a significant sector of the American economy. In 2017, outdoor recreation provided over 7.6 million jobs, 887 billion in consumer spending, 59.2 billion in state and local tax revenue, and 65.3 billion in federal tax revenue.[24]

Bend's community represents approximately 91,000 permanent residents and between 2.5 and 3 million annual visitors. We are surrounded by world-class outdoor recreation opportunities that drive our local economy. The tourism generated from people adventuring and exploring our public lands helps employ a great number of local residents, provides a market for local goods and services, and generates tax revenues that gets reinvested into Bend's infrastructure. All these aspects of the economy will be affected by climate change, and the risks of forest loss, snowpack decrease, and increased wildfire puts the strong economic opportunities from these resources at risk.

It is difficult to assess how much climate change will affect Bend's economy, but due to rising temperatures, it is reasonable to assume electricity bills will rise for Bend residents, raising the overall cost of living. Longer, hotter summers, with more 100+ degree days will necessitate a need for air conditioning. "In addition to temperature change, humidity, wind, and solar radiation are also likely to change over the years because of higher greenhouse gas emissions."[25] Climate change and warmer temperatures will have a large effect on building energy consumption due to increased use of heating and cooling appliances.

[23]"Mountain Communities for Environmental and Economic Resilience," The Mountain Pact, Accessed July 16th, 2018.
[24]Outdoor Industry Association, "The Outdoor Recreation Economy," (2017): 2.
[25]Haojie Wang, and Qingyan Chen, Impact of climate change heating and cooling energy use in buildings in the United States, Energy and Buildings, Vol 82, (2014): 428.

Conclusion

As global temperatures rise, Bend and Central Oregon will become more vulnerable to natural disasters. Summer heat waves, drought, wildfire, and winter storms are the most likely hazards to afflict Central Oregon as the climate changes. Health risks also increase with climate change, primarily for infants, young children, and the elderly. Increasing awareness and understanding of climate change, while reducing our own carbon footprint will help prevent and protect Bend's environment and citizens from dangerous natural hazards.

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Appendix D. Community Greenhouse Gas Emissions Inventory

2016 COMMUNITY GREENHOUSE GAS INVENTORY

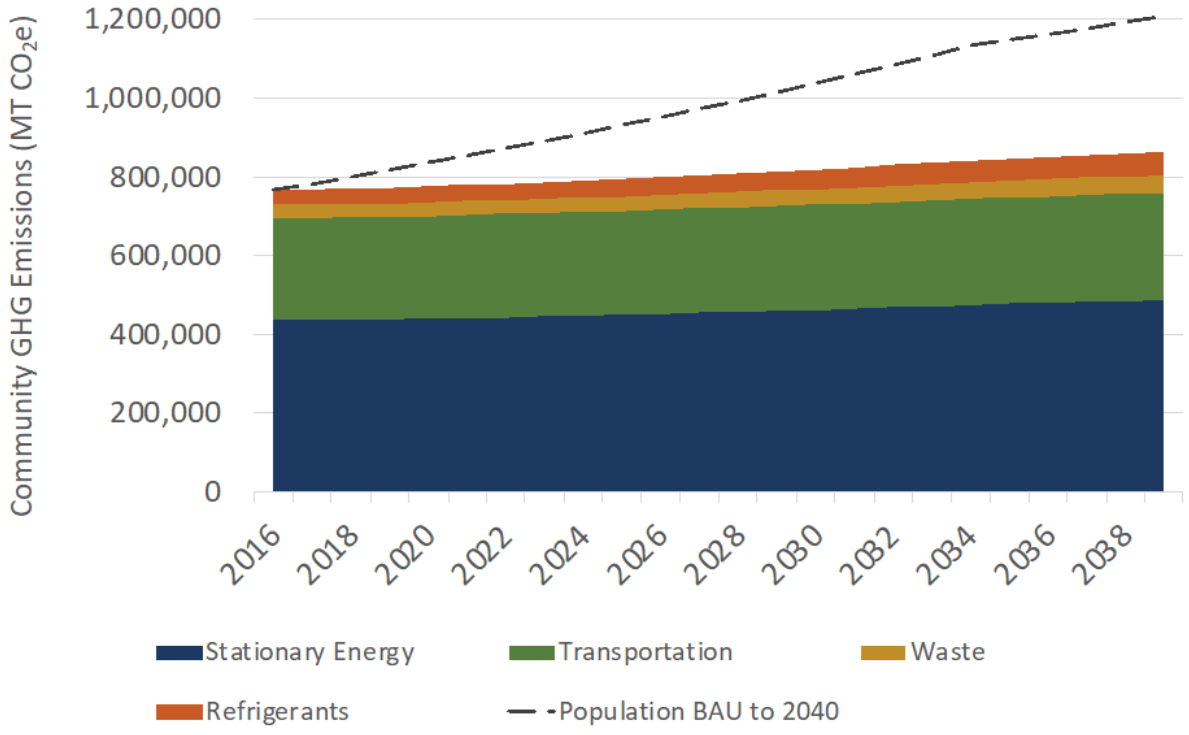
PREPARED BY GOOD COMPANY
AUGUST 2018

I. Executive Summary

The City of Bend conducted a Community Greenhouse Gas (GHG) Inventory to better understand local sources of GHG emissions to inform development of a Community Climate Action Plan (C-CAP) and to establish a community emissions tracking system to measure progress as the C-CAP is implemented. The inventory follows internationally recognized community GHG inventory protocol and accounts for all significant sources of GHG emissions driven by activities taking place within the City's geographic boundaries.

- Bend's largest sources of local sector-based emissions include residential and commercial energy use by buildings (57% of total) and residential on-road transport (27%). For buildings electricity is the largest source of emissions (58%); followed by natural gas (40%); and other fuels (2%). Smaller local sources of emissions include refrigerant loss from buildings and vehicles (6%) and landfilled waste disposal (4%). See stacked areas on Figure 1.
- Figure 1 also forecasts Bend's community emissions. The dotted grey line shows 2016 emissions rates with projected community population growth to 2040. The stacked, colored areas show the emissions benefit of existing State and Federal policies. As can be seen these policies reduce emissions by 28% compared to the population BAU.
- Even with existing climate policies, Bend's emissions will grow 13% by 2040, which highlights the need for additional local, regional, state, and federal climate action.
- Beyond sector-based emissions, the inventory also considers emissions from production of household consumption of imported goods, food, and energy products (not shown on Figure 1). When included, these emissions more than double community emissions. The largest sources include consumption of meat, clothing, furniture, and upstream energy production. See Figure 4 for details.

Figure 1: Bend's FY2016 community emissions, by sector, and existing policy forecast to 2040



** Electricity emissions calculated using location-based method*

II. Introduction

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 greenhouse gas emissions (GHG) must be reduced significantly – perhaps more than 50% globally, and by 90% in wealthier nations that are the largest emitters – by mid-century in order to avoid the worst potential climate impacts on human economies and societies that have been projected. The common international goal often referenced, to mitigate the worst climate impacts, is to limit global average temperature increases to no more than 2°C relative to temperatures at the start of the industrial revolution. As of 2018 – we've already passed the halfway point – average temperatures have increased by more than 1°C since the industrial revolution.

It's with this understanding and urgency that the City of Bend conducted this community greenhouse gas (GHG) inventory. A GHG inventory quantifies the GHG emissions associated with a specific boundary – such as the geographic boundary of a community or operational control within an organization – for a specific period of time such as a fiscal or calendar year. This report summarizes the results of Bend 2016 Community Greenhouse Gas (GHG) Emissions Inventory. A community emissions inventory considers many sources of emissions generated by the activities of residents, businesses, and government operations within Bend's UGB, including:

Stationary Energy use by residential, commercial, and industrial buildings and facilities represents a large source of community emissions. These emissions come from "tailpipes" during combustion of natural gas and fuels to generate electricity for use in Bend.

Transportation Energy, and particularly on-road vehicle transportation, of passengers and freight also represents a large fraction of community emissions. Like stationary energy, transportation emissions are generated at the tailpipe as well as upstream during production of fuels.

Fugitive Emissions of refrigerants are lost from transportation and building cooling systems. Refrigerants are powerful global warming gases. Therefore, relatively small losses have a large climate impact. Likewise, a fraction of natural gas is lost during local distribution.

Waste disposal in landfills and wastewater treatment produces methane, most of which is collected and used for energy, but a fraction leaks out to the atmosphere having a negative climate impact.

Household Consumption emissions that are generated outside of the community during the production of goods, food, energy and services that are consumed by residents of Bend. These emissions are large in scale but are more difficult to accurately measure over time compared to other sources of emissions included in the inventory.

Upstream Energy Production produces emissions from the energy used to extract and process raw materials into energy products as well as from the process emissions created during extraction. These emissions are in addition to the "tailpipe" emissions described above for the Stationary and Transportation Energy.

The 2016 inventory will be used to inform development of Bend's Community Climate Action Plan (C-CAP) and will be updated periodically to track community progress towards community goals. This report also provides a 2040 Business-As-Usual (BAU) Emissions Forecast, which estimates future emissions based on population growth as well as emissions considering the future benefits of existing state and federal policy and programs to inform the scale of additional actions required to meet community goals.

III. Inventory Boundaries

Bend's inventory follows Greenhouse Gas Protocol's Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC).[1] The GPC is focused on Sector-based Emissions. Bend's inventory also includes an estimate of the emissions embodied in local consumption of fuels, consumer goods, construction materials, and food.

The first step in any GHG inventory is setting the inventory boundary. The boundary includes defining the geographic area, time span, emissions sources and gases covered in the inventory. Bend's inventory collected fiscal year 2015-16 data for Bend's urban growth boundary (UGB). The inventory accounted for all seven Kyoto gases, but only four were relevant: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and hydrofluorocarbons (HFC).

Emissions sectors and sub-sectors included in the GPC are shown in Figure 2. These are compared to emissions included in Bend's FY16 inventory and Scope Category. Scope categories distinguish between those emissions that occur within the City's geographic boundaries from those that occur outside the City's boundaries, but that are driven by activity within the boundaries (Scope 2 and Scope 3).

Emissions Sector / Sub-Sector	Included in Bend Inventory	Scope 1	Scope 2	Scope 3
Stationary Energy				
Residential Buildings	•	✓	✓	
Commercial Buildings and Facilities	•	✓	✓	
Industrial Facilities	•	✓	✓	
Energy Generation Supplied to the Grid	NE	✓		
Agriculture, Forestry, and Fishing	NO	✓	✓	
Fugitive Emissions from Natural Gas Systems	•	✓		
Fugitive Emissions from Coal Production	NO	✓		
Transportation				
On-Road Passenger and Commercial Vehicles	•	✓	✓	
On-Road Freight Vehicles	•	✓	✓	
On-Road Transit Vehicles	•	✓	✓	
Off-Road Vehicles and Equipment	•	✓	✓	
Aviation	•	✓		
Waterborn Navigation	NO	✓		
Waste				
Solid Waste Generated in City	•			✓
Wastewater Generated in City	•			✓
Biological Treatment of Waste Generated in City	NE			✓
Incineration of Waste Generated in City	NE			✓
Industrial Process and Product Use				
Product Use (refrigerants)	•	✓		
Industrial Processes	NO	✓		
Agriculture, Forestry, and Land Use				
Livestock	NO	✓		
Land	NE	✓		
Other Agriculture	NO	✓		
Other Scope 3 Emissions Sources				
Household Consumption	•			✓
Upstream Energy Production	•			✓

NE = Emissions occur but are not reported or estimated - see justification in exclusions
NO = Activity or process does not occur within City

Scope 1	GHG emissions from sources located within the city boundary.
Scope 2	GHG emissions occurring as a consequence of the use of grid-supplied electricity within the City's geographic boundary
Scope 3	All other GHG emissions that occur outside the city boundary as a result of activities taking places within the City's geographic boundary

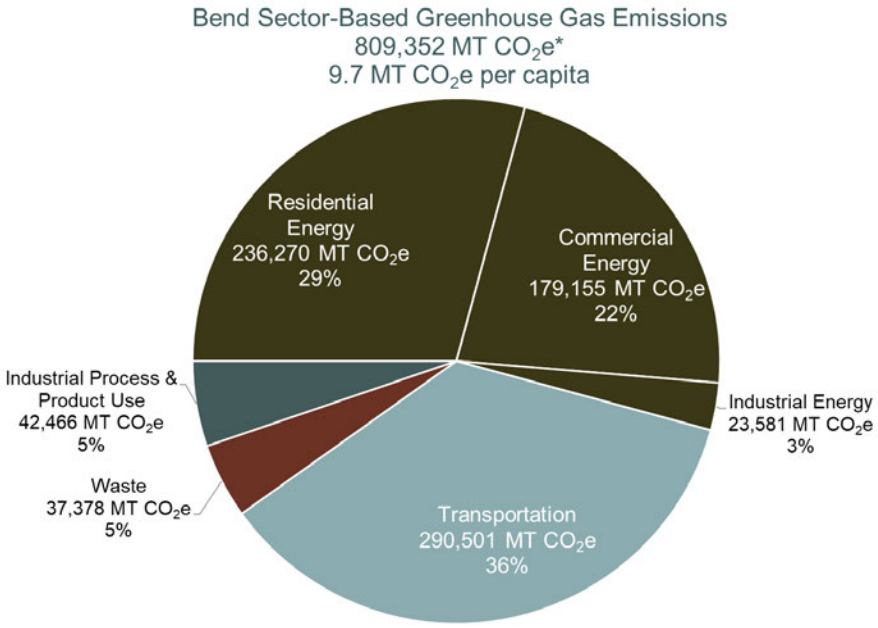
[1]GPC has become the recommended or required standard for international reporting to Carbon Disclosure Project's Cities Survey and the Global Covenant of Mayors for Climate & Energy. While Bend does not currently participate in these endeavors currently – Bend's inventory has been conducted to allow for adoption in the future. GPC may be downloaded at https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities.

IV. Inventory Results

Sector-Based Emissions

The Bend community generated 809,352 MT CO2e of local, sector-based emissions. For sense of scale, this quantity of emissions is equivalent to the carbon sequestered annually by over 1 million acres of average U.S. forest – a land area about 50 times the size of the City of Bend.

