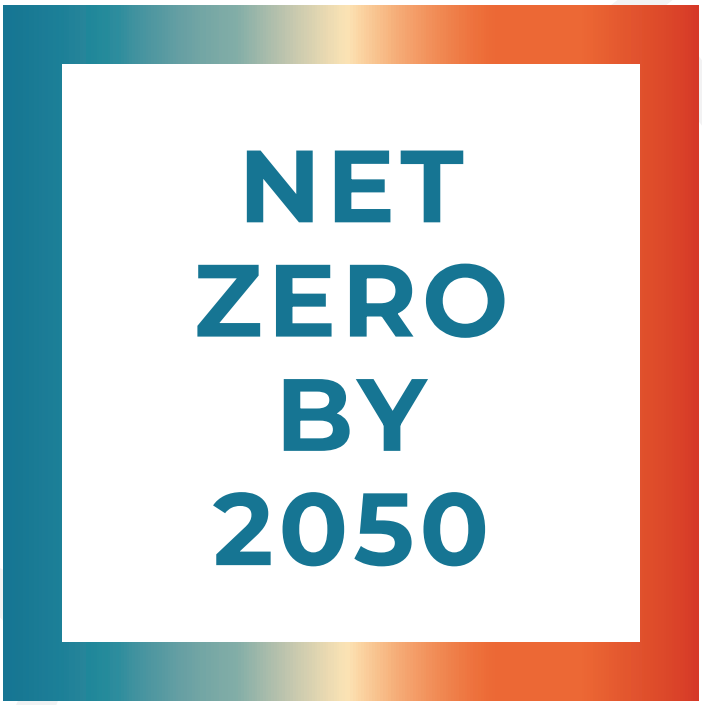
TUALATIN'S COMMUNITY CLIMATE ACTION PLAN

A Path to Net Zero by 2050

CITY OF TUALATIN

2023


NET
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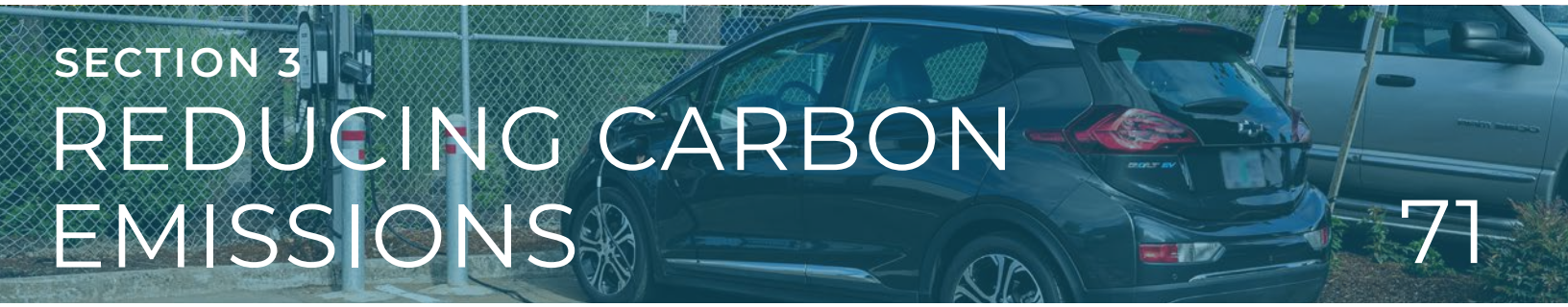

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ACKNOWLEDGEMENTS

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Oregon Department of Environmental Quality (DEQ)
Oregon Department of Transportation (ODOT)
Oregon Occupational Safety and Health Administration (OSHA)
Portland General Electric (PGE)
Republic Services
The Street Trust
Tualatin Chamber of Commerce
Tualatin Ride Connection
Tualatin Valley Fire & Rescue
Tualatin Hills Parks & Recreation District (THPRD)
Vision Action Network
Washington County

THE TUALATIN COMMUNITY

Thank you to members of the Tualatin community who engaged with the project team throughout the development of the plan. Whether you participated in the online open house, attended a workshop, or otherwise connected with the project team, we greatly appreciate your feedback and look forward to creating a more resilient and thriving Tualatin with you through this plan.

GLOSSARY OF TERMS

Adaptation	Adjustment or preparation of natural or human systems to a new or changing physical environment to keep functionality and safety intact for systems we rely on such as roads, power and water supply.
Atmosphere	The atmosphere is a 7-mile-high layer off the surface of the earth that is 78% nitrogen and 21% oxygen with small portions of other gases. This layer protects us from UV rays and also traditionally allows solar heat gain to release back to space, keeping our climates livable. As we are adding carbon emissions, the composition of the atmosphere is changing and capturing heat at ever growing rates.
Biofuels	Fuel made from biomass (plant or algae material or animal waste) is known as biofuel. Since biomass can easily be replenished (as it regrows and captures carbon emissions as fiber), biofuel is considered to be a source of renewable energy, unlike fossil fuels, such as petroleum, coal, and natural gas. Biodiesel is an example of a biofuel that is intended to be a substitute for standard diesel.
Carbon cycle	Carbon is the foundation of all life on Earth, required to form complex molecules like proteins and DNA. The carbon cycle is nature's way of recycling carbon atoms. It describes the process in which carbon atoms continually travel from the atmosphere to the Earth and then back into the atmosphere. This happens via photosynthesis in which vegetation uses carbon dioxide and sunlight to make fiber in the plant.
Carbon dioxide (CO_2)	A naturally occurring gas, and also a by-product of burning fossil fuels and biomass. It is the main human-caused greenhouse gas that affects the atmosphere and temperature gain, accounting for 79% of emissions globally. It is the reference gas against which other greenhouse gases are measured and therefore has a Global Warming Potential Unit of 1.
Carbon footprint	The total amount of greenhouse gases (CO_2 and others) that are emitted into the atmosphere each year by a person, family, building, organization, or company. A person's carbon footprint includes carbon emissions from fuel that an individual burns directly, such as by heating a home or riding in a car. It also includes carbon emissions that come from producing the goods or services that the individual uses, including emissions from power plants that make electricity, factories that make products, and landfills where trash gets sent.
Carbon sequestration	Carbon sequestration is the process of capturing and storing atmospheric carbon dioxide. This can be done naturally through plants or mechanically to capture and store carbon below ground. It is one method of reducing the amount of carbon dioxide in the atmosphere with the goal of reducing global climate change.
Climate	Climate is the average weather conditions in a place over 30 years or more.
Climate change	Climate change refers to any significant change in the measures of climate lasting for an extended period of time. This includes major changes in temperature, precipitation, wind patterns, or other changes in weather that occur over several decades or longer in varying geographies throughout the world. Each region will experience different effects.

Climate resilience	Resilience is a broad concept that can apply to individuals, communities, and social, economic, and environmental systems. Resilience is the capacity to cope with a hazardous event or long-term trend in ways that maintain essential identities, functions, and structures while also maintaining the capacity to learn, adapt, and/or transform. (Adapted from IPCC 2014)
Climate vulnerability	Climate vulnerability describes the degree to which natural, built, and human systems are at risk of exposure to climate change impacts.
Co-benefit	Additional benefits, or harms, of policies that reduce carbon emissions. These could include impacts on jobs, the health and safety of community members, ecosystem and wildlife health, and social equity.
Concentration	The amount of a chemical in a particular volume or weight of air, water, soil, or other medium. Typically reported in parts per million (ppm) or parts per billion (ppb).
Electrification of buildings	Refers to the process of using electricity from renewable sources to power the heating, cooling, and other energy needs of buildings instead of using fuels like coal, gas, and oil. Also known as "electrifying".
Emissions	The release of a substance either by combustion (burning gas or diesel) or uncontrolled releases of substances like refrigerants and methane gas into the atmosphere.
Energy efficiency	Using less energy to perform the same task or produce the same result.
Fossil fuel	Fossil fuels are found below the living surface of the earth and contain carbon and hydrogen, which can be burned for energy. Coal, oil, and natural gas are examples of fossil fuels that, through combustion, have added emissions to the atmosphere that are in excess of the living carbon cycle that vegetation creates and absorbs as it dies and regrows. The fossil sources are not part of the living carbon cycle (as vegetation is) and have only become part of our atmosphere through ever-growing combustion over the last 150 years or so.
Fuel switching	Transitioning from "carbon-intense " fuels (like gasoline or propane) to low- or zero-carbon alternatives (like renewable energy) in our homes and vehicles, and across our electricity grid. It can also mean electrifying—or switching from fuels to electricity.
Global warming potential (GWP)	The Global Warming Potential (GWP) was developed to allow comparisons of the global warming impacts of different gases. Specifically, it is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of carbon dioxide (CO_2). The larger the GWP, the more that a given gas warms the Earth compared to CO_2 over that time period. For example, methane's Global Warming Potential Unit is 25, meaning that, per molecule, it is 25 times more potent as a greenhouse gas than carbon dioxide.
Greenhouse effect	The trapping and build-up of heat in the atmosphere near the Earth's surface by greenhouse gases (carbon emissions). These heat-trapping gases can be thought of as a blanket wrapped around Earth, keeping the planet warmer than it would be without them. If the amount of these greenhouse gases increases, the average temperatures on the earth also increase.

Greenhouse gas	Gases that trap heat in the atmosphere like carbon dioxide, methane, and others. Also referred to as “carbon emissions”.
Heat wave	A period of abnormally hot weather generally lasting more than two days.
Imported emissions	Emissions that occur outside the city limits, especially emissions associated with the production of food and goods and then brought into the city to be used or consumed.
Industrial Revolution	A period of significant economic and social change that occurred in the late 18th and early 19th centuries. It was characterized by a shift from manual labor-based economies to machine-based manufacturing using combustible fuels. This started with wood energy and quickly moved to coal and oil as technology progressed. The industrial revolution marks the beginning of a strong increase in the burning of fossil fuels and related emissions of carbon dioxide as the population grew in concert with the rise of goods and food that helped people live longer and more comfortable lives.
Intergovernmental Panel on Climate Change (IPCC)	The IPCC is the scientific group assembled by the United Nations (UN) to monitor and assess all global science related to climate change. Every IPCC report focuses on different aspects of climate change and is the foundation for common understanding and action across the globe.
Local emissions	Emissions produced within the city limits (e.g. burning gasoline or natural gas).
Methane (CH_4)	The second most abundant greenhouse gas that is estimated to have 25 times more global warming potential than carbon dioxide. It is produced by oil and gas systems, livestock, landfills, and wastewater treatment plants.
Metric tonne (MT)	A common international measurement for the quantity of greenhouse gas emissions. A metric tonne is equal to 2205 lbs. or 1.1 US tons (short tons). See MT CO_2e definition below.
Mitigation	An action taken to reduce the human impact on the Earth’s climate by reducing, avoiding, or removing carbon emissions.
MT CO_2e	Metric tonnes of carbon dioxide equivalent ($MTCO_2e$) is a unit of measurement. The unit “CO_2e” represents an amount of a greenhouse gas whose atmospheric impact has been standardized to that of one unit mass of carbon dioxide (CO_2), based on the global warming potential of the gas. This standardized unit allows us to compare the potential warming impact of an emission of one greenhouse gas (like methane) to an emission of the same amount of carbon dioxide.
Natural gas	Natural gas is a fossil fuel energy source that is primarily made up of methane. Like other fossil fuels such as coal and oil, natural gas forms below the living carbon cycle of the earth. If released as is or is combusted, natural gas increases the amount of heat trapped in the atmosphere.

Net zero emissions	A state in which the greenhouse gases going into the atmosphere are balanced by removal out of the atmosphere for an entity, person, product, operation, or community.
Parts per million (ppm)	Number of parts of a chemical found in one million parts of a particular gas, liquid, or solid mixture. Example: a methane concentration of 2 ppm means that 2 out of every 1 million air molecules is methane.
Renewable energy	Energy resources that are naturally replenishing such as biomass, geothermal, solar, wind, ocean thermal, wave action, and tidal action. It is worth noting that not all renewable energy is zero emissions.
Renewable energy certificate (RECs)	A Renewable Energy Certificate (REC) is a tradable certificate that represents the environmental and social benefits associated with the generation of renewable energy. One REC is earned for each megawatt hour (MWh) of renewable energy generated, and can be bought and sold on markets. RECs allow individuals and organizations to support renewable energy generation and reduce their carbon footprint from electricity.
Weather	The state of the air and atmosphere at a particular time and place including the temperature and other outside conditions such as rain, cloudiness, etc.
Zero emissions	A state where no greenhouse gas emissions are produced.

SECTION 1

INTRODUCTION

MESSAGE FROM MAYOR FRANK BUBENIK

To the Tualatin Community,

The Tualatin City Council's vision statement strives for "An environmentally active, sustainable, responsible, and forward-thinking community that values and protects our natural resources, inhabitants, and habitat." It is this vision statement, paired with an acknowledgement that climate change poses an urgent challenge, both locally and globally, that drove the City Council to pursue the development of Tualatin's first Climate Action Plan in 2021.

We have already begun to experience the effects of climate change right here in Tualatin. The last few summers have been among the hottest on record. We have experienced the threat of wildfire and the harmful impacts of smoke from wildfires in the region. Extreme weather events like these take a toll on our community's health, wellbeing, and economy.

This plan provides a road map for how the community can address the current and future impacts of climate change in Tualatin. It will also help us make progress towards our emissions reduction goal of net zero carbon emissions by 2050. The actions included in the plan will help ensure that our community is a healthy, resilient, and thriving place to live now and for generations to come.

I know that climate change may seem overwhelming or alarming. However, if we act together and act now, we can help create a community that has adapted to climate change and is actively working to mitigate our negative contributions to climate change. This plan makes it clear that if we proceed on our current path, we will not meet our goal of net zero by 2050, nor will we be prepared to deal with the impacts of climate change. That is why it is crucial that we work with our neighbors, partner agencies, and community members to find creative and collaborative solutions to make meaningful progress on this urgent issue.

I hope you'll use this plan as a tool and join me in taking action as an individual and as a member of the Tualatin community.

Sincerely,

Mayor Frank Bubenik

MESSAGE FROM CITY MANAGER SHERILYN LOMBOS

Tualatin's Climate Action Plan is a testament to the community's dedication to addressing the pressing environmental challenges facing us today. This plan recognizes the gravity of the climate crisis and underscores our local commitment to translating that recognition into impactful actions.

It is impossible to ignore the severity of the climate crisis. Increasingly frequent and severe weather events, coupled with the undeniable transformation of our natural surroundings, compel us to take proactive measures to ensure the well-being of our city and its inhabitants. The urgency of the situation has resonated deeply with both our City Council and the wider community, who have voiced their support for effective climate action.

We understand that addressing the climate crisis requires more than just intentions; it necessitates a strategic, collaborative, and interdisciplinary approach. The Climate Action Plan presented reflects our understanding of this commitment, outlining strategies and actions that reflect the voice of our community and provide a blueprint for effective change.

Having had the privilege of serving as Tualatin's City Manager for an extended period, my connection and commitment to this community runs deep. It is with this connection in mind that I, and the City staff are dedicated to the success of our Climate Action Plan; we are committed to supporting the City Council's vision and priorities and seeing our city thrive.

I invite you to delve into the pages of our Climate Action Plan. I look forward to engaging in further discussions and collaborations to drive the successful implementation of the strategies and actions. Together, we can create a lasting impact that echoes through the generations to come.

Sincerely,

Sherilyn Lombos, *City Manager*

GOALS AND OUTCOMES

The goal of the Climate Action Plan is to provide the community and policy makers with an actionable roadmap for decreasing carbon emissions and adapting to climate change.

The plan provides actions that we can take to lessen the negative effects that come with climate change, such as increasing temperatures, heightened threat of wildfires and their smoke, and greater risk of flooding events. It also provides actions that can be taken to reduce carbon emissions. Addressing these actions provide our best chance at providing community benefits, such as improved air and water quality in Tualatin and more accessible relief from heat and wildfire smoke.

The plan will help decision makers understand the environmental, economic, and social costs and benefits to the community for each proposed action. It also outlines what we can expect our climate to look and feel like if nothing is done. Upon City Council's adoption of the plan, the City, community members, and local institutions will have a clearly defined, actionable roadmap to better reduce and adapt to the impacts of climate change.

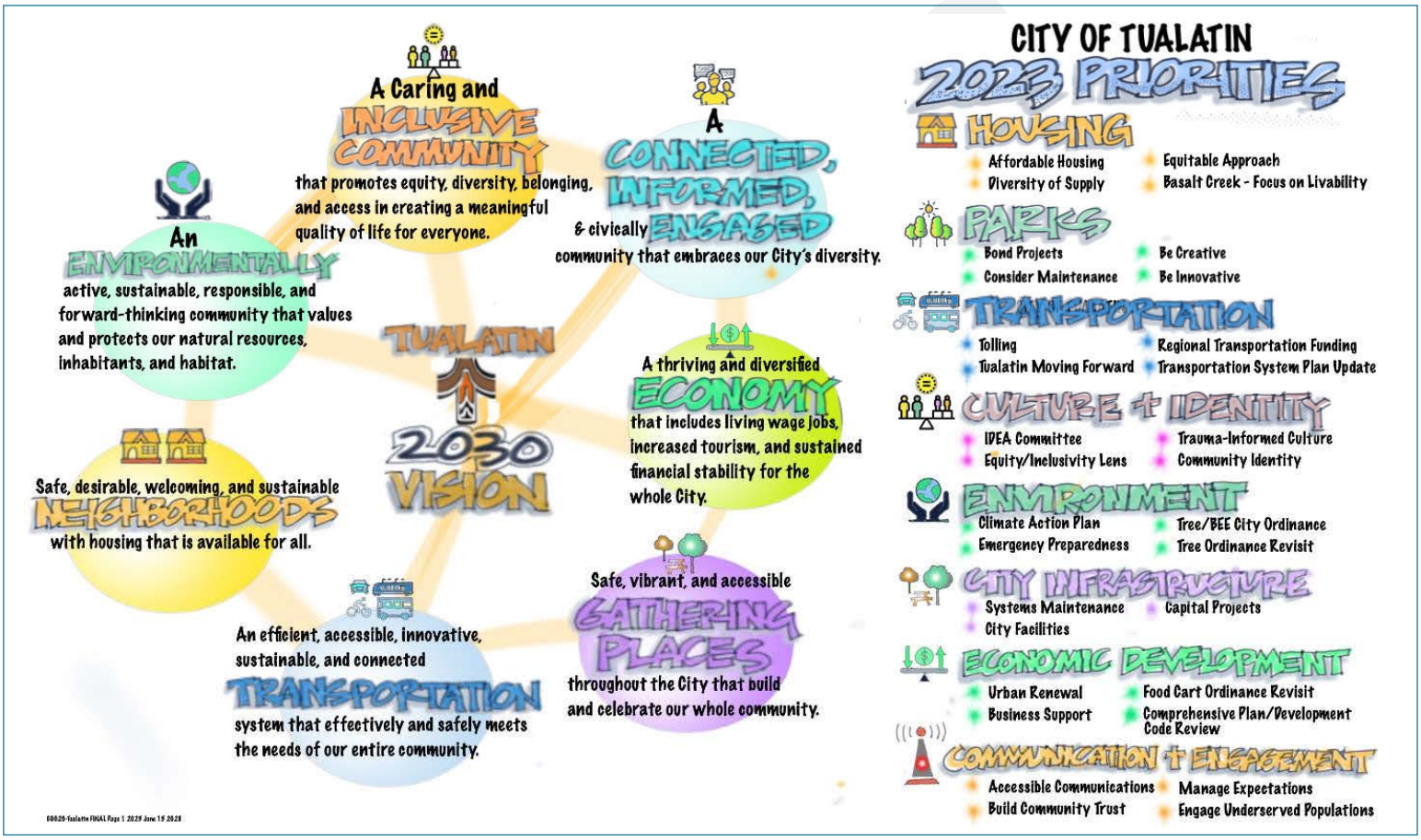

Figure 1: Illustration of Tualatin's 2030 Vision and 2023 priorities

PROCESS

Guiding principles

The development of the Climate Action Plan was rooted in four guiding principles to inform decision-making.

SCIENCE-BASED	The emissions reductions actions included in the Climate Action Plan meet or exceed existing regional and state level greenhouse gas and climate action-related policies and plans. Actions are based on the most up-to-date climate science and are proportional to the magnitude of the climate crisis.
EQUITY	The Climate Action Plan includes projected impacts on different communities and groups within Tualatin. Examples of groups within Tualatin that were considered include, but are not limited to, low-income people and families, Black, indigenous, and people of color (BIPOC) communities, students and youth, seniors, and the business community.
COMMUNITY BENEFITS	The Climate Action Plan highlights the benefits of climate action and focuses on the potential of the plan to improve community well-being.
PARTNERSHIP	The Climate Action Plan identifies actions Tualatin can take to meet its climate goals and partners that Tualatin can collaborate with to make progress towards these goals.

Our process

The Climate Action Plan was developed between January 2022 and June 2023. To ensure that the plan would be **science-based**, the project team conducted research on local climate predictions to understand how Tualatin's climate might change over time and completed an emissions inventory to identify major sources of carbon emissions in Tualatin. To foster **equity**, identify **community benefits**, and strengthen **partnerships**, the project team also engaged with community members, stakeholders, internal City staff, and the City Council to gather feedback about the plan along the way. See Figure 2 for an overview of how the plan was developed over time.

You can view a timeline showing our process in Figure 2, or read about how we developed the plan below, including:

- Research on local climate predictions
- Emissions inventory
- Community engagement
- Stakeholder engagement
- City staff review

Climate Action Plan Timeline

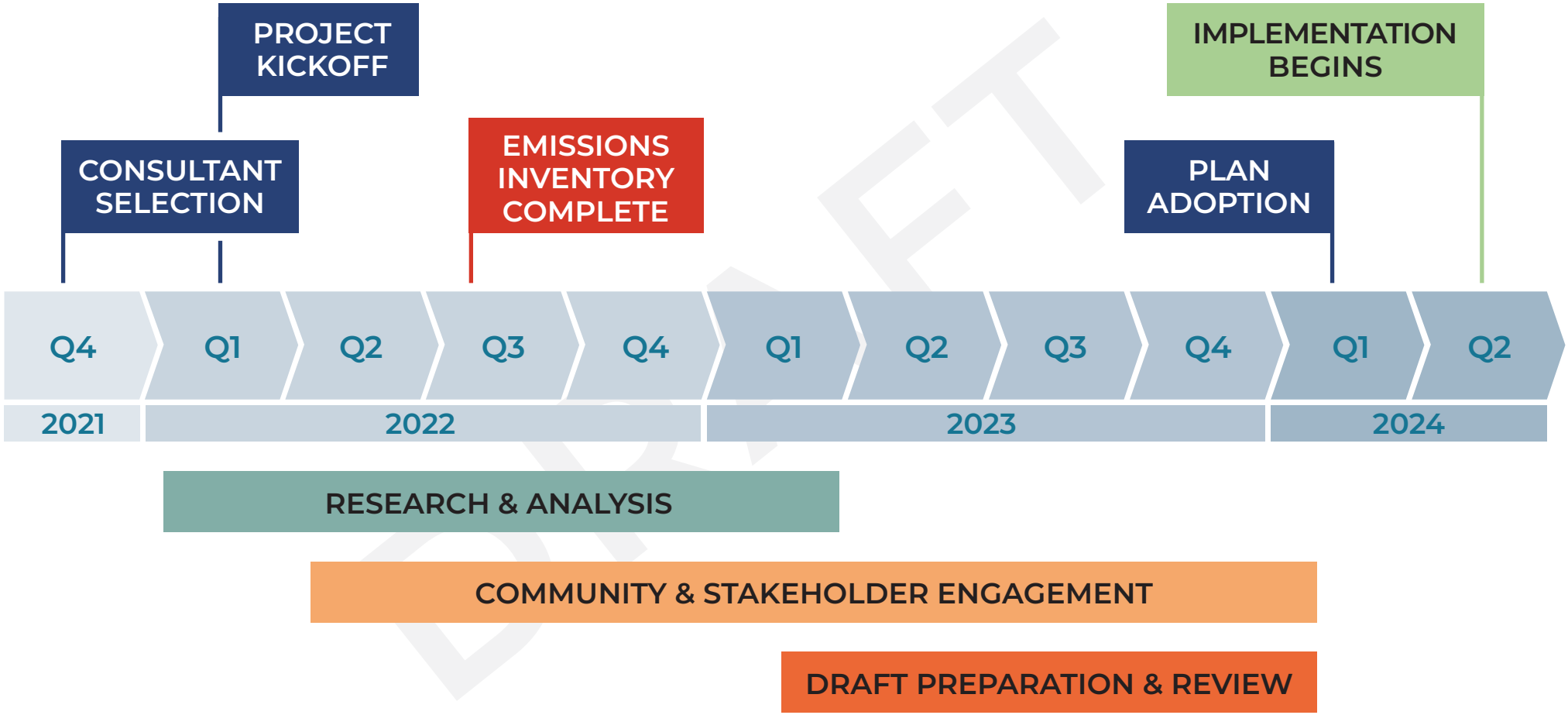

Figure 2: How the plan was developed over time.

RESEARCH ON LOCAL CLIMATE PREDICTIONS

The project team used climate models to learn more about what Tualatin's climate might look and feel like in the future under a "strong climate action" scenario and under a "no climate action" scenario. By taking strong climate action, we can limit changes. If we take no action, we will experience more drastic changes to our environment. For more information on climate predictions for Tualatin, see the Future Physical Conditions and Climate 101 Technical Reader in Appendix 1.

EMISSIONS INVENTORY

To strategically reduce our carbon emissions and fight climate change, we needed to know what our major carbon sources are. The City gathered and analyzed data to determine our community-wide carbon footprint and the major sources of carbon emissions. The inventory accounted for both emissions produced within the city limits (e.g. burning gasoline or natural gas) and emissions that occur outside the city limits because of activity within the city (e.g. emissions from farming or the production of goods).

To view the full greenhouse gas emissions inventory, see the Community Greenhouse Gas Inventory in Appendix 2.

COMMUNITY ENGAGEMENT

Community ownership is critical to the success of the plan. The project team was guided by the following public involvement goals:

- Devote energy, scope, and budget to engage diverse communities and those who historically have been left out of public planning, such as communities of color and low-income people
- Grow the relationships between the city and key stakeholders from underrepresented communities
- Be clear and transparent about decision-making at every step
- Listen to the public and follow-up
- Create accessible outreach materials and opportunities
- Be flexible

Through meaningful public engagement, the project team listened to community members who live, work, learn, and play in Tualatin and then worked to create a plan that people are able to connect with.

FIGURE 3: A community engagement board that asked participants to write down on sticky notes what concerns them most about climate change in Tualatin. Dot stickers were used to emphasize or agree with existing answers.

COMMUNITY ENGAGEMENT WAS BROKEN INTO THREE PHASES:

COMMUNITY ENGAGEMENT - PHASE 1

This phase focused on building awareness and understanding of the science behind climate change, how climate change will impact Tualatin, and what a climate action plan is.

Key themes from this phase of engagement included concerns about:

- Extreme weather
- Ecosystem and river health
- Drought and water availability
- The impacts of wildfires and smoke

Participants also expressed interest in learning more about:

- What actions have the most impact
- Electric vehicles and charging infrastructure
- Climate impacts to plants, animals, and trees
- Renewable energy sources
- How community members can work together to make meaningful changes

COMMUNITY ENGAGEMENT - PHASE 2

The project team gathered feedback on draft actions focused on adapting to climate change and reducing greenhouse gas emissions.

In terms of adapting to climate change, participants reported feeling most concerned about:

- Needing to stay home or indoors and not being able to get to work or school safely
- A potential loss of income from being unable to get to work safely
- Feelings of isolation or depression
- Power outages during extreme weather events

Participants also expressed strong interest in reducing greenhouse gas emissions by making changes at home or work, when deciding what to buy, and when traveling or commuting.

COMMUNITY ENGAGEMENT - PHASE 3

Phase 3 involved sharing the draft of the Climate Action Plan to gather feedback from the community. [insert what we heard after engagement wraps up – probably a paragraph or 2 here] Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.

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To learn more about what the community engagement process and what the project team heard, check out the Public Involvement and Communications Plan in Appendix 3.

STAKEHOLDER ENGAGEMENT

Stakeholder engagement refers to involving the individuals, groups, or entities that have significant influence or power to enact change or influence the implementation of policies. For this project, stakeholders included representatives from local businesses, transit providers, utility partners, nonprofits, state agencies, the counties, and other local government agencies.

In the June 2022 workshops, 22 individuals from 11 organizations participated in stakeholder workshops focused on adapting to climate change. Key takeaways from the adaptation-focused workshops included:

- The importance of building trust and relationships in the community
- The need for more public refuge, like outdoor and indoor shelters, to keep people and animals safe during extreme weather events
- An acknowledgement that transit is lacking in Tualatin

In the October 2022 workshops, 31 individuals from 14 organizations participated in stakeholder workshops focused on reducing carbon emissions. Key takeaways from the emissions reduction-focused workshops included:

- The City can help with identifying information gaps, educating the public, and amplifying existing programming to address carbon emissions mitigation
- There is a strong need for relationship-building to enhance partnerships, increase trust, and improve coordination between stakeholders
- A one-size-fits-all approach will not work; carbon emissions reduction strategies and actions must be tailored to the appropriate audiences and implementers with consideration for equity embedded throughout
- Policy changes are needed to achieve carbon emissions reduction goals

For more information on key takeaways from the stakeholder workshops, see the Stakeholder Workshops Summary in Appendix 4.

CITY STAFF REVIEW

The development of the Climate Action Plan was guided by the Climate Action Plan Steering Committee, a cross-departmental advisory group consisting of two city councilors and eight staff from five departments across the City who met monthly during the duration of the project.

Staff presented to the City Council seven times throughout the course of the project, both to share information and to gather the City Council's feedback.

Project team members also hosted meetings with all City departments once the plan was drafted to gather feedback from other City staff on the actions included in the draft plan.

The Climate Action Plan is the culmination of the efforts listed above.

TUALATIN'S CLIMATE GOAL AND EMISSIONS FORECAST

Climate goal

Tualatin's emissions reduction goal is net zero by 2050, which is consistent with the goal of limiting planetary warming to 1.5 degrees Celsius. This goal was selected by the Climate Action Plan Steering Committee and City Council for a few reasons.

- 1.5 degrees C of warming is the target of the 2015 Paris Climate Agreement
- As a member of the Climate Mayors group, Mayor Frank Bubenik signed a letter in 2017, alongside 465 other mayors from across the United States, in support of upholding the Paris Climate Agreement target
- This is the target most commonly adopted by other cities who have completed climate action plans
- If achieved globally, this target prevents us from going over a planetary "tipping point" of no return, which will dramatically increase the impacts of climate change

Emissions forecast

Local emissions in Tualatin are expected to decrease over time, primarily thanks to strong climate action from the State of Oregon in the stationary energy sector. **While emissions are estimated to decrease by 80%*** in 2050 compared to 2019 local emissions, without additional mitigation actions, **that is still not enough to hit our target of net zero carbon emissions by 2050 to limit global warming to 1.5°C. The Climate Action Plan includes additional actions that are needed to reach our goal.**

*Assuming that Oregon's Climate Protection Program is successfully implemented.

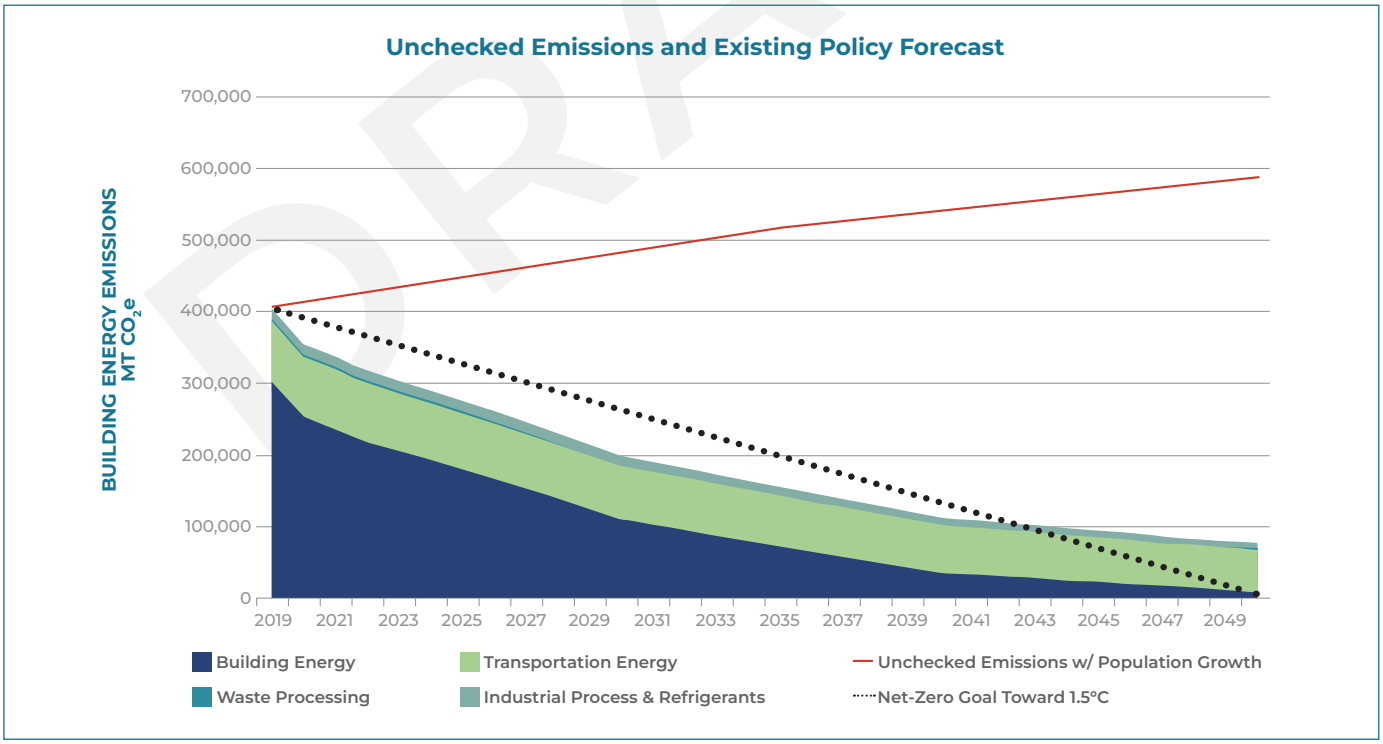


Figure 4: Tualatin's unchecked emissions forecast (the solid red line shows population growth with no policy interventions) with the existing policy forecast and a Net-Zero by 2050 trajectory (black dotted line). If Tualatin does nothing to reduce emissions, local emissions will rise by nearly 200,000 MT CO_2e by 2050. Existing policies are forecasted to significantly reduce emissions from building energy and transportation energy by 2050. However, Tualatin will not achieve our net zero by 2050 goal by relying on existing policies alone.

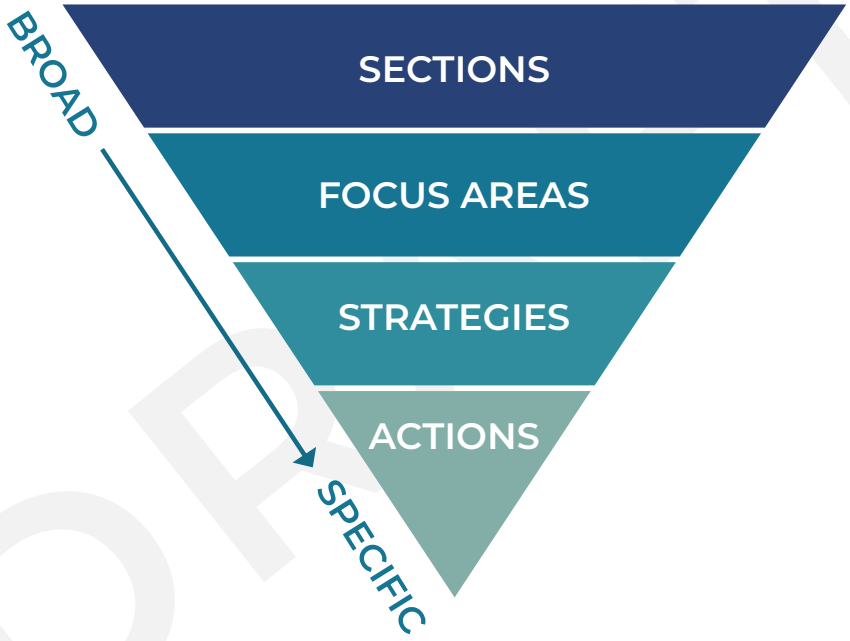
HOW TO USE THE PLAN

WHAT THE PLAN DOES This plan acknowledges that Tualatin needs to take action to meet its goal of net zero by 2050. It includes a menu of actions that Tualatin could consider taking to meet this goal.

HOW Readers can pull out the sections of the plan they are most interested in to learn about what they can do and what the City can do to address climate change in Tualatin.

HOW THE PLAN IS ORGANIZED

The plan is organized into broad ideas (sections and focus areas) that get smaller and more specific (strategies and actions).



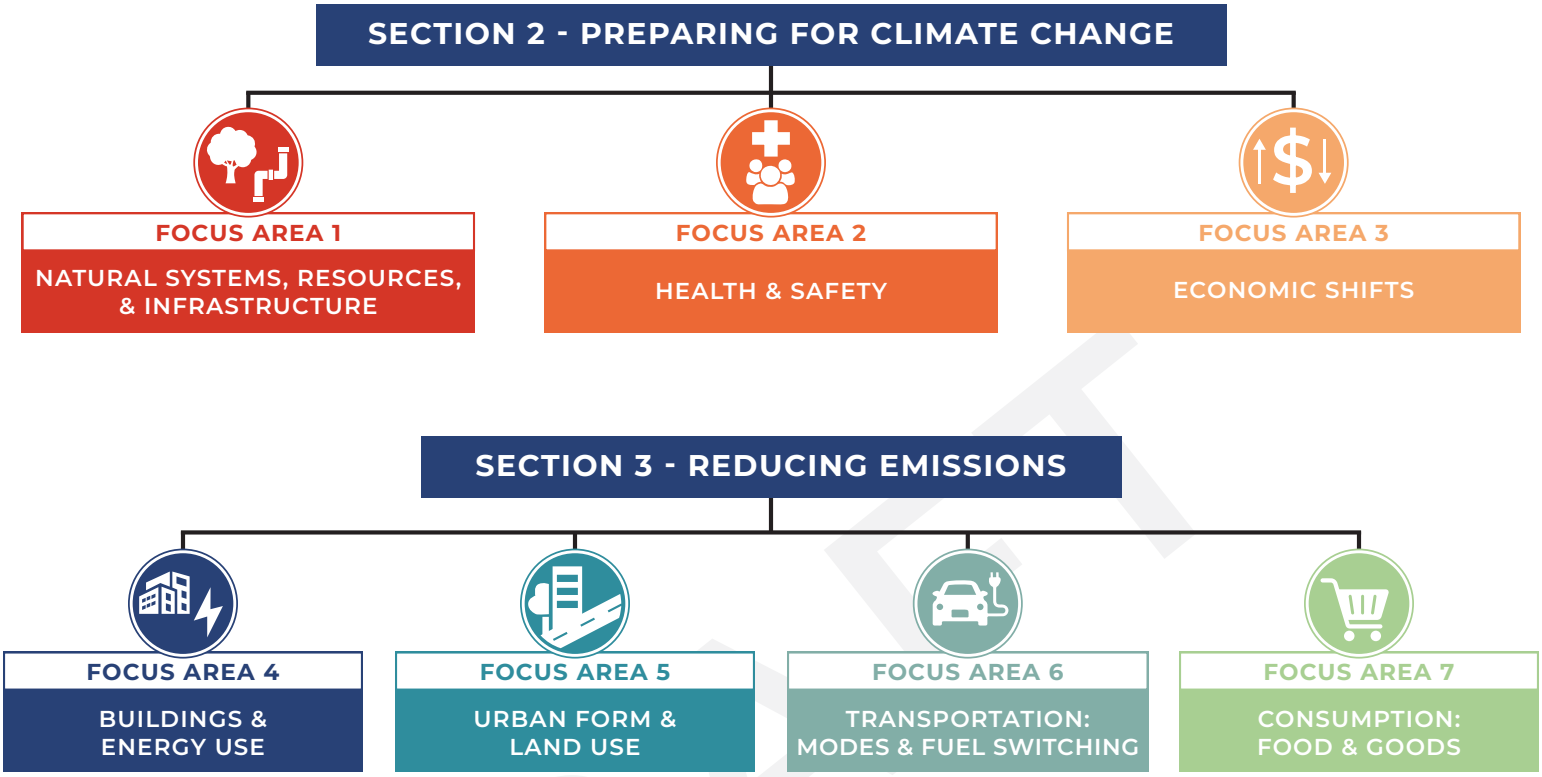
SECTIONS

Sections are like chapters in a book. Each section focuses on a different goal that the plan hopes to achieve.

SECTION 1	SECTION 2	SECTION 3	SECTION 4
Introduction	Preparing for Climate Change	Reducing Emissions	Next Steps

FOCUS AREAS

Sections are organized into Focus Areas. Each Focus Area is a grouping of strategies that aims to address climate change in a specific area of life.



STRATEGIES

Each Focus Area is subdivided into numbered Strategies. All Strategies relate to the Focus Area they fall under, but each Strategy works to capture information that is relevant to distinct scenarios (ex: heat vs smoke vs flooding). Strategies create the individual buckets that hold the plan's most detailed points, the Actions.

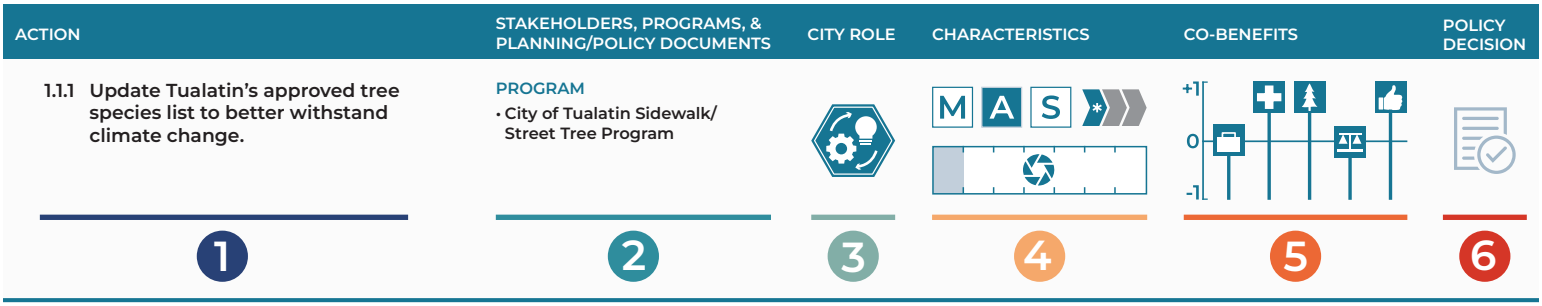
FOCUS AREA 1
NATURAL SYSTEMS, RESOURCES, & INFRASTRUCTURE

STRATEGY 1.1	Improve the resilience of Tualatin's natural systems, resources, and infrastructure to extreme heat	13 Actions
STRATEGY 1.2	Improve the resilience of Tualatin's natural systems, resources, and infrastructure to handle an increase in fire risk and smoke events.	1 Action
STRATEGY 1.3	Improve the resilience of Tualatin's natural systems, resources, and infrastructure to handle an increase in heavy precipitation events, flooding, and winter storms.	8 Actions

ACTIONS

Actions are the most specific pieces of this plan. Each action can be thought about as a "project" and each project could include planning, evaluation, community engagement, and implementation.

Actions are displayed in Action Tables that look like this:



Action Tables include five key elements:

1 Action Number & Description

Description of the action (bold text) and relevant contextual information (non-bold text).

2 Stakeholders, Programs, & Planning/Policy Documents

Identifies impacted stakeholders, potential partners, relevant programs, and planning/policy documents for the action.

3 City of Tualatin Roles

Implement
An action where the City takes the lead and has direct control, possessing or acquiring the resources to make progress.

Convene
An action where the City needs external partners to complete the action and can help by convening partners.

Support/Advocate
An action where the City primarily supports and advocates for it, but lacks direct control over the activities needed for completion.

4 Characteristics

Mitigation, Adaptation, and/or Sequestration - Will this action help people adapt to climate change, reduce carbon emissions, and/or increase local carbon sequestration?

Solid shading in the "M" box indicates mitigation actions that reduce greenhouse gas emissions

Solid shading in the "A" box indicates adaptation actions that can help community members to adapt to climate change.

Solid shading in the "S" box indicates sequestration actions that help to remove carbon from the atmosphere.

Kickoff Opportunity (years) - What is the timeframe this action could be started, given the state of the technology and resources needed to take the action?

An action that can achieve positive results in a short period of time with minimal effort or resources.

0-5 years **6-10 years** **10+ years**

Alignment with Council Vision (0-7) - How many Council vision statements does this action support?

See page 9 for the City Council's 2023 vision and priorities.

5 Co-benefits

Jobs: How does this action affect jobs in Tualatin?

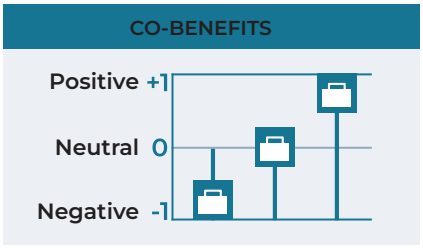
Health & Safety: How does this action affect the health and safety of Tualatin residents?

Ecosystem & Wildlife Health: How does this action benefit or harm the local ecosystems and wildlife?

Opportunity for Equity: Does this action present Tualatin with opportunities to increase equity in the community?

Community Acceptance: Does the community approve of this action?

Co-benefits are scored on a scale of negative 1 to positive 1



For example:

- A score of -1 on jobs would indicate that the action is likely to result in a net loss of jobs in Tualatin
- A score of 0 on jobs would indicate that the action is likely to have a neutral effect on jobs in Tualatin
- A score of +1 on jobs would indicate that the action is likely to result in a net gain of jobs in Tualatin.

6 Policy Decision

This action needs further discussion and a decision by the City Council in order to move forward.

Section 3 includes two additional descriptive icons

GHG benefit (# of metric tons CO_2e reduced) - How many $MTCO_2e$ can the community avoid putting into the atmosphere by taking this action?

Low (0-399,999 $MTCO_2e$) | **Medium (400,000-1,799,999 $MTCO_2e$)** | **High (1,800,000-8,000,000 $MTCO_2e$)**

Cost ($/metric ton CO_2e reduced) - How much will implementing this strategy cost per metric ton of CO_2e avoided?

$$$ significant savings (>$100/MT)

$$ savings ($10-100/MT)

$ cost neutral (-$10 to $10/MT)

$$ cost ($10-100/MT)

$$$ significant cost (>$100/MT)

SECTION 2

PREPARING FOR CLIMATE CHANGE

This section identifies climate actions aimed at helping Tualatin prepare and be resilient to the physical impacts of climate change. These actions represent important next steps to ensure that those who live, work, learn, and play in Tualatin are able to thrive.

Reducing carbon emissions (also known as "climate mitigation") is the most important action we can take to decrease the harmful effects of climate change. The faster we reduce emissions, the more we reduce the rate and scale of the changes coming. However, focusing our efforts on reducing emissions alone is no longer an option.

Oregon is already experiencing rising temperatures, long-term declines in snowpack, increasing wildfire risk, and other measurable environmental changes consistent with the effects of rising carbon emissions. These changes are expected to accelerate in the coming decades, leading to potentially significant impacts on the region's health, infrastructure, environment, and economy. As a result, we must prepare for and adapt to the impacts of a changing climate ("climate resilience") even as we work in partnership with other communities and state and federal leaders to reduce carbon emissions.

This section identifies 61 climate preparedness actions to help Tualatin prepare for the impacts of climate change and increase climate resilience. The preparedness actions included in this section were selected to address concerns of local impacts of climate change raised by community members and partner agencies who engaged with the City as a part of the planning process.

Through public engagement, the project team listened to community members who live, work, learn, and play in Tualatin and worked to create a plan that responds to community member needs and concerns.

WHAT IS CLIMATE RESILIENCE?

Resilience is a broad concept that can apply to individuals, communities, and social, economic, and environmental systems. Resilience is the capacity to cope with a hazardous event or long-term trend in ways that maintain essential identities, functions, and structures while also maintaining the capacity to learn, adapt, and/or transform. (Adapted from IPCC 2014)

WHAT WE HEARD

Community members reported feeling most concerned about:

- Needing to stay home or indoors and/or not being able to get to work or school safely due to smoke, extreme heat, and winter storms
- A potential loss of income from being unable to get to work safely
- Feelings of isolation or depression
- Power outages during extreme weather events

The project team also engaged stakeholders from state and local agencies, the energy utilities that serve Tualatin, non-profits, and businesses.

WHAT WE HEARD

Key takeaways from the adaptation-focused stakeholder meetings included the importance of building trust and relationships in the community and the need for more public refuge to keep people and animals safe during extreme weather events.

The focus on climate resilience reflects a growing recognition that climate change is accelerating and that living comfortably with the physical changes brought on by climate change will necessitate taking action through proactive planning, coordination, investment of money and resources, and information sharing within and between local agencies and community members.

CLIMATE IMPACTS IN TUALATIN

This section is intended to help readers understand the local impacts of climate change and the impact that our actions (or inactions) can have to ensure that Tualatin can become a more environmentally active and inclusive community with a thriving and diversified economy. Where possible, we share what the differences in future physical conditions will be if we and the rest of the world take action to reduce emissions (strong climate action scenario) compared to if we do not take action (no climate action scenario). For more, in-depth information about how climate change will impact Tualatin, see Appendix 1: Future Physical Conditions and Climate 101 - Technical Reader.

Climate change will impact historically underserved communities first and worst. Devoting resources to engage with, listen to, and better serve these communities moving forward will be an important commitment.

Heat

It's going to get hotter. Without climate action, Tualatin is likely to **experience a summer climate much like California's Sacramento Valley** (Figure 5) by 2080. The number of days over 90 degrees every summer are expected to increase dramatically: **from a historical average of 6 to nearly 60 by the end of the century.** In contrast, **if the world takes strong climate action, we can constrain the number of hot days to under 30.**

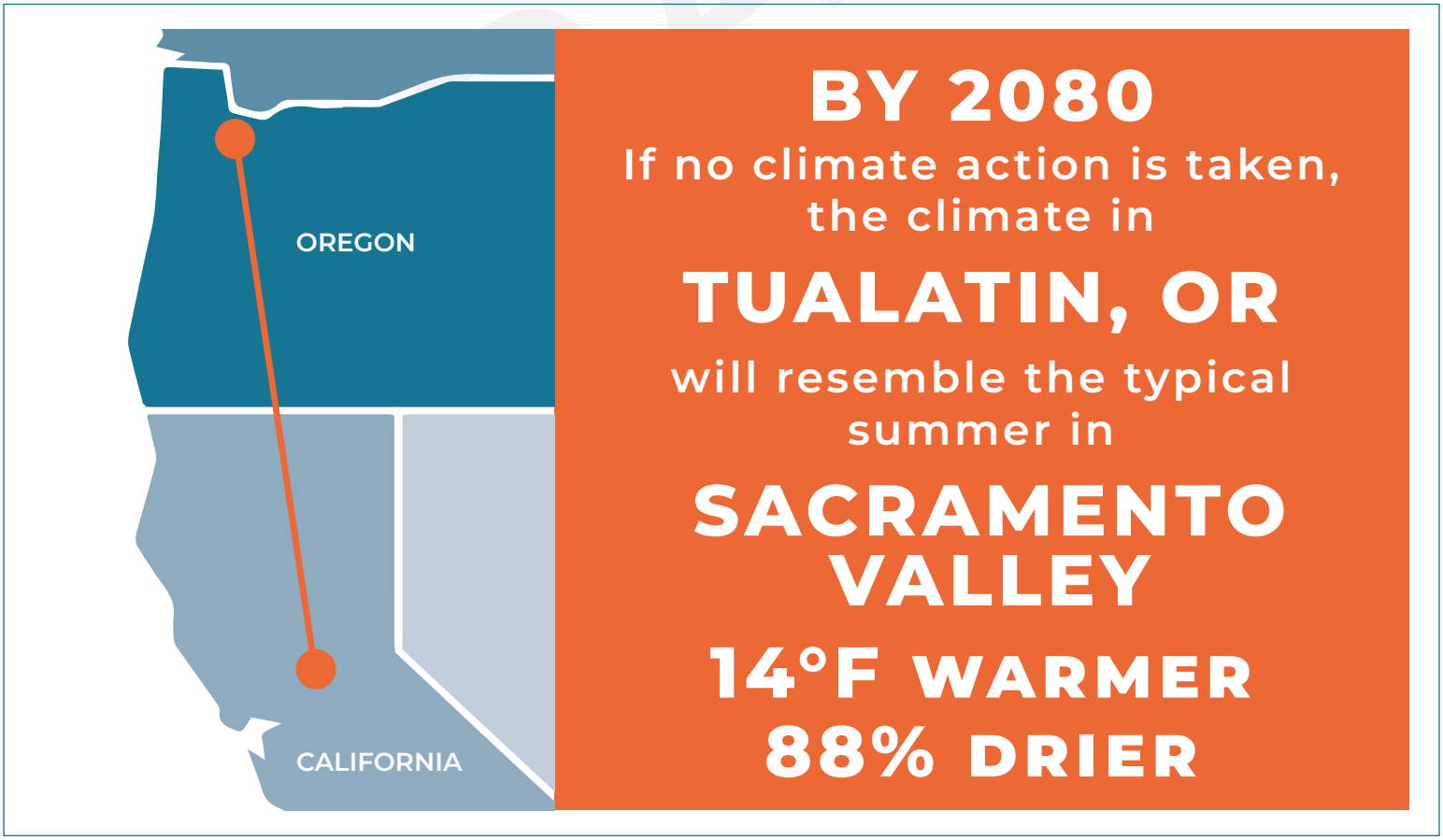


FIGURE 5: Without climate action, Tualatin's climate will feel like Sacramento Valley California's current climate.

According to the Statesman Journal, Oregon continued its pattern of historically hot temperatures in 2022, recording the 10th warmest year on record. Of the 13 hottest years recorded in Oregon, nine have come since 2000 and seven have come since 2010.

We've already begun to experience hotter summers in Tualatin. In June 2021, the Pacific Northwest experienced an extreme heat wave or 'heat dome' event. Heat records were broken across the region, as temperatures soared as high as 118 degrees Fahrenheit. Portland saw a record high temperature of 116 degrees F. Hundreds of people died across the Pacific Northwest, including 96 Oregonians.

