CLIMATE ACTION PLAN

PROPOSED DRAFT

PLANNING AND SUSTAINABILITY COMMISSION

JUNE 9, 2015

Photo: Connecting Communities. TriMet

2015 LOCAL STRATEGIES TO ADDRESS CLIMATE CHANGE

CITY OF PORTLAND OREGON 1851

Multnomah County

2050 VISION FOR PORTLAND AND MULTNOMAH COUNTY

PROSPEROUS

- Portland and Multnomah County are the heart of a vibrant region with a thriving economy.
- Green living-wage jobs are a key component throughout the regional economy.
- Households and businesses save money and resources by favoring energy-saving appliances and durable, repairable goods, and routinely share and rent vehicles and other goods.

CONNECTED

- Access to active transportation options has never been better, including frequent service transit to the city's many employment centers.
- Pedestrians, bicyclists and transit are prominent throughout Portland's vibrant community centers, bustling corridors and diverse neighborhoods.
- Vehicles are highly efficient and run on low-carbon electricity and renewable fuels.

The intertwined challenges of climate change, social inequity, economic volatility, degraded natural systems and the rising cost of living demand an integrated response that goes far beyond cutting carbon.

An 80 percent reduction of local carbon emissions by 2050 requires reimagining our community.

It means transitioning away from fossil fuels while strengthening the local economy and shifting fundamental patterns of urban development, transportation, buildings and consumption.

HEALTHY AND RESILIENT

- Homes and business buildings are affordable, healthy, comfortable, durable and highly efficient.
- The urban forest canopy, natural areas, biodiversity and habitat corridors and green roofs can be found throughout the community.
- Backyard gardens, farmers markets and other community-based food programs are plentiful, productive and thriving.
- The region's buildings, infrastructure, and natural and human systems are prepared to recover quickly from the impacts of a changed climate such as flooding, landslides and heat waves.

EQUITABLE

- Every resident, regardless of socio-economic status, has easy access to a walkable and bikeable neighborhood that includes retail, schools, parks, jobs and affordable housing.
- There are plentiful employment and small business opportunities led by and employing under-served and under-represented communities.
- Communities of color and low-income populations are involved in the development and implementation of climate-related programs, policies and actions.

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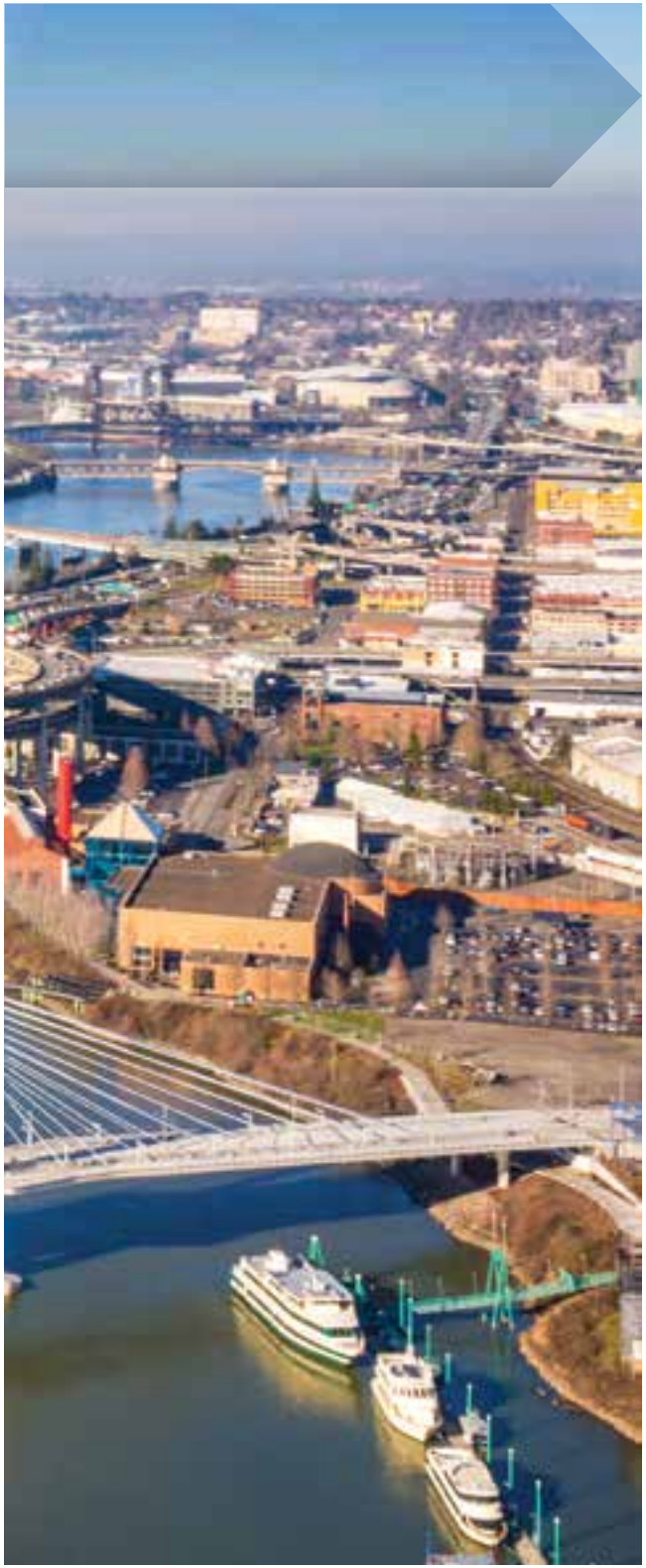
Photo: Tilikum Crossing, Bridge of the People. TriMet



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The City of Portland and Multnomah County wish to thank the following community members, organizations and staff for their contributions in developing this *Climate Action Plan*.

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The City and County are grateful to the external advisors for their guidance in preparing this plan. Acknowledging their contributions is not intended to represent their endorsement of this document, and the City and County alone bear the responsibility for the findings and actions contained in this report.

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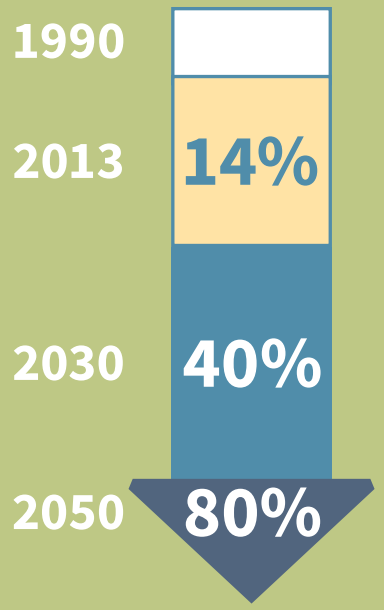
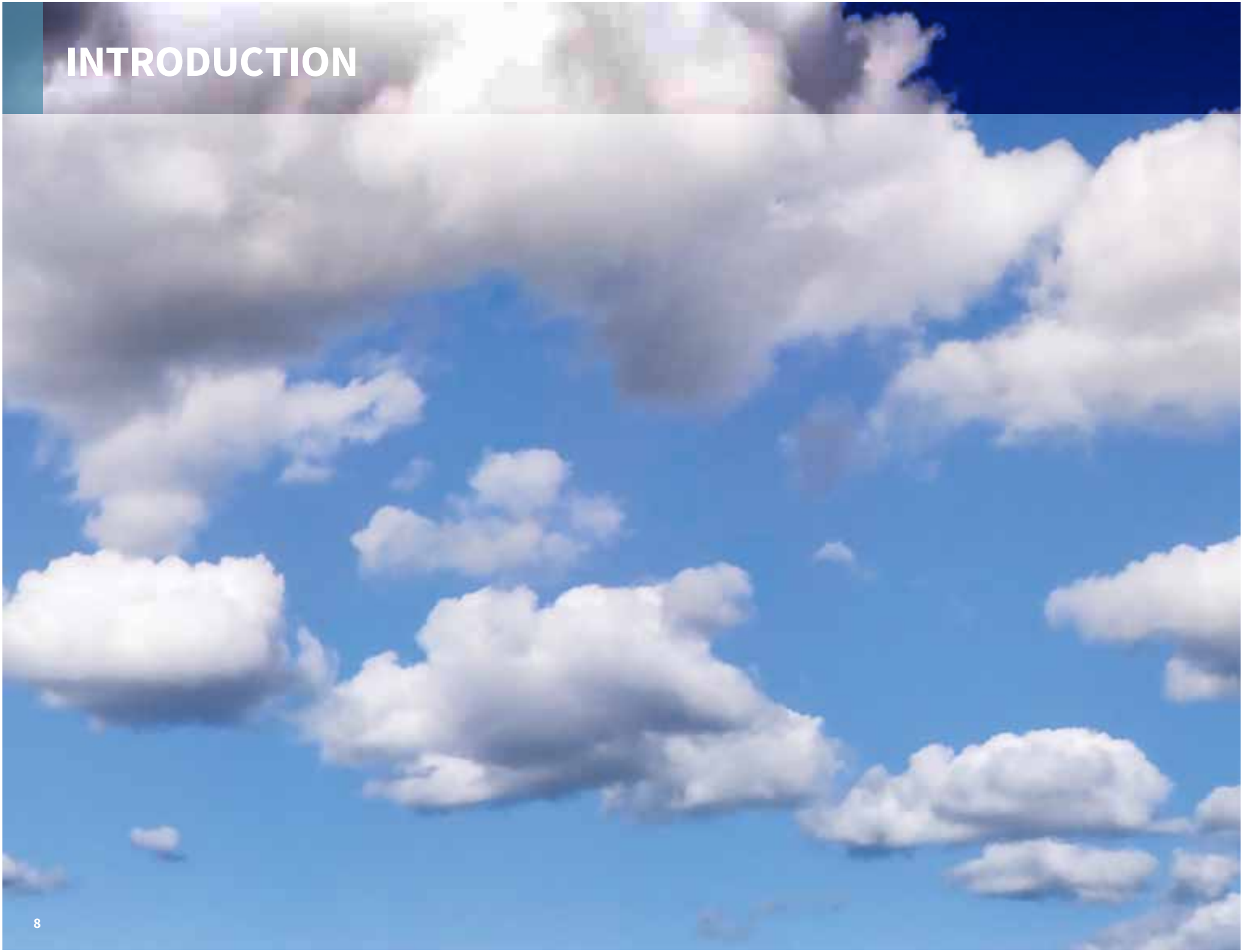


Through the adoption of the 2009 Climate Action Plan, *the City and County established a goal of* ***reducing local carbon emissions 80 percent from 1990 levels by 2050, with an interim goal of 40 percent by 2030.***

This updated Climate Action Plan *maintains these goals and provides new guidance* ***for the next five years*** *of the City and County's transition to a more prosperous, equitable and climate-stable future.*

Multnomah County

INTRODUCTION



CLIMATE CHANGE IS A SERIOUS THREAT, AND WE KNOW WHAT WE NEED TO DO

Climate change is the greatest environmental challenge of the 21st century. It poses a serious threat not just to Oregon's natural treasures — forests, mountain snows and rivers — but also to our jobs and our health.

But climate change also presents huge opportunities. Vast amounts of money will be saved and made during the transition to a low-carbon community. Portland and Multnomah County are global leaders in that transition, and we have an unparalleled opportunity to make the switch in ways that create jobs and benefit all residents.

Scientists expect that, should we fail to curb climate change, Oregonians may see more intense heat waves, droughts, rainstorms, floods, wildfires and landslides in the future. These impacts could drag down our economy, stress our natural resources and worsen inequities facing many Oregonians.

Action is required at all levels, and local governments have a unique role to play in building low-carbon communities. The good news is that the City of Portland and Multnomah County have a plan for action.

WE'RE ON OUR WAY

We've already reduced carbon emissions by 14 percent since 1990, while our population has increased 30 percent and we have 20 percent more jobs (see Figure 3, page 18). We have established a strong foundation for continuing to reduce emissions that also benefits our economic, social and cultural lives.

We can do this together. Each person, each business, each government agency has a part to play.

REDUCING CARBON EMISSIONS IS GOOD BUSINESS

Want to make our businesses more efficient and competitive and save residents money?

Reduce carbon emissions

As Portland shifts away from fossil fuels, we'll create new jobs in energy management, renewable energy and low-carbon products and services.

- **When residents weatherize their homes, it not only creates jobs for construction workers and skilled labor but also cuts utility bills.**
- **When businesses increase energy efficiency, they reduce operating costs and employ electricians, engineers, builders and plumbers.**
- **When the City and County promote training and equitable hiring and contracting policies that create opportunities for under-represented populations, it helps ensure that the economic benefits of climate action are shared by all.**

Portland businesses are already exporting the products and services they develop to respond to climate change — from highly efficient building improvements to stormwater management — to other places. As the world moves to a low-carbon economy and invests in climate-ready communities, Portland businesses will reap the rewards of their leadership.

> ***Clean technology — including green building design and construction, and clean energy like solar and wind power — provides more than 12,000 jobs in Multnomah County.***

WHEN WE PROTECT THE CLIMATE, WE WIN

When we do great work to protect our climate, good things happen. Local businesses innovate and create jobs. Residents and businesses save money they can spend locally. Our community gets healthier and our neighborhoods are more vibrant.

When Portland reduces the energy we need to power our homes and businesses, invests in renewable energy, makes smart decisions about urban development and transportation and considers climate change risks in decision-making, we see:

- Better air quality and improved human health.
- New jobs and greater reinvestment in the local economy.
- Lower energy bills.
- Shorter commute times between home, work and school and more opportunities for people to walk, bike or take public transit.
- Less damage to social and environmental systems due to drought, floods and fire and fewer disruptions in services.

EVERYONE MUST BENEFIT FROM CLIMATE ACTION

Climate change affects everyone. Our work to reduce climate change should, too.

Portland's work to protect our climate has already delivered community benefits. However, we have not shared equitably in those economic and health benefits. In particular, many communities of color and low-income people have been left out.

The City and County are committed to leveling this playing field. We're working to:

- Increase access to transit, sidewalks, bike lanes and other transportation options.
- Reduce pollution exposure.
- Improve access to parks and other natural resources.
- Reduce burdens of housing and energy costs.

Climate actions can help by:

- Promoting investments in energy-efficient homes that are safer, more comfortable and affordable.
- Investing in infrastructure that enhances pedestrian and bike safety, especially in East Portland.
- Improving accessibility and expanding transportation options, while addressing the pressures that lead to gentrification.

Money-saving opportunities will emerge and economic growth will occur during the transition to a low-carbon economy. These economic opportunities will either exacerbate existing disparities or help bring prosperity to more people. Policies and implementation approaches must be prioritized that help share the opportunities and benefits of climate action equitably.

WE MUST DO IT TOGETHER

Climate change cannot be solved by the government in isolation. Businesses, residents, institutions and non-profit organizations all have essential roles to play. Government (local, state and federal) can jump-start change through policy-making and market incentives. It can also lead by example; support the work of others through education, outreach and technical assistance; and engage communities of color and other under-served populations.

Businesses and residents ultimately determine our success. Across the community, small daily choices and behaviors, such as whether to take the bus or drive, add up. When you insulate a house, upgrade the lighting system in a commercial building or buy a fuel-efficient vehicle, these individual decisions add up to meaningful reductions in carbon emissions.

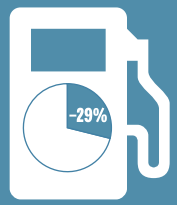
Portland is partnering with the world's greatest cities to inform and shift the global conversation on climate change. Through organizations and initiatives like the C40 Cities Climate Leadership Group, the Urban Sustainability Directors Network, the Pacific Coast Collaborative, CDP (formerly Carbon Disclosure Project) and the Carbon Neutral Cities Alliance, Portland is regularly sharing best practices, challenges and successes.

The actions taken collectively by these cities, as well as those that follow them, will add up to measurable reductions in global carbon emissions and demonstrate that preventing catastrophic climate change is possible.

WE'VE PROVEN THAT WE CAN DO THIS

Portland homes use 11 percent less energy per person today than in 1990, and each year Multnomah County reduces the energy cost burden of 10,000 low-income households.

Portland now has over 390 ecoroofs covering nearly 20 acres of rooftop, managing millions of gallons of stormwater each year.



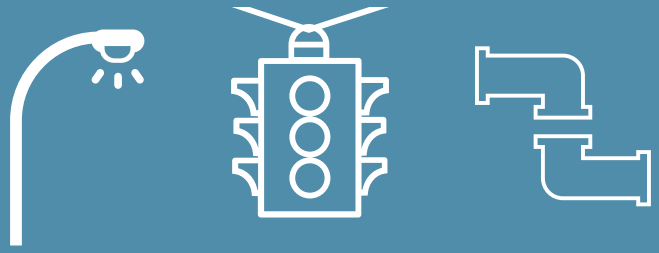
Portlanders use 29 percent fewer gallons of gasoline per person today than in 1990.

Portland is a national leader in recycling with a 70 percent overall recycling rate for residential and commercial waste.

Over three million new trees and shrubs have been planted in Portland's natural areas since 1996 through the City's revegetation work.

BE CART SMART

Since 2011, residential garbage taken to the landfill from Portland has decreased by over 35 percent.

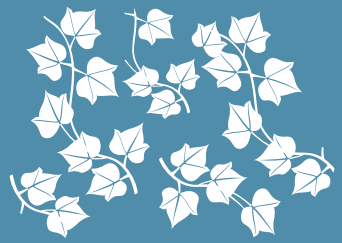


Through improvements to the efficiency of City and County operations, including traffic lights, water and sewer pumps and building lighting systems, energy savings total over $6 million a year, approximately 25 percent of the City and County's energy bill.

Solar energy systems in Portland increased from a dozen in 2003 to nearly 3,000 today.

Since 1990, the Portland region has added and expanded four major light rail lines and the Portland Streetcar, as well as over 260 miles of bikeways.

About six percent of Portlanders bike to work, nine times the national average, with over 12,000 more people bike commuting today compared to 1990.



The City has treated and managed invasive plants on over 7,400 acres of public parks, roadsides and private property (since 2008).

Transit ridership has almost doubled over the past 20 years, and TriMet provided 100 million rides in 2013.

Multnomah County is home to more than 250 green building projects.

Collection of compostable materials has more than doubled through the curbside collection program.

BACKGROUND

OREGON'S CLIMATE IS CHANGING

In the Pacific Northwest, these changes threaten agriculture and water sources, power supplies, public safety and health, forests and local economies, all of which have substantial impacts on the quality of residents' lives. Regional temperature, snowpack, snowmelt timing and river flow changes have been observed that are consistent with projected trends (Dalton et al., 2013).

Over the past 30 years, average temperatures in the Pacific Northwest have generally exceeded the 20th-century average, and the region has seen an increase in temperature of about 1.3 °F (Dalton et al., 2013). The number of extreme high nighttime minimum temperatures has increased in the Northwest over the last century as well.

Over the past 50 years, increases in winter temperature have contributed to the decline in snowpacks in the Pacific Northwest, including in the Clackamas River basin (OCAR, 2010). Glaciers have diminished, a trend expected to continue through the next 100 years. In particular, Mount Hood's glaciers have decreased in length as much as 61 percent over the past century (OCAR, 2010).

> *Climate change presents an unparalleled challenge. The world's leading scientists report that carbon emissions from human activities have begun to destabilize the Earth's climate. Human influences on climate, already apparent at the global and continental scales, are altering the social, environmental and economic systems we rely upon (IPCC, 2013).*

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THESE CHANGES COME AT A COST

Warmer temperatures and more extreme heat events are expected to increase the incidence of heat-related illnesses (e.g., heat rash, heat stroke) and deaths. A recent study projected up to 266 additional deaths in the greater Seattle area among persons 65 and older in 2085 compared to 1980–2006 (Dalton et al., 2013). In Oregon, the hottest days in the 2000s resulted in about three times the rate of heat-related illness compared with days 10 °F cooler (Dalton et al., 2013).

> *The physical impacts of a changing climate are matched by social challenges. In particular, low-income households face disproportionate impacts of climate change — exposure to heat stress in homes without air conditioning, for example — while having fewer resources to respond to these changes. Rising energy prices compound the situation and have the potential to exacerbate existing social disparities.*

Climate change will also affect natural systems and watersheds across the Portland region. Changes in precipitation patterns affect streamflow, groundwater recharge and flooding, and may increase risks of wildfire, drought, and invasive plant and animal species. Increasing surface water temperatures affect resident and migratory fish and wildlife species and their habitats, threatening their long-term survival.

Climate change will also have complex and profound impacts on Native American communities in the Portland metropolitan region, many of which have deep historical and current ties to the land's resources. For example, treaty-protected fish species may become threatened or less accessible to tribes due to impacts on water quantity and quality that affect salmon and other fisheries (Dalton et al., 2013).

CARBON EMISSIONS ARE THE BIGGEST DRIVER

Carbon emissions from the burning of fossil fuels and land use changes, including deforestation, are the primary causes of climate change. The Intergovernmental Panel on Climate Change's most recent report documents the overwhelming evidence that human activities have been the major driver of recent warming of the Earth's surface, and that climate change and its consequences will continue into the future (IPCC, 2013).

The magnitude of future climate impacts depends largely on the trajectory of future global carbon emissions. However, since 15 to 40 percent of carbon emissions will take more than 1,000 years to be removed from the atmosphere by natural processes, even dramatic near-term reductions will not eliminate climate impacts (IPCC, 2013). The legacy of past practices will continue to cause changes in climate patterns. Future emissions are one of the most important and most difficult-to-predict factors in climate models.

Portland and Multnomah County have been tracking and taking action to significantly reduce local carbon emissions for more than 20 years.

- Local emissions have dropped significantly since peaking in 2000, well ahead of the national trend (see Figure 1).
- Total local carbon emissions in 2013 were more than 14 percent below 1990 levels despite a 31 percent increase in population during that same period (see Figure 3).
- On a per-person basis, carbon emissions have fallen by 35 percent below 1990 levels (see Table 3).
- Over the same period, the number of jobs in Multnomah County grew by 20 percent (see Figure 3).

> *These trends clearly indicate that carbon emission reductions can accompany increasing population and economic growth. Equally important, over this same period Portland and Multnomah County have continued to attract national attention for a high quality of life.*

With total local carbon emissions 14 percent below 1990 levels, Portland and Multnomah County have made notable progress. These local achievements, however, underscore the magnitude of the challenge ahead.

Even in Portland and Multnomah County, where climate-friendly planning, policies and programs have prevailed over the past 20 years, emission reductions will need to accelerate substantially to achieve the goal of an 80 percent reduction by 2050.

Healthy trees, other vegetation and open spaces are also key to achieving local climate change goals by helping to sequester and store carbon.

Moreover, success in reducing emissions must be accompanied by adding jobs and reducing disparities experienced by low-income populations and communities of color.

WE MUST CUT EMISSIONS

Carbon emissions from human activities have continued to rise in recent decades, reaching the highest rates in human history between 2000 and 2010 (IPCC, 2014b). About half of all carbon dioxide emissions between 1750 and 2010 occurred in the last 40 years. The energy, industry and transportation sectors have dominated these emissions increases. On the current trajectory global transportation emissions will double by 2050.

While the challenge of climate change is more urgent than ever, our region's response is not new. For more than 20 years Portland has sought to reduce carbon emissions, starting with the City of Portland's 1993 Carbon Dioxide Reduction Strategy and followed eight years later by the joint 2001 Multnomah County-City of Portland Local Action Plan on Global Warming, and then the 2009 *Climate Action Plan*.