Figure 3: Bend's FY16 Sector-Based GHG Emissions
Note Figure 3 presents location-based emissions for electricity. Market-based emissions details are included in Figure 5 and Figure 7*



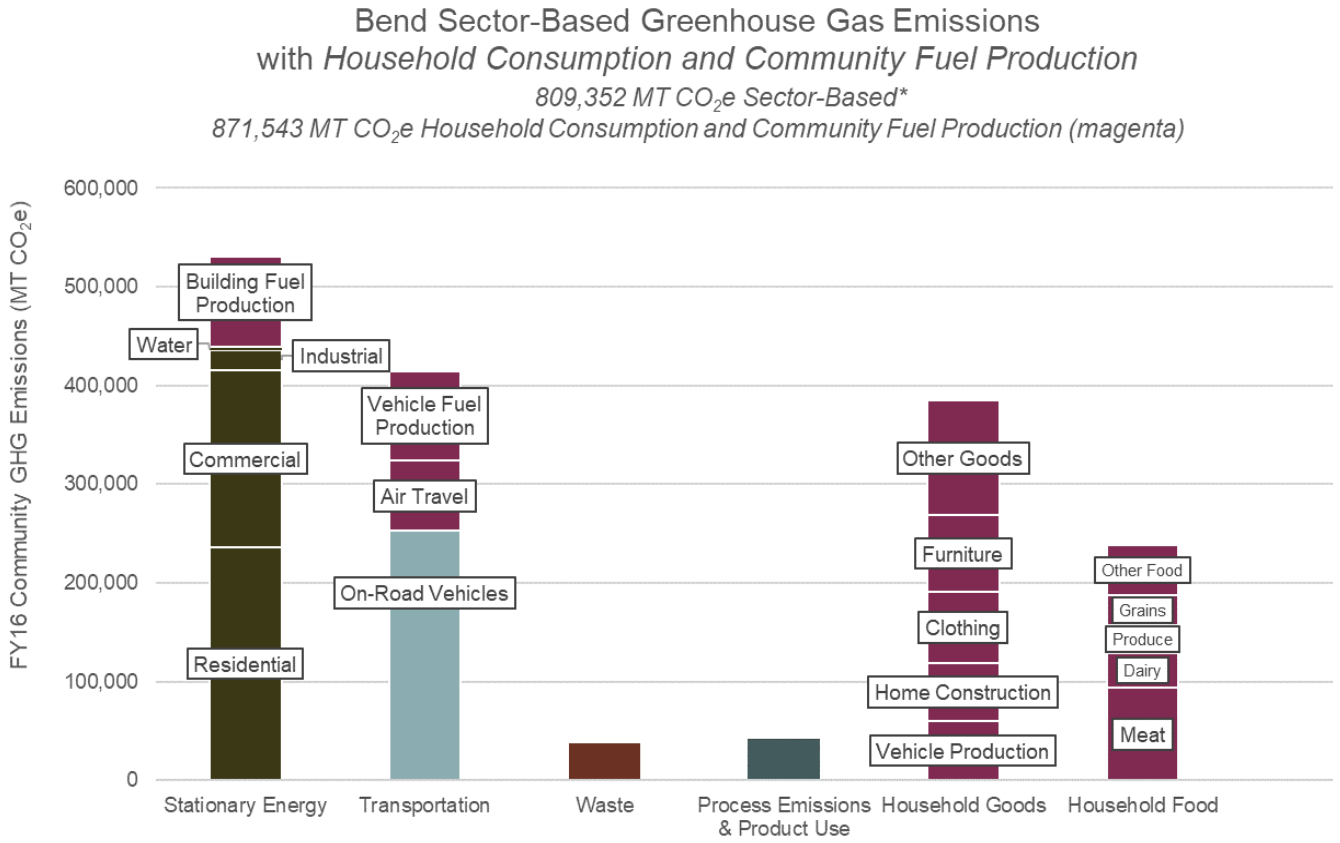
Bend's sector-based emissions[2] are similar in many ways to other communities around Oregon. These emissions are shown in Figure 3 and come primarily from combustion of natural gas and electricity use in buildings (blue segments) as well as gasoline and diesel combustion in vehicles to transport people and goods (green segment). Emissions from waste include landfill disposal of community solid waste and wastewater treatment (yellow). Emissions from local product use include refrigerant gas loss from buildings and vehicles and natural gas loss from the local distribution system (orange).

Household Consumption And Upstream Energy Emissions

In addition to accounting for sector-based emissions, Bend's Community GHG Inventory also considers emissions that are generated outside of the community during the production of goods, food, energy and services that are consumed by residents of Bend. These emissions total 871,543 MT CO2e. Figure 4 compares the scale of sector-based emissions versus emissions from household consumption and upstream fuels production.[3] ***The scale of the emissions from household consumption is almost equal to sector-based emissions generated locally, which supports the need to address these emissions during the community climate action planning process.***

[2] Sector-based emissions inventories (or in-geographic boundary inventories) include local emissions, within the City's boundaries, from energy use by homes, businesses, and vehicles as well as emissions from landfilling solid waste and wastewater treatment.
[3]Sector-based emissions account for "tailpipe" emissions from the combustion of fuels. There are also "upstream" emissions that account for the energy and process emissions during extraction and refinement of fuels.

Figure 4. Detailed summary of sector-based emissions and comparison to emissions from household consumption and fuel production.



Note Figure 3 presents location-based emissions for electricity. Market-based emissions details are included in Figure 5 and Figure 7*

Note 2: Other Goods include electronics, toys, personal care products, cleaning products, printed reading materials, paper, office supplies, and medical supplies.

Figure 5. Summary Table of Bend 2016 Community Emissions

**See page 9 for a discussion of location-based and market-based electricity emissions*

Emissions Sector / Sub-Sector	FY 16 GHG Emissions (MT CO_2e)	Notes
Stationary Energy	**439,007**	
Residential Buildings		
Electricity (Location-Based)	*127,711*	*Based on carbon intensity (CI) of regional electric grid*
Electricity (Market-Based)	*199,669*	*Based on CI for local utilities and customer purchase of green energy*
Natural Gas	*103,347*	
Other Fuels	*5,212*	*Incluces propane and fuel oil use*
Commercial Buildings and Facilites		
Electricity (Location-Based)	*116,608*	*Based on carbon intensity (CI) of regional electric grid*
Electricity (Market-Based)	*204,511*	*Based on CI for local utilities and customer purchase of green energy*
Natural Gas	*57,229*	
Other Fuels	*5,318*	*Includes propane and fuel oil use*
Industrial Facilities		
Electricity (Location-Based)	*7,603*	*Based on carbon intensity (CI) of regional electric grid*
Electricity (Market-Based)	*16,115*	*Based on CI for local utilities and customer purchase of green energy*
Natural Gas	*12,784*	
Other Fuels	*NE*	
Water (energy)	*3,195*	
Transportation	**290,501**	
Passenger Travel	*212,380*	*Includes passenger cars and light trucks*
Off Road	*32,587*	
Commercial Services	*20,967*	
Truck Freight	*18,201*	
Rail Freight	*158*	
Transit	*734*	
Bend Airport	*5,474*	*Local airport emissions only. See Other Scope 3 for other Air Travel*
Waste	**37,378**	
Solid Waste Generated in City	*32,200*	
Wastewater Generated in City	*4,056*	*Process emissions only - energy use included in Stationary*
Biological Treatment of Waste	*1,122*	
Industrial Process and Product Use	**42,466**	
Product Use (refrigerants)	*36,810*	
Fugitive Emissions from Natural Gas Systems	*5,656*	
Agriculture, Forestry, and Land Use	**0**	
Livestock	*0*	
Land	*NE*	
Other Agriculture	*0*	
Other Scope 3 Emissions Sources	**871,543**	
Household Consumption		
Goods	*384,726*	*Includes production emissions for imported construction materials,*
Food	*238,476*	*clothing, furniture, vehicles, and other goods*
Services - Air Travel	*66,240*	*Air travel by Bend residents that originates at airports outside of Bend*
Upstream Energy Production		
Transportation Fuels	*90,323*	
Natural Gas	*42,948*	
Electricity	*48,830*	
GPC Emissions (location-based electric)	**809,352**	
Per Capita	**9.7**	
GPC Emissions (market-based electric)	**977,725**	
Per Capita	**11.7**	
GPC (location-based) + Other Scope 3	**1,680,895**	
Per Capita	**20.1**	
GPC (market-based) + Other Scope 3	**1,849,267.9**	
Per Capita	**22.1**	

NE = Emissions occur but are not reported or estimated - see justification in exclusions
NO = Activity or process does not occur within City

Stationary Energy

Electricity and natural gas use by the residential and commercial sectors are the largest GPC emissions. Bend residents' homes have a larger impact than their commercial business. Industrial energy is small by comparison. By energy type, electricity had the largest impact (58% of total building energy); followed by natural gas (40%); and other fuels (2%). Figure 6 shows stationary energy emissions broken down by sub-sector and energy type.

Figure 6. Comparison of stationary energy use, by sub-sector and energy type.

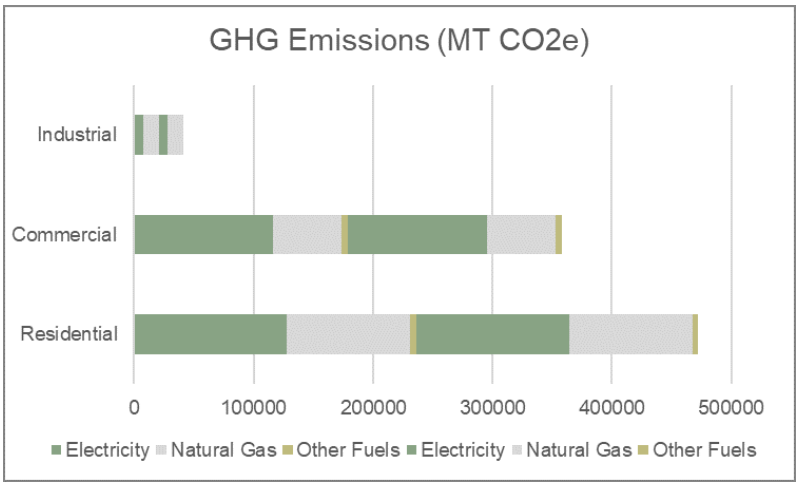
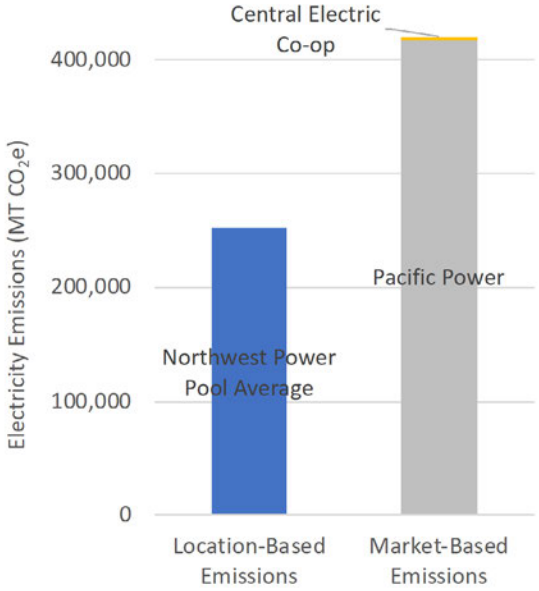


Figure 7. Comparison of location-based and market-based electricity emissions



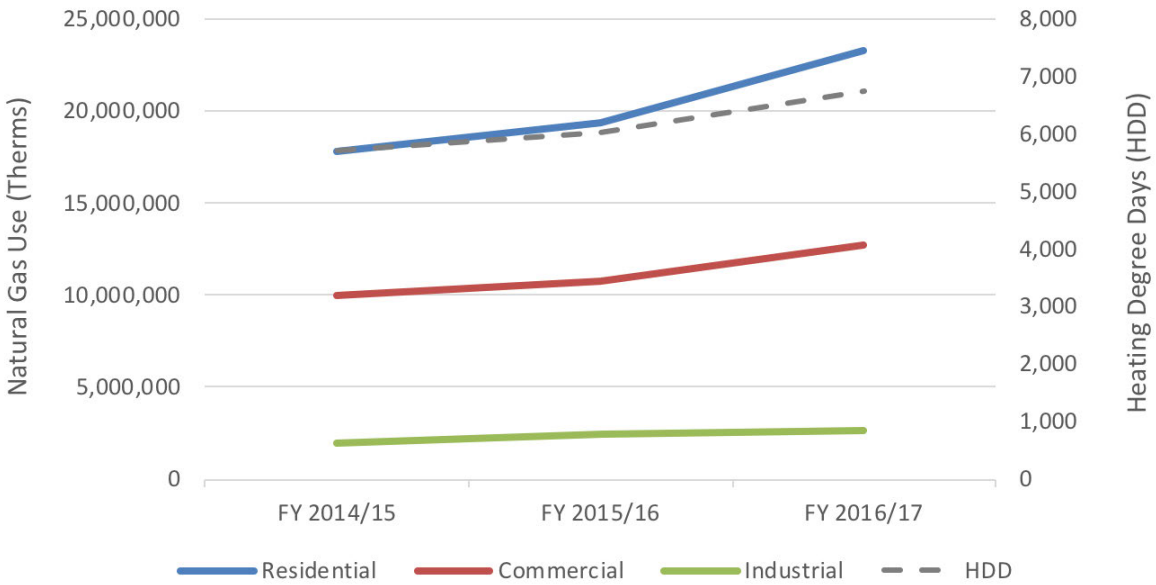
GPC requires that communities' report electricity emissions using the location-based method (blue bar on Figure 7). Location-based emissions are calculated using the regional electricity grid's GHG intensity and represent the average impacts of electricity use and efficiency efforts. GPC also recommends that communities calculate Market-based emissions which are based on the GHG intensity of electricity contracts with local utilities. Bend's market-based emissions are much larger than the location-based. Pacific Power's electricity generation from coal in 2016 is the major driver. Conversely, CEC represents a very small fraction of market-based emissions as its contracts with Bonneville Power Administration are largely served by low-GHG hydroelectric and nuclear power. The market-based method also accounts for community participation in utility green power programs. In 2016, Pacific Power's customers voluntarily purchased 10% zero GHG renewable electricity which decreases Bend's market-based emissions.

Total community electricity use increased by 5% between FY15 and FY17, with residential sector use increasing by 7.9% during the period and commercial sector use increasing by 3.7% (see Figure 8). Industrial electricity use decreased by 6.8% between FY15 and FY17.

Figure 8. Bend electricity use (in MWh), by sector. Percent (%) change, FY15-FY17.

Total community natural gas use increased by 30% between FY15 and FY17, with residential sector use increasing by 31.1% during the period; commercial sector use increasing by 27.7%; and industrial use increasing by 36.8% between FY15 and FY17 (see Figure 9). There are two suspected drivers for the overall increase in stationary energy use: 1) the Bend community population is growing at a pace of 2.2% annually, and 2) the winter of FY17 was colder than the previous two years increasing the heating load. This is demonstrated by the increase in heating degree days (Figure 9) which is a measure of the energy needed for space heating.

Figure 9. Bend natural gas use (in therms), by sector. Percent (%) change, FY15-FY17.



Transportation

Local, on-road transportation of passengers is Bend's leading source of transportation-related emissions. See Figure 10. These emissions originate from residential-owned passenger cars and trucks, which primarily use gasoline (E10) and relatively small quantities of diesel (B5). Roughly 2/3 of these emissions are the result of trips inside the City's boundaries, while the remaining 1/3 originate inside the City's boundaries, but have a destination outside the City or the inverse.