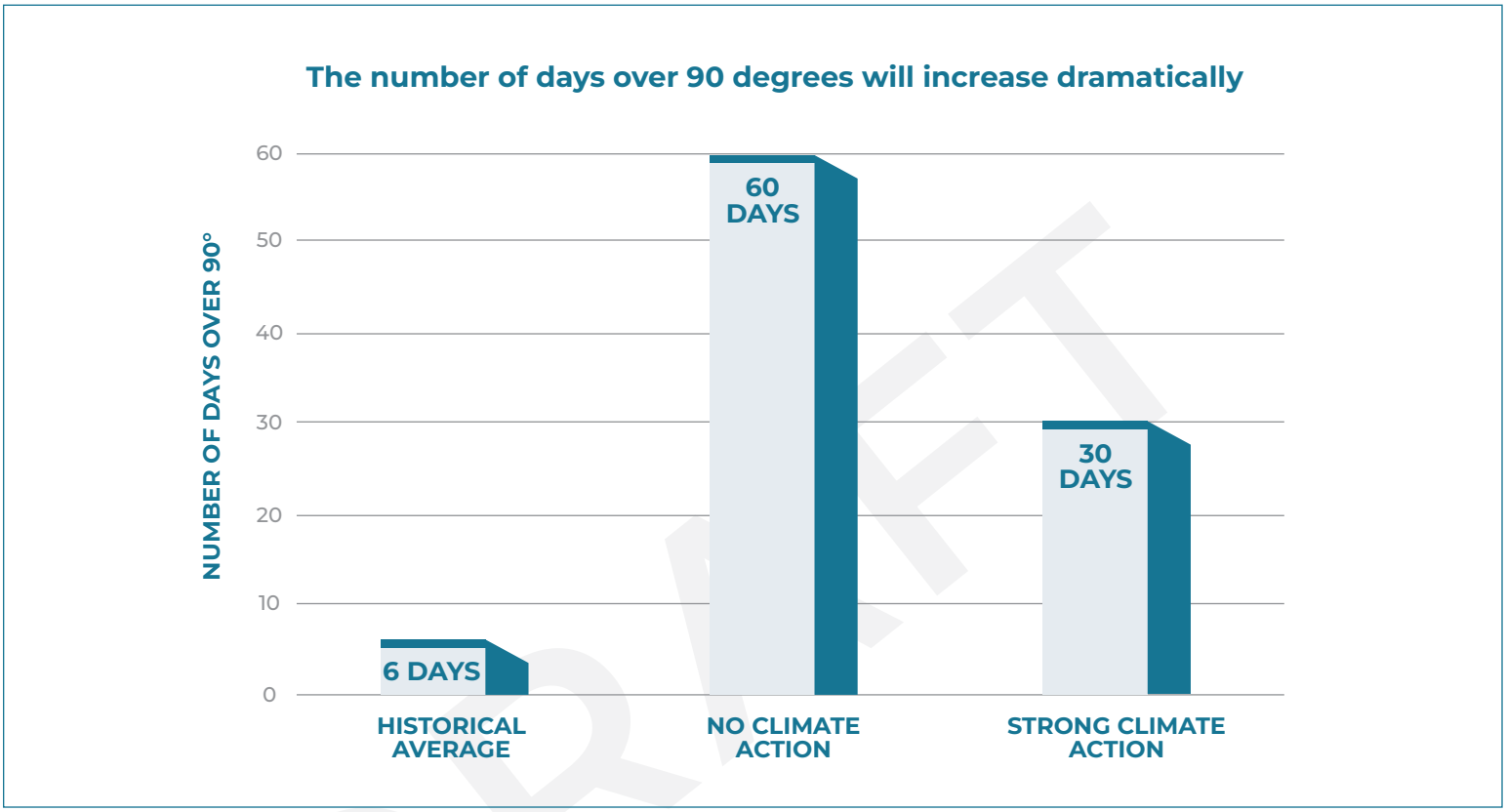


FIGURE 6: By taking strong climate action, we can help to limit the number of days over 90 degrees to 30 days each year. Without climate action, there will be about 60 days over 90 degrees each year.

> "The heat has restricted us to certain times of day when we can comfortably go outside the house in the summer time. Our air conditioner use is definitely up."
>
> **- Tualatin resident**

Fire and smoke

While Tualatin is not at a high risk for forest fires, we are at risk of smoke events from fires happening in the region. We are already seeing the devastating effects, as shown in Figure 7 (recent fire conditions), with fires around Tualatin increasing steadily in the last few years. Under the no climate action scenario, the current average of 10 days of extreme fire danger in the Portland metropolitan region will double to 20 by the end of the century. Strong climate action can decrease the number of extreme fire danger days to 17.

Wildfire smoke is expected to increase with wildfires, not just in nearby forests, but across the West. Winds carry smoke from elsewhere in Oregon, surrounding states, and even down from Canada where it settles in the valley. Smoke can cause and exacerbate numerous health conditions like acute respiratory disorders such as asthma, as well as cardiovascular disease.

The 2020 wildfire season demonstrated this when the international air quality monitoring website IQAir.com ranked Portland as number 1 for worst air quality among the world's cities in September 2020 – worse than notoriously polluted spots in countries such as India, China and Israel (NPR/OBP).

> "The wildfires from 2021 were heartbreaking and scary. With the fire approaching Oregon City, I got to the point where I started documenting items in my house for insurance purposes and packing a go-bag. It was a very scary time."
>
> **- Alexis,** *Tualatin resident*

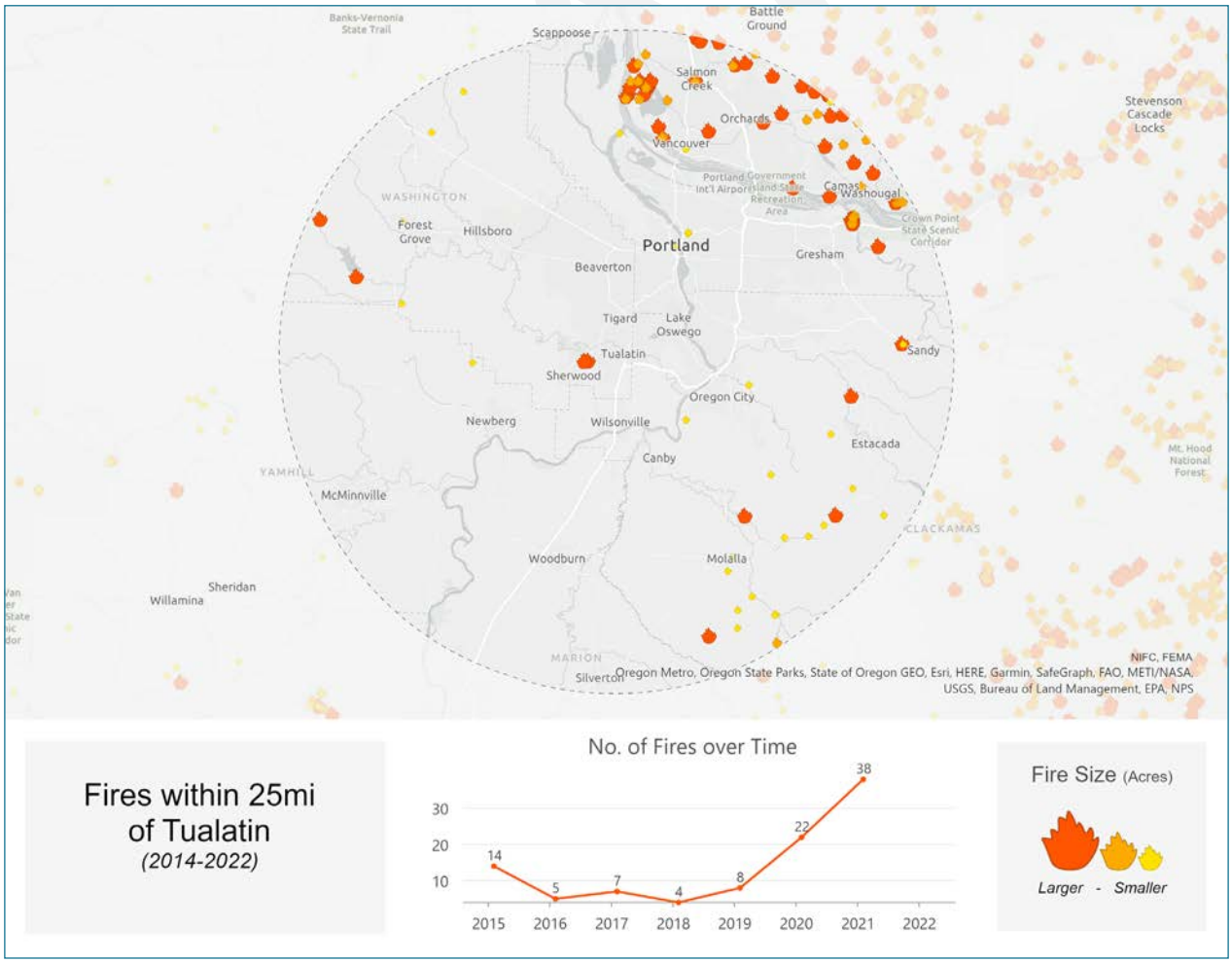


FIGURE 7: Recent wildfire conditions around Tualatin

Precipitation and flooding

Overall, annual rainfall quantities will remain nearly unchanged for Tualatin. The most noticeable change will be an increase in atmospheric rivers (also known as "rivers in the sky"), weather systems that bring large storms with heavy precipitation in short periods of time. See Figure 8 for a visual explanation of atmospheric rivers.

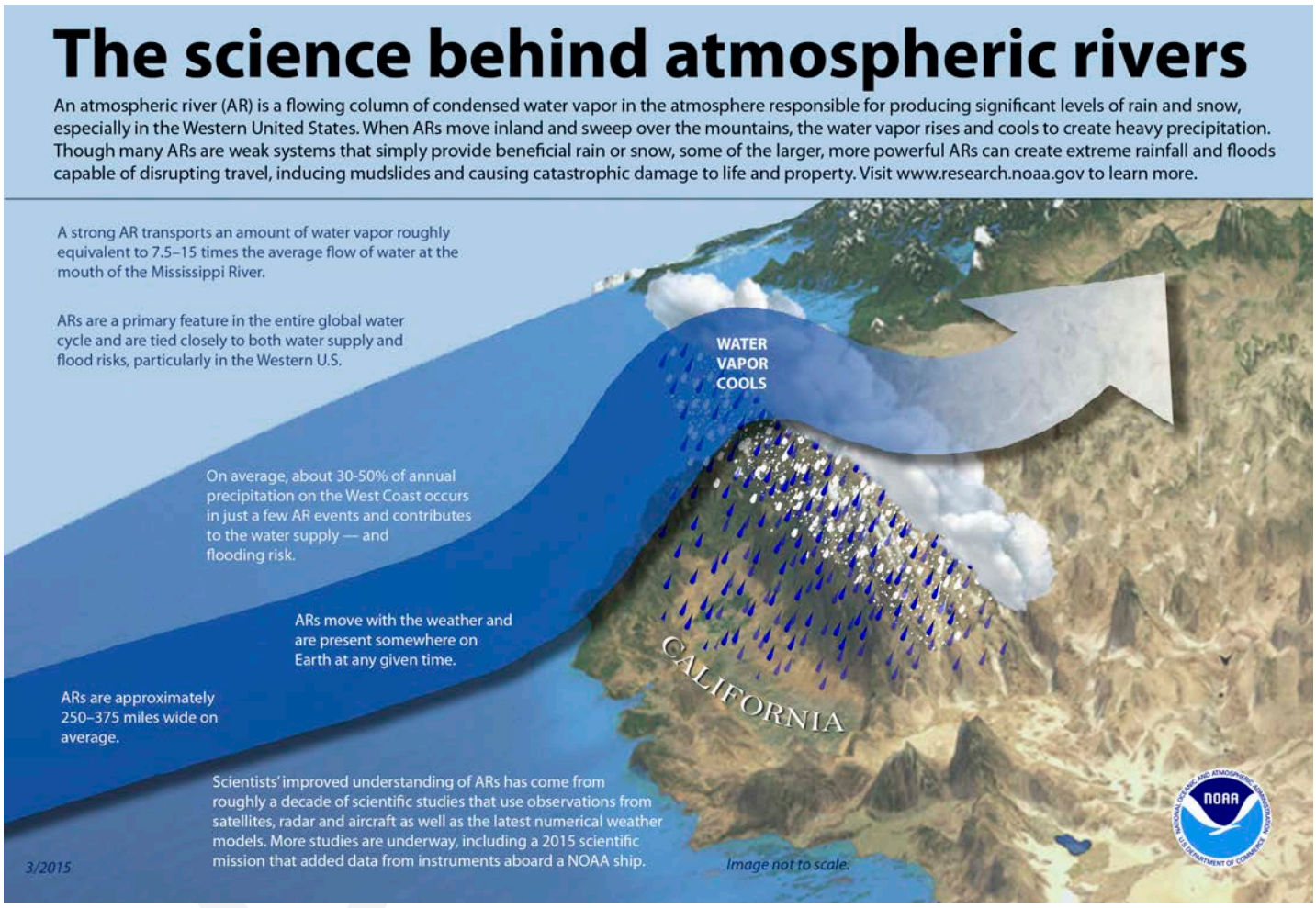


FIGURE 8: Atmospheric rivers

In the future, however, increased severity of rain events is likely to increase the likelihood and severity of flooding. The increased chance means that the blue area, which currently floods every hundred years or so, will likely see flooding much more often, every 20 to 50 years.

Flooding can have significant impacts on people's health and safety, particularly in the immediate aftermath of a flood. Floodwaters can carry harmful contaminants, such as bacteria, viruses, and chemicals, which can pose a health risk to those exposed to them. Exposure to contaminated floodwaters can cause skin infections, gastrointestinal illness, and respiratory issues. Additionally, floodwaters can hide hazards such as sharp objects, debris, and downed power lines, making it dangerous to walk or drive through flooded areas.

Additionally, this may mean that more people in Tualatin need to purchase flood insurance. It is likely that all of the places shown in pink on the map will need flood insurance, and that the premiums for those in the blue places will increase.

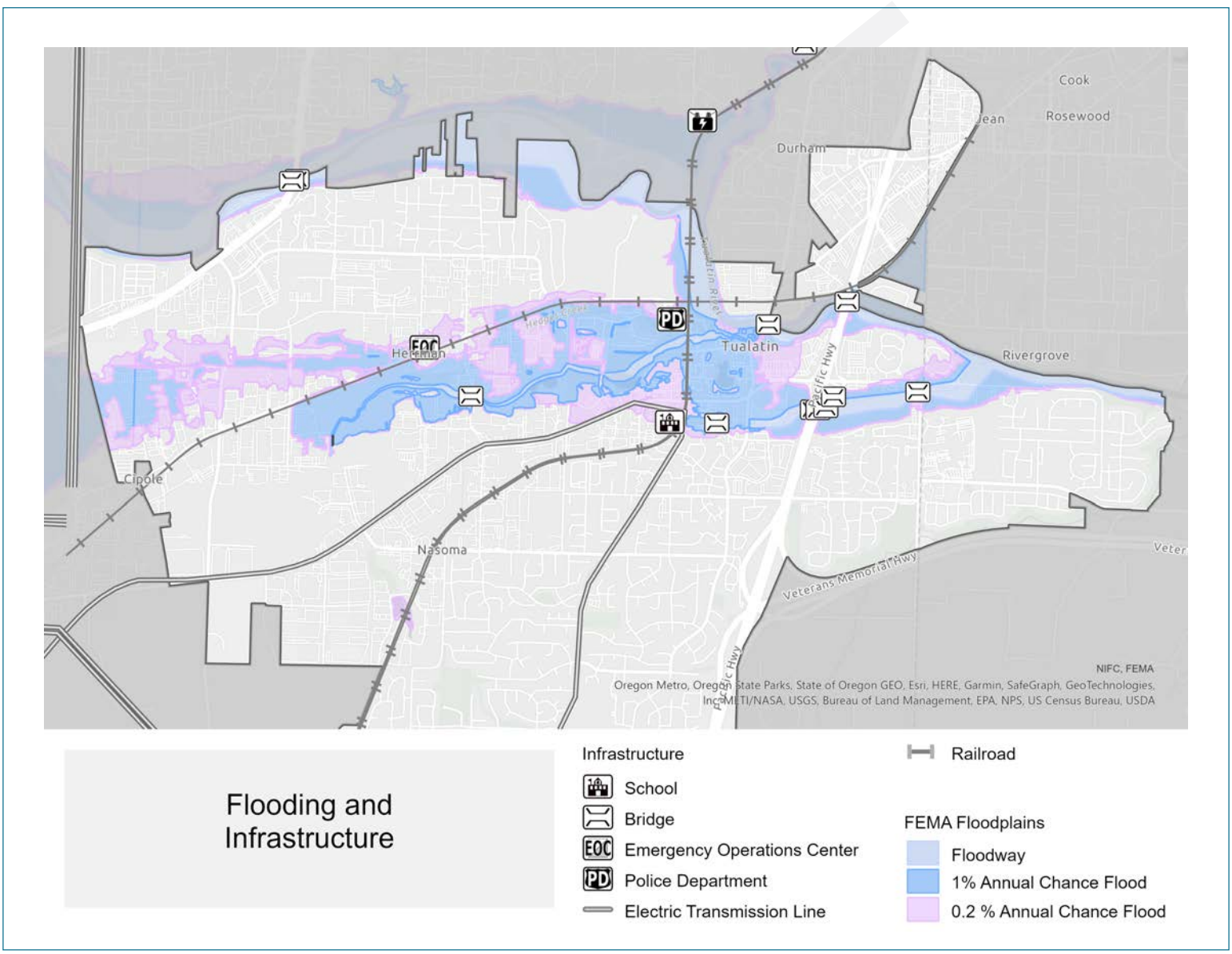


FIGURE 9: Tualatin's current flood map

THE 1996 FLOOD

Tualatin is no stranger to extreme flooding. Take the February 1996 flood, for example, in which floodwaters rose to 126.3 feet above sea level and buried downtown Tualatin under 7 feet of water. At least 29 homes, 97 multi-family units, and 85 commercial/industrial buildings in Tualatin were affected and many homeowners residing along the river were also forced to evacuate.

Volunteers, City staff, Tualatin Valley Fire & Rescue, and Federal Emergency Management Agency (FEMA) personnel joined together to evacuate neighbors, fill and distribute sandbags, and support one another. Eventually, the water receded, leaving water damage and debris in its wake. Flooding events are becoming more frequent and intense due to climate change, leaving the downtown area at heightened risk unless action is taken to prepare for these events and reduce risk. Click here to read the full Tualatin Times article.

FIGURE 10: Photos of Tualatin's downtown area during the 1996 flood.

Health impacts

Climate impacts have and will continue to impact human health. For example, we can expect more extreme heat to result in an increase in heat-related conditions, such as heat exhaustion and infectious diseases such as West Nile, Lyme, and fungal diseases. Furthermore, heat affects human health through increased stress and has been linked to increased violence in some populations. Pregnant people, people who work outdoors, the elderly, and people without access to air conditioning are at an increased risk for heat stroke and other heat related conditions.

For example, smoke from wildfires can cause poor air quality. People with asthma or other respiratory conditions may be more sensitive to and negatively affected by poor air quality. According to the Asthma and Allergy Foundation of America, the burden of asthma in the United States falls disproportionately on Black, Hispanic and American Indian/Alaska Native people. These groups have the highest asthma rates, deaths, and hospitalizations due to structural determinants of health like systemic racism, and social determinants of health, like socioeconomic status and education. See Figure 11 for a comprehensive assessment from the Oregon Health Authority that shows how climate hazards, like poor air quality, can interact with existing stress factors, like access to education, health care, and wealth, to amplify adverse effects on human health.

<table>
<tr><th>Climate-related drivers of health: environmental hazards</th><th>Stress factors: inequities in social, physical environment, cultural, and economic supports</th></tr>
<tr><td>Heat</td><td rowspan="2">Systemic inequities in policies</td></tr>
<tr><td>Infectious disease vectors</td></tr>
<tr><td>Wildfire</td><td rowspan="3">Inequities and unequal investment in social determinants of health (e.g., housing, education, income, wealth, transportation access, food security, income security, access to health care)</td></tr>
<tr><td>Air quality (e.g., pollen, wildfire smoke, smog, ozone)</td></tr>
<tr><td>Storms, floods, landslides</td></tr>
<tr><td rowspan="2">Sea level rise</td><td rowspan="2">Capacity and adaptive capacity of infrastructure, institutions, and systems to support human health (e.g., culturally specific services, surge capacity of hospitals)</td></tr>
<tr><td>Drought, water insecurity</td></tr>
<tr><th colspan="2">Effects on human health</th></tr>
<tr><td colspan="2">Hazard-related acute conditions (e.g., heat stroke, asthma attack)</td></tr>
<tr><td colspan="2">Hazard-related chronic conditions (e.g., heart disease, diabetes, respiratory illness)</td></tr>
<tr><td colspan="2">Infectious diseases (e.g., Lyme disease)</td></tr>
<tr><td colspan="2">Mental health conditions</td></tr>
<tr><td colspan="2">Adverse pregnancy outcomes</td></tr>
</table>

FIGURE 11: Climate hazards and social stress factors exacerbate negative effects on human health.

SECTION TWO: STRATEGIES AND ACTIONS

The "Preparing for Climate Change" section identifies actions the Tualatin community can to take to adapt to changing climate conditions, like extreme heat, wildfires and smoke, and precipitation and flooding. In this section, actions are categorized by strategy within each of the following three focus areas:

FOCUS AREA 1
NATURAL SYSTEMS, RESOURCES, & INFRASTRUCTURE

STRATEGY 1.1	Improve the resilience of Tualatin's natural systems, resources, and infrastructure to extreme heat	13 Actions
STRATEGY 1.2	Improve the resilience of Tualatin's natural systems, resources, and infrastructure to handle an increase in fire risk and smoke events.	1 Actions
STRATEGY 1.3	Improve the resilience of Tualatin's natural systems, resources, and infrastructure to handle an increase in heavy precipitation events, flooding, and winter storms.	8 Actions

FOCUS AREA 2
HEALTH AND SAFETY

STRATEGY 2.1	Increase preparedness and provide resources to help people who live, work, learn, and play in Tualatin better handle extreme heat events.	14 Actions
STRATEGY 2.2	Increase preparedness and provide resources to help people who live, work, learn, and play in Tualatin better handle more frequent wildfire and smoke events.	4 Actions
STRATEGY 2.3	Increase preparedness and provide resources to help people who live, work, learn, and play in Tualatin better handle the impacts of heavy precipitation events and winter storms.	14 Actions

FOCUS AREA 3
ECONOMIC SHIFTS

STRATEGY 3.1	Improve the resilience of Tualatin's businesses and workers to extreme heat.	2 Actions
STRATEGY 3.2	Improve the resilience of Tualatin's businesses and workers to handle an increase in fire risk and smoke events.	2 Actions
STRATEGY 3.3	Improve the resilience of Tualatin's businesses and workers to handle an increase in heavy precipitation events, flooding, and winter storms.	5 Actions

FOCUS AREA 1: NATURAL SYSTEMS, RESOURCES, AND INFRASTRUCTURE

Background

Climate change will put a strain on Tualatin's natural systems, resources, and infrastructure including the plants, animals, trees, the drinking water system, sewer system, stormwater system, and City parks.

As we prepare for hotter summers, wildfires and smoke, and floods, Tualatin infrastructure should be designed to handle higher temperatures and more stormwater, protecting people who spend time outside, and educating the community on how to prepare for climate hazards. The public right-of-way (streets, sidewalks, and land that is controlled by a government entity as opposed to privately owned) is already crowded and may become increasingly congested. This may make it harder to adapt to the impacts of climate change because it can be difficult to find space to provide the underground conduit needed for full electrification and undergrounding more utilities to withstand weather and increased stormwater flows.

"We're already seeing the impacts of drought and extreme heat on trees in Tualatin. Native tree species that used to thrive here, like the Western Red Cedar, are now struggling to stay healthy and we're seeing more and more of these trees die off in our parks and across the city each year."

- Tom Steiger, *Tualatin's Parks Maintenance Manager*

Strategy 1.1 Improve the resilience of Tualatin's natural systems, resources, and infrastructure to extreme heat

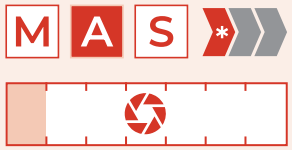
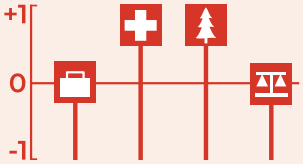
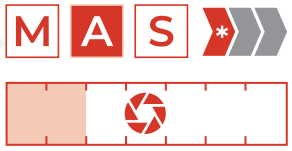
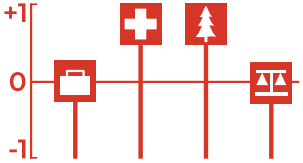
Extreme heat can negatively impact natural systems, resources, and infrastructure by contributing to drought, increasing the likelihood of wildfires, and putting strain on plants and animals. High temperatures can cause asphalt and concrete to expand, leading to buckling, cracking, and other damage to roads, bridges, and other infrastructure. Figure 12 shows how surface temperatures vary based on surface type. Cement, red brick, and blacktop (asphalt) become extremely hot when air temperatures exceed 90 degrees Fahrenheit. This can be dangerous for pets and other animals.

Time	Grass in shade	Grass in sun	Air Temp	Cement	Red Brick	Blacktop
7am	70	74	76	78	78	80
8	72	77	77	80	81	81
9	78	85	88	93	95	89
10	82	86	90	99	105	103
11	85	98	92	105	115	121
12pm	88	100	93	112	125	130
1	90	103	94	115	130	135
2	91	105	95	125	135	140
3	91	105	95	124	134	140
4	89	102	95	118	131	137
5	87	98	93	112	122	131
6	85	96	91	106	110	122
7	83	86	90	100	105	112
8	80	80 (dusk)	87	95	98	103
9	78	78 (dark)	84	90	92	93

FIGURE 12: Surface temperatures vary by surface type.

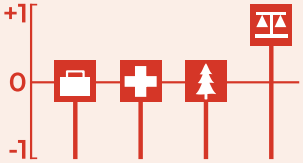
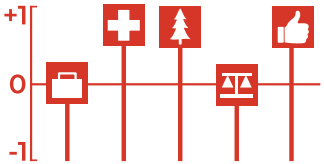
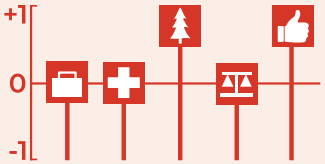
Extreme heat can also cause power outages, particularly if demand for electricity increases as people use air conditioning to stay cool. Power outages can impact critical infrastructure, such as hospitals and pumps in the drinking water system, leading to health and safety concerns. Addressing the impacts of extreme heat on Tualatin's natural systems, resources, and infrastructure will require investment in information gathering, policy changes, and information sharing.

Actions

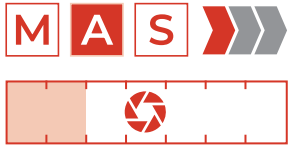
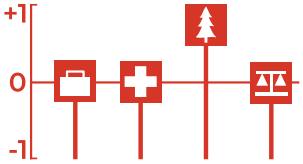
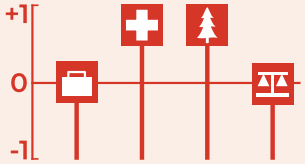
ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
1.1.1 Update Tualatin's approved street tree species list to better withstand climate change. Increased temperatures, drought, fires, precipitation, and extreme weather events are expected. Trees should be selected based on their ability to withstand these changes, their growth rate, and their resiliency to pests and disease. This action must be completed before action 1.1.2.	**STAKEHOLDERS** • City of Tualatin Public Works and Parks Departments **PROGRAM** • City of Tualatin Sidewalk/ Street Tree Program		 • Environmental		
1.1.2 Develop and conduct a communications campaign to increase awareness about drought-resistant species and street tree requirements in Tualatin. The campaign should aim to increase awareness of the updated approved street tree list (from action 1.1.1), as well as include information about the City's tree removal ordinance (TDC Ch. 33) and landscaping with drought-resistant plants to reduce water use. Communications channels could include a resource page on the City's website and print pieces for what to know about sustainable and resilient landscaping in Tualatin.	**PROGRAM** • City of Tualatin Sidewalk/ Street Tree Program		 • Connected, Informed, Engaged • Environmental		

Key

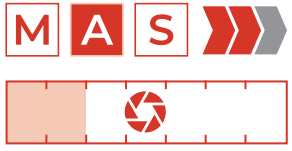
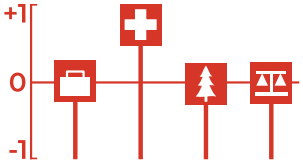
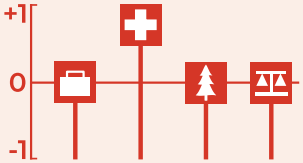
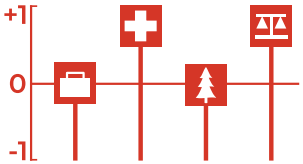
- M MITIGATION ACTIONS
- A ADAPTATION ACTIONS
- S SEQUESTRATION ACTIONS
- IMPLEMENT
- CONVENE
- SUPPORT/ADVOCATE
- QUICK START
- 0-5 YRS
- 6-10 YRS
- 10+ YRS
- YES, POLICY DECISION
- ALIGNMENT WITH COUNCIL VISION (0-7)
- JOBS
- HEALTH & SAFETY
- ECOSYSTEM & WILDLIFE HEALTH
- OPPORTUNITY FOR EQUITY
- COMMUNITY ACCEPTANCE

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
1.1.3 Conduct a canopy cover study in Tualatin to better understand gaps in canopy cover and identify opportunities to equitably increase shade in Tualatin. The study should include the entire geographical area of Tualatin, including publicly and privately owned properties.			 • Environmental		
IN PROGRESS **1.1.4 Maintain or increase canopy cover/ shade in parks, along public roadways, and on private property in Tualatin.** Consider education and incentives to help achieve this action. Prioritize active transportation mode paths and routes and high equity need areas, such as low-income residential neighborhoods and near child and/or elder car facilities. This action is supported by Strategy 5.2.	STAKEHOLDER • Friends of Trees		 • Gathering Places • Transportation • Neighborhoods • Environmental		
1.1.5 Continue partnering with the Regional Water Providers Consortium to share educational materials and resources related to water conservation and source water protection. Staff should continue to assist with the development and refinement of print and digital materials, purchase conservation-related materials through the Consortium's annual print order, and distribute these materials to community members at community destinations and events.	STAKEHOLDER • Regional Water Providers Consortium		 • Connected, Informed, Engaged • Environmental		

Key

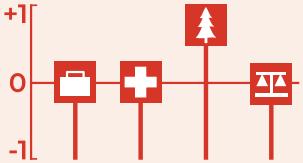
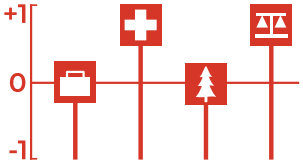
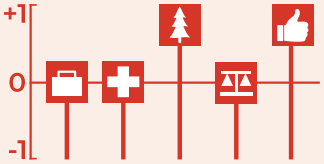
ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
1.1.6 **Consider higher future temperatures when updating Public Works Construction Code, the Development Code, and the Municipal Code** to ensure that road, water, sewer, and stormwater infrastructure and new developments are better able to withstand higher temperatures.			 • Environmental • Transportation		
IN PROGRESS 1.1.7 **Advocate for Clean Water Services to update its stormwater treatment facility species list with species that are able to withstand increased temperatures, drought, occasional snow and ice storms, and fire.** The City of Tualatin currently follows the Clean Water Services Low Impact Development Approach Handbook, specifically the Public-Private Plant List for determining which plant species to select and plant in water quality facilities. Some native plant species are under significant threat of extinction (e.g. the Oregon Ash). Discretion should be used when selecting species to plant in water quality facilities to ensure that plants and trees are likely to survive and thrive in changing climate conditions.	STAKEHOLDER • Clean Water Services		 • Environmental		

Key

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
1.1.8 Develop parking lot design standards that result in cooler, shaded lots and prevent flooding risks. This could include requiring or providing incentives for cool pavement techniques to reflect heat, increase shade cover from trees and/or solar canopies, and increase drainage, storage, and/or hardscape permeability to better manage influxes of stormwater. This action also supports Strategy 1.3.	STAKEHOLDERS • City of Tualatin Public Works and Community Development Departments		 • Environmental • Transportation		
1.1.9 Create park design standards to increase shade cover, shelter, increase the availability of drinking water fountains and water features in City parks.	POLICY/PLANNING DOCUMENT • Parks System Plan		 • Gathering Places • Environmental		
1.1.10 Work with TriMet and Ride Connection to increase shelter at bus stops. Prioritize efforts in higher equity needs areas of Tualatin. Additional shelter can provide shade in extreme heat events and cover during heavy precipitation events.	STAKEHOLDERS • TriMet • Ride Connection		 • Transportation		

Key

- M MITIGATION ACTIONS
- A ADAPTATION ACTIONS
- S SEQUESTRATION ACTIONS
- IMPLEMENT
- CONVENE
- SUPPORT/ADVOCATE
- QUICK START
- 0-5 YRS
- 6-10 YRS
- 10+ YRS
- YES, POLICY DECISION
- JOBS
- HEALTH & SAFETY
- ECOSYSTEM & WILDLIFE HEALTH
- OPPORTUNITY FOR EQUITY
- COMMUNITY ACCEPTANCE
- ALIGNMENT WITH COUNCIL VISION (0-7)

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
1.1.11 Support Clean Water Services in implementing the strategies included in their Thermal Load Management Plan. This program serves to help maintain the Tualatin River Watershed and mitigate the urban heat island effect by providing shade to reduce stream temperatures and diverting effluent through projects like purple pipe.	STAKEHOLDER • Clean Water Services		 • Environmental		
1.1.12 Increase access to water for cooling, including rivers, pools, swimming holes, and splash pads. Access issues could include number of locations, availability of transportation to those locations, hours of operation, and/or cost to use facilities.	POLICY/PLANNING DOCUMENT • City of Tualatin Parks System Plan		 • Inclusive Community • Gathering Places		
1.1.13 Protect and restore the Tualatin River watershed. The Tualatin River and the species that live in and around it are at risk from extreme heat. Protecting and restoring the riparian ecosystem can help to reduce stream temperatures, provide habitat, and provide recreation opportunities for community members.	STAKEHOLDERS • Friends of Trees • Tualatin Riverkeepers • Tualatin River Watershed Council		 • Environmental • Connected/Informed/ Engaged • Gathering Places		

Key

Strategy 1.2

Improve the resilience of Tualatin's natural systems, resources, and infrastructure to handle an increase in fire risk and smoke events

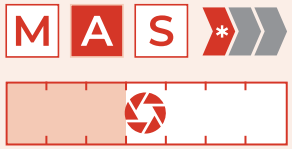
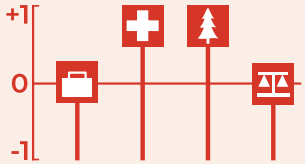
Natural systems and resources are vulnerable to the devastating effects of wildfires. Fire damage can lead to the loss of habitat and biodiversity and reduced soil and water quality. Fires can also impact infrastructure like roads, bridges, and buildings, causing damage and requiring costly repairs. While fire risk is low within the boundaries of Tualatin, these impacts may be experienced by community members who recreate or travel elsewhere in the Portland metropolitan region and in the state.

Wildfire smoke can have significant impacts on both plants and animals. Smoke can reduce the amount of sunlight that reaches the ground, which can affect the growth and productivity of plants in parks, natural areas, and gardens. It can also damage plant tissues and alter their physiology, making them more susceptible to disease and pests.

Smoke can be harmful to pets, particularly dogs and other pets that spend time outside, since smoke can negatively impact an animal's health and lead to behavioral issues. Wild animals are susceptible too since smoke can cause changes in migration patterns and feeding habits. In addition, the loss of habitat due to fires can lead to a decline in animal populations and biodiversity.

Given the far-reaching consequences of wildfire and smoke on natural systems, resources, and infrastructure, it is important to take action to prepare for fire and smoke events.

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
1.2.1 Share resources from Firewise USA via Tualatin Valley Fire & Rescue to increase community access to wildfire preparedness resources. The Firewise USA program is a global nonprofit organization that is devoted to eliminating death, injury, property, and economic loss due to fire, electrical, and related hazards. Oregon's Department of Forestry (ODF) manages the program at the state level, and ODF district offices and fire departments manage the program at the local level.	STAKEHOLDER • Tualatin Valley Fire & Rescue		 • Connected, Informed, Engaged • Neighborhoods • Environmental		

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- YES, POLICY DECISION
- ALIGNMENT WITH COUNCIL VISION (0-7)
- JOBS
- HEALTH & SAFETY
- ECOSYSTEM & WILDLIFE HEALTH
- OPPORTUNITY FOR EQUITY
- COMMUNITY ACCEPTANCE

Strategy 1.3

Improve the resilience of Tualatin's natural systems, resources, and infrastructure to handle an increase in heavy precipitation events, flooding, and winter storms

Instances of severe flooding happen in Tualatin when large amounts of water inundate low-lying areas within a short period of time. In Tualatin, this typically affects areas like Tualatin-Sherwood Road, the downtown area, and segments of Boones Ferry Road (see Figure 13). This type of flooding is typically caused by heavy rainfall – an event that is becoming more and more likely as the climate changes. The impact of severe flooding can be devastating, causing damage to homes and businesses, disrupting transportation and utilities, and putting residents at risk of injury or death.

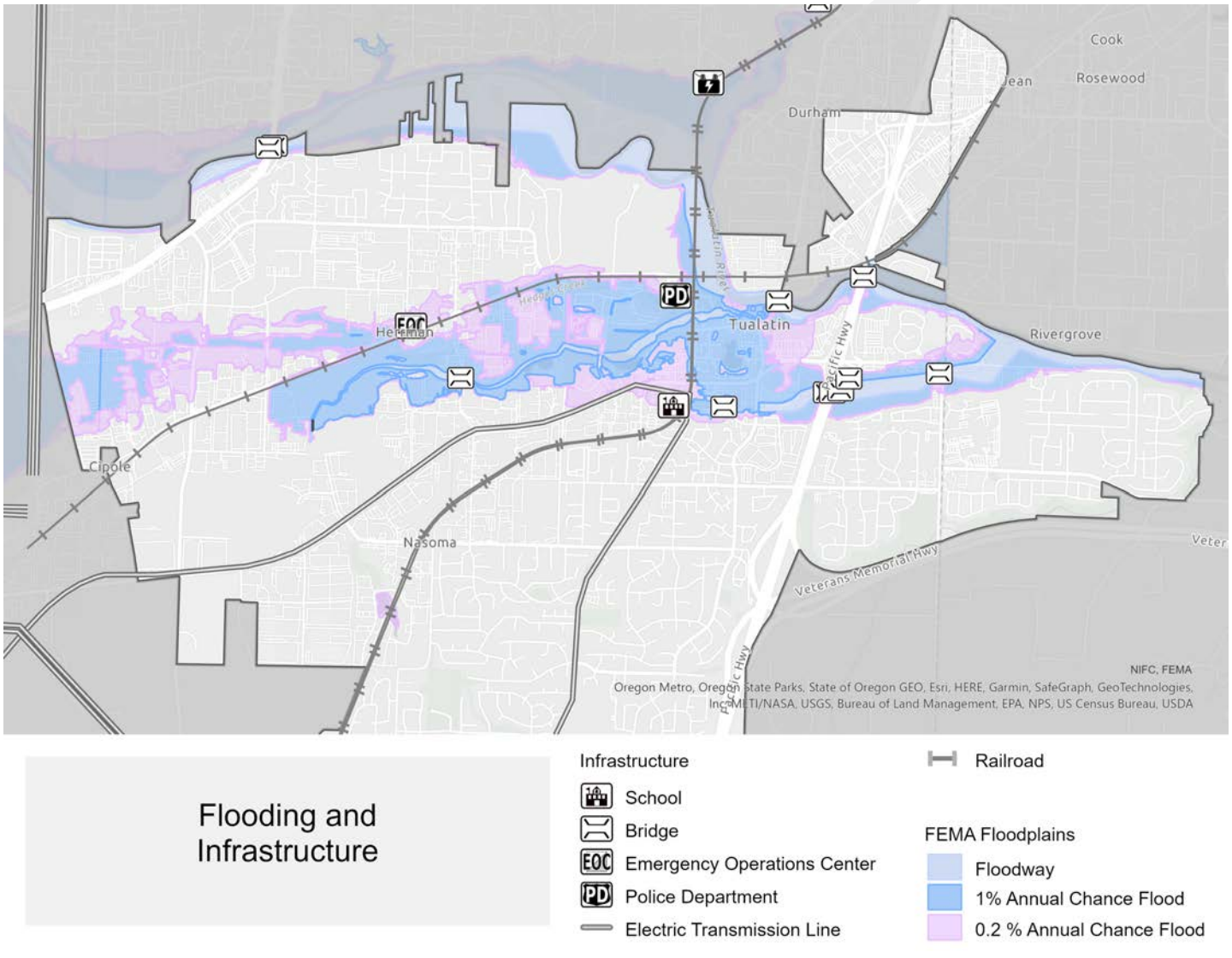
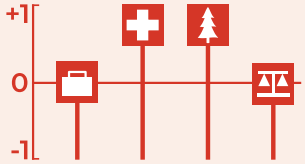
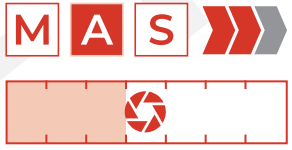
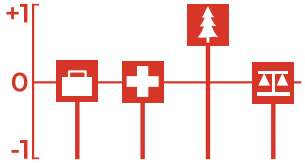
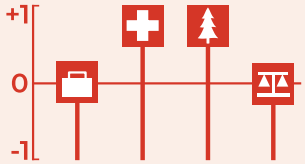
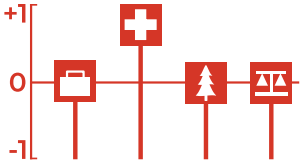
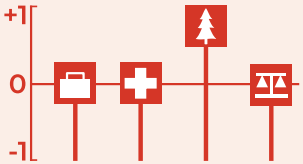
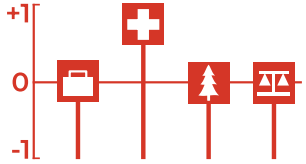


FIGURE 13: Tualatin's current flood map

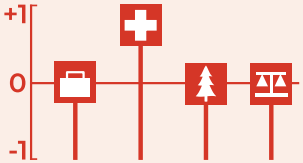
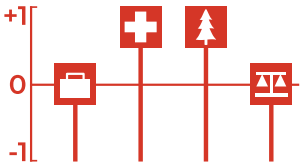
Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
1.3.1 Install backflow prevention devices in City sewer and stormwater systems as necessary to prevent flood damage.	STAKEHOLDER • City of Tualatin Public Works Department		 • Environmental		
1.3.2 Encourage property owners to increase drainage, storage, and/or permeability on private properties. One example could be lowering stormwater rates for property owners that certify that they've increased drainage, storage, and/or permeability on their properties.	STAKEHOLDER • Clean Water Services		 • Gathering Places • Transportation • Environmental		
1.3.3 Evaluate strategies to reduce flooding in floodprone areas. This could include storage tanks located under parking lots and intersections, larger stormwater facilities, etc. to better manage flood waters and protect infrastructure and people.			 • Gathering Places • Transportation • Environmental		

Key

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
1.3.4 Increase flood capacity on publicly owned lands. This could include reviewing and revising the Parks Department's levels of service methodology to be more qualitative or acquiring or alternating public land, including park land, to increase stormwater capacity. Changes to use of park land will require altering the City's charter prohibition on developing infrastructure in parks.	PLANNING/POLICY DOCUMENT • City charter		 • Gathering Places • Environmental		
1.3.5 Increase sustainability of outdoor spaces. Tools could include rain gardens, backyard habitat certification, pollinator pockets, SITES certification, etc. This action also supports Strategies 1.1 and 1.2.			 • Gathering Places • Environmental		
1.3.6 Advocate for increased grid resiliency and redundancy to minimize service disruptions as the building and transportation sectors electrify. There are concerns about the increased demand for electricity from buildings and vehicles putting a strain on the electrical grid's capacity and reliability as fossil fuels are phased out. Resiliency and redundancy efforts are needed to support the increased demand for electricity.	STAKEHOLDER • Portland General Electric (PGE) PROGRAM • PGE Smart Grid Test Bed				

Key

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
1.3.7 Enhance signage in areas where flooding may occur and wayfinding signage when sections of roadways are likely to be unpassable. The City currently has a list of known roads that tend to flood. Staff should continue to monitor and adjust this list as need arises. Consider developing a signage plan for large flooding events. This action supports Strategy 2.3.	STAKEHOLDER • City of Tualatin Public Works Department		 • Connected, Informed, Engaged • Transportation		
IN PROGRESS **1.3.8 Consider constructing large, regional stormwater management facilities to increase stormwater management capacity.** Larger facilities provide greater flood mitigation and ease development burden.	STAKEHOLDER • Clean Water Services		 • Environmental		

Key

FOCUS AREA 2: HEALTH AND SAFETY

Background

Climate change will impact the people that live, work, learn, and play in Tualatin. While all individuals will experience the impacts of climate change, some populations, like people with low incomes, people of color, young children, older adults, and people who work outside will likely experience these impacts first and worst due to existing inequities.

WHAT WE HEARD

Community members reported needing to stay home or indoors and not being able to get to work or school as their top concerns related to climate impacts in Tualatin. People were also concerned about the potential loss of income from not being able to work at full capacity during climate events, feelings of isolation and depression (especially for older community members), loss of electricity, and difficulty breathing or dangerous air quality during smoke events.

Community members also expressed interest in a City-provided resilience kit for households to help people prepare for Tualatin's likely climate hazards. Resilience kits could include information about City resources like the sandbag program to assist with the impacts of localized flooding as well as ways to stay cool at City facilities like the Library and splash pad at the Lake of the Commons. It could also include more general emergency preparedness materials like best practices for storing an emergency supply of water.

The City asked participants what help they needed to cope with the impacts of climate change. The most common suggestions revolved around financial assistance, improving or expanding City services, and information sharing. The City can play a large role in sharing relevant information in a timely manner, particularly in response to extreme weather or emergency events. Religious institutions and community leaders can also help to connect the community to important resources to keep people safe and informed.

In emergencies and extreme weather events, people look to their neighbors, family, and friends for help. Fostering strong relationships between community members and groups within Tualatin, as well as relationships with neighboring communities, is critical to increasing climate resilience in Tualatin.

FIGURE 14: Participants in the Youth-focused climate action workshop in Fall 2022.

WHAT WE HEARD

Participants in the Youth workshop were very concerned about the wellbeing of those most vulnerable to extreme weather and what they need to cope and survive. Participants were eager to help each other and create community systems of support. Several participants were interested in working with the City to implement portions of the final Climate Action Plan, which could include creating systems for mutual aid and care.

The City acknowledges that barriers, like lack of resources, time, and trust, can impact individuals' abilities to prepare for climate change. It is critical to build trust between the City and communities who have historically been marginalized and underserved. The City currently invests in the Community Emergency Response Team (CERT), a group that is dedicated to informing, training, and linking community volunteers and their neighborhoods to more effectively respond when disasters strike. It would be beneficial to use CERT as a model to continue and expand investment in building relationships with trusted leaders from communities who have historically been excluded to increase the likelihood of successful preparedness efforts across the entire Tualatin community.

FIGURE 15: Members of Tualatin's Community Emergency Response Team (CERT), a community group dedicated to informing, training, and linking community volunteers and their neighborhoods to more effectively respond when disasters strike.

Strategies & actions

Strategy 2.1

Increase preparedness and provide resources to help people who live, work, learn, and play in Tualatin better handle extreme heat events

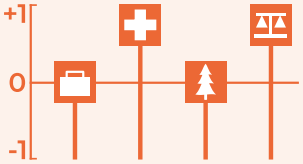
Extreme heat can lead to heat exhaustion, heat stroke, and other heat-related illnesses, particularly among vulnerable populations such as the elderly, young children, and those with pre-existing medical conditions. The additional stress caused by extreme heat can impact people's safety and well-being by leading to more crime, more human-wildlife interactions, and food spoilage.

> "The heat dome events over the last few years have shown us that the increased stress caused by extreme heat events often result in an increase in emergency response calls. As police, we recognize the importance of implementing strategies to help community members and officers stay safe during these events."
>
> **- Greg Pickering,** ***Tualatin Police Chief***

Extreme heat also increases the demand for air conditioning and other forms of cooling, leading to increased energy use and carbon emissions.

FIGURE 16: Community members cooling off at the splash pad at the Lake of the Commons.

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
2.1.1 Update Rental Housing Maintenance Standards (TMC 6-13-040) to include standards for adequate cooling. As of June 2023, TMC 6-13-040 states that, "There shall be a permanently installed heat source with the ability to provide a room temperature of 68 degrees Fahrenheit three feet above the floor, measured in the approximate center of the room, in all habitable rooms." For example, City of Tempe, AZ's code (Section 21-34) states that, "Every rental housing unit shall have cooling, under the tenant's control, capable of safely cooling all habitable rooms, bathrooms and flush toilet rooms located therein to a temperature no greater than 88 degrees, if cooled by evaporative cooling, or 82 degrees, if cooled by air conditioning."	**STAKEHOLDER** • City of Tualatin Community Development Department **PLANNING/POLICY DOCUMENT** • Tualatin Municipal Code 6-13-040		 • Neighborhoods • Environmental		

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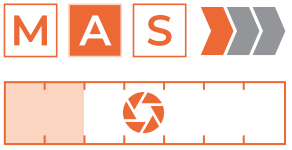
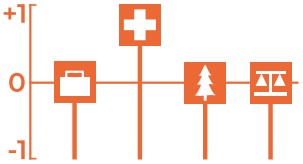
ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
2.1.2 Provide safe and reliable indoor shelters during extreme weather events, including extreme heat, freezing temperatures, and hazardous air quality due to wildfire smoke. Shelter considerations include accessibility, adequate air filtration during air quality events, places to charge phones, medical devices, and other electronics, and allowing pets. Expand access by increasing shelter hours by partnering with CERT and/or Washington County to staff shelters and expanding access by partnering with Ride Connection to increase transportation options to and from shelters. Consider additional shelter locations beyond the Library to increase access for community members not located near downtown. This action supports Strategies 2.2 and 2.3.	STAKEHOLDERS • Community Emergency Response Team (CERT) • Ride Connection • Washington County Emergency Management • Washington County Public Health		 • Inclusive Community • Gathering Places		

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- OPPORTUNITY FOR EQUITY
- COMMUNITY ACCEPTANCE

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
2.1.3 Provide safe and reliable indoor shelters for Tualatin's unhoused population during extreme weather events, including extreme heat, freezing temperatures, and hazardous air quality due to wildfire smoke. Unique considerations for offering shelter to the unhoused include building type, hours of operation, transportation, communication methods, and availability of cots or beds. Shelters must be equipped with adequate air filtration and places to charge phones and devices. Consider options to allow pets at indoor shelters in extreme weather events. This action supports Strategies 2.2 and 2.3.	STAKEHOLDERS • Washington County Homeless Services • Washington County Emergency Management • City of Tigard		M A S • Inclusive Community • Gathering Places	+1 0 -1	
IN PROGRESS **2.1.4 Share information about available shelters in anticipation of and during extreme weather events, including extreme heat, freezing temperatures, and hazardous air quality due to wildfire smoke.** Information should be shared through a variety of communications methods (e.g. social media, website, physical flyers, etc.) and should be available in both English and Spanish. This action supports Strategies 2.2 and 2.3.			M A S • Inclusive Community • Gathering Places	+1 0 -1	
2.1.5 Promote programs that provide low or no-cost air conditioners to residents in need. Target outreach towards low-income residents, people with disabilities, elderly people, and other vulnerable populations.	STAKEHOLDERS • Oregon Housing and Community Services • Oregon Health Authority • Oregon Department of Energy • Care Oregon		M A S • Inclusive Community	+1 0 -1	

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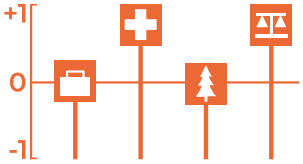
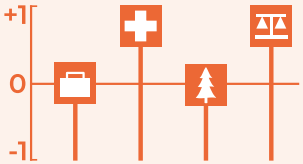
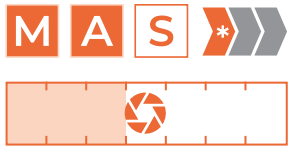
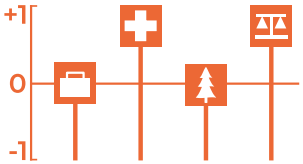
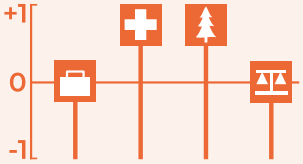
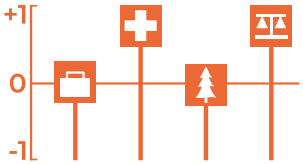
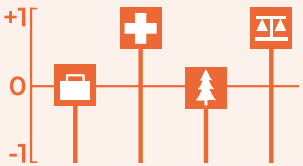
OPPORTUNITY FOR EQUITY
COMMUNITY ACCEPTANCE

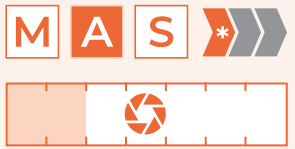
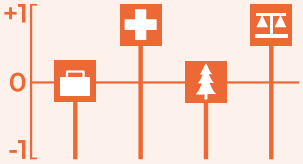
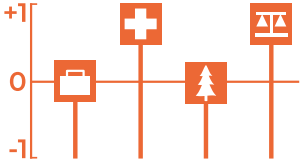
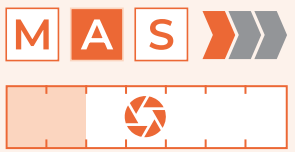
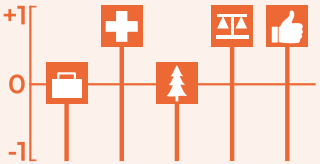
ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
2.1.6 Promote assistance programs that help residents pay electricity bills to cover the increased need for cooling (or heating, during winter storms) their homes. PGE offers resources like payment plans, payment extensions, bill due date changes, and an income-qualified bill discount program.	PROGRAMS • PGE's Income-Qualified Bill Discount • Low-Income Home Energy Assistance Program (LIHEAP) • Oregon Energy Assistance Program (OEAP) Washington County residents seeking financial assistance can apply for LIHEAP and/or OEAP via Community Action. Clackamas County residents seeking assistance can apply via Clackamas County Social Services or St. Vincent de Paul.		 • Inclusive Community		
2.1.7 Promote program options for providing financial assistance to weatherize homes for low-income residents, particularly those who live in dwellings with fewer shared walls (i.e. mobile homes, trailers, or single family homes).	STAKEHOLDER • Energy Trust of Oregon		 • Inclusive Community • Environmental		
2.1.8 Provide information and education on which energy-saving improvements (like heat pumps) people can prioritize to reduce the costs of cooling. Heat pumps can also be used for low-emissions heating of buildings, so this action also supports Strategy 2.3.	STAKEHOLDER • Energy Trust of Oregon		 • Inclusive Community • Neighborhoods • Environmental		

Key

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
2.1.9 Actively enforce the City's tree codes. Private trees are subject to TDC Ch. 33 and street trees are subject to TDC Ch. 74. The City could educate and communicate about tree code requirements and/or "fix it tickets" to encourage retaining and replanting tress. A "fix it ticket" refers to a correctable violation of the code where the fee would be waived once the citation is fixed. This action supports Strategy 5.2.	PLANNING/POLICY DOCUMENT • Tualatin Development Code (TDC)		 • Transportation • Neighborhoods • Environmental		
2.1.10 Update the City's tree code to retain or increase tree cover. Private trees are subject to TDC Ch. 33 and public trees are subject to TDC Ch. 74.	PLANNING/POLICY DOCUMENT • Tualatin Development Code (TDC)		 • Transportation • Neighborhoods • Environmental		
IN PROGRESS **2.1.11 Share emergency preparedness resources in a free, easy-to-access preparedness kit available in English and Spanish.** Preparedness information should relate to extreme weather events due to climate change (like extreme heat, wildfire and smoke, and heavy precipitation and flooding) as well as other disasters like earthquakes. This action also supports Strategies 2.2 and 2.3.	STAKEHOLDERS • Community Emergency Response Team (CERT) • Washington County Emergency Management • Clackamas County Disaster Management		 • Connected, Informed, Engaged		

Key

M MITIGATION ACTIONS
A ADAPTATION ACTIONS
S SEQUESTRATION ACTIONS
IMPLEMENT
CONVENE
SUPPORT/ADVOCATE
QUICK START
0-5 YRS
6-10 YRS
10+ YRS
YES, POLICY DECISION
JOBS
HEALTH & SAFETY
ECOSYSTEM & WILDLIFE HEALTH
OPPORTUNITY FOR EQUITY
COMMUNITY ACCEPTANCE
ALIGNMENT WITH COUNCIL VISION (0-7)

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
2.1.12 Promote the Energy Trust of Oregon's Landlord Provided Cooling Space Initiative program to provide support for cooling resources at or near multifamily housing properties.	STAKEHOLDER • Energy Trust of Oregon PROGRAM • Landlord Provided Cooling Space Initiative program		 • Inclusive Community • Connected, Informed, Engaged		
2.1.13 Incentivize developers to abide by the Oregon Residential Reach Code to ensure adequate cooling in new residential developments. As of August 2021, the Oregon Residential Reach code defines a "conditioned space" as a living space that is kept between 55-85 degrees Fahrenheit.			 • Neighborhoods • Environmental		
IN PROGRESS **2.1.14 Share information about available shelters in anticipation of and during extreme weather events, including extreme heat, freezing temperatures, and hazardous air quality due to wildfire smoke.** Information should be shared through a variety of communications methods (e.g. social media, website, physical flyers, etc.) and should be available in both English and Spanish. This action supports Strategies 2.2 and 2.3.			 • Inclusive Community • Gathering Places		

Key

Strategy 2.2

Increase preparedness and provide resources to help people who live, work, learn, and play in Tualatin better handle more frequent wildfire and smoke events

Wildfire smoke can have significant impacts on human health, particularly for those with respiratory issues or other pre-existing health conditions. The tiny particles and gases in smoke can penetrate deep into the lungs and cause irritation, inflammation, and other negative health effects. Exposure to wildfire smoke can exacerbate asthma and other respiratory illnesses, increase the risk of heart attacks and strokes, and cause coughing, wheezing, and shortness of breath. It can also worsen existing lung and heart conditions, and increase susceptibility to respiratory infections.