> *These plans supported ambitious carbon-reduction efforts, like public transit expansions and green building policies, which promise to benefit the region's long-term economic, social and environmental prosperity.*

Through the adoption of the 2009 *Climate Action Plan,* the City and County established a goal of reducing local carbon emissions 80 percent from 1990 levels by 2050, with an interim goal of 40 percent by 2030. This updated *Climate Action Plan* maintains these goals and provides new guidance for the City and County's transition to a more prosperous, sustainable and climate-stable future.

This plan also builds on other related City and County plans, including the Climate Change Preparation Strategy and associated Risk and Vulnerabilities Assessment (see page 140 for more details).

SUCCESS REQUIRES PARTNERSHIPS

Cities are a primary cause of global carbon emissions. With the concentration of the world's population living in cities expected to increase, cities present an essential opportunity to reduce emissions. At the same time, reducing carbon emissions is a global challenge that local governments cannot solve alone.

> *The broad-scale coordination and planning needed to achieve an 80 percent reduction in local carbon emissions will require that governments, businesses, nonprofits, community organizations, academia and residents collaborate extensively and take the lead in their own activities.*

Federal and state action

At the national level, the federal government must shift its energy policies away from fossil fuels and align its vast research and development resources with climate protection.

The State of Oregon has an invaluable role to play in transportation investments, strengthening building codes, regulating utilities, managing forest lands, reducing waste and guiding local land use policies. Oregon has established a statewide goal to reduce carbon emissions to 10 percent below 1990 levels by 2020 and 75 percent by 2050. To pursue these goals, in 2010 the Oregon Global Warming Commission adopted the *Interim Roadmap to 2020* identifying key strategies for the state to act upon.

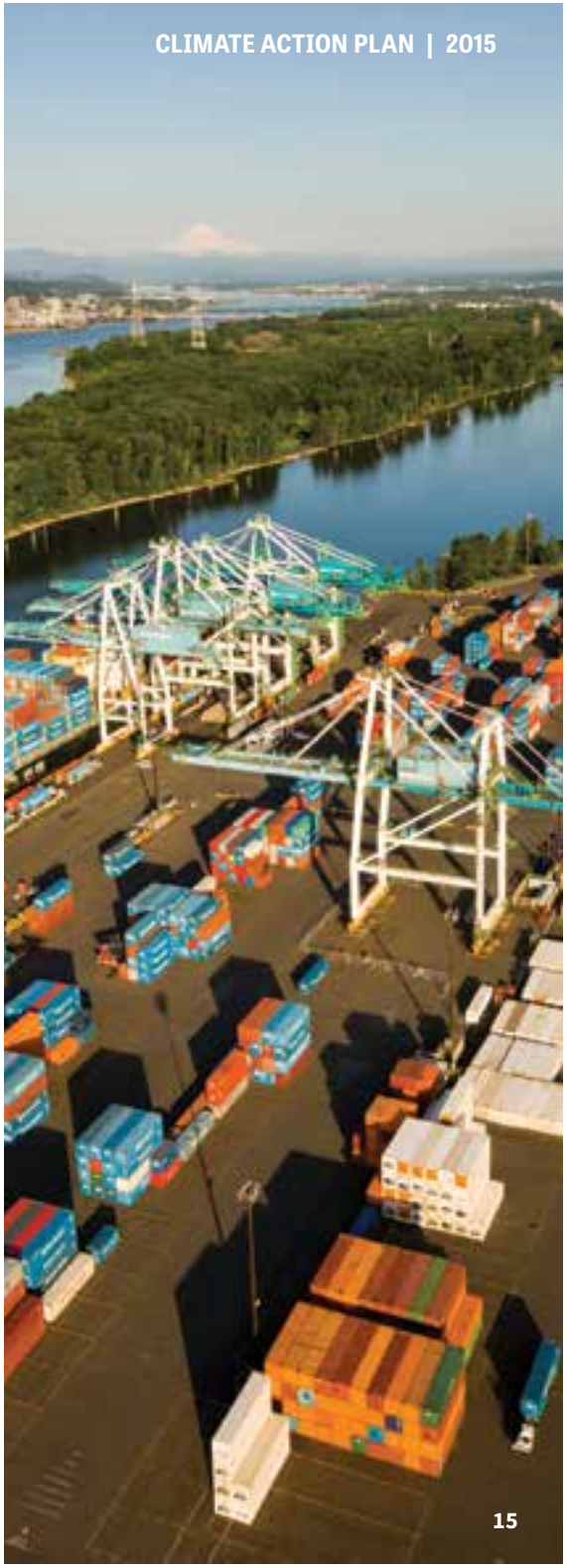
The current state strategy continues to prioritize policies, programs and investments to accelerate the transition to clean energy. This *Climate Action Plan* will be integrated closely with state policies and programs.

Regional and local action

Local governments have an indispensable role to play as well in developing the fundamental shape of the community, transportation systems and buildings, and in helping individuals and businesses make informed choices about everyday decisions.

- In 2014 Metro completed its Climate Smart Communities project, which analyzed options to achieve transportation-related carbon emission goals.
- TriMet, the regional transit provider, continues to play a critical role in achieving local climate goals by providing essential public transportation service and infrastructure, including increasing service on key bus lines in 2014 and completing the Milwaukie Light Rail project in 2015.

Guided by this *Climate Action Plan,* Portland and Multnomah County governments will work closely with other regional and local governments to carry out policies and programs to minimize household, business and government emissions, protect and improve the urban forest and natural areas and prepare for the environmental, economic and social challenges from a changing climate.



LOCAL CARBON EMISSION TRENDS AND GOALS

Local emissions have declined well ahead of the national trend

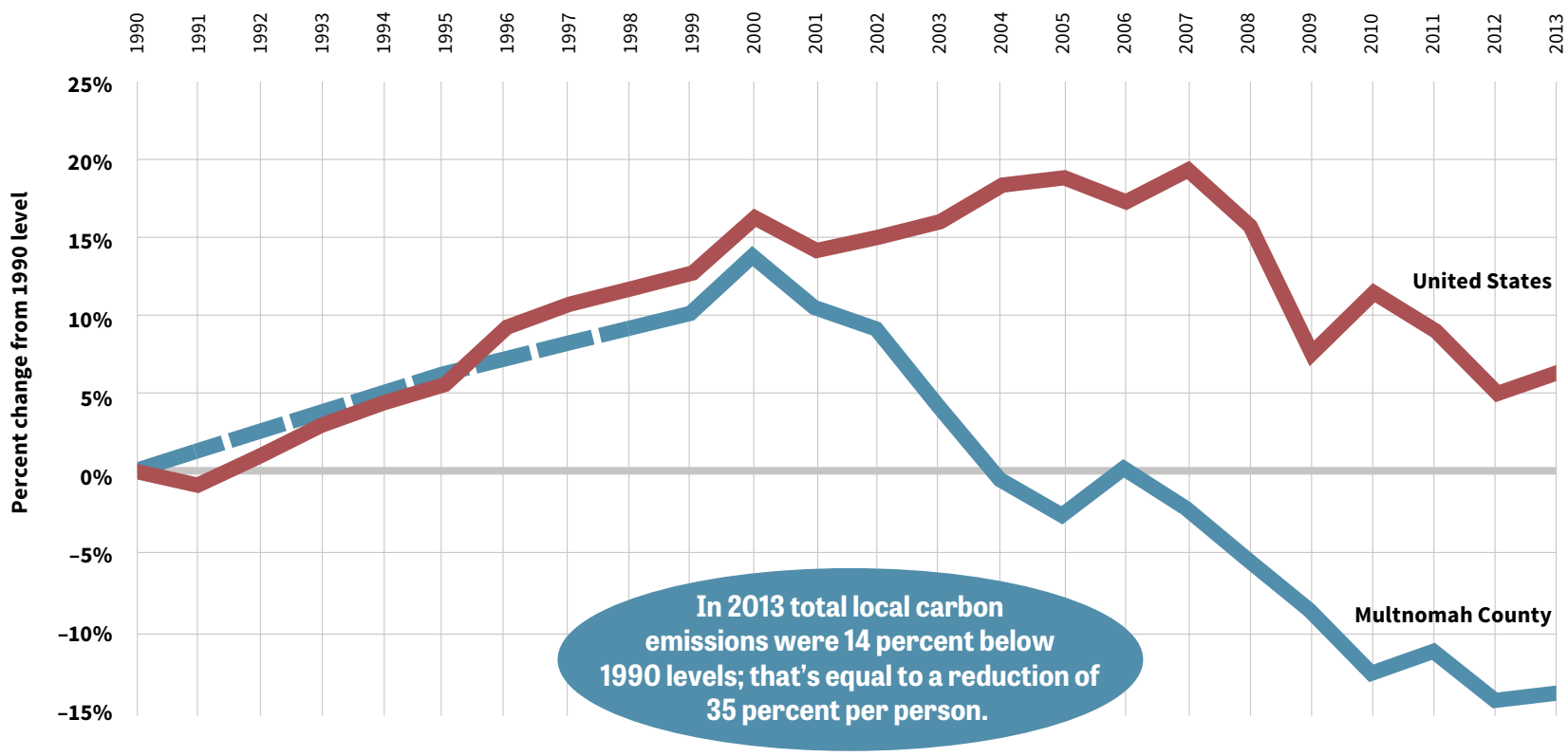


Figure 1. Communitywide carbon emissions (1990–2013). *Source: Portland Bureau of Planning and Sustainability*

Since 2000, when local emissions hit their highest levels, Multnomah County's emissions have declined. Among other factors, these reductions are due to a combination of:

(1) Improved efficiency in buildings, appliances and vehicles,
(2) A shift to lower-carbon energy sources,
(3) More walking, biking and transit, and
(4) Reduced methane emissions from landfills and more recycling.

We still have work to do

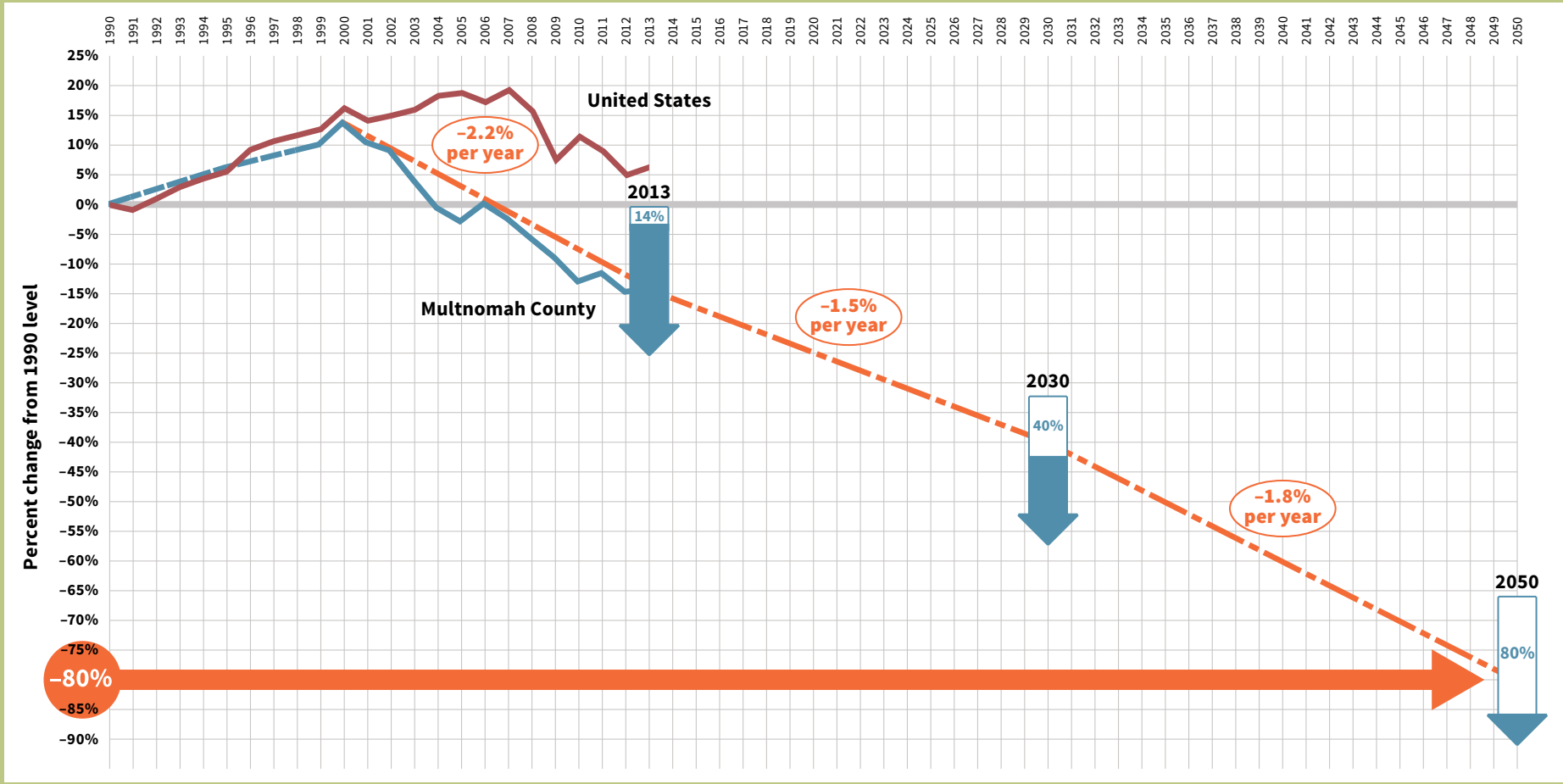


Figure 2. Carbon emission trend and reduction goals. *Source: Portland Bureau of Planning and Sustainability*

Portland and Multnomah County have committed to reducing local carbon emissions by 80 percent below 1990 levels by 2050, with an interim goal of a 40 percent reduction by 2030.

Population and jobs up, carbon emissions down

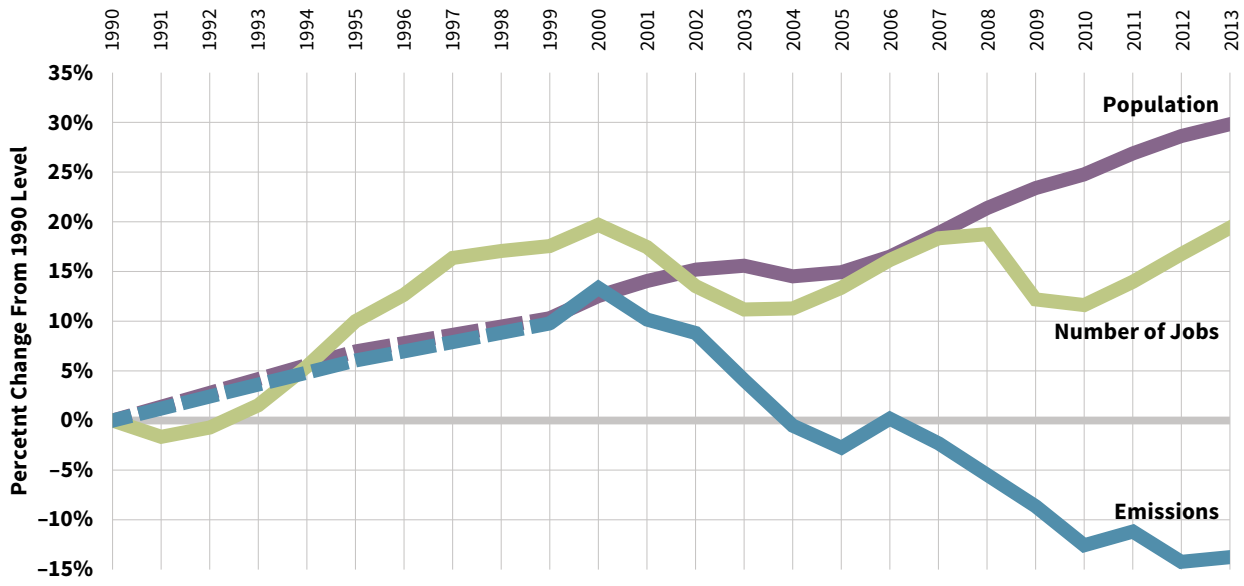


Figure 3. Change in Multnomah County carbon emissions compared to growth in population and jobs (1990–2013). *Source: Portland Bureau of Planning and Sustainability*

Total local carbon emissions in 2013 were 14 percent below 1990 levels, despite a 31 percent increase in population and a 20 percent growth in jobs during the same period.

2050 CARBON BUDGET

Carbon emissions in Portland and Multnomah County primarily result from:

- Energy used in buildings and industry.
- Fuels used in transporting people and goods.
- Methane from the landfills that accept waste from residents and businesses.

The following tables and graphs show carbon emissions from those sectors, as well as the related energy use and miles driven in Multnomah County in 1990 and 2012. The 2030 columns depict a scenario that puts Portland and Multnomah County on a track to meet the 2050 emissions reduction goal. The 2050 columns represents a scenario that achieves the 80 percent carbon-reduction goal.

For example, by 2030 emissions from the building energy and transportation sector must be approximately 40 percent below 1990 levels (see Table 1). In 2050, residents must be able to meet all of their needs while using 62 percent less electricity and driving 59 percent fewer miles than they do today (see Table 2). (This also assumes a shift to cleaner electricity sources and more efficient vehicles.)

Any number of scenarios could hypothetically achieve the 2050 goals; the one described here reflects the City and County's best judgment of a probable and achievable scenario. (Key assumptions are described in Appendix 5: Carbon budget assumptions.)

Drive less and use less electricity to help meet Portland's goal

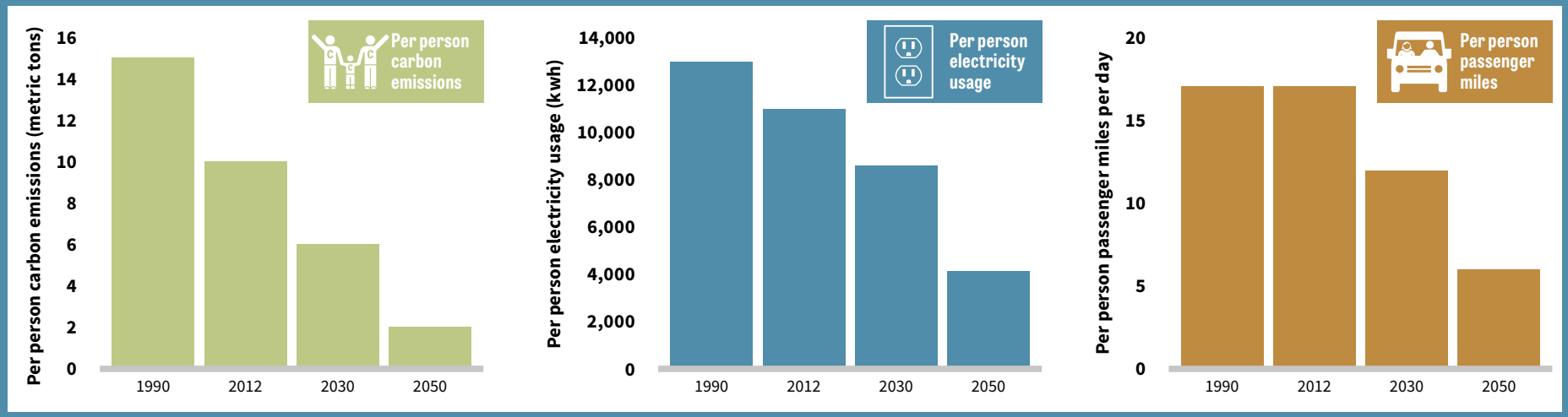


Figure 4. Per person carbon emissions, electricity use and passenger miles in 2030 and 2050. *Source: Portland Bureau of Planning and Sustainability*

To achieve the needed per person carbon emission goals, by 2050 residents must meet all of their needs while using 62 percent less electricity than they do today and driving 59 percent fewer miles per day.

2050 CARBON BUDGET

All sectors must reduce emissions to reach future goals

	1990	2012	Percent Change from 1990	2030	Percent Change from 1990	2050	Percent Change from 1990
Building energy	5,512,000	4,772,000	–13%	3,707,000	–33%	1,112,000	–80%
Transportation	2,979,000	2,830,000	–5%	1,661,000	–44%	655,000	–78%
Waste disposal	498,000	93,000	–81%	40,000	–92%	10,000	–98%
Total	**8,989,460**	**7,695,000**	**–14.4%**	**5,408,000**	**–40%**	**1,777,000**	**–80%**

Table 1. Composition of Multnomah County carbon emissions (in metric tons CO_2e). *Source: Portland Bureau of Planning and Sustainability*

Emissions from the building energy, transportation and waste disposal sectors have declined since 1990. Much more significant reductions are required, however, to achieve the 2030 and 2050 carbon emission goals of this *Climate Action Plan*.

Every person must help by using less energy and driving fewer miles

	1990	2012	Percent Change from 1990	2030	Percent Change from 2012	2050	Percent Change from 2012
Population	584,000	766,000	31%	923,000	20%	1,148,000	50%
Per person carbon emissions (metric tons)	15	10	–35%	6	–42%	2	–85%
Natural gas (therms per person)	390	350	–10%	300	–14%	140	–61%
Electricity (kWh per person)	13,000	11,000	–15%	8,630	–20%	4,130	–62%
Passenger miles per day per person	17	17	–1%	12	–29%	6	–64%

Table 2. Budget for a low-carbon future. *Source: Portland Bureau of Planning and Sustainability*

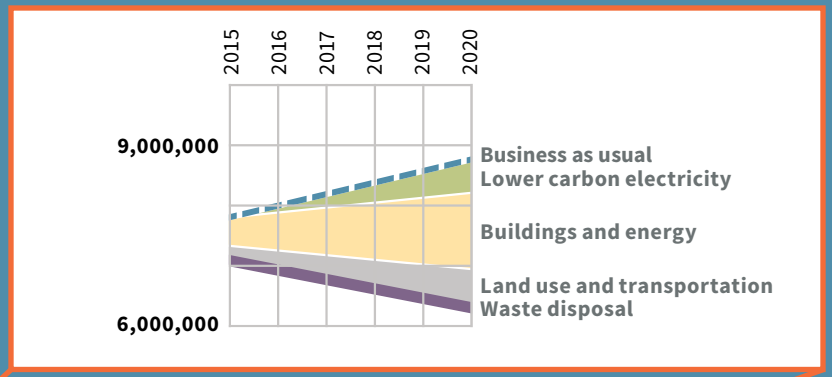
Although population has increased by 31 percent, per person and total carbon emissions from energy use and transportation fuels have decreased since 1990.

> ***Emission reduction targets incorporate assumptions about population growth, technological improvements such as vehicle efficiency and actions by governments other than the City of Portland and Multnomah County discussed further in Appendix 3. Given these assumptions, Table 2 shows key energy and vehicle use characteristics for a scenario that achieves the 2030 and 2050 goals.***

EMISSION REDUCTIONS NEEDED TO REACH 2050 GOAL

Implementing the actions and achieving the 2030 objectives outlined in this *Climate Action Plan* must result in significant progress toward the goal of an 80 percent reduction in emissions by 2050. Where possible, the reductions have been quantified, but for many actions it is difficult to estimate the expected impacts. Quantitative measures are generally available in the categories of (1) buildings and energy and (2) land use and transportation. Figure 5 shows the scale of expected emission reductions from these categories from a sector-based inventory perspective.