The next largest source is air travel by Bend households. While Bend does have a small municipal airport, the majority of these emissions are from Bend residents departing from airports outside of the Bend community.

Off road equipment, which is dominated by construction equipment and also includes recreational vehicles, is the next largest category. Commercial service vehicles include local freight, restaurant delivery, and

service providers such as electricians, plumbers, etc. Heavy-duty freight vehicles operating within the UGB represent 6% of transportation-related emissions.

Figure 11 compares 2016 DMV registration data on the % of internal combustion engine vehicles (ICE), which are typically less efficient than electric vehicles (EV), hybrid electric vehicles (HEV), or plug in hybrid EVs (PHEV) for regions around Oregon. This graphic illustrates a climate action opportunity and potential progress metric focused on increasing the fuel efficiency of the community's vehicle fleet. A second important metric going forward is the number of trips diverted from vehicles to bike or walking.

Figure 10. Distribution of on-road transport emissions, by vehicle category, as estimated by RSPM.

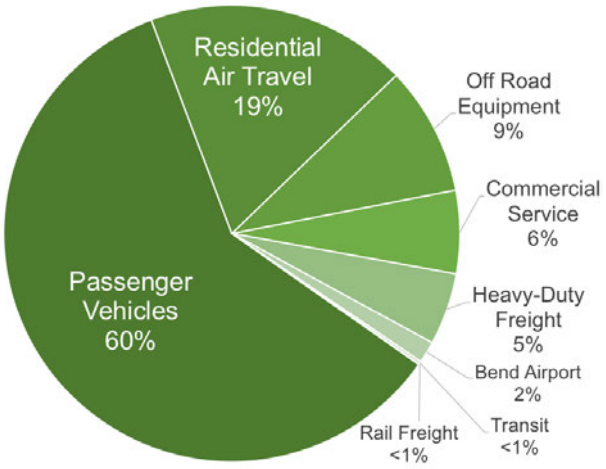
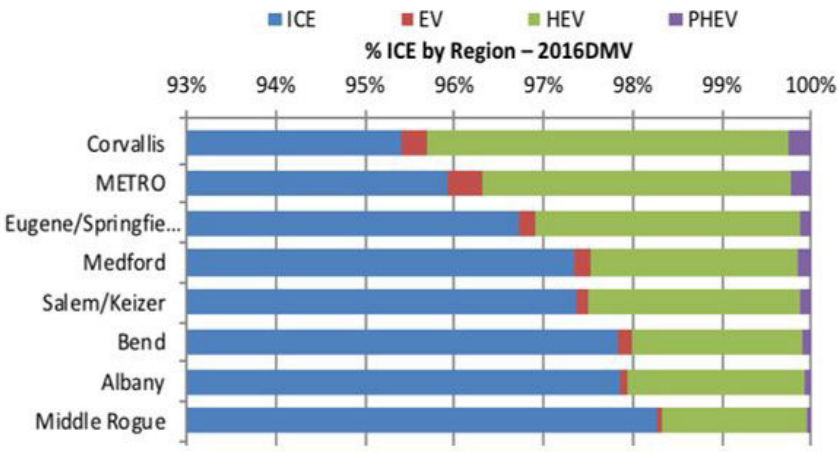


Figure 11. Comparison of fuel-efficient vehicle in Oregon communities.



Other Scope 3 Emissions

Bend's inventory goes beyond GPC requirements to include two known large sources of Other Scope 3 Emissions – household consumption of goods and upstream emissions for production of fuels used by the community. Household consumption of imported goods, food, and services is a significant source of community emissions. These sources of emissions are not currently included in the GPC, due to limitations related to accurately accounting for these emissions over time at the community level.[4] While these accounting limitations are real, the scale of consumption-based emissions is large enough to warrant inclusion in community climate action plans.

Oregon Department of Environmental Quality (ODEQ) highlighted the importance of consumption-based emissions in the State of Oregon's Greenhouse Gas Inventory. The most recent version of Oregon's inventory (released in May 2018) shows that sector-based emissions are on a downward trend, but that consumption-based emissions have increased by 10% between 2010 and 2015.

Within this category, emissions from the production of imported food, furniture, clothing, vehicles, and home building materials consumed by Bend residents that are produced outside the community. While household consumption represents a significant source of emissions, these emissions are imported and therefore the community has less control over the energy sources and efficiency of production. That said – the community does control demand for various types of products which presents mitigation opportunities. The Scope 3 emissions that are considered in this inventory include:

Household Goods: Emissions from extraction, manufacture, and transportation of raw materials into final products such as construction, automobile, furniture, clothing, and other goods.

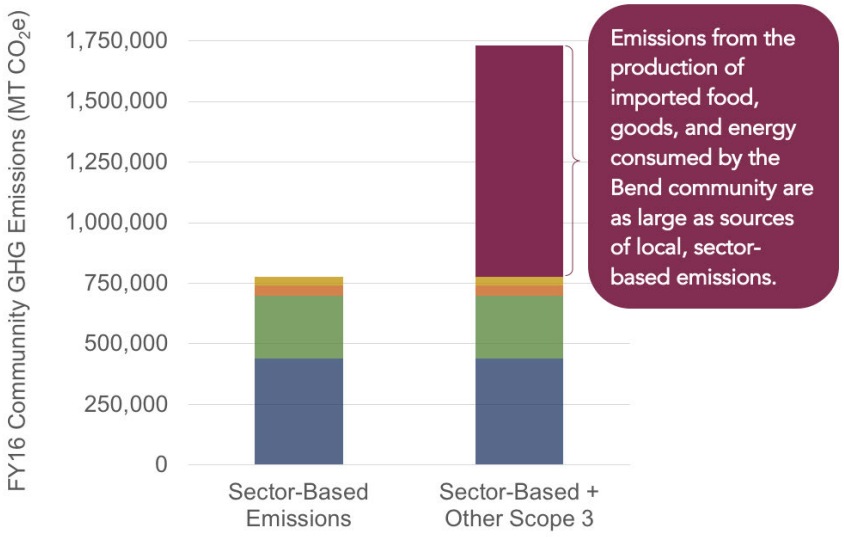
Household Food: Emissions from agricultural (energy for irrigation, production of fertilizers, methane emissions from livestock, etc.), transportation of raw materials and finished products emissions. Categories included are cereal, dairy, meat, produce, and other foods.

Energy (Fuel Production): Process and energy emissions from the extraction and production into usable fuel products (e.g. electricity from household outlets, gasoline pumped into cars, natural gas combusted by furnaces, etc.). These upstream emissions are considered at the community-scale for electricity, natural gas, gasoline, diesel, propane, and fuel oil.

As can be seen in Figure 12, the scale of consumption-based emissions as a category is larger than Bend's sector-based emissions. Figure 4 provides more details and shows that the largest sources of these emissions include meat, transportation fuels, clothing, and furniture.

ODEQ's Materials Management program is currently focused on identifying the most effective actions to address consumption-based emissions. These actions include avoiding wasted food; the recovery and reuse of building materials; and lifespan extension of consumer goods with repair, reuse and purchasing durable goods

Figure 12: Comparison of sector-based emissions to consumption



[4]The GPC authors; C40 Cities; and Oregon Department of Environmental Quality are all currently working to develop tools that will allow for more accurate community tracking of these emissions in the future

V. Business As Usual Forecast To 2040

In order to effectively plan for community GHG mitigation actions, it is useful to consider a business-as-usual emissions forecast which considers long-term emissions trends based on existing local, state, and federal policies and programs, utility projections, and population growth.

The figure below shows two business-as-usual (BAU) emissions scenarios:

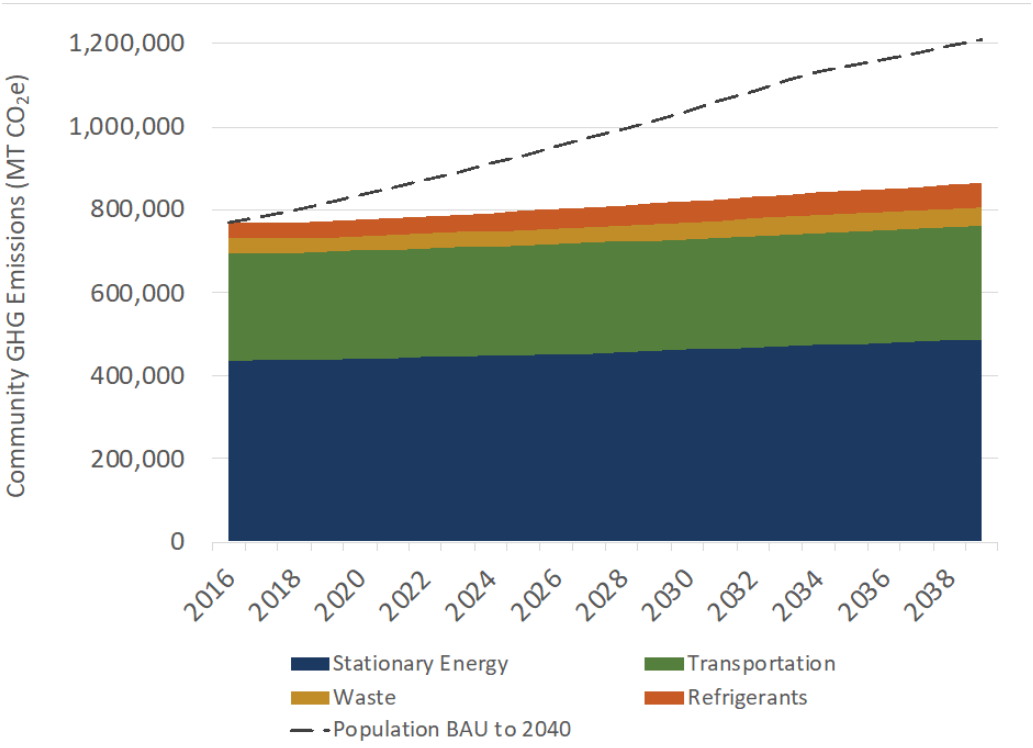
- Population BAU: The dashed line in Figure 13 represents 2016 community emissions rates and increases them by projected population increases.
- Existing Policy BAU: The stacked areas in Figure 13 shows the emissions reductions expected from existing regional, state, and federal policies.

Policies considered in the Existing Policy BAU scenario include:

- Oregon's Renewable Portfolio Standard (RPS)[5]
- Energy Trust of Oregon's energy efficiency programs [6]
- Federal vehicle fuel economy standards (CAFE)[7]
- Oregon SB263 (for food waste recovery)[8]

These policies are forecast to reduce emissions 28% compared to 2016 community emissions by 2040. The largest sources of emissions reductions come from increasing Federal light-duty fuel economy standards and increasing renewable electricity as a result of Oregon's RPS. With the reductions from these existing policies, Bend's projected 2040 community emissions are forecast to increase by 13% compared 2016 emissions.

Figure 13: Estimated future emissions reduction based on existing and future policies.



[5] Forecast based on PacifiCorp's 2017 Integrated Resource Plan (May 2018) for load forecast and Energy Information Administration's 2017 Annual Energy Outlook for forecast of annual emissions coefficients.
[6] Forecast based on PacifiCorp's 2017 Integrated Resource Plan (May 2018)
[7] Forecast based on Oregon Department of Transportation GreenSTEP modeling with data and assumptions provided by City of Bend staff.
[8] Forecast based on food waste diversion requirements in SB263.

VI. Methodology Overview

Protocols and Tools

This inventory follows Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories by Greenhouse Gas Protocol (GHGP). This inventory also follows GHGP's Scope 2 Guidance for location-based and market-based electricity emissions accounting and ICLEI's US Community Protocol for guidance on calculation of consumption-based emissions.

ICLEI's ClearPath Community-Scale emissions management software was used for the majority of emissions calculations. Emissions calculations outside of ClearPath are documented in the FY16 GHG Inventory Audit Trail. The Audit Trail catalogs all data, calculation, and resource files used to complete the inventory. This Audit Trail clearly documents data sources and methods for replication in future inventories.

All community GHG emissions presented in this report are represented in metric tons of carbon dioxide equivalent (MT CO2e). Quantities of individual GHGs are accounted for in the ICLEI's ClearPath carbon calculator and include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), CFCs, PFCs, and sulfur hexafluoride (SF6) per the Kyoto Protocol. All GHG calculations use the global warming potentials (GWP) as defined in the International Panel on Climate Change's 5th Assessment Report (IPCC AR5).

Data Collection

Good Company worked with Gillian Ockner, Project Manager for the City of Bend to collect the data required to calculate emissions. City, County, and State staff members as well as private businesses that serve the Bend community graciously provided data and expertise. See Appendix A for additional information on data and emissions factors used in this inventory.

Two data models were used in the course of Bend's community inventory to estimate primary data using methods outlined in the previously mentioned GHG protocols. These include: Oregon Department of Transportation's (ODOT) GreenSTEP transportation model and Oregon Department of Environmental Quality's (ODEQ) Oregon Household Carbon Calculator. The ODOT model is used to estimate on-road passenger and freight transport vehicle-miles traveled and associated GHG emissions. ODEQ's Oregon Carbon Calculator was used to estimate household consumption-based emissions for the Bend community.

Summary of Inventory Exclusions

Emissions Sector/Sub-Sector	Justification for Exclusion
Agriculture, Forestry and Fishing	No significant activity identified within City. The City should consider including land-use change emissions in the future depending on future community growth rates and the types of land being developed.
Fugitive Emissions from Coal Production	No significant activity identified within City.
Waterborn Navigation	No significant activity identified within City.
Livestock	No significant activity identified within City.
Industrial Processes	No significant activity identified within City.
Off-Road Vehicles and Equipment	No significant activity identified within City.
Incineration of Waste Generated in City	No significant activity identified within City.
Industrial propane and fuel oil	Based on the relatively small emissions from industrial electricity and natural gas use – use of these fuels expected to be small and therefore were not estimated.

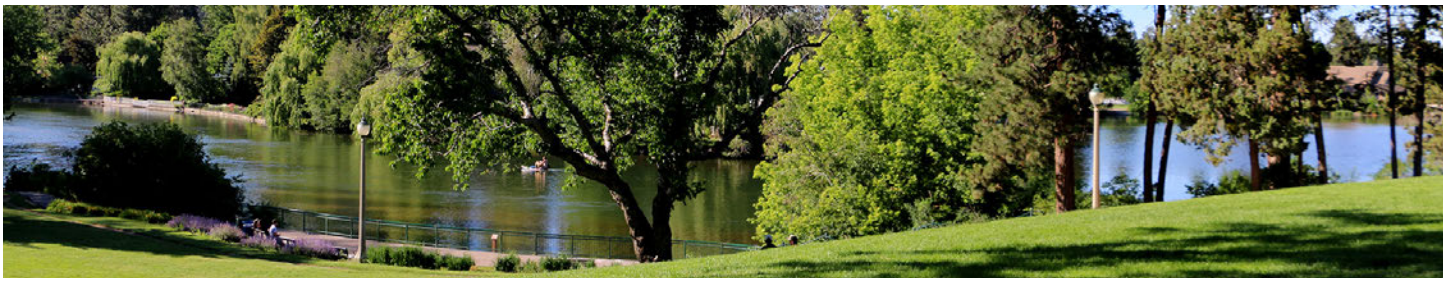
Figure 14:Inventory summary of data and emissions factors.