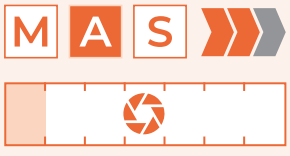
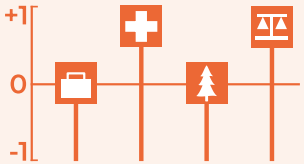
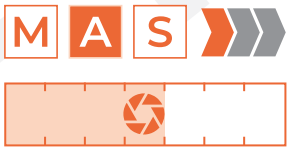
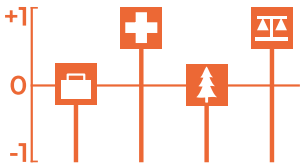
Additionally, prolonged exposure to wildfire smoke can have long-term health impacts, including reduced lung function and an increased risk of chronic respiratory diseases. It is essential for individuals living in areas impacted by wildfire smoke to take precautions, such as staying indoors and using air filters or masks, to protect their health.

Wildfire smoke doesn't impact all populations equally, and it can exacerbate existing inequities in health outcomes. Low-income and historically overburdened communities are often disproportionately impacted by wildfires and their smoke, as they are more likely to have fewer resources to evacuate or protect themselves during a wildfire and/or work outside in unfiltered air conditions. In addition, these populations may have higher rates of pre-existing health conditions, making them more vulnerable to the health impacts of smoke.

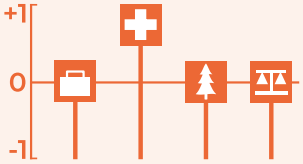
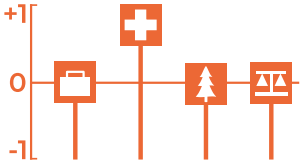
Addressing the inequitable impacts of wildfire smoke will require a multifaceted approach that includes reducing the risk of wildfires, improving access to healthcare and other resources, and ensuring that vulnerable populations have the support they need to respond to and recover from wildfires and smoke.

FIGURE 17: Photos from the corner of 108th Ave and Herman Rd. Left: During a wildfire smoke event in 2020. Right: On a clear day in May 2023.

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
2.2.1 **As they become available, promote programs that provide low or no-cost masks and HVAC filters and/or air filtration systems to residents in need.** Target outreach towards low-income residents, people with disabilities, elderly people, and other vulnerable populations.			 • Inclusive Community		
2.2.2 **Promote higher standards of air filtration in new builds and renovations to filter out hazardous particles during poor air quality events.** Advocate at the state level and consider regulating this through the municipal code.	STAKEHOLDERS • City of Tualatin Community Development Department		 • Inclusive Community • Connected, Informed, Engaged • Economy • Gathering Places		

Key

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
2.2.3 Amplify existing educational materials about fire and smoke preparedness and resilience. Utilize existing resources such as TVF&R's wildfire preparedness resources and the Oregon Health Authority's recommendations on wildfire smoke and public health. Update the City's website and provide timely information via social media and other channels during fire and smoke events.	STAKEHOLDERS • Tualatin Valley Fire & Rescue • Oregon Health Authority				
2.2.4 Amplify existing educational materials from IQAir and the Oregon Health Authority about which building air filters, face masks, and/or respirators are the most effective in filtering out harmful chemicals in wildfire smoke. Share educational materials through standard City Communications channels, and explore other options to get this information to the business community (e.g. include in a Chamber of Commerce newsletter or ask the Business CIO to share it with their members). This action supports Strategy 3.2.	STAKEHOLDERS • Tualatin Chamber of Commerce • Commercial Community Involvement Organization				

Key

Strategy 2.3

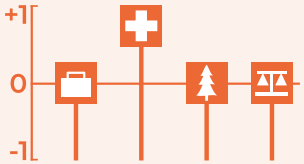
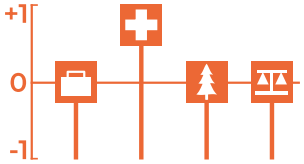
Increase preparedness and provide resources to help people who live, work, learn, and play in Tualatin better handle the impacts of heavy precipitation events and winter storms

Flooding can have significant impacts on people's health and safety, particularly in the immediate aftermath of a flood. Floodwaters can carry harmful contaminants, such as bacteria, viruses, and chemicals, which can pose a health risk to those exposed to them. Exposure to contaminated floodwaters can cause skin infections, gastrointestinal illness, and respiratory issues. Additionally, floodwaters can hide hazards such as sharp objects, debris, and downed power lines, making it dangerous to walk or drive through flooded areas.

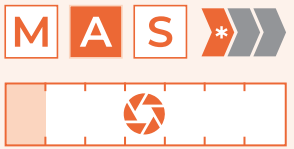
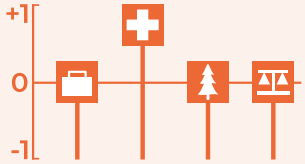
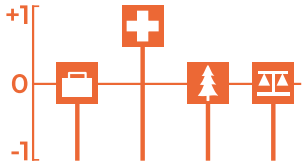
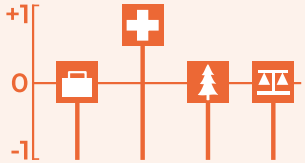
In addition to the immediate health and safety impacts of flooding, there can also be longer-term effects. Floods can lead to the growth of mold and other pathogens, which can cause respiratory issues and other health problems. Floods can also damage water and sanitation systems, leading to a lack of access to clean water and adequate sanitation facilities, which can contribute to the spread of waterborne diseases.

The disruption of daily life brought on by severe flooding can also have mental health impacts, such as stress and anxiety. Tualatin's public transit infrastructure needs to be improved to become better prepared for increased atmospheric river and flooding events. Additionally, it is important to educate and inform community members about flood preparedness, provide material or financial resources to residents, and improve coordination within and between public agencies and utilities.

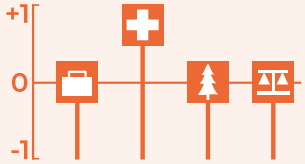
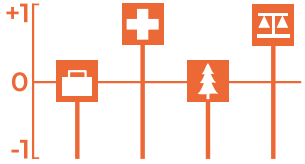
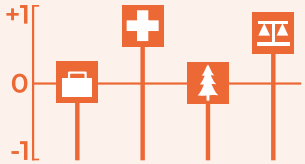
Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
IN PROGRESS **2.3.1 Improve Tualatin's river level monitoring capabilities.** Currently, Public Works staff monitor river levels using data from the Farmington gauge (FRM03), located upstream, and forecast anticipated river levels. The addition of river level forecasting for the river gauge at Community Park would allow for more accurate predictions and a more timely response.	STAKEHOLDER • National Oceanic and Atmospheric Administration PLANNING/POLICY DOCUMENT • Capital Improvement Plan		 • Connected, Informed, Engaged		
2.3.2 Share information at the start of the rainy season each year about the city's free sandbag program to help protect buildings against flooding. Materials should be translated into Spanish and the information should be made available through a variety of communications channels, including but not limited to the City's e-newsletter, social media, and/or flyers in community desinations.	STAKEHOLDERS • City of Tualatin Public Works Department				

Key

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
IN PROGRESS **2.3.3 Communicate about the City's flooding emergency response plan to inform community members about what to expect and how to prepare in the event of a major flood.** Materials should be translated into Spanish and made available through a variety of communications channels, including (but not limited to) social media, City website, and placing signs near flooded areas to alert people to dangerous areas and detour routes.			 • Connected, Informed, Engaged		
2.3.4 Communicate with community members in advance of and in response to changing conditions during winter storm or flooding events. The City already communicates about the Snow and Ice Response Plan in advance of winter storm events, and road closures due to flooding so that community members are better able to plan their commutes. Build on the work already being done and strive to make communication targeted, proactive, specific about the event taking place, bilingual, and accessible via multiple communications channels.			 • Connected, Informed, Engaged • Economy		
2.3.5 Host a evacuation/reunification planning workshop and/or share resources on how to plan for evacuation and reunification as part of the CERT preparedness fair.	STAKEHOLDER • Community Emergency Response Team (CERT)		 • Connected, Informed, Engaged		

Key

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
2.3.6 Advocate for Tigard-Tualatin School District to add bus routes to pick students who live within a mile of TTSD schools up during inclement weather events. These areas are not currently served by school buses, which typically requires these students to walk to school in the cold if schools are open during inclement weather events.	STAKEHOLDER • Tigard-Tualatin School District (TTSD)		 • Connected, Informed, Engaged		
IN PROGRESS **2.3.7 Advocate to TriMet, Ride Connection, and other transit providers to improve public transportation by increasing the frequency of transit service, add more stops, and improve shelter at stops.** More frequent and reliable transit service can help people who need or want to use transit feel confident that they will get to where they need to go on time and with less exposure to extreme weather conditions.	PLANNING/POLICY DOCUMENTS • Aligns with the Housing Production Strategy 1, recommendation 1.3b: Identify opportunities to increase transit service.		 • Inclusive Community • Transportation		
2.3.8 Improve access to the sandbag program by delivering bags to high equity needs areas, setting up multiple fill stations, and/or communicating about the program in multiple languages. Consider partnering with CERT to deliver sandbags.	STAKEHOLDER • Community Emergency Response Team (CERT)		 • Inclusive Community		

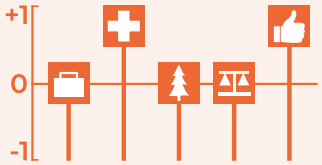
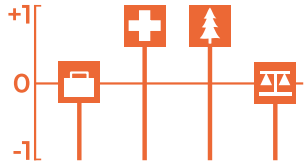
Key

M MITIGATION ACTIONS
A ADAPTATION ACTIONS
S SEQUESTRATION ACTIONS
IMPLEMENT
CONVENE
SUPPORT/ADVOCATE
QUICK START
0-5 YRS
6-10 YRS
10+ YRS
YES, POLICY DECISION
JOBS
HEALTH & SAFETY
ECOSYSTEM & WILDLIFE HEALTH
OPPORTUNITY FOR EQUITY
COMMUNITY ACCEPTANCE
ALIGNMENT WITH COUNCIL VISION (0-7)

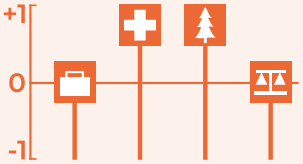
ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
2.3.9 Host a clothing drive to provide blankets and warm winter coats to community members in need during the winter months.			M A S • Inclusive Community	+1 0 -1	
IN PROGRESS **2.3.10 Provide public education about the purpose of and benefits from stormwater facilities at water quality facility sites.** Educational strategies could include signage at water quality facilities, classroom visits and presentations, and utilizing existing City communications channels.	STAKEHOLDER • City of Tualatin Community Development and Public Works Departments		M A S • Connected, Informed, Engaged • Environmental	+1 0 -1	
IN PROGRESS **2.3.11 Quickly restore City services if disruptions occur during and after extreme weather events.** Services include clearing roads of snow, ice, and debris, and repairing broken water, sewer, and stormwater system components. Revisit relevant Public Works planning documents to ensure that the City's response plans prioritize restoring services for vulnerable populations, essential goods and services, and major corridors and workplaces. This action supports Strategy 3.3.	STAKEHOLDER • City of Tualatin Public Works and Parks Departments		M A S • Economy • Transportation • Neighborhoods	+1 0 -1	

Key

M MITIGATION ACTIONS
A ADAPTATION ACTIONS
S SEQUESTRATION ACTIONS
IMPLEMENT
CONVENE
SUPPORT/ADVOCATE
QUICK START
0-5 YRS
6-10 YRS
10+ YRS
YES, POLICY DECISION
ALIGNMENT WITH COUNCIL VISION (0-7)
JOBS
HEALTH & SAFETY
ECOSYSTEM & WILDLIFE HEALTH
OPPORTUNITY FOR EQUITY
COMMUNITY ACCEPTANCE

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
2.3.12 Support utilities in quickly restoring power during and after winter storms by removing administrative barriers and streamlining the permitting process. Many of PGE's powerlines exist as overhead powerlines at this time, and therefore are at risk from exposure to extreme weather events. This action also supports Strategy 3.3. Support PGE's efforts to underground powerlines. This supports Strategies 1.1, 1.2, and 1.3.	STAKEHOLDER • Portland General Electric (PGE)		 • Economy • Transportation • Neighborhoods		
2.3.13 Change City zoning ordinances to regulate development in the 100-year flood plain. As the frequency and intensity of atmospheric river events that lead to flooding occur, the risk of flooding negatively impacting people and property increases. Limiting new development in flood-prone areas can help to reduce the risk of flood damage and safety issues, leading to cost savings (less damage) and safer communities. This action supports Stategy 3.3.	STAKEHOLDER • City of Tualatin Community Development Department		 • Economy • Transportation • Neighborhoods • Environmental		

Key

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
2.3.14 Change City code to enhance flood resilient development in flood-prone areas. Flood resilient development refers to designing and constructing buildings, infrastructure, and communities in a way that minimizes the risk and impact of flooding. It involves implementing measures that enhance the ability of built environments to withstand and recover from flood events, thereby reducing potential damage and disruption. Examples of strategies related to flood resilient development include requiring elevated foundations, conducting floodplain mapping to identify high-risk areas, and investing in green infrastructure and natural flood management practices. This action supports Strategy 3.3.	STAKEHOLDER • City of Tualatin Community Development Department		 • Economy • Transportation • Neighborhoods		

Key

- M MITIGATION ACTIONS
- A ADAPTATION ACTIONS
- S SEQUESTRATION ACTIONS
- IMPLEMENT
- CONVENE
- SUPPORT/ADVOCATE
- QUICK START
- 0-5 YRS
- 6-10 YRS
- 10+ YRS
- YES, POLICY DECISION
- ALIGNMENT WITH COUNCIL VISION (0-7)
- JOBS
- HEALTH & SAFETY
- ECOSYSTEM & WILDLIFE HEALTH
- OPPORTUNITY FOR EQUITY
- COMMUNITY ACCEPTANCE

FOCUS AREA 3: ECONOMIC SHIFTS

Background

Climate change will impact the economic system, including the production of materials, supply chain, businesses, workers, and consumers. A long-term business outreach and engagement plan could build on the business engagement that was conducted during the climate action planning process. This could include an annual Climate Action Fair to highlight green career pathways or other trade programs available, while also sharing timely information about climate hazards and preparedness strategies. Affordable and centrally-located workforce housing will continue to be needed to address an on-going issue of insufficient workforce housing options.

While climate change will disrupt the economic system in many ways, it will also provide new opportunities in the region. For example, as the climate warms, the Pacific Northwest may experience increased agricultural yields and a change in the type of crops that thrive here(Figure 18). This could provide opportunities for increased food processing in Tualatin. The Pacific Northwest will experience population growth, leading to a larger available workforce.

WHAT WE HEARD

Businesses are still recovering from the impacts of the COVID-19 pandemic and labor shortages, often resulting in minimal capacity for businesses to engage on the topic of climate change as they deal with more pressing operational needs. Business leaders expressed interest in learning more about local climate hazards and convening to proactively plan for climate impacts.

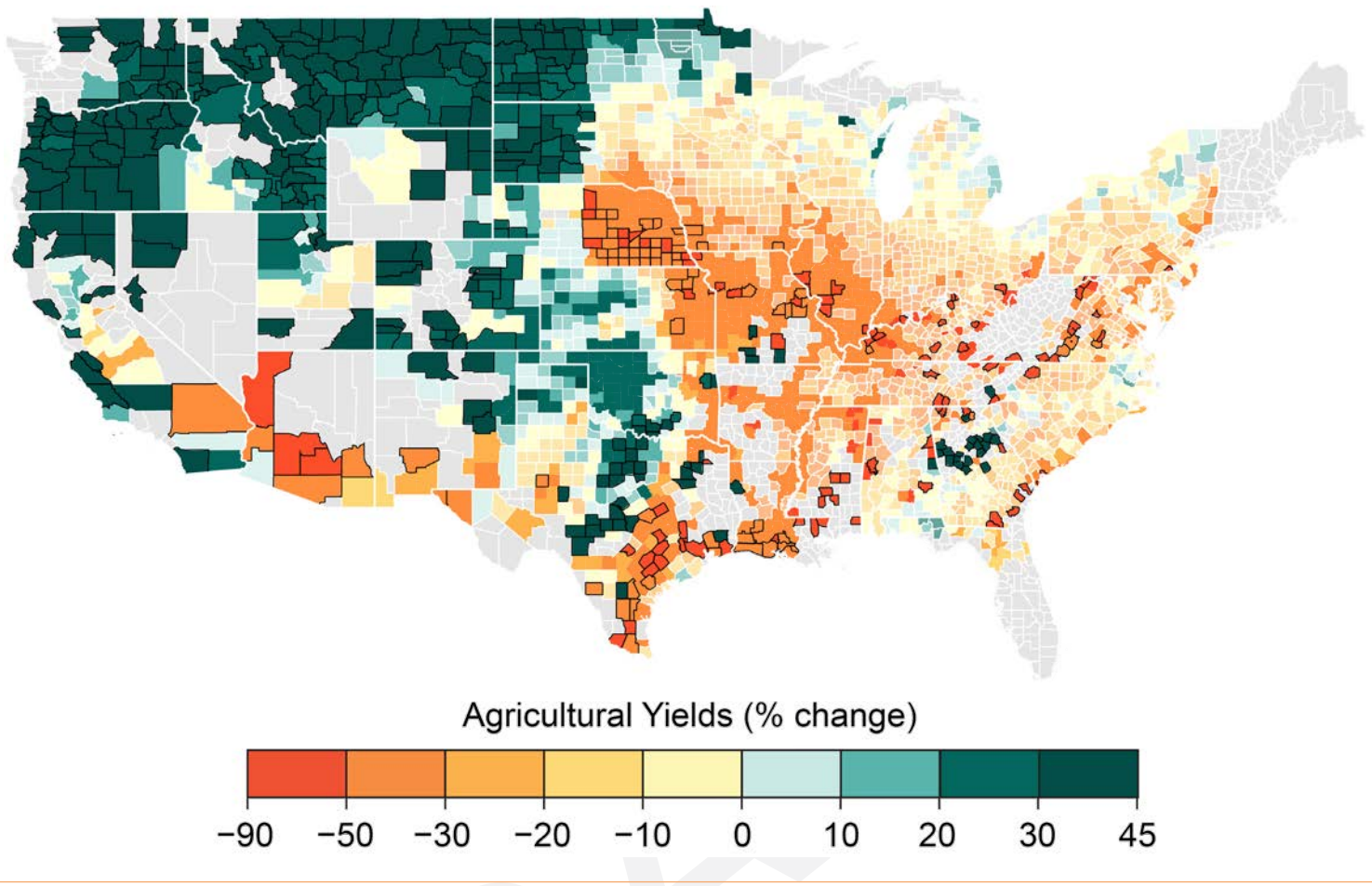


Figure 18: Projected impact of climate change on yields of corn, wheat, soybeans and cotton by the years 2080-2099. Areas where yields are projected to decline (warmer colors) include some of our current important agricultural regions, such as the Corn Belt and California's Central Valley. Agricultural yields are expected to increase in the northwest. Map source: Fourth National Climate Assessment, Figure 7.6 (Source data: Hsiang et al 2017).

Strategy 3.1 Improve the resilience of Tualatin's businesses and workers to extreme heat

Extreme heat can have various negative impacts on the economy, including damage to infrastructure and equipment that can lead to significant financial losses. More stringent worker protection rules, like OSHA's heat illness prevention rule, help to protect workers' health by requiring workers to take more breaks in certain heat conditions. Heat-related illnesses can cause absenteeism and increased healthcare costs. These factors can lead to decreased productivity and increased expenses. Moreover, industries such as manufacturing, construction, and food processing can be negatively impacted by extreme heat, leading to reduced economic activity and revenue. Taking action to prepare for extreme heat is crucial to minimizing its impacts on the economy and reducing the risk of negative heat-related impacts.

However, there are also opportunities for some sectors to benefit from hotter temperatures. In the Willamette Valley, hotter temperatures may result in increased agricultural productivity, which may provide an opportunity for more food production and distribution to occur here.

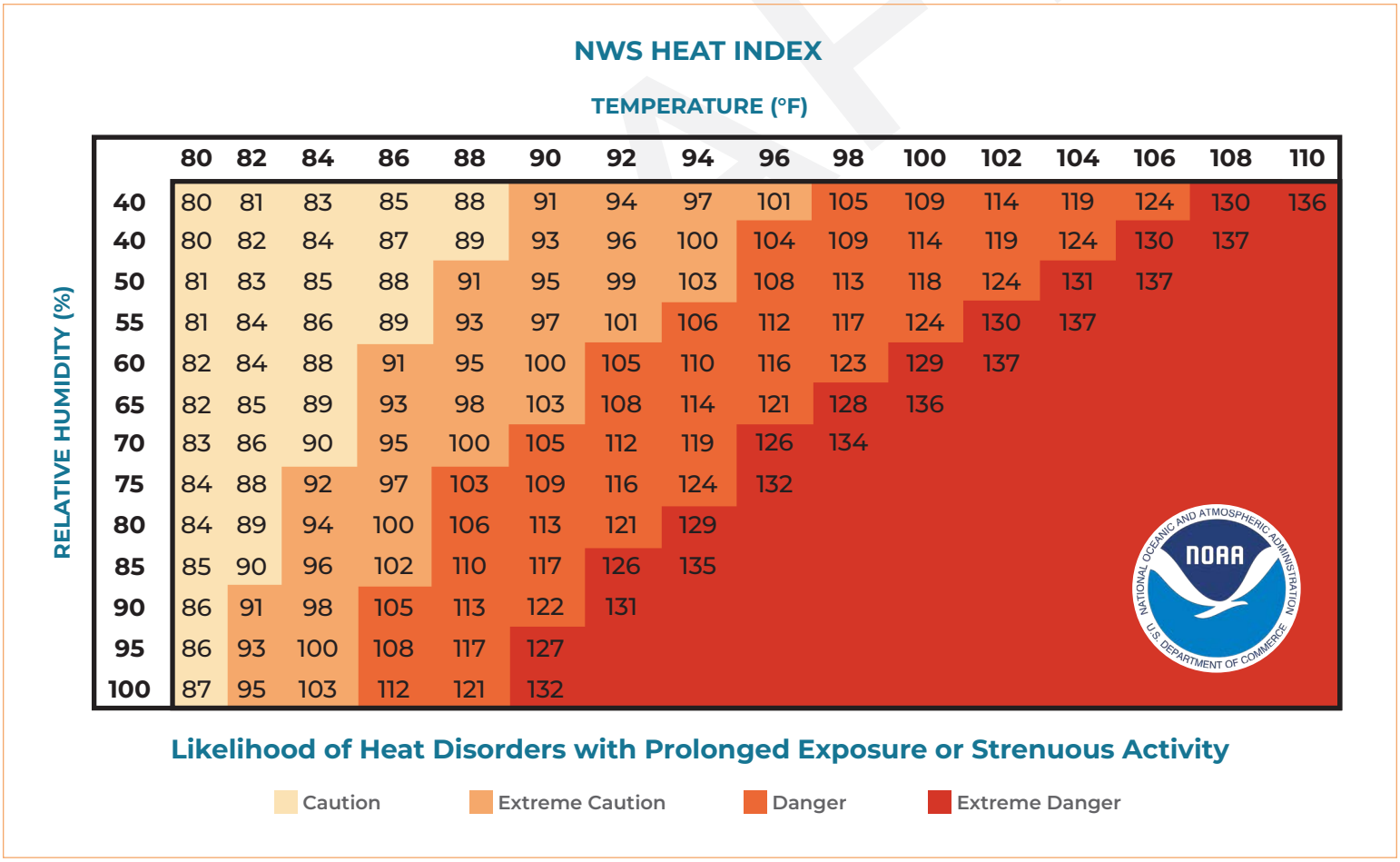
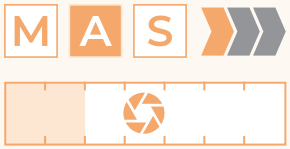
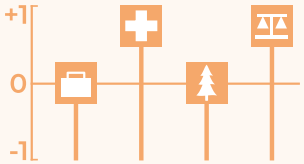
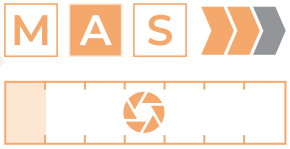
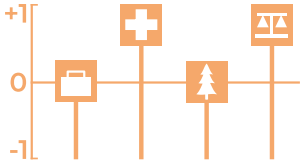


Figure 19: The heat index tells us how hot it might feel outside based on air temperature and humidity. This chart from the National Weather Service shows the likelihood of heat illness occurring with prolonged exposure or strenuous activity under various heat indices.

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
3.1.1 Advocate for OSHA to create educational toolkits that employers can use to easily understand and communicate about new OSHA rules related to safely working in extreme heat, poor air quality, and other hazardous climate-related conditions. The toolkit should be available in both digital and print formats to improve access. This action also supports strategy 3.2.	STAKEHOLDER • Oregon Occupational Health and Safety Administration		 • Connected, Informed, Engaged • Economy		
3.1.2 Update development code to require more stringent cooling requirements in commercial and industrial buildings that create a lot of heat, such as food processing, cooking, brewing, drying and curing. To incentivize these changes, the City could consider providing grants (like storefront matching grants) or incentives to encourage retail to have permanent cooling and install awnings on storefronts to increase shade and shelter.			 • Economy		

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- OPPORTUNITY FOR EQUITY
- COMMUNITY ACCEPTANCE

Strategy 3.2

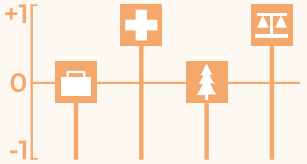
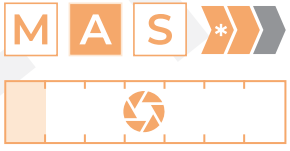
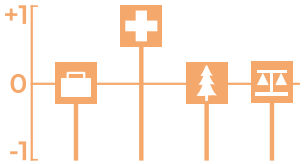
Improve the resilience of Tualatin's businesses and workers to handle an increase in fire risk and smoke events

While wildfire risk itself is quite low in most of Tualatin, we will continue to experience the impacts of fires and wildfire smoke that happen in surrounding areas and states. Wildfires and smoke can have significant impacts on businesses and the economy, particularly those that rely on outdoor activities or natural resources. The direct impacts of wildfires, such as the destruction of infrastructure and property, can result in substantial financial losses. The indirect impacts of smoke, such as reduced visibility and health concerns, can cause disruptions in transportation, tourism, and recreation industries, leading to reduced revenue and economic activity. Smoke can also impact agriculture and forestry industries, leading to reduced or damaged crop yields and timber production.

More stringent worker protection rules, like the Occupational Safety and Health Administration's wildfire smoke protection rules, can impact operations by requiring additional monitoring, and communications. Employers are required to provide high-quality masks and/or respirators under severe air quality alert conditions. In addition, the health impacts of smoke can cause absenteeism and increased healthcare costs, leading to decreased productivity and increased expenses for businesses.

The economic impacts of wildfires and smoke can be significant, underscoring the importance of effective management strategies to reduce the risk of wildfires, prepare for smoke events, and minimize impacts of these events on the economy.

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
3.2.1 Develop a financial assistance program to help businesses who are forced to reduce operating hours or close due to wildfire or smoke events.					
3.2.2 Work with the business community to better prepare for supply chain disruptions due to fire and smoke events. The business community continues to feel the impacts from the COVID-19 pandemic, labor shortages, and supply chain disruptions. Some members of the business community expressed that they were unprepared to deal with the impacts of supply chain disruptions due to wildfire and smoke events. Building awareness that these events are likely to become more frequent may help the business community to better prepare for future events.	STAKEHOLDER • Chamber of Commerce				

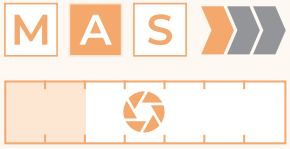
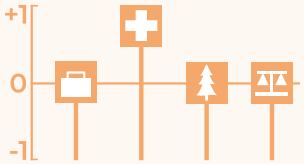
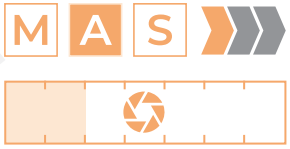
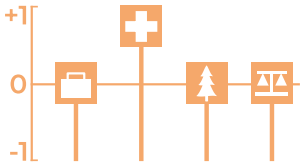
Key

Strategy 3.3

Improve the resilience of Tualatin's businesses and workers to handle an increase in heavy precipitation events, flooding, and winter storms

Extreme precipitation and flooding can have significant impacts on businesses and the economy, particularly those that are located in flood-prone areas. The direct impacts of flooding, such as property damage, destruction of infrastructure, and losing business due to a flooding-related closure can result in substantial financial losses. Floods can also cause supply chain disruptions, impacting businesses that rely on the transportation of goods or services through affected areas. Additionally, the health impacts of flooding, such as the spread of waterborne illnesses and mold, can lead to increased healthcare costs and decreased productivity. The economic impacts of extreme precipitation and flooding can be significant, underscoring the importance of effective preparedness strategies to reduce the risk of flooding and minimize its impacts on the economy.

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
3.3.1 **Work with businesses to determine the need for improved external communication in advance of a winter storm or flooding event** (e.g. communicate about the City's snow and ice response plan) **and in response to changing conditions during a winter storm or flooding event** (e.g. any road closures due to flooding), to increase safety and ensure that employees are better able to plan their commutes.			 • Connected, Informed, Engaged • Economy		
3.2.2 **Coordinate flood response and preparedness workshops with businesses in downtown area.**	STAKEHOLDERS • Chamber of Commerce • Business CIO • Community Emergency Response Team (CERT) • Core Area Parking District Board		 • Connected, Informed, Engaged • Economy		

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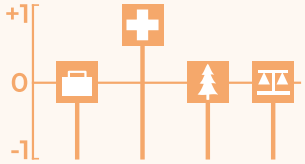
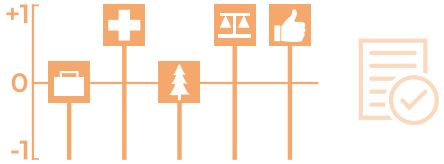
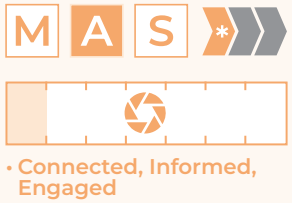
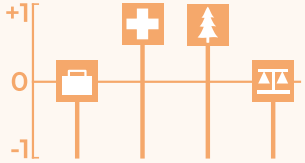
ECOSYSTEM & WILDLIFE HEALTH
OPPORTUNITY FOR EQUITY
COMMUNITY ACCEPTANCE
ALIGNMENT WITH COUNCIL VISION (0-7)

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
3.3.3 Improve businesses' access to sandbag program by delivering bags to flood prone areas, setting up multiple fill stations, and/or communicating about the program in multiple languages.	STAKEHOLDER • Community Emergency Response Team (CERT)				
3.3.4 Provide Minority/Women Business Enterprise (MBE/WBE) businesses and small businesses access to alternative power sources, like generators, during power outages. Members of the business community expressed how detrimental power outages can be to their livelihoods and the success of their small businesses. The City could consider purchasing additional generators to have on hand for minority owned and small businesses to 'check out' in the event of a power outage.					
3.3.5 Enhance outreach and education through the Private Water Quality Facilities Program.	STAKEHOLDER • City of Tualatin Community Development Department				

Key

SECTION 3

REDUCING CARBON EMISSIONS

It is crucial to rapidly reduce carbon emissions to address climate change. Section 3 includes an overview of climate science, Tualatin's carbon emissions inventory results, and actions the Tualatin community can take to reduce carbon emissions across four focus areas: buildings and energy, urban form and land use, transportation, and consumption.

Some emissions reduction strategies can have bigger impacts than others. Strategies were analyzed in terms of their carbon emissions reduction potential to help decision-makers and community members identify which strategies are likely to have the most impact. Kickoff opportunity timeframes for the actions that support each strategy were also identified, and were based on the the availability of technology and resources needed to implement each action. To reach Tualatin's emissions reduction goal, it is important to prioritize strategies that have a large carbon emissions reduction impact and can be taken on quickly. Co-benefits are also identified to help decision-makers prioritize which strategies and actions to take on first given capacity and budget constraints.

CLIMATE 101 – HOW DOES CLIMATE CHANGE HAPPEN?

This section explains the basics of the science behind climate change and how human activity has altered the climate rapidly over a very short time.

The greenhouse effect

The atmosphere is a thin layer that extends about 7 miles off the surface of earth – or the cruising height of most commercial jets. If the earth were the size of a basketball, the atmosphere would be about the size of a layer of plastic wrap around the ball. Light from the sun passes through the atmosphere. Some of that light is reflected back into space. The rest of the light is trapped as heat within the atmosphere by carbon dioxide and other greenhouse gases, warming the earth and the oceans.

The more carbon dioxide and other greenhouse gases in the atmosphere, the more heat is prevented from escaping the earth and the hotter things get. It should be noted that this is not the same as the ozone layer, which filters out ultraviolet radiation, but does not interact with heat in the same way.

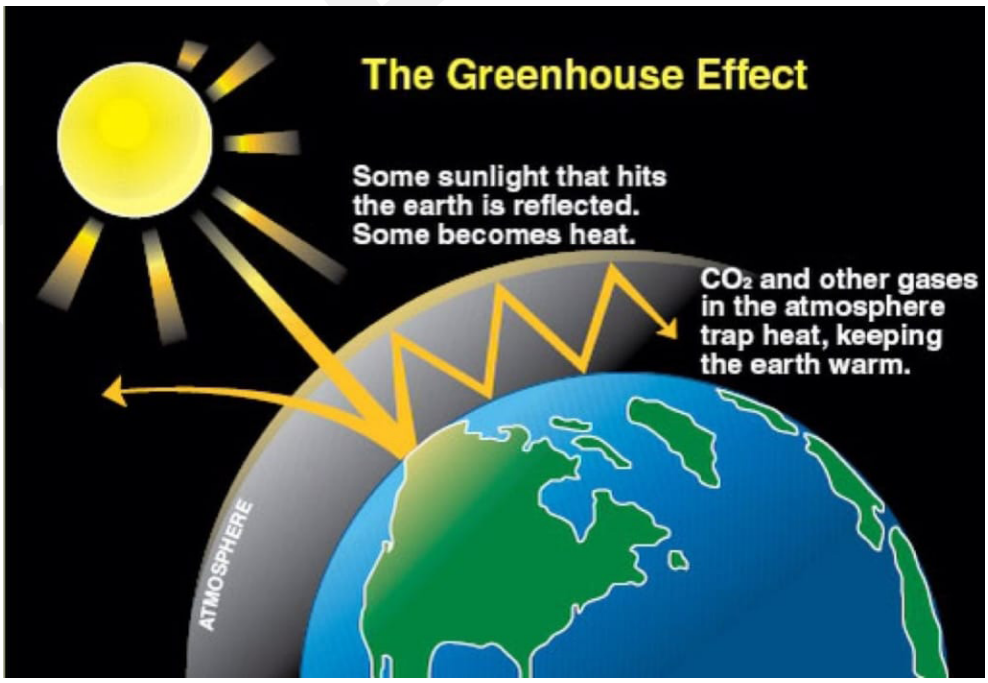


FIGURE 20: The greenhouse effect is a result of carbon dioxide (CO_2) and other greenhouse gases in the atmosphere trapping heat, which warms the earth over time (note: the atmosphere is not drawn to scale. The atmosphere is far thinner than is depicted here). Figure created by Aaman Kler.

WHAT ARE GREENHOUSE GAS EMISSIONS, CARBON EMISSIONS, AND CARBON POLLUTION?

Greenhouse gas emissions refer to the release of gases into the atmosphere that trap heat and contribute to the greenhouse effect. These gases include carbon dioxide, methane, nitrogen oxides, and fluorinated gases. Human activities such as burning fossil fuels, deforestation, and industrial processes are the primary sources of greenhouse gas emissions.

Carbon emissions specifically refer to the release of carbon dioxide (CO_2) and methane (CH_4) into the atmosphere. Carbon emissions are a significant contributor to greenhouse gas emissions. These are different than air toxins – which are regulated under the Clean Air Act, but have a local effect.

Carbon pollution is another term used to describe the release of carbon dioxide into the atmosphere. It is often used in the context of the negative environmental impacts of carbon emissions, particularly their contribution to climate change.

This plan uses these three terms interchangeably.

Causes of climate change

When coal, oil, gas, diesel or propane are burned, they release carbon that has been trapped underground for millions of years – increasing the concentration of carbon in the atmosphere far beyond the natural balance where the vegetation and oceans can reabsorb it at the same rate. The increase in the use of fossil fuels as the primary energy source since the industrial revolution has increased the concentration of carbon dioxide in the atmosphere quickly (Figure 21), leading to climate change.

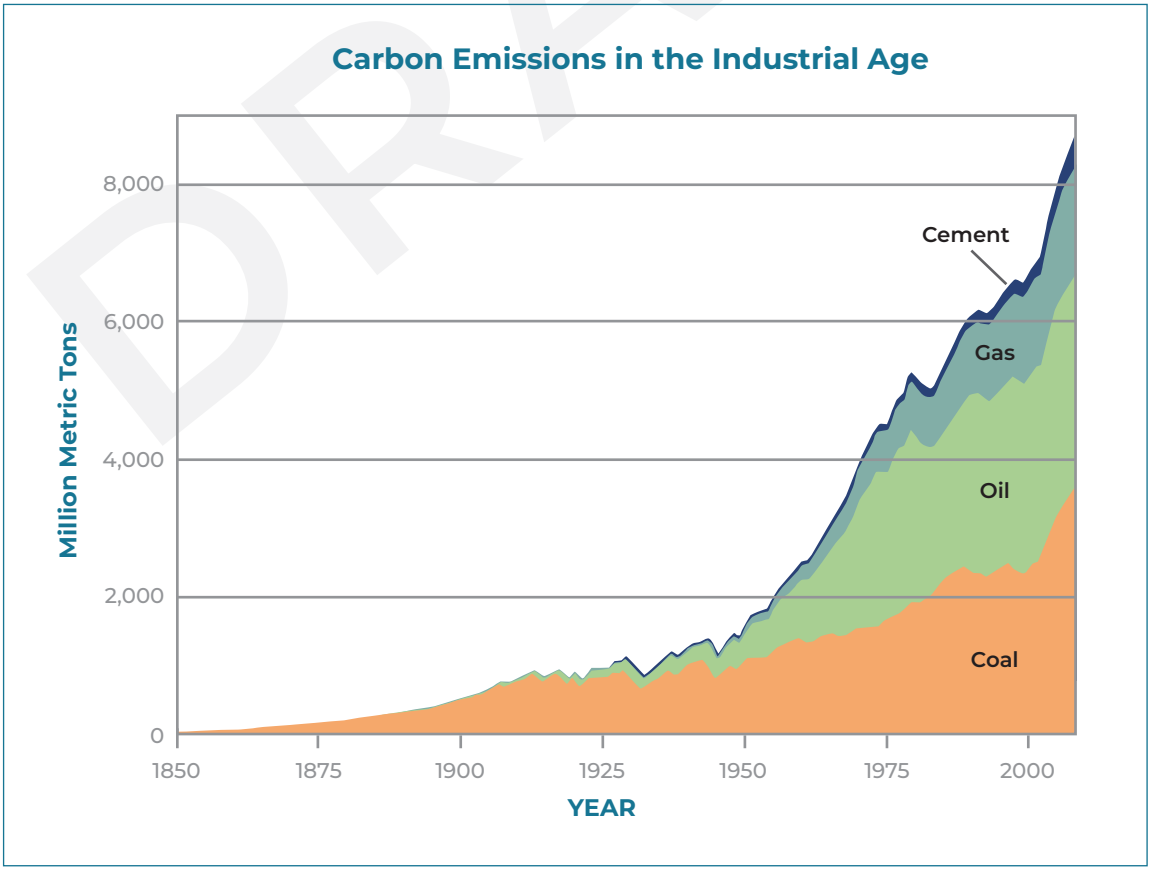


FIGURE 21: Increasing use of fossil fuels since the mid-19th century.

With dramatically more people burning fossil fuels, our atmosphere is rapidly filling with carbon pollution (Figure 22). The addition of carbon to the atmosphere is outpacing the ability of plants and trees to grow and reabsorb it. The imbalance between emissions and the natural carbon cycle is increasing the concentrations of carbon in the atmosphere and increasing the earth's temperature via the greenhouse effect. These carbon emissions are in a feedback loop with the increase in human population making climate change accelerate with population growth.

That said, per person emissions are not the same across the world. The average person in a developing nation will have a carbon footprint that is roughly 5% of an average person born and raised in a developed nation where wealth and consumption are higher, which yield more carbon emissions (Figure 23).

To learn more about the science behind climate change, see Appendix 1: Climate 101 Technical Reader.

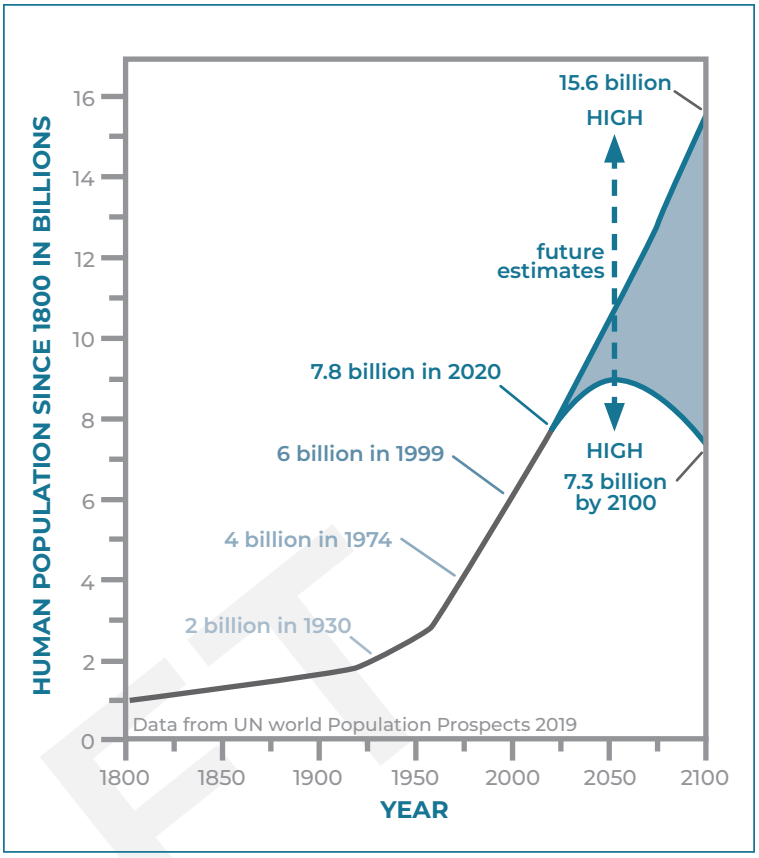


FIGURE 22: Increasing human population since the 19th century. Figure from Wikimedia Commons.

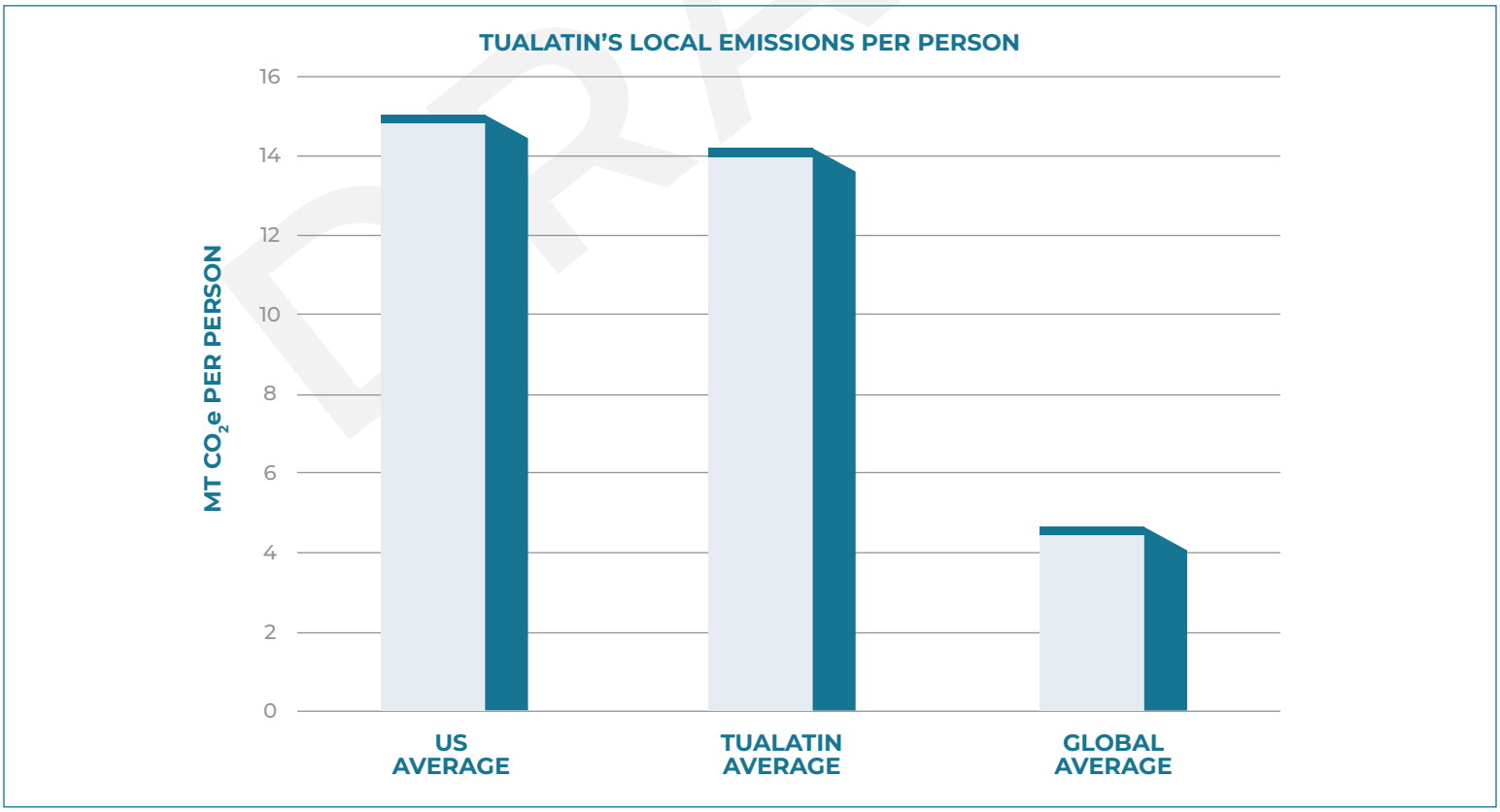


FIGURE 23: In 2019, the Tualatin community generated nearly 386,000 MT CO_2e of local emissions – about 14.2 MT CO_2e per resident. This is less than the U.S. average of 15.2 MT CO_2e per person and considerably greater than global average of 4.5 MT CO_2e per person. The term "local emissions" refers to emissions produced within the city limits from activities like heating or cooling buildings and driving cars.

Science-based goal

Tualatin knows that it is crucial to rapidly reduce carbon emissions to address climate change. Our emissions reduction goal is net zero by 2050, which is consistent with limiting planetary warming to 1.5 degrees Celsius. This goal was selected by the Climate Action Plan Steering Committee for a few reasons.

- If achieved in developed nations, this target prevents us from going over a planetary "tipping point" of no return (1.5 degrees Celsius), which will dramatically increase the impacts of climate change with potentially catastrophic consequences
- This target is the goal of the 2015 Paris Climate Agreement – the globally recognized standard for safety and well-being
- As a member of the Climate Mayors group, Mayor Bubenik signed a letter in 2017, alongside 465 other mayors from across the U.S., in support of upholding the Paris Climate Agreement target
- This target most commonly adopted by other cities who have completed climate action plans

For these reasons, this was the recommendation from the City's consultant and was agreed upon by our Climate Action Plan Steering Committee, consisting of two City Councilors and eight staff from five departments across the City that the plan set the roadmap to achieve net zero by 2050.

By switching to carbon-free electricity and fuels and employing strategies such as carbon sequestration to draw down the carbon pollution in the atmosphere, we can avoid the worst effects of climate change. If we act now, we can improve our quality of life now, and preserve our future.

TUALATIN'S CLIMATE GOAL:

Achieve net zero carbon emissions by 2050 to reduce Tualatin's contribution to climate change and limit the impacts of global warming.

A goal of "net zero" carbon emissions means that the city aims to achieve a balance between the amount of greenhouse gas emissions it produces and the amount of greenhouse gas emissions it removes from the atmosphere.

This is typically done by reducing emissions through various strategies such as transitioning to renewable energy, improving energy efficiency in buildings, promoting sustainable transportation using carbon free or human powered energy, and reducing overproduction and waste, among other measures. Any remaining emissions can then be offset by activities that remove carbon dioxide from the atmosphere, such as reforestation or carbon capture and storage.

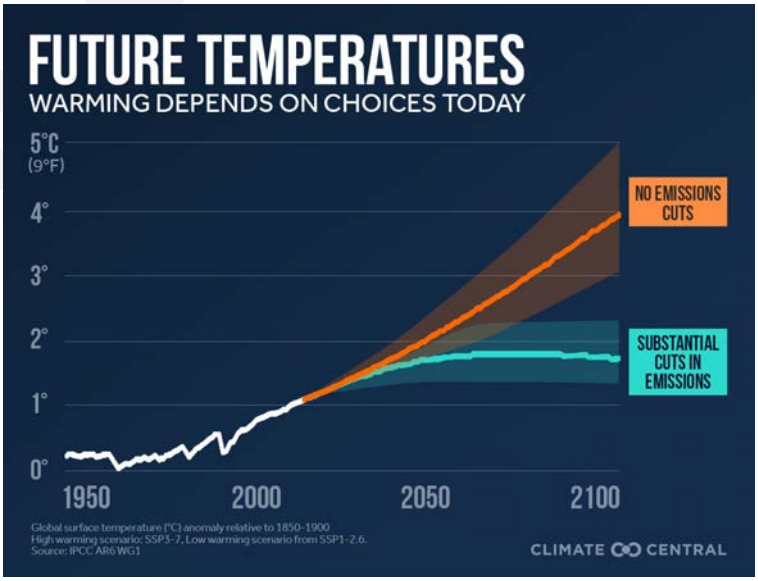


FIGURE 24: Climate action can lead to a better future. Graphic from Climate Central.

TUALATIN'S CARBON FOOTPRINT

The City of Tualatin completed a Community Greenhouse Gas Inventory to better understand sources of greenhouse gas emissions (i.e., climate pollution) to inform development of a community climate action plan. The inventory follows internationally recognized community greenhouse gas inventory protocols and accounts for all significant sources of greenhouse gas emissions driven by activities taking place within the City of Tualatin's geographic boundary (local emissions). Beyond protocol requirements, the inventory also measures consumption-based emissions (imported emissions).

Emissions inventory results

In 2019, Tualatin's local and imported emissions totaled nearly 677,000 metric tonnes of carbon dioxide equivalents (MT CO_2e).

The City of Tualatin's 2019 Community Greenhouse Gas Inventory includes the following emissions sources: building energy, transportation energy, waste and wastewater emissions, industrial processes and refrigerants, agriculture, forestry, land use, and consumption-based emissions.

Tualatin's largest source of local emissions is the building energy sector (42%), which includes emissions from electricity and natural gas, followed by transportation emissions (12%) from the burning of gasoline and traditional diesel. The largest sources of imported emissions in Tualatin are emissions from goods production (15%) like furniture and clothing, food production (13%), and fuel production (12%). Figure 25 shows Tualatin's emissions break down by sector.

LOCAL VS. IMPORTED EMISSIONS

Local emissions come from activities that take place within City limits, like heating and cooling buildings, cooking food, driving cars, disposing of waste, industrial processes like manufacturing, and leaked refrigerants from appliances that help to keep people and food cool.

Imported emissions come from things that are made outside of the city's geographic boundary but benefit the people within the geographic boundary who use those items or services. This includes things like the production of food and goods, and air travel.