2015 Climate Action Plan identifies actions through 2020



Saving energy in residential and commercial buildings is key to meeting the 2050 goal

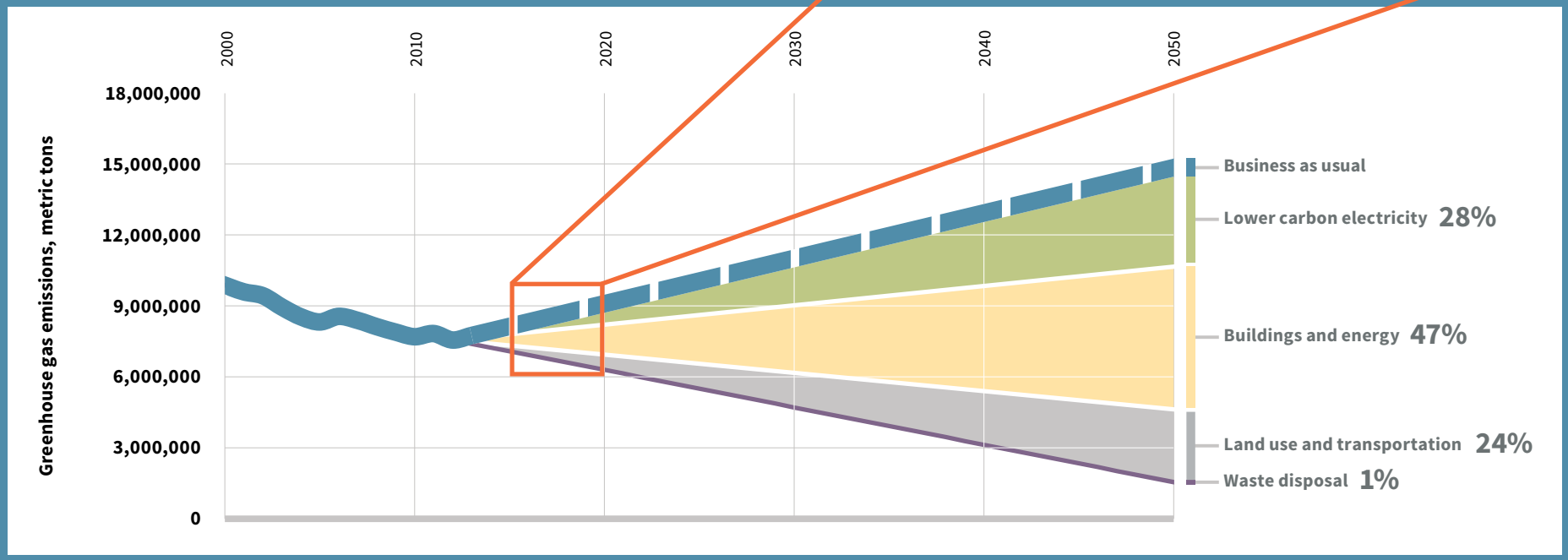


Figure 5. Emissions reductions needed to reach 2050 goal (Sector-based inventory). *Source: Portland Bureau of Planning and Sustainability*

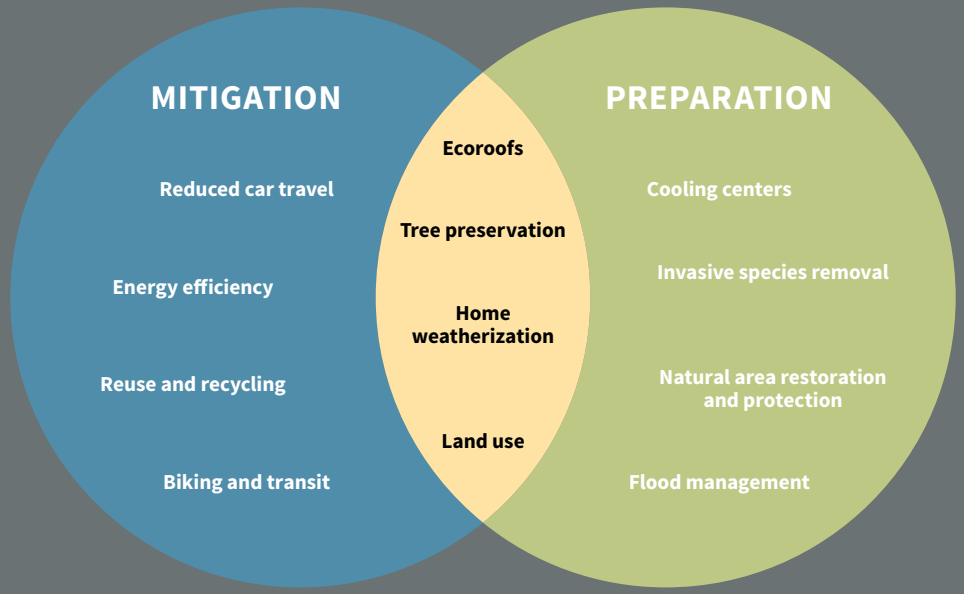
WE NEED TO PREPARE FOR IMPACTS

The potential impacts from climate change will be substantial and serious, and preparing for them requires significant change in City, County and regional policies, investments and programs. At the same time, the Portland area likely is not immediately vulnerable to some of the gravest threats affecting other communities, such as sea-level rise, tropical storms and severe drought.

Portland's future climate is expected to include warmer winters with more intense rain events and hotter, drier summers with an increased frequency of high-heat days. While addressing the primary cause of climate change — carbon emissions — remains a crucial component of the City and County's climate work, preparing for the impacts of a changing climate, especially for those most vulnerable, is also required.

This *Climate Action Plan* integrates both the work to slow the effects of climate change by reducing carbon emissions (also known as "climate mitigation") while also preparing for the impacts we will likely experience (see Figure 6). Successful climate change preparation must (1) reduce climate-related vulnerabilities for residents and businesses, and (2) respond to and recover from the impacts when they do occur.

CLIMATE ACTION MEANS ADDRESSING BOTH MITIGATION AND PREPARATION



This* Climate Action Plan *includes actions to slow the effects of climate change by reducing carbon emissions (also known as "climate mitigation") as well as actions to prepare for the impacts we will experience ("climate preparation" or "adaptation"). Some actions help to both mitigate and prepare for climate change.

Figure 6. Relationship between climate change mitigation and preparation. *Source: Portland Bureau of Planning and Sustainability*

COMPARED TO RURAL AREAS, CITIES HAVE LESS VEGETATION TO REDUCE HEAT

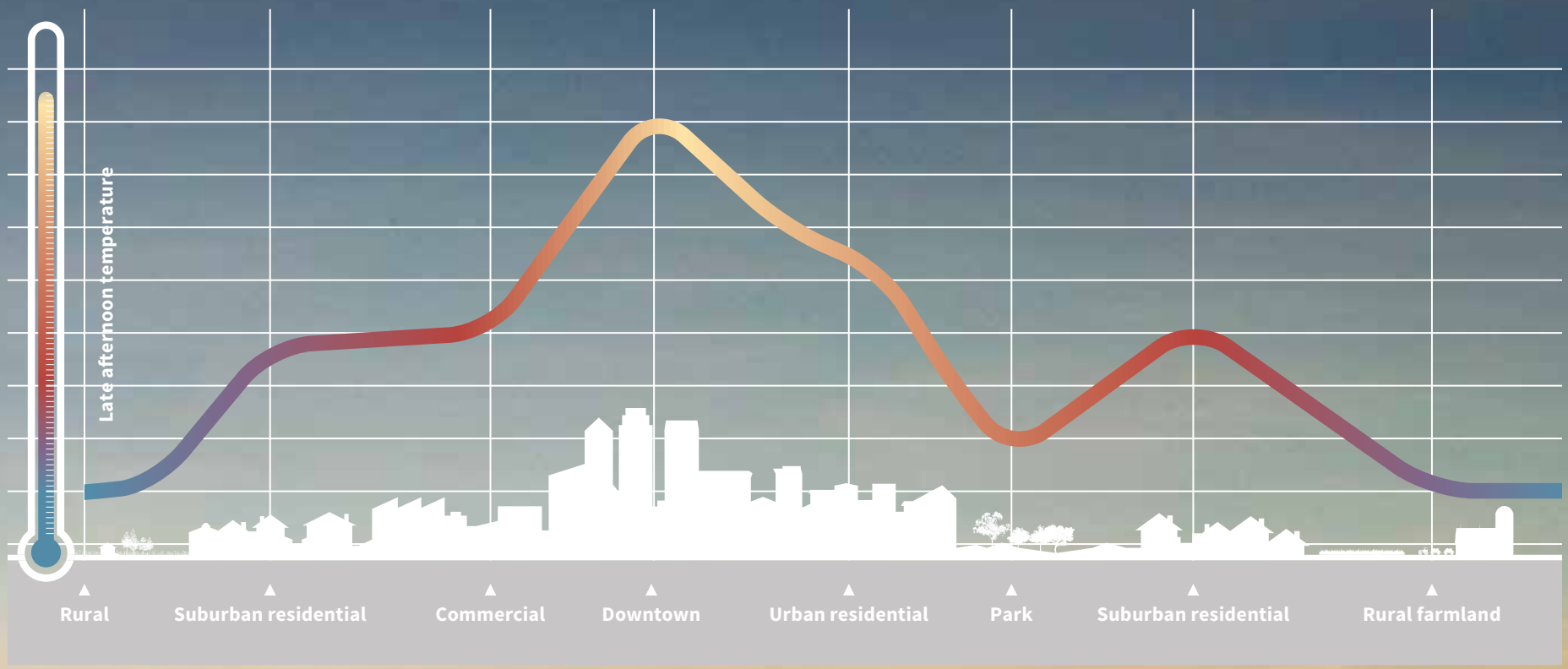


Figure 7. Urban heat island effect. *Source: Portland Bureau of Planning and Sustainability*

Increased temperatures in the summer will be magnified by the urban heat island effect, which results from the higher concentrations of buildings and paved surfaces in the urban environment that retain much of that heat and inhibit overnight cooling.

Hotter, drier summers with more high heat days

Hotter, drier summers would result in several significant impacts for the Portland area. By some measures, nighttime heat waves have increased in western Oregon over the last century, causing problems for public health (Bumbaco et al., 2013).

Higher temperatures will lead to increased surface water temperatures, reduced flows in streams and negative impacts on aquatic habitats and the fish and wildlife they support. There is also the potential to increase major forest pest damage and mortality of plant and tree species now common to the area.

Over time increased wildfires in the urban forest, natural parks and open-space areas within Portland's urban environment is also possible. They often harm air quality and human health, and damage or destroy public and private property, in addition to harming wildlife, habitat and recreation areas.

Higher temperatures also result in increased illness and death. Air pollution, such as ground-level ozone and pollen counts, exacerbates Portland's already high rates of respiratory illness and allergies. Many of the areas most impacted by Portland's urban heat island effect (see Figure 7) include downtown, along major roads and in and around industrial areas (see Figure 41, page 112). Many of these urban heat island areas occur where populations most vulnerable to heat live, including older adults living alone and people with health conditions that can be exacerbated by heat and reduced air quality such as asthma.

> *Unlike many communities in Oregon and other parts of the country, Portland is well positioned in terms of water supply.*

The Bull Run watershed supply is not dependent on snowpack, and the Columbia South Shore Well Field provides both capacity and flexibility. Based on available population and demand projections, adequate water supplies are available to Portlanders for at least the next 30 years.

Warmer winters with the potential for more intense rain events

More intense rain events in the winter may have far-reaching impacts locally. Potential economic, social and environmental impacts from flooding may include water damage to homes and businesses, as well as roads, railroad tracks, levees, bridges and culverts.

In addition, more rain falling in the winter will continue to stress Portland's systems for managing stormwater runoff and urban flooding. Wetter winters may also increase the incidence of landslides, particularly following prolonged periods of precipitation when the soil is already saturated with water. Additional costs due to emergency response, business closures, lost productivity and cleanup activities can be expected.

MULTNOMAH COUNTY'S PRIMARY CLIMATE RISKS

HOTTER, DRIER SUMMERS WITH MORE HIGH-HEAT DAYS

Risk 1: Increased temperatures (both day and night) and frequency of high-heat days

Risk 2: Increased incidence of drought

Risk 3: Increased wildfire frequency and intensity

WARMER WINTERS WITH THE POTENTIAL FOR MORE INTENSE RAIN EVENTS

Risk 4: Increased incidence and magnitude of damaging floods

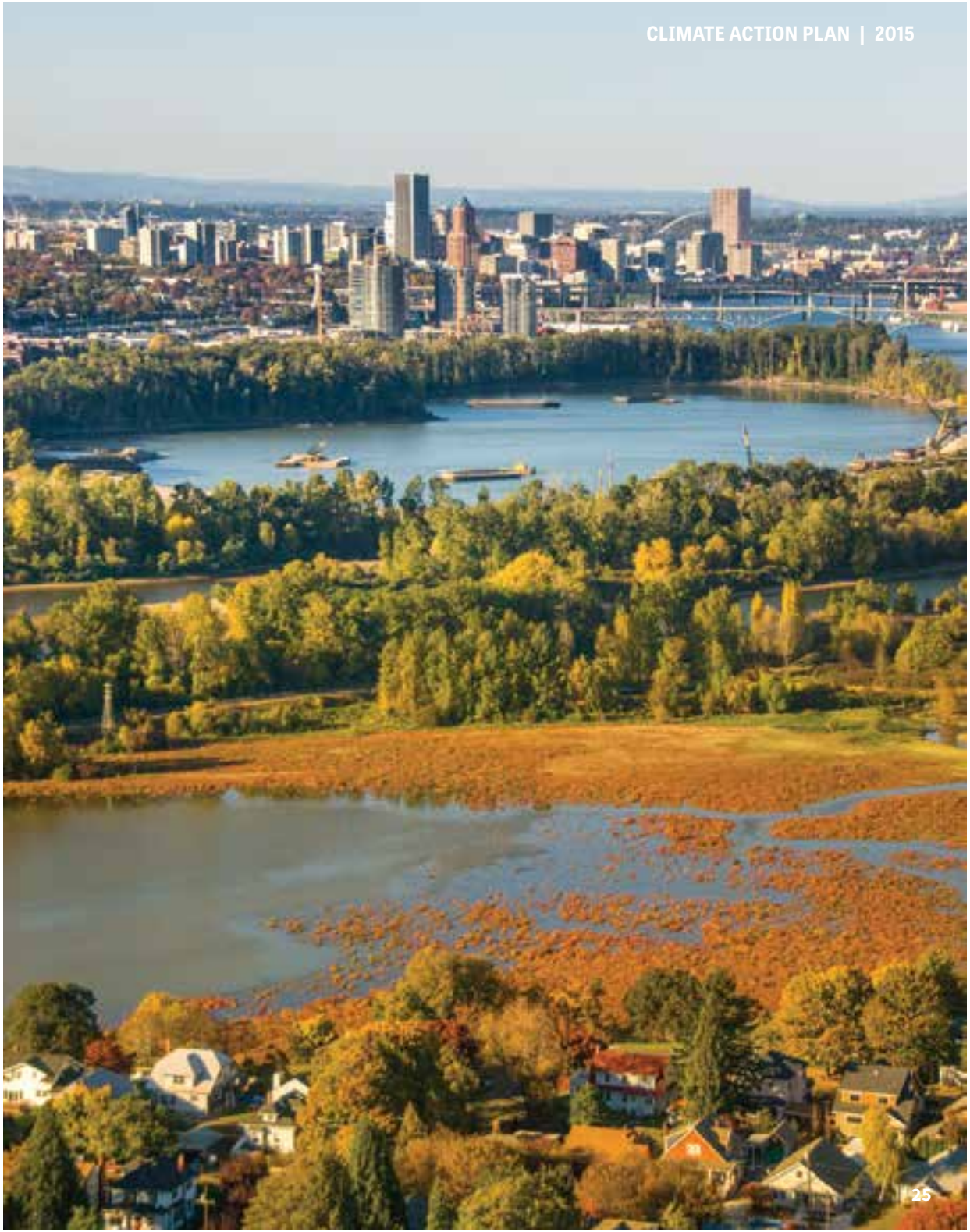
Risk 5: Increased incidence of landslides

Multiple benefits come from preparing for climate change

Many of the actions that help with climate change preparation are already underway and benefit the community in other ways. One example is the significant work that has been done to acquire and restore natural areas and floodplains and install bioswales and ecoroofs to reduce flooding and improve stormwater management. Similarly, to protect public health, the County currently monitors a variety of mosquito species that can carry diseases such as West Nile Virus. Existing vector control and integrated pest management efforts enable better identification and response to new mosquito species that may migrate here as the climate changes. All of these activities benefit the community and improve resilience to natural hazards today, regardless of future climate conditions.

Protecting those most vulnerable to climate change impacts

All populations are affected by climate change, but not all communities have the same ability to respond. As a result, some are more vulnerable than others. In Portland, communities of color and low-income populations experience disparities that result in disproportionate vulnerabilities to the impacts of climate change. These disparities include greater risk of poor health, reduced access to quality affordable housing, limited access to transportation options and parks, higher mortality rates and other legacies of inequitable public policies. By pursuing climate resilience, the City and County seek to ensure that the benefits of taking actions to prepare for climate change are shared by the whole community and across multiple generations.



CLIMATE ACTION PLAN AT A GLANCE

This *Climate Action Plan* identifies twenty 2030 objectives and more than one hundred actions to be completed or significantly underway in the next five years. This plan puts Portland and Multnomah County on a path to reduce carbon emissions 80 percent from 1990 levels by 2050 (and 40 percent by 2030) and to prepare for the impacts of a changing climate. It focuses principally on major actions to be taken to accelerate emission reductions.

To draft this *Climate Action Plan,* City and County staff worked with a Steering Committee, an Equity Working Group and technical advisors. These groups helped to identify the near-term actions most likely to result in the long-term changes necessary to achieve these ambitious climate action goals, while also advancing other community goals related to prosperity, the environment, health and equity.

BUILDINGS AND ENERGY

2030 OBJECTIVES

1. Reduce the total energy use of all buildings built before 2010 by 25 percent.
2. Achieve zero-net carbon emissions in all new buildings and homes.
3. Supply 50 percent of all energy used in buildings from renewable resources, with 10 percent produced within Multnomah County from onsite renewable sources, such as solar.

READ MORE ON PAGES 58–69

URBAN FORM AND TRANSPORTATION

2030 OBJECTIVES

4. Create vibrant neighborhoods where 80 percent of residents can easily walk or bicycle to meet all basic daily, non-work needs and have safe pedestrian or bicycle access to transit. Reduce daily per capita vehicle miles traveled by 30 percent from 2008 levels.
5. Improve the efficiency of freight movement within and through the Portland metropolitan area.
6. Increase the fuel efficiency of passenger vehicles to 40 miles per gallon and manage the road system to minimize emissions.
7. Reduce lifecycle carbon emissions of transportation fuels by 20 percent.

READ MORE ON PAGES 70–87

CONSUMPTION AND SOLID WASTE

2030 OBJECTIVES

8. Reduce consumption-related emissions by encouraging sustainable consumption and supporting Portland businesses in minimizing the carbon intensity of their supply chains.
9. Reduce food scraps sent to landfills by 90 percent.
10. Reduce per capita solid waste by 33 percent.
11. Recover 90 percent of all waste generated.

READ MORE ON PAGES 88–97

FOOD AND AGRICULTURE

2030 OBJECTIVES

12 Reduce consumption of carbon-intensive foods and support a community-based food system.

READ MORE ON PAGES 98–101

URBAN FOREST, NATURAL SYSTEMS AND CARBON SEQUESTRATION

2030 OBJECTIVES

13 Sequester carbon through increased green infrastructure (trees, plants, soil) and natural areas. Reduce effective impervious areas by 600 acres. Expand the urban forest canopy to cover at least one-third of the city with a minimum canopy cover of 25 percent of each residential neighborhood and 15 percent of the central city, commercial and industrial areas.

READ MORE ON PAGES 102–105

CLIMATE CHANGE PREPARATION

2030 OBJECTIVES

14 Reduce risks and impacts from heat, drought and wildfire by preparing for hotter, drier summers with increased incidence of extreme heat days.

15 Reduce risks and impacts from flooding and landslides by preparing for warmer winters with the potential for more intense rain events.

16 Build City and County staff and community capacity to prepare for and respond to the impacts of climate change.

READ MORE ON PAGES 106–117

COMMUNITY ENGAGEMENT, OUTREACH AND EDUCATION

2030 OBJECTIVES

17 Engage communities, especially impacted under-represented and under-served populations, in the development and implementation of climate change-related policies and programs.

18 Motivate all Multnomah County residents and businesses to change their behavior in ways that reduce carbon emissions.

READ MORE ON PAGES 118–123

LOCAL GOVERNMENT OPERATIONS

2030 OBJECTIVES

19 Reduce carbon emissions from City and County operations by 53 percent from fiscal year 06–07 levels.

Multnomah County

READ MORE ON PAGES 124–129

IMPLEMENTATION

2030 OBJECTIVES

20 Build City and County staff and community capacity to ensure effective implementation and equitable outcomes of climate action efforts.

READ MORE ON PAGES 130–134

UNDERSTANDING PORTLAND'S CARBON EMISSIONS

PORTLAND MEASURES CARBON EMISSIONS IN TWO WAYS

The *Climate Action Plan* analyzes local carbon emissions in two different ways. The primary method calculates local emissions from energy use in our vehicles, homes and businesses, as well as emissions from materials that are thrown in the garbage. This method is known as a "sector-based" emissions inventory and is the inventory used to track progress toward the goal of reducing local carbon emissions 80 percent by 2050.

The sector-based inventory, however, does not account for global carbon emissions that result from local consumption of goods that were produced in other places (e.g., clothes, furniture, food) and services (e.g., health care, banking). To understand the impact of these actions, a "consumption-based" carbon emissions inventory models carbon emissions from the full lifecycle of goods and services, including production, pre-purchase transportation, wholesale and retail, use and disposal.

Whereas the sector-based inventory includes emissions associated with the production of goods in Multnomah County (regardless of who buys them), the consumption-based inventory seeks to attribute emissions to the local consumption of goods and services (regardless of where those goods are produced).

Taken together, the sector-based and consumption-based inventories offer insight into the underlying causes of global climate emissions — and therefore the opportunities to make reductions.

The use of both methods gives a more complete picture of the global carbon emissions for which Portland and Multnomah County bear some responsibility. Both inventories are discussed in more detail in the following pages.

SECTOR-BASED EMISSIONS INVENTORY

A sector-based emissions inventory allocates carbon emissions primarily among the local residential, commercial, industrial and transportation sectors according to energy use of each sector.

Read more on pages 30–35

CONSUMPTION-BASED EMISSIONS INVENTORY

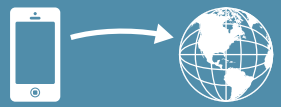
A consumption-based emissions inventory attributes carbon emissions based primarily on the local consumption of goods and services, regardless of where those goods were produced.

Read more on pages 36–41

CARBON EMISSIONS DON'T CARE ABOUT JURISDICTIONAL BOUNDARIES

If a Portlander purchases a new iPhone that was manufactured in China, the sector-based inventory would attribute the emissions from the production of the iPhone to China — where the carbon emissions were produced.

However, a consumption-based inventory would attribute those same carbon emissions to the ultimate consumer in Portland — where the demand for the product was created.



SECTOR-BASED CARBON EMISSIONS

Portland and Multnomah County have been tracking local carbon emissions for over 20 years through an annual sector-based emissions inventory.

For Portland and Multnomah County, a conventional sector-based carbon emissions inventory shows emissions resulting from four primary categories: fuel use in transportation and energy use in homes, commercial buildings, and industrial facilities (see Figure 8). The City maintains an annual inventory of countywide emissions from these sources, together with landfilled solid waste.

This inventory method allocates carbon emissions among the residential, commercial, industrial and transportation sectors according to energy use and carbon intensity of energy used in each sector. It also assigns emissions to solid waste disposed based on the tonnage of materials hauled to regional landfills. This sector-based carbon emissions inventory is widely used by local, state and national governments.