Emissions Category	Category Description	Description of Data and Emissions Factors
Stationary Energy		
Residential Energy Commercial Energy Industrial Energy	These categories include direct emissions from natural gas, fuel oil, propane combustion by the residential, commercial, and industrial sectors within the City of Bend's geographic boundaries. Also includes the indirect emissions from grid electricity use by the same sectors for the same geographic boundaries.	Electricity and natural gas data provided by utilities and considered highly accurate. Fuel oil and propane use estimated using state-level per capita fuel usage data and Bend's annual population. Emissions factors for natural gas, fuel oil, and propane are programmed into ICLEI's ClearPath and are considered highly accurate. The Electricity location-based emissions factors are taken from EPA eGRID 2016 data for the Northwest Power Pool (NWPP) subregion. Market-based factors for PacifiCorp and Central Electric Cooperative, Inc. are provided by Oregon Department of Environmental Quality.
Water	Direct emissions from pumping and treating potable water for consumption.	Electricity data is provided by City staff and local private vendors and is considered highly accurate. A small fraction energy use, for one of the private vendors, was estimated using a known delivered water volume and energy intensity values (kWh / gallon) from other local vendors to estimate pumping energy use. Location-based and market-based electricity emissions factors are as described for Stationary Energy.
Transportation		
On-Road Energy	Direct emissions from gasoline and diesel for passenger and freight transportation.	Vehicle miles traveled and greenhouse gas emissions are estimated by Oregon Department of Transportation staff using the GreenSTEP model. Emissions factors for gasoline and diesel and calculation methodology are considered highly accurate. Data source 1 is considered more accurate and therefore used to report results.
Transit	Direct emissions from gasoline and diesel for passenger and transit transportation.	Fuel volume data provided by Cascade East Transit staff. Default fuel emissions factors are programmed into ClearPath.
Bend Air Port	Direct emissions from jet kerosene and aviation gasoline for local air travel.	Fuel volume data provided by City staff. Default composting emissions factors are programmed into ClearPath.
Rail Freight	Direct emissions from gasoline and diesel for passenger and freight transportation.	Fuel volume estimate using gross ton miles provided by BNSF for local transportation planning and BNSF reported fuel use per ton mile. Fuel volume data provided by Cascade East Transit staff. Default fuel emissions factors are programmed into ClearPath.
Industrial Process and Product Use		
Refrigerant Loss (buildings and vehicles)	Fugitive loss of refrigerants from building and vehicle air conditioning systems.	Actual data on refrigerant loss is not available at the local level. State-level data from Oregon's 2013 GHG Inventory is down-scaled by population to estimate emissions. Emissions factors are taken from The Climate Registry's 2015 Default Emissions Factors.
Waste		
Landfill Solid Waste	Fugitive methane emissions from mixed solid waste generated in the Bend community and disposed of at Knott Landfill. Its important to note that Knott Landfill is modern landfill that collects landfill gas (LFG) and generates electricity. Even using best practices, achieving 100% LFG collection is difficult and therefore solid waste landfill disposal produces GHG emissions.	Deschutes County provided total shorts tons of material transferred to Knott Landfill. Fugitive methane from Knott was taken from the Environmental Protection Agency's Facility Level Information on Greenhouse Gas Emissions Tool (FLIGHT) which reports emissions (MT CO2e) using the First Order Decay Model and IPCC's AR4 GWP for methane. Methane GWP was adjusted with AR5 values for input into ClearPath. Total Knott Landfill emissions
Composting Organic Waste	Fugitive methane and nitrous oxide emissions from composting of organic wastes (wood, yard debris, and food). It should be noted that while composting does produce emissions they are significantly less than if the same material were landfilled. Also land-application of compost increases soil carbon sequestration. That benefit is not accounted for in GPC methodology.	Deschutes County provided total shorts tons of material transferred to Deschutes Recycling / Composting center. Total County waste weights were down-scaled per capita for City of Bend. Default composting emissions factors are programmed into ClearPath.
Wastewater	Fugitive nitrous oxide emissions from nitrification / denitrification process and from discharge of treated effluent and carbon dioxide and methane emissions from combustion of biogas. Fugitive methane emissions from septic systems.	City staff provided values for nitrogen discharged in plant effluent, as well as annual biogas production volumes. Bend's 2016 population, used to estimate nitrification/denitrification emissions, is from Portland State University's 2016 Oregon Population Report. City staff provided data on the community population served by septic systems. Default composting emissions factors are programmed into ClearPath.

Appendix E. Part 1 - Public Survey (January 2019) Results

Community Climate Action Plan

Community Survey Report



Introduction

In response to our community's call for action, the City of Bend is supporting the creation of a Community Climate Action Plan (CCAP) to serve as a roadmap to reduce fossil fuel use in Bend. The City is engaging the community to achieve our climate action goals and create a plan that is right for Bend.

First steps towards creating Bend's CCAP included engaging community representatives, holding community conversations and developing an online community survey. The motivation for these activities was to raise awareness about the CCAP and to collect community opinions, impressions and ideas about a shared vision for Bend's climate action goals.

The purpose of this report is to summarize the results of and capture the themes from the CCAP's first online community survey.

During fall 2018, City staff compiled a list of proposed climate action ideas generated by the Climate Action Steering Committee (CASC), a citizen advisory group appointed by Bend City Council, along with technical working groups representing stakeholders, resource experts and interested community members. The working groups proposed dozens of action ideas across four sectors. The proposed action ideas can be found on the project web page.

Working group sectors	
Transportation	Waste and materials
Energy in buildings	Energy supply

The City of Bend used the online survey to collect community feedback on the proposed action ideas between Jan. 2 and Feb. 4, 2019. Over 1,500 people submitted surveys. The goal of the survey was to engage and learn from as many community members as possible. The results are not statistically representative, meaning the respondent sample is not predictive of the opinions of the Bend community. This report summarizes the comments collected from community members using the survey. Full survey results are available as an appendix to this report.

The CASC will consider the results of the community survey when prioritizing the final actions for the CCAP. Other factors considered by the CASC include:

- The amount of potential carbon reduction
- Other non-climate benefits that would result from the action, such as economic benefits and social benefits
- The cost effectiveness of the action
- Alignment with other community planning efforts and community values
- Feasibility

Key themes

The following themes were observed from the survey results.

- Generally, there was more support for actions that would create incentives or personal cost savings and some concern that regulatory actions are not right for Bend.
- Some commenters were concerned that climate action investments would create a financial burden on Bend residents in the form of increased personal costs or taxes.
- Commenters generally supported investments that would yield long-term benefits, such as investments in public transportation, energy efficiency in buildings, renewable energy facilities and community planning.
- Commenters generally supported actions that would create choices and opportunities for self-regulation, such as the ability to reduce the frequency of curbside waste pickup.
- Commenters generally supported actions that would create incentives by reducing the time and cost of permitting processes.
- Commenters advised that actions should avoid or mitigate financial burdens to low income populations.
- Some commenters expressed concern that solar and wind technologies, while aspirational, are not efficient enough at this time to merit substantial investment.
- Some respondents expressed confusion about the survey or were unsure if the proposed action ideas were already happening. Others felt they couldn’t comment because there was no cost or efficiency analysis provided with the ideas.

Distribution and Notice

The City of Bend promoted the online survey using the methods described below.

Tool	Description
City of Bend website	Notice of the survey was posted to the City of Bend home page and included on the CCAP web page.
Social media posts	The City promoted the survey on its Facebook and Twitter accounts and used paid social media advertisements to increase the reach of posts to include Bend Community members who do not follow the City's social media.
City Edition video	City staff posted a short City Edition video with interviews from CASC members to promote the CCAP and online survey. The video was posted on City of Bend social media.
Email lists	City staff sent notices via email to the following email lists: • CCAP interested parties • Bend Current • Business Registration Newsletter • Neighborhood Leadership Alliance Newsletter • Working group participants
Media advisory	City staff distributed an advisory to local media contacts to encourage local media coverage of the survey availability.
"Go to you" meetings with survey handouts	City staff and CASC members attended meetings with local organizations and community groups to encourage survey participation. Staff distributed small handouts with the survey instructions for meeting participants to take away. Meetings were scheduled with the following organizations: • Rotary Club of Greater Bend • Rotary Club of Bend – Mt. Bachelor • Bend Green Drinks • Boyd Acres Neighborhood Association • Orchard District Neighborhood Association • Larkspur Neighborhood Association • Bend Economic Development Advisory Board • Bend Chamber of Commerce Board of Directors • Central Oregon Climate Change Coalition • Central Oregon Builders Association • Central Oregon Association of Realtors • OSU Cascades Sustainability Club • Deschutes County Bike and Pedestrian Advisory Board

Tool	Description
Partner tool kit: Sample notice materials for partners to use	City staff prepared sample text that project partners could use or adapt to encourage survey participation through their existing communication channels. Staff also made a survey handout available for partners to distribute. Sample language provided to partners was used for • Email notices • Social media posts • Website content • Flyer or handout Partners include: • Climate Action Steering Committee members • Working group members • Neighborhood Associations • Partner agencies • Community non-profit organizations
Radio interview	City staff participated in three radio interviews on local radio stations to promote the survey including KPOV and KBND.
Local news interview	Local news channel 21: KTVZ interviewed City staff about the survey and staff urged the public to take the survey.
Flyers	City staff posted paper flyers around Bend that provided information about the survey including a web link. Flyers were posted in coffee shops, grocery stores, public recreation centers, restaurants, and retail locations.
Tabling events	CASC members set up “pop-up” tabling outreach stations at various community locations where people gather. CASC members had an iPad available for people to take the survey, and also distributed survey flyers to individuals to take the survey at home. Tabling locations included: • Bend Senior Center • The Pavilion Skating Rink • The Podski Food Truck Lot • First Presbyterian Church • Unitarian Universalist Fellowship of Central Oregon

Respondents

Over 1,500 people submitted surveys. Nearly 90 percent of respondents said they live in Bend, and 45 percent said they work in Bend. The age distribution reported by respondents was fairly balanced among people over the age of 30, with most surveys submitted by people over the age of 60 (35 percent) followed by ages 45-59 (28 percent) and ages 30-44 (25 percent). About the same number of women submitted surveys as men, with 1 percent of respondents identifying as non-binary. Most respondents identified as White/Caucasian (79 percent), followed by Latinx and Asian-American/Pacific Islander (each 2 percent) and African American/Black (1 percent). A large number of respondents reported a personal income level per year of over $100,000 (22 percent) followed by $50,000-$74,999 (18 percent) and $75,000-$99,999 (15 percent).
A majority of respondents reported owning their home (78 percent) compared to respondents who lease their home (16 percent).

Quality of Life Events

Survey participants were asked how important it was to them that Bend prioritize different quality of life elements while reducing fossil fuel use on a five-point scale of “very important” to “not important”.
A majority of respondents said each of the six quality of life elements listed in the survey were important or very important. While all elements were important to most respondents, “protecting the natural environment” received more “very important” responses relative to other elements.

Relatively more important ↑ ↓ **Relatively less important**	o Protecting the natural environment o Community health and safety o Affordability o Economic vitality o Social equity o Security and resilience

Proposed climate action ideas

Survey participants were asked how important it was to them that Bend prioritize different quality of life elements while reducing fossil fuel use on a five-point scale of “very important” to “not important”.
A majority of respondents said each of the six quality of life elements listed in the survey were important or very important. While all elements were important to most respondents, “protecting the natural environment” received more “very important” responses relative to other elements.

Transportation

Level of agreement

The transportation actions that received relatively more agreement from respondents included:

- Investing in infrastructure that make it easier to use alternative transportation
- Expanding public transportation services
- Encouraging employers to provide incentives for alternative transportation like
- public transportation passes

Comment themes

About three-quarters of respondents who provided a written comment expressed general agreement with the proposed transportation action ideas or provided additional suggestions. Comment themes included:

- Support for actions that encourage people to walk or use bikes
  - Creating separate or protected bike lanes
  - Concern about current level of safety for people who use bikes
  - Creating better east/west connections across Bend
- Support for increased and more accessible public transportation
  - Extending area of service and hours of operation to include Sundays and late evenings
  - Making public transportation more affordable or free
  - Adding shelters to bus stops to help protect bus users from the elements
  - Using different modes of public transportation in addition to traditional buses
  - Extending Amtrak to provide better connections to central Oregon
- Support for reducing reliance on personal-use cars, especially automobiles with high emissions
  - Enacting smog testing
  - Prioritizing investments in biking, walking, and public transportation
- Mixed thoughts on supporting the use of electric vehicles
  - Some respondents thought incentivizing electric vehicles and increasing the number of charging stations is a good idea
  - A similar number of respondents were concerned that electric vehicles don't decrease carbon emissions if they use electricity generated by coal-fired power plants
- Support for using alternative energies including electricity generated from wind, solar and renewable natural gas
- Concern for placing an undue burden on people who rely on traditional cars, particularly the elderly, low or middle-income populations, and people who travel from rural areas
- Support for improving roads and infrastructure to improve the flow of traffic
- Support for avoiding unnecessary spending and taxes
- Support for considering additional alternative transportation modes in the winter months

Comment themes from respondents who disagreed with the proposed transportation action ideas:

- Disagree with using city funds for climate-related initiatives
- Disagree that there is a need for climate-related initiatives
- Concern that initiatives will lead to increased taxes
- Concern that climate-related initiatives will lead to more regulations and bigger city government

Energy in Buildings

Level of agreement

The energy in buildings actions that received relatively more agreement from respondents included:

- Creating community outreach and education programs to increase awareness of available resources and benefits of energy efficiency in buildings
- Developing new programs and tools that help community members measure and understand the energy use of their buildings
- Creating policy incentives like expedited or low-fee permitting processes for increasing energy efficiency in buildings or renewable energy installations
- Providing financial incentives like grants and financing assistance for energy efficiency improvements and renewable energy installations
- Creating programs and financial incentives specifically for low- to moderate-income residents that help them invest in energy efficiency upgrades

Comment themes

About two-thirds of respondents who provided a written comment expressed general agreement with the energy in buildings ideas or provided additional suggestions. Comment themes included:

- Support for updating building codes to include energy-efficiency requirements for new construction
  - Requiring measures such as solar panels, energy-efficient materials for insulation and windows, making buildings air-tight
  - Making sure materials are cost-effective so housing costs don't rise
- Support for using incentives programs and grants
  - Incentives should be used instead of penalties
  - Mixed thoughts about whether the incentives should be available to all or primarily for low- and middle-income populations
- Support for making clean energy affordable
- Concern that these ideas require spending and staffing that the City doesn't have
- Support for incentivizing landlords and property owners to renovate older buildings to be more efficient, including City buildings
- Support for working with utilities to increase the amount of energy generated from renewable sources
- Support for limiting sprawl development to make communities less dependent on automobiles

Comment themes from respondents who disagreed with the proposed energy in buildings action ideas:

- Energy efficiency should be regulated by the market, not the government
- Energy efficiency is already regulated by the federal and state governments and should not also be regulated by cities
- Disagree that there is a need for climate-related initiatives

About two-thirds of respondents who provided a written comment expressed general agreement with the energy in buildings ideas or provided additional suggestions. Comment themes included:

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- Support for incentivizing landlords and property owners to renovate older buildings to be more efficient, including City buildings
- Support for working with utilities to increase the amount of energy generated from renewable sources
- Support for limiting sprawl development to make communities less dependent on automobiles

Comment themes from respondents who disagreed with the proposed energy in buildings action ideas:

- Energy efficiency should be regulated by the market, not the government
- Energy efficiency is already regulated by the federal and state governments and should not also be regulated by cities
- Disagree that there is a need for climate-related initiatives
- Concern that incentive programs and grants would result in more local taxes
- The City should focus on foundational programs and infrastructure instead of climate-related initiatives

Waste and Materials

Level of agreement

All of the waste and materials actions received comparatively high levels of agreement from survey respondents.