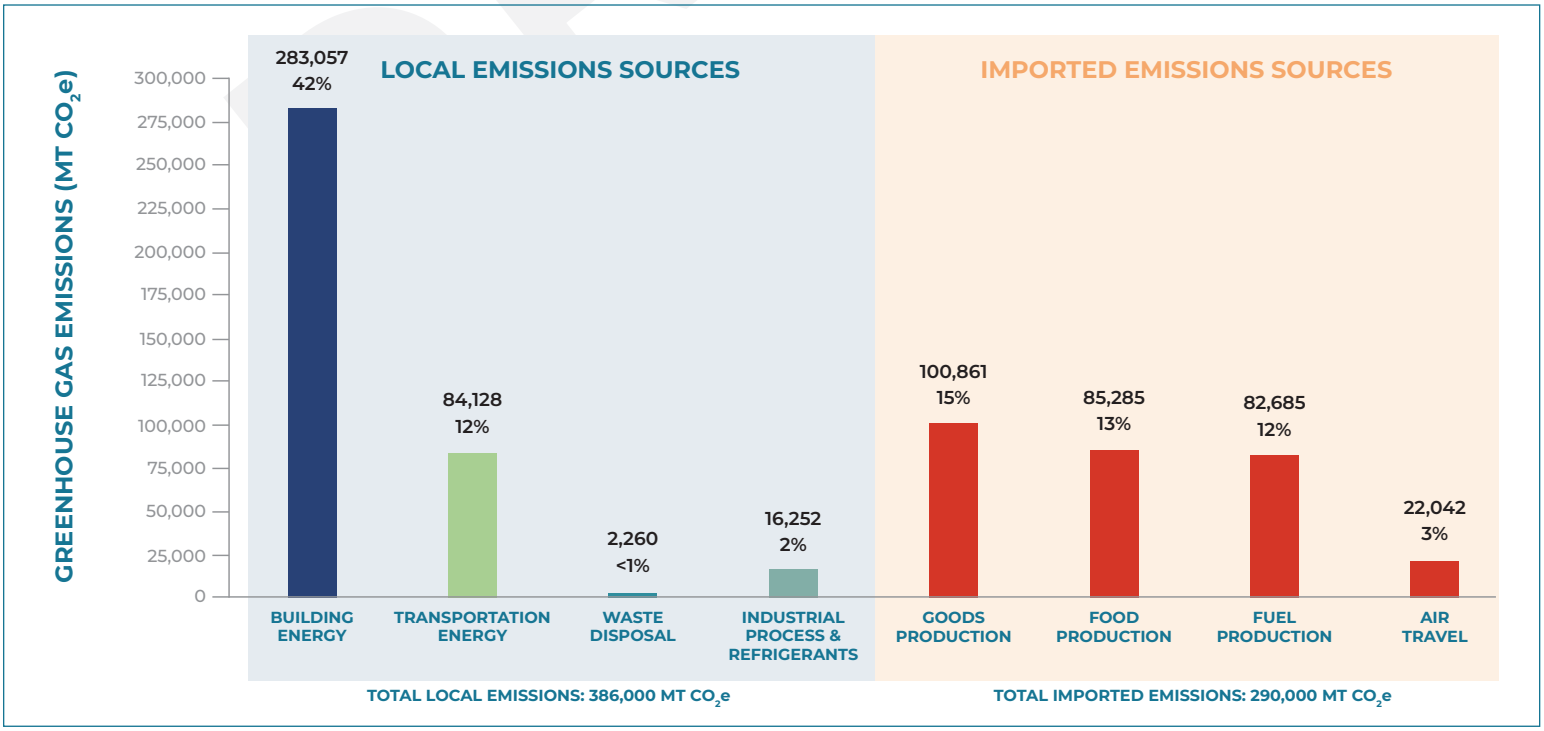


FIGURE 25: Tualatin's emissions sources

Emissions forecast

Local emissions in Tualatin are expected to decrease over time, primarily thanks to strong climate regulations from the State of Oregon in the stationary energy sector, which includes electricity generation and natural gas use. While emissions are estimated to decrease by 80% in 2050 compared to 2019 local emissions without additional mitigation actions, that is still not enough to hit our target of 100% greenhouse gas emissions mitigation to limit global warming to 1.5°C. The Climate Action Plan includes the additional strategies and actions that provide our best chance at reaching our ambitious goal of net zero by 2050.

Figure 26 shows forecasted emissions by sector (colored wedges) as compared to forecasted growth based on population growth only (solid red line) and the Paris Accord 1.5 degrees Celsius warming goal of net-zero emissions by 2050 (black dotted line). Tualatin will need to take further action to decrease emissions, primarily from transportation, but also from industrial processes and refrigerants, waste processing, and building energy to meet its goal of net zero by 2050.

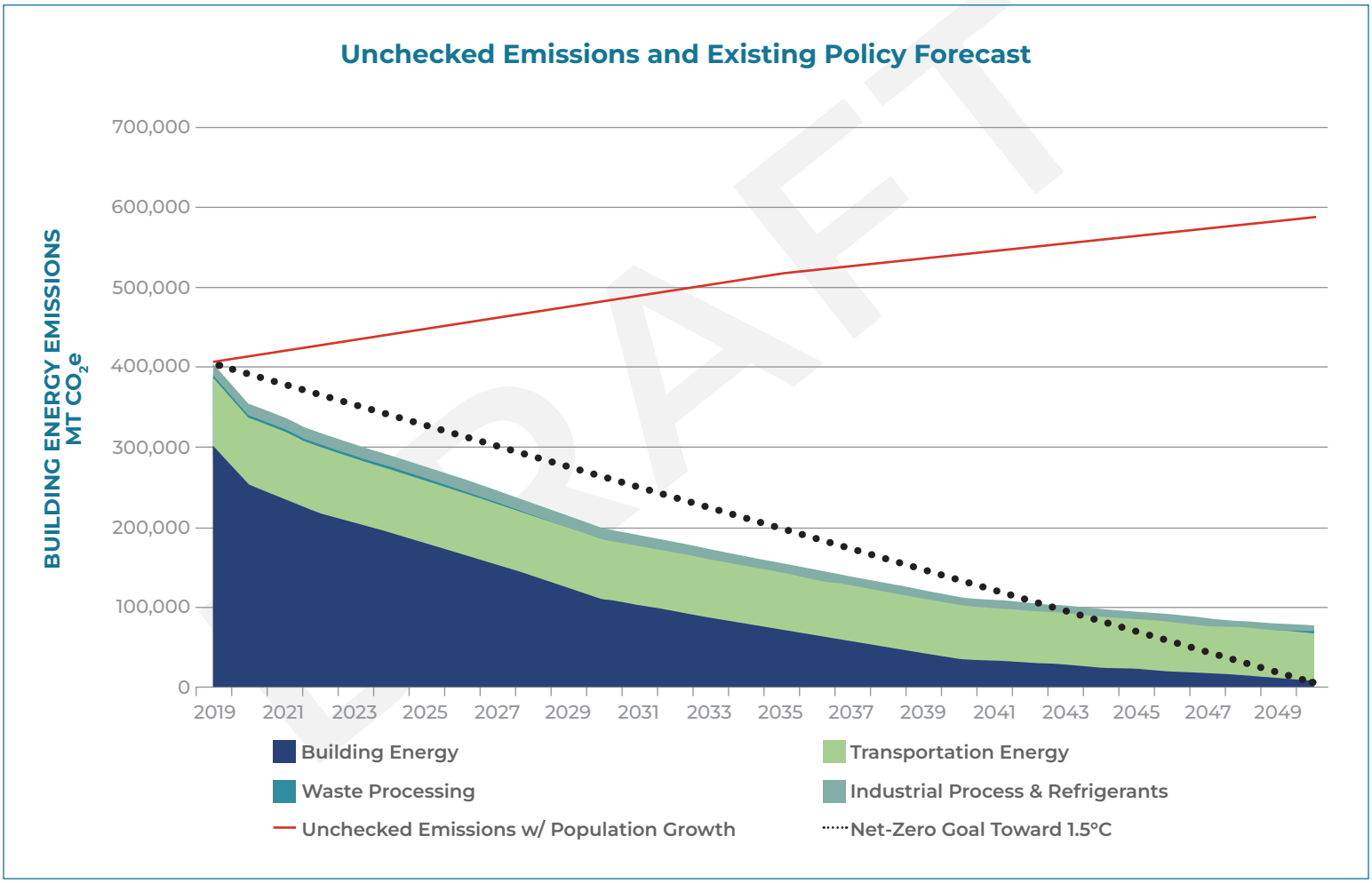


FIGURE 26: Tualatin's unchecked emissions forecast (solid red line, population growth with no policy interventions) with forecasted emissions based on existing state and federal policy, and a net-zero by 2050 trajectory (black dotted line). This graph tells us that Tualatin will need to take additional action to decrease emissions and meet its goal of net zero by 2050.

SECTION THREE: STRATEGIES AND ACTIONS

The Reducing Carbon Emissions section includes four focus areas and identifies strategies and actions the Tualatin community could pursue in order to meet its goal of reducing carbon emissions to net zero by 2050.

Some of these strategies were analyzed in terms of their emissions reduction potential (MT CO_2e) and their cost per MT CO_2e to help decision makers better understand the impacts and costs of different strategies. These strategies were analyzed because they have proven to be high-impact strategies in other communities taking climate action and/or because the data was available to complete the analysis. This is not to suggest that the strategies that were not analyzed are not important – all strategies and actions that lead to emissions reduction are valuable efforts towards reducing emissions—but with limited resources and time, it is critical to understand where to direct our efforts.

FOCUS AREA 4
BUILDINGS AND ENERGY

STRATEGY 4.1	Energy efficiency and conservation	11 Actions
STRATEGY 4.2	Transition to 100% carbon-free electricity supply	4 Actions
STRATEGY 4.3	Transition to 100% renewable natural gas (RNG) and clean hydrogen supply	4 Actions
STRATEGY 4.4	Electrification of space and water heating for new buildings	2 Actions
STRATEGY 4.5	Electrification of space and water heating for existing buildings	4 Actions
STRATEGY 4.6	Voluntary purchase of verified carbon offsets	3 Actions

FOCUS AREA 5
URBAN FORM AND LAND USE

STRATEGY 5.1	Dense future development resulting in reduced future vehicle miles traveled	7 Actions
STRATEGY 5.2	Urban/community forestry & carbon sequestration	7 Actions

FOCUS AREA 6
TRANSPORTATION – MODES AND FUEL SWITCHING

STRATEGY 6.1	Fuel switching - Electric vehicles (EVs), renewable diesel, biodiesel, ethanol and other low-emissions fuels	10 Actions
STRATEGY 6.2	Active transportation to reduce car miles and fossil fuel (gasoline) use	10 Actions
STRATEGY 6.3	Transit transportation to reduce car miles and fossil fuel (gasoline) use	4 Actions
STRATEGY 6.4	Remote work options to reduce car miles and fossil fuel (gasoline) use	2 Actions

FOCUS AREA 7
CONSUMPTION – FOOD AND GOODS

STRATEGY 7.1	Landfill diversion of organic materials (composting)	4 Actions
STRATEGY 7.2	Reduce emissions from food	4 Actions
STRATEGY 7.3	Reduce emissions from road materials	2 Actions
STRATEGY 7.4	Reduce consumption of new materials	5 Actions
STRATEGY 7.5	Responsible waste management	4 Actions
STRATEGY 7.6	Reduce emissions from landscaping	1 Actions
STRATEGY 7.7	Refrigerants Management (AIM Act)	1 Actions

FOCUS AREA 4: BUILDINGS AND ENERGY

Background

Carbon emissions from the buildings and energy sector come from the combustion of natural gas and from electricity generated from fossil fuels to heat water and power buildings. Building energy use by residential, commercial, and industrial buildings and facilities represents a large source (283,057 MT CO_2e, or 42%) of community emissions. Small quantities of combusted propane and other fuels are also included. Additionally, a fraction of natural gas is lost due to leaks during local distribution; natural gas (aka methane) is also a greenhouse gas, and is 25 times more potent than CO_2.

Electricity use in commercial buildings makes up the largest portion of carbon emissions from the buildings and energy sector. However, electricity use in residential and industrial buildings and natural gas use in all buildings also contribute to Tualatin's building emissions (Figure 27).

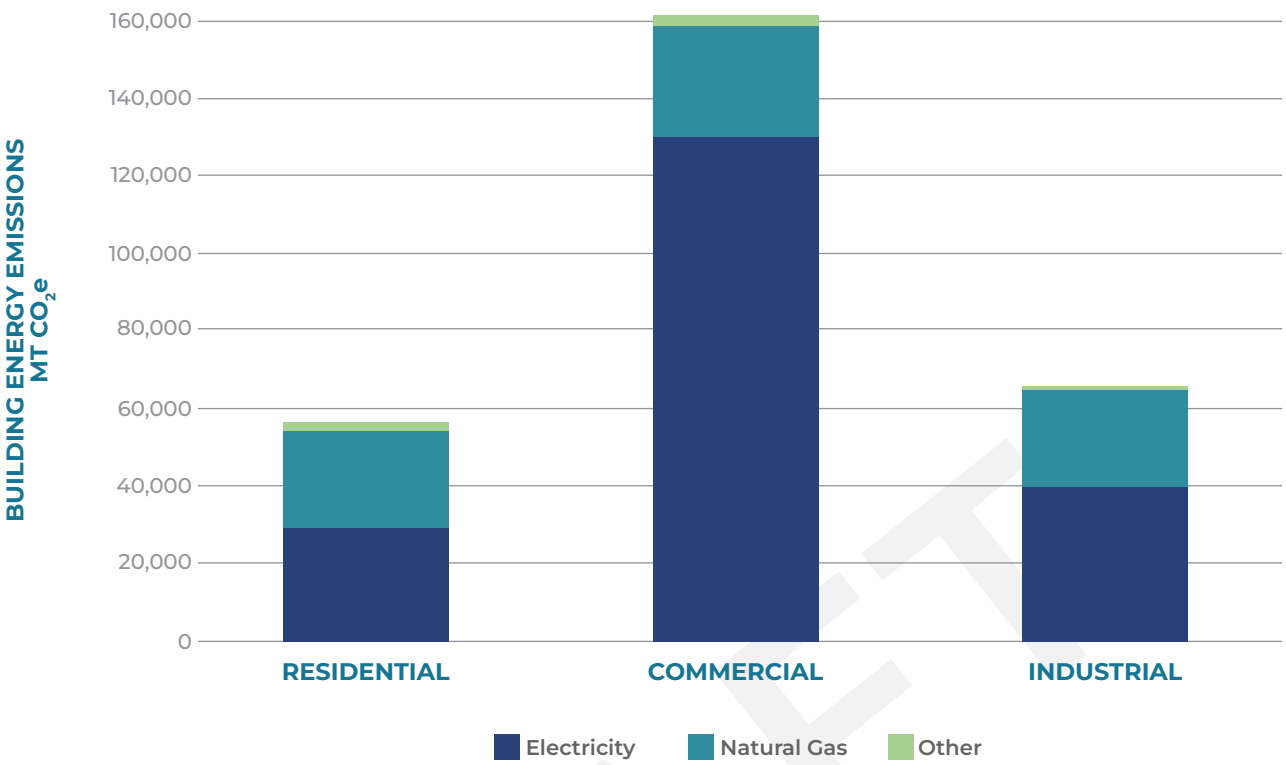


FIGURE 27: Building energy by type and energy source.

Strategies & actions

Tualatin has identified the following strategies and actions to reduce carbon emissions from the building and energy sector. Combined, these strategies could help Tualatin reduce its carbon footprint by about 9.6 million MT CO_2e, or by 78%.

Strategy 4.1 Energy efficiency and conservation

The energy efficiency and conservation strategy is estimated to avoid 1,530,000 MT CO_2e. It is a cost neutral strategy since up-front investments in energy efficiency and conservation tend to result in energy savings over time.

STRATEGY	GHG BENEFIT (MT CO_2e AVOIDED)	COST PER MT CO_2e REDUCED
4.1	LOW MED HIGH	$ cost neutral (-$10 to $10/MT)

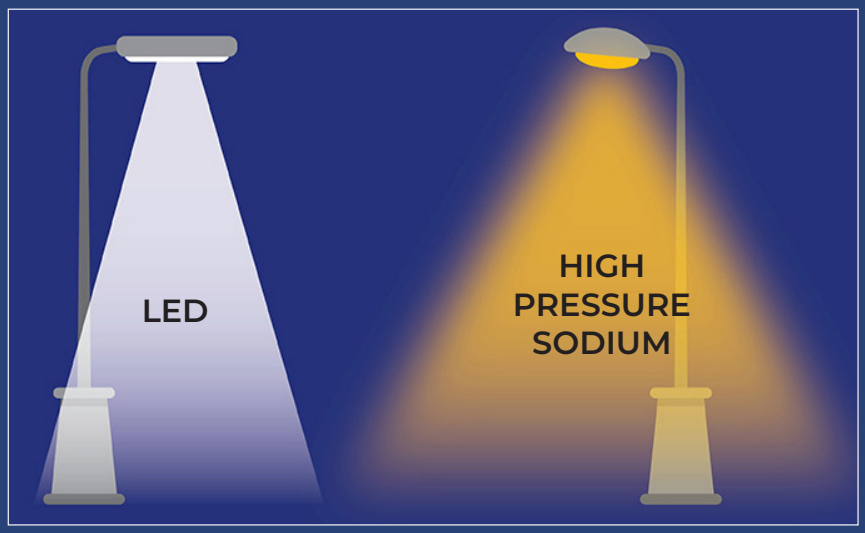
Energy efficiency and conservation refer to practices that reduce the amount of energy needed to perform a specific task or function. Energy efficiency refers to using less energy to perform the same task or produce the same result, while conservation involves reducing overall energy use by avoiding unnecessary energy consumption. Energy efficiency and conservation are important because they help to reduce greenhouse gas emissions by reducing the amount of energy needed – especially if it is fossil energy. In addition to reducing emissions, energy efficiency and conservation can also help to save money and improve air quality.

As Tualatin continues to experience more extreme weather, energy efficiency measures can provide the added benefit of helping people stay comfortable indoors by using less energy to heat or cool buildings.

The Energy Trust of Oregon estimates that 71% of residential customers, 49% of commercial customers, and 62% of industrial customers in Tualatin have participated in an energy efficiency program that has resulted in savings.

TUALATIN'S LED STREETLIGHT CONVERSION PROGRAM

The City of Tualatin is upgrading its streetlights to more energy-efficient, dark sky friendly lights. The project, in coordination with Portland General Electric (PGE), is converting all of the City's streetlights from High-Pressure Sodium (HPS) to Light Emitting Diode (LED) lights. The project began in late 2019 and has resulted in a 58% reduction in average monthly street light energy use and associated costs, saving the city thousands of dollars by significantly reducing its energy use.

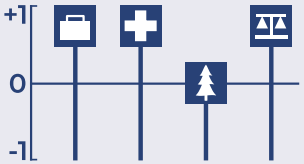
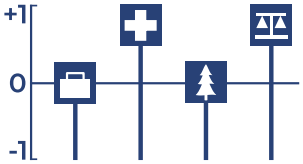


Key

Low (0-399,999 $MTCO_2e$) | Medium (400,000-1,799,999 $MTCO_2e$) | High (1,800,000-8,000,000 $MTCO_2e$)

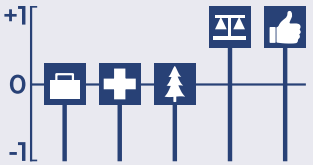
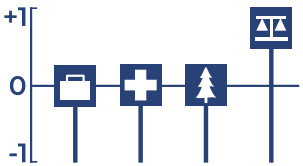
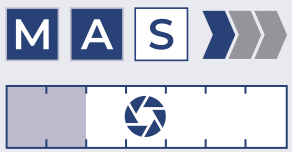
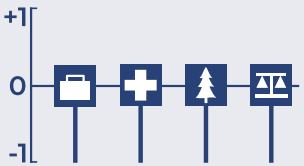
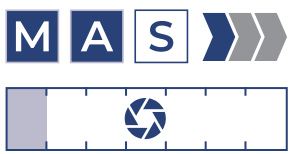
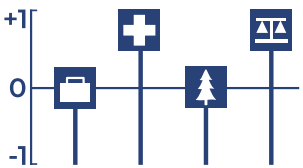
$$$	$$	$	$$	$$$
significant savings (>$100/MT)	savings ($10-100/MT)	cost neutral (-$10 to $10/MT)	cost ($10-100/MT)	significant cost (>$100/MT)

Actions

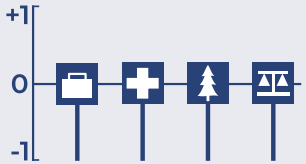
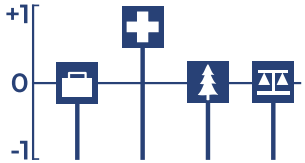
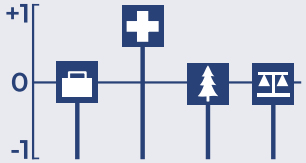
ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
4.1.1 Upgrade building envelopes, including roofs, walls, windows, doors, and foundations, to improve barriers between exterior and internal environments in buildings and increase efficiency. Examples of building envelope upgrades could include adding insulation, installing draft protection for doors and windows, or installing white or green roofs.	**STAKEHOLDERS** • City of Tualatin Community Development Department • Energy Trust of Oregon (ETO) • Community Action **PROGRAMS** • ETO Residential Incentives program • ETO Oregon Cash Incentives for businesses program • ETO Strategic Energy Management program		 • Environmental		
4.1.2 Incentivize builders, consumers, and contractors to build to the Oregon Building Codes Division's "Built Energy Smart" residential and commercial reach codes. State Executive Order 20-04 directs state agencies to reduce emissions by at least 45 percent below 1990 emissions levels by 2035 and at least 80 percent below 1990 levels by 2050. As a result, the Oregon Building Codes Division updated the residential and commercial reach codes to provide guidelines on improving energy efficiency, upgrading building envelopes, and supporting electrification.	**STAKEHOLDER** • City of Tualatin Community Development Department **POLICY DOCUMENTS** • Municipal code • Development code		 • Environmental		

Key

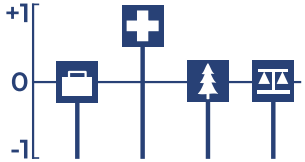
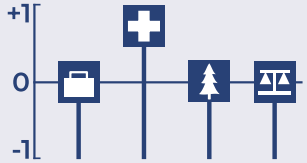
- M MITIGATION ACTIONS
- A ADAPTATION ACTIONS
- S SEQUESTRATION ACTIONS
- IMPLEMENT
- CONVENE
- SUPPORT/ADVOCATE
- QUICK START
- 0-5 YRS
- 6-10 YRS
- 10+ YRS
- YES, POLICY DECISION
- ALIGNMENT WITH COUNCIL VISION (0-7)
- JOBS
- HEALTH & SAFETY
- ECOSYSTEM & WILDLIFE HEALTH
- OPPORTUNITY FOR EQUITY
- COMMUNITY ACCEPTANCE

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
4.1.3 Replace high-pressure sodium (HPS) lightbulbs with light-emitting diode (LED) bulbs. LED bulbs last longer and are significantly more energy efficient than HPS bulbs.	STAKEHOLDER • Energy Trust of Oregon (ETO) PROGRAMS • ETO Lighting Incentives for residents • ETO Business Lighting trade ally program for businesses		 • Environmental		
4.1.4 Replace appliances and electronics with certified energy efficient appliances and electronics, such as EnergyStar-certified appliances.	STAKEHOLDER • Energy Trust of Oregon (ETO) PROGRAMS • ETO DIY Resources + Cash Incentives for residents • ETO Oregon Cash Incentives for businesses		 • Environmental		
4.1.5 Require home energy scores to be completed at point of sale for homes.	STAKEHOLDERS • Energy Trust of Oregon (ETO)		 • Connected, Informed, Engaged • Environmental		
4.1.6 Partner with the Community Energy Project to make the Home Energy Score program available for free to lower income home sellers in Tualatin. This program offers free home energy scores to home sellers at or below 80% median income.	STAKEHOLDER • Community Energy Project PROGRAM • Home Energy Score Program		 • Environmental		

Key

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
4.1.7 Establish citywide water conservation program. This program could inlcude incentives for reducing indoor and outdoor water use and community education. Lower water use results in less energy used to pump water throughout the system.	STAKEHOLDER • City of Tualatin Public Works and Finance Departments		 • Environmental		
4.1.8 Enroll in the Strategic Energy Management (SEM) program. SEM provides the tools and education to start saving energy today and continue saving over time. SEM participants learn how their businesses use energy and identify where waste is happening. Program participants have the opportunity to share best practices with a cohort of peers, learn to increase employee engagement and monitor the progress of their energy savings work.	STAKEHOLDER • Energy Trust of Oregon (ETO) PROGRAM • Strategic Energy Management program		 • Environmental		
4.1.9 Advocate that the State adopt stronger building codes to require upgraded building envelopes, energy efficiency measures, and other factors needed to support electrification. Oregon Department Of Energy will work with the Building Codes Division to adopt building efficiency goals for 2030 for new residential and commercial construction. Municipalities are required to adopt the Oregon Structural Specialty Code (OSSC) at a minimum.	STAKEHOLDERS • City of Tualatin Community Development Department • Oregon Department of Energy (ODOE) • Oregon Building Codes Division		 • Environmental • Neighborhoods		

Key

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
4.1.10 Complete a voluntary home energy assessment or obtain a Home Energy Score to identify ways to improve the energy efficiency, comfort, and health and safety of your home. Home Energy Score systems help homeowners, homebuyers, and renters better understand a home's energy use, and how even small improvements can make a big difference in energy savings.	**STAKEHOLDERS** • Energy Trust of Oregon (ETO) **PROGRAM** • Home Assessment program		 • Environmental		
4.1.11 Install smart heating, ventilation, and air conditioning (HVAC) controls, such as smart thermostats, in buildings to optimize energy efficiency.	**STAKEHOLDER** • Energy Trust of Oregon (ETO) **PROGRAMS** • ETO Residential Incentives • PGE Smart Thermostat Program and Rebates		 • Environmental		

Key

Strategy 4.2 // Transition to 100% carbon-free electricity supply

The transition to 100% carbon-free electricity supply strategy is the most impactful from an emissions reduction standpoint. It is estimated to avoid 7,881,000 MT CO_2e. This strategy is predicted to result in a cost of $10-35/MT CO_2e reduced because this strategy relies on investment into increasing renewable energy generation from energy sources like wind and solar.

STRATEGY	GHG BENEFIT (MT CO_2e AVOIDED)	COST PER MT CO_2e REDUCED
4.2	 LOW MED HIGH	$$ cost ($10-100/MT)

Even though the State of Oregon's Climate Protection Act requires that Portland General Electric (PGE) decrease its emissions to zero by 2040, the Tualatin community can still take meaningful, immediate action to reduce its largest source of emissions: electricity. Residents and businesses in Tualatin can help to support carbon-free energy projects that would not otherwise have funding to get built by purchasing renewable energy credits (RECs). Portland General Electric offers two programs for its customers to purchase RECs and support renewable energy generation in the Pacific Northwest.

- The Green Future Choice Renewable Power program is available to households and small businesses that choose to enroll for an additional $7-12 per month
- The Green Future Enterprise program is available to large commercial and industrial business customers who choose to enroll

WHAT ARE RENEWABLE ENERGY CREDITS (RECS)?

With the purchase of renewable energy credits, you will not have electricity from a specific generation facility delivered directly to your home, but the amount of electricity you consume will be replaced in the Northwest power grid by renewable resources.

Portland General Electric (PGE) offers renewable energy credits through its Green Future Choice program. This program allows PGE customers to purchase 100% renewable energy that is validated by a third party for $7-12 extra per month.

Key

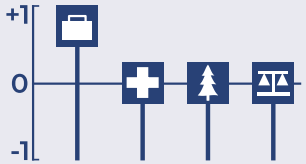
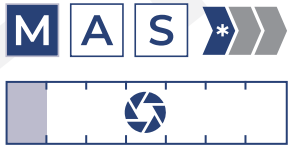
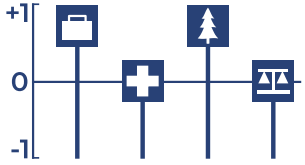
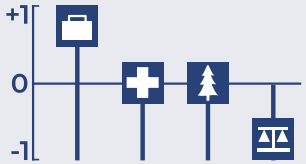
Low (0-399,999 $MTCO_2e$)

Medium (400,000-1,799,999 $MTCO_2e$)

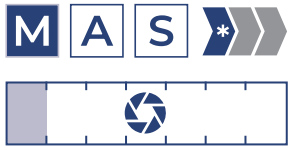
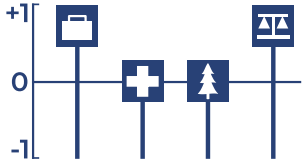
High (1,800,000-8,000,000 $MTCO_2e$)

$$$	$$	$	$$	$$$
significant savings (>$100/MT)	savings ($10-100/MT)	cost neutral (-$10 to $10/MT)	cost ($10-100/MT)	significant cost (>$100/MT)

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
4.2.1 Participate in the SolSmart program. SolSmart is a free program that provides technical assistance to local governments to reduce barriers to installing solar in their communities. The City can earn bronze, silver, or gold designation by meeting a set of criteria.	**STAKEHOLDER** • City of Tualatin Community Development Department **PROGRAM** • SolSmart				
4.2.2 Enroll in PGE's Green Future Choice or Green Future Enterprise Renewable Power program(s) to match 100% of electricity use with renewable energy and help build more renewable energy projects in Oregon.	**STAKEHOLDER** • Portland General Electric (PGE) **PROGRAMS** • Green Future Choice (for individual and small business customers) • Green Future Enterprise (for commercial/industrial customers)				
4.2.3 Install rooftop solar. Solar panels typically provide cost savings over time, reduce emissions, and increase grid resiliency. Rebate programs exist to help property owners offset the upfront costs of installing rooftop solar. Request a free quote through Energy Trust of Oregon's Solar Program.	**STAKEHOLDERS** • Oregon Department of Energy (ODOE) **PROGRAM** • Oregon Solar and Storage Rebate Program				

Key

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
4.2.4 Enroll in the Oregon Community Solar Program. The Oregon Community Solar Program gives thousands of Oregonians new opportunities to go solar without needing to own a home, have a sunny roof, or make upfront payments. Community Energy Project connects income qualified customers to the program.	STAKEHOLDER • **Community Energy Project** PROGRAM • **Oregon Community Solar program**		 • Environmental		

Key

Strategy 4.3 Transition to 100% renewable natural gas (RNG) and clean hydrogen supply

The transition to 100% renewable natural gas (RNG) and clean hydrogen supply strategy is estimated to avoid 1,704,750 MT CO_2e. This strategy is estimated to cost $15-75/MT CO_2e reduced, in part because supplies of renewable natural gas and clean hydrogen are still limited.

STRATEGY	GHG BENEFIT (MT CO_2e AVOIDED)	COST PER MT CO_2e REDUCED
4.3	LOW MED HIGH	$$ cost ($10-100/MT)

Unlike standard natural gas, which is gathered by drilling and hydraulic fracturing (or "fracking), renewable natural gas is a carbon-neutral resource produced from local, organic materials like food, dairy, forestry waste, wastewater, or landfills. As these materials decompose, they produce methane. That methane can be captured, conditioned to pipeline quality, and delivered in the existing pipeline system to homes and businesses where it can be used in existing appliances and equipment. This process closes the loop on waste and provides a renewable energy option for the natural gas system, in the same way that wind and solar are used to generate renewable electricity. This gas is currently available in limited quantities, but should be encouraged for use as it becomes more accessible.

Hydrogen fuel holds promise as a climate solution due to its potential to provide clean energy in various sectors. Hydrogen can be produced through a variety of methods, as reflected by the hydrogen "colors" shown in Figure 28. When produced using renewable sources like wind, nuclear, or solar power through a process called electrolysis, hydrogen generates zero greenhouse gas emissions. Green, yellow, and pink hydrogen are produced from renewable sources. The hydrogen can then be used as a versatile energy carrier for applications such as fuel cell vehicles, industrial processes, and energy storage. This can help to reduce reliance on fossil fuels and mitigate climate change by decreasing carbon emissions across multiple sectors of the economy.

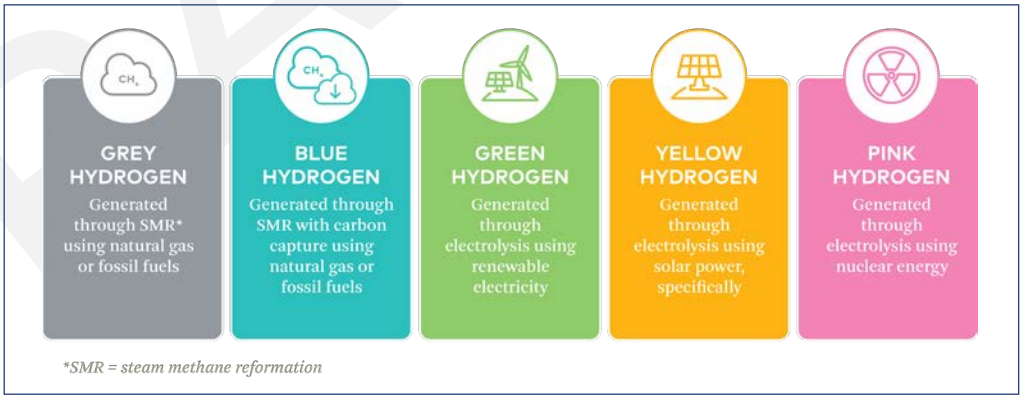


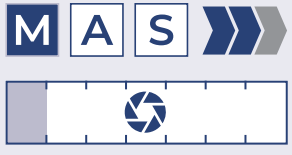
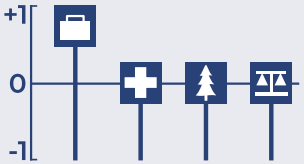
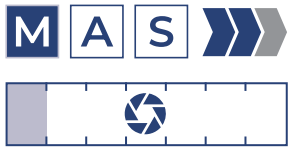
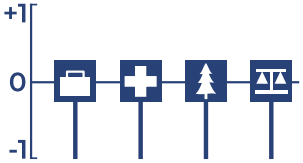
FIGURE 28: Green, yellow, and pink hydrogen are climate-friendly options produced from renewable resources like wind, solar, and nuclear power. Grey and blue hydrogen are less climate-friendly options as they are produced using fossil fuels.

Key

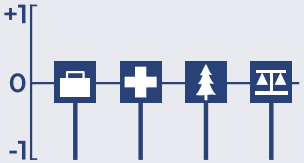
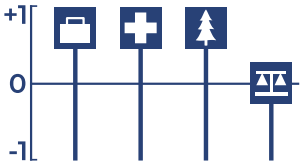
Low (0-399,999 MTCO$_2$e) | Medium (400,000-1,799,999 MTCO$_2$e) | High (1,800,000-8,000,000 MTCO$_2$e)

$$$	$$	$	$$	$$$
significant savings (>$100/MT)	savings ($10-100/MT)	cost neutral (-$10 to $10/MT)	cost ($10-100/MT)	significant cost (>$100/MT)

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
4.3.1 Purchase renewable natural gas (RNG) directly from Northwest Natural if available. Senate Bill 98 (SB 98) passed the Oregon legislature in 2019. SB 98 allows for RNG to be distributed system-wide. As of spring 2023, 2-3% of Northwest Natural's natural gas supply comes from RNG sources and SB 98 allows Northwest Natural to increase their purchase of RNG sources by 5% every 5 years. Northwest Natural filed with the Public Utility Commission, and is awaiting a docket date for a RNG tariff that would allow customers to opt-in to purchase additional RNG to cover all or a portion of their usage.	**STAKEHOLDER** • Northwest Natural **PROGRAM** • Northwest Natural is developing a program		 • Environmental		
4.3.2 Advocate for state and federal level financial and political support to increase the number of on-site hydrogen electrolyzers or thermal mass-based resistance boiler retrofits at sites that have large, industrial heat loads. Electrolysis of hydrogen is a promising option for carbon-free hydrogen production from renewable and nuclear resources. Electrolysis is the process of using electricity to split water into hydrogen and oxygen.	**STAKEHOLDER** • City of Tualatin City Manager's Office, Economic Development		 • Environmental		

Key

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
4.3.3 Advocate for increased production of renewable natural gas (RNG). Existing supplies of RNG are limited. Advocating for increased supply of RNG will help Tualatin offset its emissions from natural gas use.	STAKEHOLDERS • City of Tualatin City Manager's Office • Northwest Natural				
4.3.4 Advocate for policies to ensure that production, transportation, storage, and use of clean hydrogen is done safely. Clean hydrogen has the potential to reduce emissions in hard-to-decarbonize sectors, increase the reliability of renewable energy, foster innovation, create jobs, and contribute to a sustainable and resilient energy future.	STAKEHOLDERS • City of Tualatin City Manager's Office • Northwest Natural				

Key

Strategy 4.4 Electrification of space and water heating for new buildings

The electrification of space and water heating for new buildings strategy is estimated to be relatively low, avoiding 76,700 MT CO_2e. This is in part because much of Tualatin is already built out, with minimal space available for new development in 2023. However, this strategy would likely result in cost savings of $50/MT CO_2e reduced since it is cheaper to electrify space and water heating from the outset than to retrofit existing systems.

STRATEGY	GHG BENEFIT (MT CO_2e AVOIDED)	COST PER MT CO_2e REDUCED
4.4	LOW MED HIGH	$$ savings ($10-100/MT)

Electrification refers to the process of replacing non-electric power sources with electricity as the primary source of energy. It involves transitioning from traditional fuel-based systems, such as coal, oil, and gas, to electric power for various applications, including transportation, heating, and industrial processes. By embracing electrification, societies can reduce greenhouse gas emissions, improve energy efficiency, and foster sustainable development.

For new builds, electric appliances are a significant cost saver compared to natural gas heating and separate air conditioning. Electric heat pumps are all-in-one, energy efficient climate control units that are capable of both heating and cooling buildings and can be powered from renewable electricity. As our peak energy demand slowly shifts from a winter and heat demanding load to a summer and cooling demanding load, heat pumps manage the transition without needing to be replaced.

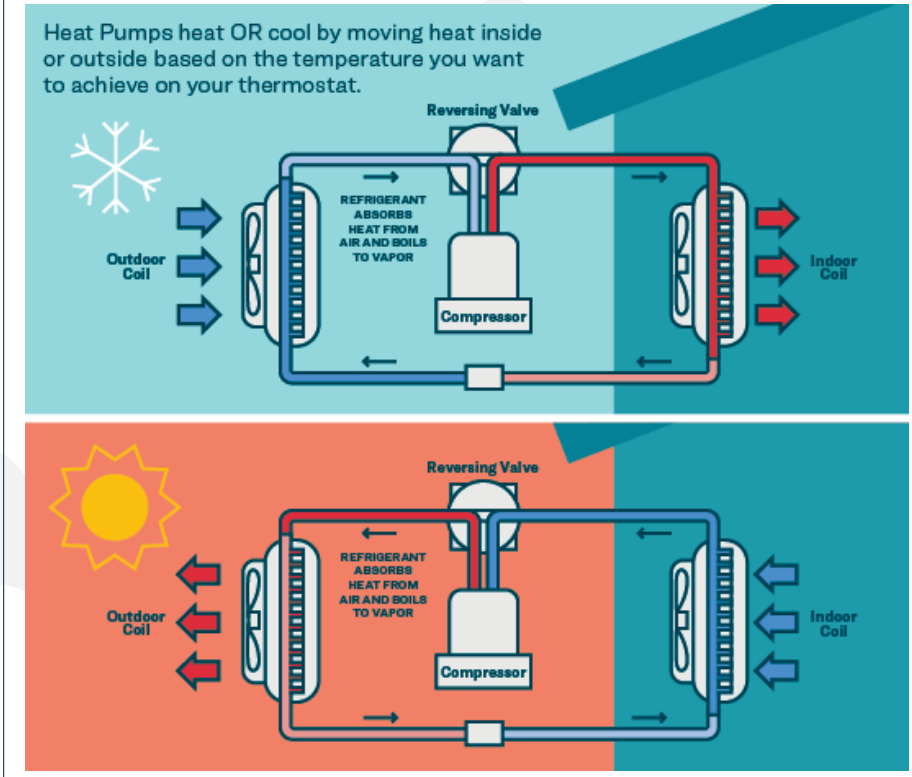


FIGURE 29: Heat pumps are an energy efficient way to heat or cool buildings. Image from the Sierra Club.

Key

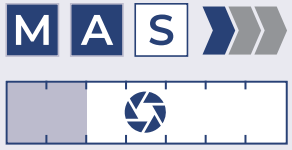
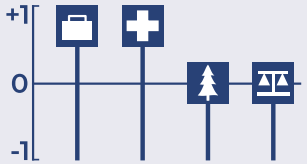
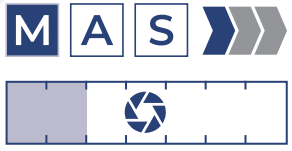
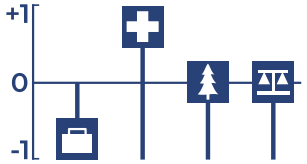
Low (0-399,999 $MTCO_2e$)

Medium (400,000-1,799,999 $MTCO_2e$)

High (1,800,000-8,000,000 $MTCO_2e$)

$$$	$$	$	$$	$$$
significant savings (>$100/MT)	savings ($10-100/MT)	cost neutral (-$10 to $10/MT)	cost ($10-100/MT)	significant cost (>$100/MT)

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
4.4.1 Require electric water heaters and electric heat pumps in new buildings. Electric water heaters and heat pumps are more efficient than gas-powered water heaters and furnaces and can be powered by renewable energy sources instead of fossil fuels.	**STAKEHOLDERS** • City of Tualatin Community Development Department • Energy Trust of Oregon (ETO) • Oregon Department of Energy (ODOE) **PROGRAMS** • ETO residential and commercial water heater incentives • ODOE Rental Home Heat Pump program		 • Neighborhoods • Environmental		
4.4.2 Ban natural gas hookups in new single family and commercial buildings. This action only impacts new buildings. Potential benefits of this action include reducing carbon emissions, increasing the energy efficiency of buildings, promoting clean energy sources, and reducing the indoor air quality hazards associated with natural gas stoves. Potential drawbacks of this action include concerns about electrical grid capacity, short-term energy affordability, and reducing energy choice.	**STAKEHOLDERS** • City of Tualatin Community Development Department • Northwest Natural		 • Neighborhoods • Environmental		

Key

Strategy 4.5 Electrification of space and water heating for existing buildings

The electrification of space and water heating for existing buildings strategy is estimated to result in a medium emissions reduction benefit at 708,350 MT CO_2e. This strategy is estimated to cost up to $50/MT CO_2e, due to the fact that it is typically more expensive to retrofit existing systems than it is to electrify from the outset.

STRATEGY	GHG BENEFIT (MT CO_2e AVOIDED)	COST PER MT CO_2e REDUCED
4.5	LOW MED HIGH	$$ cost ($10-100/MT)

Electrification for existing buildings may be cost prohibitive in the short term. However, substantial savings are expected in the longer-term as equipment prices decrease, natural gas supply costs increase, and additional financial incentives become available through the Oregon Department of Energy (the Community Heat Pump Deployment Program and the Oregon Rental Home Heat Pump Program) and the IRS (the Energy Efficient Home Improvement Credit and the Residential Clean Energy Property Credit). This is especially likely given the additional need for air conditioning due to hotter summers in the future.

Key

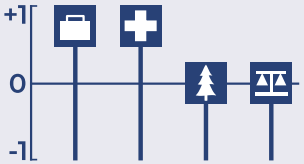
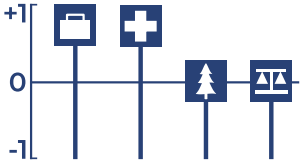
Low (0-399,999 MTCO$_2$e)

Medium (400,000-1,799,999 MTCO$_2$e)

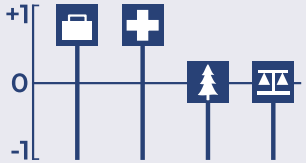
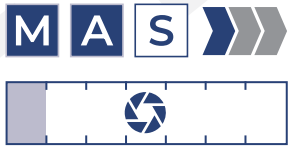
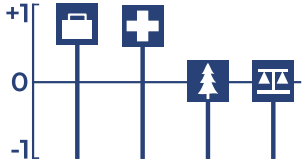
High (1,800,000-8,000,000 MTCO$_2$e)

$$$	$$	$	$$	$$$
significant savings (>$100/MT)	savings ($10-100/MT)	cost neutral (-$10 to $10/MT)	cost ($10-100/MT)	significant cost (>$100/MT)

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
4.5.1 Replace existing gas furnaces with heat pumps to heat and cool homes and buildings. Financial incentives may be available through the Oregon Department of Energy's Community Heat Pump Deployment Program and Oregon Rental Home Heat Pump Program, and through the IRS's Energy Efficient Home Improvement Credit and Residential Clean Energy Property Credit.	**STAKEHOLDERS** • Northwest Natural • Oregon Department of Energy (ODOE) **PROGRAMS** • ODOE Community Heat Pump Deployment Program • ODOE Rental Home Heat Pump program		 • Environmental		
4.5.2 Replace existing gas water heaters with electric water heaters. Water heating accounts for 20% of the average home's energy use. An energy efficient water heater can save hundreds of dollars per year in energy costs.	**STAKEHOLDERS** • Northwest Natural • Oregon Department of Energy (ODOE) • Energy Trust of Oregon (ETO) **PROGRAMS** • ODOE Community Heat Pump Deployment Program • IRS Energy Efficient Home Improvement Credit • IRS Residential Clean Energy Property Credit		 • Environmental		

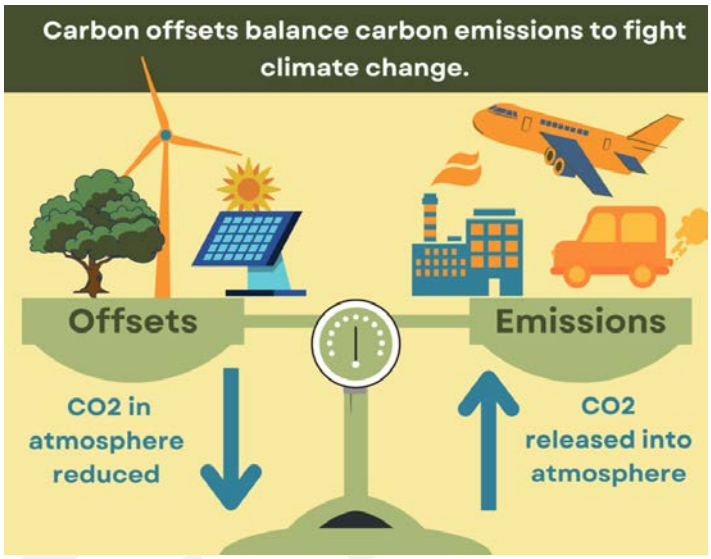
Key

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
4.5.3 Require replacing gas furnaces with heat pumps when they fail. Heat pumps provide both heating and cooling capabilities, are highly energy-efficient, and are more environmentally-friendly option compared to fossil fuel-based furnaces.	**STAKEHOLDERS** • City of Tualatin Community Development Department • Northwest Natural • Energy Trust of Oregon (ETO) • Oregon Department of Energy (ODOE) **PROGRAMS** • ETO Heating Solutions Incentives • ODOE Rental Home Heat Pump program				
4.5.4 Require replacing gas water heaters with electric water heaters when they fail. Heat pump water heaters are highly energy-efficient, can deliver significant energy savings, offer both heating and cooling capabilities, and result in less carbon emissions compared to gas water heaters as the electricity grid continues to decarbonize.	**STAKEHOLDERS** • City of Tualatin Community Development Department • Northwest Natural • Energy Trust of Oregon (ETO) **PROGRAM** • ETO Water Heater Incentives				

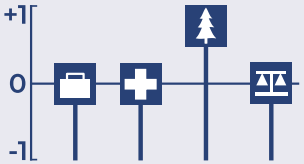
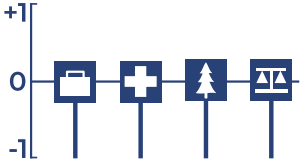
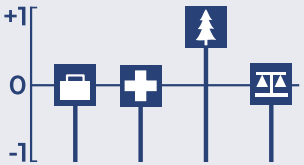
Key

Strategy 4.6 Voluntary purchase of verified carbon offsets

Not all activities have an available decarbonization option at the pace required to reach science-based emissions reduction targets. Some activities face technological limitations, and others may be cost-prohibitive. For those activities that cannot be decarbonized or entirely avoided in the near term (like air travel), the purchase of carbon offsets can help to reach decarbonization goals. With sound vetting, carbon offsets can be an important tool to decrease global carbon emissions while providing useful co-benefits such as job programs, poverty alleviation, and habitat conservation.



Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
4.6.1 Enroll in Northwest Natural's Smart Energy program to offset emissions from natural gas use in homes and commercial and industrial buildings that use natural gas. Carbon offsets are financial instruments that represent the reduction, avoidance, or removal of greenhouse gas emissions from one source to compensate for emissions occurring elsewhere.	STAKEHOLDERS • Northwest Natural PROGRAM • Northwest Natural's Smart Energy program		 • Environmental		
4.6.2 Educate the community about high-quality, reliable carbon offsets. It is important to identify and promote high-quality and reliable offset options because carbon offsets can be difficult to accurately measure and verify, run the risk of being double-counted, and may have negative social and environmental impacts.	STAKEHOLDERS • City Communications Team		 • Connected, Informed, Engaged • Environmental		
4.6.3 Purchase verified carbon offsets for unavoidable emissions, such as air travel and industrial processes. Carbon offsets can help to balance out unavoidable emissions by removing carbon dioxide from the atmosphere.			 • Environmental		

Key

FOCUS AREA 5: URBAN FORM AND LAND USE

Background

Urban form refers to the physical structure of a city, including its layout, building density, transportation networks, and public spaces. Land use refers to the way in which a piece of land is used, including residential, commercial, industrial, and agricultural uses. Together, urban form and land use shape the built environment of a city and influence its social, economic, and environmental outcomes. The relationship between urban form and land use determines the accessibility, livability, and sustainability of a city, and is a key consideration in urban planning and design.

Changes to Tualatin's development code that affect urban form and land use can help to create a more climate-friendly Tualatin by increasing density, making alternative transportation modes more accessible, and allowing mixed-use development so that residents can access goods and services closer to home.

Strategies & actions

Tualatin has identified the following strategies and actions focused on decreasing carbon emissions by addressing urban form and land use in Tualatin.

Strategy 5.1 // Dense future development resulting in reduced future vehicle miles traveled

The dense future development resulting in reduced vehicle miles traveled strategy is estimated to result in a relatively low emissions reduction benefit at 33,100 MT CO_2e. Cost savings of $500/MT CO_2e reduced are associated with this strategy because fewer vehicle miles traveled should result in savings on gasoline and car maintenance.

STRATEGY	GHG BENEFIT (MT CO_2e AVOIDED)	COST PER MT CO_2e REDUCED
5.1	LOW MED HIGH	$$ savings ($10-100/MT)

Increased population density can reduce vehicle miles traveled (VMT) by fostering shorter commute distances. In denser areas, people often live closer to work, schools, and amenities, reducing the need for long car journeys. Additionally, improved public transportation and infrastructure for walking and biking in densely populated regions encourage alternative modes of travel, further diminishing VMT. This synergy of proximity and accessible transportation options can lead to a more sustainable and less car-dependent urban environment.

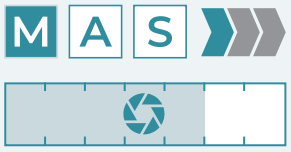
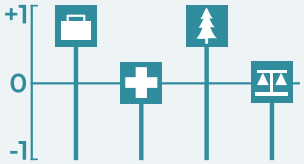
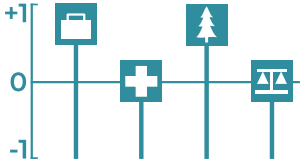
In addition to the climate benefits associated with reducing vehicle miles traveled, there are several benefits of increased density in cities. These benefits include efficient use of land and resources, smaller environmental impacts in terms of lower carbon emissions, less air pollution, and less damage to ecosystems, better public health outcomes as community members rely more heavily on active transportation instead of cars, and greater social cohesion, resiliency, and mental health outcomes.

Key

Low (0-399,999 $MTCO_2e$) | Medium (400,000-1,799,999 $MTCO_2e$) | High (1,800,000-8,000,000 $MTCO_2e$)

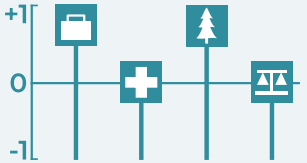
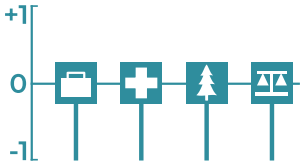
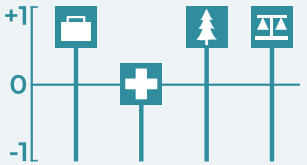
$$$	$$	$	$$	$$$
significant savings (>$100/MT)	savings ($10-100/MT)	cost neutral (-$10 to $10/MT)	cost ($10-100/MT)	significant cost (>$100/MT)

Actions

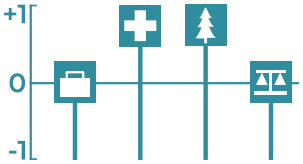
ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
5.1.1 Reduce barriers to compact urban development in the downtown/ town center(s), transit corridors. This could include identifying and reducing regulatory barriers, flexible uses within industrial and commercial zones, reducing financial obstacles, restructuring System Development Charges (SDCs) for smaller additional incentives, offering flexible land use codes, and ensuring the transportation system can support planned densities.	STAKEHOLDERS • City of Tualatin Community Development and Public Works Departments		 • Economy • Gathering Places • Transportation • Neighborhoods • Environmental		
IN PROGRESS **5.1.2 Expand housing variety and choice by incentivizing and/or prioritizing the building of smaller, clustered, and attached housing, accessory dwelling units (ADUs), and other multifamily housing.** Actions includes strategies like providing flexibility in land use, removing land use code and permitting process barriers, supporting affordable housing developments, and offering new incentives like eliminating or reducing SDCs and attached housing loans. Increased housing variety may help reduce the number of residents who commute from out of town (currently 93%) to work in Tualatin.	STAKEHOLDERS • City of Tualatin Community Development, Public Works, Finance, and Parks Departments		 • Economy • Gathering Places • Transportation • Neighborhoods • Environmental		

Key

- M MITIGATION ACTIONS
- A ADAPTATION ACTIONS
- S SEQUESTRATION ACTIONS
- IMPLEMENT
- CONVENE
- SUPPORT/ADVOCATE
- QUICK START
- 0-5 YRS
- 6-10 YRS
- 10+ YRS
- YES, POLICY DECISION
- ALIGNMENT WITH COUNCIL VISION (0-7)
- JOBS
- HEALTH & SAFETY
- ECOSYSTEM & WILDLIFE HEALTH
- OPPORTUNITY FOR EQUITY
- COMMUNITY ACCEPTANCE

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
5.1.3 Build walkable neighborhoods where residents can meet most of their daily needs without the use of a car. This includes identifying opportunity areas to apply flexible zoning practices to enable nonconforming land uses, improving transportation infrastructure to promote active transit, pursuing transit-orientated development, increasing access to parks and open space, and providing incentives for mixed-use development.	STAKEHOLDERS • City of Tualatin Community Development and Parks Departments		 • Economy • Gathering Places • Transportation • Neighborhoods • Environmental		
5.1.4 Identify opportunities for increased density. Identify areas in town that would support higher density, including community support and political will to densify, barriers to densification, and geographic opportunities that could support density.	STAKEHOLDER • City of Tualatin Community Development Department		 • Inclusive Community • Neighborhoods • Environmental		
5.1.5 Increase dense development in areas identified in action 5.1.4. To accomplish this, reduce barriers and provide incentives to encourage more high density development near downtown, transit, and other areas identified in 5.1.4. This could include removing or reducing parking minimums, reviewing current parking use, acquiring property for development, and financial incentives. This action should also align with and support housing types and densities identified in the Housing Needs Analysis.	STAKEHOLDER • City of Tualatin Community Development Department		 • Inclusive Community • Neighborhoods • Environmental		

Key

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
5.1.6 Develop a decision matrix to consider alternatives to roadway widening to ease traffic congestion. Road widening is not always the best solution to reducing traffic congestion. Reducing traffic congestion will require a multi-pronged approach including things like investing in bicycle and pedestrian infrastructure and public transit or supporting more complimentary land use types that result in shorter travel distances. These alternatives and their likely outcomes and climate impact should be evaluated.	**STAKEHOLDERS** • City of Tualatin Community Development and Public Works Departments **PLANNING/POLICY DOCUMENT** • Transportation System Plan		 • Transportation • Environmental		
5.1.7 Reduce traffic speeds in neighborhoods, the downtown and Bridgeport areas, and in other high bike/pedestrian traffic areas to increase safety. Reduced vehicle speeds decrease the likelihood of a pedestrians severe injury or death. Lower speeds also make streets more welcoming to non-car users, helping increase alternative modes of transportation by being designed to be and feel safe. Measures such as restriping streets, reducing speed limits, improved street design and streetscaping, road diets, and other traffic calming measures are ways to accomplish this. Programs such as Vision Zero are excellent tools to help advance this action.	**STAKEHOLDERS** • City of Tualatin Community Development and Public Works Departments		 • Transportation • Environmental		

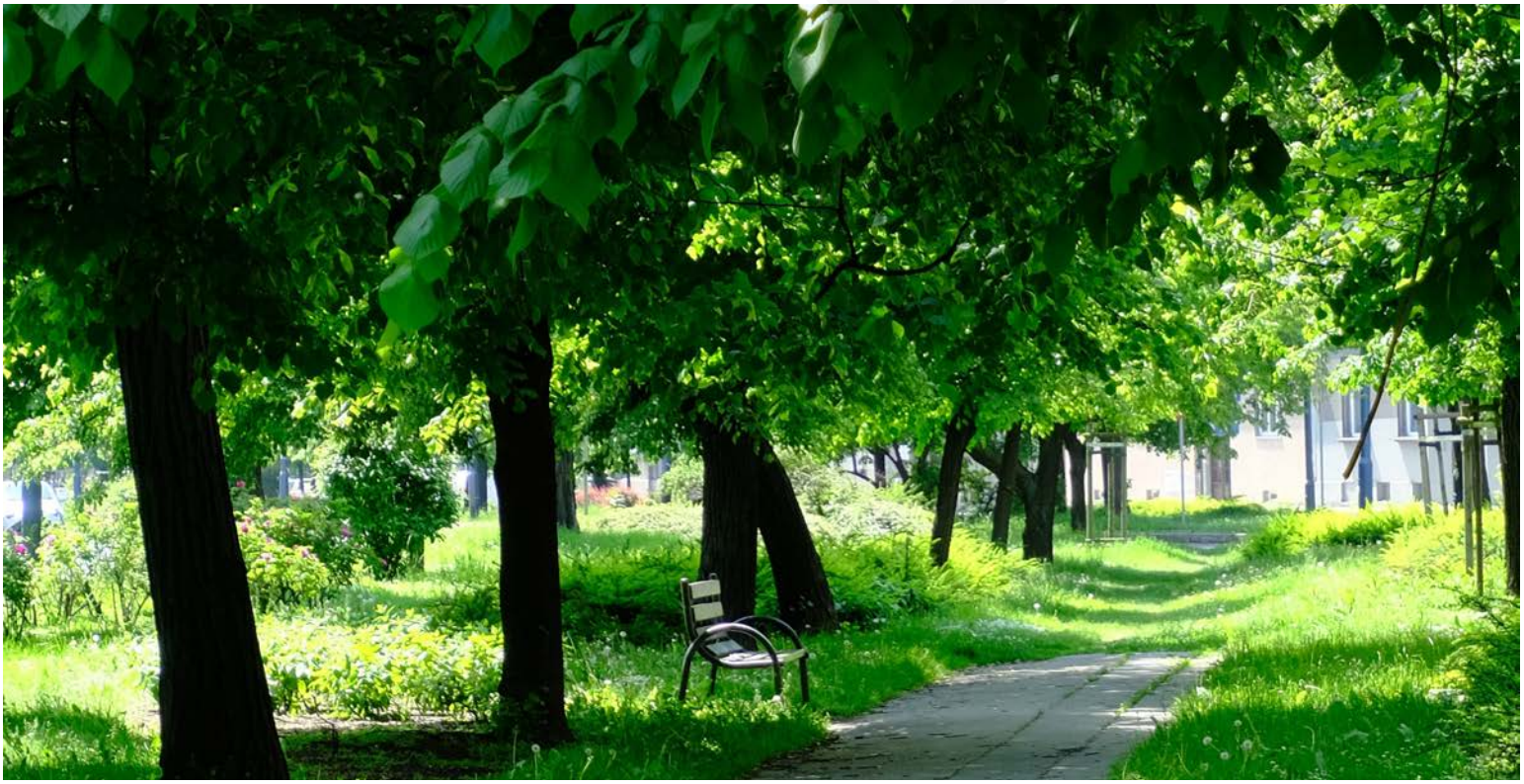
Key

Strategy 5.2 Urban/community forestry & carbon sequestration

The urban/community forestry & carbon sequestration strategy is estimated to have a relatively low emissions reduction benefit at 171,700 MT CO_2. However, there are additional adaptation benefits from shade and cooling that are not captured in this number. This strategy is estimated to cost $15-100/MT CO_2e reduced since it can be costly to plant and maintain trees.