Two factors influence the emissions trends over time:

1. The amount of energy used in the different sectors (residential, commercial, industrial, transportation).
2. The carbon-intensity (carbon emissions per unit of energy) of the energy source (e.g., electricity, natural gas, gasoline, diesel).

The carbon intensity of energy used in Multnomah County has declined substantially, resulting in reduced carbon emissions (see Figure 12). In 2013, carbon emissions per unit of energy were 16 percent lower than in 1990.

A majority of carbon emissions produced locally come from powering our homes, businesses and vehicles

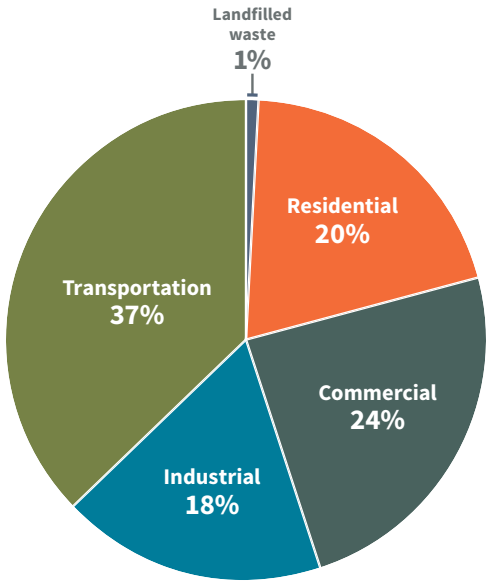


Figure 8. Total Multnomah County carbon emissions by sector (Sector-based inventory, 2013). *Source: Portland Bureau of Planning and Sustainability*

Nearly 40 percent of the emissions from Multnomah County result from transporting people and goods, while over 60 percent come from electricity and fossil fuels used in homes, commercial buildings and industrial processes

This decline reflects the continued growth of renewable energy resources like wind and solar in the Pacific Northwest as well as the transition from fuel oil to natural gas for heating. Portland has one of the highest participation rates in voluntary green power purchase programs in the country, with participants accounting for more than seven percent of all electricity sales.

For the transportation sector, a seven percent decrease in carbon intensity has largely been achieved by the increased use of biofuels in Oregon, including a Renewable Fuel Standard that requires minimum blends of five percent biodiesel and 10 percent ethanol in all transportation fuels sold in Oregon.

While this *Climate Action Plan* accounts for decreased carbon emissions from a shift from fuel oil to natural gas for home heating, recent studies suggest that the lifecycle emissions from these energy sources may be larger than previously understood. Fugitive emissions from natural gas extraction are a concerning emissions source. The City and County will continue to monitor research on lifecycle emissions and advocate for policies that promote lowest carbon alternatives.

Black carbon, a short lived climate pollutant, comes from incomplete combustion of fossil fuels and wood and changes the climate by: (1) directly warming the atmosphere by absorbing energy from the sun and releasing it as heat, (2) by darkening mountain snow and ice, leading to faster melting, and (3) changing the properties of clouds, including reflectivity, stability and precipitation (U.S. EPA, 2012b).

SECTOR-BASED CARBON EMISSIONS

The big three emission sources: Electricity, natural gas and fuel for our vehicles

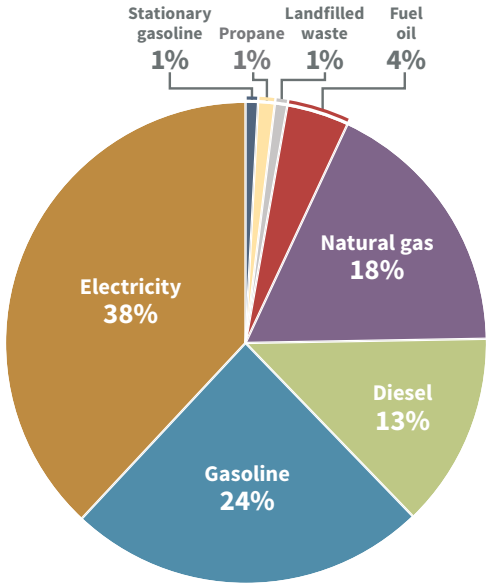


Figure 9. Total Multnomah County carbon emissions by source (Sector-based inventory, 2013). *Source: Portland Bureau of Planning and Sustainability*

Electricity generation is the single largest source of local carbon emissions, 38 percent primarily driven by the carbon intensity of coal and natural gas burned to produce the electricity that serves Multnomah County.

Transportation fuels account for 37 percent of carbon emissions.

Direct use of natural gas is the third major source, at 18 percent, primarily used to heat buildings and in industrial processes.

Investing in energy efficiency and switching to green power reduces use of carbon-intensive fuel sources

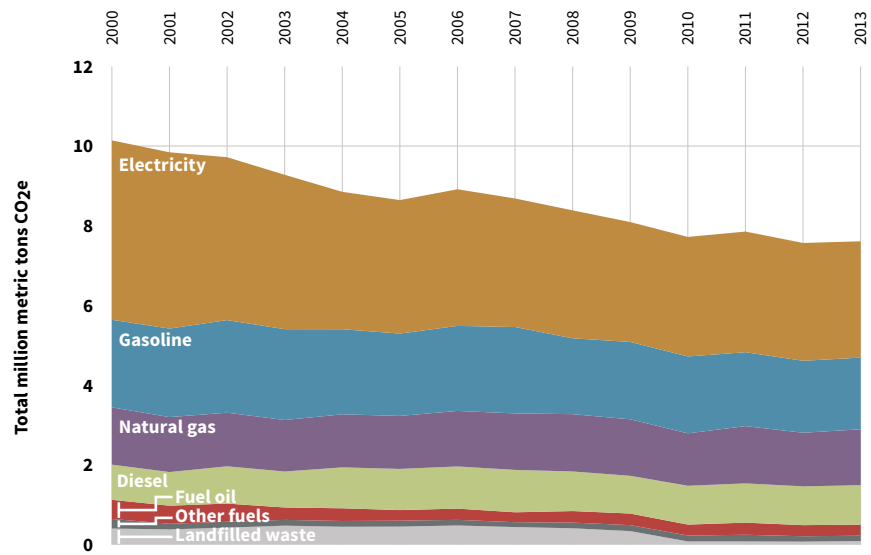


Figure 10. Multnomah County Carbon Emissions trend by source (Sector-based inventory, 2013). *Source: Portland Bureau of Planning and Sustainability*

Emissions from electricity have declined significantly in the last 12 years. This has largely been due to efficiency investments and the shift towards less carbon-intensive fuel sources both through switching from coal to natural gas and through the addition of renewable energy resources like wind and solar. The chart also reflects the decline in gasoline use and shift away from fuel oil for heating.

SECTOR-BASED CARBON EMISSIONS

Carbon emissions down in all sectors

TOTAL EMISSIONS (METRIC TONS CO_2 EQUIVALENT)

	1990	1995	2000	2005	2010	2011	2012	2013	Change since 1990	Change since 2005
Residential	1,725,000	1,755,000	2,007,000	1,639,000	1,553,000	1,626,000	1,523,000	1,540,000	–11%	–6%
Commercial	1,877,000	2,042,000	2,393,000	2,005,000	1,892,000	1,923,000	1,867,000	1,884,000	0%	–6%
Industrial	1,911,000	2,126,000	2,314,000	1,483,000	1,332,000	1,423,000	1,361,000	1,348,000	–29%	–9%
Transportation	2,979,000	3,155,000	3,120,000	3,145,000	2,948,000	2,883,000	2,822,000	2,830,000	–5%	–9%
Solid waste	498,000	478,000	411,000	460,000	84,000	84,000	80,000	93,000	–81%	–57%
Total	8,990,000	9,556,000	10,245,000	8,732,000	7,809,000	7,939,000	7,653,000	7,695,000	–14%	–8%
% change from 1990		**6%**	**14%**	**–3%**	**–13%**	**–12%**	**–15%**	**–14%**		

PER CAPITA EMISSIONS (METRIC TONS CO_2 EQUIVALENT)

	1990	1995	2000	2005	2010	2011	2012	2013	Change since 1990	Change since 2005
Residential	3.0	2.8	3.0	2.4	2.1	2.2	2.0	2.0	–32%	–17%
Commercial	3.2	3.3	3.6	3.0	2.6	2.6	2.5	2.5	–24%	–17%
Industrial	3.3	3.4	3.5	2.2	1.8	1.9	1.8	1.8	–46%	–20%
Transportation	5.1	5.0	4.7	4.7	4.0	3.9	3.7	3.7	–28%	–20%
Solid waste	0.9	0.8	0.6	0.7	0.1	0.1	0.1	0.1	–86%	–62%
Total	15.4	15.3	15.5	12.9	10.6	10.6	10.1	10.0	–35%	–19%
% change from 1990		**–1%**	**1%**	**–16%**	**–31%**	**–31%**	**–35%**	**–35%**		

**This inventory is intended to track emissions trends to inform City and County decision-making and not to assert ownership or otherwise offer a legal accounting of emissions or reduction credits. See Appendix 3: Sector-based Emissions Inventory Methodology for more details.*

Table 3. Multnomah County sector-based carbon emissions, 1990–2013. *Source: Portland Bureau of Planning and Sustainability*

Total carbon emissions have declined 14 percent since 1990, and emissions per person in Multnomah County have fallen 35 percent since 1990.

SECTOR-BASED CARBON EMISSIONS

Table 3 shows Multnomah County carbon emissions by sector from 1990 to 2013 both in total and per capita terms based on the sector-based emissions inventory. Figure 11 focuses on sector trends in recent years, showing that emissions declined in all sectors from 2005 to 2013. Table 3 key findings include the following:

1 Emissions resulting from **residential and multifamily energy use** have declined 11 percent below 1990 levels, a per-person decrease of 32 percent. This is primarily a result of the improved efficiency of appliances and lighting, weatherization retrofits of homes, the transition from oil to natural gas as a home heating fuel, and the increased use of renewable energy by utilities.

2 Emissions from **energy use in the commercial and industrial sectors** combined have declined by 10 percent since 1990, while the total number of jobs has increased by 20 percent over the same period. This is the result of improved efficiency and shifts toward lower-carbon fuels, both in direct use and by electric utilities.

3 Over the last three years, **transportation sector emissions** have declined below 1990 levels and as of 2013 were five percent below 1990 in absolute terms. Total gasoline sales in Multnomah County in 2013 were seven percent below 1990 levels, a notable fact given the 31 percent increase in population over the same period. Per person, emissions from transportation have declined by 28 percent since 1990 as a result of increasingly complete and connected neighborhoods, regional transportation investments, shifts from driving to walking and bicycling, improved vehicle fuel efficiency and use of lower-carbon fuels such as biodiesel, ethanol and electricity.

Healthy connected neighborhoods, green power and energy efficiency support downward emissions trends in all sectors

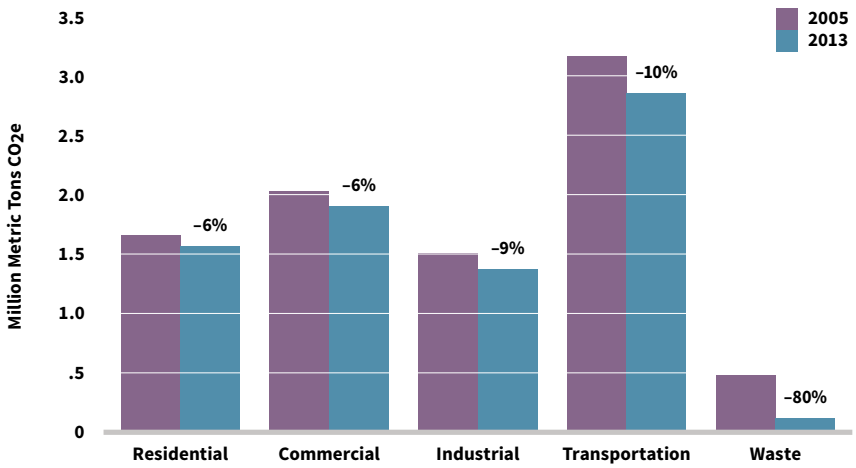


Figure 11. Total Multnomah County carbon emissions and percent change from 2005–2013 (Sector-based inventory, 2005 and 2013). *Source: Portland Bureau of Planning and Sustainability*

Emissions declined across all sectors between 2005 and 2013.

SECTOR-BASED CARBON EMISSIONS

COMPONENTS OF CARBON REDUCTION IN MULTNOMAH COUNTY

Several factors have interacted to produce the net changes in carbon emissions for each sector from 1990 to 2013 (see Figure 12).

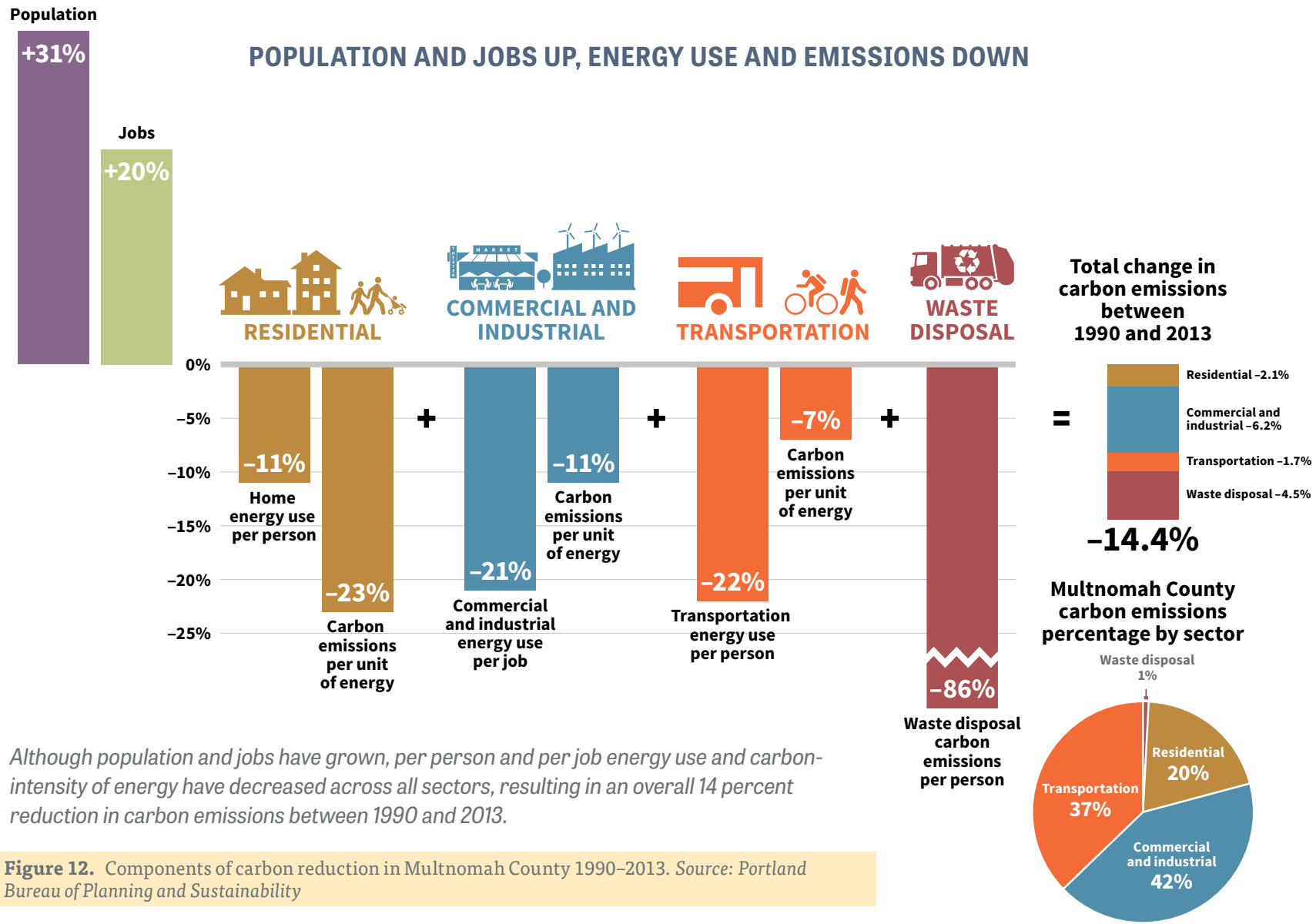
To read Figure 12, begin with the purple bar on the left that shows the 31 percent increase in population from 1990 to 2013. Next, the two brown bars for the residential sector show that home energy use per person has declined by 11 percent since 1990, reflecting improvements in the energy efficiency of homes, heating systems and appliances, changes in the number of people in each household and changes in the weather. The carbon intensity of the energy used in homes, the second brown bar, fell by 23 percent as a result of increased low-carbon electricity from sources such as wind, as well as homes switching from oil furnaces to natural gas. Multiplying these factors together and weighting the results by the percentage the residential sector represents of overall emissions, shown by the pie chart, leads to the residential sector's 2 percent contribution to the overall 14 percent decrease in emissions.

The commercial and industrial sector shows a similar pattern, using jobs as a key factor rather than population. While the number of jobs increased by 20 percent from 1990 to 2013 (green bar on the left side), energy use per job decreased by 21 percent (first blue bar) and the carbon intensity of the energy used in the commercial and industrial sector fell by 11 percent (second blue bar). When multiplied by the commercial and industrial sector's 42 percent share of overall emissions (shown by the pie chart), the result is the sector's contribution of a 6 percent reduction in total emissions.

For transportation and waste disposal, population is used as the primary factor, as with the residential sector. The 22 percent decrease in per person transportation energy use (first orange bar) is a result both of fewer miles driven in vehicles and increased fuel efficiency of vehicles. The 7 percent drop in the carbon intensity of the energy used in transportation (second orange bar) is due to the increased use of renewable fuels, including five percent of biodiesel in diesel fuel and 10 percent ethanol in all gasoline sold in Oregon.

The 86 percent decrease in per person emissions from solid waste disposal (red bar) reflects the tripling of the recycling rate since 1990 and the capture of methane — a potent greenhouse gas — at landfills that receive waste from Multnomah County residents and businesses.

SECTOR-BASED CARBON EMISSIONS



Although population and jobs have grown, per person and per job energy use and carbon-intensity of energy have decreased across all sectors, resulting in an overall 14 percent reduction in carbon emissions between 1990 and 2013.

Figure 12. Components of carbon reduction in Multnomah County 1990–2013. *Source: Portland Bureau of Planning and Sustainability*

CONSUMPTION-BASED CARBON EMISSIONS

For the first time, Portland and Multnomah County have assessed the lifecycle carbon emissions that result from local consumption of goods and services, known as a "consumption-based" inventory. A consumption-based inventory models carbon emissions based on spending by Multnomah County households, as well as government entities and certain categories of purchases made by businesses (capital and inventory formation), regardless of where in the world the emissions are produced.

The consumption-based inventory complements the sector-based inventory, as shown in Figure 14. Key observations include:

- Both inventories include the 6.4 million metric tons of emissions that result from household use of fuels and electricity, as well as goods and services that are produced and consumed in Multnomah County, like a microbrewery or a local bank (green shaded area).
- The sector-based inventory also includes 1.5 million metric tons of emissions resulting from goods and services produced in Multnomah County but consumed elsewhere or by those who don't reside in the county (red shaded area).
- The consumption-based inventory is the inverse. It excludes 1.5 million metric tons of emissions from the goods and services that are exported from Multnomah County (some concrete or manufactured metal parts, for example), or consumed by those who do not reside in the county. However, the consumption-based inventory adds 9.4 million metric tons of emissions from goods and services produced elsewhere but consumed by county residents (such as clothing, electronics or food), government entities, and some categories of purchases by businesses, including capital equipment like cooking appliances or machinery (blue shaded area).

Consumer choice affects carbon emissions

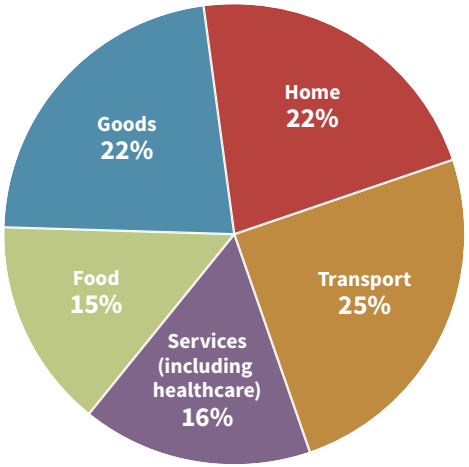


Figure 13. Multnomah County carbon emissions from consumption by category (Consumption-based inventory, 2011). *Source: Portland Bureau of Planning and Sustainability*

Over half of consumption-based carbon emissions in Multnomah County come from food (e.g., energy used to pump water for irrigation, and make fertilizers and pesticides, as well as methane from livestock), goods (e.g., energy used to extract, process and transport raw materials to make clothing, electronics and furniture) and services (e.g., energy used by businesses like banking, dry cleaning and healthcare). The remaining emissions come from home energy use (e.g., heat, lights, appliances, sewage treatment) and fuels used for transportation (e.g., cars and airplane trips).

CONSUMPTION-BASED INVENTORY METHODOLOGY

Multnomah County's 2011 consumption-based inventory builds on Oregon's 2005 and 2010 inventories produced by the Oregon Department of Environmental Quality (DEQ). DEQ adapted the Oregon model to utilize Multnomah County spending data compiled from multiple sources, including the U.S. Bureau of Economic Analysis and the U.S. Bureau of Labor Statistics. The model also considers actual usage data for electricity and fuel sales in Multnomah County as well as emissions associated with waste disposed at landfills.

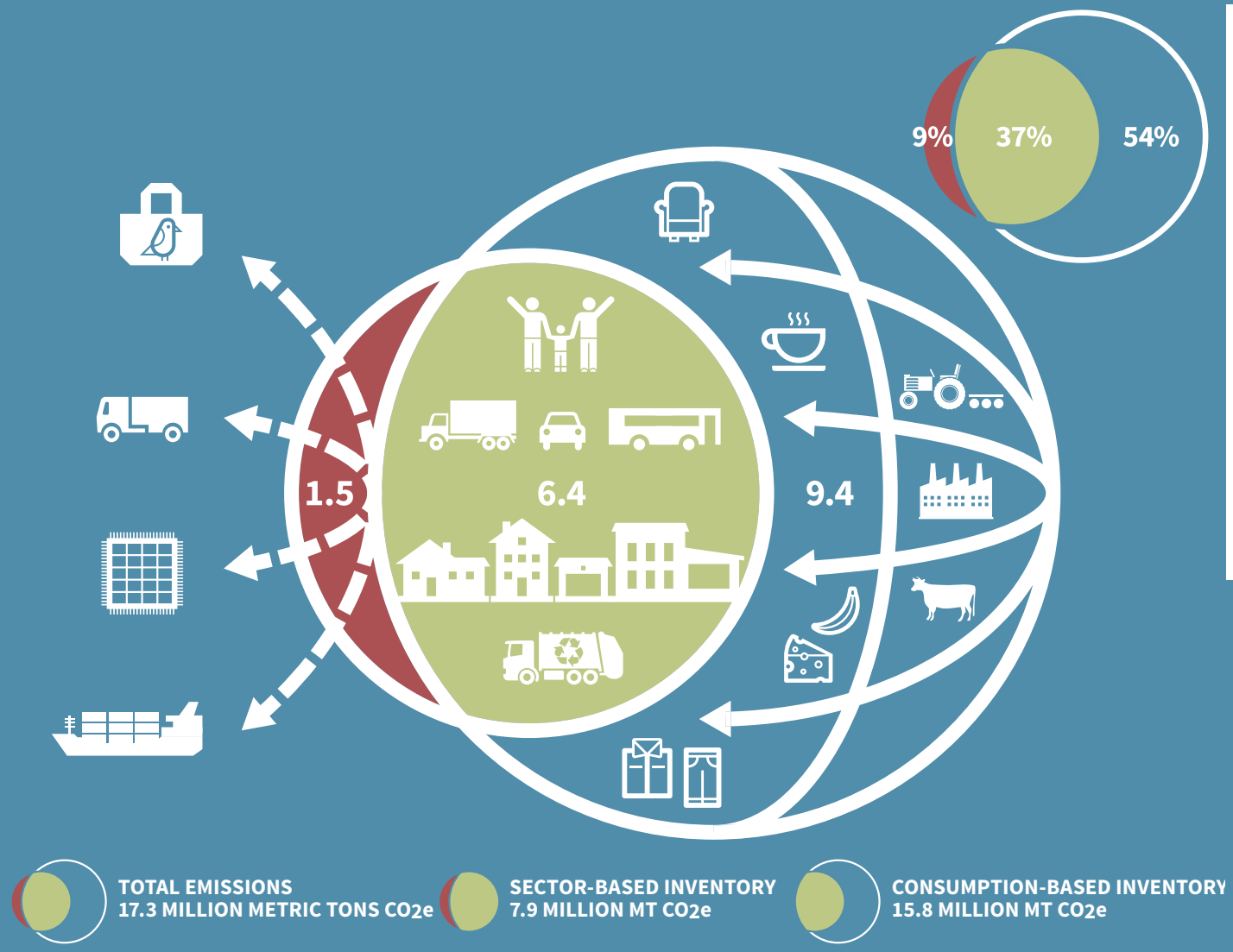
The model analyzed data on spending based on three types of consumers in Multnomah County: households, government entities and business capital investment. The consumption-based inventory incorporates all emissions associated with satisfying the demand from those consumers.