- Creating outreach and education programs to increase awareness of available resources and benefits of reducing waste
- Delivering training programs that build the community's skills and knowledge to reduce waste, including local residents and the construction industry
- Recognize and reward champion organizations that produce low amounts of waste
- Creating programs that reduce waste such as curbside composting, sustainability competitions, and repair cafes
- Promoting the economic benefits of purchasing products locally
- Provide financial incentives for businesses to use less packaging and produce less waste
- Creating new programs and tools that help encourage reusing materials such as refillable bottles and food containers
- Creating policies that reduce waste such as requiring composting or low-waste for city-permitted events

Comment themes

Over three-fourths of respondents who provided a written comment expressed general agreement with the proposed waste and materials action ideas or provided additional suggestions. Comment themes included:

- Support for increased and continuing education about recyclable materials and reducing waste
  - Being able to identify recyclable materials and what happens to them after being picked up/dropped off
  - Conducting field trips to landfills
  - Starting waste education early
- Mixed thoughts on financial incentives versus mandated compliance
  - Some respondents thought that positive incentives, financial or other, are the right direction for Bend
  - Others thought that financial penalties are necessary for businesses and individuals that are motivated by profit margins
- Support for banning single-use plastics including plastic bags, single-use food and drink containers, straws, etc.
- Support for curbside composting and other food waste from restaurants and grocery stores
- Support for self-regulation with the belief that government mandates increase resistance and individuals should be free to choose to comply
- Support for harnessing energy from alternative sources such as biogas or methane production from landfills and breweries
- Support for increasing options for curbside waste removal
  - Create the option for bi-weekly or monthly trash pick up
  - Create the option to use smaller trash cans
- Support for reducing packaging where possible; some comments supported taxing businesses that use non-recyclable materials
- Support for repair cafes and methods to reuse appliances and building materials
- Concern that adoption of these ideas will result in increased costs to individual residents in the form of penalties or taxes
- Support for decreasing waste and single-use plastics at festivals and events

Comment themes

Comment themes from respondents who disagreed with the proposed waste and materials action ideas:

- Waste and materials reduction should be market-driven and self-regulated with little to no oversight from government
- Concern that adoption of these ideas will lead to increased costs to the City as well as individual residents in the form of taxes
- Disagree that there is a need for climate-related initiatives
- Concern that Bend is losing its individual identity and becoming more like surrounding metropolitan areas

Energy Supply

Level of agreement

The energy supply actions that received relatively more agreement from respondents included:

- Simplifying and speeding up permitting processes for renewable energy installations
- Installing solar panels or other renewable energy sources on public buildings like schools and libraries
- Investigating investment strategies for various low-carbon energy sources for the community like community solar projects, energy storage systems, or biodigesters that turn waste into energy
- Providing financial incentives like grants, tax-breaks and financing assistance for renewable energy installations
- Set community-wide goals for renewable energy use in Bend

Comment themes

About two-thirds of respondents who provided a written comment expressed general agreement with the proposed energy supply action ideas or provided additional suggestions. Comment themes included:

- Support for widespread use of solar energy and belief that it should be used wherever possible, especially because it is such a plentiful resource in the Bend area
- Support for maximizing solar power in city and public buildings, schools, and the ice rink
- Concern regarding the efficiency of solar energy; most commenters agreed that renewable energy is desired but were concerned that solar energy is not efficient enough at this time to merit major investments
- Support for requiring solar panels and energy efficient materials for all new construction
- Support for self-regulation with the belief that government mandates increase resistance and individuals should be free to choose to comply
- Support for financial incentives and penalties. Some commenters believe that education efforts will not be very useful and that financial tools will lead to much higher adoption rates
- Support for increasing the use of natural gas and biofuels
- Support for increasing efficiency and use of existing resources such as hydropower
- Concern that changes in energy supply will disproportionately affect low-income populations

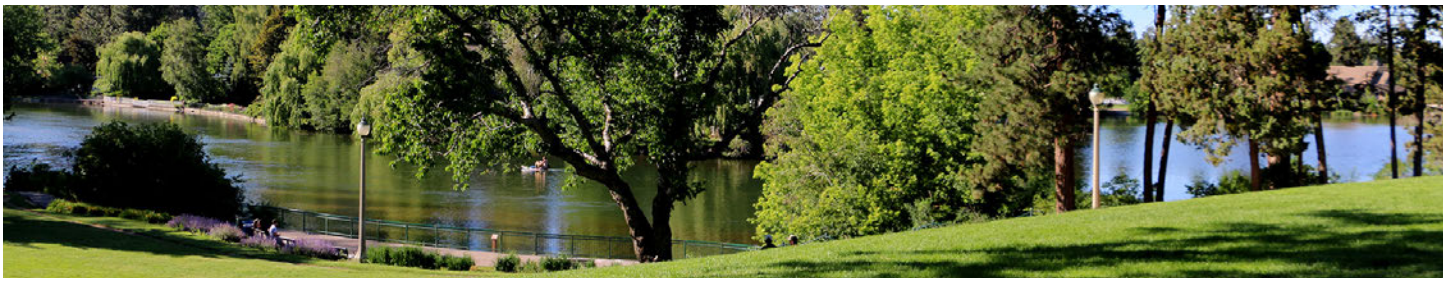
Comment themes

Comment themes from respondents who disagreed with the proposed energy supply action ideas:

- Concern that alternative energies are not as efficient or reliable as current sources
- Energy sources should be regulated by the market; renewable energy use will increase when it becomes more financially viable
- Concern that investments in alternative energies will result in higher taxes and make the area less affordable
- Disagree that there is a need for climate-related initiatives

Appendix E. Part 2 - Public Survey (July 2019) Results Summary

Community Climate Action Plan | Online Open House



Introduction

What is the CCAP?

The Bend Community Climate Action Plan was created after the Bend City Council set a goal to reduce community fossil fuel use by 40% by 2030 and 70% by 2050. The Plan is a set of strategies that will guide the City and the Community as they work together to reduce their fossil fuel usage. The strategies consist of new programs, policies, and systems that the Bend community proposed and vetted. They are meant to encourage and support residents, businesses, and other agencies to reduce the community's fossil fuel use.

Process to Date

The City and the Climate Action Steering Committee (a volunteer committee made up of Bend residents) developed the Plan with extensive participation with the Bend community. The timeline below shows the process of developing the Plan.

- **Summer 2018** - The Climate Action Steering Committee developed a vision for the Community Climate Action Plan and created objectives for different sectors.
- **Fall 2018** - The Committee hosted working group meetings with stakeholders (both community members and experts) to brainstorm potential climate actions for further consideration. These actions describe ways citizens, businesses, and institutions in Bend can reduce their fossil fuel use.
- **Winter 2019** - Members of the general community shared their feedback on the working groups' proposed action ideas through an online survey.
- **Spring 2019** - The Committee and the City worked with partners and technical experts to identify and quantify the impact of 15 specific strategies (each with associated implementation actions) to include in the Plan.
- **Summer 2019** - The City hosted an online open house to further educate the Bend community on the Plan and to collect a final round of feedback from the community on the 15 specific strategies identified for inclusion in the Plan. The City also used the online open house to solicit ideas for additional strategies to consider for inclusion in the final Plan.

Details on Comment Period

The online open house was available between July 1 and July 31, 2019. In this timeframe, it received 878 discreet users who visited the site 1,219 times. The City received 181 comment submissions from a survey included in the online open house.

The goal of the online open house was twofold. First, to educate community members about the Community Climate Action Plan, and second, to gain their feedback on the strategies proposed for inclusion in the Plan. The results of the survey included in the online open house are not statistically representative, meaning the respondent sample is not predictive of the opinions of the Bend community. This report summarizes the comments collected from community members using the survey.

How Will the Survey Results be Used?

The City and the Committee will take the comments from the online open house into account as they select additional strategies beyond the original 15 proposed strategies to include in the final Plan. They will also consider these comments as they make final adjustments to the original 15 strategies they recommend for inclusion in the Plan.

Distribution and Notification

The City of Bend promoted the online open house using the methods described below.

Tool	Description
City of Bend website	Notice of the online open house was posted to the City of Bend home page and included on the Plan's web page.
Social media posts	The City promoted the survey on its Facebook and Twitter accounts and used paid social media advertisements to increase the reach of posts to include Bend Community members who do not follow the City's social media.
City of Bend newsletters	The City promoted the online open house in the following newsletters: • Bend Current • Business Registration Newsletter • Neighborhood Leadership Alliance newsletter
Email lists	City staff sent notices via email to the following email lists: • Community Climate Action Plan Project Update List • Working group participants • Key stakeholders
Media advisory	City staff distributed an advisory to local media contacts to encourage local media coverage of the survey availability.
Partner Organization Communication Channels	City staff provided language to Climate Action Steering Committee members to distribute through newsletters, at events, or other channels. These included: • The Environmental Center "Living the Green" newsletter • The Environmental Center "The Energy Challenge" newsletter • The Environmental Center Member Appreciation Lunch • Central Oregon Climate Change Coalition

Tool	Description
	• Citizens Climate Lobby • Central Oregon Builders Association • OSU-Cascades Student Newsletter • OSU-Cascades Staff Newsletter • Cascade Natural Gas Social Media accounts

Key Takeaways

The following key takeaways were observed from the survey results:

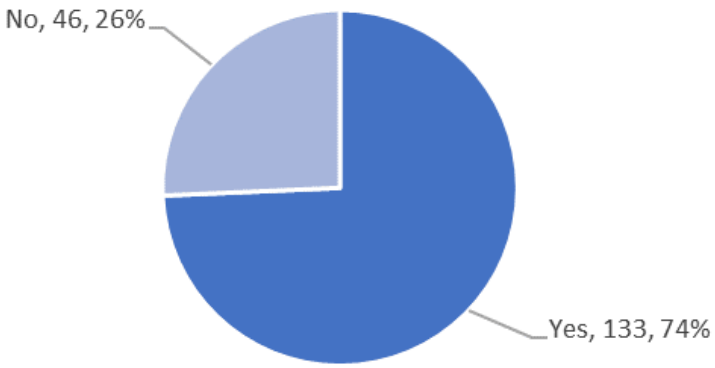
- There was no clear consensus among public feedback. Some members of the public found certain strategies easier to implement, while some members of the public found the same strategies difficult to implement.
- The majority of respondents (74 percent) had heard of the Plan before visiting this online open house.
- Respondents generally categorized strategies as easier to implement if they could be implemented by individuals, while they categorized strategies as harder to implement if
- they needed to be implemented by the City, businesses, or institutions.
- Strategies identified as easier to implement were most frequently related to the Waste and Materials sector followed by the Transportation sector.
- The strategies identified as harder to implement were most frequently related to the Transportation sector, followed by equally frequent mentions of the Energy in Building and Energy Supply sectors

Summary of Responses

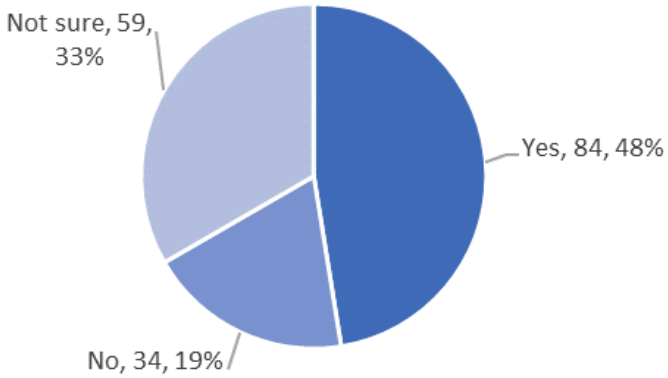
Multiple Choice Responses

The online open house included two multiple choice questions. The results of these questions are listed below.

1. Before visiting this online open house, had you heard of the Bend Community ClimateAction Plan (n = 179)?



2. Do you think these proposed strategies are accessible to you and other members of the Bend community (n = 177)?



Open-Ended Responses

The online open house included four open-ended response questions. They were:

1. Of the proposed strategies listed for the four sectors, which ones will be easier for you to implement?

2. Which of the proposed strategies will be hard for you to implement? What would make them easier for you to implement?

3. Is there anything else you would like to see included in the Community Climate Action Plan?

4. Do you have any additional comments related to the Community Climate Action Plan?

The responses to these questions were categorized based on which sector they pertained to. The most common responses are described below. Note that some strategies were categorized as easier to implement by some respondents and harder to implement by other respondents so they are included in both categories. Responses that were not directly related to any of the four sectors are included in the “Other Comments” section.