STRATEGY	GHG BENEFIT (MT CO_2e AVOIDED)	COST PER MT CO_2e REDUCED
5.2	LOW MED HIGH	$$ cost ($10-100/MT)

Given that Tualatin is a relatively small municipality, the opportunity for large-scale carbon sequestration is low. While trees and plants do help to sequester carbon, maintaining existing trees, and planting new ones, provides an abundance of community benefits by removing climate pollution from the atmosphere and providing shade to provide natural cooling and reduce energy needs. The City of Tualatin manages trees in the planter strip and maintains list of approved street tree species for different width strips and proximity to powerlines.



Key

Low (0-399,999 $MTCO_2e$)

Medium (400,000-1,799,999 $MTCO_2e$)

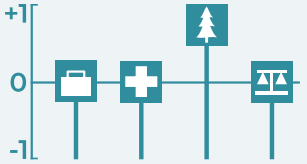
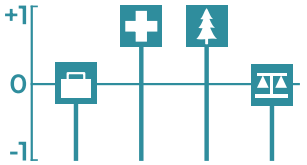
High (1,800,000-8,000,000 $MTCO_2e$)

$$$	$$	$	$$	$$$
significant savings (>$100/MT)	savings ($10-100/MT)	cost neutral (-$10 to $10/MT)	cost ($10-100/MT)	significant cost (>$100/MT)

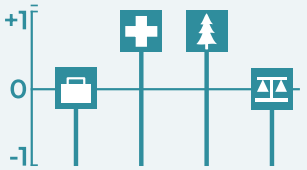
Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
5.2.1 Increase canopy cover in response to tree canopy study from action 1.1.3 to equitably increase shade in Tualatin. While there is limited opportunity for carbon sequestration in Tualatin, trees do pull carbon dioxide out of the air and provide shade, an important adaptation benefit.	STAKEHOLDERS • City of Tualatin Parks and Public Works Departments		 • Gathering Places • Transportation • Environmental		
5.2.2 Update street tree list with climate adapted and/or drought resistant tree options. Consider including large shrubs to increase biodiversity and reduce impacts on infrastructure. The street tree list was last updated in 2019. Revisiting the list every 5 years can help the City be responsive to changing climate conditions.	STAKEHOLDERS • City of Tualatin Parks and Public Works Departments PROGRAM • Sidewalk/Street Tree program		 • Environmental		
IN PROGRESS **5.2.3 Continue to partner with Friends of Trees to plant trees in Tualatin.** The City of Tualatin has partnered with Friends of Trees for 25 years and currently offers three tree planting events per year. These events focus on stream shading. The City could explore options to partner with Friends of Trees to plant street trees and/or trees in stormwater treatment facilities.	STAKEHOLDERS • City of Tualatin Volunteer Services staff and Parks Department • Friends of Trees PROGRAMS • Friends of Trees volunteer program • City of Tualatin Volunteer Services		 • Connected, Informed, Engaged • Gathering Places • Environmental		

Key

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
5.2.4 Strengthen tree removal regulations (TDC Ch. 33) to encourage tree preservation during redevelopment and landscaping on private property. This action supports Strategy 1.1.	STAKEHOLDER • City of Tualatin Community Development Department POLICY DOCUMENTS • City of Tualatin Development Code		 • Neighborhoods • Environmental		
5.2.5 Actively enforce the City's tree codes. Private trees are subject to TDC Ch. 33 and street trees are subject to TDC Ch. 74. The City could educate and communicate about tree code requirements and/or "fix it tickets" to encourage retaining and replanting tress. A "fix it ticket" refers to a correctable violation of the code where the fee would be waived once the citation is fixed. This action supports Strategy 2.1.	STAKEHOLDER • City of Tualatin Police, Community Development, and Parks Departments POLICY DOCUMENTS • City of Tualatin Development Code		 • Neighborhoods • Environmental		
5.2.6 Update code to increase the planter width to a minimum of 5 feet wide for street trees. Wider planter strips can help prevent damage to underground infrastructure, resulting in less tree removal.	STAKEHOLDERS • City of Tualatin Community Development, Public Works, and Parks Departments PLANNING/POLICY DOCUMENTS • City of Tualatin Development Code • Transportation System Plan		 • Transportation • Neighborhoods • Environmental		

Key

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
5.2.7 Encourage tree preservation during development. Evaluate establishment and enforcement of replanting requirements. Provide guidance to ensure that the right trees are planted in the right places.	**STAKEHOLDER** • City of Tualatin Community Development Department **POLICY DOCUMENTS** • City of Tualatin Development Code		 • Transportation • Neighborhoods • Environmental		

Key

- M MITIGATION ACTIONS
- A ADAPTATION ACTIONS
- S SEQUESTRATION ACTIONS
- IMPLEMENT
- CONVENE
- SUPPORT/ADVOCATE
- QUICK START
- 0-5 YRS
- 6-10 YRS
- 10+ YRS
- YES, POLICY DECISION
- ALIGNMENT WITH COUNCIL VISION (0-7)
- JOBS
- HEALTH & SAFETY
- ECOSYSTEM & WILDLIFE HEALTH
- OPPORTUNITY FOR EQUITY
- COMMUNITY ACCEPTANCE

FOCUS AREA 6: TRANSPORTATION – MODES & FUEL SWITCHING

Background

Transportation energy, particularly on-road vehicle transportation of passengers and freight, also represents a large portion of community carbon emissions (84,128 MT CO_2e, or 12%). Transportation emissions are generated at the tailpipe by combustion of gasoline, diesel, other liquid and gas fuels, or from non-renewable electricity generation for electric vehicles.

The majority of Tualatin's transportation emissions come from passenger cars. Air travel, freight, and commercial vehicles also contribute significantly to Tualatin's transportation-related emissions (Figure 30).

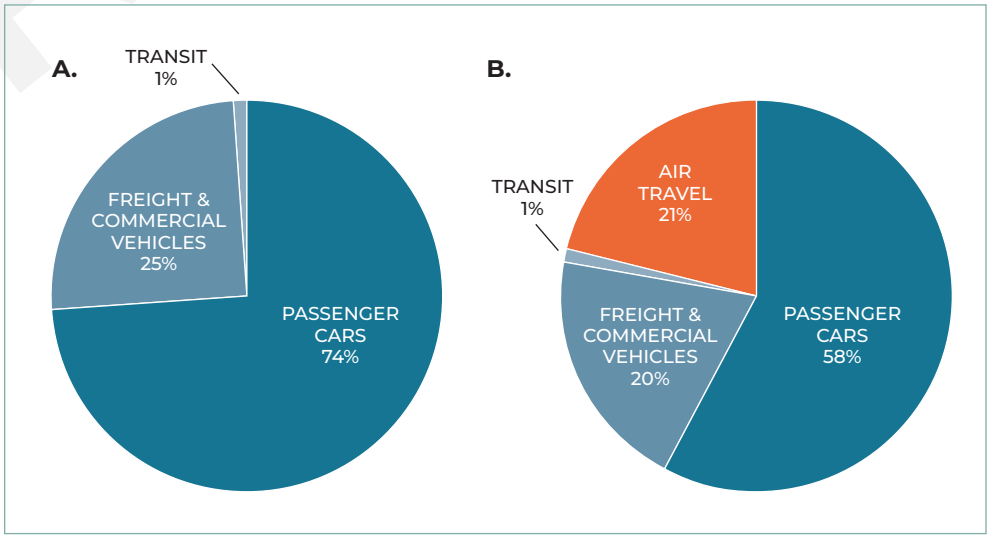


FIGURE 30: Tualatin's transportation emissions breakdown: A: excluding air travel, B: including air travel.

Strategies & actions

Tualatin has identified the following strategies and actions to reduce carbon emissions from the transportation sector. Together, these strategies can help Tualatin reduce its carbon footprint by nearly 120,000 MT CO_2e in a single year, or 20% of the emissions reductions needed to meet the goal of net zero in 2050. Between now and 2050, this is expected to add up to 1.7 million MT CO_2e.

Strategy 6.1 // Fuel switching - Electric vehicles (EVs), renewable diesel, biodiesel, ethanol, and other low-emissions fuels

The fuel switching strategy is estimated to result in a medium emissions reduction benefit at 2,184,685 MT CO_2e. This strategy is likely to result in cost savings or be cost-neutral over time because, while there are upfront costs to purchase EVs and install charging infrastructure, savings in fuel and maintenance costs even out over time. Additionally, renewable diesel costs roughly the same as fossil fuel-based diesel due to rules under Oregon's Clean Fuel Program.

STRATEGY	GHG BENEFIT (MT CO_2e AVOIDED)	COST PER MT CO_2e REDUCED
6.1	 LOW MED HIGH	$$ savings ($10-100/MT)

Increasing adoption of electric vehicles or another low-greenhouse gas fossil gasoline substitute could help reduce Tualatin's carbon emissions by about 1.6 million MT CO_2e by 2050, about 12% of the emissions reductions needed to meet Tualatin's goal of net zero by 2050.

As of late 2022, the Oregon Department of Environmental Quality's Advanced Clean Cars II rulemaking prohibits the sale of new gasoline powered passenger vehicles after 2035 and requires 10% sales of EV's each year stepped from 2025-2035. This, along with recent federal legislation and pledges by car manufacturers, is predicted to lower prices and increase supply of electric vehicles across the spectrum of automotive consumers. Prices for electric vehicles vary across models, but in general, new EVs can be bought at roughly similar price to new conventional cars.

EVs shift the ongoing cost burden from gasoline to electricity. A recent study analyzed the cost burden for EVs versus gasoline cars for each US census tract. The study found that on average, EV owners in Oregon would pay significantly less for their EV fueling than for a conventional car's gasoline. The study noted a decrease of between 50% and 85% in fueling costs for EV owners in Oregon.

EVs have drawbacks such as limited driving range on a single charge, longer recharging times compared to traditional vehicles, and variable charging infrastructure availability. Environmental concerns include the environmental impacts of battery production, including habitat disruption and resource depletion, as well as challenges related to battery disposal and recycling. Additionally, EVs' environmental benefits can be reduced if they rely on electricity from fossil fuels instead of renewable energy sources.

Key

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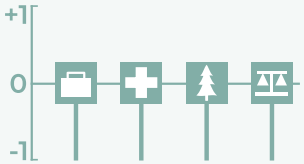
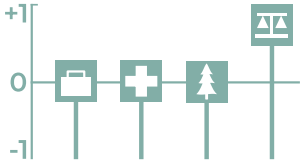
Medium (400,000-1,799,999 MTCO$_2$e)

High (1,800,000-8,000,000 MTCO$_2$e)

$$$	$$	$	$$	$$$
significant savings (>$100/MT)	savings ($10-100/MT)	cost neutral (-$10 to $10/MT)	cost ($10-100/MT)	significant cost (>$100/MT)

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
6.1.1 Establish parking and charging infrastructure requirements for electric vehicles (EVs) at new developments. Oregon Senate Bill 1044 sets zero emission vehicle (ZEV) targets for the state of Oregon. Under SB 1044, at least 90% of new vehicles sold annually will be EVs by 2035. Establishing EV parking and infrastructure requirements for new developments will make EV charging more available now while paving the way for the near future when EVs become more common.	STAKEHOLDERS • City of Tualatin Community Development Department • Oregon Department of Land Conservation and Development PROGRAMS • City municipal code update POLICY DOCUMENTS • City of Tualatin Municipal Code • Climate Friendly and Equitable Communities rulemaking • DLCD - Climate Friendly and Equitable Communities rulemaking		 • Transportation • Neighborhoods • Environmental		
6.1.2 Promote programs to help fund installation of EV chargers at new and existing affordable housing and multifamily complexes. Prioritize multifamily housing and workplaces.	STAKEHOLDERS • City of Tualatin Finance Department and City Manager's Office • Portland General Electric (PGE) PROGRAMS • PGE Transportation Matching Fund Program • PGE Drive Change Fund		 • Inclusive Community • Transportation • Neighborhoods • Environmental		

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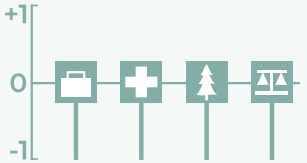
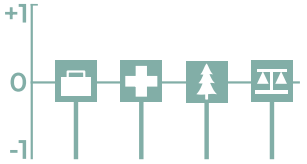
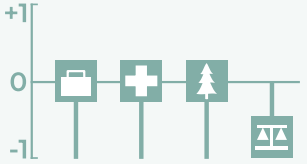
- JOBS
- HEALTH & SAFETY
- ECOSYSTEM & WILDLIFE HEALTH
- OPPORTUNITY FOR EQUITY
- COMMUNITY ACCEPTANCE

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
6.1.3 Develop policies and priorities around installation of publicly accessible charging stations in the right-of-way, including electric vehicle charging. Perform a study to determine needs and preferred locations for charging infrastructure.	STAKEHOLDERS • City of Tualatin Public Works and Community Development Departments, and the City Manager's Office PLANNING DOCUMENTS • Transportation System Plan (TSP)		M A S • Transportation • Neighborhoods • Environmental		
6.1.4 Increase the number of events promoting electric vehicles. For example, 'EV Rodeos' can help increase community members' familiarity and comfortability with EVs.	STAKEHOLDER • Portland General Electric (PGE) • Forth Mobility		M A S • Connected, Informed, Engaged • Transportation • Environmental		
6.1.5 Set targets for community electric vehicle (EV) adoption to encourage community usage of electric vehicles. In 2019, Oregon Senate Bill 1044 outlined new Zero Emission Vehicle (ZEV) adoption targets through 2035. Tualatin will set targets to support the wider statewide EV adoption goals and periodically report on progress.			M A S • Connected, Informed, Engaged • Transportation • Environmental		

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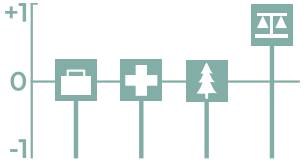
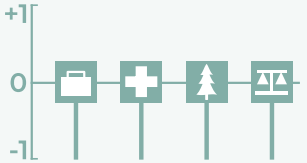
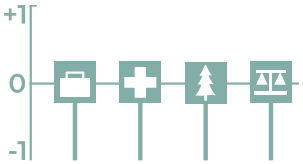
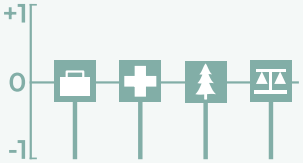
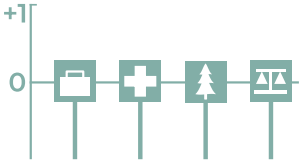
OPPORTUNITY FOR EQUITY
COMMUNITY ACCEPTANCE

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
6.1.6 Conduct an electric car share pilot program at low income or high equity needs residential areas in Tualatin. EV car share pilot programs can help increase community members' familiarity and comfortability with EVs while providing a low-cost, low emissions way for community members to get around town.			 • Inclusive Community • Transportation • Environmental		
6.1.7 Advocate to ODOT, Metro, and/ or other regional partners to bring *corridor* chargers to Tualatin. EV corridor charging involves installing charging stations along highways to create a network for long-distance travel, reducing range anxiety and providing convenient charging infrastructure for EVs on major routes. It aims to facilitate intercity and interstate travel by allowing EV drivers to charge their vehicles at regular intervals during long trips.	STAKEHOLDERS • City of Tualatin Community Development and Economic Development Departments • Oregon Department of Transportation (ODOT) PROGRAM • ODOT's state National Electric Vehicle Infrastructure (NEVI) plan		 • Transportation • Environmental		

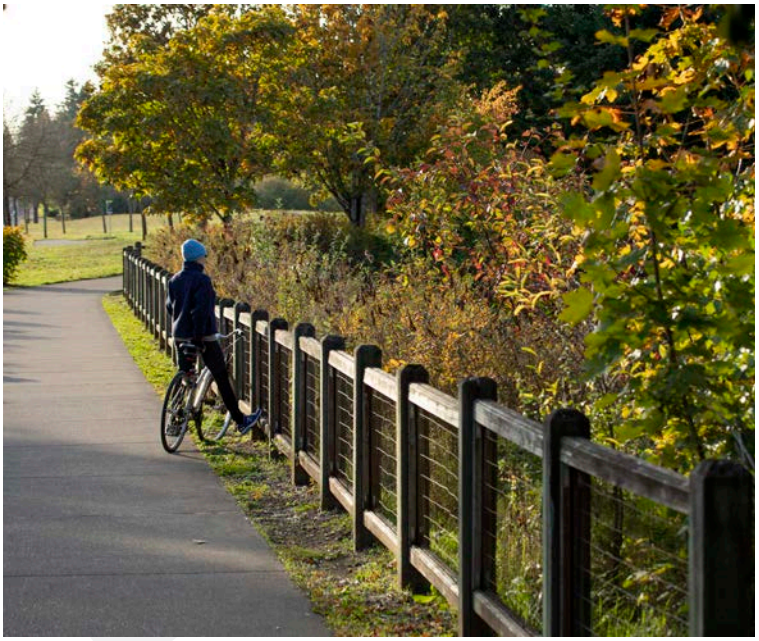
Key

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
6.1.8 Install publicly-accessible community EV chargers in Tualatin. Community charging focuses on installing charging infrastructure in local areas like residential neighborhoods and commercial districts, typically in parking lots, shopping centers, or other public spaces, to provide convenient charging options for EV owners who primarily use their vehicles for daily commuting or short-distance travel within the community. As of June 2023, the City of Tualatin is partnering with Forth Mobility to pursue a Charging and Fueling Infrastructure (CFI) grant.	STAKEHOLDERS • City of Tualatin Community Development and Economic Development Departments • US Department of Transportation (US DOT) • Oregon Department of Transportation (ODOT) • Forth Mobility PROGRAM • US DOT's Charging and Fueling Infrastructure (CFI) grant program		 • Transportation • Environmental		
6.1.9 Provide community education around the benefits of R99 diesel. Identify and prioritize reaching out to employers with large vehicle fleets in Tualatin.			 • Transportation • Environmental		
6.1.10 Require gas stations within City limits to transition to R99 diesel. See Chapter 16.60 of the City of Portland's code for a local example of a similar policy.	STAKEHOLDERS • Gas stations located in Tualatin		 • Environmental		

Key

Strategy 6.2 // Active transportation to reduce car miles and fossil fuel (gasoline) use

Active transportation, including walking, biking, and rolling, can help to reduce carbon emissions by reducing the number of cars on the road. Research suggests that use of active transportation modes is dependent on individual factors like demographics and medical conditions, social factors like coworker or spouse beliefs and behaviors or community support for bicyclists and pedestrians, and physical factors like bicycle lanes or the speed and volume of traffic along a route. Offering safe and enjoyable routes for pedestrians and cyclists can help to make active transportation options more appealing. Fewer cars on the road also improves air quality and can result in positive health outcomes due to increased physical activity, safety, social connections, and more time spent outside.



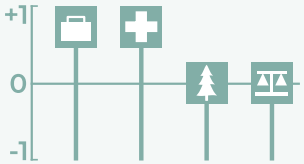
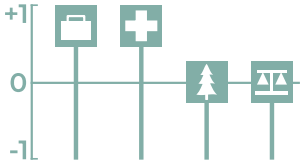
MICROMOBILITY IN TUALATIN

Micromobility refers to transportation using lightweight vehicles such as bicycles or scooters, and electric micromobility refers to things like electric bicycles (e-bikes) or scooters (e-scooters). Typically, micromobility options can be borrowed as part of a self-service rental program in which people rent vehicles for short-term use within a town or city.

Tualatin's e-scooter pilot program kicked off in August 2022 and became permanent a year later. As of September 2023, over 3,000 community members have used the scooters to make over 14,900 trips totaling over 17,000 miles and saving over 14,900 pounds of carbon dioxide. That's equivalent to taking 3,315 gasoline-powered cars off the road for one year!

FIGURE 31: Heat map showing Lime scooter rides in Tualatin.

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
IN PROGRESS **6.2.1 Update the Transportation System Plan (TSP) to increase the use of active transportation options,** including any human-powered transportation such as walking, cycling, or using non-motorized modes of transportation. Embed active transportation modes throughout the entire plan and focus on making walking or rolling an easy and accessible option to move throughout the City.	STAKEHOLDERS • City of Tualatin Community Development Department POLICY DOCUMENT • Transportation System Plan		 • Economy • Transportation • Neighborhoods • Environmental		
IN PROGRESS **6.2.2 Update the Transportation System Plan (TSP) to increase the use of electric micromobility options** such as e-bikes, e-scooters, and electric skateboards. Embed electric micromobility modes throughout the plan and focus on making these options a viable option to move throughout the City. Electric micromobility modes offer many of the same benefits as active transportation but are worthy of independent consideration given charging needs, potential safety concerns and conflicts with non-motorized active transit users.	STAKEHOLDER • City of Tualatin Community Development Department POLICY DOCUMENT • Transportation System Plan		 • Economy • Transportation • Neighborhoods • Environmental		

Key

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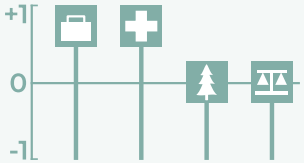
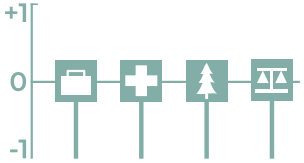
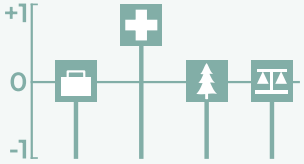
- 6-10 YRS
- 10+ YRS
- YES, POLICY DECISION
- ALIGNMENT WITH COUNCIL VISION (0-7)
- JOBS
- HEALTH & SAFETY
- ECOSYSTEM & WILDLIFE HEALTH
- OPPORTUNITY FOR EQUITY
- COMMUNITY ACCEPTANCE

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
6.2.3 Prioritize building and completing transportation projects that enhance bicycle, pedestrian, and transit access in Tualatin included in the updated Transportation System Plan.	STAKEHOLDERS • City of Tualatin Community Development and Public Works Departments POLICY DOCUMENT • Transportation System Plan		 • Economy • Transportation • Neighborhoods • Environmental		
6.2.4 Promote transportation options programs like Get There Oregon to help commuters and employers shift commute habits and work practices. Get There Connect allows users to compare commute options, find a carpool, participate in challenges, and track statistics like reduced carbon emissions, money saved, and more.	STAKEHOLDER • Oregon Department of Transportation (ODOT) PROGRAM • Get There Oregon		 • Transportation • Environmental		
6.2.5 Provide education and support programs to encourage the use of active transportation.	STAKEHOLDERS • Oregon Department of Transportation (ODOT) • Tigard Tualatin School District (TTSD) PROGRAMS • ODOT's Get There Oregon program • TTSD's Safe Routes to School program • Safe Routes to Parks		 • Connected, Informed, Engaged • Transportation • Environmental		

Key

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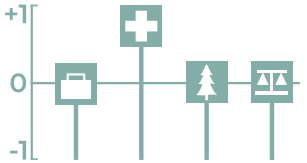
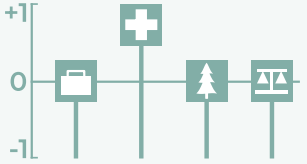
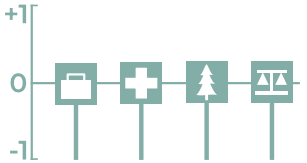
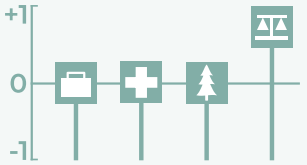
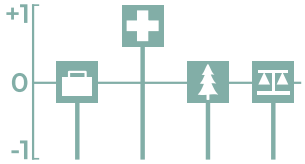
OPPORTUNITY FOR EQUITY
COMMUNITY ACCEPTANCE

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
6.2.6 Develop a Complete Street Policy. This policy informs future public improvements on streets and shared paths. Complete Streets are an approach to planning, designing, building, operating, and maintaining streets that are designed to be safe and feel safe for everyone. They are designed for speeds that reduce the chance of death or serious injury and give priority to the needs of those who are most vulnerable, including pedestrians, bicyclists, and transit riders, making it easier and safer for people to move along and across the street. This policy can guide future Transportation System Plan (TSP) updates and future transportation projects.	STAKEHOLDERS • City of Tualatin Community Development and Public Works Departments POLICY DOCUMENT • Transportation System Plan (TSP)		 • Economy • Gathering Places • Transportation • Neighborhoods • Environmental		
6.2.7 Increase funding for Neighborhood Transportation Safety Program (NTSP) for sidewalk and bike infrastructure infill, improving connectivity to schools, parks, shopping, and important community resources to make roads streets safer for non-car users. Programs such as Safe Routes to School, Safe Routes to Parks, and other programs that aim to reduce serious crashes are excellent tools to help advance this action.	STAKEHOLDERS • City of Tualatin Community Development, Public Works, and Finance Departments PROGRAM • City of Tualatin's Neighborhood Transportation Safety program		 • Transportation • Neighborhoods • Environmental		

Key

- M MITIGATION ACTIONS
- A ADAPTATION ACTIONS
- S SEQUESTRATION ACTIONS
- IMPLEMENT
- CONVENE
- SUPPORT/ADVOCATE
- QUICK START
- 0-5 YRS
- 6-10 YRS
- 10+ YRS
- YES, POLICY DECISION
- ALIGNMENT WITH COUNCIL VISION (0-7)
- JOBS
- HEALTH & SAFETY
- ECOSYSTEM & WILDLIFE HEALTH
- OPPORTUNITY FOR EQUITY
- COMMUNITY ACCEPTANCE

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
6.2.8 Explore public electric micromobility charging options. Perform a study to determine needs and preferred locations for charging infrastructure.	STAKEHOLDER • City of Tualatin Public Works Department		 • Transportation • Environmental		
6.2.9 Provide financial incentives for electric micromobility options like e-bikes and/or e-scooters, especially for low-income people and people with disabilities.	STAKEHOLDER • Portland General Electric (PGE) POTENTIAL PROGRAM • PGE Drive Change Fund		 • Inclusive Community • Transportation • Environmental		
6.2.10 Increase Safe Routes to School programming for Tualatin schools by partnering with TTSD's Safe Routes to School coordinator. Prioritize schools in higher equity need and/or high traffic areas in Tualatin.	STAKEHOLDERS • City of Tualatin Community Development Department • Tigard-Tualatin School School District (TTSD) PROGRAM • TTSD's Safe Routes to School program		 • Transportation • Neighborhoods • Environmental		

Key

Strategy 6.3 // Transit transportation to reduce car miles and fossil fuel (gasoline) use

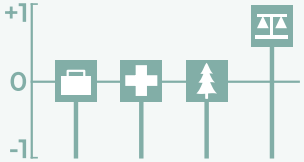
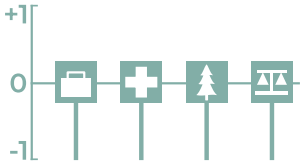
Transit transportation through Ride Connection and TriMet bus and WES services can help to reduce carbon emissions by reducing the number of cars on the road.

Tualatin currently lacks frequent and reliable transit service that connects community members to the places where they live, work, and have fun. Many transit stops in Tualatin are unsheltered, making travel by transit less appealing during times of extreme weather. Additionally, many community members indicated that taking transit feels unsafe to them. Increasing efforts to ensure safety on transit service is an important step to increasing ridership.

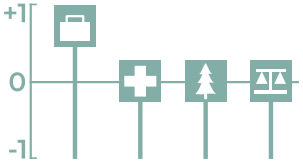
WHAT WE HEARD

Stakeholders, particularly large employers, shared that transit service in Tualatin is underutilized by employees because it does not take them where they need to go, it does not run frequently enough to be considered reliable, and/or the hours of transit operation do not match up with employee commuting hours.

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
IN PROGRESS **6.3.1 Advocate for increased transit service coverage, frequency, and safety.** Robust and reliable transit service can increase the appeal of taking transit over driving and create greater mobility for the entire community.	STAKEHOLDERS • City of Tualatin City Manager's Office, Community Development Department • TriMet • Ride Connection				
6.3.2 Educate employers about opportunities to supply employees with transit passes or incentives. TriMet offers flexible transportation programs like the Universal Annual Pass Program, Annual Pass Program, and Monthly Pass Program.	STAKEHOLDERS • City of Tualatin Economic Development • TriMet PROGRAMS • TriMet Universal Annual Pass program • TriMet Annual Pass program • TriMet Monthly Pass program				

Key

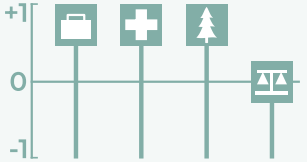
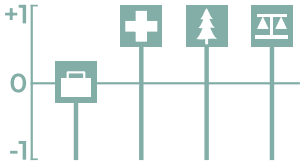
ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
6.3.3 Convene large businesses in Tualatin to lobby TriMet to expand transit service to destinations with large employee populations.	STAKEHOLDERS • Large employers in Tualatin • TriMet • Chamber of Commerce		 • Economy • Transportation • Environmental		
IN PROGRESS **6.3.4 Increase micromobility access through programs like the e-scooter program in Tualatin.** Micromobility options like e-scooters and e-bikes help to support low-carbon transportation, particularly for first and last-mile travel.	STAKEHOLDER • City of Tualatin Public Works PROGRAM • E-Scooter program		 • Economy • Transportation • Environmental		

Key

Strategy 6.4 // Remote work options to reduce car miles and fossil fuel (gasoline) use

Remote work can significantly reduce car miles and emissions by allowing employees to work from home when feasible. This reduces the need for daily commutes, leading to fewer cars on the road and decreased traffic congestion. This lowers the overall carbon footprint associated with transportation, benefiting both the environment and air quality.

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
IN PROGRESS **6.4.1 When possible and appropriate, provide remote work options to employees.** Reducing commuter trips results in fewer emissions and contributes to improved air quality.			 • Inclusive Community • Economy • Transportation • Environmental		
IN PROGRESS **6.4.2 Provide virtual meeting options.** Reducing travel for meetings results in fewer emissions and contributes to improved air quality. Providing virtual meeting options also increases access for people who are unable to join meetings in person.			 • Inclusive Community • Connected, Informed, Engaged • Economy • Transportation • Environmental		

Key

FOCUS AREA 7: CONSUMPTION – FOOD & GOODS

Background

Consumption-based emissions are generated outside of the community during the production of goods, food, fuels, and service products consumed by residents, like air travel. Consumption-based emissions presented here are estimated (see Appendix 2 for more information) and therefore the results have a greater level of uncertainty compared to other sources of emissions.

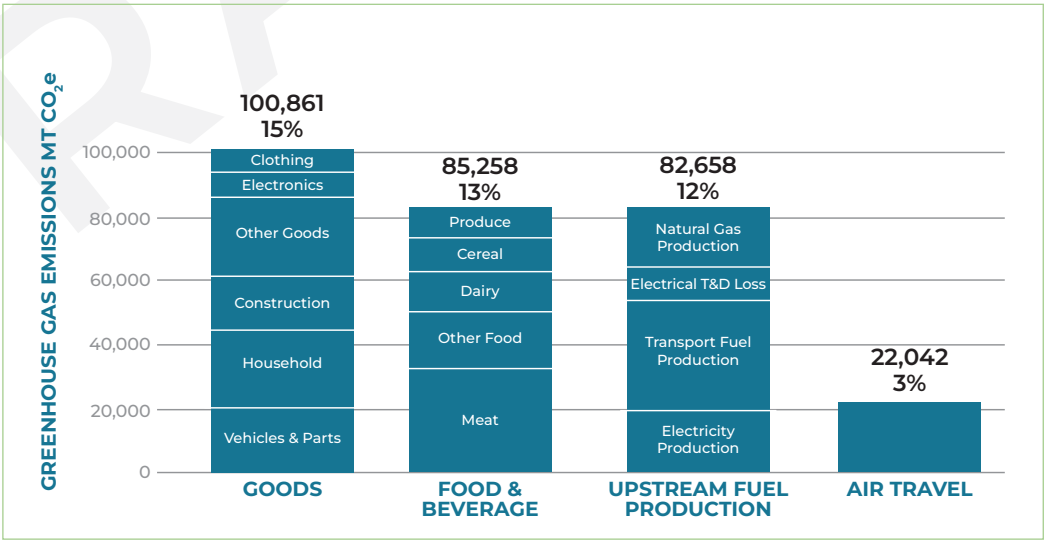


FIGURE 32: Breakdown of Tualatin's consumption-based emissions.

Goods, like household goods, clothing, and electronics, make up 100,861 MT CO_2e (or 15%) of Tualatin's emissions. Food and beverage production accounts for 85,258 MT CO_2e (13%) of Tualatin's emissions. It is worth noting that some foods produce more carbon emissions than others. For example, within the meat category, beef and lamb contribute significantly more to climate change than chicken or fish.

Producing the fuels that people consume also result in carbon emissions. In Tualatin, upstream fuel production, including the production of electricity, natural gas, and transportation fuels, accounts for 82,658 MT CO_2e (12% of Tualatin's carbon emissions). Air travel accounts for 22,042 MT CO_2e, or 3% of Tualatin's overall emissions.

Strategies & actions

Tualatin has identified the following strategies and actions to reduce carbon emissions from the consumption of food and goods in Tualatin. According to the Oregon Department of Environmental Quality, "Since the late 1980s, recycling and composting have captivated the public's attention as a solution to environmental problems associated with solid waste. But the State of Oregon and many other organizations recognize that there's an even higher priority than recycling and composting: waste prevention. In fact, Oregon law defines waste prevention as the number one priority method for managing solid waste in Oregon.

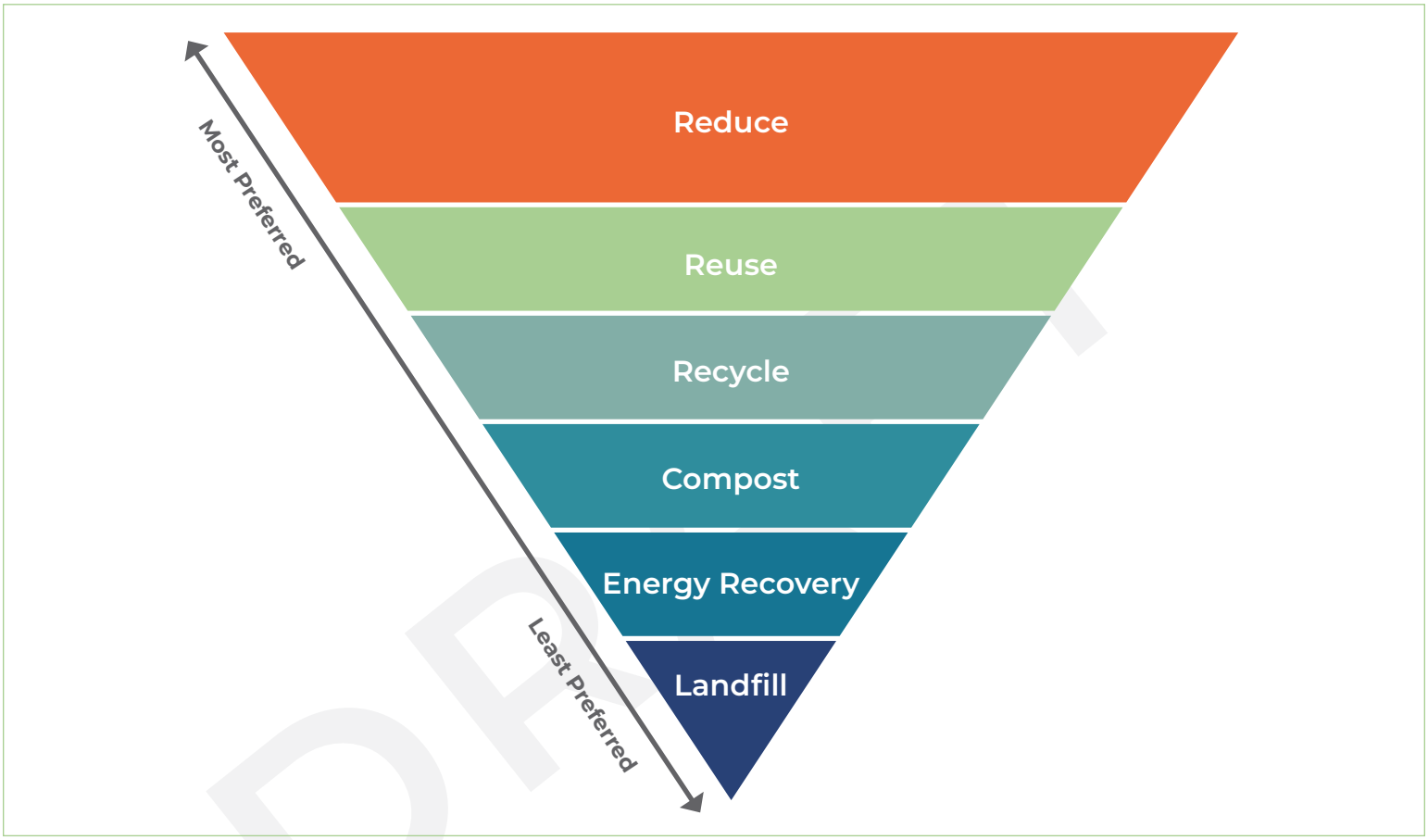


FIGURE 33: Materials management pyramid from Oregon DEQ.

Strategy 7.1 // Landfill diversion of organic materials (composting)

The landfill diversion of organic materials (composting) strategy is estimated to have a low emissions reduction benefit at 21,140 MT CO_2e. There are far more emissions associated with producing food than there are with disposing of kitchen scraps, the most impactful way to reduce landfill emissions is to reduce unnecessary consumption. This strategy is categorized as cost neutral.

STRATEGY	GHG BENEFIT (MT CO_2e AVOIDED)	COST PER MT CO_2e REDUCED
7.1	LOW MED HIGH	$ cost neutral (-$10 to $10/MT)

In communities across the state, the local waste utility picks up kitchen scraps along with the yard waste in the curbside bin. These scraps are then composted along with the yard waste. The inclusion of kitchen scraps in the yard waste bin decreases the need for landfill-bound garbage collection, allowing some customers to downsize their garbage collection bins, possibly saving money over all.

Tualatin will offer a curbside composting (also known as residential organics) pilot program so residents can put food waste into yard debris bins. The pilot program will run from July 1, 2023 to December 2023. After that, the City Council will decide whether or not to add this additional service into the regular garbage rates.

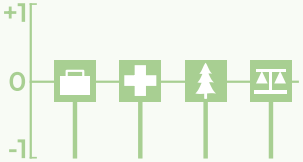
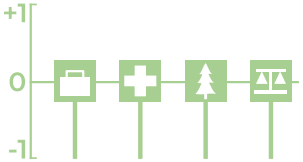
Increasing the rate of landfill diversion of organic materials (composting) could help reduce Tualatin's carbon emissions by about 21,000 MT CO_2e by 2050, representing about 0.002% of the emissions reductions needed to meet Tualatin's goal of net zero by 2050.

Key

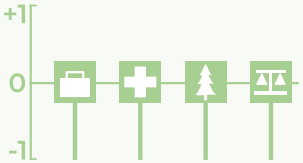
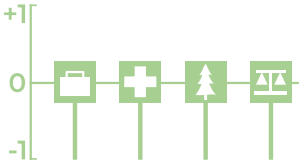
Low (0-399,999 MTCO_2e) | Medium (400,000-1,799,999 MTCO_2e) | High (1,800,000-8,000,000 MTCO_2e)

$$$	$$	$	$$	$$$
significant savings (>$100/MT)	savings ($10-100/MT)	cost neutral (-$10 to $10/MT)	cost ($10-100/MT)	significant cost (>$100/MT)

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
7.1.1 Require curbside composting at multifamily housing sites. The City of Tualatin is conducting a residential organics (curbside composting) pilot program with Republic Services from July to December 2023. Tualatin residents who live in in single-family, duplex, triplex, or fourplex homes will be able to include food scraps in their green yard debris curbside carts.	STAKEHOLDERS • City of Tualatin Public Works Department • Republic Services PROGRAM • Residential Organics (Curbside Composting) pilot program				
IN PROGRESS **7.1.2 Educate community members about best practices for curbside composting to support the curbside composting programs.** The City of Tualatin is conducting a residential organics (curbside composting) pilot program with Republic Services from July to December 2023. Tualatin residents who live in in single-family, duplex, triplex, or fourplex homes will be able to include food scraps in their green yard debris curbside carts.	STAKEHOLDERS • City of Tualatin Public Works Department • Republic Services PROGRAM • Residential Organics (Curbside Composting) pilot program				

Key

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
IN PROGRESS **7.1.3 Support Washington County's commercial and industrial composting program.** Currently, the City supports the program by sharing information and assisting with compliance, if needed. In 2019, the City adopted Ordinance 1420-19 to reinforce the goals of the program.	STAKEHOLDERS • City of Tualatin Public Works Department • Washington County • Republic Services PROGRAM • Commercial Compost Collection program				
7.1.4 Work with Republic Services to incentivize reduced food waste. Look to Eugene's "Love Food Not Waste" program as a model.	STAKEHOLDERS • City of Tualatin Public Works Department • Republic Services				

Key

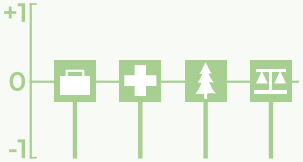
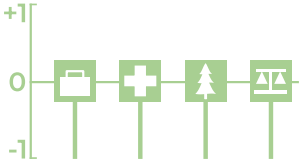
- M MITIGATION ACTIONS
- A ADAPTATION ACTIONS
- S SEQUESTRATION ACTIONS
- IMPLEMENT
- CONVENE
- SUPPORT/ADVOCATE
- * QUICK START
- 0-5 YRS
- 6-10 YRS
- 10+ YRS
- YES, POLICY DECISION
- ALIGNMENT WITH COUNCIL VISION (0-7)
- JOBS
- HEALTH & SAFETY
- ECOSYSTEM & WILDLIFE HEALTH
- OPPORTUNITY FOR EQUITY
- COMMUNITY ACCEPTANCE

Strategy 7.2 // Reduce emissions from food

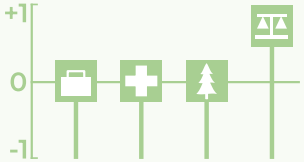
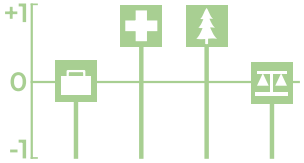
Producing food produces emissions, but not all foods are produced equally. Reducing emissions from food will require changes in dietary choices, as well as reducing food waste. Some foods, like meat and dairy, result in more emissions than others, like produce and cereals. For example, beef and lamb products are particularly high in emissions compared to other protein sources. The choices we make about what foods to buy and how much food to buy matter.

It is estimated that about 40% of all food in the United States is wasted. Growing and raising food sources is a resource-intensive process that requires inputs like water, fertilizer, labor, use of tools and machinery, and ultimately transportation to deliver food products from where they are grown or processed to where they will be bought and sold. All of these inputs result in some carbon emissions and contribute to climate change.

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
7.2.1 Participate in annual Food Waste Prevention Week educational campaign. This campaign aims to educate and inspire real cultural change around food waste in order to help families save money, reduce the negative impact of food waste on the environment, and address hunger in our communities. Oregon DEQ convenes a group of sponsors and partners to coordinate this campaign each spring. IN PROGRESS	STAKEHOLDERS • City of Tualatin Public Works Department • Oregon Department of Environmental Quality (ODEQ) PROGRAM • ODEQ's Don't Let Good Food Go Bad campaign		 • Connected, Informed, Engaged • Environmental		
7.2.2 Provide education about climate impacts related to food consumption. Food consumption has significant climate impacts. The production and transportation of food contribute to greenhouse gas emissions, deforestation, and water scarcity. Shifting towards sustainable and plant-based diets can help reduce these climate impacts and promote a more environmentally friendly food system.	STAKEHOLDER • City of Tualatin Public Works Department		 • Connected, Informed, Engaged • Environmental		

Key

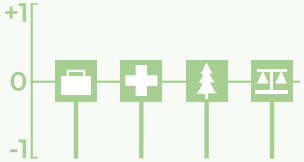
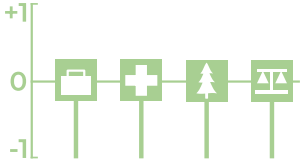
ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
7.2.3 Reduce food waste from food processors. Edible food waste can be donated to food banks. Inedible food waste like food scraps can be turned into compost, animal feed, etc.					
7.2.4 Buy locally-sourced food. Locally-produced food travels fewer miles from the farm to your table, reducing emissions from transporting food (also known as "food miles traveled").					

Key

Strategy 7.3 // Road materials management

Road construction can result in a lot of carbon emissions. There are low-emission concrete and asphalt mixes available on the market to use in road construction. Additionally, Environmental Product Declarations (EPDs) and other certifications provide credible environmental performance data for a variety of products on the market. There are also opportunities to increase the reuse and recycling of materials following the demolition of roads and other public infrastructure.

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
7.3.1 Update Public Works construction code to require low emission concrete and asphalt materials. These could include warm mix asphalt (WMA), supplementary cementitious materials (SCMs) for portland cement, etc	STAKEHOLDERS • City of Tualatin Public Works and Community Development Departments				
7.3.2 Determine the most effective policy and program pathway(s) to require construction and demolition waste materials to be sorted for reusable or recyclable materials. Sorting materials out for reuse and recycling can help to reduce demand for raw materials. This helps to reduce the carbon intensity of construction materials.	STAKEHOLDER • City of Tualatin Public Works Department • Republic Services				

Key

Strategy 7.4 // Reduce consumption of new materials

According to DEQ's materials management pyramid, reducing consumption, particularly of new materials, is the most preferred way to reduce waste. Reducing consumption of new materials can be achieved through prioritizing the repair of broken items instead of buying new and sharing materials with family, friends, and neighbors.

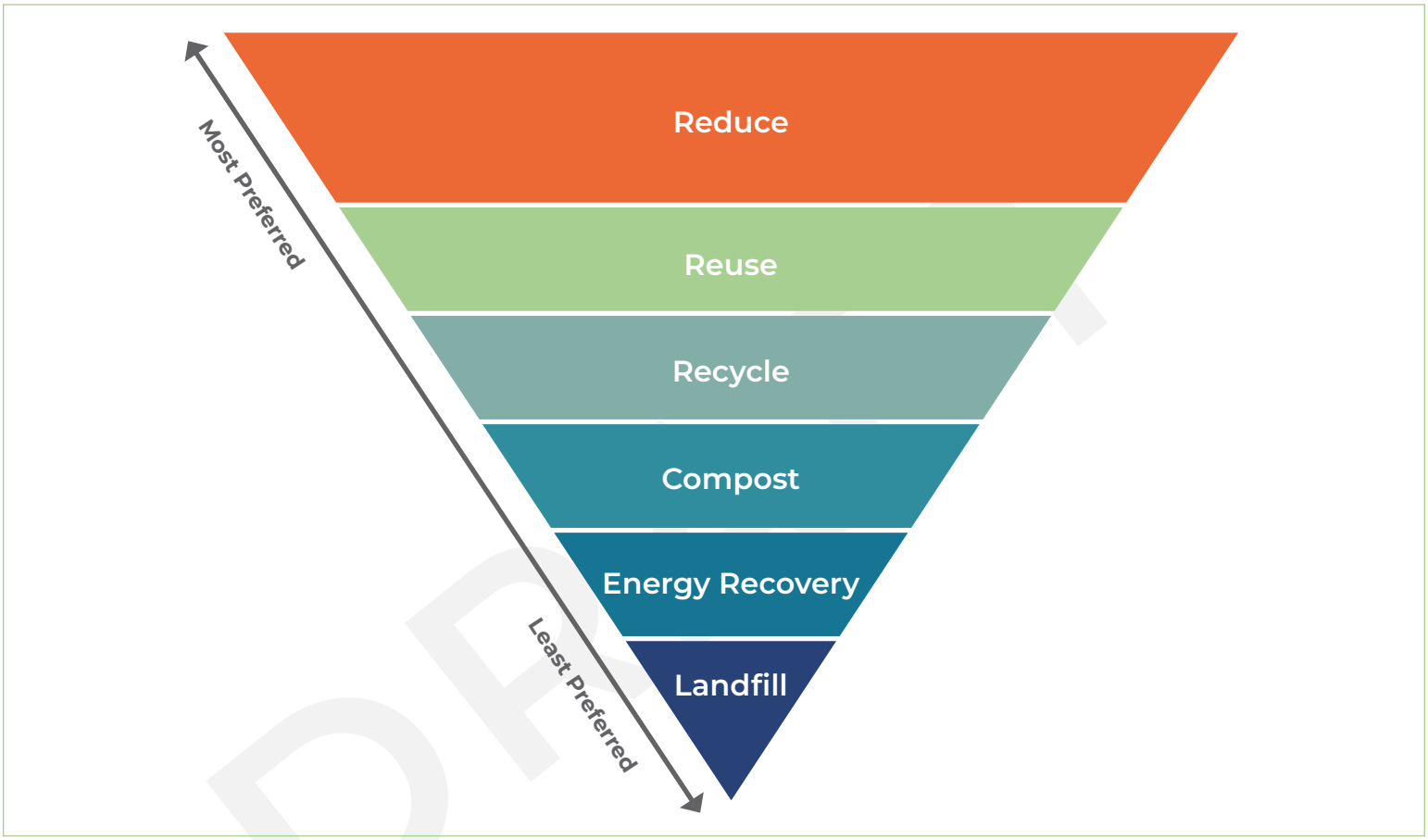
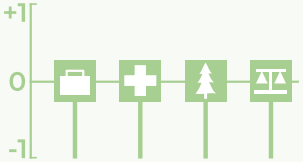
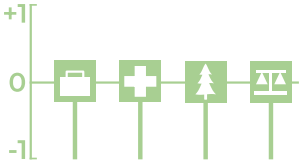


FIGURE 34: Materials management pyramid from Oregon DEQ.