The data includes spending by those types of consumers on 440 different commodities. The model considered the lifecycle emissions of each commodity, specifically looking at five lifecycle phases (production, pre-purchase transportation, wholesale/retail, use and post-consumer disposal). Emissions were calculated using average emission intensities applied to each commodity based on whether the emissions were produced in Multnomah County, the rest of the US or elsewhere in the world.

An overview of DEQ's model and methodology as revised for Multnomah County is noted in Appendix 4.

CONSUMPTION-BASED CARBON EMISSIONS

GLOBAL EMISSIONS AS A RESULT OF LOCAL CONSUMER DEMAND ARE MORE THAN TWICE THE VOLUME OF EMISSIONS PRODUCED LOCALLY



Both inventories include emissions from household and government use of energy, as well as emissions from in-county businesses serving in-county consumers. The sector-based inventory also includes emissions from the production of goods that occur within the county for sale elsewhere — the supply side of the economy — while the consumption-based inventory includes the much larger portion of emissions from the consumption of goods that are produced elsewhere, reflecting the demand side of the economy.

Figure 14. Relationship between Sector- and Consumption-based emission inventories (2011). *Source: Portland Bureau of Planning and Sustainability*

CONSUMPTION-BASED CARBON EMISSIONS

LIFECYCLE CARBON EMISSIONS

Lifecycle carbon emissions are the net carbon emissions produced throughout the life of individual products — "cradle to grave." Lifecycle emissions include the upstream emissions that come from: (1) producing and distributing a product before it's ever purchased by a consumer, (2) the use of the product and (3) decomposition of the product in a landfill.

For example, to produce a washing machine, fossil fuels and metals are extracted and processed into plastics and sheet metal. Electrical components and computer chips also need to be manufactured. Those components are shipped and assembled into the final product, which is then distributed to wholesalers and retailers and finally purchased by a consumer. Once the washing machine begins washing clothes it directly uses energy, generating carbon emissions for the rest of its life.

More than half of Portland's consumption-based emissions result from the production of goods rather than from the transportation, use or disposal of those goods, as shown in Figure 15. While emissions occur throughout all stages of a product's lifecycle, for most goods the majority of emissions occur during production, which includes natural resource extraction, processing and manufacturing (see Table 4). Therefore, decreasing the carbon intensity of production supply chains is a powerful opportunity for businesses and industry to reduce global emissions.

In addition, individuals, businesses, governments and other organizations will need to meet their needs by choosing products and services with lower emissions across the entire lifecycle. This includes both making informed choices about which products and services to buy as well as utilizing opportunities to rent, share, fix and reuse goods. Choosing to shift spending from purchasing new shoes, for example, to repairing a serviceable pair of existing shoes can help reduce emissions.

Shifting toward efficiency and reuse can help reduce emissions

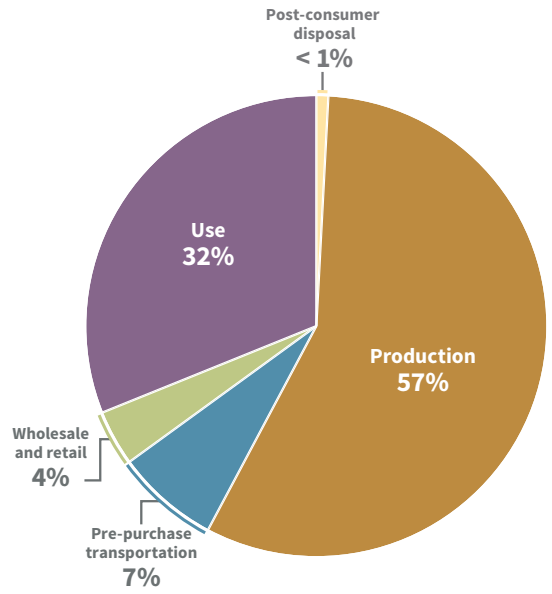


Figure 15. Multnomah County carbon emissions from consumption by lifecycle phase (Consumption-based inventory, 2011). *Source: Portland Bureau of Planning and Sustainability*

More than half of all lifecycle carbon emissions are generated from the production of goods. The transportation, sale and disposal of those goods generate relatively few emissions in comparison. In addition, approximately 32 percent of lifecycle carbon emissions come from the use of those goods, such as energy used for lighting, appliances and personal vehicles.

USING PRODUCTS MOST EFFICIENTLY CAN REDUCE LIFECYCLE CARBON EMISSIONS

Nearly one-third of Portland's consumption-based emissions come from the use of products. Therefore, it's valuable to understand the nature of this lifecycle phase ("use phase"). Vehicles, appliances, lighting and electronics all require energy in their use and thus are responsible for the generation of associated carbon emissions.

Often emissions from a product's use can be reduced with common carbon reduction strategies. For example, to reduce emissions from the use of a vehicle, walking and biking are the best options, followed by taking public transit and using high blends of biofuels. Purchasing high-efficiency Energy Star appliances and lighting, unplugging and turning off electronics and enrolling in utility green power programs will help to reduce the impact from home energy use.

In the case of goods that require the use of appliances, such as washing a pair of jeans, the use phase also creates an opportunity to reduce emissions. In the case of a pair of its 501 jeans, Levi's has estimated 72 pounds of lifecycle carbon emissions, with 58 percent of emissions coming from the use of the jeans if they are washed in warm water and machine-dried once per week (Levi Strauss & Co., 2009). Washing the jeans in cold water and line drying can save 38 pounds of carbon emissions — cutting lifecycle emissions in half and likely extending the life of the jeans as well.

CONSUMPTION-BASED CARBON EMISSIONS

ONLY VEHICLES, APPLIANCES AND LIGHTING PRODUCE MORE EMISSIONS DURING THEIR USE THAN DURING THEIR PRODUCTION

Category	Total GHG emissions	Production	Transportation services*	Wholesale and retail**	Use	Post-consumer disposal	Percent of total emissions
Vehicles and parts	2,821	313	—	—	2,508	0.16	18%
Food and beverages	2,312	2,275	—	—	—	37	15%
Appliances	2,063	65	—	—	1,998	0.1	13%
Services	1,488	1,485	—	—	—	4	9%
Other manufactured goods	1,216	1,216	—	—	—	1	8%
Transportation services*	1,102	—	1,102	—	—	—	7%
Healthcare	1,060	1,060	—	—	—	1	7%
Construction	1,055	1,042	—	—	—	14	7%
Furnishings and supplies	637	621	—	—	—	17	4%
Retailers**	523	—	—	524	—	—	3%
Electronics	523	339	—	—	184	0.5	3%
Clothing	332	332	—	—	—	1	2%
Lighting and fixtures	293	7	—	—	286	0.01	2%
Wholesale**	160	—	—	160	—	—	1%
Other	142	142	—	—	—	0.1	1%
Water and wastewater	72	72	—	—	—	0.04	0
TOTAL	**15,806**	**8,969**	**1,102**	**684**	**4,977**	**74**	**100%**
Percent of Total Emissions	**100%**	**57%**	**7%**	**4%**	**31%**	**0.5%**	

**Emissions from "Transportation services" are from the services that transport people, such as buses, taxis and airplanes, as well as the transportation of finished products from the final producer through wholesale and retail channels. Emissions from personal vehicle use are included in "Vehicles and parts." Emissions from transportation of unfinished goods (supply chain transportation) are included in the respective categories, such as food and clothing.*

***Emissions from "Wholesale" and "Retailers" come from the operation of their facilities, including heating, cooling, lighting, refrigeration and other equipment like forklifts. This category also includes the lifecycle emissions of operational supplies that retailers or wholesalers consume but don't sell to their customers, like paper bags or receipts.*

Table 4. Total lifecycle carbon emissions summary (1,000 metrics tons CO_2 equivalents) (Consumption-based inventory, 2011). *Source: Portland Bureau of Planning and Sustainability*

Because vehicles, appliances and lighting produce more emissions during their use than in their production, replacing these aging technologies with new, energy efficient ones is an important opportunity to reduce carbon emissions.

CONSUMPTION-BASED CARBON EMISSIONS

EMISSIONS FROM PRODUCTION AND USE VARY GREATLY BY PRODUCT

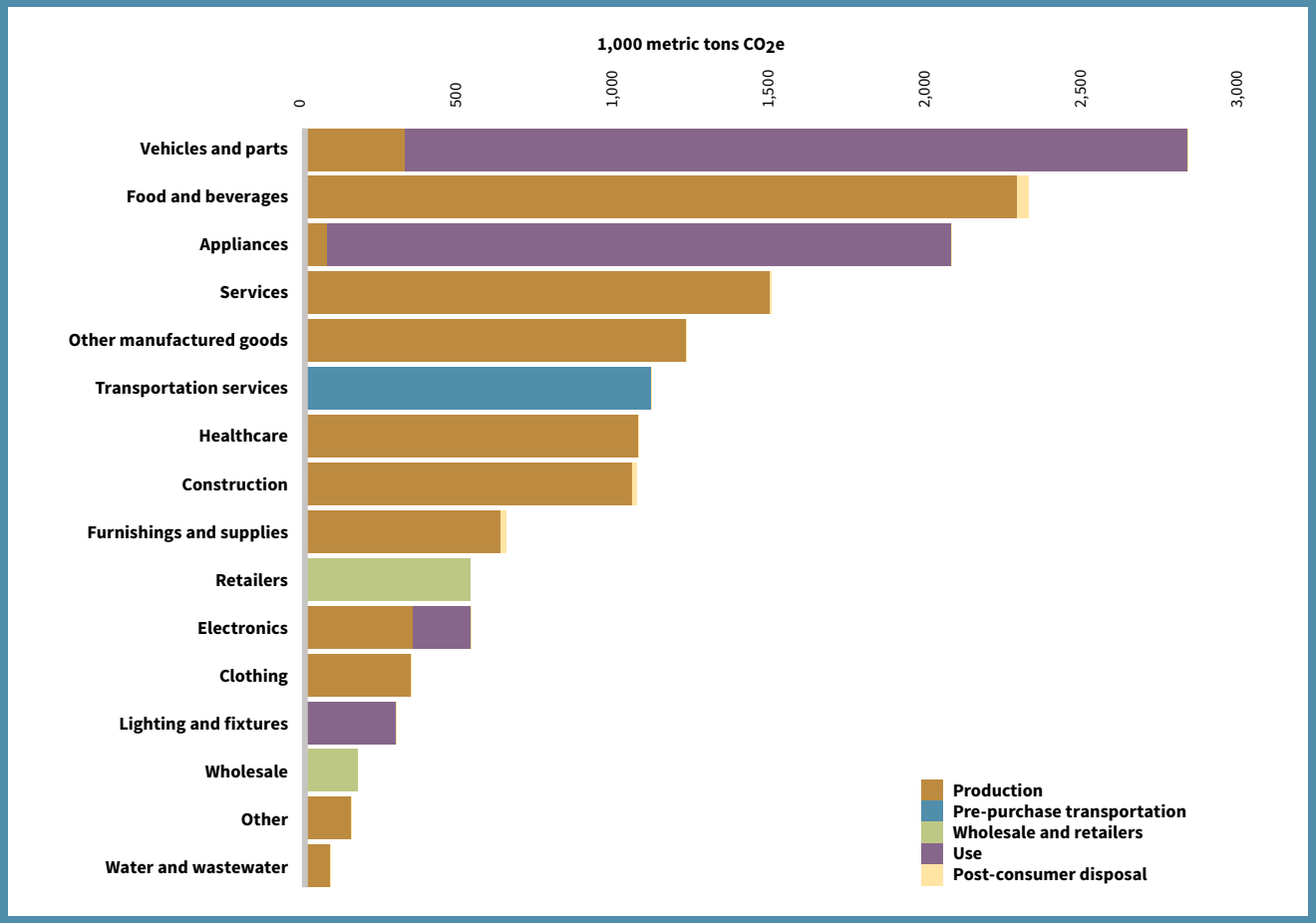


Figure 16. Five-Phase lifecycle carbon emissions summary by product and service (1,000 metrics tons CO_2 equivalents) (Consumption-based inventory, 2011). *Source: Portland Bureau of Planning and Sustainability*

Retail, wholesale and transportation services generate emissions from the operation of vehicles and facilities that deliver or store commodities for consumers. The emissions from the production of those commodities are counted under each individual category (e.g., appliances, food and electronics).

Emissions from three categories represent nearly half of all consumption-based emissions: vehicles and parts (18 percent), food and beverages (15 percent) and appliances (13 percent). Emissions attributed to vehicles and appliances are mostly from their use (e.g., fuel and electricity). In contrast, emissions from food and beverages primarily result from their production.

For most categories of goods and services, the production phase generates a majority of emissions and therefore repair or reuse may be a less carbon-intensive solution. Only vehicles, appliances and lighting produce more emissions during their use than during their production, in which case replacement with more efficient products is more likely to produce carbon benefits.

CONSUMPTION-BASED CARBON EMISSIONS

INCOME LEVELS ALSO IMPACT CARBON EMISSIONS

A consumption-based inventory also highlights how, on average, carbon emissions vary for households at different income levels. Figure 17 shows that lifecycle emissions from households with less than $15,000 per year of income are 80 percent lower than households with greater than $150,000 of income per year, on average. In other words, as household income increases so does spending on goods and services — along with the associated lifecycle carbon emissions of those goods and services.

This analysis helps to inform program development strategies that consider the differences in consumption behaviors of various income groups. For example, programs can encourage higher income families to shift toward more sustainable consumption activities while supporting lower-income families to maintain their existing lower-carbon consumption through technical and financial assistance. All approaches must be tailored with sensitivity to both class and culture.

Higher incomes correlate with higher carbon emissions

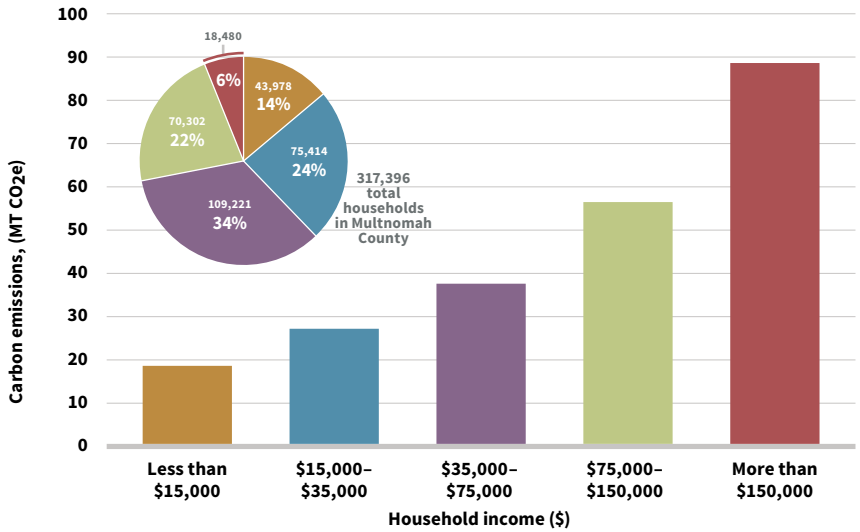
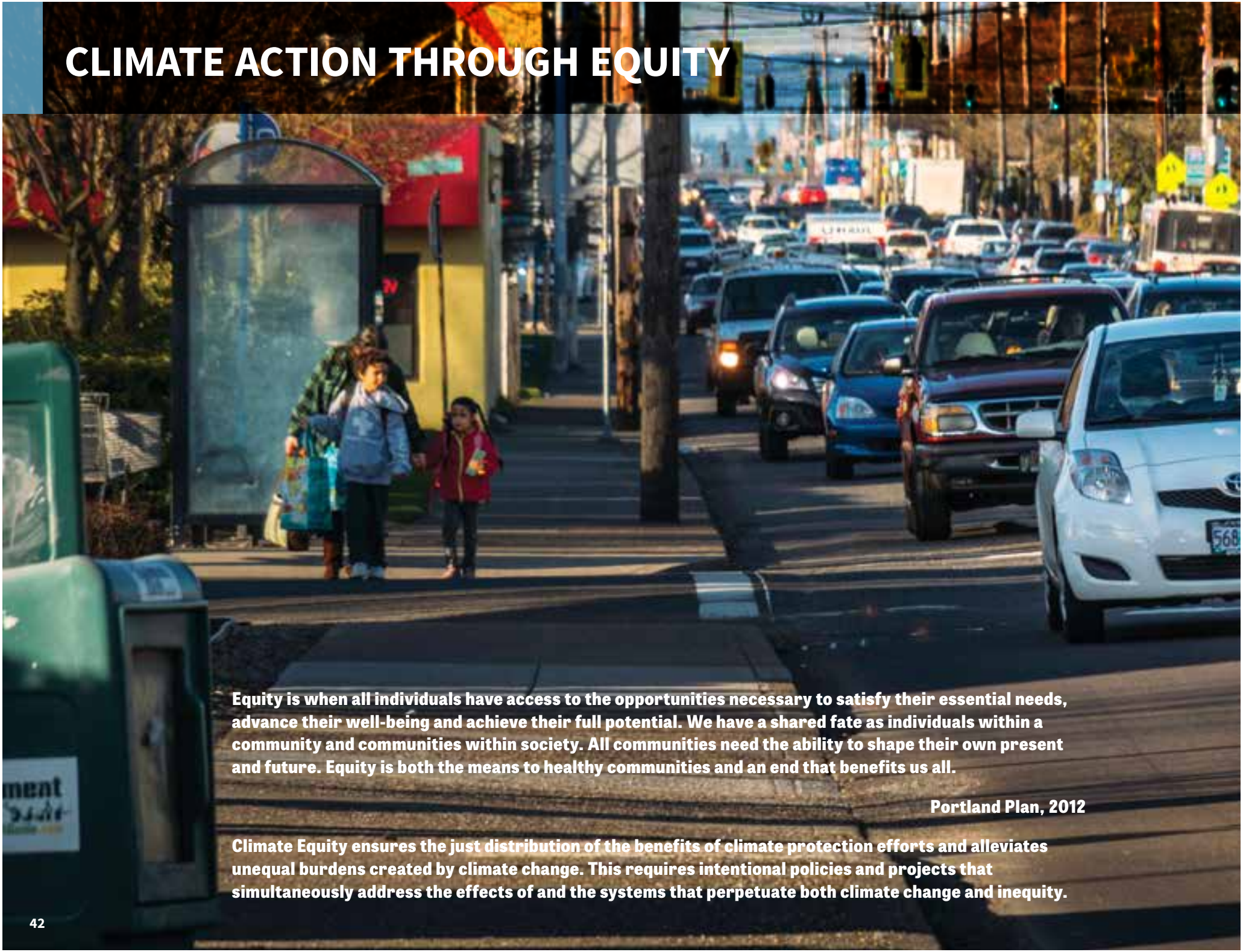


Figure 17. Carbon emissions from consumption of goods and services for average Multnomah County households by income (Consumption-based inventory, 2011). *Source: Portland Bureau of Planning and Sustainability*

The lifecycle carbon emissions associated with households with higher incomes can be several times higher than the emissions of households with lower incomes, on average.

CLIMATE ACTION THROUGH EQUITY



Equity is when all individuals have access to the opportunities necessary to satisfy their essential needs, advance their well-being and achieve their full potential. We have a shared fate as individuals within a community and communities within society. All communities need the ability to shape their own present and future. Equity is both the means to healthy communities and an end that benefits us all.

Portland Plan, 2012

Climate Equity ensures the just distribution of the benefits of climate protection efforts and alleviates unequal burdens created by climate change. This requires intentional policies and projects that simultaneously address the effects of and the systems that perpetuate both climate change and inequity.

SUCCEEDING ON CLIMATE MUST INVOLVE EVERYONE

Portland and Multnomah County have begun to see encouraging results from two decades of carbon-reduction efforts. In 2013 per person carbon emissions were 35 percent below 1990 levels, and total emissions had declined 14 percent. Though this progress is laudable, reaching an 80 percent reduction in carbon emissions by 2050 requires even broader support, engagement and participation.

Government action alone is not enough; everyone must be a part of the solution. Currently, however, not everyone has equitable opportunities to participate and benefit.

> *Our vision for a climate-positive future cannot be achieved without advancing equitable outcomes and addressing existing disparities.*

Communities of color and low-income populations have historically been under-served by programs and investments and under-represented in decision making on climate policy. Lack of low-carbon, safe transportation options, inefficient housing and the inability to afford healthy food are examples of disparities experienced by these communities that result in fewer benefits from climate action opportunities.

These inequities primarily result from ongoing institutional racial bias and historical discriminatory practices that have resulted in the inequitable distribution of resources and access to opportunities.

When the City's first climate plan was adopted in 1993, Portland was considered the "whitest" city of its size in the country (Abbott, 1997). Today, people of color comprise more than 25 percent of the population, more than double the percentage in 1990. This trend is expected to continue, as one in two students in Portland Public Schools are students of color (Portland Public Schools, 2013).

These demographic shifts coincide with stark disparities. Recent reports have concluded that communities of color in Multnomah County experience considerably lower incomes, health outcomes and access to affordable housing than their white counterparts (Curry-Stevens et al., 2010; Urban League, 2009; NAYA, 2008). For example, median annual household income for people of color in Portland average $36,000 compared to $55,000 for whites, a gap that has widened in the last decade (American Community Survey, 2012).

Climate change is likely to amplify the impacts of these existing inequities and low-income populations will disproportionately bear the burdens of climate change impacts. In addition, the many economic and health benefits of carbon reduction investments are not shared equitably across the city, especially among people of color and low-income communities.

If an equity lens is not applied, initiatives to reduce carbon emissions may widen and exacerbate these disparities. To that end, the City and County have strived to integrate equity throughout this *Climate Action Plan* (see sidebar on page 49).

Terminology

When *Climate Action Plan* actions prioritize equity, they are prioritizing under-served and under-represented people and places.

Under-served means people and places that historically and currently do not have equitable resources, access to infrastructure, healthy environments, housing choice, etc. Due to historical inequitable policies and practices, disparities may be recognized in both access to services and in outcomes.