Energy Supply

In general, respondents thought the strategies are easier to implement for the following reasons:

- Renewable energy technology exists and is already available
- People can individually choose to add things like solar panels to their houses

In general, respondents thought the strategies are harder to implement for the following reasons:

- Renewable sources of energy such as solar panels are expensive to install
- Adopting renewable sources of energy is often not within an individual’s control (especially for renters looking to add renewable energy to homes)
- It can be hard to add renewable energy to private residences because of siting constraints
- Some HOAs do not allow solar panels on private homes

Additional strategy ideas proposed by respondents:

- Implement a net metering policy
- Develop incentives for owners/managers of multifamily residences to add solar

Respondents made the following general comments:

- These strategies could be made more accessible by implementing incentives for the purchase and installation of solar panels and by building community solar projects
- Many of the strategies proposed in the energy supply sector are not choices individuals can make, making them harder to implement
- Many individuals in Bend have already implemented the strategies in this sector that are available to them and think it would be challenging to do more to reduce emissions in this sector

Energy in Buildings

In general, respondents thought the strategies are easier to implement for the following reasons:

- Improving home energy efficiency is voluntary and available for individuals to implement
- In general, respondents thought the strategies are harder to implement for the following reasons:
- Upgrading energy efficiency of homes can be quite expensive and renters often don't have the option
- Many respondents have already made a number of energy efficiency upgrades to their homes and further upgrades are either not available or not cost-effective
- Updating energy efficiency of buildings besides homes is difficult because of the cost involved
- Additional strategy ideas proposed by respondents:
- Promote density of residential buildings through zoning changes
- Create incentives for
    - All-electric homes
    - Homebuyers to choose green homes
    - Owners/managers of multifamily residences to undertake energy efficiency upgrades
    - Developers to achieve LEED standards in new buildings
    - Developers to build net zero buildings
- Create requirements for new developments to be energy efficient
- Make public buildings net zero
- Implement a tax on large houses
- Join the Zero Energy Ready Oregon (ZERO) coalition
- Increase awareness of successful energy efficiency work and environmental design through awards and demonstrations

Respondents made the following general comments:

- The Plan should focus on improving the efficiency of existing buildings rather than new buildings or developments

Waste and Materials

In general, respondents thought the following strategies would be easier to implement:

- Composting
- Reducing consumption
- Reducing personal waste
- Recycling
- Using resale shops for construction materials

In general, respondents thought the strategies would be harder to implement for the following reasons:

- Lack of recycling infrastructure
- Additional strategy ideas proposed by respondents:
- Implement a plastic bag ban
- Promote low-carbon food choices (e.g. promote reducing meat consumption)
- Respondents made the following general comments:
- Recycling infrastructure and options should be expanded for residents of Bend and the surrounding areas
- Composting should be more accessible through a curbside composting program

Transportation

In general, respondents thought the strategies would be easier to implement for the following reasons:

- Increasing their number of bike trips is an individual's choice
- Increasing their use of electric vehicles is an individual's choice and they would not have to change their driving habits

In general, respondents thought the strategies would be harder to implement for the following reasons:

- Bike and pedestrian infrastructure is not sufficient to be able to increase trips
- Public transportation service is not frequent enough and does not have a wide enough range of service to allow individuals to get where they need to go
- There are no other options for people to get where they need to go besides cars (this was especially emphasized by people who live outside of Bend)

Additional strategy ideas proposed by respondents:

- Implement congestion pricing
- Implement variable rate parking pricing in downtown Bend

- Create vehicle emission requirements
- Limit cars in downtown Bend
  - By creating pedestrian only zones
  - By adding parking lots on the perimeter of the city and implementing a shuttle system from these parking lots
- Improve public transportation in Bend by
  - Adding electric vehicles to the public transportation fleet
  - Encouraging tourists to use public transportation
  - Improving transit for kids to school
  - Providing rapid transit to Mt. Bachelor
  - Adding a free shuttle from Old Mill to Downtown
  - Adding bus only lanes
  - Making transit free
- Implement a gas tax
- Reduce emissions from construction vehicles
- Add incentives for consumers to buy e-bikes
- Add incentives for consumers to buy more efficient cars
- Respondents made the following general comments:
- Accessibility in general can be improved by providing more bike and pedestrian infrastructure and expanding public transportation services and frequencies
- The Plan focuses too much on electric vehicles because
  - EVs have environmentally damaging components, specifically batteries
  - The electricity currently used to charge EVs in Bend still creates greenhouse gas emissions
  - Public transit should be a higher priority

Other Comments

Additional strategy ideas proposed by respondents:

- Create a sustainability advisory board as part of the city's citizen boards
- Create land use regulations for homes and natural areas to reduce greenhouse gas emissions
- Improve Bend's Urban Tree Canopy
- Increase public awareness of Bend's greenhouse gas emissions and the change over time of emissions through public displays
- Create a tool library
- Convert streetlights to be solar-powered
- Develop advice documents telling consumers where they can spend money to support lower emissions

Respondents made the following general comments:

- The Bend community needs a more aggressive plan so it can reduce its greenhouse gas emissions faster and by a greater magnitude

- The greatest barrier to implementing these strategies and actions is their cost
- More incentives should be offered to make these strategies more accessible
- The City should implement regulations to reduce emissions instead of or in addition to encouraging voluntary action
- The City should coordinate with other governmental bodies at the county, state, and federal level to implement strategies to reduce emissions
- Individuals have already done a lot to reduce their emissions in various sectors and they are unsure what more they could do that is realistic and effective
- The Plan should focus on strategies that are low cost and high impact
- The Plan should focus on strategies that will improve the quality of life for Bend residents
- The City should also develop an adaptation plan
- The City should publish a list of the actions in order of their priority with estimated timelines for implementation
- Taxes should not be increased to implement these actions
- It is difficult for renters to implement many of these actions
- Bend's share of national and global emissions is quite small so reducing emissions in Bend will not have a significant impact
- Continued education on climate change and these climate strategies is needed
- The City should take a leadership role in implementing these strategies and actions
- More specific action items would be helpful to show individuals how they can reduce emissions
- These strategies should be voted on before being implemented
- The Plan could lead to overregulation by the City
- The Plan should not be implemented because climate change is not caused by human activities

Appendix F. Greenhouse Gas Cost and Modeling

Sector / Strategies	GHG Methodology and Assumptions	Cost Methodology and Assumptions
Energy Supply		
1. Expand distributed commercial and residential solar PV	Navigant completed an assessment on behalf of PacifiCorp titled, *Private Generation Long-Term Resource Assessment (2017-2036)*. This report provides estimates of potential capacity from a variety of distributed electricity generation resources including solar PV for the state of Oregon. The report provides an estimate of market penetration of installed nameplate capacity estimates in megawatts (MW). In the Annual Market Penetration - Base Case solar PV capacity in Oregon is estimated at about 330 MW, while the High Case its esimated as 590 MW. The difference between the Base and High scenario's are based on analytical assumptions made about system costs and retail market electricity rates. The High case was used for this analysis as most appropriate given the Bend CAP implementation actions for the solar PV strategy will result of lower system / financing costs. The Oregon estimate is downscaled, using the ratio of Bend to Oregon electricity load in PAC territory, to estimate Bend's solar potential for the residential and commercial sectors. This totals about 32 MW between 2017 - 2036 or about 1.6 MW annually. This generation is used to estimate potential in Central Electric Co-Ops service territory using a ratio of retail electricity sales for CEC and Pacific Power. Emissions savings are calculated using projections of Pacific Power and CEC utility-specific emissions factors between 2020 and 2050. Note that GHG benefit from the private sector will decrease over time as PacifiCorp complies with Oregon SB 1547.	Residential installation costs, in the Navigant report, are assumed at $3,500 / install kW; and commercial at $2,300 / install kW. Annual fixed O&M Costs assumptions are $25/kW per year for residential and $23/kW for commercial. Systems included in the base case, for all sectors, is assumed to have a 10 year or less simple payback period. Solar PV systems typically have a lifespan of 20 - 35 years. After the payback period, these systems will result in a net savings for the system owner resulting in a negative cost effectiveness, meaning that these systems will reduce emissions and provide a financial savings.

2. Install solar panels on public buildings like schools, libraries, and city buildings	Ameresco performed an initial assessment of a solar PV project for City of Bend and identified 8 potential projects. The assessment estimates electricity generation during the first year of operation (about 1,000 MWh). System generation over the project lifespan is calculated assuming a 30 years lifespan with a 0.5% annual degradation rate. Emissions savings are calculated using projections of Pacific Power utility-specific emissions factors between 2020 and 2050. Similar assessments have not been conducted for other community public buildings. To estimate potential for schools a building inventory was used to identify 6 schools all build post-2000 and with roofspace between 60,000 - 200,000 square feet. For each of these 6 facilities it was assumed a 200kW solar PV system could be installed. Generation for these systems was calculated with National Renewable Energy Laboratory's PVwatts calculator at about 290 MW in year1 . System generation over the project lifespan is calculated assuming a 30 year lifespan with a 0.5% annual degradation rate. Emissions savings are calculated using projections of Pacific Power utility-specific emissions factors between 2020 and 2050. *Note: The estimate performed for schools is very preliminary and included for illistrative purpose only. More work is required to determine site-specific feasibility.*	System costs and revenues for City projects are estimated by Ameresco. Initial costs are estimated at $1.3 million with an annual resource savings of $80,000. Simple payback for all City projects is between 15 and 22 years. Payback times are less than average system lifespans and therefore are projected to save money; therefore cost effectiveness for GHG reduction is calculated at -$50 per MT CO2e. Financial analysis for schools solar PV systems is unavailable, but is assumed for the purpose of this analysis that these systems will have similar costs and revenue as City systems and therefore a simuilar cost effectiveness.
3. Community purchases all renewable electricity	Between 2019 and 2040, Oregon Senate Bill 1547 requires that Pacific Power provides Oregon customers with coal-free power by 2030 and 50% renewable power by 2040. Emissions savings from SB1547 are calculated and presented as "Existing Oregon Electric Policy" in the table of results. While SB1547 is not an action included in Bend's list of CAP strategies, it is include in the analysis because it will have a significant effect on the community's emissions and determines the quantity of *additional* renewable electricity the community would need to purchase in order to reach a goal of 100% renewable. Emissions reductions from SB1547 are calculated assuming a linear reduction of coal generation in Bend's electricity supply through 2030 and in parallel a linear increase of renewable electricity towards 50% by 2040 versus a business as usual scenario. The non-renewable fraction of Bend electricity in 2040 is assumed to be natural gas generation. No additional reductions are assumed between 2040 and 2050 beyond adjustments for population growth. Emissions reductions for additional community purchase of renewable electricity (i.e., 100% renewable electricity) are calculated as the difference between a BAU scenario and remaining emissions post-implementation of SB1547. It is assumed this action is implemented over a 5-year period between 2020 - 2025. This assupmtion was made for illistrative purposes and is subject to change as the community works with partners to further consider how best to approach this action.Central Electric Co-Op is not considered in this action as its contracts with Bonneville Power Administration are	Costs for Pacific Power compliance with SB1547 are not readily available. Costs for additional purchase of renewable electricity credits (RECs) are based on the current range of Pacific Power BlueSky Pricing which is between $7 and $20 per MWh. These values provided an estimate, but future costs are subject to significant change based on a number of factors, such as quantity purchased, year of purchase, generation type and location.

	from 95% low-carbon or renewable resources (mostly hydro with some nuclear).	
4. Build/explore a biodigester at the wastewater treatment facility	The community's wastewater and brewery waste can be used as the feedstock in an anaerobic digester to generate renewable natural gas. Renewable natural gas provides the same energy as conventional, fossil fuel natural gas with fewer emissions, and once produced and cleaned, can be injected into natural gas pipelines for use in heating equipment or vehicles. Ameresco estimated that Bend could provide about 720,000 therms of renewable natural gas annually. Combustion of renewable natural gas is a biogenic source of energy (i.e. part of the current carbon cycle) and therefore emissions free. Emissions reductions are calculated for the substitution of renewable for fossil natural gas and adjusted for the energy and emissions generated in the course of producing the renewable natural gas.	Cost data is taken from Ameresco's initial assessments of local potential. Ameresco's work is detailed, but appears preliminary, and therefore more study is likely required. System costs include a new anaerobic digester sized for local sources of fats, oils, and greases ($2.5 million); new Deschutes Brewery digester ($5 million); and a gas cleaning system ($5.4 million); along with existing wastewater treatment plan capacity. Revenue from the systems includes sales of the energy (about $900,000 per year, assuming $1.20 / therm) and Federal Renewable Fuel Standard credits at $500,000 annually. Operational costs (labor, energy, and maintenance) for the FOG, brewery, and gas cleaning system are not currently available. Therefore the cost effectiveness value is taken from Center for Climate Solutions report titled *Greenhouse Gas Marginal Abatement Cost Curve Development and Macroeconomic Foundational Modeling for Oregon*.
5. Contract for a natural gas offset program for community gas use (25% participation rate)	Cascade Natural Gas does not currently offer a program for customers to purchase carbon offsets to mitigate the impact of combusting natural gas. Another Oregon natural gas utility, Northwest Natural, does have an ongoing program in partnership with The Climate Trust, called SmartEnergy. To be implemented locally, this strategy would require local parties to staff program development and market research; programmatic implementation; and ongoing administration on monthly billings and annual accounting and administration for carbon credit transactions. Emissions reductions are calculated based on Bend's 2016 consumption of natural gas by the residential and commercial sectors and an assumption that between 2020 and 2030, the community will voluntarily participate in the program reaching a participation rate of 25% for residential and commercial customers by 2030.	Costs for this strategy are based on regulatory-grade carbon offset prices in California's Cap-and-Trade market for the low end. As of May 2019, credits are trading at about $18 per metric ton of reduction. An additional $3 per metric ton is added to account for local administrative program costs (billings; program administration; and accounting). Credit prices on the high end are based on separate Good Company research to develop and administer utility-sponsored, local forestry-related carbon offset projects. Credits for this type of program are estimated at $40 per metric ton. Like the previous $5 per metric ton is added for administrative program costs.

Building Energy Efficiency		
1. Improve voluntary uptake of energy efficiency projects in Bend	Energy Trust of Oregon (on behalf of Pacific Power) and Central Electric Co-Op (on behalf of Bonneville Power Administration) provided energy efficiency programs in Bend. Two sources were considered in estimating energy efficiency resource potential in Bend. The first is annual historic Energy Trust of Oregon energy savings data for project implemented in Bend, which range from annual installed savings of 2,000 MWh to 12,000 MWh and 60,000 to 100,000 therms saved between 2008 and 2018. The second is based on Energy Trust of Oregon's 2014 Energy Efficiency Resource Assessment, which when scaled down for Bend results in an annual average reduction of 6,000 MWh and 125,000 therms. Annual average values from the two sources were very similar and therefore used to project future reductions. Emissions reductions for electricity are calculated using projections of Pacific Power and CEC utility-specific emissions factors between 2020 and 2050.	Energy Trust of Oregon considers three categories of efficiency resources - cost effective, achievable, and technical. Energy Trust of Oregon focuses on developing cost effective resources, or resources that are equal to or less than the cost of wholesale electricity and natural gas in Oregon. A report from Center for Climate Solutions titled *Greenhouse Gas Marginal Abatement Cost Curve Development and Macroeconomic Foundational Modeling for Oregon* considered over 130 individual efficiency measures and found the cost effectiveness for the bulk of the efficiency potential to be between -$50 and $50 per ton reduced. Because ETO programming is focused on cost-effective resources and serves the voluntary market, this strategy is assigned a cost of between -$50 and $0 per ton reduced.
2. Implement benchmarking and disclosure programs for energy performance	Energy benchmarking (e.g., Home Energy Score) measures a building's energy use and motivates the local market to implement voluntary energy efficiency projects. Home Energy Scores are commonly assessed during the home sale process to provide information to potential buyers about the building's energy use and costs. The score can provide a competitive advantage when selling a home as a higher score means more efficiency, fewer costs, and a more comfortable living space. It can be in a seller's best interest to maximize their score to attract buyers and have a competitive advantage over other sellers. Energy Benchmarking provides a motivation to improve voluntary uptake of the cost-effective resources represented in the previous strategy, but may also provide the motivation for owners to go beyond cost-effective resources into more expensive types of projects with longer payback periods in order to achieve a greater score. Emissions reductions for this action are assumed to be equal to the difference between ETO's assessment of cost-effective resources and technical resource potential.	Energy Trust of Oregon considers three categories of efficiency resources - cost effective, achievable, and technical. Energy Trust of Oregon focuses on developing cost effective resources, or resources that are equal to or less than the cost of wholesale electricity and natural gas in Oregon. A report from Center for Climate Solutions titled *Greenhouse Gas Marginal Abatement Cost Curve Development and Macroeconomic Foundational Modeling for Oregon (available for download online)* considered over 130 individual efficiency measures and found the cost effectiveness for the bulk of the efficiency potential to be between -$50 and $50 per ton reduced. Because this strategy might motivate a home owner to participate in ETO programming and may choose higher cost efficiency options to achieve a higher score, this strategy is assigned a cost of between -$50 and $50 per ton reduced.