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
7.4.1 Host and promote Repair Fairs to help consumers repair goods and instruct participants how to make their own repairs. Repair Fairs help consumers avoid purchasing more goods. Repair services are available for a variety of products, including small appliances such as lamps and toasters, tools, clothing and textiles, small electronics, home and garden tools, furniture, and toys. IN PROGRESS	STAKEHOLDERS • City of Tualatin Public Library • Washington County Health & Human Services (HHS)		 • Connected, Informed, Engaged • Environmental		
7.4.2 Expand Library of Things offerings to increase community access to minimal-use items (such as power tools, home appliances, entertainment, etc.). Communicate about Library of Things offerings to increase public awareness of this resource. Consider expanding to a "tool library" model to increase access to useful tools. IN PROGRESS	STAKEHOLDER • City of Tualatin Public Library PROGRAM • Library of Things		 • Environmental		

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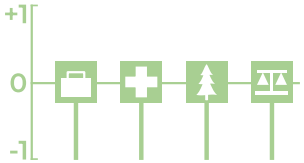
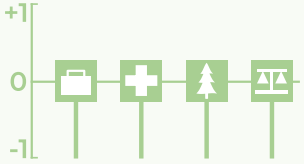
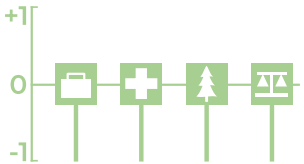
6-10 YRS
10+ YRS
YES, POLICY DECISION
ALIGNMENT WITH COUNCIL VISION (0-7)
JOBS
HEALTH & SAFETY
ECOSYSTEM & WILDLIFE HEALTH
OPPORTUNITY FOR EQUITY
COMMUNITY ACCEPTANCE

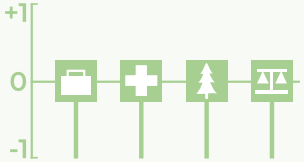
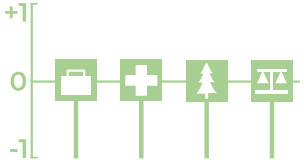
ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
IN PROGRESS **7.4.3 Join Tualatin's "Buy Nothing" group on Facebook.** The Buy Nothing project aims to "empower each of us to keep even more items in use, while we build strong communities and sustainable livelihoods for the makers, fixers, and others who transform old into new, over and over again."	PROGRAM • **Buy Nothing Tualatin**		 • Connected, Informed, Engaged • Environmental		
7.4.4 Conduct an educational campaign to increase awareness about the impacts of consumer choices on emissions. Consumer goods can have large or small carbon footprints depending on where and how they are made, and what they are made out of.			 • Connected, Informed, Engaged • Environmental		
7.4.5 Create a directory of repair services near Tualatin. Repairing broken items instead of buying new can help community members save money and reduce their emissions from new goods.			 • Connected, Informed, Engaged • Environmental		

Key

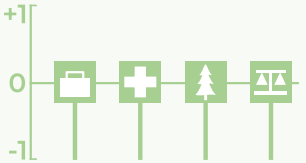
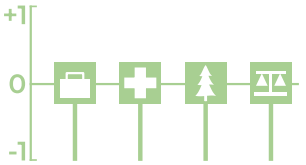
Strategy 7.5 // Responsible waste management

Does this go in the trash, the recycling, or the compost bin? The responsible waste management strategy seeks to empower community members to understand how to manage waste appropriately to reduce their environmental impact.

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
7.5.1 Develop a simple and comprehensive waste and consumption public educational campaign touching on topics such as recycling, food waste, and low-impact consumption practices. Simplifying the information into a one-stop-shop for waste prevention and management can help community members think about the life cycle of the goods they buy and empower them to make informed consumer decisions.	STAKEHOLDERS • Washington County Solid Waste & Recycling • Metro		 • Connected, Informed, Engaged • Environmental		
7.5.2 Educate students about recycling and composting best practices. If students learn about how to recycle and compost and school, they are more likely to share that information with their families and practice those habits at home.	STAKEHOLDERS • Tigard-Tualatin School District (TTSD) • Metro PROGRAM • Metro resource conservation and recycling education classroom presentations		 • Environmental		

Key

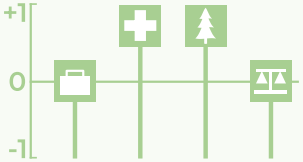
ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
7.5.3 Share educational information about the Recycling Modernization Act. This law updates Oregon's outdated recycling system by building on local community programs and leveraging the resources of producers to create an innovative system that works for everyone. The Oregon legislature passed the Recycling Modernization Act (SB 582) during the 2021 legislative session. The new law became effective Jan. 1, 2022 and recycling program changes will start in July 2025.	STAKEHOLDER • Oregon Department of Environmental Quality (ODEQ) PROGRAM • ODEQ Recycling Modernization Act educational videos		 • Connected, Informed, Engaged • Environmental		
7.5.4 Increase recycling options at multifamily housing. State and regional agencies are reviewing refuse service standards to better serve multifamily housing communities in all areas of solid waste, recycling, and organics disposal. The City may need to consider code updates to increase the size of containment areas.	STAKEHOLDERS • City of Tualatin Public Works and Community Development Departments • Republic Services • Oregon Department of Environmental Quality • Oregon Metro		 • Environmental		

Key

Strategy 7.6 // Reduce emissions from landscaping

Gas-powered landscaping tools, like mowers and leaf blowers, are sources of carbon emissions. Switching to electric or battery-powered tools can reduce emissions and have the added bonus of operating more quietly than their gas-powered counterparts.

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
7.6.1 Ban small-motor, gasoline-powered landscaping equipment, like leaf blowers, lawn mowers, etc. According to the Environmental Protection Agency, gasoline-powered lawn and garden equipment accounts for a major portion of nonroad gasoline emissions. They also emit pollutants that are harmful to human health.					

Key

- M MITIGATION ACTIONS
- A ADAPTATION ACTIONS
- S SEQUESTRATION ACTIONS
- IMPLEMENT
- CONVENE
- SUPPORT/ADVOCATE
- QUICK START
- 0-5 YRS
- 6-10 YRS
- 10+ YRS
- YES, POLICY DECISION
- ALIGNMENT WITH COUNCIL VISION (0-7)
- JOBS
- HEALTH & SAFETY
- ECOSYSTEM & WILDLIFE HEALTH
- OPPORTUNITY FOR EQUITY
- COMMUNITY ACCEPTANCE

Strategy 7.7 Refrigerants Management (AIM Act)

The refrigerants management strategy is estimated to have a relatively low emissions reduction benefit at 323,800 MT CO_2e. It is categorized as cost neutral and refrigerants will be regulated by the EPA.

STRATEGY	GHG BENEFIT (MT CO_2e AVOIDED)	COST PER MT CO_2e REDUCED
7.7	LOW MED HIGH	$ cost neutral (-$10 to $10/MT)

Refrigerants are extremely potent greenhouse gases that are used in appliances, like refrigerators, and systems, like air conditioning, that we use every day. The American Innovation and Manufacturing (AIM) Act was enacted by Congress on December 27, 2020 to reduce emissions from refrigerants. The AIM Act directs EPA to address hydrofluorocarbons (HFCs) by phasing down production and consumption, maximizing reclamation and minimizing releases from equipment, and facilitating the transition to next-generation technologies through sector-based restrictions.

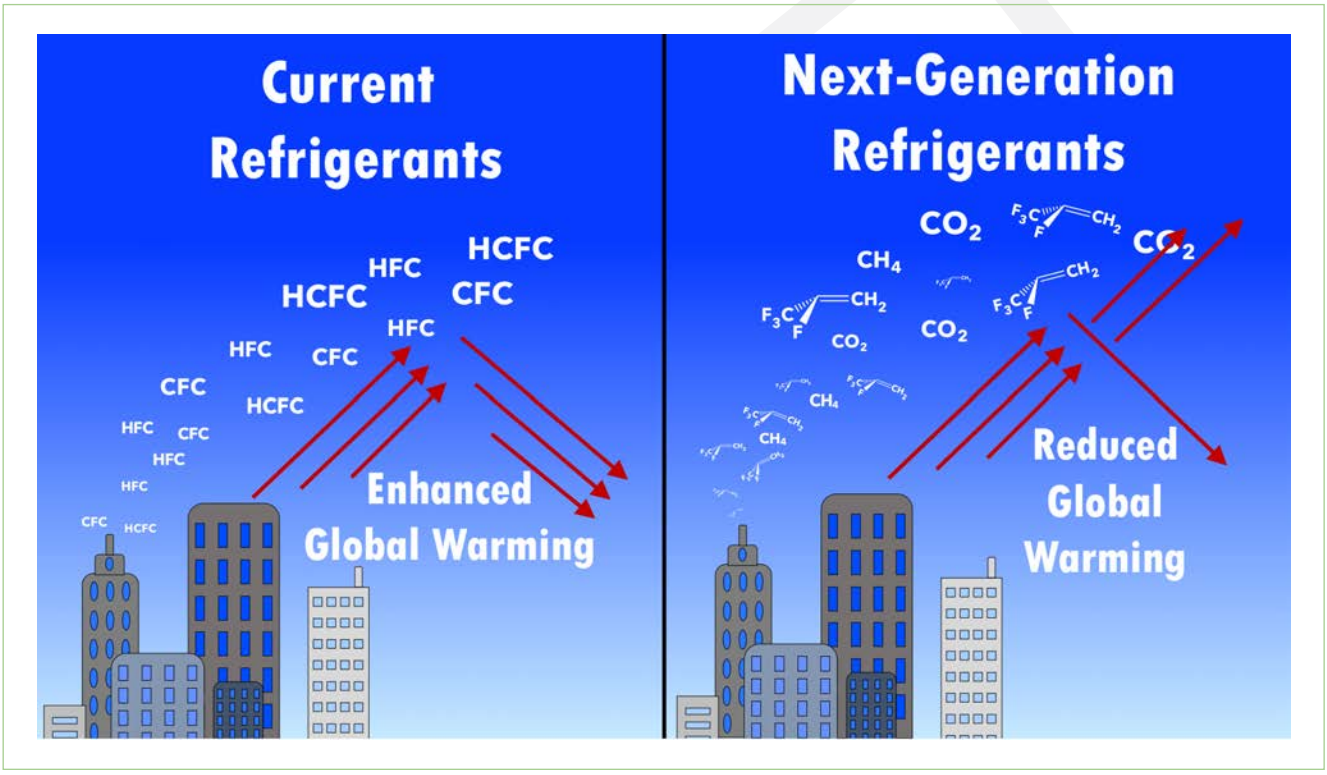


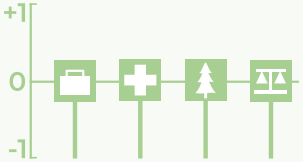
FIGURE 35: Current refrigerants are made up of greenhouse gases, like HFCs, that are highly effective at trapping heat in the atmosphere. Next-generation refrigerants will be engineered to trap less heat, contributing less to global warming.

Key

Low (0-399,999 MTCO_2e) | Medium (400,000-1,799,999 MTCO_2e) | High (1,800,000-8,000,000 MTCO_2e)

$$$	$$	$	$$	$$$
significant savings (>$100/MT)	savings ($10-100/MT)	cost neutral (-$10 to $10/MT)	cost ($10-100/MT)	significant cost (>$100/MT)

Actions

ACTION	STAKEHOLDERS, PROGRAMS, & PLANNING/POLICY DOCUMENTS	CITY ROLE	CHARACTERISTICS	CO-BENEFITS	POLICY DECISION
7.7.1 Incentivize smaller supermarkets and restaurants to upgrade their refrigeration systems as low-carbon refrigerants become standard and high-carbon refrigerants are phased out. The American Innovation and Manufacturing (AIM) Act authorizes the Environmental Protection Agency to address carbon emissions from refrigerants by phasing down their production and consumption, maximizing reclamation and minimizing releases from equipment, and facilitating the transition to next-generation technologies through sector-based restrictions.	STAKEHOLDER • Small supermarkets and restaurants		 • Economy • Environmental		

Key

- M MITIGATION ACTIONS
- A ADAPTATION ACTIONS
- S SEQUESTRATION ACTIONS
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- CONVENE
- SUPPORT/ADVOCATE
- QUICK START
- 0-5 YRS
- 6-10 YRS
- 10+ YRS
- YES, POLICY DECISION
- ALIGNMENT WITH COUNCIL VISION (0-7)
- JOBS
- HEALTH & SAFETY
- ECOSYSTEM & WILDLIFE HEALTH
- OPPORTUNITY FOR EQUITY
- COMMUNITY ACCEPTANCE

SECTION 4

NEXT STEPS

ONGOING CLIMATE ACTION EFFORTS

We know that achieving our goal of net zero carbon emissions by 2050 won't be easy and we can't do it alone. We also know that it's not too late to take action to ensure that our community is a healthy and thriving place to live now and for generations to come. The community Climate Action Plan was created to provide a comprehensive framework to reduce carbon emissions and prepare the Tualatin community for the local impacts of climate change that we have already begun to experience.

To achieve Tualatin's climate goals, the city aims to prioritize actions that enhance equity, provide benefits to the community, and build on partnerships with other agencies, community organizations, and the business community. Climate mitigation and resilience work is already happening, and will continue, at multiple levels, including at the local, state, and federal levels.

Community

No individual action, city effort, or statewide program will ultimately be the sole reason for success in reducing carbon emissions and adapting to a changing global climate. However, the cumulative actions that we take together can, and will, make a difference for Tualatin residents, Oregonians, Americans, and people around the globe.

Community engagement doesn't stop with the adoption of this plan. The City will continue to engage with community members as we move towards implementing the actions in this plan to ensure that the community has a voice in how change is made. Additionally, our What You Can Do factsheets provide information on how you can begin to reduce your carbon footprint today.

Locally

The energy and water utilities that serve the Tualatin community, parks and government agencies, transportation and waste service providers, as well as housing and sustainability professionals have all been important partners developing the climate action plan and will play key roles in its implementation.

Many of our partners are working towards their own climate goals. Two key utility providers in Tualatin have established carbon pollution reduction targets. PGE's goal is to achieve "at least an 80% reduction in greenhouse gas emissions from power served to customers" by 2030 and "zero greenhouse gas emissions from power served to customers" by 2040. Under Portland's Climate Emergency Declaration, the City of Portland aims to "achieve a 50% reduction in carbon emissions from 1990 levels by 2030, and reach net-zero carbon emissions before 2050."

We look forward to building on these relationships and making change together.

Regionally

Tualatin is a member of the Partners for a Sustainable Washington County Community and USDN Cascadia Network groups. These groups share best practices and collaborate on regionally-applicable projects. The City is also partnering with Metro on the development of a regional climate action plan funded by the EPA's Climate Pollution Reduction Grant (CPRG).

Statewide

In 2007, Oregon legislators adopted a policy to achieve a goal of reducing Oregon's climate pollution by 75% by 2050. As of 2020, the state was not on track to meet this goal.

In 2021, the Environmental Quality Commission adopted rules which establish a new Climate Protection Program to reduce greenhouse gas emissions and address the effects of climate change. This rulemaking established a new program to set limits on greenhouse gas emissions from significant sources in Oregon, including large stationary sources (like buildings), transportation fuels, and other liquid and gaseous fuels; defined regulatory applicability and program requirements; and prioritized equity by promoting benefits and alleviating burdens for environmental justice and impacted communities.

The Land Conservation and Development Commission launched the Climate-Friendly and Equitable Communities (CFEC) rulemaking in September 2020 to address emissions from transportation. The Commission adopted rules to implement the CFEC program in July 2022 and later amended the program with temporary rules in April 2023. CFEC rules require the eight most populated communities in Oregon (including the Portland Metro Region) to change their local transportation and land use plans to do more to ensure Oregonians have more safe, comfortable ways to get around, and don't have to drive long distances just to meet their daily needs.

In April 2023, the Oregon Global Warming Commission published a Roadmap to 2030 to guide climate action at the state level. The roadmap includes six overarching strategies for maintaining and increasing Oregon's climate action ambition.

Federally

Tualatin is a member of the Urban Sustainability Directors Network (USDN), an organization that focuses on creating equitable, resilient, and sustainable communities by advancing the field of local government sustainability and equipping practitioners across the U.S. to be catalysts of transformative change.

The City is a member of the Climate Mayors Network, a group of over 500 cities across the U.S. who have committed to emissions reduction and upholding the Paris Climate Agreement through significant climate action and policy.

There is an abundance of federal funding opportunities for climate pollution reduction projects through the Infrastructure Investment and Jobs Act (IIJA, also known as the Bipartisan Infrastructure Law) of 2021 and the Inflation Reduction Act (IRA) of 2022. The City is partnering with Forth Mobility and other nearby municipalities to pursue $15 million in funding for electric vehicle charging and fueling infrastructure. This funding is one of many opportunities made available through the IIJA.

PUTTING THE PLAN INTO ACTION

What's next?

Creating a Climate Action Plan is a meaningful first step towards addressing climate change in Tualatin. Implementation of the actions in this plan can begin once the plan is adopted by the City Council. However, we will only achieve our ambitious goal if we invest time, energy, and resources in taking action. Here are 7 actions the City could implement in the next 5 years to help Tualatin institutionalize climate action and achieve its climate goals.

Actions

ACTION
Create a climate action staff advisory group to select priorities and projects, increase buy-in, and move actions included in the plan forward. This could be modeled after the Neighborhood Transportation Safety Program group, and/or could be a continuation of the existing Climate Action Plan Steering Committee.
Develop a climate action engagement strategy to be used during plan implementation. Engagement efforts should focus on information sharing, gathering feedback on the implementation of specific actions, and celebrating the climate action work already being completed by community members.
Hire a professional facilitator (consultant) to facilitate climate action-focused project ideation workshops to better prepare for federal funding dollars.
Fund one (1) full time employee to manage implementation of the Climate Action Plan. Implementation of the CAP will require ongoing stakeholder coordination, project management, identifying and obtaining external funding (Climate & Sustainability Analyst).
Add a 'Climate Impacts' section to all staff reports for City Council and the Planning Commission. Similar to the 'Financial Implications' section on the existing staff report template, including a dedicated section will require staff and elected officials to consider how a given recommendation impacts Tualatin's climate goals.
Include 'Climate Impacts' as a scoring criteria in Requests for Proposals (RFPs) for City projects. Including climate impacts as a scoring criteria could be a good tool to help staff differentiate between proposing firms.
Increase communication and education around climate change for community members and City staff. This action acknowledges that it is important to keep the conversation about climate going after the plan is adopted. Focus on highlighting 'climate wins' that are taking place in the community to inspire action, and provide information on actions that folks can take at the individual or household level.

Completion of the community Climate Action Plan is just the start. The City is also considering undertaking an operational climate action plan to address emissions from City operations, as well as a Sustainability Plan to address broader issues that impact the environment.

Together, we can create a more resilient and thriving Tualatin.

APPENDICES

APPENDIX 1: CLIMATE 101 - FUTURE PHYSICAL CONDITIONS TECHNICAL READER

Future Physical Conditions and Climate 101 – Technical Reader

June 2022

Report produced by Good Company
for the City of Tualatin

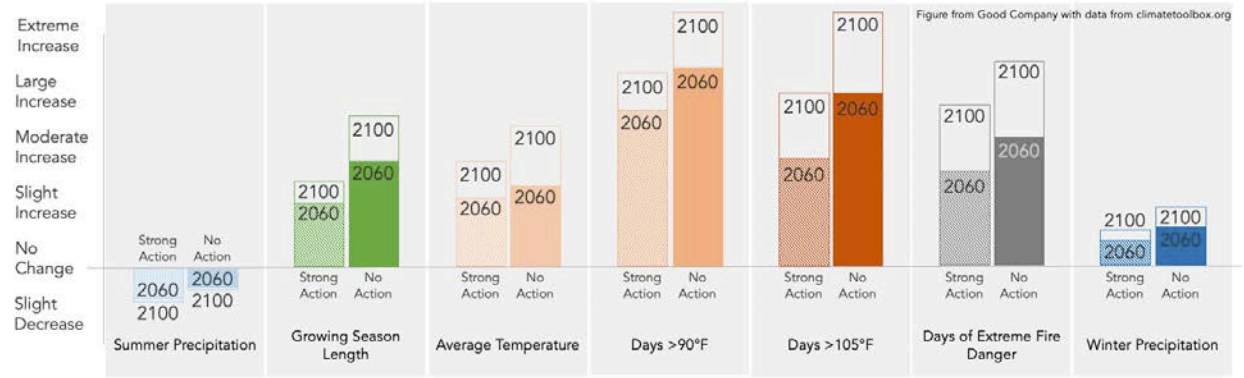
Future Physical Conditions – How Will Climate Change Affect Tualatin?

The intention of this document is to help the people of Tualatin understand the local impacts of climate change and the impact that our actions (or inactions) can have to ensure that Tualatin can continue to be a prosperous, just, and beautiful place to live. Where possible, we share what the differences in future physical conditions will be if we and the rest of the world take action to reduce emissions (Strong Climate Action scenario) compared to if we do not take action (No Climate Action scenario). Figure 1 shows a summary of the expected changes from 2060 to 2100 with and without climate action. Tualatin acknowledges that climate change will impact historically underserved communities first and worst, and is committed to devoting resources to engage with, listen to, and better serve these communities moving forward.

Snapshot: It's Going to Get Hotter with More Intense Rain Events

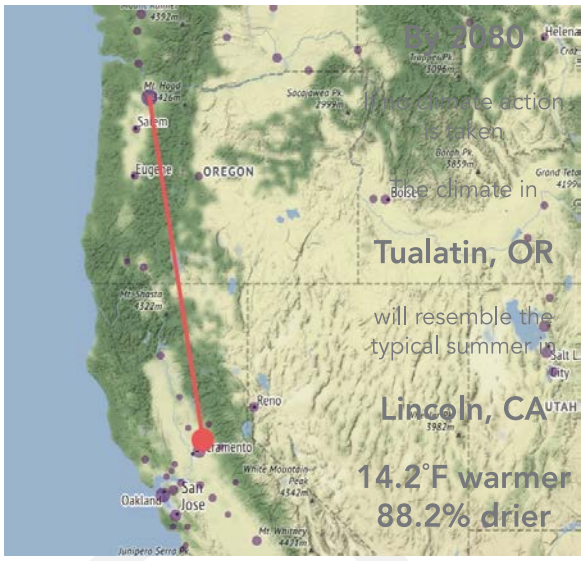
Figure 1 compares the scale of change in key factors by mid-century and by the end of the century under strong climate action and no climate action scenarios. In both scenarios, we will feel the impacts of climate change and will need to adapt but if we act quickly, we can avoid the worst of the impacts.

Figure 1: Climate change depending on global climate action (Good Company figure, Climate Toolbox data)



By the end of the century, without climate action, Tualatin is likely to ***experience a summer climate much like California's Sacramento Valley***[1]***.*** (Figure 2) The number of days over 90 degrees every summer are expected to increase dramatically: ***from a historical average of 6 to nearly 60 by the end of the century.*** In contrast, if we take strong climate action, ***we can constrain the number of hot days to under 30.***

Figure 2: Tualatin will be like Central California



In terms of water, Tualatin will have *mostly unchanged total rainfall with an increase in big storm events ("atmospheric rivers") resulting in more rainfall over shorter periods of time.* The Tualatin River watershed is in the coast range and does not rely on snowpack for year-round flow and so flow through Tualatin will remain largely unchanged. The Willamette River, on the other hand, relies on disappearing winter snows for its summer flow and will experience drastically decreased flows in the summer.

Wet Season

Precipitation

Overall rainfall quantities will remain nearly unchanged for Tualatin. The most noticeable change will be an increase in "atmospheric rivers", weather systems that bring large storms with heavy precipitation. Maybe Oregonians will finally start carrying umbrellas.

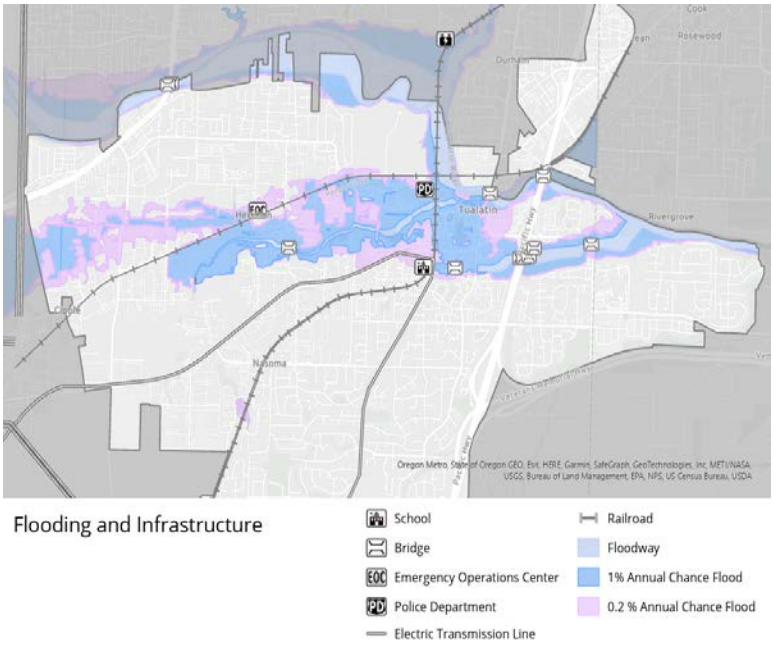
Flooding

Flooding is extremely location-specific and dependent on the local topography. Figure 3 shows the current flood map for Tualatin. The darker blue areas show where historically there has been a 1% chance of a flood occurring in a year (1 in 100 chance). This is sometimes known as the hundred-year flood. The pink area shows where the has been a 0.2% chance of flooding in a given year (known as a 500 year flood). As of the time this

[1] From University of Maryland Center for Environmental Science. https://fitzlab.shinyapps.io/cityapp/

document was written (spring 2022) FEMA had not yet released the most recent flood maps, so this map only reflects historical conditions. In the future, however, increased severity of rain events is likely to increase the likelihood and severity of flooding. The increased chance means the blue area may come to represent a 2-5% chance per year (50 to 20 year flood), and the pink areas may expect flooding every hundred instead of five-hundred years. In short, larger flooding events are becoming increasingly likely.

Figure 3: Current Flood Map



Dry Season

Heat

As mentioned before, an increase in average temperatures is expected whether we take action on climate or not, but we can avoid the worst of it (Figure 4). While rising temperatures create risk for plants and animals (including humans), higher temperatures will expand the growing season, creating an opportunity for agriculture. Under a strong climate action scenario, ***Tualatin can expect an increase in growing season from 239 days a year to 289 days a year. Under a "no change" scenario, the growing season will be nearly the whole year at 330 days.*** This change in growing season presents an opportunity for agricultural production as an increase in growing season can lead to an increase in production with appropriate crop choices. Increased

Figure 4: Expected range of temperature change by mid and late century

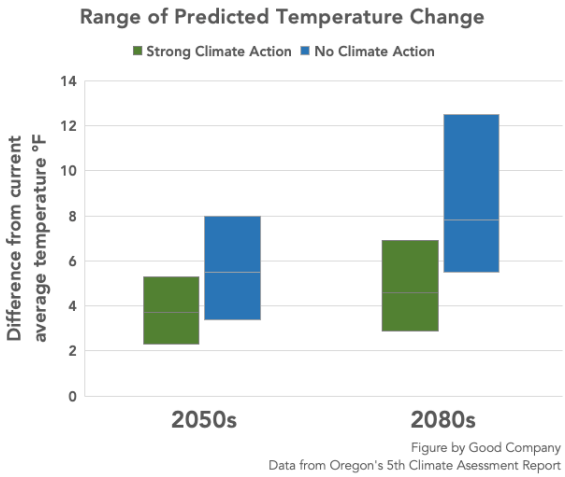


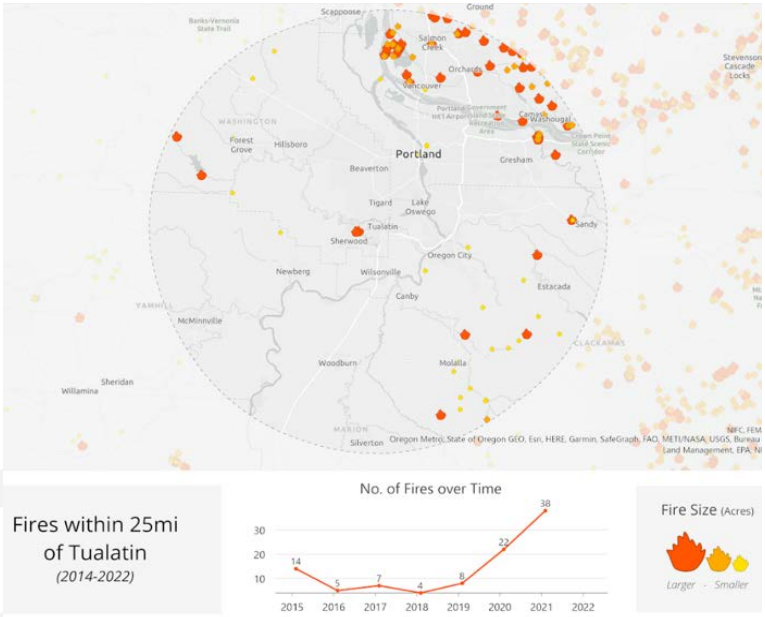
Figure by Good Company
Data from Oregon's 5th Climate Assessment Report

heat and decreased snow will likely lead to drought, and so increasing water storage in the Willamette basin will be critical to utilizing the expanded growing season.

Fire

The fire pattern of the forests of the Coast Range to the west of Tualatin is characterized by infrequent, high severity fires. The combination of dense Douglas fir regrowth after logging combined with an increase in summer heat is likely to intensify the fires, leading to more severe fires that will leave mostly-dead forest and increase burned areas. We are already seeing the devastating effects, as shown in Figure 5, with fires around Tualatin increasing steadily in the last few years. Without climate action, the current average of 10 days of extreme fire danger will double to 20 by the end of the century. Strong climate action can decrease the number of extreme fire danger days to 17.

Figure 5: Recent fire conditions around Tualatin



Air Pollution

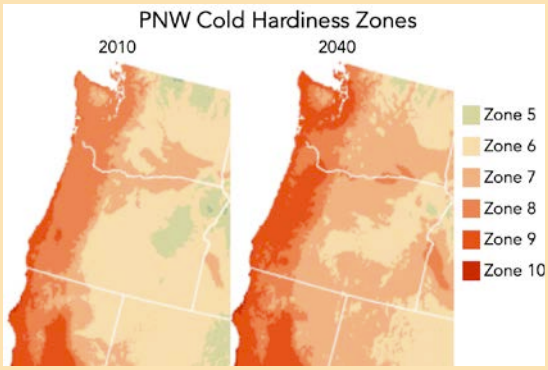
Pollen levels are expected to increase with the increase in growing season, worsening seasonal allergies. Ozone levels are also expected to climb as temperatures increase, worsening asthma, emphysema, and other respiratory disorders. Wildfire smoke is expected to increase with wildfires, not just in nearby forests, but across the West. Smoke can cause and exacerbate numerous health conditions including acute respiratory disorders like asthma, but also cardiovascular disease.

Year-Round

Plant and Animal Ranges Change

Figure 6

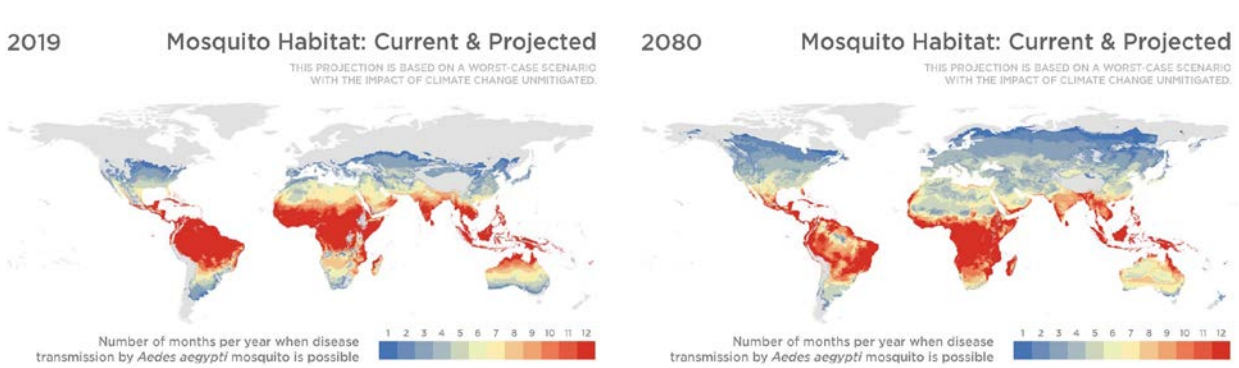
Make lemonade? The USDA defines cold hardiness zones to tell gardeners which plants will be able to survive the winter. Tualatin's zone will shift from 8b to 9a (Chico, CA) under strong climate action and to 9b (Napa, CA) under no climate action. This means more citrus trees and passion fruit but fewer apples and pears.



The ability of plants and animals to survive is affected by a combination of water availability and temperature. Changing either of those factors will result in a change in which plants and animals that can live around Tualatin. Although living things have some capacity to adapt to changes in their environment, the rate of climate change generally exceeds the rate of adaptation observed in the wild or in fossil records.

Many of the species that currently inhabit our forests and streams will not be able to survive in the changing conditions. For example, native trout and salmon are expected to decrease by 60%. Other plants and animals, on the other hand, may thrive under the new conditions. warming waters are also expected to increase the frequency of harmful algal blooms. In addition, changing conditions can also change

Figure 7: Expanding malaria mosquito habitat

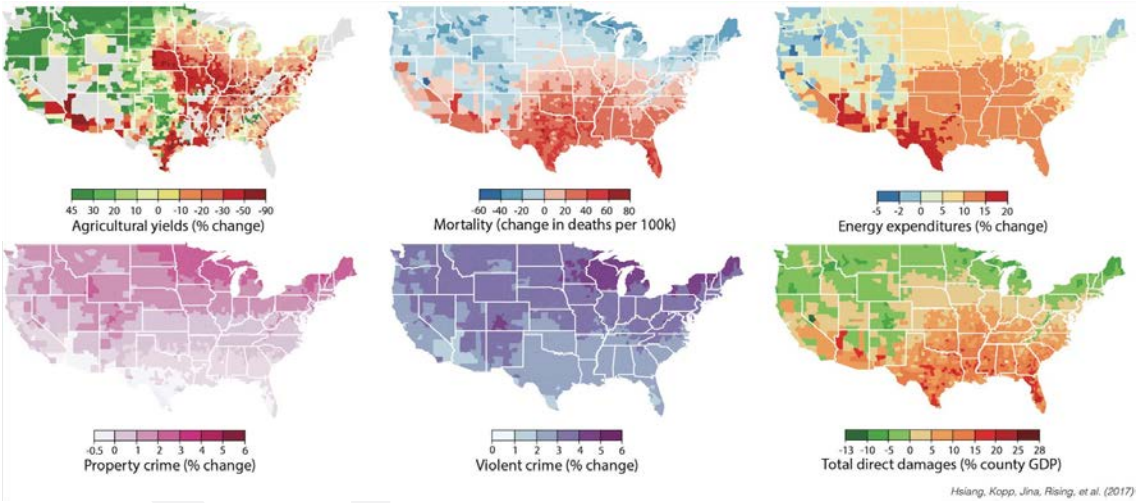


the range of diseases. The range of the mosquito that carries malaria is predicted to shift all the way up to Alaska without climate action (Figure 76[2]).

Increasing Population

The United States will experience changes across an array of sectors. Overall, the Pacific Northwest will remain one of the best places to live in the country. Figure 8[3] shows decreasing affordability and comfort in the southern and midwestern states and more moderate changes in the northwest. This will likely lead to people moving to more comfortable conditions in the northern states. As other parts of the country suffer through droughts, hurricanes, and intolerable heat waves, it is likely that the increasing population trend in the Willamette Valley will continue, resulting in higher demand for homes and resources in our area.

Figure 8: Quality of Life Changes Across the U.S.



[2] Figure adapted from Ryan, S.J. et al, 2019. Global expansion and redistribution of Aedes-borne virus transmission risk with climate change. PLOS Negl Trop Dis. 13(3): e0007213

[3] Figure adapted from *Estimating economic damage from climate change in the United States*, Hsaing et al, Science 2017

Health Effects

The Oregon Health authority put together a comprehensive assessment of how climate change will affect Oregonians' health[4]. We can expect many of the above-mentioned effects along with an increase in heat-related conditions, such as heat exhaustion and infectious diseases such as West Nile, Lyme, and fungal diseases. Furthermore, heat affects human health through increased stress and has been linked to increased violence[5] in some populations. Pregnant people, people who work outdoors, the elderly, and people without access to air conditioning are at particularly increased risk for heat stroke and other heat related conditions.

<table>
<tr><th>Climate-related drivers of health: environmental hazards</th><th>Stress factors: inequities in social, physical environment, cultural, and economic supports</th></tr>
<tr><td>Heat</td><td rowspan="2">Systemic inequities in policies</td></tr>
<tr><td>Infectious disease vectors</td></tr>
<tr><td>Wildfire</td><td rowspan="3">Inequities and unequal investment in social determinants of health (e.g., housing, education, income, wealth, transportation access, food security, income security, access to health care)</td></tr>
<tr><td>Air quality (e.g., pollen, wildfire smoke, smog, ozone)</td></tr>
<tr><td>Storms, floods, landslides</td></tr>
<tr><td rowspan="2">Sea level rise</td><td rowspan="2">Capacity and adaptive capacity of infrastructure, institutions, and systems to support human health (e.g., culturally specific services, surge capacity of hospitals)</td></tr>
<tr><td>Drought, water insecurity</td></tr>
<tr><th colspan="2">Effects on human health</th></tr>
<tr><td colspan="2">Hazard-related acute conditions (e.g., heat stroke, asthma attack)</td></tr>
<tr><td colspan="2">Hazard-related chronic conditions (e.g., heart disease, diabetes, respiratory illness)</td></tr>
<tr><td colspan="2">Infectious diseases (e.g., Lyme disease)</td></tr>
<tr><td colspan="2">Mental health conditions</td></tr>
<tr><td colspan="2">Adverse pregnancy outcomes</td></tr>
</table>

[4] Table from OHA Climate assessment report

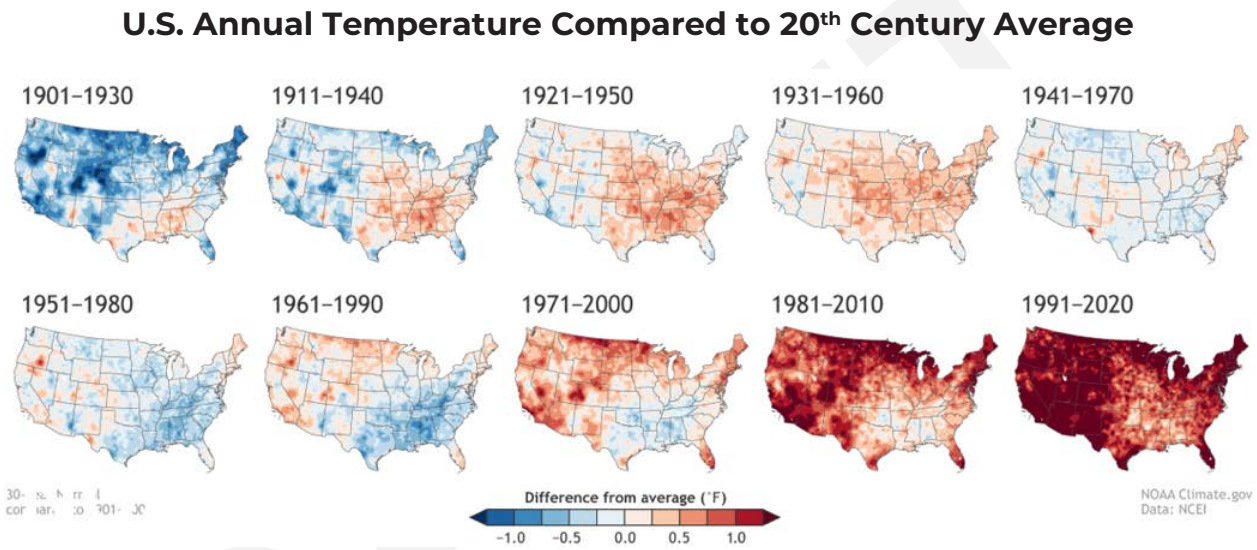
[5] "The Causal Effect of Heat on Violence: Social Implication of Unmitigated Heat Among the Incarcerated" Anita Mukherjee and Nicholas J Saunders, National Bureau of Economic Research Working Paper 2021

Climate 101

How Do We Know Climate Change Is Actually Happening?

The average temperature has unmistakably been going up over the last century, way beyond what we have seen before. This is supported by a wide range of evidence from melting glaciers[6] and polar ice caps[7] to earlier bird migrations[8].

Figure 9: Increasing temperatures across the U.S.



What is a Greenhouse Gas (GHG)? Greenhouse gasses are any of a number of gasses that trap heat in the atmosphere, causing the greenhouse effect. Some are naturally produced: we breathe out carbon dioxide (CO_2) and cow burps contain methane (CH_4). These can also be released through human activity: burning wood or coal releases CO_2 and decomposition in landfills releases CH_4. Burning fossil fuels such as coal and natural gas accounts for 85% of the human caused CO_2 emissions. Some GHGs are synthetic: hydroflourocarbons and other fluoridated gasses are used in industrial processes and refrigerants. CO_2 makes up most of the GHGs in the atmosphere but CH_4 and the synthetic gasses have a much greater ability to trap heat. Higher concentrations of these gasses in the atmosphere leads to more heat trapped on earth.

[6] https://www.climate.gov/news-features/understanding-climate/climate-change-glacier-mass-balance
[7] https://e360.yale.edu/digest/theres-been-a-six-fold-increase-in-polar-ice-cap-melting-since-the-1990s
[8] https://www.scientificamerican.com/article/millions-of-birds-are-migrating-earlier-because-of-warming/

What is Causing Climate Change?

Climate change is caused by increased carbon dioxide (CO2) and other greenhouse gas emissions since the industrial revolution[9]. When coal, oil, or gas are burned, they release into the atmosphere CO2 that has been trapped underground for millions of years – increasing the concentration of carbon in the atmosphere far beyond the natural balance. The massive increase in the use of fossil fuels since the industrial revolution (Figure 10[10]) has increased the concentration quickly.

Figure 10: Increasing use of fossil fuels

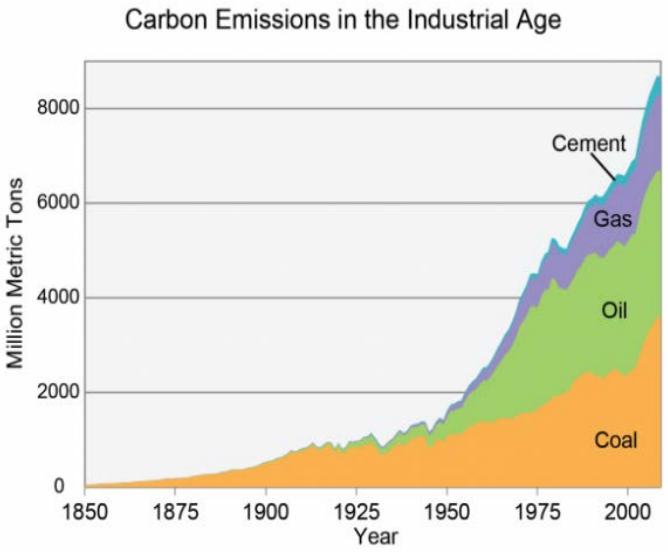
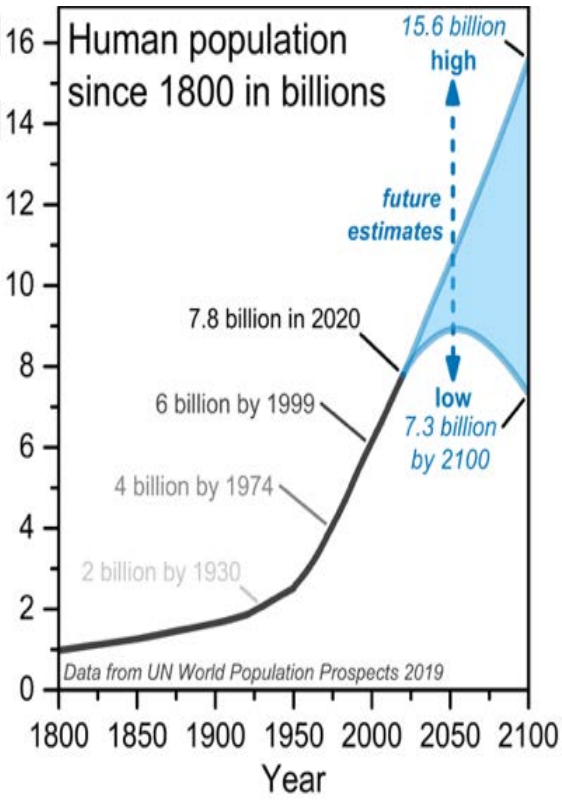


Figure 11: Increasing human population

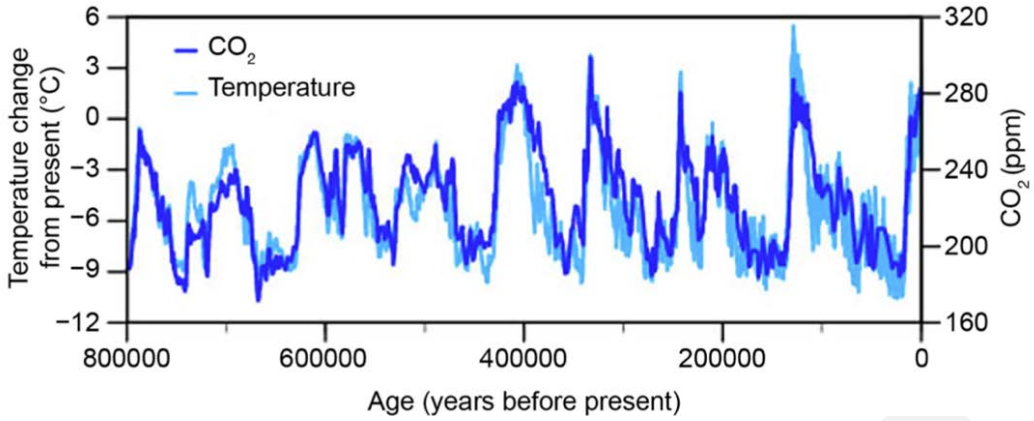


Dramatically more people on earth (Figure 11[11]) and more people burning fossil fuels is filling our atmosphere rapidly and causing the change in climate to occur. When you add widespread burning of fossil fuels to the carbon cycle, plants cannot reabsorb the amount of carbon generated quickly enough. Increased concentrations of CO2 and other greenhouse gases increase the earth's temperature via the greenhouse effect. In Figure 12 you can see how tightly correlated global temperature change and the

[9] https://www.globalchange.gov/browse/multimedia/carbon-emissions-industrial-age
[10] Figure from NOAA, Temperature Change and Carbon Dioxide Change
[11] Figure from Wikimedia Commons

concentration of carbon in the atmosphere have been through history.

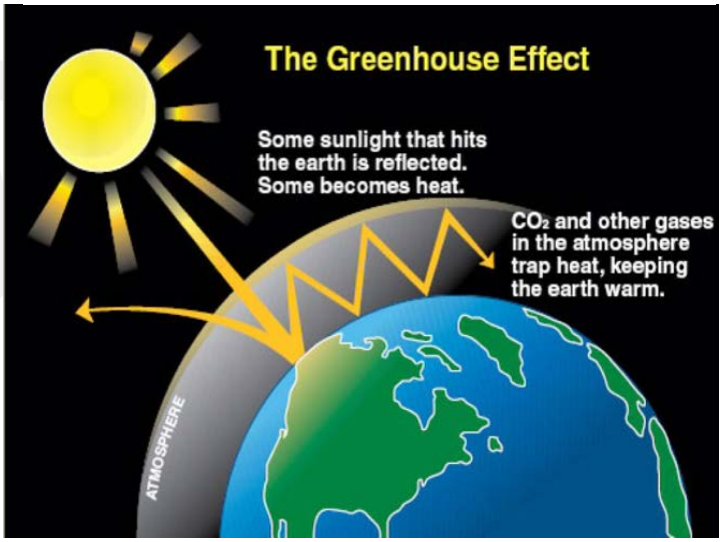
Figure 12: CO_2 and temperature are tightly linked



How Does the Greenhouse Effect Work?

The atmosphere is a thin layer that extends about 7 miles off the surface of earth. The atmosphere allows light from the sun to pass through it, but it bounces heat around, a little like a clear blanket. Light from the sun is converted to heat on earth and some of that heat is trapped by the atmosphere.

Figure 13: The greenhouse gas effect

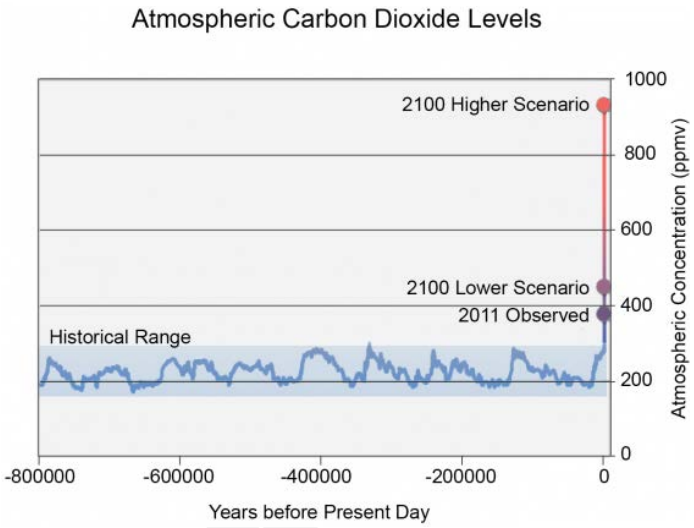


The more CO_2 (and other greenhouse gases) in the atmosphere, the more heat is prevented from escaping the earth and the hotter things get.[12] It should be noted that this is not the same as the Ozone layer, which filters out ultraviolet light, but does not interact with heat in the same way.

[12] Greenhouse effect figure created by Aaman Kler

Haven't CO_2 and Temperature and Always Bounced Around? What Makes Now Different?

Figure 14: Skyrocketing atmospheric CO_2



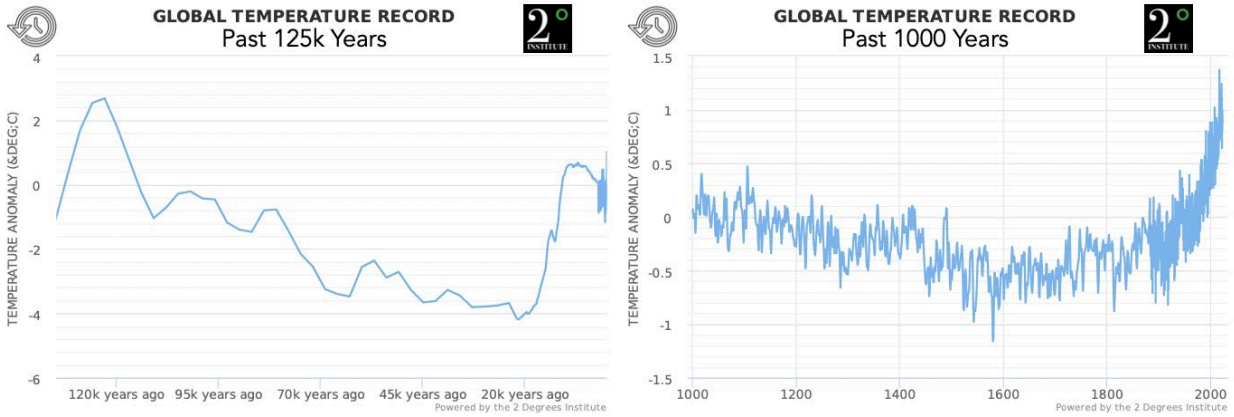
CO_2 has gone up and down over the course of human history, but it has never been nearly as high as it is right now (Figure 10[13]). For all of previous human history, CO_2 levels were dramatically lower than they are now, hovering between 200 and 300 parts per million. ***In the last 70 years, the concentration of carbon dioxide in the earth's atmosphere increased to 415 parts per million, it has not been this high since 4 million years ago, millions of years before modern humans[14]!*** Back then, the earth's temperature was an average of 7 degrees higher than now, sea levels were 80 feet higher (this would inundate most of the east coast of the US) and forests stretched all the way to the poles.[15,16] It was a very different earth.

As for temperature, yes, things were much hotter (and colder) at other times, but our current temperatures are hotter than they have been for the last thousand years. In fact, temperatures haven't been this high since more than 100 thousand years ago, when humans were just moving out of Africa.

Not only are global temperatures higher than any time during the history of civilization, but they are going up fast and the full effects of increased greenhouse gasses will continue to unfold for centuries. Without climate action, our children and grandchildren will inhabit a much hotter and more hostile world.

[13] Figure from ClimateChange.gov, Appendix 3: Climate Science Supplement of the nca3 report
[14] https://theconversation.com/climate-explained-what-the-world-was-like-the-last-time-carbon-dioxide-levels-were-at-400ppm-141784
[15] https://www.theguardian.com/science/2019/apr/03/south-pole-tree-fossils-indicate-impact-of-climate-change
[16] https://www.axios.com/earth-carbon-dioxide-levels-human-history-03dc4dc7-660a-44a9-b85c-d8777c4be8c8.html

Figure 15: Historical temperature records



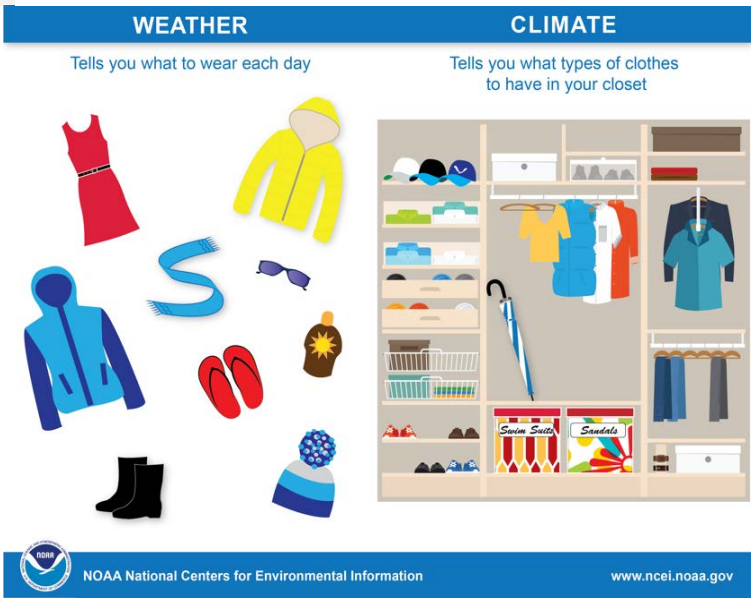
How Could People Possibly Affect the Big, Huge Atmosphere So Fast?

The atmosphere is actually not that large compared to the size of the earth! It is only a thin layer. If the earth were a basketball, the atmosphere would be like a piece of cling film wrapped around it. Not so much, huh?

What is the Difference Between Climate and Weather?

Climate is the general pattern: in Tualatin's climate, we get rain in winter and sun in summer. People in another climate might experience snow in winter and thunderstorms in the summer. ***Climate is affected by long-term factors*** like latitude and distance from an ocean, while ***weather changes day to day and affected by short term factors*** like air pressure and wind.