Under-represented recognizes that some communities have historically and currently not had equal voice in institutions and policy-making and have not been served equitably by programs and services.

In this *Climate Action Plan,* the terms *under-served* and *under-represented* focus action and implementation attention toward:

- **People/Communities of color:** Individuals or groups who identify as African and African-American, Native American/Indigenous Nation/ Native Hawaiian, Asian-American or Asian/Pacific Islander, and/or Latino/Hispanic/Chicano descent.
- **Low-income populations:** People, households, families and neighborhoods with below-average incomes. Because of socioeconomic patterns, low-income also overlaps with people of color and many older adults. However, a focus on low-income people does not substitute for a focus on racial and ethnic justice.

CASE STUDY: EAST PORTLAND

East Portland, home to 25 percent of Portland's population, reflects both the demographic change and missed opportunities to reduce carbon emissions in under-served communities. Thirty-eight percent of East Portland residents are people of color, notably more diverse than the city as a whole (see Figure 18). That percentage has grown substantially since 2000 (see Figure 19) as many people of color have been pushed to East Portland due to a combination of factors. In particular, the lack of affordable housing in many close-in neighborhoods which has been exacerbated by housing discrimination. Housing preference also played a role in this demographic shift, although to a lesser degree.

East Portland is more diverse than Portland as a whole

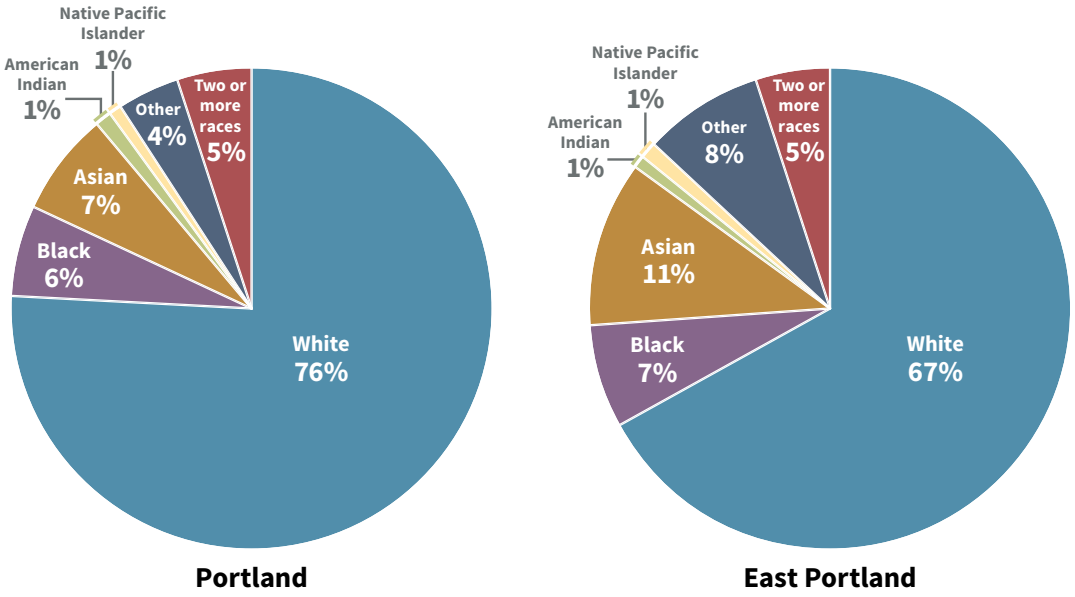


Figure 18. Racial distribution in Portland vs. East Portland. *Source: Portland Bureau of Planning and Sustainability and U.S. Census Bureau*

In addition to the racial diversity shown in the figure above, ethnic diversity is also greater in East Portland. For example, 15 percent of East Portland residents identify as Hispanic compared to nine percent for all of Portland. This means that when ethnicity is also considered, the proportion of communities of color in East Portland is likely much higher than indicated in the figure above.

Rising housing costs, among other factors, have pushed communities of color to East Portland

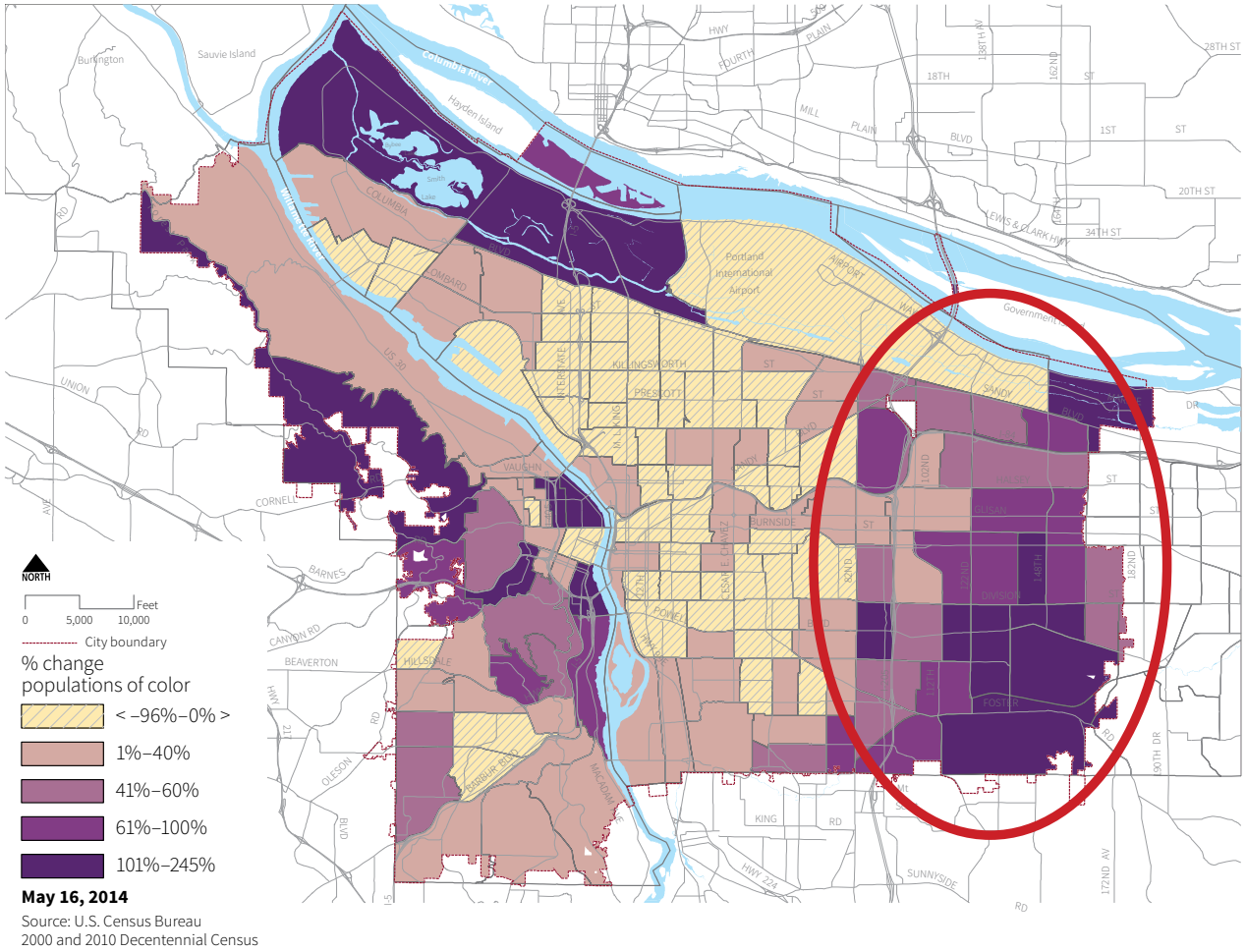
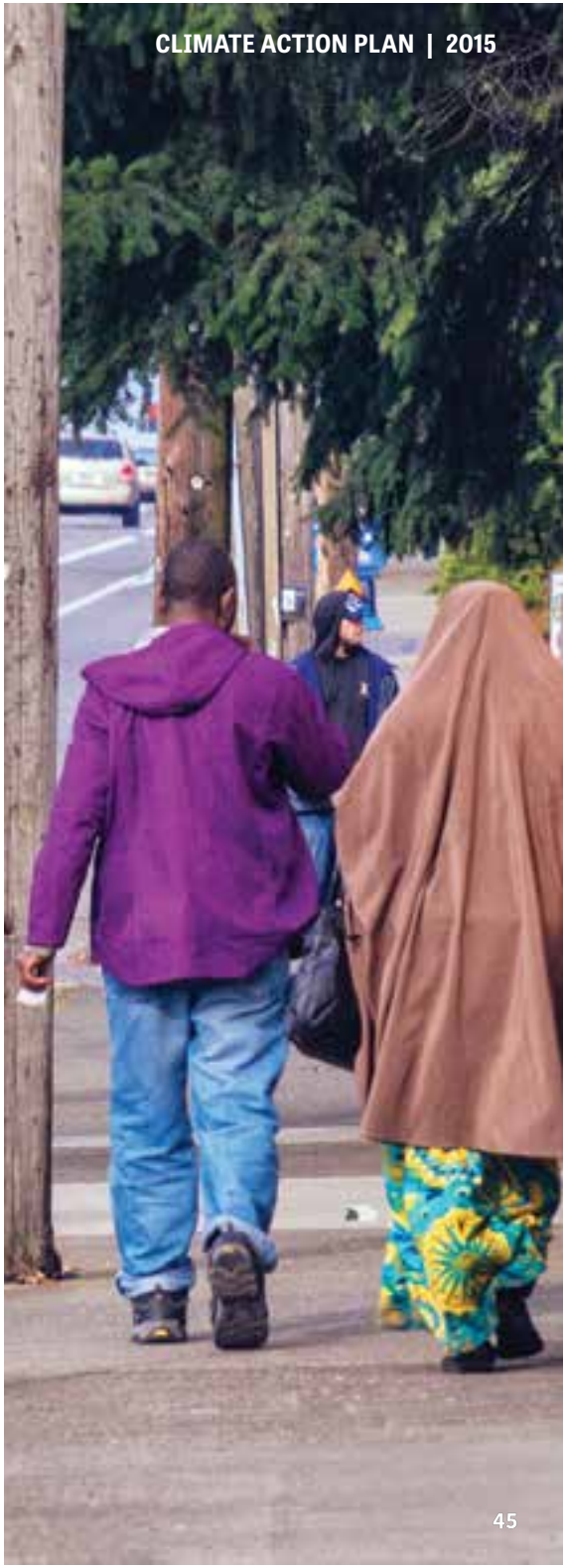


Figure 19. Percent change in populations of color (2000–2010). *Source: Portland Bureau of Planning and Sustainability*

East Portland has experienced significant growth in communities of color from 2000 to 2010.



East Portland has higher rates of poverty than the city as a whole

POPULATIONS	Portland	East Portland
All populations	16%	19%
RACE		
White	14%	16%
Black	36%	40%
American Indian	32%	38%
Asian	17%	17%
Native Hawaiian/other Pacific Islander	23%	36%
Two or more races	23%	26%
ETHNICITY		
Hispanic or Latino	28%	30%

Table 5. Percent of population below poverty by race and ethnicity for Portland and East Portland (ACS 2006–2010). *Source: Bureau of Planning and Sustainability*

All populations of color experience greater poverty than white populations. For example, the Black population experiences poverty at over twice the rate of the White population. In addition, people living in East Portland have higher rates of poverty than the city as whole, as well as within racial and ethnic categories.

TRANSPORTATION CARBON EMISSIONS: EAST PORTLAND

To achieve adopted 2050 carbon goals, transportation-related emissions must decrease by nearly 40 percent by 2030 (see the Carbon Budget, page 20). One of the key strategies in this *Climate Action Plan* to reduce emissions from transportation is making neighborhoods more walkable and bikeable. Specifically, Objective 4 calls for creating "vibrant neighborhoods where 80 percent of residents can easily walk or bicycle to meet all basic daily, nonwork needs and have safe pedestrian or bicycle access to transit" by 2030.

Today, due in large part to poor public investments in transportation, East Portland neighborhoods lag well behind the average for the rest of Portland on key indicators of complete neighborhoods such as bike lanes, sidewalks and access to transit, as shown in Table 6. Similarly, Figures 20 and 21 show the relative concentration of low-income households in areas that lack frequent transit service and sidewalks in East Portland.

East Portland needs more complete neighborhoods

Indicators of neighborhood completeness	Average percent complete for East Portland neighborhoods	Average percent complete for Portland neighborhoods (excluding East Portland)
½ mile from bike lanes	21%	44%
Streets with at least one sidewalk fully paved	40%	59%
½ mile of MAX ¼ mile of frequent transit service or ⅛ mile of regular transit service	42%	54%

Table 6. Neighborhood completeness indicators for East Portland neighborhoods as compared to the rest of Portland. *Source: Portland Bureau of Planning and Sustainability*

Due to lack of investment, East Portland neighborhoods fare worse than the rest of Portland on key complete neighborhood indicators including bike lanes, sidewalks and access to transit making low-carbon transportation options for these communities less viable.

East Portland lacks frequent transit service

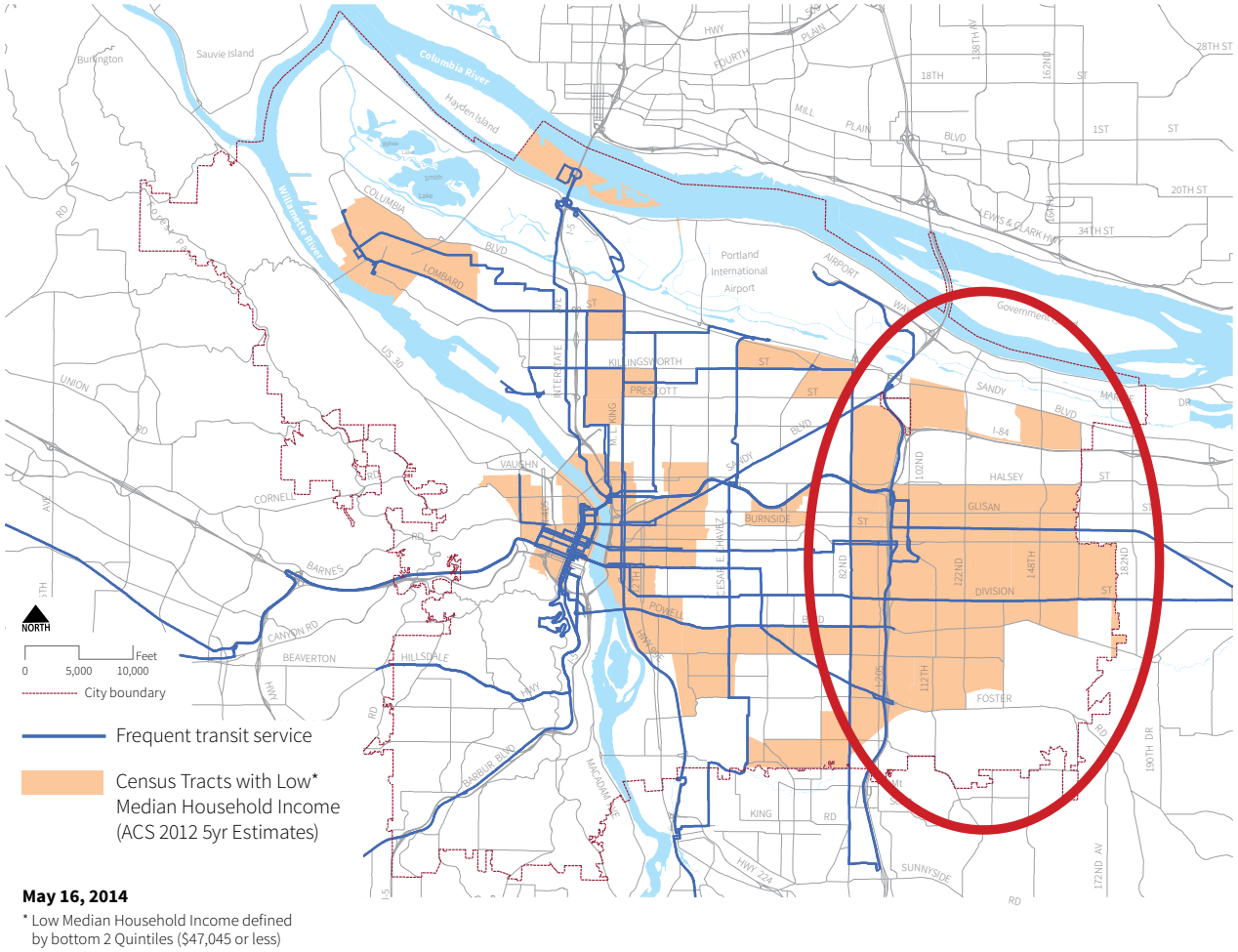


Figure 20. Low-income populations and frequent transit service (streetcar, lightrail or a bus every 15 minutes during peak hours). *Source: Portland Bureau of Planning and Sustainability*

Low-income populations can be found throughout Portland, particularly in the inner city and East Portland. Frequent service transit is significantly limited in East Portland, where 25 percent of the city's population lives.

Better access to transit will reduce carbon emissions

Improving the proximity of transit and affordable housing is a clear opportunity to advance equity while reducing carbon emissions. Lower-income households drive 25 to 30 percent fewer miles when living within one-half mile of frequent transit compared to similar households further from transit, and 50 percent when within one-quarter mile of frequent transit service (TransForm, 2014).

In contrast, higher-income households living within one-quarter mile of frequent transit service drive more than twice as many miles as similarly located lower-income households (TransForm, 2014).

The opportunity to reduce miles driven, and the associated carbon benefits, are greater if transit investments are prioritized in areas with low-income population areas.

Improved walking and biking infrastructure will reduce carbon emissions

Achieving climate action goals depends on getting more people to walk, bike and take transit. Citywide those three modes of commuting combined is currently only 22 percent and needs to exceed 60 percent by 2030 to reach adopted carbon reduction targets.

Improving transit service, walking and bicycling infrastructure and strengthening neighborhood business districts in East Portland are also essential to achieving this *Climate Action Plan's* 2030 objective of 80 percent of residents living in complete neighborhoods.

Addressing gentrification and displacement

Land use and transportation policies and priorities are key to achieving Portland's long-term carbon reduction goals. However, the same investments that have helped the community combat climate change also attract new residents, which can increase gentrification and displacement (voluntary and involuntary) pressures on existing residents and neighborhood small businesses.

The City and County are committed to understanding and minimizing the effects of gentrification, assessing the risk of gentrification for different neighborhoods, and identifying and implementing best practices. The *Climate Action Plan* Equity Implementation Guide (separate document) provides tools and resources to help staff examine these issues as they implement the actions outlined in this plan.

East Portland lacks sidewalks

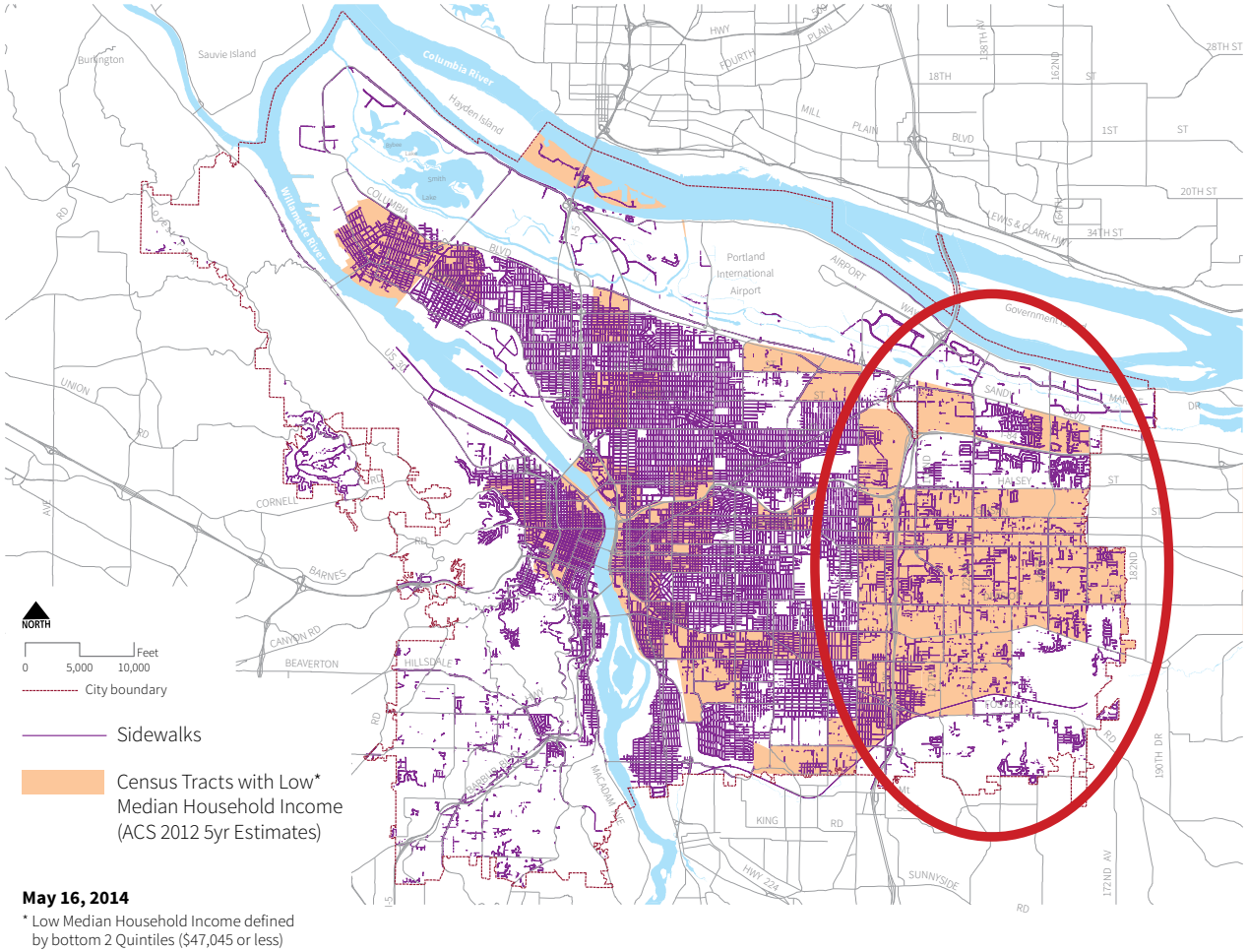


Figure 21. Low-income populations and streets with sidewalks. *Source: Portland Bureau of Planning and Sustainability*

Fewer streets with sidewalks have been built in East Portland. When combined with limited access to frequent service transit, commuting without a car can be challenging and hazardous for residents of these neighborhoods.

Equity Working Group

Through funding from the Bullitt Foundation, Partners for Places and Multnomah County, six organizations were funded to partner with City and County staff to integrate equity into the *Climate Action Plan* through the creation of an Equity Working Group.

The organizations were selected because of their expertise and experience working for communities of color and low-income populations. They also stood out for their potential to bridge policy issues to grassroots work.

Through this process, the City and County sought to be intentional about building a relationship of mutual capacity building. For staff, this meant learning to translate policy and process to be responsive to community needs; for the community members, it meant building an understanding of climate change policy. The process met these goals and served as a catalyst for new collaborations between Equity Working Group members and City and County staff.

"For the community-based grantees, we learned how to better navigate the government bureaucracy while developing our own internal leadership around the issues of climate change. This small investment in our organizations had great returns in terms of building new capacity within various groups that are often ignored in the civic process due to cultural or language barriers."

Duncan Hwang, APANO

"From our involvement on the *Climate Action Plan* Equity Committee, we have made meaningful relationships with other community organizations to work on climate change and environmental issues. We hope to start a Native climate change council to educate and develop advocates in our community and interconnect with other Native organizations' climate-change-related projects."