3. Support policies that increase energy efficiency of buildings, i.e. advocating for stricter energy efficiency state codes	The City of Bend will support the development and implementation of Oregon Zero Energy Ready Building Energy Codes directed by the Oregon Governor Executive Order 17-20. This Executive Order directs appropriate agencies to amend existing code to achieve at least equivalent performance to U.S. Dept. of Energy Zero Ready Standard by 2023. Modeling assumes that code will be in effect for all homes built within Bend between 2025 and 2050. Emissions reductions are calculated assumes DOE Zero Energy Ready Homes are verified by a qualified third-party and are at least 40%-50% more energy efficient than a typical new home. These reductions are applied to current energy use rates for Bend homes and projected forward based on new housing needs detailed in the *Bend Housing Needs Analysis - Bend's Growth to 2028*.	Local costs for this action are not currently available, but are expected to be very low compared to a future business as usual scenario. Technologies and building approaches that are currently expensive will come down in cost by the mid-2020s. In the near-term, costs for this action consist of a fraction of a City FTE to advocate for these policies towards implementation in the mid-2020s. Marginal costs for construction are not considered in this analysis as it is assumed these codes will represent the *minimum* requirements for new construction and therefore comparison with an alternative costs is not applicable.
Waste and Materials		
1. Promote smaller home size with new incentives that encourage building smaller homes.	Choosing smaller housing lowers household carbon footprints from a variety of sources. Smaller houses use less building materials during construction and maintenance. A smaller space also means less heating and cooling requirements over the home's 70+ year lifespan. A smaller space also likely means having to purchase less furniture and other goods to fill the space. Emissions reductions from building materials and energy use are provided by Oregon Department of Environmental Quality's report titled *A Life Cycle Approach to Prioritizing Methods of Preventing Waste from the Residential Construction Sector in the State of Oregon*. This report compares a variety of home square footages, but this strategy assumes that future single family homes in Bend will decrease in size from 2,300 square feet to 1,600. These per unit savings are applied to single family home projections for Bend as reported in *Bend Housing Needs Analysis - Bend's Growth to 2028,* which estimates that about 325 single family homes will be needed annually in Bend. Given Portland State University projections of population growth for Bend, this same rate is assumed through 2050. Emissions reductions are calculated based on the per housing unit reductions detailed in ODEQ's report for building materials and energy use. The same rate of reduction is applied to other consumption-based emissions sources included in *Bend's 2016 Greenhouse Gas Inventory* that will be impacted by a smaller home including furnishings and other goods.	Cost effectiveness for smaller homes is calculated based on cost savings from construction of a smaller space in addition to life-cycle energy use. Building costs are assumed to be $150 per square foot per Homeadvisor.com. Annual energy costs are based on statistics from U.S. Energy Information Administration's, *Residential Energy Consumption Survey,* for appropriately sized homes in Bend's climate zone. Costs for decreased consumption of furniture and other goods are not readily available and therefore are not factored into the estimate, but if they were included would further increase the climate benefit. In other words, this strategy would result in a greater costs savings per unit reduced of climate pollution.

2. Develop outreach and education materials that promote waste prevention (support repair and reuse, reduce wasted food)	In December of 2016, ODEQ released the Strategic Plan for Reuse, Repair, and Extending the Lifespan of Products in Oregon. In the plan, ODEQ cites a 2009 study from the U.K. that found that best practices for "quick wins" for extending the lifespan of products could reduce more than twenty times the greenhouse gas emissions than best practices for commercial and industrial recycling. The study estimates that "product lifespan optimization" could reduce business as usual emissions by 0.7%. To estimate emissions reductions, this value is applied to Bend's 2016 consumption-based emissions for building materials, clothing, furniture, and the other goods categories.	Cost effectiveness for waste prevention, which includes repair and reuse, presented in Center for Climate Strategies report *Greenhouse Gas Marginal Abatement Cost Curve Development and Macroeconomic Foundational Modeling for Oregon* found the cost effectiveness of waste prevention at -$270 / MT CO_2e ($270 is saved for every ton of emissions reduction). This cost effectiveness considers avoided emissions for production of a new replacement good
3. Improve non-food waste recovery (45% material recovery by 2025)	Between now and 2025, Deschutes County will need to increase the landfill recovery of materials from 33% to 45% of total collected materials. The Deschutes County Solid Waste Mater Plan (DRAFT July 2018) details the materials of focus to meet these recovery goals - which include food waste, construction and demolition waste (e.g. wood waste, carboard, metals), and also mentions textiles. There are additional Oregon sub-goals of 25% recovery of food waste by 2020 and 25% of plastics waste by 2025, as well as decreasing total waste generation by 15% by 2025 (compared to 2012) and 40% by 2050. Bend's current SWMP focuses on achieving its County-specific recovery goal and does not offer much planning toward the generation goal. Therefore emissions calculations here focus on recovery goals. There are four strategies considered in this analysis related to solid waste - this one, food waste recovery, foods waste prevention, and C&D waste recovery. See the other rows for specifics on food waste and C&D waste. This row represents increased comingled recycling material recovery for projected Bend population increases as well as additional material colleciton required to reach the 45% recovery goal. In order to achieve that goal our analytical team had to assume a very highl recovery of food waste (50%) and wood waste (50%). Calculations of emissions reductions use EPA's Waste Reduction Model combined with projected solid waste totals from the County's DRAFT SWMP.	Costs for this action are not readily available.

4. Improve Food Waste Recovery	The State of Oregon has a statewide goal to recover 25% of food waste by 2020. That goal is likely not feabible for Bend by 2020, but County staff thought the goal is realistic by 2025. The analysis goes on to assume a 50% recovery of food waste by 2050. Current and projected food waste quantities are found in Deschutes County's draft Solid Waste Master Plan (SWMP). These totals account for population growth over the time periods. County solid waste totals presented in the SWMP for food were downscaled using a ratio of Bend / Deschutes County population to estimate City of Bend food waste quantities. To achieve a food waste recovery goal of 25% by 2025, Bend will need to process about 6,000 wet short tons of food waste into compost, and in 2050 will need to process about 20,000 tons. Greenhouse gas reductions are calculated using EPA's Waste Reduction Model (WARM) using Oregon and Bend specific waste facility inputs for the material going to compost instead of landfilling.	The action is assumed to be cost neutral for the community. County staff indicated that little to no additional capital or operational expense is expected. Collection towards the 2025 goal will utilize existing yard waste receptacles, equipment, hauling routes, and collection frequency and the compost processing facility already exists and has excess capacity. Infrastructure and equipment needs for collection beyond 25% were not readily available and require addtional study.
5. Improve Food Waste Prevention	This action assumes that the community of Bend, through a variety of recommended actions from EPA and ODEQ, will reduce edible food waste by 5% compared to current disposal rates. The Bend community does not currently have a source reduction goal; therefore 5% was selected to illistrate the potential, but is not grounded in existing, local policy. This stragegy focuses on reducing household and commercial edible food waste. To better undestand implementation actions for this strategy is the ReFed Road Map to Reduce U.S. Food Waste. To estimate GHG reductions, it is assumed that Bend community food waste is source reduced at a rate of 1% annually over the period 2020 - 2025 to culminate in a total 5% reduction compared to 2016 levels.We also assume that the community remains diligent to hold this rate of reduction at 5% annually post-2025 compared to 2016 generation rates. Current and projected food waste quantities are found in Deschutes County's draft Solid Waste Master Plan (SWMP). The fraction of edible food waste is available from ODEQ's 2016 Solid Waste Composition Study for the "Rest of Oregon" region. For this region edible food waste represents about 60% of the total. Greenhouse gas reductions are calculated using EPA's Waste Reduction Model (WARM) using Oregon and Bend specific waste facility inputs.	Costs for this action assume 1 full time employee to run and maintain programatic efforts over the time period. 1 FTE is estimated at $100,000 annually (salary + benefits). Community financial savings from avoiding edible food waste are valued at $2.5 per pound of food waste per information from the ReFed Roadmap document.

6. Incentivize or require use of low-carbon Portland cement substitute materials	This action assumes that the community of Bend achieves significant substitution of Portland cement, used locally for construction,which is subsituted with lower-carbon cement materials (e.g. blast furnace slag). Emissions reductions from this source for residential construction were estimated using results and modeling performed for Bend's 2016 Community Greenhouse Gas Inventory. Concrete use in commercial and residential construction sectors is estimated for this analysis based on ODEQ's State of Oregon 2015 Consumption-based GHG Inventory, Appendix B. Details for these construction service sectors is found in EPA's U.S. Economic Environmental Input Output model. For this strategy it is assumed that the community of Bend will substitute 30% low-carbon materials (e.g. blast furnace slag) for 50% of community Portland cement consumption. Emissions reductions are calculated based factors for various types of cement materials in various ready-mix concrete blends from environmental product disclosures (EPD) published the National Ready Mix Concrete Association.	Portland cement and low-carbon cement subsitutes are taken from per ton material cost data published by the Portland Cement Association, Utility Solid Waste Activities Group, and American Road & Transportation Builders Association. Low carbon subsitutes were found to be between $5 - $10 dollars less per short ton of concrete using a 30% substitution rate.
7. Improve Construction and Demolition Waste Recovery	Deschutes County Draft Solid Waste Master Plan (SWMP) estimates that as much as 30% of the County's total waste is from building construction and demolition. The County is planning a waste composition study to learn more about C&D waste quantities and composition. County staff speculates that C&D waste offers material recovery opportunities for cardboard, metals, and clean wood waste. To estimate GHG savings for this strategy C&D waste quantities for these materials, as reported in the Draft SWMP, were estimated by assuming 30% of these materials are from C&D sources. For this strategy it is assumed that new sorting requirements and infrastructure are put in place to allow for sorting and recovery from this waste stream. Specific material recovery for these materials, by weight, is assumed to be at the same recovery rate as is currently achieved in the County for these materials. Greenhouse gas reductions are calculated using EPA's Waste Reduction Model (WARM) using Oregon and Bend specific waste facility inputs.	The County is in the early stages of planning recovery for C&D waste and therefore capital and opertional costs for this strategy have yet to be determined and are not readily available for this analysis.

Transportation		
1. Increase bicycle and pedestrian trips as transportation mode (substitute bikes and walking for 10% of vehicle miles traveled)	Substituting a walking or a bicycle for a car for trips that are less than 4 miles is one of the most effective climate actions that both saves money and improves health. Currently 23% of Bend's streets are considered "low stress" and 77% are considered "high stress" for biking. The City of Bend has made a commitment to developing a low stress bike network to prevent crashes, increase bike ridership, and facilitate livability. To achieve Oregon's climate goals of Oregon Sustainable Transportation Strategy, 30% of trips need to be by bike by 2050. As of 2016, Bend community bike trips are slighly greater than 3% of the total. Whether Oregon reaches this goal is the combination of safe infrastructure and individual transportation choices. The City is doing its part to develop safe and connected bike infrastructure, but the Bend community at large will need to participate in order to realize the emissions reduction potential of the low stress bike network. To scale GHG reductions for this action three sources were considered - 1) Bend Transportation System Plan, Attachment E (2018); 2) Oregon Department of Transportation report for Individual Transportation Options Pilot Project (2008); and 3) City of Bend Commute Factors report by Commute Options (2019). These sources indicate that the share of walking trips will increase 6% over todays rates by 2040 and bike trips will increase by 1%. Commute Options data shows that walking and biking trips substituted for vehicle trips have an average distance of 3 miles. For this action, it is assumed that given the City's planned investment in a low stress biking network that the community can achieve a annual average rate of 15% walk trips and another 15% of trips by bike. If the community achieves this - it will result in an estimated 10% of vehicles miles traveled by 2040 (assuming an average walk trip distance of 1mile and 3 miles by bike). Emissions reductions are calculated based on ODOT projections of Bend VMT in 2040 and uses 2016 vehilce emissions rates as used in Bend's 2016 GHG Inventory.	Costs are assumed to be equal to the revenue available for stand alone bike and ped upgrades reported in 2040 Bend Metropolitan Transportation Plan, Table EX1, as $15,000,000 between now and 2040. Finacial savings are calculated based on a cost of $0.137 per passenger mile traveled in a single occupany vehicle based on Argonne National Laboratory's AFLEET carbon calculator.