Figure 16: Climate vs weather

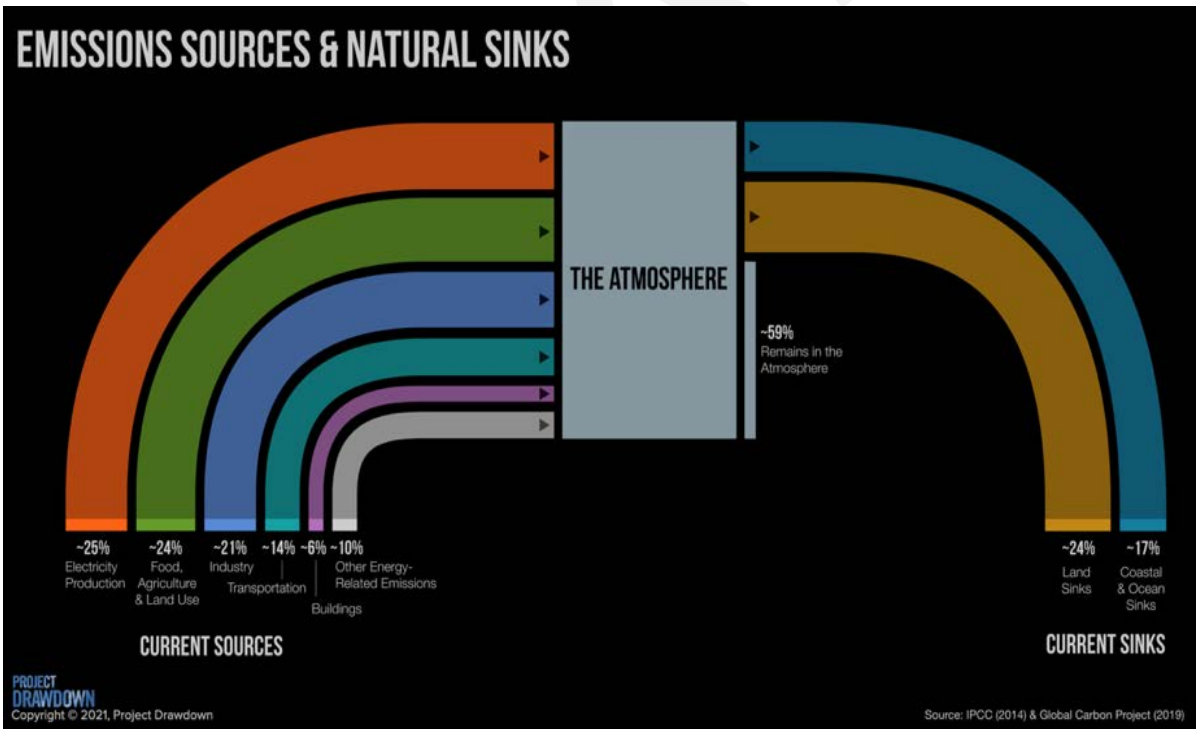


Doesn't the Earth Regulate Itself? Shouldn't the Plants Pull in the CO_2 and Bring Everything Back Into Balance?

Ideally yes, but our actions have added too much CO_2 for the earth to reabsorb. The earth is a complex system. There are some processes that decrease the amount of CO_2 (these are referred to as "sequestration")– the oceans can consume some of it, and so can the plants.

Theoretically, oceans, forests, and all vegetation on earth can absorb about 40% of all greenhouse gas emissions we are currently putting into the atmosphere. But increasing temperatures can also decrease the supply of water, making it more difficult for plants to grow. There are other feedback loops: melting snow turns white ice into dark rocks or water, absorbing heat instead of reflecting light; and melting permafrost means that a whole lot of frozen dead plants start to decay and release even more CO_2. We must reduce our emissions first before the natural systems can keep up.

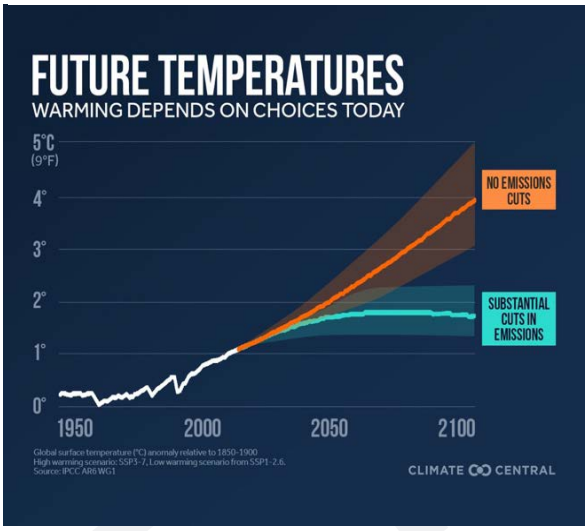
Figure 17: Earth's emissions sources vs sinks



Is It Hopeless?

No! By switching to carbon-free electricity and fuels and employing strategies such as carbon sequestration to draw down the greenhouse gases in the atmosphere, we can avoid the worst effects of climate change. If we act now, we can improve our quality of life now, and preserve our future.

Figure 18: Climate action can lead to a better future



APPENDIX 2: CITY OF TUALATIN COMMUNITY GREENHOUSE GAS INVENTORY

City of Tualatin

Community Greenhouse Gas Inventory

Acknowledgements

Project team

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Special thank you to Oregon Department of Transportation, Oregon Department of Environmental Quality, and Portland General Electric, Northwest Natural, Constellation, and Calpine Energy for providing necessary data for this inventory.

Consulting team

Good Company, a sustainability consulting firm based in Eugene, OR conducted the analysis for the City of Tualatin. Beth Miller, Claudia Denton, and Aaron Toneys of Good Company provided data gathering assistance to City staff and facilitated the use of Good Company's Carbon Calculator for Communities (G3C – Community), a proprietary GHG inventory tool, to conduct analysis. They are the primary authors of this report.

Table of Contents

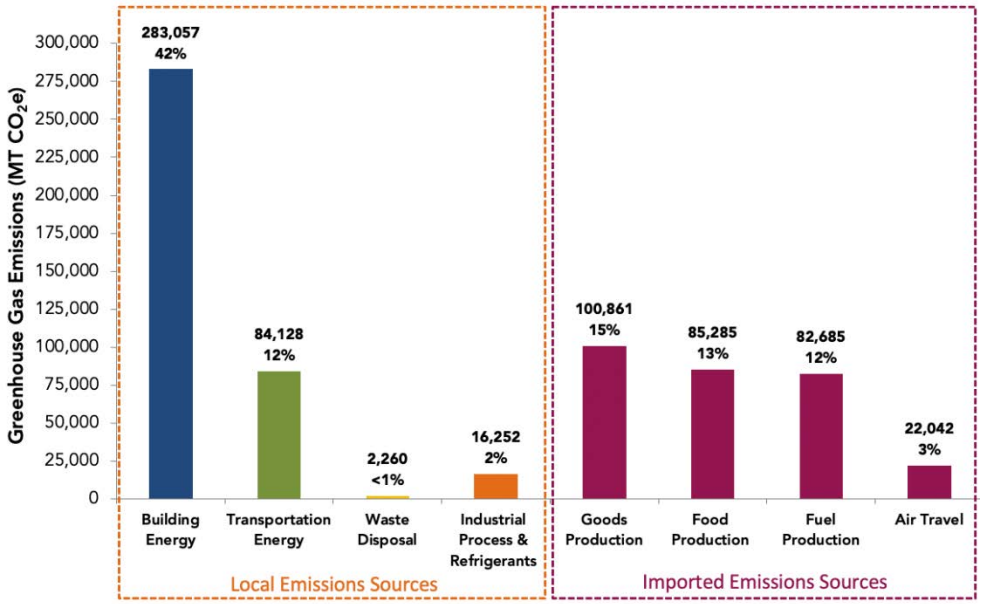
Executive Summary

The City of Tualatin completed a Community Greenhouse Gas (GHG) Inventory to better understand sources of GHG emissions (i.e., climate pollution) to inform development of a community climate action plan (CAP). The inventory follows internationally recognized community GHG inventory protocols and accounts for all significant sources of GHG emissions driven by activities taking place within the City of Tualatin's geographic boundary. Beyond protocol requirements, the inventory also measures consumption-based emissions from imported goods and food, air travel, and the purchase of carbon offsets.

Summary of Findings

- During 2019, with a population of **27,135,** all emissions combined (local and imported emissions) totaled **nearly 677,000 MT CO_2e**, or an average of **25 MT CO_2e** per resident.
- Of this, local emissions totaled nearly **386,000 Metric Tons of carbon dioxide equivalent (MT CO_2e),** or an average of **14 MT CO_2e** per resident.
    - The largest sectors were **energy use by buildings** (primarily electricity and natural gas use, 73%) and **transportation** (primarily gasoline combustion, 22%). **Industrial processes and refrigerants** accounted for 4% and **waste disposal** accounted for 1% of local emissions.
    - Commercial electricity made up **45%** of building and **33%** of local emissions.
- Imported emissions from household consumption and production of fuel and energy sold in Tualatin totaled **over 290,000 MT CO_2e** and include upstream emissions from production of goods (35%), food (29%), fuel production (28%), and air travel (8%).

Figure 1: City of Tualatin's 2019 GHG Emissions



Introduction

Human activity in the form of consumption of fossil fuels is the primary cause of global warming and changes in climate that have occurred over the past few decades and accelerated in recent years.[1] The best available evidence indicates that human-caused greenhouse gas (GHG) emissions must be reduced significantly by 2030 to avoid "severe, pervasive and irreversible impacts for people and ecosystems."[1] We are already observing physical changes to Oregon's climate, including hotter temperatures, drought, wildfire smoke, and less mountain snow[2]. Understanding the areas of greatest risk gives us the opportunity to act, rather than react, to these changing conditions and helps us be as resilient as possible. The most common international goal to mitigate the worst climate impacts aligns with the Paris Climate Accord, which seeks to limit global average temperature increases to 1.5°C (2.7°F) 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 (1.8°F) since the Industrial Revolution and are on track to increase to 1.5°C (2.7°F) by 2040[1].

It is with this understanding and urgency that The City of Tualatin commissioned this community greenhouse gas (GHG) inventory and chose a target of 1.5°C in alignment with the Paris Climate Accord. The City of Tualatin's 2019 Community GHG Inventory includes the following emissions sources:

Building Energy use by residential, commercial, and industrial buildings and facilities represents a large source of community emissions. These emissions come from combustion of natural gas and from electricity generated from fossil fuels to heat water and power buildings. Small quantities of combusted propane and other fuels are also included. Additionally, a fraction of natural gas is lost during local distribution, releasing methane, a potent greenhouse gas pollutant.

Transportation energy, particularly on-road vehicle transportation of passengers and freight, also represents a large fraction of community emissions. Transportation emissions are generated at the tailpipe by combustion of gasoline, diesel, other liquid and gas fuels, or from electricity generation for electric vehicles.

Waste disposal in landfills and **wastewater** treatment produces methane, of which a fraction leaks out to the atmosphere, having a negative climate impact.

Industrial Process & Refrigerants Refrigerant emissions come from transportation and building cooling systems. Refrigerants are powerful global warming gases. Therefore, relatively small losses have a large climate impact. Known, significant industrial process emissions are also included here. These emissions are not from the energy used in a factory, for example, but from the other processes involved in manufacturing. In inventory protocol, this is referred to as Industrial Process and Product Use.

[1] Intergovernmental Panel on Climate (2014). Assessment Report 5 Synthesis Report: Climate Change 2014. http://www.ipcc.ch/report/ar5/syr/

[2] Mote, P.W., J. Abatzoglou, K.D. Dello, K. Hegewisch, and D.E. Rupp, 2019: Fourth Oregon Climate Assessment Report. Oregon Climate Change Research Institute. occri.net/ocar4.

Agriculture, Forestry, & Land Use generate emissions from agricultural activity (e.g., animal waste and agricultural inputs) and community land use change (e.g., development of forest or grasslands). *These emissions are not a significant factor for Tualatin.*

Consumption-based Emissions are generated outside of the community during the production of goods, food, fuels, and service products consumed by residents. Note: *Consumption-based emissions presented in this inventory are* ***estimated (see Appendix D for more information)*** *and therefore the results have a greater level of uncertainty compared to other sources of emissions.*

What's Included? (Boundaries & Methodology)

Protocol and Inventory Boundaries

This community inventory follows Greenhouse Gas Protocol's Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC).[3] The GPC focuses on accounting for sector-based emissions, which can be thought of as local sources of emissions. This inventory also includes an estimate of the emissions embodied in local consumption of consumer goods, construction materials, and food, to inform community climate action planning. Consumption of consumer goods is a large emissions source, but it is often excluded from inventories.

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. The greenhouse gas inventory presented in this report is based on data from calendar year 2019 for the City of Tualatin's city limits. 2019 was used as the baseline year because it was the last "normal" year before the COVID-19 pandemic occurred. However, available data was collected for years 2018-2021 in order to assess trends over a short time period. This inventory considers all seven recognized greenhouse gases – carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3). All gases are reported in terms of carbon dioxide equivalent (CO_2e), or the amount of carbon dioxide it would take to create the same warming effect.

Scopes

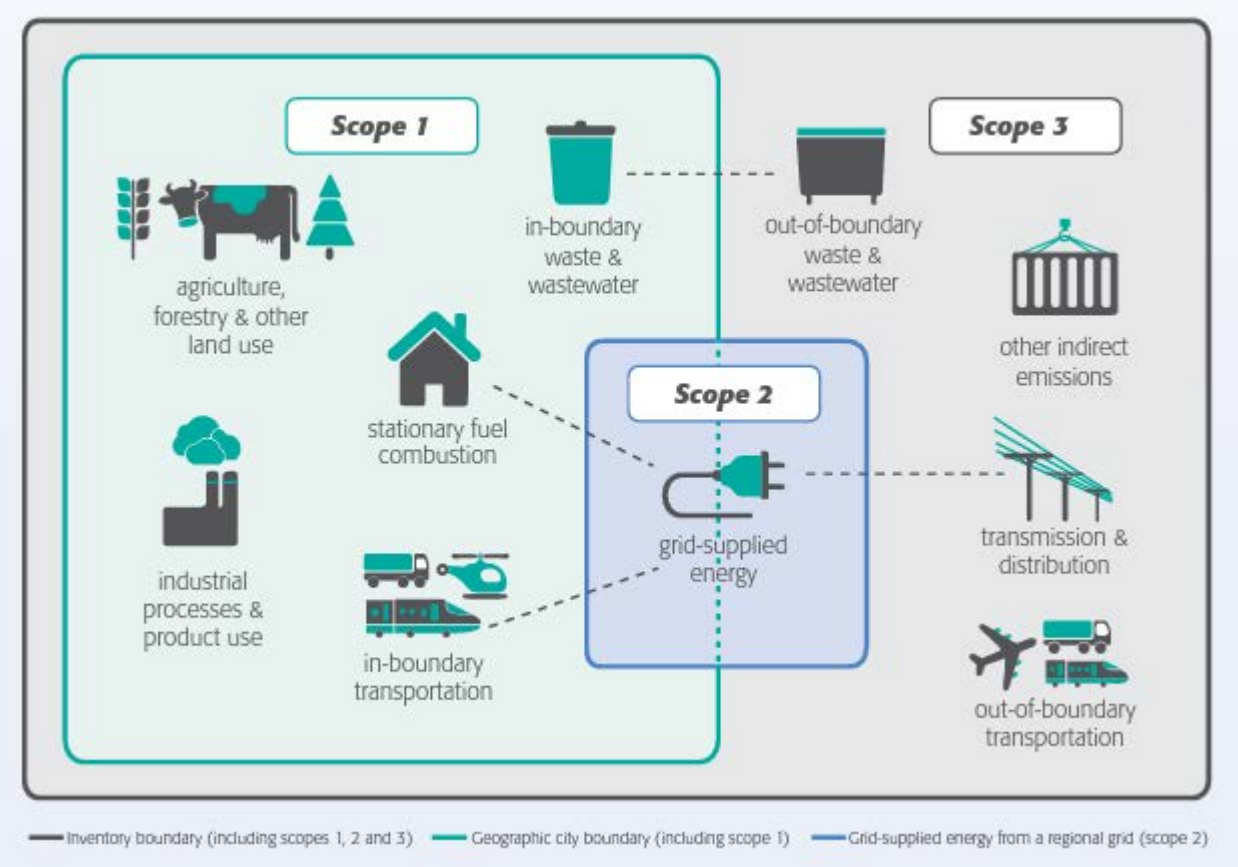
As described above, GHG emissions are often organized by sector (e.g., buildings, transportation, waste, etc.). Another way to organize them is by their origin location, either within a community or outside – these are referred to as *scopes*. Scope categories, as outlined in **Table 1** and **Figure 2** (next page) distinguish between those emissions that occur within the geographic boundaries (Scope 1) from those that occur outside the boundaries, but that are driven by activity from within the geographic boundary (Scope 2 and Scope 3). Emissions sectors and sub-sectors included in the GPC are shown in **Table 2** (page 9). These are compared to emissions included in the 2019 community inventory by scope category.

[3] GPC has become the recommended or required standard for international reporting to CDP's Cities Survey and the Global Covenant of Mayors for Climate & Energy. The GPC may be downloaded at https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities.

Table 1: Scope descriptions

Scope 1	GHG emissions from sources located within the geographic boundary.	E.g., Burning of fossil fuels to heat homes or power cars
Scope 2	GHG emissions occurring as a consequence of the use of grid-supplied electricity within the geographic boundary.	E.g., Emissions from coal and natural gas power plants
Scope 3	All other GHG emissions that occur outside the boundary as a result of activities taking places within the boundary.	E.g., Production of fuels, goods, and food

Figure 2: A graphical illustration of scopes[4]



[4] Global Protocol for Community-Scale Greenhouse Gas Inventories

Table 2: Crosswalk of Emission and Scope Categories.

Emissions Sector / Sub-Sector	Included in Inventory	Scope 1	Scope 2	Scope 3
Stationary Energy (Buildings)				
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	NO			
Waterborn Navigation	NE			
Waste & Wastewater				
Solid Waste	•			✓
Wastewater Treatment	•			✓
Biological Treatment of Waste	•			✓
Incineration of Waste	NO			
Industrial Process and Product Use				
Product Use (refrigerants)	•	✓		
Industrial Processes	•	✓		
Agriculture, Forestry, and Land Use				
Livestock	NO			
Land	NO			
Other Agriculture	NO			
Other Scope 3 Emissions Sources				
Household Consumption	•			✓
Air Travel	•			✓
Upstream Energy Production	•			✓
Negative Emissions (Sequestration & Offsets)				
Purchased carbon offsets	•	✓		

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

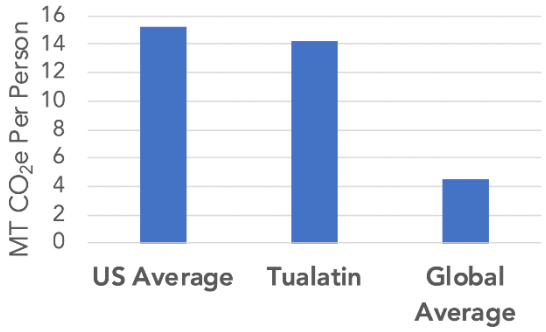
Inventory Results

Local Emissions

The Tualatin community generated nearly **386,000 MT CO_2e** of local emissions – about **14.2 MT CO_2e** per resident. **This is less than the U.S. average of 15.2 MT CO_2e per person and considerably greater than global average of 4.5 MT CO_2e per person (Figure 3).**[5] Protocols refer to local emissions as sector-based emissions. Those emissions are generated close to home and are most often under the community's direct control. **This quantity of GHGs is equivalent to the carbon sequestered by over 457,000 acres of average U.S. forest[6] - a land area about 85 times the size of Tualatin.**

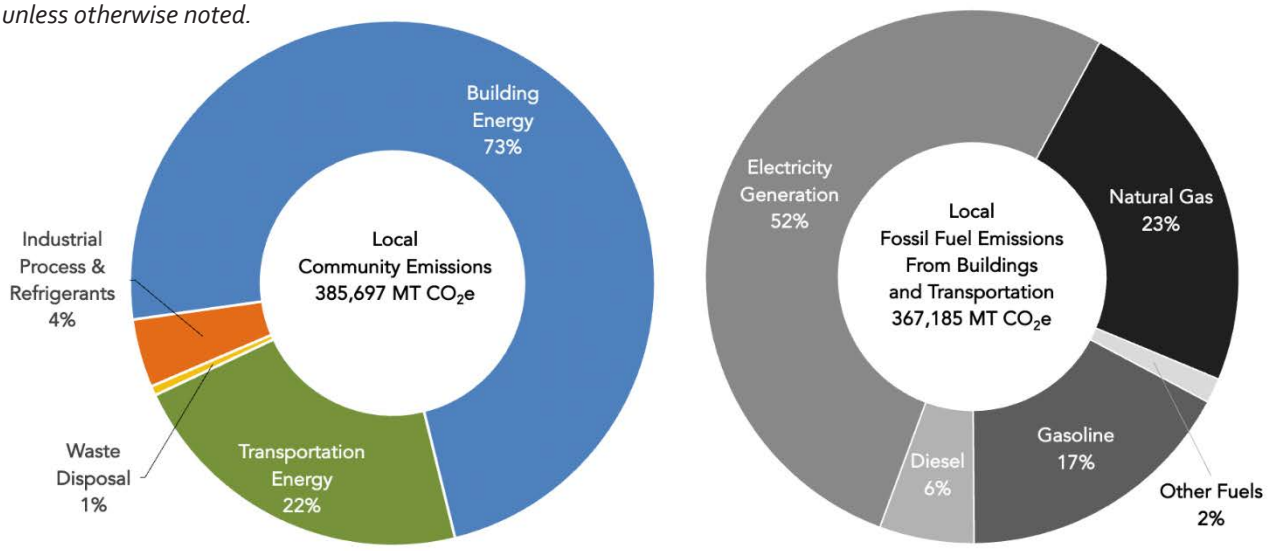
Definition: MT CO_2e
Metric Tons of carbon dioxide equivalent – a unit of measure. Most greenhouse gases are more potent in warming the atmosphere than carbon dioxide. To calculate and compare emissions easily, all gases are calculated and combined into a carbon dioxide equivalent, typically measured in metric tons.

Figure 3: Comparison of per person emissions



Tualatin's local emissions are shown on the left side of **Figure 4** and come primarily from Building Energy, such as electricity use and combustion of natural gas by buildings and other facilities (**blue segments**) and transportation sources, mainly gasoline and diesel combustion in vehicles (**green segment**). Emissions from Industrial Process & Refrigerants include federally reported special industrial emissions and

Figure 4: 2019 Local Community Emissions and Fossil Fuel Details, which come from building and transportation energy. *Note: All figures present market-based accounting for electricity emissions unless otherwise noted.*



[5] Data from World Bank. For details visit https://data.worldbank.org/indicator/EN.ATM.CO2E.PC
[6] US EPA GHG Equivalencies Calculator https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

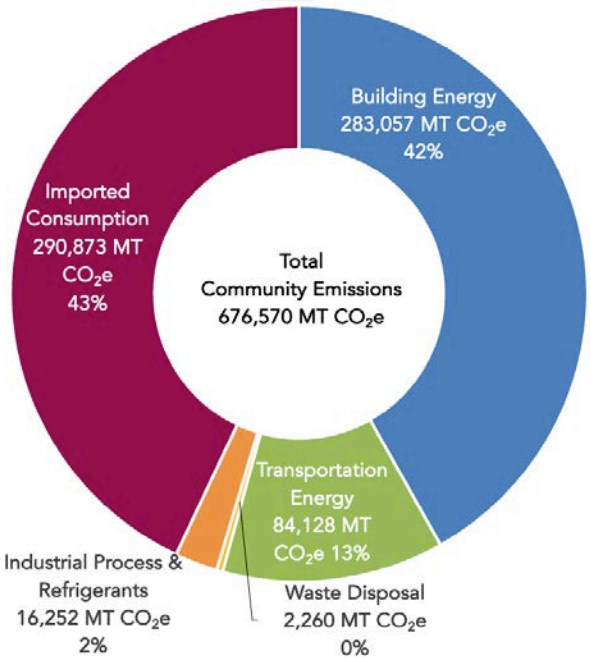
refrigerant gas loss from buildings and vehicles (**orange**). Waste emissions include landfill disposal of community solid waste and wastewater treatment (**yellow**). In Tualatin, there are no calculated emissions from Agriculture, Forestry, and Land Use. The right side of Error! Reference source not found. details fossil fuel use. Note that all emissions from **buildings** and **transportation** are from **fossil fuels** (**95% of total**); **waste** and **industrial process and refrigerants** are non-fossil fuel emissions. Although all building energy emissions are from fossil fuels, that does not mean that all building electricity is from fossil fuel sources. Electricity generated from zero carbon sources, such as hydropower, does not contribute to the city's emissions.

Imported Emissions

In addition to accounting for local emissions, the inventory also estimates **imported (consumption-based) emissions**, which are generated outside of Tualatin to produce and provide the imported **goods, food, services, air travel,** and **production and transport of fuels** consumed by local households. Imported emissions total **about 290,000 MT CO_2e** in addition to sources of local emissions. **This quantity of GHGs is equivalent to the carbon sequestered by nearly 343,000 acres of average U.S. forest[7], an area 3.7 times the size of the City of Portland. Figure 5** compares the scale of local, sector-based emissions to imported emissions from household consumption, while

Figure 6 on the following page shows another comparison

Figure 5: 2019 Community Local + Imported Emissions



Within **goods**, the largest purchasing categories include **vehicles & parts, appliances,** and **construction materials.** Within **food**, the largest emissions are from the **production of meats,** particularly **beef** and **lamb** products.

Upstream emissions from **fuel production** (gasoline, diesel, electricity, and natural gas) and **air travel** from flights taken by residents (regardless of airport location) are also significant sources of consumption-based emissions. For more details on these emissions, see Error! Reference source not found. and the related section on page 15.

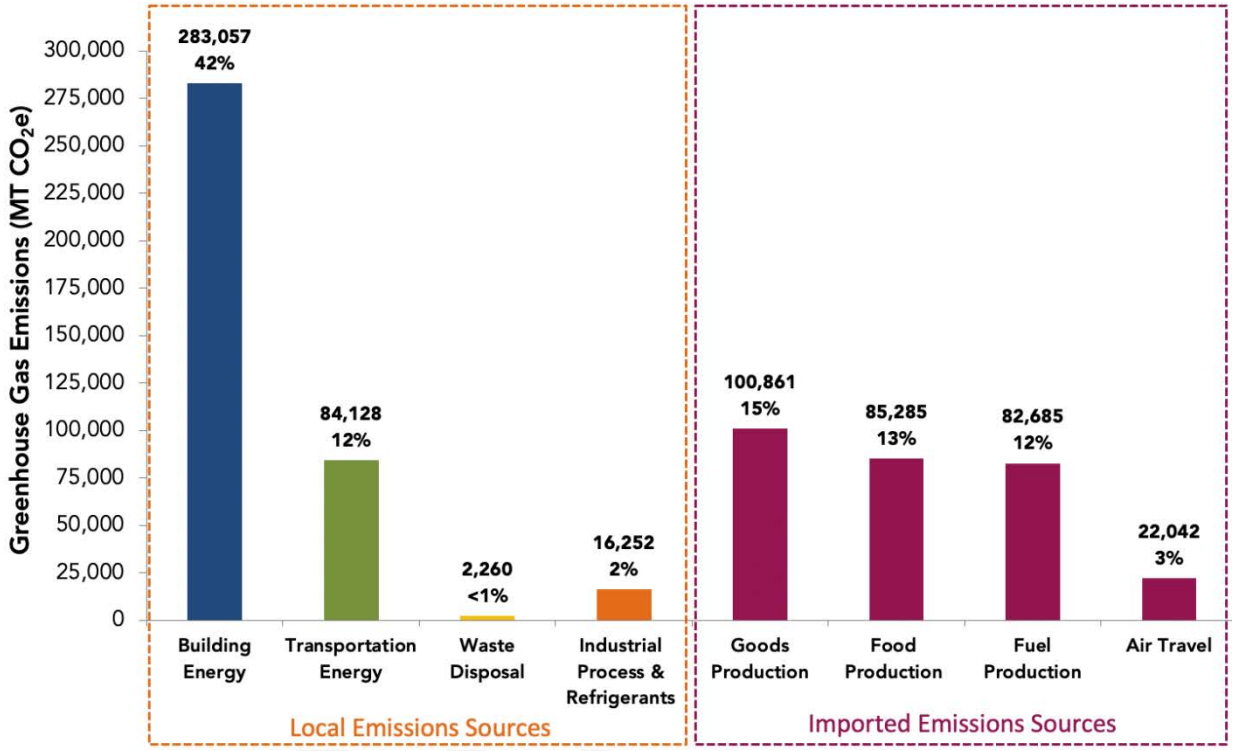
Total emissions

Local and imported emissions combine for a total nearly 677,000 MT CO_2e**, or** 25 MT CO_2e **per resident.** This quantity of GHGs is roughly equivalent to the carbon sequestered by 800

[7] US EPA GHG Equivalencies Calculator https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

thousand acres of average U.S. forest, an area roughly 4.4 times the size of Crater Lake National Park[8]. There are net **negative emissions** sources as well, from voluntary purchase of **carbon offsets** from Northwest Natural Gas customers (**over 640 MT CO_2e**). Note that the net benefit from Portland General Electric (PGE) customers' purchase of Renewable Energy Credits is already accounted for in the building energy sector (market-based accounting) and reduced emissions by **over 12,000 MT CO_2e.**

Figure 6: Tualatin's emissions sources and offsets



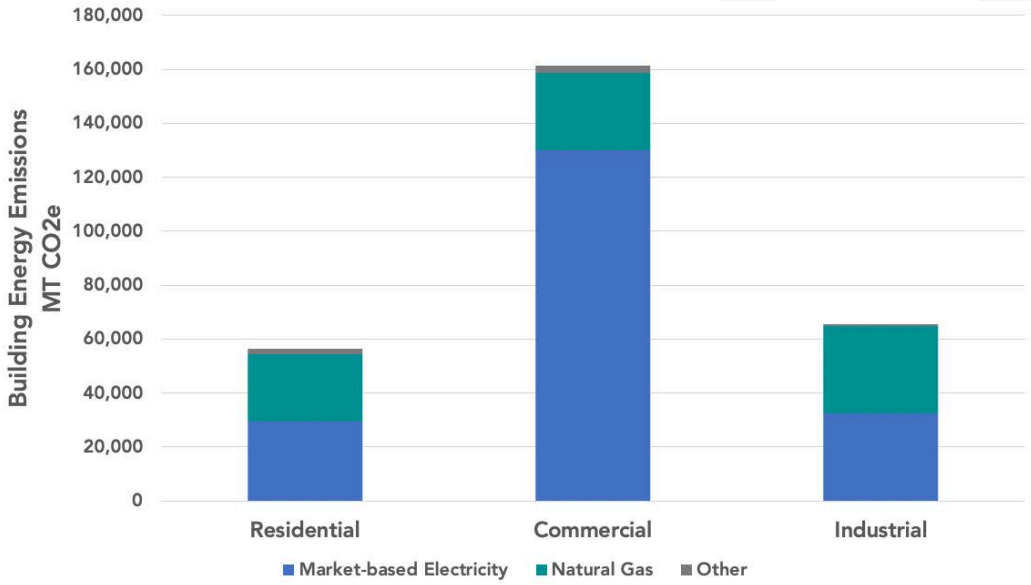
[8] National Park Foundation https://www.nationalparks.org/connect/explore-parks/crater-lake-national-park

Inventory Highlights

Building Energy

Energy used in buildings is Tualatin's largest source of local GHG emissions accounting for **73%** of local emissions. These emissions come from a mix of electricity, natural gas use, and other stationary combusted fuels and come to over **283,000 MT CO_2e**.[9] See Appendix D: Summary of Data and Emissions Factors on page 31 for more information on building energy data sources and reporting accuracy. Tualatin's commercial and industrial uses (**227,000 MT CO_2e**) have more than four times the impact of residential uses (**56,000 MT CO_2e**), over half from commercial electricity use. By energy type, electricity had the largest impact (68% of total building emissions); followed by natural gas (30%); and other fuels (2%). **Figure 7** shows emissions by sub-sector and energy type. Fugitive natural gas escaping from local distribution systems was reported by Northwest Natural and accounts for 0.3% of total building emissions (not visible in the graphic due to small scale). Emissions from electricity usage for wastewater processing are included in the Industrial category and make up 3.5% of those emissions.

Figure 7: Building Energy Usage by Type and Energy Source



The City of Tualatin has installed solar panels that generated nearly 12,000 kWh of electricity to supplement city usage. This solar energy displaced roughly 5 MT CO_2e.

Portland General Electric (PGE) supplies electricity to the Tualatin community. Each electric utility has its own specific emissions factor (MT CO_2e emitted per kilowatt-hour [kWh] of electricity) which is dependent on the utility's power generation supply contracts. In 2019, PGE's emissions factor was 0.42 MT CO_2e per megawatt-hour, a 17% decrease since 2010, meaning that the carbon intensity of electricity

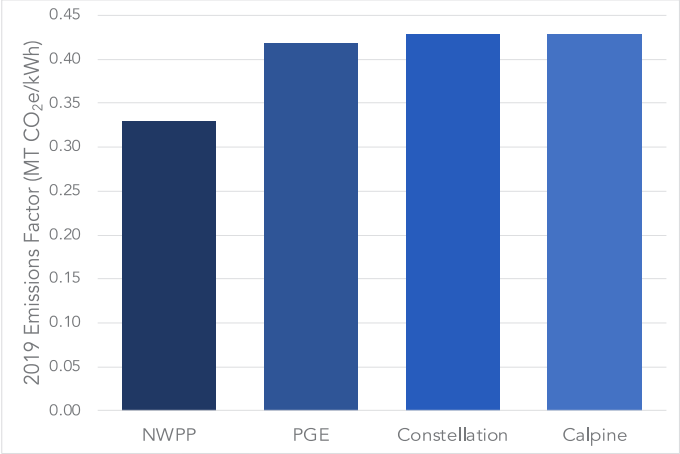
[9] All emissions estimates use market-based accounting for electricity unless otherwise noted. Market-based electric accounting totals **283,057 MT CO_2e**, while location-based accounting totals **249,866 MT CO_2e**. See Appendix C page Electricity for information about market-based vs. location-based accounting.

generation decreased over time. The market-based electricity accounting method uses utility-specific factors and accounts for voluntary community participation in utility-sponsored green power programs.

In 2019, PGE's residential and businesses customers in Tualatin purchased renewable energy in the form of Renewable Energy Credits (RECs) equal to about 6% of demand, which decreased market-based electricity accounting emissions by 12,015 MT CO_2e.

Large users may also choose to buy power from other utilities, which will have different emissions factors. In Tualatin, there are two outside utilities with contracts within the city, Calpine and Constellation energy. Figure 8 contrasts the emissions factors for the region (NWPP) with those for PGE, Constellation, and Calpine.

Figure 8: Electricity Emissions Factors

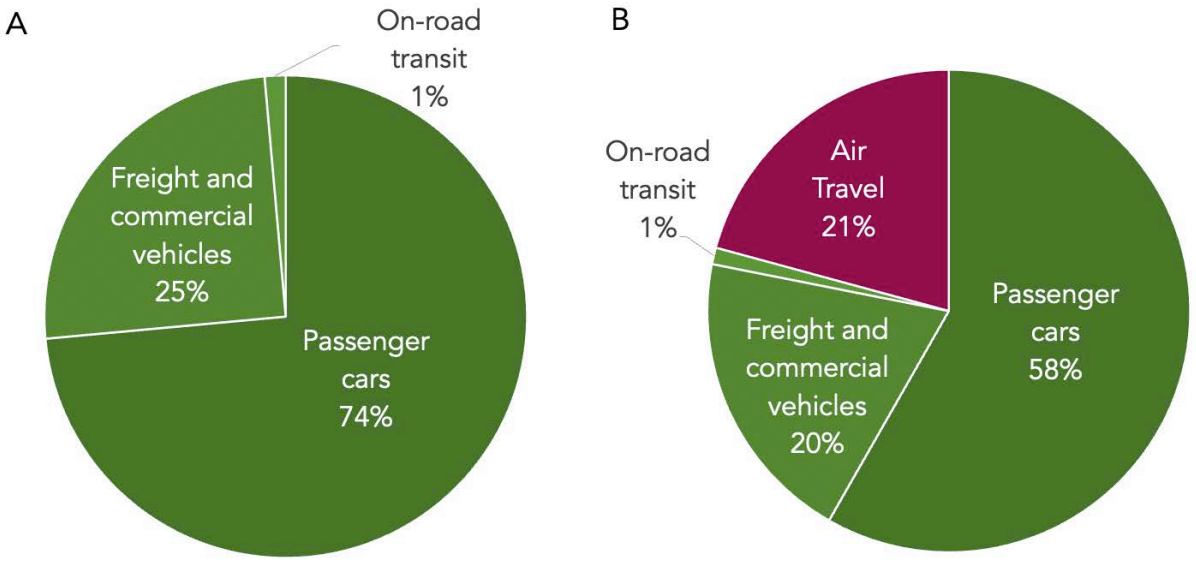


Transportation

Transportation emissions are the second largest source of local emissions for Tualatin, totaling over **84,000 MT CO_2e**. See Appendix D: Summary of Data and Emissions Factors on page 31 for more information on transportation emissions data sources and reporting accuracy. On-road passenger vehicles were the leading source of local transportation emissions and are responsible for **74%** of local transportation emissions. These emissions originate from fossil gasoline sales, primarily used by private use cars and trucks, but may include a small percentage of non-road uses such as small boats. This category also includes the small amount of electricity used by electric vehicles (**<1%**). The next largest category is fossil diesel sales, primarily used by freight and commercial vehicles at **25%**; the majority of these emissions are expected to be from on-road vehicles but may also include non-road equipment. Additionally, emissions from TriMet's public transit services were estimated to be **1%**. There were no known offroad fuel sales, although some of the fuel sales probably went to offroad uses (such as gasoline powered lawnmowers). See **Figure 9**.

Tualatin does not have an airport within the geographic boundary so there are no local air travel emissions, but many residents do travel by airplane, and air travel is part of the community's **consumption-based emissions**. As is shown in **Figure 9**, emissions from air travel (**magenta**) are a significant source of emissions in addition to local transportation emissions (**green**). Consumption-based air travel emissions are estimated at just over **22,000 MT CO_2e**. See Appendix D: Summary of Data and Emissions Factors on page 31 for more information on air travel data sources and reporting accuracy.

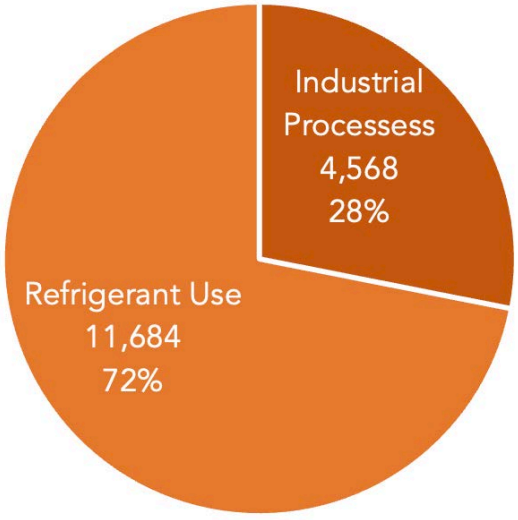
Figure 9: Transportation emissions breakdown. A: Tualatin's transportation emissions excluding air travel, B: Tualatin's transportation emissions including air travel



Industrial Process and Refrigerants

Industrial Process and Refrigerant (IPR) emissions are the third largest source of emissions. IPR emissions are fugitive emissions; unintentional emissions, leaks, or discharges of gases and vapors from pressurized equipment or facilities. They come from specialized industrial uses or refrigeration systems – CFCs, HFCs, PFCs, SF_6, and NF_3 – and have a large climate impact, up to 23,500 times the Global Warming Potential of an equivalent weight of CO_2 depending on the gas.

Figure 10: IPR Emissions



Fugitive loss of refrigerants from residential and commercial buildings and vehicle air conditioning and refrigeration equipment are the largest proportion of Tualatin's IPR emissions. These sources are estimated for Tualatin using state per capita data, downscaling from emissions reported in the State of Oregon's 2015 GHG Inventory, and are estimated at about **12,000 MT CO_2e**. Within the State of Oregon, sources of residential, commercial, and transportation refrigerant emissions (in DEQ's inventory as High Global Warming Potential gases) have grown by 21% since 2009[10].

Industrial process emissions (excluding energy use) were identified for one facility within Tualatin using the Oregon Department of Environmental Quality reported greenhouse gas emissions for facilities with

[10] Oregon Greenhouse Gas Sector-Based Inventory https://www.oregon.gov/deq/aq/programs/Pages/GHG-Inventory.aspx

air quality permits[11]. These emissions total close to **5,000 MT CO_2e**[12] for 2019. See Appendix D on page 31 for more information on industrial process and refrigerants data sources and reporting accuracy.

Solid Waste & Wastewater

Solid Waste and Wastewater emissions total less than **2,500 MT CO_2e** – less than 1% of local emissions. Tualatin haulers send landfilled waste to Arlington Landfill (Eastern Oregon), Wasco Landfill (Eastern Oregon), and Coffin Butte landfill (Western Oregon). These landfill emissions are estimated to total roughly **1,600 MT CO_2e**.

Wastewater is processed by Clean Water Services and is included in the analysis. A negligible number of septic systems are located in the city. Total wastewater process emissions, not including septic, are estimated to total **about 675 MT CO_2e**. See Appendix D on page 31 for more information on data sources and reporting accuracy related to solid waste and wastewater treatment.

Imported Emissions

Emissions from Consumption of Imported Goods, Food, Fuel, and Air Travel

Tualatin's inventory goes beyond GPC protocol requirements to highlight the known large sources of imported emissions from consumption activities. These emissions are considered Other Scope 3 in GPC protocol. This means the community has less control over management of these emissions as compared to sources of local emissions. These consumption-based emissions will be in another community's local accounting. That said – these emissions are included in the inventory because they are large, they are caused by local demand, it follows State of Oregon inventory practices, and because opportunities exist to reduce these emissions locally by reducing consumption. These emissions were estimated at nearly 290,000 MT CO_2e and make up 43% of total **emissions (Figure 11).** See Appendix D on page 31 for more information on sources and reporting accuracy for imported emissions, including goods, food, services, and upstream fuel production.

[11] Available at https://www.oregon.gov/deq/aq/programs/Pages/GHG-Emissions.aspx

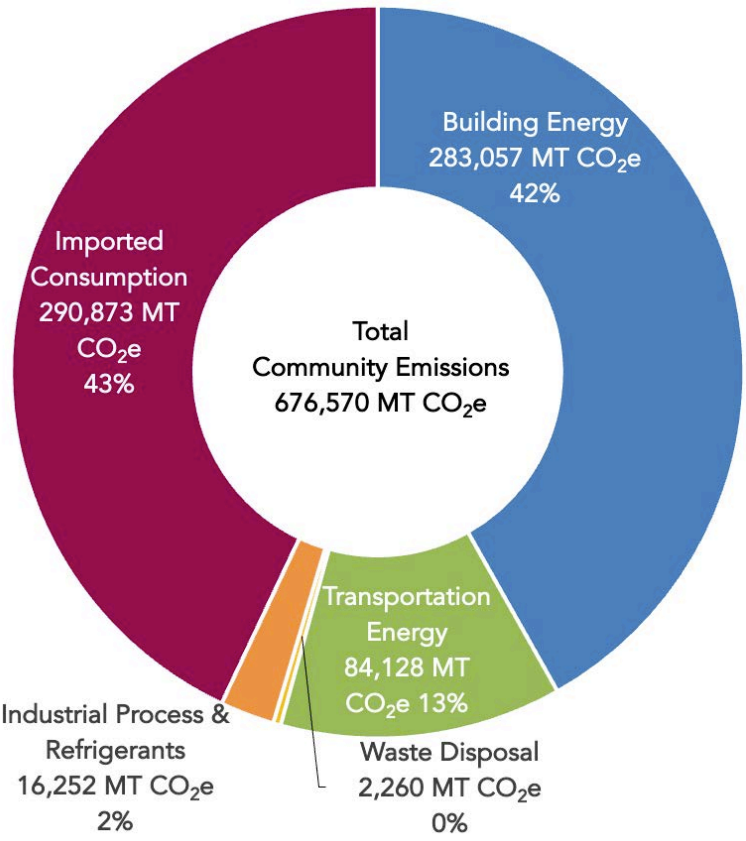
[12] These facilities are monitored by EPA's FLIGHT and/or Oregon DEQ due to the significant climate impacts. EPA's FLIGHT database values will vary from this analysis, as the online tool uses IPCC AR4 GWP values, and this GHG Inventory uses updated IPCC AR5 GWP values in line with the most recent science. Oregon DEQ also reports AR4 GWP values, but individual gas data was not available to convert into AR5 GWP value totals. Applicable Industrial Process emissions data for Microchip Technologies and ON Semiconductor was calculated from EPA FLIGHT. Applicable Industrial Process emissions data for Owens Corning Corp. was requested from Oregon DEQ. Building energy was excluded.

Consumption of imported **goods** is the largest source for Tualatin's imported emissions at **35% of imported emissions.** The largest contributors to this category **include building materials, vehicle parts,** and **furnishings and supplies**Error! Reference source not found.**.** The next largest category is **food** and beverage, where largest emissions are from **meat**, specifically **beef** and **lamb** products. Upstream **fuel production**, specifically gasoline production, is another large source, which goes hand-in-hand with passenger transportation being a large local emissions source. Air travel is also a significant source of Tualatin consumption-based emissions. Note that these air travel emissions are from air travel trips taken by residents regardless of airport location and are not based on Portland airport fuel use alone.

Category Descriptions

- **Goods:** Emissions from extraction, manufacture, and transportation of raw materials into final products such as building materials, automobile, furniture, clothing, and other goods.
- **Food & Beverage:** Emissions from agriculture (energy for irrigation, production of fertilizers, methane emissions from livestock, etc.), transportation of raw materials, and finished products emissions. Categories include produce, cereals, dairy, meat, and other foods.

Figure 11: 2019 Community Local + Imported Emissions



- **Upstream Fuel Production:** Process and energy emissions from the extraction and production of 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, and diesel (not available for propane and fuel oil). These emissions are separate from those that are generated when the fuel is used in your car or house.

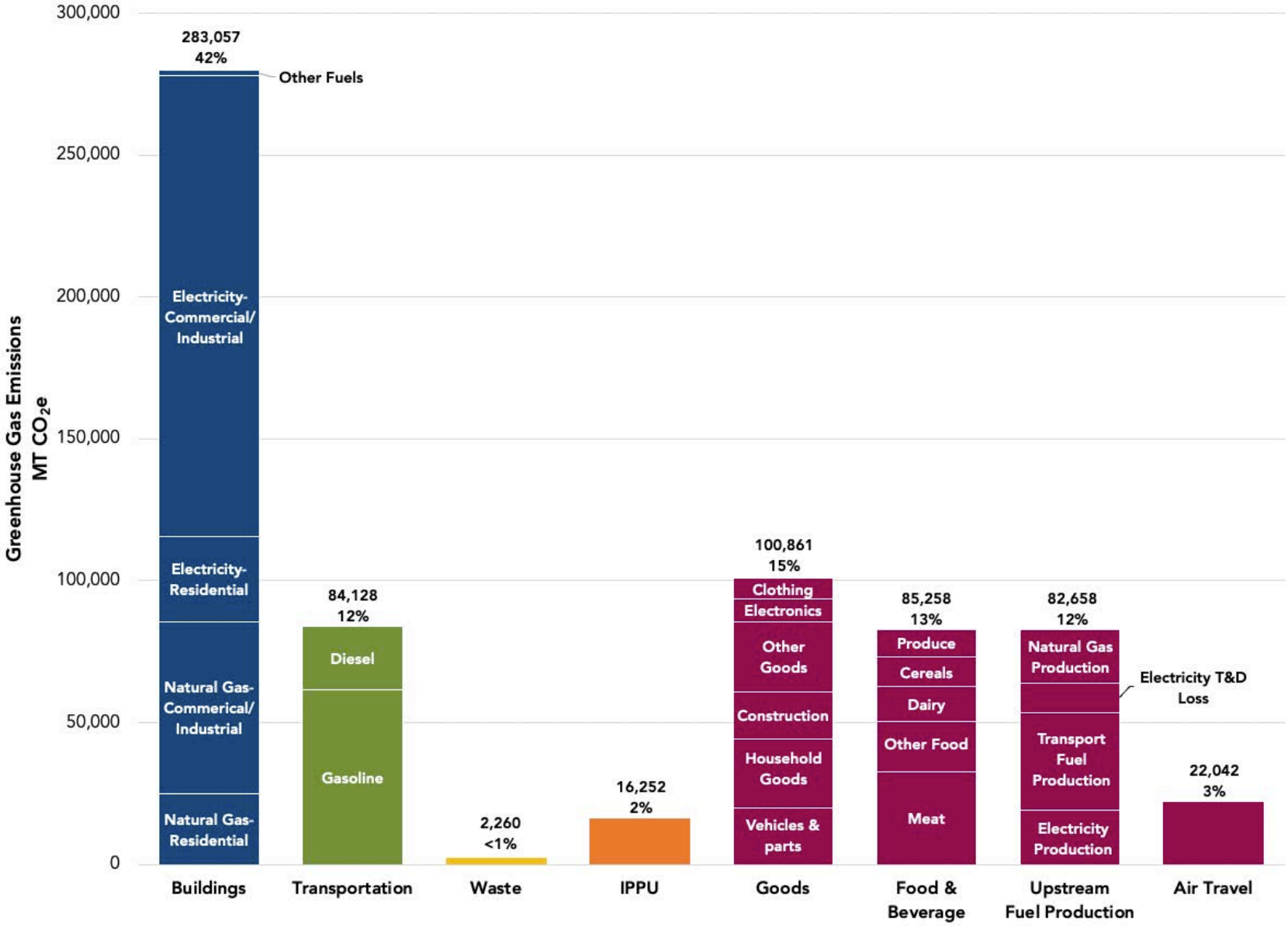
- **Air Travel:** Emissions associated with air travel by the community (regardless of the airport's location).

Figure 12 on the following page gives a full categorical breakdown of all emissions

Negative Emissions

Negative emissions are from carbon offsets purchased by natural gas consumers. Less than 1% of the natural gas used in Tualatin is offset by community members who participate in Northwest Natural's Smart Energy Offsets program (**664 MT CO_2e**). This program allows customers to purchase carbon offsets from The Climate Trust on their bill to offset emissions from their natural gas use. See Appendix D on page 31 for more information on carbon offset data sources and reporting accuracy.

Figure 12: Full breakdown of emissions categories

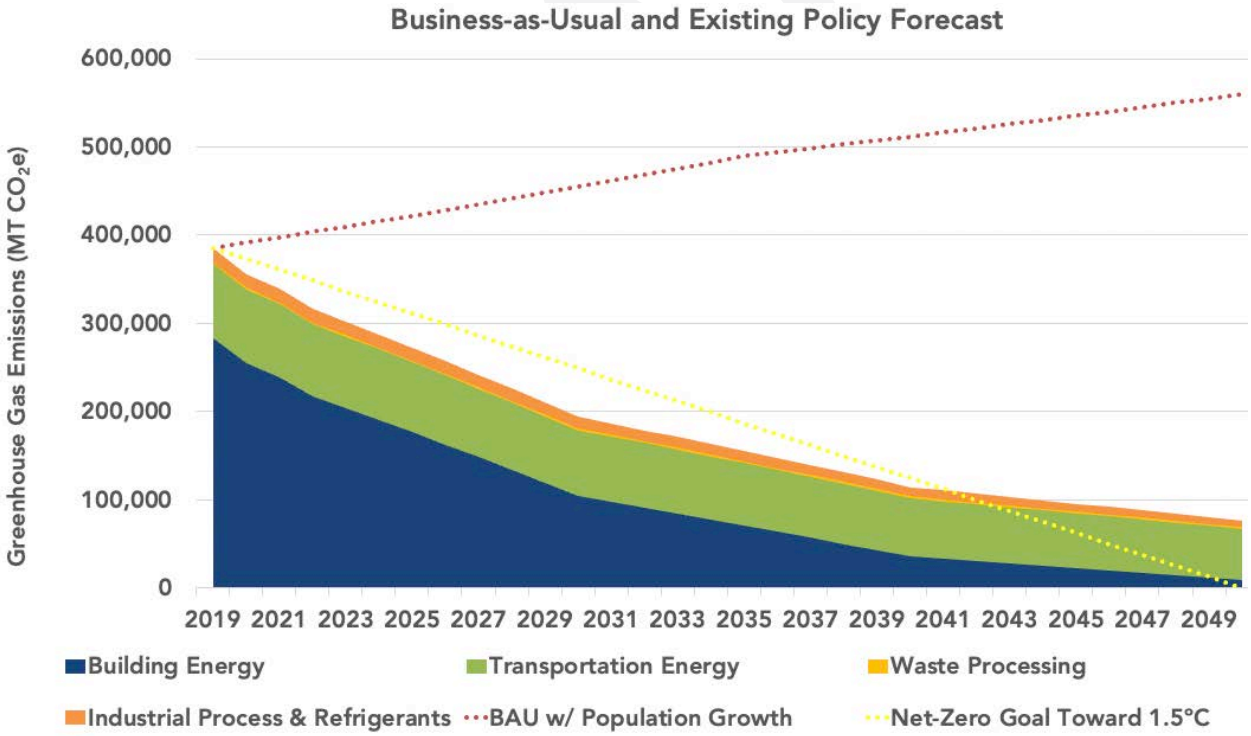


Local Emissions Forecast & the Paris Accord Climate Goal

Local emissions in Tualatin are expected to decrease over time, primarily thanks to strong climate action from the State of Oregon in the stationary energy sector. The Oregon Clean Energy Targets, Oregon Climate Protection Program, as well as specific data from PGE and Northwest Natural, were reviewed for modeling stationary energy emissions reductions and are expected to reduce emissions from electricity, natural gas, and other stationary fuels by 97% in 2050. Additionally, state and federal policy impacting transportation, refrigerants, and waste emissions are included here. **While emissions are estimated to decrease by 80%** in 2050 compared to 2019 local emissions without additional mitigation actions, **that is still not enough to hit our target of 100% GHG emissions mitigation to limit global warming to 1.5°C.**

Additional goals and actions beyond current projections and legislation will be modeled as part of the community Climate Action Plan to help meet our target. Figure 11 shows forecasted emissions by sector (colored wedges) are compared to forecasted growth based on population growth only (dotted red line) and the Paris Accord 1.5°C warming goal of net-zero emissions by 2050 (yellow dotted line).

Figure 13: Tualatin's Business-as-Usual Forecast (red, population growth with no policy interventions) with Forecasted Emissions Based on Existing State and Federal Policy, and a Net-Zero by 2050 Trajectory (yellow dotted line)



Thanks to the existing state and federal policies impacting GHG emissions, Tualatin can expect a reduction of 80% of local emissions in 2050 compared to 2019, with only about 77,000 MT CO_2e remaining, primarily from the transportation sector. For Tualatin, this is primarily from E10 gasoline sales. While policy can be difficult to detail and implement, there are approaches available to reducing

transportation GHG emissions. *More details on community climate action planning and mitigation will be detailed in the upcoming community Climate Action Plan.*

Note that imported emissions are not included in this forecast. Primarily, this is because changes in imported emissions are very challenging to track, and data is limited. Additionally, policy options are limited as the sources of emissions are local to other communities. Local emissions are more commonly used for community goal setting.

Appendix A: More Detailed Data

Table 3: Detailed Emissions Breakdown

Emissions Sector / Sub-Sector All emissions reported in MT CO_2e	2019 Emissions		Per capita	
	Market-based*	Location-based	Market-based	Location-based
Stationary Energy	283,057	249,862	0.7	0.7
Residential Buildings				
Electricity	29,490	32,118	0.1	0.1
Natural Gas	24,721		0.1	
Other Fuels	2,009		0.01	
Commercial Buildings and Industrial Facilities				
Electricity	161,311	125,730	0.4	0.3
Natural Gas	60,935		0.2	
Other Fuels	2,757		0.01	
Fugitive Emissions from Natural Gas Systems	726		0.0	
Wastewater Treatment Energy	1,108	865	0.0	0.0
Transportation	84,128	84,074	0.2	0.2
Gasoline	61,629		0.2	
Diesel	21,068		0.1	
On-Road Transit Vehicles	1,180		0.0	
Electric Vehicles	251	196	0.0	
Waste	2,917		0.01	
Solid Waste Landfill and Compost	2,242		0.01	
Wastewater Treatment & Septic Systems	675		0.00	
Industrial Process and Product Use	16,252		0.04	
Refrigerants	11,684		0.03	
Industrial Process	4,568		0.01	
Consumption-based & Upstream Emissions	290,873	285,248	0.8	0.8
Household Consumption				
Goods	100,861		0.3	
Food	85,285		0.2	
Upstream Energy Production	82,685	77,059	0.2	0.2
Air Travel	22,042		0.1	
Negative Emissions (Sequestration & Offsets)	-677		0.0	
Purchased Offsets	-677		0.0	
Local Emissions	386,355	353,104	1.0	0.9
Local + Consumption	677,228	638,352	1.8	1.7

*For an explanation of market vs location-based accounting see Appendix C: Electricity.