Amanda Kelley-Lopez, Wisdom Council of Elders

"I appreciate the City and County's willingness to integrate equity into all aspects of the CAP. Equity is not being treated as an afterthought or being marginalized into a separate category, but rather merged into the CAP as a whole. That is very gratifying to see."

Claudia Arana Colen, Upstream Public Health

HOW EQUITY IS INCORPORATED INTO THIS *CLIMATE ACTION PLAN*

VISION: The City and County's vision of equitable climate action is reflected throughout the Vision for 2050 (see page 2).

EQUITY COMMITMENTS: The City and County are committed to equitably implementing the actions in the *Climate Action Plan* in ways that address health, safety and livability, access, prosperity and inclusive engagement (see the Climate Equity Commitments, page 132).

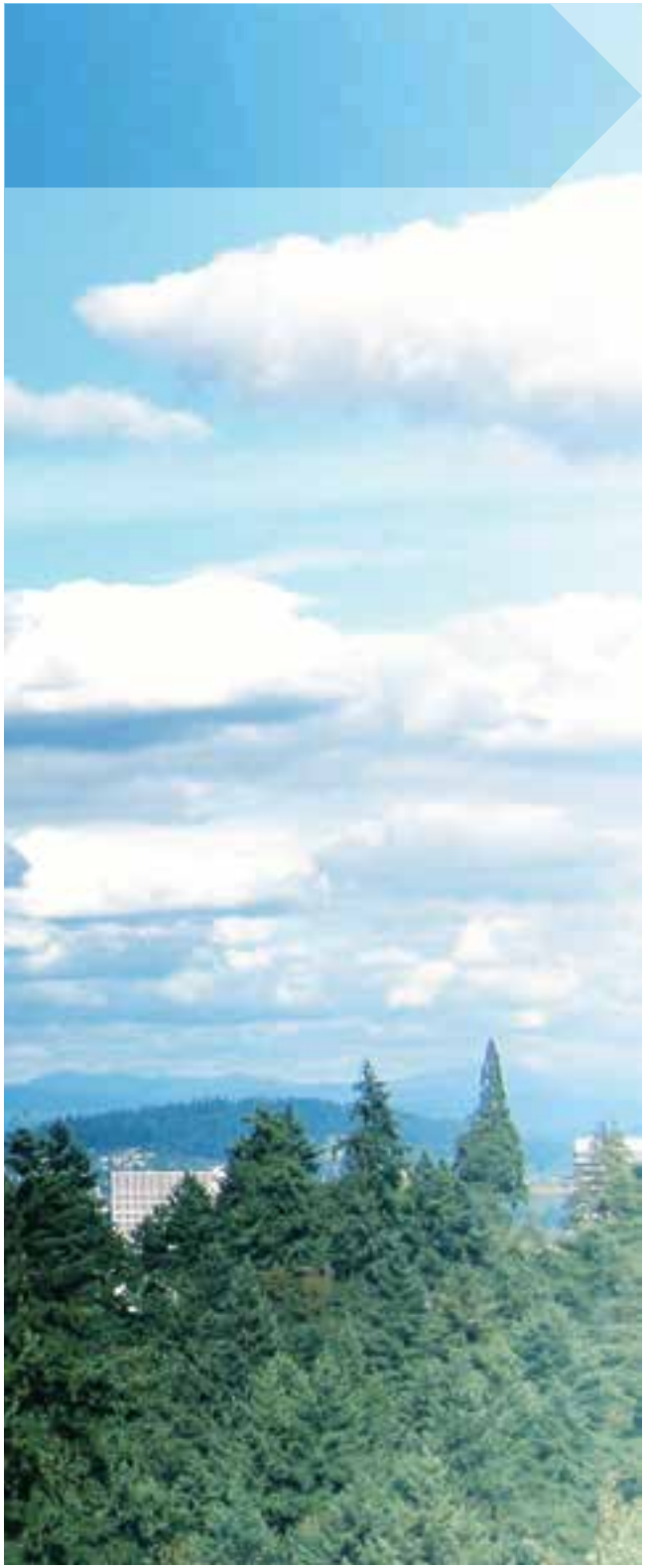
ACTIONS: Strategies and actions to advance equity and reduce disparities are highlighted in the chapter narratives, as well as called out explicitly in several key actions. In addition, actions with a significant opportunity to advance equity are identified with this icon E.

EQUITY OBJECTIVES: In addition, City and County staff will incorporate key equity considerations in the implementation of the actions contained in this plan (as outlined in Appendix 1, Climate Equity Objectives, page 146).

EQUITY IMPLEMENTATION GUIDE: The *Climate Action Plan* Equity Implementation Guide (separate document) provides support for City and County staff on best practices and tools for integrating equity into their work.

CLIMATE-EQUITY METRICS: The City and County will develop climate-equity metrics to track the degree to which the Equity Considerations are integrated into the decision-making processes and implementation of this *Climate Action Plan,* and will transparently report on progress.

A PROSPEROUS, HEALTHY AND EQUITABLE COMMUNITY



This *Climate Action Plan* seeks to identify the actions the City and County can take that have the greatest potential to reduce emissions and prepare for a changing climate. However, while this plan is fundamentally intended to respond to climate change, it will only be successful if it does so in ways that create jobs, advance social equity, improve public health, strengthen natural systems and enhance quality of life. These co-benefits are key opportunities to leverage the impact of the *Climate Action Plan*.

PUBLIC HEALTH

Climate change presents a significant risk to the health of the community. Increases in heat related illness, asthma and vector borne diseases are just some health-related impacts of a changing climate, and these impacts will compound the health inequities that already exist. Actions to reduce carbon emissions and prepare for the impacts of climate change can result in significant benefits to community members' health and quality of life, particularly if health outcomes are a consideration in their design and implementation.

Addressing the Social Determinants of Health

In the United States, street address and zip code are strikingly good predictors of health. The social, economic and physical environments in which people live powerfully shape their opportunities and well-being, for better and worse. Understanding these conditions provides insights on how policy can mitigate negative health outcomes.

Built space, infrastructure, and environmental quality all have a direct impact on our health. Housing is an important determinant of health, and substandard housing can be addressed through carbon reduction actions. Poor housing conditions are associated with a wide range of health conditions, including respiratory infections, asthma, lead poisoning, injuries and mental health. Geographic access to jobs, services and safe places to exercise and play shapes behaviors, choices and economic opportunities. Living near high-traffic corridors with exposure to more air pollution and impervious surfaces can directly impact our respiratory health.

Health Co-benefits

Many of the health benefits of climate action are direct. For example, increasing safe, accessible active transportation options such as walking, biking and taking transit improves opportunities for physical activity, reduces air pollution and reduces risk of crash-related injury. In turn, these impacts can decrease obesity, chronic disease, respiratory ailments and traffic injuries. They may also improve mental health.

Strategies to improve a community's access to fresh fruits and vegetables can improve nutritional quality. Greening the city through increases in tree canopy, restoring and protecting natural systems and investing in green infrastructure can reduce temperatures and urban heat island effects. These efforts reduce the risk of heat-related illness, especially in areas where residents are more vulnerable to heat. Greening can also improve air quality and reduce noise, improving respiratory and mental health. Similarly, a growing body of research documents improved physical and mental health as a result of having access to natural areas, trees and other green infrastructure (American Public Health Association, 2013).

Preparation actions that reduce a community's exposure to and risk from climate changes can also directly benefit health, particularly if these actions are focused on those at highest risk. In addition, reducing the community's risk from natural hazards that would be exacerbated by climate changes (e.g., landslides, flooding, extreme heat and wildfires) — and strengthening emergency management capacity to respond to hazards when they do occur — can reduce the number and severity of resulting illnesses and injuries.

Finally, climate action can also indirectly improve health by making it easier for community members to maintain their own health. For example, actions that reduce household energy costs or create living wage jobs could mean a family has more money to spend on daily needs, education, medical care or leisure activities, all of which are powerful factors that affect health.

Actions that have a high potential to improve health locally are noted in the with a "HEART" icon (see page 56).

Health impacts from diesel exhaust

Black carbon, a short lived climate pollutant, poses a risk to public health and increases the impact of climate change regionally through localized warming and by accelerating the melting of nearby snowpack. Exhaust from diesel equipment is a significant source of black carbon in the Portland metro region. Diesel exhaust is particularly harmful to people's health, exacerbating asthma and other respiratory diseases as well as causing cardiovascular disease and strokes. A 2012 study showed that 460 premature deaths in Oregon could be attributed to diesel exhaust and cost the state nearly $3.5 billion dollars in loss of life and productivity (Oregon DEQ, 2015). Addressing diesel exhaust, black carbon and other short lived climate pollutants is a smart strategy both for climate and public health.

PROSPERITY

Climate action policies and programs can strengthen the local economy by driving demand for innovative products, processes and services that improve efficiency while competing favorably on price or performance. Because most routine daily activities generate carbon emissions, nearly every activity represents an opportunity to identify cleaner and more sustainable alternatives. This fundamental reassessment presents significant economic opportunities.

Accelerating job growth

Already, innovative businesses and individuals have begun to take advantage of these opportunities. Clean technology — including green building and clean energy — provides over 12,000 jobs in Multnomah County. Portland is home to some of the nation's leading developers, builders, architects, engineers and product manufacturers in the green building and green infrastructure industries. In addition, a critical mass of clean energy firms, such as wind developers, photovoltaic manufacturers, biodiesel producers and energy efficiency consultants call the region home. Portland is also a national leader in innovative bicycling products and services.

These businesses offer economic benefit to the community by creating skilled and semi-skilled, well-paying jobs while contributing directly to local environmental quality. For example, Oregon's rapidly growing clean energy sector is showing strong demand for trained workers, from solar installers to wind turbine technicians. Bicycle manufacturers and shops contribute $90 million annually and add 1,500 jobs to the local economy (Dean Runyan Associates, 2014).

The Economic Opportunities of Climate Action

Portland's Economic Development Strategy and the *Climate Action Plan* both recognize that well-designed carbon reduction activities generate positive economic impacts. These benefits fall into four categories:

- **Direct job creation.** Carbon-reduction activities like energy efficiency improvements in homes and commercial buildings create jobs for contractors, electricians and other building-sector trades.
- **Traded-sector competitiveness.** By meeting local demand for low-carbon solutions, Portland firms develop expertise that makes them competitive nationally and internationally.
- **Commercialization of emerging technologies.** As early adopters of low-carbon products and services, the City and County can provide crucial market support for innovative solutions and entrepreneurial business opportunities.
- **A desirable community.** Many of the same qualities that accompany lower carbon emissions — efficient transportation, clean air, nearby parks and walkable neighborhoods — also make Portland an attractive place for firms to locate. Locating in a region with a high quality of life and vibrant community helps companies attract and retain talented employees.

Clean tech jobs have been growing at a faster rate than other sectors.

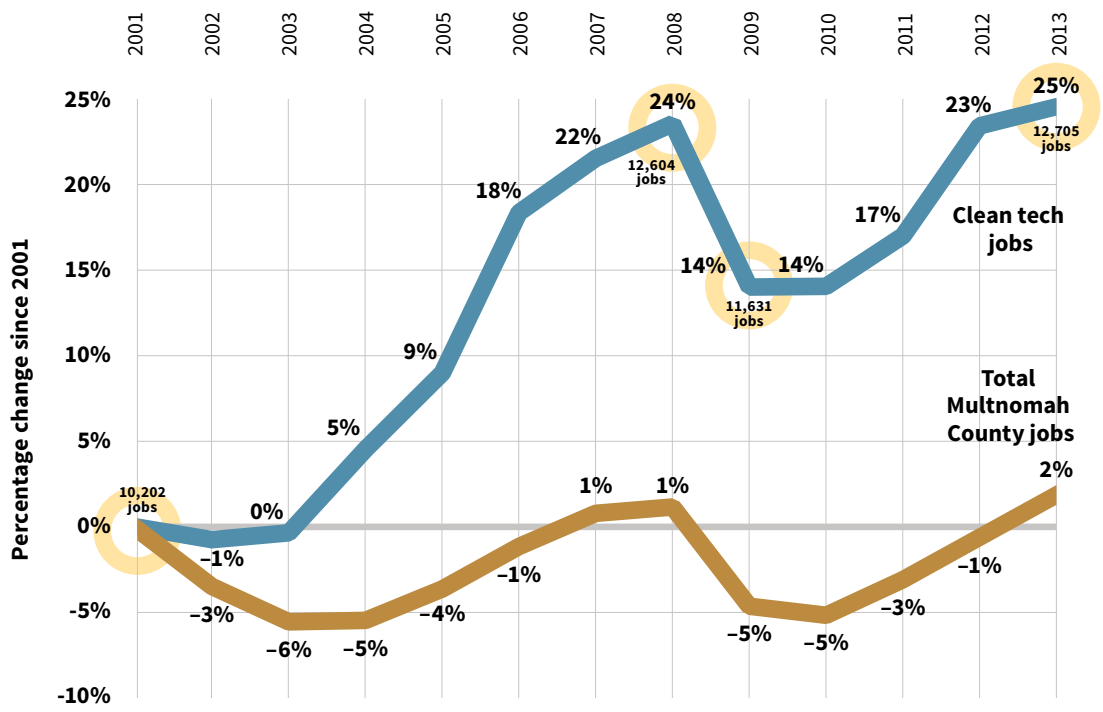


Figure 22. Growth in clean tech jobs vs. total jobs, Multnomah County, 2001–2013. *Source: Portland Development Commission*

Since 2001, job growth in clean technology fields such as green building, energy efficiency and waste management has outpaced other economic sectors.

These industries represent just a small sample of the potential depth and breadth of economic activity that climate protection efforts will stimulate. Ambitious efforts to retrofit every building in Multnomah County for energy performance, develop the next generation of biofuels, design new ways to package goods and meet countless other needs with more sustainable practices can help drive new innovation, industry and new jobs.

Keeping our dollars local

Beyond job creation, a shift away from fossil fuels such as coal, petroleum and natural gas can have substantial indirect economic benefits. Because Oregon has almost no fossil fuel resources, dollars spent on extraction of these energy sources contribute little to the local economy. By redirecting energy dollars to pay for efficiency improvements and non-fossil fuel energy, businesses and residents will spend more money locally on labor and materials, expanding markets for locally produced products and services.

Close coordination between the region's land use and transportation policies has proven this kind of economic benefit potential. Compact growth has enabled Portland area residents to drive less than residents of other American cities, saving more than $1 billion each year in transportation costs (Cortright, 2007). A substantial portion of these saved dollars are spent in the local economy where they have economic multiplier effects, rather than flowing to largely nonlocal energy companies.

Dramatically expanded emissions reduction efforts can generate a similar positive economic effect. By aligning supply-side economic development strategies with demand-side carbon reduction efforts, the Portland region is poised to create local jobs while achieving its climate-protection goals.

By aligning supply-side economic development strategies with demand-side carbon reduction efforts, the Portland region is poised to create local jobs while achieving its climate-protection goals.

Diversity matters

Creating a just, fair and inclusive community in which everyone can participate and prosper will pay big dividends. Equity is not only a matter of social justice; it is an economic necessity (PolicyLink, 2011). Building on the capabilities of Portland's low-income populations and communities of color is a value proposition that will benefit the entire community. In fact, companies with the most racial and ethnic diversity are 35 percent more likely to have financial returns above their respective national industry medians. Conversely, companies in the bottom quartile both for gender and for ethnicity and race are lagging financially (McKinsey & Company, 2015).

Actions that have a high potential to support jobs and prosperity are noted in the with a "DOLLAR" icon (see page 56).

ENVIRONMENTAL QUALITY

The natural environment — trees, rivers and streams, fish and wildlife and the larger ecosystems of which they, and we humans, are a part — can benefit greatly from actions to reduce carbon emissions and prepare for the impacts of climate change. Strategies that minimize the severity of climate changes, or cause them to occur more gradually, can alleviate stress on natural resources and wildlife, or allow them to adapt to changes over time. This in turn will help protect and improve public health and safety, make native species more resilient to pests, disease and weather changes, and help preserve biodiversity.

Actions that encourage compact urban development patterns and limit sprawl can protect natural resources outside the urban area from development. At the same time, strategies that preserve and enhance sensitive natural resources inside the city, like forests and wetlands, can protect important wildlife habitat and help maintain ecosystem functions. Preserving the health of these ecosystems can also make them less susceptible to natural disasters, like wildfires or landslides, or allow them to recover naturally after a disaster occurs.

Delivering ecosystem services

Ensuring the health of natural green infrastructure — such as networks of streams, rivers, trees and vegetation — help these systems provide important ecosystem services such as:

- Managing stormwater.
- Providing habitat.
- Improving air and water quality.
- Reducing flooding risk.
- Providing areas for human recreation and respite.
- Improving resilience to climate change impacts.

Actions that offer significant improvement in local environmental quality are noted in the with a "TREE" icon (see page 56).

Trees, rivers and wetlands build resilience to climate change impacts and help sequester carbon

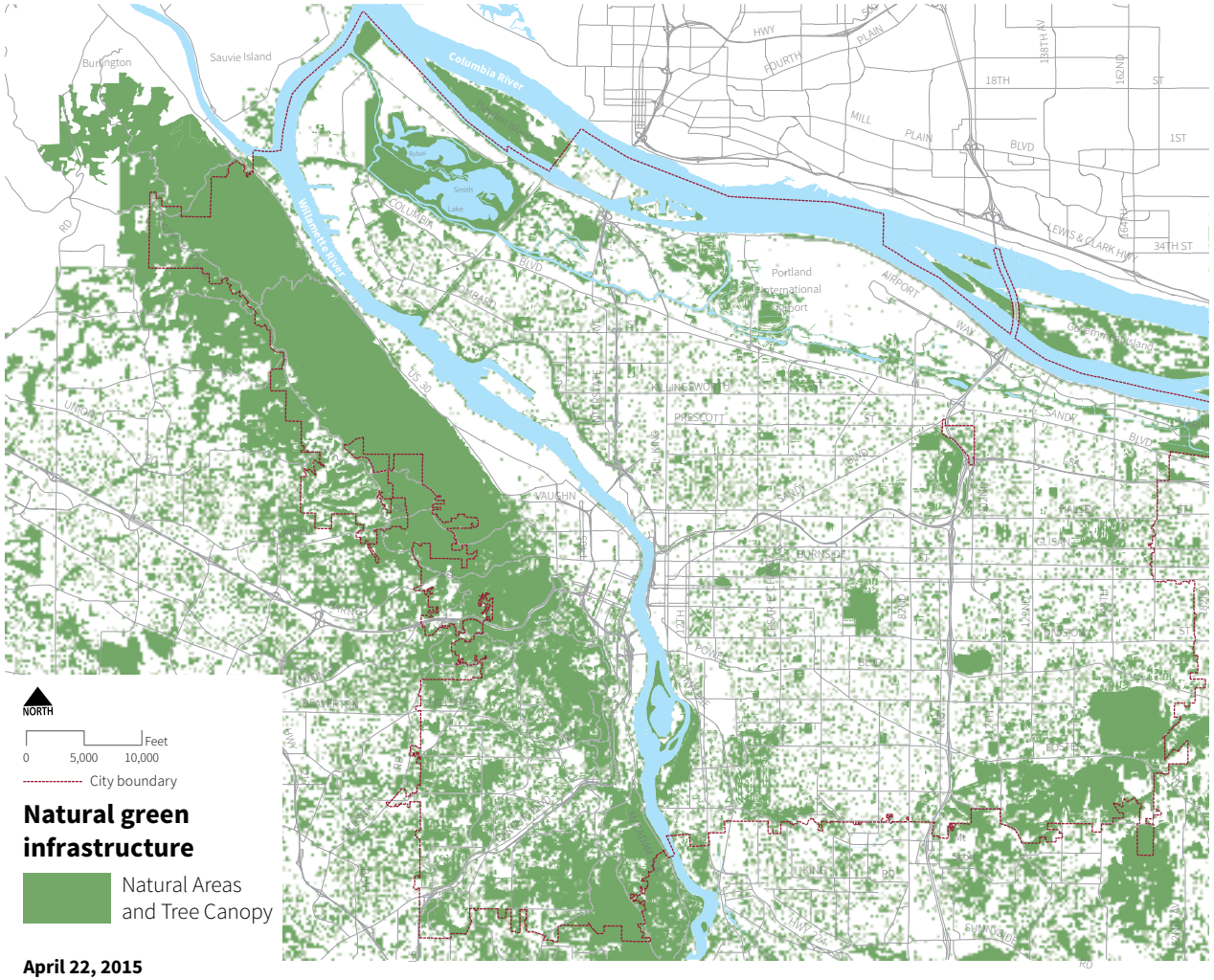
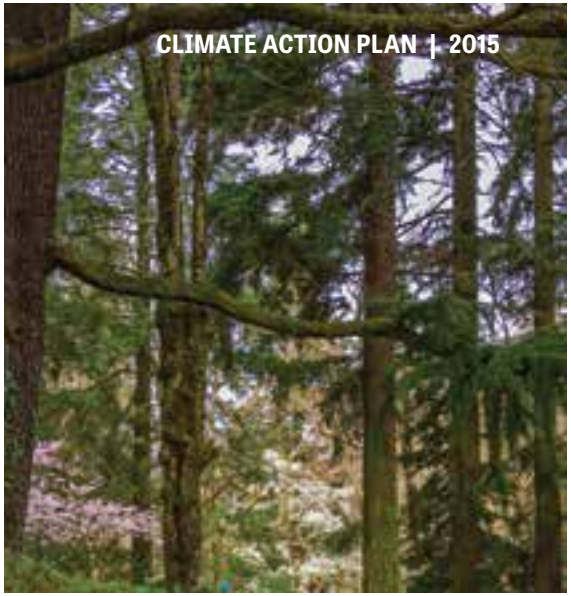


Figure 23. Natural resource areas. *Source: Portland Bureau of Planning and Sustainability*

Strategies that preserve and enhance trees and natural areas both inside and outside of the city protect important wildlife habitat, support ecosystem functions and help cool and clean the urban environment.



OBJECTIVES AND ACTIONS

To put Portland and Multnomah County on track to reach the 2050 goal of an 80 percent reduction in carbon emissions, this document details 20 specific objectives and related actions to achieve the interim goal of a 40 percent reduction in emissions by 2030.

The objectives and associated actions are grouped into the following categories:

- BUILDINGS AND ENERGY
- URBAN FORM AND TRANSPORTATION
- CONSUMPTION AND SOLID WASTE
- FOOD AND AGRICULTURE
- URBAN FOREST, NATURAL SYSTEMS AND CARBON SEQUESTRATION
- CLIMATE CHANGE PREPARATION
- COMMUNITY ENGAGEMENT, OUTREACH AND EDUCATION
- LOCAL GOVERNMENT OPERATIONS
- IMPLEMENTATION

POTENTIAL CARBON IMPACT

The carbon-reduction potential of actions has been noted with the icons below. These estimates represent the approximate magnitude of the carbon reduction if fully implemented.

C C C C	**Reduces total annual carbon emissions by more than 8,000 metric tons**
C C C	**Reduces total annual carbon emissions by 2,500 to 8,000 metric tons**
C C	**Reduces total annual carbon emissions by 800 to 2,500 metric tons**
C	**Reduces total annual carbon emissions by less than 800 metric tons or lays the foundation for other efforts, though by itself may not reduce emissions measurably**

CO-BENEFITS

Nearly all of the actions contained in this *Climate Action Plan* support the co-benefits of prosperity, equity, environmental quality and health, either directly or indirectly.