2. Support the transition to Electric Vehicle's with an EV Readiness Plan (substitute EV's for 25% of gasoline vehicle miles traveled)	Electric vehicle technology is progressing rapidly - increasing battery range and reducing production costs. This will reduce the cost of electric vehicles and increase the number and type of styles available for purchase. It is difficult to predict how rapidly EVs will replace conventional fossil fuel combustion vehicles, so emissions reductions for this strategy are calculated for 3 levels of change; by 2050: 10% of vehicle miles traveled (VMT); 25% of VMT; and 50% of VMT; all alongside the 94% state goal. Current EV and hybrid registrations in Deschutes County are about 4% of total, as reported by Oregon Department of Environmental Quality for Oregon's Clean Fuels Program. Emission reductions are calculated based on levels of change as applied to projected VMT in 2030. The ratio of carbon scores for electricity and gasoline (E10) used to calculate emissions reductions are taken from Oregon Clean Fuels Program reporting.	Costs are based on previous Good Company work for the City of *Eugene's Fleet Division and Fire Department Climate Action Plan (available for download online)*. That plan includes EV technology and market research for a variety of vehicle types as well as a number of scenarios that consider a range of initial vehicle costs combined with various combinations of Federal, State, and local utility financial incentives. This research found a range between -$50 per ton for small passenger vehicles at current market prices for new EVs combined with all currently available incentives up to $75 per ton for larger vehicles without available incentives. These prices include consideration of consider reduced fuel and maintenance costs for EVs compared to internal combustion engines per reporting from Argonne National Laboratory's AFLEET tool as well as charger and infrastructure costs.
3. Increase transit ridership (substitute transit for 2% of vehicle miles traveled)	Between 2020 and 2040 Cascade East Transit plans a 60% increase in the frequency of service for fixed routes within the City of Bend. No additional routes are current planned within the City. In addition, modeling done for Bend's TSP predicts a 1.7% increase in ridership by 2040. Emissions reductions for this strategy are calculated with information provided by Cascade East Transit staff; the 2016 National Transit Database (NTD); and an emissions benefits calculator for transit developed by Transit Cooperative Research Program. The tool was used to calculate the baseline transit benefit in Bend for 2016 as well as the benefit with increased service frequency, ridership, and Bend population in 2050.	Costs for this strategy are based on all current CET operational costs for Bend bus service. These costs were used as a ratio with CET service miles to estimate future costs for additional service miles. Finacial savings from avoided fuel costs are calculated based on a cost of $0.137 per passenger mile traveled in a single occupany vehicle based on Argonne National Laboratory's AFLEET carbon calculator.
4. Convert City and other public agency fleets to electric vehicles and alternative	This strategy assumes that by 2030, the City's gasoline use (E10) will be 100% substituted with electric vehicles and that 100% of fossil diesel use (B5) is substituted with renewable biodiesel (R99). Fuel use data was provided by the City and Oregon Department of Environmental Quality, and fuel carbon scores from the Clean Fuels Program are used to estimate emissions reductions. Data on "other public fleets", such as school buses, was not readily available for this analysis and therefore was not included.	Costs for this strategy are based on previous Good Company research performed in development of City of Eugene's Fleet Division and Fire Department Climate Action Plan. Light-duty electric vehicles and renewable diesel are considered for a variety of cost scenarios for these two fuels. Details of this work are included in the plan, which is available for download at https://www.eugene-or.gov/DocumentCenter/View/38211/Eugene-Fleet-Division-and-Fire-Department-Internal-Climate-Action-Plan (as of 6/2019).

5. Promote ride sharing in car and van pools (double car/vanpool participants in Commute Options program by 2030)	According to a 2008 Oregon Department of Transportation report, Individual Transportation Options Pilot Project, carpooling is the mode of choice for 21% of trips. This share is predicted to increase 4% by 2040 to 25% according to modeling described conducted in support of Bend's Transportation System Plan (Attachment E: Detailed Technical Analysis). To account for the effect of CAP implementation action, and the work of groups like Commute Options the mode share in 2040 for this action is increased to 6% by 2040. It is assumed that the number of passengers increase from 1 to 2.1 during these trips. Emissions reductions are calculated based on 2016 passenger vehicle emissions rates from Bend's 2016 GHG Inventory.	No additional capital or operational cost are assumed for this action. Finacial savings are calculated based on a cost of $0.137 per passenger mile traveled in a single occupany vehicle based on Argonne National Laboratory's AFLEET carbon calculator.

Appendix G: Bend Oregon's Community Climate Action Plan: Funding and Financing Pathways Map

estimates rough and based on limited project info - see doc for assumptions | *see key below* | *green = city capital* | *yellow = external partner*

COMMUNITY CLIMATE ACTION PLAN

Type of Action	Key Climate Action Initiatives	$ Type	Top Funding & Finance Pathways	Sample Funders / Partners	Case Examples
Energy Supply + Energy In Buildings	**ES3D/EB2D: Launch Revolving Loan Fund to Finance Renewable Energy + Energy Efficiency Projects** $50,000 - 250,000 in seed funding, 1.5-3% admin costs	Loan	Bank Loan, Private Investment Fund	Coalition for Clean Energy	Colorado Clean Energy Fund
		Budget	Bend OR, City Budget - One Time Allocation	City of Bend, OR	Montpelier Energy Fund
		Grant	State, Nonprofit and/or Foundation Grants	Reinvestment Fund, EnergyTrust	Baltimore Loan Program
	ES3E: Develop Community Solar Projects $360,000 per farm [360kW scale] saves 540 tons CO_2/yr	Special	Community Shared Equity (Special Purpose Entity/VNM)	Clean Energy Collective	Boardman Hill, VT
		Partner	Developer or Utility Owned w/ User Subscription	Central Electric Coop, Pacific Power	Decatur Island, WA
		Loan	Revolving Loan Fund (anchor investment)	Spark Northwest	Sust. Energy Trust, WA
	ES3F: Pilot Renewable Microgrid and Battery Storage $360k [40 kW solar + 110 kW storage] CERP = 200k	Partner	Energy Saving Contract	ENGIE Services	Lakeport, CA Microgrid
		Partner	Power Purchasing Agreements (PPA)	CEC/Pacific Power + Gridscape	Fremont, CA Microgrid
		Fee	Municipal 'Resilience' User Fee (on electricity bill)	CEC / Pacific Power	Hawaii Microgrid Tariff
		Loan	Renewable Energy Loan Fund or Green Bond/s	Oregon SELP	Camden, NJ Microgrid
		Grant	Federal / State Renewable Energy Grants	Oregon DOE, EnergyTrust	Eugene, OR - Ontario, CA
	ES3H: Create a Commercial PACE Program $250k start up costs, once established ~$900,000 loaned/yr	Budget	City Budget (for ~1 FTE C-PACE Admin)	City of Bend / Deschutes County	Reno, NV
	ES4: Build Biodigestor at Wastewater Treatment Facility $12.9 million [fill in with info from Cassie] CERP = 140k	Partner	PPP w/ ESCO, contract could be PPA or ESPC	Ameresco	Woodland Meadow
		Bond	Green Bond / Revenue Bond	WellsFargo, JPMorgan, MorganStanley	Grand Rapids, MI
		Grant	Oregon DOE Renewable Energy Grant *$250k max*	Oregon DOE, EnergyTrust	Junction City Biomethane
	ES5: Install Solar Panels on Public Buildings $1.3 million [1.9MW on schools/city buildings] CERP = 20k	Partner	Energy Savings Performance Contract	ENGIE Services / Ameresco	Redmond, OR - Solar
		Partner	Power Purchasing Agreements (PPA)	CEC / Pacific Power	Haverhill, MA - Solar
		Loan	Renewable Energy Loan Fund (once established)	Oregon Energy Loan Program	Las Vegas, NV - Solar
		Grant	Nonprofit, Foundation and/or State Grants	Seed Fund, OR DOE, EnergyTrust	Portland, OR - Solar
		Bond	Green Bond/s	WellsFargo, JPMorgan, MorganStanley	Lakeport, CA
Transport	**T3A: Create a Mobility Hub Program** $250,000 per hub [4 hubs in initial scope]	Partner	Public Private Partnership / Sponsorship	Cascade East Transit	Kansas City - Think Big
		Bond	Green Bond/s	WellsFargo, JPMorgan, MorganStanley	Sound Transit - Seattle
		Fee	New Transport User Fee for Bend Drivers	Bend Transportation	Chicago Transit Fee
	T5A: Convert City/Agency Fleet to EVs + Alternative Fuel $40k/EV, $1-5k/charging stn [600 total vehicles] CERP = 50k	Special	Lease-Purchasing Agreement	Go Electric Oregon - Nissan Leaf	New Bedford, MA - EVs
		Budget	Integrate Into Capital Planning - Group Purchase	Sourcewell & Climate Mayors	Chula Vista, CA
		Bond	Green Bond/s	WellsFargo, JPMorgan, MorganStanley	LeasePlan
		Grant	Zero Emission Vehicle Federal/State Grants	MultiState ZEV Funding	New York State ZEV Grants
Waste	**W1A/C: Multifam Program + Expand Solid Waste System** Managed by county [Facility & Infrastructure]	Partner	Performance Contract / PPP	Covanta, Cascade Disposal	Long Beach Refuse-to-Energy
		Bond	Green Bond/s	WellsFargo, JPMorgan, MorganStanley	Rethink Waste
		Partner	Public Private Partnership - Loan Capacity	Closed Loop Fund	Scott County, IA
	W3: Improve Food Waste Recovery & Curbside Compost Managed by private contractors / county. CERP = 210,000	Fee	Raise Waste Hauler Rate / User Fees	Bend Garbage & Recycling	Culver City, CA
	W4A: Increase Construction/Demolition Waste Recovery Managed by county. CERP = 150k	Grant	Federal/State Grants	Oregon DEQ	Bunn Box C&D Recycler
		Partner	Public Private Partnership	Closed Loop Fund	Lakeshore Recycling
Outreach Education Incentives Policy	**Outreach Campaigns and Educational Programs** Additional FTE across agencies	Grant	Nonprofit and/or Foundation Grants	OELP, EEAO, EnergyTrust	Enviro Education Oregon
	Incentives To Transition To Sustainable Economy Costs highly variable	Budget	Integrate into Capital Planning	EnergyTrust	EnergyTrust
	Policy Initiatives & Zoning Requirements Additional FTE across agencies and departments	Budget	Integrate into Capital Planning	LEAN, EnergyTrust	Berkeley, CA

For questions, contact the HIP Investor Inc. at HIPinvestor.com, ClimateAction@HIPinvestor.com

Source: City Climate Action Plan; HIP Investor Inc. research.

Budget *City or Agency Budget* | **Fees** *Renewable Energy Credits, Developer Impact Fees, Traffic Congestion* | **Cross-Sector Partnership** *Public-Private-Partnerships, Pay for Performance* | **Bonds** *General Obligation, Green, (QECB, QZAB), Lease Revenue* | **Grants** *WorldBank, IFC, Corporate, Foundations* | **Leases + Loans** *PACE, Federal, Utility, On-bill Financing* | **Funds/Special** *Revolving Loan, Catastrophe Bond Insurance*

Appendix H. Advisory Groups

The City of Bend thanks the following individuals and organizations for contributing to the development of this Community Climate Action Plan by participating in technical working groups, discussion groups or by providing other direct input to advise this Plan.

John Aubrey, *Bend La Pine School District*
Dan Avery, *Oregon Department of Energy*
Brad Bailey, *Bend Garbage & Recycling/Republic Services*
Susan Baker, *Bend Garbage & Recycling/Republic Services*
Rachael Baker, *City of Bend*
Sydney Baler, *Community Member*
Kip Barret, *Economic Development for Central Oregon (EDCO)*
Neil Baunsgard, *The Environmental Center*
Bend Economic Development Advisory Board
Zavi Borja, *Latino Outdoors*
Elaine Blatt, *Oregon Department of Environmental Quality*
Jeff Beaman, *Central Electric Cooperative*
Grant Burke, *City of Bend*
Andrea Breault, *Central Oregon Intergovernmental Council*
Lou Capozzi, *Bend 2030*
Matt Chancellor, *Pacific Power*
Dana Christensen, *Community Member*
Jacob Clark, *Bend Habitat for Humanity*
Theresa Conley, *Oregon Department of Transportation*
Ryan Davies, *Central Electric Cooperative*
Tyler Deke, *Bend Metropolitan Planning Organization*
Robert Del Mar, *Oregon Department of Energy*
Jim Delp, *Community Member*
Ned Dempsey, *Community Member*
Mark Ellington, *Bend Parks and Recreation District*
Joe Emerson, *Zero Energy Project*
Michael Graham, *Oregon Department of Energy*
Kari Greer, *Pacific Power*
Peter Grube, *Dream Home building and Design & Aerobarrier*
Jeni Hall, *Energy Trust of Oregon*
Robert Hamerly, *GreenSavers*
Doug Hansel-Pady, *ECI Insulation*
Brian Hockaday, *Lyft*
Diane Hodiak, *350 Deschutes*
Meghan Hoey, *Worthy Brewing*
Wendy Holzman, *Deschutes County Bicycle and Pedestrian Advisory Committee*
Dave Howe, *City of Bend*
Jody Howe, *Central Electric Cooperative*
Brian Hudspeth, *Bend Parks and Recreation District*
Kelly Hughes, *Ruffwear*
Roger Kainu, *Oregon Department of Energy*
Lauren Johnson, *Newport Avenue Market*
Adrian Jones, *Community Member*
Gary Judd, *City of Bend*
Tim Kaiser, *Earth Advantage*
Ani Kasch, *The Environmental Center*
Dan Kirschner, *Northwest Gas Association*
Denise LaBouda, *Council on Aging*
Theil Larson, *Community Member*
Brad Lemmon, *Community Member*
Mike Lillesand, *Energy Trust of Oregon*
Meiko Lunetta, *High Desert Food and Farm Alliance*
Heather Ficht, *East Cascade Works*
Carol Fulkerson, *Central Oregon Coalition for Access*
Carrie Mack, *350 Deschutes*
Chris Macwhorter, *Community Member*
Klaus Mager, *Citizens Climate Lobby*
James Marshall, *Community Member*
Vic Martinez, *Payne West Insurance*
Lewis McFarland, *Community Member*
Nate Merrill, *Energy Trust of Oregon*
Jane Merrow, *Community Member*
Sean Micken, *Sunlight Solar*
Owen Mitz, *Community Member*
Mark Molner, *Community Member*
Jeff Monson, *Commute Options*
Jason Mustard, *Oregon Department of Environmental Quality*
Tyler Neese, *Central Oregon Association of Realtors*
Sophie Paez, *Bend Habitat for Humanity*
Louise Palmer, *Community Member*
Connie Peterson, *Juniper Group of Sierra Club*

Roy Radcliff, *Bend Parks and Recreation Department*
Scott Reich, *Bend Bikes*
Steve Reiner, *Community Member*
Connor Reiten, *Northwest Gas Association*
Kathy Reynolds, *Citizens Climate Lobby*
Mike Riley, *The Environmental Center*
Denise Rowcroft, *The Environmental Center*
Tom Rowley, *Business Oregon*
Anthony Roy, *Earth Advantage*
Janel Ruehl, *Central Oregon Intergovernmental Council*
Todd Russell, *Deschutes County*
Patty Satkiewicz, *Pacific Power*
Timm Schimke, *Deschutes County*
Joel Schoening, *Oregon Beverage Recycling Cooperative*
Helen Seidler, *Community Member*
Rob Shatting, *Bend Parks and Recreation District*
Kristen Steiner, *Bend Garbage & Recycling/Republic Services*
Dan St. Germain, *Energy Trust of Oregon*
Marty Stipe, *Energy Trust of Oregon*
Randy Stuzman, *Bend Garbage & Recycling*
Bruce Sullivan, *BASE Zero, LLC*
Erwin Swetnam, *Cascade Disposal*
Tim Sylvester, *Gunter Group Consulting*
Indigo Teiwes, *HydroFlask*
Mike Tucker, *Windermere Real Estate*
Kyle Webb, *OSU Cascades*
ML Vidas, *Energy Trust of Oregon*
Steve Vinci, *Morrison Hershfield*
Robin Vora, *Community Member*
Jay Ward, *Energy Trust of Oregon*
Elizabeth Weigand, *Agricultural Connections*
Jackie Wilson, *The Environmental Center*
Keith Wooden, *Housing Works*
Christina Zamora, *Neighbor Impact*