Table 4: Available data over multiple years

Available Emissions Data by Sector (MT CO_2e / year)	2018	2019	2020	2021
Building Energy				
Electricity (Market-Based)	*No Data*	191,909	169,193	153,445
Natural Gas	81,314	85,655	80,702	*74,402*
Other Fuels *	4,942	4,767	4,587	4,587
Transportation				
Gasoline (E10)	66,886	62,809	63,002	82,319
Diesel (B5)	18,533	21,068	21,725	27,382
Electric Vehicles (Market-Based)	153	251	331	607
Waste				
Landfilled Solid Waste	849	2,242	1,098	1,418
Wastewater Treatment Process	742	675	683	695
Process & Fugitive Emissions				
Refrigerant Loss **	11,684	11,684	11,684	11,684
Manufacturing	7,366	4,568	5,003	*No Data*
Fugitive Natural Gas	689	726	684	*631*

* Last available data is from 2019, used as proxy for 2020 and 2021 with population adjustments.

** Data estimated from statewide averages and scaled down for population.

Appendix B: Glossary of Terms

GHG

Short for greenhouse gases. Emission of greenhouse gases are the cause of current climate change. An inventory of GHGs measures gases in units of carbon dioxide equivalents (CO_2e). A GHG inventory is also known as a carbon footprint.

GHGP/GPC/Protocol

This type of inventory follows a set protocol, the GHG Protocol (GHGP) standard for cities and communities known as Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC). This protocol determines what is included within a set boundary and categorizes emissions by sector. See Sector-based inventory for more information.

GWP

Short for global warming potential. This refers to the potency of emissions to trap heat in the atmosphere. Carbon dioxide has a GWP of 1, and other GHG gases are more potent and expressed as a multiple of carbon dioxide. For example, methane has a GWP of 28, meaning one molecule has 28 times the effect of one molecule of carbon dioxide (IPCC AR5 values).

Imported, Consumption-based Emissions (Other Scope 3)

Emissions from consumption of imported goods and services, also known as Other Scope 3 Emissions per GPC protocol, include emissions from upstream fuel production and household consumption, such as food, household goods, and air travel.

IPCC AR5

The United Nations Intergovernmental Panel on Climate Change (IPCC) releases Assessment Reports every six to seven years providing an overview of the state of knowledge concerning climate change science. The fifth report, AR5, is the most recent version released in 2014. The 6th assessment is due to be released shortly after the production of the report.

KWh

Short for kilowatt hour. Kilowatt hours are a standard unit for electricity consumption, and a measure of electrical energy equivalent to a power consumption of 1,000 watts for 1 hour. For example, a 50-inch LED TV uses about 0.016 kWh per hour. It would take roughly 62.5 hours for this TV to use 1 kWh of energy[13].

Sector-based Greenhouse Gas Inventory (Local Emissions)

This refers to preparing an inventory that is broken down by various sectors of the community that have common GHG characteristics. In this report, sector-based emissions are also known as **local emissions**. This type of inventory follows a set protocol (GPC) determining what is included in each sector. Mainly,

[13] Electricity Plans: https://electricityplans.com/kwh-kilowatt-hour-can-power/#:~:text=Here%20are%20some%20of%20the,around%202.3%20kWh%20per%20hour

sector-based emissions include emissions from building energy and vehicles along with local sources of GHGs from waste, uncontrolled loss of industrial and refrigerant gases, and agriculture. Note that emissions from household consumption of goods and services are not included in sector-based inventories. Standard sectors include:

- **Building Energy:** emissions from energy used or produced in a fixed location, e.g., electricity, natural gas, propane, and fuel oil. The GPC term is stationary energy.
- **Transportation:** emissions from vehicles and mobile equipment.
- **Waste:** landfilled waste emissions and wastewater treatment emissions.
- **Process Emissions & Product Use:** refrigerants and other fugitive gases from industrial processes.
- **Agriculture, Forestry & Land Use:** emissions from agriculture (e.g., animal waste and agricultural inputs) and community land use change (e.g., development of forest or grasslands).

Location-based Electricity Emissions Accounting

Refers to GHG intensity of the regional electricity grid, representing the average impacts of electricity use and efficiency efforts across the region. Contrast with Market-based Electricity Emissions Accounting.

Market-based Electricity Emissions Accounting

Refers to the GHG intensity of electricity contracts with local utilities. Contrast with Location-based Electricity Emissions Accounting.

MT

Short for Metric Ton (~2,200 lbs.). This is a common unit by international standards.

MT CO_2e

Metric Tons of carbon dioxide equivalent – a unit of measure. Most greenhouse gases are more potent in warming the atmosphere than carbon dioxide. To calculate and compare emissions easily, all gases are calculated and combined into a carbon dioxide equivalent, typically measured in metric tons.

Scope (as in Scope 1, Scope 2, Scope 3)

Scopes are one method to define the source of emissions. Scope categories distinguish between emissions that occur within a geographic boundary (scope 1), from electricity generation serving the community (scope 2), and emissions that occur outside the boundary, but that are driven by activity within the boundary (scope 3).

Therm

Common reporting unit of natural gas that represents 100,000 British thermal units. A therm is roughly equivalent to 100 cubic feet of natural gas.

Appendix C: Methodology & Protocols

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 accounting emissions and ICLEI's US Community Protocol for guidance on calculation of consumption-based emissions (i.e., other Scope 3 as defined by GPC protocol).

Good Company's carbon calculator tool *G3C – Community* was used for emissions calculations. Emissions are documented in the Inventory Audit Trail. G3C – Community is an Excel-based calculator that documents all activity data; emissions factors; and emissions calculations used in the inventory. The audit trail catalogs all data, calculation, and resource files used to complete the inventory. These resources are highly detailed and will allow for those conducting future inventories to fully understand and replicate the methods used in this inventory.

GHG emissions presented in this report are represented in metric tons of carbon dioxide equivalent (MT CO_2e). The gases considered in the analysis are consistent with protocol and include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), Chlorofluorocarbons (CFCs), and perfluorocarbons (PFCs) per the Kyoto Protocol (Sulfur Hexafluoride, SF_6, was not applicable). All GHG calculations use 100-year 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 Tualatin's staff to collect the data required to calculate emissions. Tualatin's staff, along with other local and regional government staff and private entities that serve the community, graciously provided time, data, and expertise. Data and emissions factors are described in Appendix D: Summary of Data and Emissions Factors.

Inventory Exclusions

Table 5: Summary of Inventory Exclusions

NE = Emissions occur but are not reported or estimated
IE = Included Elsewhere as part of another data set where a split is not available
NO = Activity or process does not occur within boundary

Emissions Sector / Sub-Sector	Key	Justification for Exclusion
Building energy: Potable Water Treatment and Delivery Energy	IE/NE	Tualatin is served mainly from the City of Portland through the Bull Run and groundwater systems. This water is gravity fed, and any additional local pumping is included in building energy. Treatment energy is not included because it occurs outside the city boundary.
Building energy: Energy Generation Supplied to the Grid	NO	No significant activity identified within Tualatin's geographic boundary. Some local community solar is likely but expected to be insignificant, with the exception of the solar generation by the city mentioned in the report.
Building energy: Agriculture, Forestry, and Fishing	NO	No activity identified within Tualatin's geographic boundary.

Building energy: Fugitive emissions from Coal Production	NO	No activity identified within Tualatin's geographic boundary.
Transportation: Rail	NE/IE	A short strip of freight rail track is located inside Tualatin. The emissions associated with this are expected to be insignificant and because there are no freight stops within the community, this can be excluded by protocol. A short section of TriMet light rail is located inside Tualatin. The community's share of transit emissions, including the WES rail, are included in on-road transit emissions.
Transportation: Aviation	NO	Aviation emissions within the GPC are specific to air travel that is confined to the Community's geographic boundary; no such activity identified within Tualatin's geographic boundary. That said – the community's air travel emissions for flights that extend beyond the community's boundaries are estimated and included as an Other Scope 3 emissions source. These emissions represent an estimate of air travel emissions by community residents for transboundary trips outside of the community's geographic boundary.
Transportation: Waterborne navigation	NO	There are no marinas along the Tualatin River where it borders the city. Any fuel use for small craft (such as fishing boats) is expected to be insignificant and likely to be included in transportation fuel sales.
Agriculture, Forestry, and Land Use	NO/NE	No livestock activity or industrial-scale agriculture activity identified within Tualatin's geographic boundary. Land Use change emissions from development is not expected to be significant, but data was not available.

Electricity

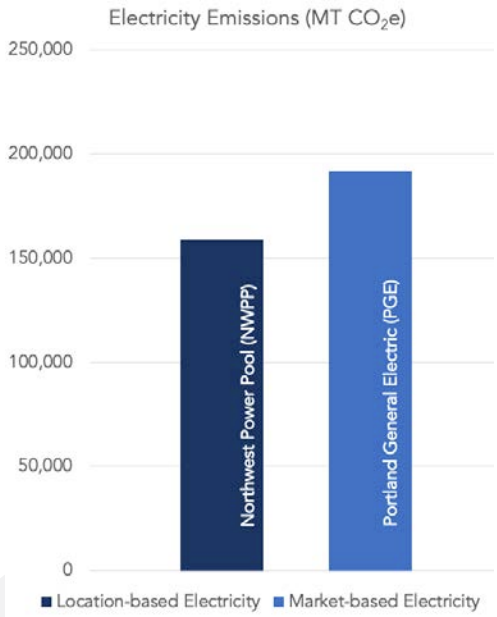
Activity data was collected from Portland General Electric (PGE). Data was collected directly from the utility, including percentage of RECs purchased. A split for commercial and industrial uses was not available.

The Community Inventory Protocol (GPC) requires that communities report electricity emissions using two accounting methods: location-based and market-based.[14] **Market-based accounting** is based on the GHG intensity of electricity contracts with local utilities and is used in most of the figures presented in this report as the GPC protocols recommended methodology to track progress towards goals over time. **Location-based electricity accounting emissions** are calculated using the regional electricity grid's (Northwest Power Pool, NWPP) GHG intensity and represent the average impacts of electricity use and efficiency efforts.

[14] For details visit http://www.ghgprotocol.org/scope_2_guidance.

- **Location-based method** (or regional grid) multiplies an organization's electricity use by the average emissions intensity of a specific regional electricity grid that is published by the Environmental Protection Agency (eGRID 2019). Note that over time there may be differences in emissions results for inventory years due to the use of an updated eGRID emissions factor (typically released every 1-2 years). Location-based electricity accounting offers a means of assessing the average impacts of electricity use on the regional electricity grid.

Figure 14: Electricity emissions using both accounting methods



- **Market-based method** (or utility-specific) represents emissions specific to the utility and takes into account community purchase of renewable energy certificates. Market-based electricity accounting is commonly used for target and goal tracking and is useful to assess and manage GHGs associated with electricity generation and supply. It also highlights benefits for energy efficiency actions, particularly in communities served by utilities with very low GHG electricity. That is, the less electricity used in the community, the more low-GHG electricity there is available for export to communities with more GHG intensive electricity sources.

Appendix D: Summary of Data and Emissions Factors

Emissions Category	Category Description
Building Energy (Stationary Energy in GPC Protocol)	
Residential Energy	*These categories include direct emissions from natural gas, fuel oil, and propane combustion by the residential, commercial, and industrial sub-sectors within the geographic boundary. Also includes the emissions from grid electricity used by the same sub-sectors for the same geographic boundary.*
Commercial Energy	
Industrial Energy	
Electricity and natural gas data provided by Portland General Electric, Northwest Natural Gas, Calpine, and Constellation Energy. Electricity and gas data included information on retail sales and participation in renewable electricity and carbon offset programs. Residential and commercial fuel oil and propane use was estimated using state-level per capita 2019 fuel usage data downscaled by Tualatin's 2019 population. Emissions factors for natural gas, fuel oil, and propane are from U.S. EPA's emissions factors hub and The Climate Registry's 2018 Default Emissions Factors and are considered highly accurate. Location-based electricity emissions factors are taken from EPA eGRID 2019 data for the Northwest Power Pool (NWPP) sub-region. Market-based electricity accounting emissions factors for electric utilities are taken from Oregon Department of Environmental Quality's report titled, *2010 – 2019 Greenhouse Gas Emissions from Electricity Use*. Available online at https://www.oregon.gov/deq/aq/programs/Pages/GHG-Emissions.aspx. Utility data is considered highly accurate; non-utility data (e.g., fuel oil and propane) is considered to have medium accuracy.	
Fugitive Natural Gas System Emissions	*Fugitive loss of natural gas from the local product distribution system.*
Northwest Natural Gas reported a 0.12% system leakage rate. Note that the NWN reported rate is less than half of the protocol default proxy value of 0.3%. This data is considered highly accurate.	
Transportation	
On-Road Energy	*Direct emissions from gasoline and diesel for passenger & freight transportation.*
Fuel sales data for gasoline, diesel, propane, and compressed natural gas (CNG) was provided by the ODOT Fuels Tax Group. It quantifies the total volume of fuel sold within city borders. This data is considered highly accurate. This is following the Fuel sales methodology from the GPC. It has the advantage of being inexpensive to collect and easy to compare across years.	
Transit	*Direct emissions from gasoline and diesel (on-road) and electricity (light rail) for passenger transit transportation.*
Emissions data was collected from TriMet Transit District's Operational GHG inventory. These emissions were estimated and downscaled by Tualatin's population to TriMet's service territory. Data	

received from TriMet is considered highly accurate; however, the estimate based on population is considered moderately accurate.	
Rail - Passenger & Freight	*Direct emissions from gasoline and diesel for passenger and freight transportation within the geographic boundary.*
WES emissions are included in transit emissions. No Amtrak or other passenger rail activity occurring in the boundary. A short strip of freight rail track is located inside Tualatin. Data was not available, and emissions are expected to be insignificant. Furthermore, most transportation emissions are based on fuel sale data, of which no fuel is sold for rail uses.	
Off-Road	*Direct emissions from gasoline and diesel for off-road vehicles such as construction equipment, etc.*
Fuel sales data for dyed diesel and biodiesel was provided by the ODOT Fuels Tax Group. This data is considered highly accurate, although there were no reported dyed fuel sales in 2019.	
Waste	
Landfill Solid Waste	*Fugitive methane emissions from mixed solid waste generated in the community regardless of disposal location.*
Tualatin has multiple destination landfills. For waste landfilled at Coffin Butte, Wasco, and Arlington landfills, EPA reported 2019 emissions were downscaled based on reported short tons from Tualatin customers. This methodology follows IPCC's first order decay model and is designated by EPA as EE-6 calculations. This activity data is considered highly accurate.	
Wastewater Treatment Process Emissions	*Fugitive nitrous oxide emissions from discharge of treated effluent (wastewater).*
Wastewater treatment plant process emissions for biogas combustion and effluent discharge are calculated using data provided by Clean Water Services staff. For biogas combustion data included square cubic feet per day of biogas and the percent methane in the biogas. For Nitrogen effluent discharge, data was not available and was estimated using ICLEI U.S. Community GHG Protocol methodology and service population. Emissions calculations for nitrification / denitrification are based on service population. This activity data is considered medium-to-highly accurate.	
Septic Systems	*Direct emissions from the combustion of biosolids (wastewater).*
Septic fugitive emissions were not estimated for this report and are expected to be minimal.	
Industrial Process & Refrigerants (Industrial Process & Product Use in GPC protocol)	

Refrigerants (Product Use in GPC protocol)	*Fugitive loss of refrigerants and other high GWP gases from building and vehicle air conditioning systems.*
Fugitive refrigerant loss and other non-industrial high GWP gas emissions are estimated using Oregon state-level data attributed to the community on a per capita basis. Activity data for state-level fugitive emissions from refrigerants, aerosols, and fire suppression systems is reported in the Oregon Department of Environmental Quality's (ODEQ's) Oregon Greenhouse Gas Inventory (as High Global Warming Potential [HGWP] sources) in quantities of CO_2e. Data used is from Oregon's GHG inventory includes HGWPs for the residential & commercial and transportation sub-sector (industrial emissions calculated separately, see Industrial Processes below). High GWP gas emissions are estimated from State of Oregon totals and therefore are considered as having mid-level accuracy.	
Industrial Processes	*Fugitive loss of industrial high GWP gases from industrial processes. Stationary building emissions (fuel combustion, etc.) are not included and are part of Building Emissions.*
Three applicable facilities inside the boundary were identified by the EPA FLIGHT tool and/or Oregon DEQ's air quality monitoring reports. These industrial facilities are required to report significant air quality and/or climate emissions. Only one of these had non-energy emissions. EPA reports include specific gases and quantities with clear separation of building energy emissions. Pre-calculated values used IPCC AR4 GWP values and were re-calculated to reflect more accurate IPCC AR5 GWP values. Building energy emissions were excluded to avoid double counting. Oregon DEQ reports total emissions in CO_2e and do not list specific high GWP gases or quantities, nor a split between Industrial Process and building energy emissions. Oregon DEQ was contacted with a request for an Industrial Process split which was provided. Emissions were reported using AR4 GWP values and were not possible to re-calculate using AR5 values. Other DEQ reported facilities either emitted biogenic emissions or 100% building energy emissions and were not included. This data is considered highly accurate.	
Imported Emissions	
Goods	*Upstream energy and process emissions raw material extraction, manufacturing, and out-of-state transportation of goods.*
Food	*Upstream energy and process emissions from the growing, processing and transportation of foods.*
Services	*Upstream energy emissions from air travel by community members from all airports regardless of location.*
Accurate data on quantities and suppliers for the goods and food consumed by community households is not readily available. Therefore, the State of Oregon's 2015 consumption-based emissions inventory (CBEI) was used to estimate these sources of emissions. State of Oregon CBEI results were downscaled for Tualatin using US Census Bureau data on households' income and number of households within various income brackets. Note that ODEQ conducts the Oregon CBEI every 5 years and therefore this	

methodology may not be used to estimate emissions on an annual basis. Emissions estimates were therefore adjusted for inflation and nationwide trends in spending between 2015 and 2019. Spending trends were taken from the Bureau of Labor Statistics.

Air travel is based on U.S. Census Data and Oregon's version of the UC Berkeley Household Cool Climate Calculator. Given the inventory year and that data is estimated from a large and complicated economic model, this activity data is considered as having mid-to-low accuracy.

Upstream Fuel Production	*Upstream energy and process emission from the production and distribution of natural gas, gasoline, diesel, and electricity consumed either directly or indirectly by the Community.*

Data for gasoline, diesel, natural gas, and electricity use is same as previously described. Lifecycle emissions factors for the various fuel types are provided by Oregon Department of Environmental Quality's Clean Fuels program carbon intensity scores. Upstream fuel and energy emissions are calculated as the difference between direct tailpipe emissions (reported under Transportation) and total lifecycle emissions. Activity data for electricity and natural gas is considered highly accurate while transportation fuel use is considered moderately accurate because the precise feedstocks for biofuels sold within the community is not readily available. Upstream emissions can vary significantly for biofuels depending on feedstocks and therefore calculated emissions are considered moderately accurate. Upstream emissions factors are for regulatory purposes and are therefore considered highly accurate.

Negative Emissions

Purchased Carbon Offsets	*Community purchase of verified carbon offsets.*

Carbon offsets purchased by Northwest Natural Gas account holders' participation in NWN's Clear Energy program were provided by the utility as therm-equivalents and MT CO_2e. This activity data is considered highly accurate.

APPENDIX 3: PUBLIC INVOLVEMENT & COMMUNICATIONS PLAN

Tualatin Climate Action Plan
Public Involvement Plan

Public Involvement Goals

- **Devote energy, scope, and budget to engage diverse communities and those who historically have been left out of public planning, such as communities of color and low income people**. We will create a welcoming and culturally relevant engagement program, and explicitly reach out to and prioritize feedback from those who are first and worst impacted by climate change.
- **Grow the relationships between the city and key stakeholders from underrepresented communities** to strengthen the results of this outreach and build trust with community members.
- **Be clear and transparent about decision-making at every step.** We will communicate complete, accurate, understandable, and timely information to the public and partners throughout the project. Community members will know their role in shaping the plan and will be able to understand how important decisions are made.
- **Listen to the public and follow-up.** We will practice active listening to better understand the lived experiences of community members, and we will follow-up with how we incorporated (or didn't incorporate) what they shared into the Climate Action Plan. Listening to understand, not respond, and following up with the public, will help create community ownership of the plan and help people "see" themselves in it.
- **Create accessible outreach materials and opportunities.** We will meet people where they are, in their preferred language, and when it is convenient for them.
- **Be flexible.** We know it will take time to build relationships and build community awareness and understanding of climate change and the Climate Action Plan. We will be flexible and respond to community needs.

Public Involvement Schedule

Phase 1: Build awareness and understanding (Spring – Summer 2022)

Goals: Introduce the project to the public, build relationships with hard-to-reach populations, and develop community awareness and understanding of climate change and what a Climate Action Plan is.

Activity	Purpose	Status	Key Takeaways
Community Meetings and Events Ongoing	Share information about the project at English-language and Spanish-language community events and meetings.	Phase 1 Outreach Complete	**Top concerns:** Wildfires and smoke, drought, protecting the ecosystem and the river, and extreme weather. **Want to learn more about:** What actions will have the most impact, how we can work together, protecting animals, bioswales and rain gardens, how to drive less and improve access to bicycling, and what other cities are doing about climate change

Diverse Stakeholder Engagement Ongoing	Build relationships with communities of color, low-income people, and others who have historically been left out of public planning who we will engage and involve throughout the project.	Phase 1 Outreach Complete	**Presentation to Tualatinos:** Discussed the importance of educating people, especially children, about how to take care of the environment; interest in how builders create environmentally friendly buildings; desire to learn more about how to help.
Project Website Launch Spring 2022 Ongoing updates	Share information about the project. The website will be updated regularly and will provide opportunities for community input that align with project milestones.	Launched	**Comment form feedback:** A Climate Action Plan matters because it lays out steps to address climate change and shows the community's commitment to future generations. People are concerned about the impacts of climate change, especially to animals and pets.
Project Factsheets and Graphics	Provide information about the project and opportunities for community engagement.	Complete	Check out the factsheet here!

Phase 2: Gather feedback on draft adaptation and mitigation actions (Fall - Winter 2022)

Goals: Continue developing relationships with diverse communities, share initial adaptation and mitigation strategies with community members, and provide opportunities for engagement and feedback.

PI Activity	Purpose	Status	Key Takeaways
Diverse Stakeholder Engagement Ongoing	Build relationships with diverse stakeholders to engage and involve throughout the project.	Phase 2 Outreach Complete	• People were concerned about water availability, future water scarcity, and air quality during fire smoke events. • Access to a place with clean air and cooler temperatures (and ACs) in the summer is important. The cost of running ACs is a concern. • Many would like to learn more about climate change and what actions have an impact. Additionally, how can communities work together? • Health during extreme weather conditions was a worry - especially for those who work outside and may not be able to support their

			families if it is too dangerous to work. ● Businesses are worried about their bottom line when reducing their work hours due to extreme weather or fire smoke events.
Online Open House #1 Fall 2022	Provide project overview and update, present initial adaptation strategies and mitigation actions, and gather feedback from community members. Open houses to be developed in English and Spanish.	Complete	● During extreme weather events, people are most concerned about **power outages, the cost to cool or heat their homes or businesses, dangerous driving or bicycling conditions** during heavy rain or winter storms, and air quality during wildfires. ● People need help **- financial assistance or more information** - to prepare for and take care of themselves during extreme events, and to reduce their emissions (i.e., putting solar panels on their home, buying a new electric or hybrid car, etc.).
Interactive Workshops Mid-Late Fall 2022	In these 2 hour workshops, participants will learn about the project and discuss the needs of impacted groups. Our goal will be to determine what support stakeholders need and help them understand the CAP and the initial draft adaptation and mitigation actions and strategies.	Complete	● **Access to information is key during, and in preparation for, extreme weather situations.** Information should be specific, easy to understand, and provided in Spanish and English. ● **Everyone is worried about power outages.** Students are especially worried if school has to go online during winter storms. ● Homeowners and small businesses would benefit from **education and information about what to do first** (i.e., install a heat pump, go solar, install smart irrigation, etc.). ● Small business owners are concerned about **how climate change will impact their bottom line** (i.e., the financial impacts to their business), which directly affects their ability to support their families.

Community Meetings and Events Ongoing	Share information about the project at English-language and Spanish-language community events and meetings.	Phase 2 Outreach Complete	***Attended Tualatinos and Latino Business Networking meetings, the Tigard Farmers Market, and a Chamber of Commerce networking event.*** ● Many business owners are concerned about how climate change will affect employees and their families, especially people who work outside (i.e., construction, agriculture, and landscaping). ● Access to information in Spanish through trusted sources is important. ● Many asked about resources for small businesses and information about what businesses can do. ● People were excited the City was creating a CAP. One person mentioned that they would like to install a heat pump, but it is cost prohibitive.
Website updates Ongoing, monthly	Share information about the project. The website will be updated regularly and will provide opportunities for community input that aligns with project milestones.	Ongoing	

Phase 3: Share draft Climate Action Plan (Winter – Spring 2023)

Goals: Continue developing relationships with diverse communities; share draft Climate Action Plan with community members and provide opportunities for engagement and feedback.

Activity	Purpose	Status	Key Takeaways
Diverse Stakeholder Engagement Ongoing	Build relationships with diverse stakeholders to engage and involve throughout the project. Facilitate hand-off of relationships to the City of Tualatin for sustained relationships.	Ongoing	
Community Meetings and Events Ongoing	Share information about the project at English-language and Spanish-language community events and meetings.	Ongoing	

Online Open House #2 Late Spring – Early Summer 2023	Share draft Climate Action Plan and gather feedback from the public. Open houses to be developed in English and Spanish.	Upcoming
Local Business Outreach Late Spring – Early Summer 2023	Share information about the draft Climate Action Plan with local businesses, gather feedback and understand concerns.	Upcoming
Website updates Ongoing, monthly	Share information about the project. The website will be updated regularly and will provide opportunities for community input that aligns with project milestones.	Ongoing

APPENDIX 4: STAKEHOLDER WORKSHOPS SUMMARY

Stakeholder Workshops Summary

Background

The project team engaged stakeholders from state and local agencies, the energy utilities that serve Tualatin, non-profits, and businesses to gather feedback and inform the development of the Climate Action Plan. The project team convened seven workshops, one meeting per focus area. Three workshops focused on climate adaptation, with deep dives into natural systems, resources, and infrastructure, human health and safety, and economic shifts. Four workshopsfocused on reducing greenhouse gas emissions, with deep dives into buildings and energy, urban form and land use, transportation, and consumption.

Adaptation workshops

In June 2022, 22 individuals from 11 organizations participated in stakeholder workshops focused on adapting to climate change.

The purpose of the adaptation-themed workshops was to share information and solicit input on the following topics:

- The current and future impacts of climate change in Tualatin
- The role(s) that your business or organization can play in ensuring successful adaptation to a changing climate
- What information and/or help do you need to start adapting to the changing conditions?
- How can the City of Tualatin help you move forward?

Natural Systems

Participants

Name	Title	Organization
Rich Mueller	Parks & Rec Manager	City of Tualatin
Carol Murdock	Water Resource Program Manager	Clean Water Services
Scott Wagner	Nature & Trails Specialist	Tualatin Valley Parks & Rec
Jonathan Taylor	Economic Development Manager	City of Tualatin
Paris Edwards	Climate Specialist	ODOT
Rachel Sykes	Public Works Director	City of Tualatin
Bert Olheiser	Street/Storm/Sewer Division Manager	City of Tualatin
Nic Westendorf	Deputy Public Works Director	City of Tualatin
Maddie Cheek	Management Analyst	City of Tualatin
Terrance Leahy	Water Division Manager	City of Tualatin
Josh Proudfoot	Director, Climate and ESG	Good Company, a division of Parametrix
Beth Miller	Scientist	Good Company, a division of Parametrix

Key takeaways

The natural systems, resources, and infrastructure discussion focused on the following impacts:

- **Trees** – It is important to consider changing climate conditions when selecting and replanting trees to maintain existing canopy cover and increase canopy cover in areas that need it.
- **Water** – The Bull Run watershed, Tualatin's primary drinking water source, faces threats from climate change. Threats include algae blooms due to excessive heat and reduced tree cover due to excessive heat and fire conditions, which could exacerbate heat and reduce shading, negatively impacting the ecosystem and water quality.
- **Heat** - Maintenance staff out working in the heat will need additional support, protective measures, and creative solutions to deal with hotter temperatures. Infrastructure will need to be designed to withstand the future temperature ranges.
- **Fire** – The threat of wildfire in Tualatin is minimal, but some outlying neighborhoods may be in danger. The City could benefit from investing in Firewise outreach to increased preparedness. Partner agencies in the region (Tualatin Valley Parks and Recreation District and Clean Water Services) have already completed fire resiliency studies. These could be a good resource for the City of Tualatin to use.
- **Flooding** – Tualatin's downtown area is in serious flood danger. Need to increase stormwater retention and design parks and other areas so that they are able to serve as stormwater retention in the event of a serious flooding event.

Health & safety (People)

Participants

Name	Title	Organization
Sarah Allison	Sustainability Analyst	Clackamas County Sustainability & Solid Waste
Greg Pickering	Interim Police Chief	City of Tualatin
Armando Jimenez	Public Health Programs Manager	Clackamas County Public Health
Tom Bozicevic	Technical Specialist	OSHA
Julie Ludemann	Parks & Recreation Supervisor	City of Tualatin
Troy Gagliano	Local Govt Affairs	PGE
Tangerine Behere	Service Planner	Tualatin Ride Connect
Betsy Rodriguez-Ruef	Community Engagement Coordinator	City of Tualatin
Ally Parzych	Director of Development and Community Partnerships	Vision Action Network
Jonathan Taylor	Economic Development Manager	City of Tualatin
Josh Proudfoot	Director, Climate and ESG	Good Company, a division of Parametrix
Beth Miller	Scientist	Good Company, a division of Parametrix
Nic Westendorf	Deputy Public Works Director	City of Tualatin
Maddie Cheek	Management Analyst	City of Tualatin

Key takeaways

The health and safety (people) discussion focused on the following themes:

- **Social cohesion** – Relationships between people are crucial to building resilient communities. Outreach to marginalized communities will require lots of work to build and improve trust. Building relationships with neighboring communities can help to improve social cohesion and use resources more efficiently.
- **Shelter** – More public refuge in parks, at transit stops and centers, and in buildings is needed to keep people safe during heat and smoke events in particular.
- **Health** – There are very real physical and mental health impacts from climate change. Development of a household resiliency kit to help people prepare for likely Tualatin climate hazards could help to increase preparedness.

Economic Shifts

Participants

Name	Title	Organization
Matt Kaiser	Senior Policy Analyst, Legislative Coordinator	OSHA
Anneleah Jaxen	CEO	Tualatin Chamber of Commerce
Jonathan Taylor	Economic Development Manager	City of Tualatin
Liz Miller	Sustainability Manager	Pacific Foods
Nic Westendorf	Deputy Public Works Director	City of Tualatin
Maddie Cheek	Management Analyst	City of Tualatin
Josh Proudfoot	Director, Climate and ESG	Good Company, a division of Parametrix
Beth Miller	Scientist	Good Company, a division of Parametrix

Key takeaways

The economic shifts discussion focused on the following themes:

- **Difficult conditions for businesses** – Many businesses are fighting for survival following the COVID-19 pandemic and recent economic conditions. This makes it challenging to look to the future and prioritize climate action at the moment.
- **Need for information and resources** – The City of Tualatin needs to develop a long-term, ongoing outreach plan to engage more businesses to provide education about coming conditions, training on new OSHA rules pertaining to heat, fire, and smoke.

Mitigation workshops

In October 2022, 31 individuals from 14 organizations participated in stakeholder workshops focused on reducing carbon emissions.

The goals of the mitigation-themed stakeholder workshops were to share information and solicit input on the following topics:

- Climate science basics (Climate 101)
- The current and future impacts of climate change in Tualatin (Future physical conditions)
- Tualatin's community carbon footprint and best practices and barriers to reducing emissions

- The role(s) that organizations and businesses can play in decreasing carbon emissions in the community
- The role(s) that the City of Tualatin can play to support organizations and businesses in decreasing carbon emissions in the community

Buildings and energy

Participants

Name	Title	Organization
Roger Kainu	Energy Analyst	Oregon Department of Energy
Hannah Cruz	Senior Stakeholder Relations and Policy Manager	Energy Trust of Oregon
Troy Gagliano	Manager, Local Government Affairs	PGE
Nina Carlson	Government Affairs Representative	Northwest Natural
Jonathan Taylor	Economic Development Director	City of Tualatin
Jerianne Thompson	Library Director, DEI Officer	City of Tualatin
Jacob Buchannan	Operations Manager	CenterCal | Bridgeport Village
Josh Proudfoot	Director, Climate and ESG	Good Company, a division of Parametrix
Beth Miller	Scientist	Good Company, a division of Parametrix
Nic Westendorf	Deputy Public Works Director	City of Tualatin
Maddie Cheek	Management Analyst	City of Tualatin

Key takeaways

Themes from the buildings and energy stakeholder workshop included:

- **Education and information sharing** – The City can play a big role to help with education and amplification of existing programming (e.g. from Northwest Natural, PGE, Energy Trust of Oregon).
- **Barriers to action** – Cost seems to be the biggest barrier for folks to reduce greenhouse gas emissions right now.
- **Relationship building and partnerships** – Ongoing relationships between city and commercial/industrial actors needed to ensure they feel supported and have education and resources needed to tackle GHG mitigation.
- **Policy makers have a role to play** – Policy changes can and must play a role in speeding this up
- **A “one-size-fits-all" approach won’t work** – Different folks have different needs; there can’t be a one-size-fits-all approach to solutions or communications. Messaging and targeted different groups’ unique needs must be responsive to this.

Urban form and land use

Participants

Name	Title	Organization
Erin Engman	Senior Planner	City of Tualatin

Mike McCarthy	City Engineer	City of Tualatin
Steve Koper	Assistant Community Development Director	City of Tualatin
Steve Kelley	Senior Planner	Washington County
Jerianne Thompson	Library Director, DEI Officer	City of Tualatin
Jonathan Taylor	Economic Development Director	City of Tualatin
Anouksha Gardner	Strategic Partnership Manager	The Street Trust
Josh Proudfoot	Director, Climate and ESG	Good Company, a division of Parametrix
Beth Miller	Scientist	Good Company, a division of Parametrix
Nic Westendorf	Deputy Public Works Director	City of Tualatin
Maddie Cheek	Management Analyst	City of Tualatin

Key takeaways

Themes from the urban form and land use workshop included:

- **There are many chicken and egg situations when it comes to urban form and land use** – At some point the infrastructure must be established in order to get people to use it, but this requires political will. Decision makers need to accept that some things might not be utilized right away, but options do need to be provided.
- **Identifying information gaps** – There are a handful of unknowns/information gaps that the City could benefit from better understanding (e.g. the types of trees the City should be planting moving forward given changing climate conditions, which may result in a revised tree species list)
- **Policy changes are needed –** Code updates are needed to make some of these best practices materialize in reality.
- **There are unmet funding needs –** These needs can prevent best practices from being adopted currently (E.g. Funding to incentivize blended development and mixed use neighborhoods, or transit incentives)
- **Equity must be considered and prioritized** – To ensure that changes to code and distribution of funding and other resources is equitable.

Transportation – modes and fuel switching

Participants

Name	**Title**	**Organization**
Basil Christopher	Bicycle and Pedestrian Coordinator	ODOT
Juliae Riva	Clean Fuels Program Grants Coordinator, Transportation Electrification	PGE
Troy Gagliano	Manager, Local Government Affairs	PGE
Tangerine Behere		Ride Connection
Brett Hoffman	Building Maintenance Technician	City of Tualatin
Mike McCarthy	City Engineer	City of Tualatin

Josh Proudfoot	Director, Climate and ESG	Good Company, a division of Parametrix
Beth Miller	Scientist	Good Company, a division of Parametrix
Nic Westendorf	Deputy Public Works Director	City of Tualatin
Maddie Cheek	Management Analyst	City of Tualatin

Key takeaways

The transportation – modes and fuel switching stakeholder discussion focused on the following topics:

- **Communication and education** – Amplify, promote, or educate folks on existing programs and options to switch transportation modes and/or fuels.
- **There is a desire for the City of Tualatin to lead by example** – By reducing or offsetting transportation-related emissions (e.g. the City should electrify its own fleet and share that story with the public (this work is in progress as of spring 2023), adopt a city policy that requires carbon offsets to be purchased for any business-related flights).
- **Partnership is key** – The City must partner with local transit agencies and major employers in Tualatin others to reduce barriers to low-carbon transit.
- **Incentives are important** – Consider creating policies that incentivize public transportation and make use of alternative transportation modes more appealing to residents and workers in Tualatin. It is important to lead with solutions/better alternatives instead of taking convenience and ease away from folks with no backup plan. Equity issues embedded in this as well.

Consumption – food and goods

Participants

Name	Title	Organization
Travis Comfort	Municipal Contract Administrator	Republic Services
Elaine Blatt	Senior Policy and Program Analyst	Oregon Department of Environmental Quality
Ricardo Palazuelos	Bilingual Community Outreach Specialist	Washington County
Carolina Martins	Sustainability Specialist	Washington County
Liz Miller	Sustainability Manager	Campbells
Lindsay Marshall	Management Analyst	City of Tualatin
Josh Proudfoot	Director, Climate and ESG	Good Company, a division of Parametrix
Beth Miller	Scientist	Good Company, a division of Parametrix
Nic Westendorf	Deputy Public Works Director	City of Tualatin
Maddie Cheek	Management Analyst	City of Tualatin

Key takeaways

The consumption – food and goods stakeholder workshop focused on the following themes:

- **Building trust is key to enable borrow/sharing at a large scale to work** – trustworthy programs, groups, and/or venues must be established. Folks also need to trust that they'll be able to borrow what they need when they need it to deter them from buying new.
- **A one-sized-fits-all approach will not work –** Must tailor messaging to be culturally appropriate, goal-specific, and it must be communicated through the right channels to reach the right folks.
- **More venues are needed where folks can borrow, share, buy used/durable items, and/or drop off unwanted items that are still in good shape.** "One stop shop" for disposal has worked for other places – reduces barriers to sorting and time spent trying to get items to the right places.
- **Education and communications** –The City of Tualatin can play a huge role in educating the public (E.g. what local repair shop options exist, meal planning and food storage).
- **Right message, right place, right time** – It is important to communicate and educate about these issues as people come into contact with them (e.g. flyers about food waste reduction at grocery stores and restaurants).
- **Consistency and coordination** – Consistent messaging and collective efforts needed to ensure that folks are receiving the same messages consistently in many places.

APPENDIX 5: FALL 2022 OUTREACH SUMMARY

TUALATIN CLIMATE ACTION PLAN

FALL 2022 OUTREACH SUMMARY

The City of Tualatin conducted public outreach between September and November 2022 to share information about the development of the City's first Climate Action Plan (CAP) and to solicit feedback that will inform the CAP. In this phase of outreach, the City of Tualatin shared information about what Tualatin's climate is projected to be like by the end of the century and how community members can help reduce their impact on climate change. The City also solicited feedback about what help people need from the City to cope with the impacts of climate change and reduce their greenhouse gas emissions.

Over 250 people were engaged through this phase of outreach. Opportunities for engagement, as well as highlights from the feedback received, are summarized below.

Opportunities for engagement

- **1 Online Open House** offered in Spanish and English with a total of 69 responses (67 in English, 2 in Spanish); available from September 24 – November 13, 2022.
- **3 in-person workshops** with a total of 45 participants. Spanish interpretation was available at all workshops.
    - Households and Interest Groups: 17 total participants (12 English, 5 Spanish)
    - Youth: 21 total participants (20 English, 1 Spanish)
    - Small Businesses. 7 total participants (4 English, 3 Spanish)
- **2 In-person tabling events (Tigard Farmers Market and Tualatin Public Library)** with approximately 165 people engaged.
- **4 Latino Business Network meetings** attended where information about the workshops and online open house was shared.

How engagement opportunities were promoted:

- Mailers sent to all addresses within Tualatin advertising the online open house.
- Social media posts to the City's Facebook page and Instagram account.
- An article in the local newspaper, Tualatin Life, promoting the online open house.
- Posts on the project website.
- Canvassing to local businesses.
- Tualatin Chamber of Commerce networking event.
- Emails sent to interested parties on the stakeholder list.

- Personalized emails to businesses and community groups in Tualatin.
- Promotion in the Tualatin Chamber of Commerce weekly newsletter.
- Phone calls to Spanish-speaking community members about workshops and online open house.
- Flyers promoting the open house in the Tualatin Public Library and local businesses.
- A-frame signs placed at Tualatin Community Park, Atfalati Park, the Lake of the Commons, and the entrance to the Tualatin River Greenway Trail promoting the online open house

Public Feedback Key Themes

Overall, participants expressed interest in reducing their greenhouse gas emissions and a desire for the City to do more to address climate change. Participants would like the City to **provide more information and opportunities** to learn more about how to reduce their emissions and how to prepare for extreme weather events, as well as **financial help or incentives** to off-set the costs of reducing their greenhouse gas emissions (i.e., installing solar panels or a heat pump) and adapting to climate change (i.e., weatherizing home and businesses and/or repairing damage), which can be cost prohibitive. Key themes are summarized below:

- **Access to information** is key during, and in preparation for, extreme weather situations. Information should be specific, easy to understand, and provided in Spanish and English. Participants expressed interest in a City-hosted "resource hub" as a one-stop landing place for information related to climate adaptation, emergency preparedness, and extreme weather.
- Everyone is worried about **power outages**. Students are especially worried about them if school has to go online during winter storms.
- **Hazardous road or sidewalk conditions** can make it unsafe to walk, bicycle, or drive to work or school during extreme weather.
- People need **resources to stay warm and safe** – at home or on the way to work or school.
- A City **incentivization or "green" certification program for small businesses** could be a way to encourage businesses to reduce their greenhouse gas emissions.
- Homeowners and small businesses would benefit from **education and information about what to do first** (i.e., install a heat pump, go solar, install smart irrigation, etc.).
- There was overall interest in a **public Climate Action Fair** to learn about resources, gather needed supplies and ways to be proactive, and learn how to reduce greenhouse gas emissions.
- Small business owners are concerned about **how climate change will impact their bottom line (i.e., the financial impacts to their business),** which directly affects their ability to support their families. There was also concern about extreme weather, which typically leads to a decrease in customers.
- The **City can act as conduit between community members and large entities** (like utility companies) to help Tualatin adapt to climate change and reduce greenhouse gas emissions.

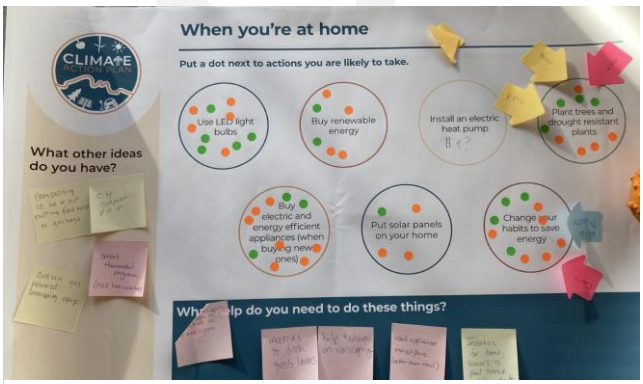
- Spanish-speaking participants emphasized that they would like to **actively fight climate change**, rather than reacting to its effects. They raised the concern that while individual actions to reduce climate change should be encouraged, **institutional level changes and programs are needed to make real progress.**
- Many people want to make a difference, but they need **resources and support,** and they **want to feel that they are a part of a community working together**. Spanish-speaking participants were especially **interested in how community members can work together to make a positive impact** on the environment, society, and the economy (with an emphasis on the workforce). It was especially **important for these efforts to be community focused**, possibly channeled through a school or church group.
- **Youth participants expressed interest in implementing mitigation activities**, such as reforestation and recycling.

The workshop activities and online open house questions were both organized around "tools for adaptation" (how to deal with climate change impacts) and "actions for mitigation" (how to reduce your impact on the environment) and followed a similar line of questioning. The following summarizes the feedback from online and in-person participation around these themes.

Mitigation: Actions people can take to help slow climate change

Participants were asked how they would be willing to help reduce their greenhouse gas emissions and contribution to climate change by making changes at home, when traveling, and when buying things. During the in-person workshops participants were asked to put a dot by the actions they thought they could complete. Online participants selected the actions in each category they were likely to take.

When you're at home or your business



Poster from Households and Interest Groups workshop.

Participants expressed eagerness to make adjustments to their daily lives to mitigate climate change. The most frequently marked options in this category were to **use LED light bulbs, change your habits to save energy, and buying more energy efficient appliances.**

- **Top for Households:** Use LED light bulbs, change your habits to save energy, buy energy efficient appliances, and plant trees. For Spanish-speaking participants, using LED light bulbs and planting trees and drough resistant plants were top choices.
- **Top for Youth:** For both English and Spanish participants, use LED light bulbs, change your habits to save energy, heat or cool your space using clothes, shade, or fans, reduce food waste, and plant trees.
- **Top for Small Business:** Install an electirc heat pump or solar panels, and buying renewable energy. For Spanish-speaking participants, installing solar panels was the top choice.
- **Top for online open house:** Use LED lightbulbs, buy energy efficient appliances, and change your habits.

When you buy things

At the workshops, most of the actions in this category had a similar number of dots and check marks, and all had been selected by nearly half of all participants in that group (except in the Small Business group). **Recycling was a very popular option, as was eating more plants, and buying fewer new things. Buying local and buying more used or durable items** were both the top selections in the Small Business group.

- **Top for Households:** Fairly even distribution across all choices, with eat more plants slightly higher. For Spanish-speaking participants, recylcing, eating more plants, and meal planning were top choices.
- **Top for Youth:** For both English and Spanish participants, there was a fairly even distribution across all choices, with recycling slightly higher.
- **Top for Small Business:** Even distribution across buying few new things, more used or durable items, reparing broken items, and buying energy efficient appliances. For Spanish-speaking participants, buying local and adapting sustainable purchasing policies were top choices.
- **Top online open house:** Recycling was the most popular option, followed by buying fewer new things and reparing broken items.

When you travel / Getting to and traveling for work

Responses to the “when you travel” category were less consistent than the other two. In the Youth workshop, **most participants were willing to carpool or walk, bike, roll, or skateboard when possible**, but only a few marked the other options. **Youth participants were also hesitant about using public transit** due to not feeling safe, routes and schedules being inconvenient, or not having parental permission.

- **Top for Households:** Walk, bike, roll, or skateboard when posible, buy an electirc or hybrid car, carpool, and take public transit. For Spanish-speaking participants, carpooling and taking public transit were top choices.

- **Top for Youth:** For both English and Spanish participants, carpool, and walk, bike, roll or skateboard were top choices.
- **Top for Small Business:** Working remotely (selected by all participants), coordinate carpooling, and electrifying the business vehicle fleet. For Spanish-speaking participants, wokring remotely was the top choice.
- **Top online open house:** Walk, bike, roll, or skateboard when posible, and buy an electric or hybrid car.

What help people need from the City to mitigate climate change

The City asked participants what help they needed to reduce their greenhouse gas emissions. The most common suggestions revolved around **education** or **providing financial incentives and/or assistance**.

Many participants highlighted that **many of the options are cost prohibitive and that finding the funds to complete these actions is an equity issue.** Any support the City could provide in stipends, incentives, or discounts towards actions would be helpful. An online commenter also brought up that many of these actions are impossible if you rent your home.

Many participants would be willing to take transit, walk, or bike if transit service and active transportation infrastructure were improved. Many felt that public transit is often not safe nor convenient, and dedicated paths for biking or walking are needed to encourage both.

Adaptation: How a changing climate impacts people

Changing climate patterns mean that Tualatin is seeing (and will continue to see) **more hot days per year, more wildfires and smoke, more severe rain and flooding, and more severe storms in the winter**. In this round of outreach, the City sought to understand what the community needs to deal with these severe weather conditions. n

During the in-person workshops, participants discussed how they cope with each extreme weather event and what help they need from the City to stay safe. Online participants were able to choose between a list of concerns about each climate impact and asked to select the top five things that made it hard to deal with each impact.

Key themes across all extreme weather scenarios

Across all four extreme weather scenarios, **needing to stay home (indoors) or not being able to get to work or school**, were the biggest concerns for workshop participants. People were particularly concerned about the **potential loss of income and feelings of isolation and depression** (especially for older community members). In the online open house, **loss of electricity** was the top concern in all but the Wildfires and Smoke category, where the top concern was **difficulty breathing or dangerous air quality.**

Below is a summary of the highlights from the feedback received:

- **Loss of work and income was a top concern, especially for Spanish-speaking participants.** Farmworkers were specifically mentioned as bearing this burden as they may not only have to work in unsafe conditions but may also have to forgo work (and thus income to support their families) if weather conditions make it unsafe to work.
- Inclement weather can make it hard or **unsafe for employees to get to work and/or work outside**. This was especially important to Spanish-speaking participants in the Small Businesses workshop.
- **Amplified negative impacts for certain populations** (particularly in terms of financial burden, risk of death, and safety). These included: People living in poverty, people with fixed incomes, hourly wage earners (may have to miss work and not get a paycheck during severe weather situations), farmworkers, and those without shelter or housing.
- **Damage caused by flooding or storms, and the resulting repairs** is a further financial concern, especially for those with limited resources. Many people also noted that they do not know what to expect during these types of events, and **more information is needed during and in preparation for them** (i.e., creating an emergency kit, plan for evacuation or reunification, etc.)
- **Transportation to school was a key issue at the Youth workshop**. Many participants walk to school, which extreme weather conditions can make difficult or even impossible. Participants suggested **adding bus routes to pick up students who live within a mile of school during inclement weather events** (as they are not served by school buses). Alternatively, **better service from public transportation** (i.e., more frequent service, more stops, or better stop shelters) would be useful.
- Youth workshop participants were very concerned about the **wellbeing of those most vulnerable to extreme weather** and what they need to cope and survive. Participants were eager to help each other and **create community systems of support**. Several participants were interested in working with the City to implement portions of the final CAP, which could include creating systems for mutual aid and care.
- Many participants expressed concern about **increased cost of electricity during peak times during the day.** Spanish-speaking workshop participants noted that excessive heat requires more use of energy to prevent food spoilage and create a safe working environment.

What help people need from the City to adapt to a changing climate

The City asked participants what help they needed to cope with the impacts of climate change. The most common suggestions revolved around **financial assistance, information sharing**, **and improving or expanding City services.** Below is a summary of the key suggestions and requests:

Provide financial assistance

- Provide access to supplies and money needed to **cope with and prepare for extreme weather**. This included air conditioners, generators, air filters or masks.
- Help people pay **electricity bills**, business and home **repairs** (after damage), and **rent** (especially important if people are not able to go to work). Spanish-speaking workshop participants suggested creating **programs to help businesses who are forced to reduce or close due to wildfire smoke.**
- Provide **blankets and warm coats**.
- **Support for low-income people** who may not be able to make expensive repairs or prepare/recover from extreme weather events.

Improve and expand City services, ordinances, and infrastructure:

- Quickly **restore services** during and after weather events (i.e., clearing roads, restoring power, etc.).
- Help accessing **alternative power sources,** such as generator, during power outages. This was especially important to Spanish-speaking participants in the Small Businesses workshop.
- **Change City zoning ordinances** to limit development in flood plains.
- Provide a **safe place to go** during extreme weather (especially important for people who can't afford or do not have heating and cooling).
- Provide **places to charge phones and devices** during a power outage.
- Provide **extra transit and school bus routes** when it is too dangerous to walk outside.
- Plant more **trees** to provide shade and mitigate climate change.
- Create **regulations that protect employees and distribute information** about how to access safety equipment (such as masks).

Provide more information:

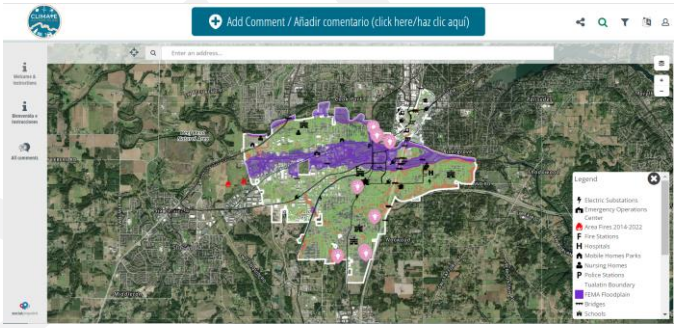
- **Opportunities to learn** about how to prepare an emergency kit, create an evacuation plan, prepare your home or business for disasters, what to do during an emergency, etc.
- How to **landscape with drought resistant** plants to reduce water use.
- Which **energy-saving improvements** (installing solar, heat pumps, pervious pavement/etc.) should people do first and how.
- **Stormwater management** for your home, business, and neighborhood.
- How to **reduce natural gas use** in a business.

- Information about **how business owners can protect their employees** during extreme weather events, which was especially important to Spanish-speaking workshop participants.

Create and leverage communication channels:

- Need for **emergency communications** so that people can help each other during emergencies, know where to go to access (i.e., food, water, etc.), and get updates.
- **Youth participants suggested using school communications,** Instagram and Facebook, signs in stores, mail, text flash alerts to communicate with them and the community.
- **Spanish business owners mentioned that radio is a useful tool for their community** as they often have the radio playing in the background.
- **Religious institutions or other community leaders** were suggested by Spanish-speakers as a good way to distribute information. Finding a trusted leader to share information with the Latino/a community is especially important as some community members may mistrust the government.

Additional feedback



In the online open house, participants had the opportunity to participate in an **interactive map.** Top comments revolved around a development in the southern Tualatin, where people were **concerned about trees being cut down.** Related, people suggested that the City create **clearer permitting and rules around how people remove and plant trees**. There were also location suggestions of where to place **water filling stations, ebike charging stations, and shade structures** (mostly near Tualatin Community Park).

Participants noted that many solutions to extreme weather (e.g., using AC, needing more electricity to control the temperature indoors, driving instead of walking because of heat/ice, buying more items to protect from weather), also contribute to climate change. Participants also suggested that City staff coordinate with other nearby cities and entities.

Spanish-speaking participants expressed **interest in learning about the root causes of climate change** and suggested a workshop focused on the topic. This was similar to a suggestion made by Youth workshop participants, who were interested in sharing information about climate change with their parents and guardians.

Who we heard from

Online Open House: Of the 74% of all respondents to the open house who shared their demographic data, the majority identified as white. The second largest racial or ethnic identity selected was Latino/a

or Hispanic (12%). About half of participants were between the ages of 25 to 64 and just over a third of all participants indicated that they were 65 years of age or older. About a third of participants had a household income between $40,000 to $99,999, a little over a quarter had a household income of $100,000 or above, and 20% indicated an income of less than $40,000. Most participants (38%) hold a postgraduate degree, 26% have a 2-year degree, and another 26% have a 4-year college degree.

Workshops: Of the 44 total workshop participants, 21 were 18 years old or younger and approximately nine (9) were either bilingual in Spanish and English, or predominately spoke Spanish.

What's Next?

The City of Tualatin will use the information gathered during this phase of outreach to inform the development of the draft Climate Action Plan, which will be shared with the public in a second online open house in Spring 2023.