The icons below indicate the actions with the highest potential for significant, direct benefits to local conditions in Portland and Multnomah County. For example, the health icon is shown for transportation actions that would also reduce local toxic air pollutants and improve air quality, but the health co-benefit icon is not marked for actions to reduce coal-fired electricity because those health benefits would be experienced outside of Multnomah County.

- $ **High potential to support jobs and prosperity**
- E **High potential to advance equity**
- **High potential to improve local environmental quality**
- **High potential to improve health**

LEAD AGENCY

To assist with implementation and accountability, lead City bureaus and County departments are identified. The lead agency(s) is the primary entity responsible for initiating the implementation of the action and reporting on progress. Successful implementation will often require collaboration and coordination with other bureaus/departments as well as public and private-sector partners.

City acronyms
BDS = Bureau of Development Services
BES = Bureau of Environmental Services
BPS = Bureau of Planning and Sustainability
OGR = Office of Government Relations
OMF = Office of Management and Finance
PBEM = Portland Bureau of Emergency Management
PBOT = Bureau of Transportation
PDC = Portland Development Commission
PP&R = Portland Parks and Recreation
Water = Portland Water Bureau

County acronyms
DCA = Department of County Assets
DCHS = Department of County Human Services
DCJ = Department of Community Justice
DCM = Department of County Management
DCS = Department of Community Services
HD = Health Department
MCEM = Multnomah County Office of Emergency Management
MCSO = Sheriff's Office
OS = Multnomah County Office of Sustainability

TERMINOLOGY

In this document, "plan" refers to the entire climate protection and preparation effort. Carbon emissions reductions — 80 percent by 2050 and 40 percent by 2030 — are goals. Objectives are specific means of achieving the 2030 interim goal. Actions are detailed steps to be taken in the next five years (i.e., by the end of 2019). This plan thus refers to a 2050 goal, 2030 objectives and five-year actions.

"Plan"	=	**The entire climate protection and preparation effort**
"Goals"	=	**Carbon emissions reductions — 80 percent by 2050 and 40 percent by 2030**
"Objectives"	=	**Specific means of achieving the 2030 interim goal**
"Actions"	=	**Detailed steps to be taken in the next five years**

IMPLEMENTATION TIMEFRAME

- **Near-term** = Plan adoption to June 2016
- **Mid-term** = 2016 to 2018
- **Long-term** = 2019 and beyond
- **Existing and/or ongoing** = currently underway
- **Uncertain** = depends on funding or other factors

BUILDINGS AND ENERGY

Buildings are the single largest contributor to carbon emissions in Multnomah County, accounting for nearly half of all sector-based emissions. Reducing carbon emissions from building energy use requires two changes:

- Improving energy efficiency.
- Reducing the carbon intensity of energy supplies, primarily by increasing renewable sources of electricity such as solar and wind power.

Fossil fuels still dominate the electricity generation mix

Unlike the municipal utilities of Seattle, Tacoma, and Eugene, which get nearly all of their power from zero-carbon sources, Portland's electric utilities rely primarily on coal- and natural-gas fired power plants. Two-thirds of the electricity that serves Multnomah County is generated from coal and natural gas (see Figure 23).

Despite gains in wind and solar generation since 2009, renewable energy accounts for a small percentage of overall electricity generation for Multnomah County. Wind energy is the predominant renewable energy resource locally, as shown in Figure 23. Although more than 2,000 solar energy systems have been installed since 2009, solar still accounts for less than one percent of Multnomah County's electricity generation mix. There is huge potential for renewable energy resources regionally.

Policy choices affect carbon emissions

Portland and Multnomah County work closely with an extensive set of organizations, public agencies and businesses that are advancing energy efficiency and renewable energy. These organizations include Energy Trust of Oregon, Northwest Energy Efficiency Alliance, Oregon Department of Energy, Clean Energy Works, NW Natural, Earth Advantage, Portland General Electric and Pacific Power.

Our power isn't as green as we think it is

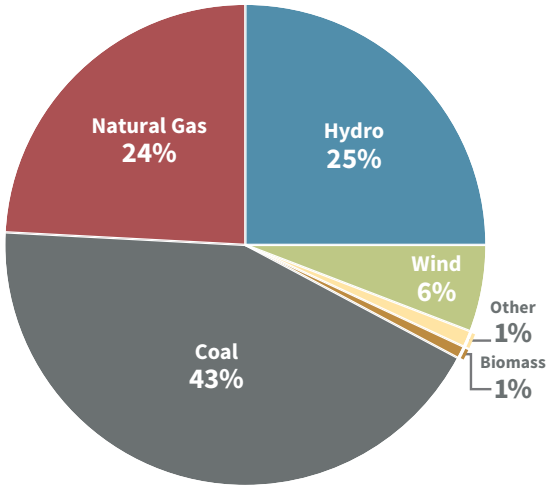


Figure 24. Weighted average of electricity fuel sources for Multnomah County (2010–2012). *Source: Portland Bureau of Planning and Sustainability*

Despite substantial hydropower in the Pacific Northwest, two-thirds of the electricity that serves Multnomah County is generated from coal and natural gas.

Among these partners, the City and County have several unique roles to play. Local governments:

- Set forward-looking vision and call attention to policy priorities and requirements.
- Have extensive relationships and communicate routinely with businesses and residents.
- Can lead by example.

Promising new policies that could advance efforts to reduce energy use in buildings are identified in this plan.

Carbon pricing

When we increase the price of something, we generally use less of it. Putting a price on carbon has been shown to reduce emissions in the places where it has been tried. British Columbia, Canada and the state of California both have some form of carbon pricing.

There are many considerations for carbon pricing, including:

- Which fuels and sectors are included?
- How can regressive impacts for low-income populations be prevented?
- What should the pricing mechanism be (for example, a tax or a cap-and-trade system)?
- What price should be placed on carbon?
- What are the economic impacts on energy-intensive industries and businesses?

A 2014 analysis prepared for the Oregon legislature concluded that a state carbon tax would have very small net economic impacts while reducing carbon emissions (State of Oregon Legislative Revenue Office, 2014). If the state does not move forward with a carbon price, Action 1H calls for the City and County to consider local adoption of a carbon pricing mechanism.

Building performance ratings and transparency

Energy performance ratings are tools that standardize and score how efficiently homes and other buildings use energy. Making a building's rating transparent to prospective buyers and tenants can help the real estate market more accurately value energy efficiency in buildings. Actions 1A and 1B propose energy rating requirements for commercial buildings and homes. Portland is joining 12 cities and two states that have similar building energy performance transparency requirements including Washington, D.C.; Austin; San Francisco; Berkeley; Seattle; New York City; Chicago; Boston; Cambridge; Minneapolis; Philadelphia; California and Washington State. As part of policy development, the City will explore building size thresholds, technical assistance opportunities and reporting options.

ENERGY PERFORMANCE TRACKING AND TRANSPARENCY MAKE ENERGY EFFICIENCY MORE VISIBLE

Tracking energy performance annually helps building owners and operators identify the best opportunities to improve environmental performance, especially for multi-tenant buildings where utility data is not easily accessible. Approximately 100 commercial building owners in Multnomah County currently track their energy performance using Energy Star Portfolio Manager, a free tool provided by the U.S. Environmental Protection Agency (EPA) that scores energy performance between 1 and 100.

EPA's initial analysis of annual energy performance tracking with Portfolio Manager suggests these practices result in average energy savings of seven percent over three years (EPA, 2012). It also helps the City and County connect owners to resources that can help them save energy.

The 2009 *Climate Action Plan* included an action to require energy performance tracking for all commercial and multifamily buildings. To understand the barriers and opportunities related to widespread adoption of energy tracking, the City joined the Building Owners and Managers Association, Northwest Energy Efficiency Alliance, Energy Trust of Oregon, Portland Development Commission, Better Bricks and Clark Public Utilities in a Building Performance Partnership.

ENERGY STAR® PortfolioManager®

Together they recruited buildings to participate in the Kilowatt Crackdown, a free competition that challenged building owners and managers in the Portland region to save energy and reduce operating expenses.

Kilowatt Crackdown provided building owners and tenants assistance in tracking energy use with Energy Star Portfolio Manager, analyzing opportunities for savings and identifying action items to improve building performance. Sixty-four buildings totaling almost 15 million square feet took part in the contest, which recognized participants and winners in May 2014. An initial analysis found that participants reduced natural gas use by an average of 7.5 percent and electricity use by 2.5 percent.

While these efforts are commendable, the voluntary program enrolled only 25 percent of Portland's office space. Because the potential for energy savings in the commercial building sector is much greater, one of the actions in this *Climate Action Plan* requires major office buildings to track energy use and report performance to the City of Portland on an annual basis.

Renewable energy

Programs like Solar Now! and Solarize Portland built demand, reduced costs and provided technical assistance to install solar. At the same time, the City and County's improved permitting, zoning and land-use practices reduce barriers for consumers. However, installations of rooftop solar have declined over the past few years, as Figure 25 shows.

Substantially growing the market for solar by 2019 will require:

- Policy changes to remove barriers to market entry for new participants and allow new business models, such as community solar (see page 69), to emerge.
- Renewed marketing and outreach in collaboration with partners like Energy Trust of Oregon, Solar Oregon and others.
- Continued focus on reducing soft costs, like permitting and inter-connection fees.

Reaching a peak in 2010, rooftop solar installations have declined over the past few years

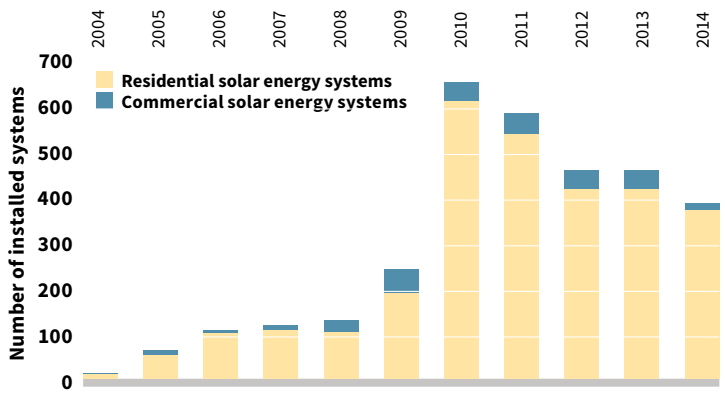


Figure 25. Solar energy systems installed annually (2004–2014). *Source: Energy Trust of Oregon, Oregon Public Utility Commission*

The loss of important incentives for solar has resulted in fewer installations in recent years.

Portland reduced barriers to solar installation

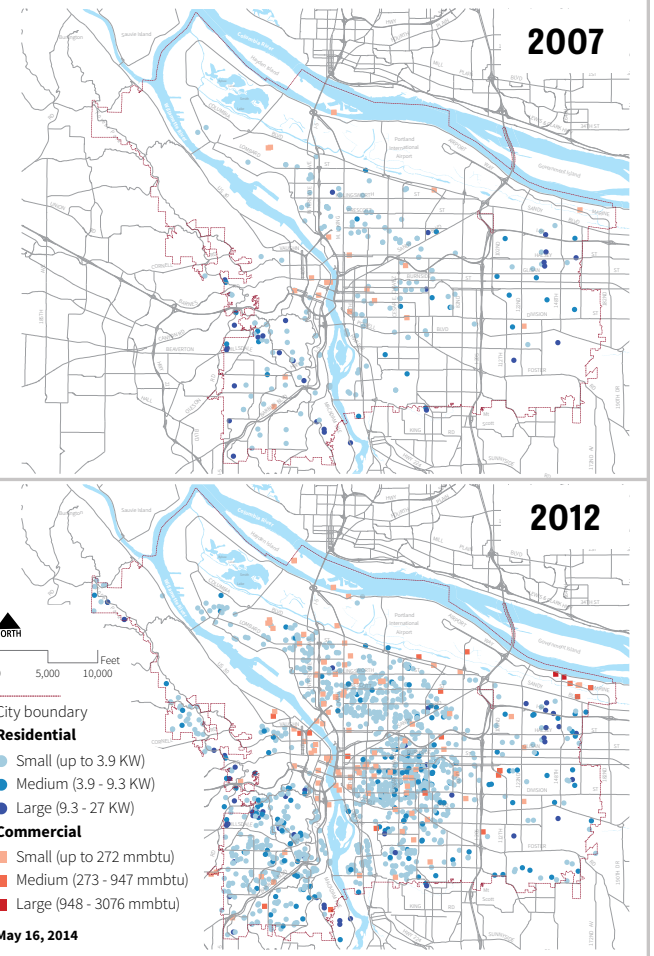


Figure 26. Portland rooftop solar from 2007–2012. *Source: Portland Bureau of Planning and Sustainability*

Comparison of solar installations in 2007 and 2012 illustrates the dramatic increase of rooftop solar in Portland.

Clean energy programs should benefit households vulnerable to cost burdens

Making homes and buildings more efficient and able to produce their own energy onsite are critical actions for reducing carbon emissions. Energy efficiency and renewable energy contribute to:

- Less air pollution.
- Better respiratory health.
- Lower energy costs for households and businesses.
- More dollars reinvested in the local economy.

However, if not carefully designed, energy efficiency and renewable energy programs may fail to serve low-income households.

Energy costs are part of housing costs, which disproportionately burden lower income households. “Housing burden” is often understood to mean households spending 30 percent or more of their income on housing costs.

Currently, people of color are more likely to suffer from housing burden than White households. About 36 percent of White households experience housing burden compared to 54 percent of Black households and 50 percent of Hispanic households (Greater Portland Pulse, 2013, based on American Community Survey data from 2006–2010).

The costs to provide energy for heating, lighting and appliances are strongly influenced by the efficiency of homes and apartments. Many low-income families live in less-efficient buildings with outdated heating systems and appliances.

Data on energy costs borne specifically by low-income households in Multnomah County are not publicly available. However, when looking at the proportion of income spent on home energy costs, low-income households may pay up to three times as much as median-income households.

If investments are made in energy efficiency and renewable energy, the City and County need to ensure that those investments do not have unintended negative consequences for tenants such as higher rental rates.

CULLY WEATHERIZATION 2.0 PROJECT

Living Cully — together with Clean Energy Works, the County, City and other partners — is working to weatherize single-family homes in the Cully neighborhood. This project is advancing the benefits of carbon reduction, energy savings, workforce development and positive health outcomes. Cully Weatherization 2.0 supports neighborhood stabilization efforts by helping to mitigate displacement through addressing critical home repairs and weatherization for low- to moderate-income homeowners.

This project has a specific focus on achieving equity goals by working with firms owned by women and people of color and by prioritizing services to homeowners of color. Diverse stakeholders are working collectively to leverage resources and make implementation processes more efficient in order to expand the number of retrofits completed.

Cully Weatherization 2.0 builds off of the success of the Changing the Climate in Cully project (2010), and seeks to:

- **Weatherize 100 homes in the Cully neighborhood, helping to reduce carbon emissions, improve energy efficiency and save homeowners money.**
- **Create economic opportunity, with 50 percent of the project revenues going to companies owned by people of color and women.**
- **Support community wealth building through training and living wages, particularly for people of color and women.**
- **Help mitigate displacement for Cully residents through quality home improvements and weatherization.**
- **Achieve positive health outcomes for families resulting from completed home retrofits and home improvements.**

The project has successfully served low-income homeowners (100 percent), homeowners of color (over 40 percent) and older adults (70 percent), and half of the total revenues have been earned by companies owned by women and people of color (as of April 2015).

Project partners are looking to replicate this service delivery approach in other under-served and under-represented neighborhoods throughout the region.

To ensure that energy efficiency upgrades do not result in increased cost burden to low-income populations and communities of color that are already under financial stress, programs must be designed with this in mind. The impacts on and benefits to these communities will be explicitly addressed in program design and implementation of the *Climate Action Plan*. Approaches include:

- Targeted energy upgrades, or those that focus limited investment dollars on the most cost-effective measures first, that help neutralize the cost burden of energy retrofits for income-qualified buildings or homes.
- Increased incentives for income-qualified households. Energy Trust's Savings Within Reach program is an effective example of this approach.
- Programs like MPower Oregon (www.mpoweroregon.com) that enable owners of affordable multifamily housing properties to access unsecured financing and to share energy savings benefits with tenants, some of whom are among the most vulnerable residents of Multnomah County.
- Green lease mechanisms that enable a fair proportion of costs and benefits to be allocated to both tenants and landlords. The City and County can help educate property owners and managers about emerging financing and leasing tools.

Programs should reach deeper into communities

Opportunities for low-income populations and communities of color to participate in energy efficiency and renewable energy programs must be expanded and enhanced. This not only impacts how energy efficiency and renewable energy programs are designed, but in how they are communicated and marketed. For example, currently, program messages may not ever reach immigrant and refugee communities or communities of color.

Designing equitable and inclusive clean energy programs requires the thoughtful involvement of and coordination with diverse partner agencies and stakeholders. The pursuit of efficiency and renewables in meeting climate objectives should benefit, not burden low-income populations and communities of color. Effective strategies exist to share the employment, environmental and economic benefits of infrastructure investments with all residents of Multnomah County.

BUILDINGS AND ENERGY

2030 OBJECTIVE 1 Reduce the total energy use of all buildings built before 2010 by 25 percent.

Because buildings last for many decades, more than half of the buildings that will exist in 2050 already exist today. Efforts to reduce emissions from buildings need to address both existing structures and new construction.

From 2008 to 2013, total energy use in residential and commercial buildings decreased by four percent, due both to new programs like Clean Energy Works and the Kilowatt Crackdown and to the Energy Trust's foundational programs.

This progress is encouraging, but existing programs and policies alone are unlikely to achieve the 25 percent reduction. The actions described below will support, enhance and accelerate building energy efficiency programs through partnerships and policy.

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
1A	**Commercial Energy Performance Benchmarking —** Implement energy performance tracking and annual reporting program for commercial buildings and explore options for multifamily buildings. Support improved access to utility data for building owners and managers seeking to improve energy and water performance.	C C C C $ E	**City:** BPS	Near-term
1B	**Residential Energy Performance Ratings —** Require energy performance ratings for all homes so that owners, tenants and prospective buyers can make informed decisions about energy costs and carbon emissions.	C C C C $ E	**City:** BPS	Mid-term
1C	**Energy Partnerships —** Establish long-term partnerships to coordinate equitable access to energy-efficiency resources, incentives, assistance, financing, outreach, education and other tools to residents and businesses. Support neighborhood efforts, including ecodistricts, to improve energy performance of buildings.	C C C C $ E	**City:** BPS **County:** OS	Existing and/or ongoing
1D	**Operations and Maintenance —** Work with partner organizations to promote building retro-commissioning and operation and maintenance practices that improve affordability, comfort, indoor air quality and energy efficiency in all commercial and multifamily buildings.	C C C C $ E	**City:** BPS **County:** OS	Mid-term
1E	**Funding —** Establish a clean energy fund to invest in energy efficiency and renewable energy projects. Develop and expand financing tools such as Clean Energy Works and commercial Property Assessed Clean Energy that are broadly accessible to households and building owners, including rental properties, throughout the community. Remove financial barriers to building retrofits, including limiting property tax increases due to completed energy projects.	C C C C $ E	**City:** BPS, PDC **County:** OS	Near-term

Potential impact

- C C C C — Magnitude of carbon emissions reduction
- $ — High potential to support jobs and prosperity
- E — High potential to advance equity
- High potential to improve local environmental quality
- High potential to improve health

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
1F	**Residential Retrofits —** Partner with Clean Energy Works, Energy Trust of Oregon, utilities and contractors to retrofit 1,000 homes and improve the efficiency of 1,000 multifamily units per year. Establish minimum standards for rental housing.	C C C C $ E	**City:** BPS **County:** OS	Existing and/or ongoing
1G	**Small Commercial —** Support energy efficiency improvements to small commercial buildings, especially in under-served communities. Ensure financial tools such as Commercial Property Assessed Clean Energy can be used by small commercial buildings.	C C C C $ E	**City:** BPS **County:** OS	Mid-term
1H	**Carbon Price —** Support a statewide carbon tax or cap to generate new funding for carbon reduction while alleviating regressive impacts. If the state does not adopt a carbon price, consider local adoption of a carbon pricing mechanism. Prioritize local investments that create jobs and benefit low-income populations and communities of color.	C C C C $ E	**City:** BPS	Existing and/or ongoing
1I	**Weatherization Requirement —** Explore removing the City Charter weatherization prohibition to allow requirements for energy efficiency improvements at the time of sale. Consider benefits and address burdens to low-income populations and communities of color in any future requirements.	C C C C $ E	**City:** BPS	Long-term

CLEAN ENERGY WORKS TRANSFORMS THE MARKET FOR HOME PERFORMANCE

Clean Energy Works (CEW) is a nonprofit organization launched by the City of Portland Bureau of Planning and Sustainability that has helped thousands of Oregonians make their homes more energy efficient. CEW makes energy efficiency upgrade projects easy and manageable, connecting homeowners with financing and high-quality contractors. CEW is also a triple-bottom line organization, and economic development and social equity are important to their mission along with energy savings and carbon reduction.

Clean Energy Works results (as of May 2015):

4,200

Upgraded 4,200 homes in Oregon for energy efficiency

Generated $83 Million in economic development

$83,000,000

56%

56% of hours were worked by people of color and women

$6.7 million earned by firms owned by women and people of color

Created 470 jobs that pay living wages and benefits

Saving about 4.4 million kilowatt-hours and 1.17 million therms each year or the equivalent of the total energy used by 850 homes per year

4.4 MILLION kWh 1.17 MILLION THERMS = 850

5,000

Avoiding about 5,000 metric tons of carbon emissions each year

BUILDINGS AND ENERGY

2030 OBJECTIVE 2 Achieve zero net carbon emissions in all new buildings and homes.

The best time to begin addressing building efficiency is in the initial building design stage. Buildings that have been designed and built with performance as a primary goal are capable of significantly outperforming similar, previously built buildings that have been retrofitted for efficiency. Because total emissions from buildings must be reduced by much more than can be accomplished with retrofits alone, it is critical that buildings built after 2030 generate more energy from clean sources than they consume, resulting in a net emissions reduction.

In the last three years, several homebuilders and developers have pioneered the design of net-zero energy projects in the Portland area, and even more have adopted the Architecture 2030 targets into their projects.

Still, few new building construction projects are seeking this high level of performance. The actions below are intended to move new development toward nearly-zero energy building design and ensure that more efficient standards result in actual energy savings.

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
2A	**Oregon Building Code —** Continue participating actively in the process to revise the Oregon building code to incorporate performance that targets net-zero energy by 2030.	C C C C $ E	**City:** BPS	Existing and/or ongoing
2B	**Minimum Performance —** Establish minimum energy performance targets for new construction and major renovations.	C C C C $ E	**City:** BPS	Mid-term
2C	**Net-Zero Energy Projects —** Build market demand for net-zero energy buildings through incentives, education, demonstration projects, partnerships and recognition.	C C C C $ E	**City:** BPS	Near-term
2D	**System Development Charges —** As part of upcoming renewal of systems development charge methodologies, evaluate options that could promote housing affordability, reduce environmental impacts and fund capital projects that meet climate action objectives.	C C C C $ E	**City:** BPS, PBOT, Water, BES, PP&R, BDS	Long-term

Potential impact

- C C C C **Magnitude of carbon emissions reduction**
- $ **High potential to support jobs and prosperity**
- E **High potential to advance equity**
- **High potential to improve local environmental quality**
- **High potential to improve health**

GETTING TO ZERO

Several initiatives in the building industry support low-to-no energy use by maximizing energy-efficient construction techniques, incorporating on-site renewables and reducing occupants' energy use. These certifications and programs include:

- **Passive buildings** — A design and construction approach used to attain super-insulated, virtually air tight buildings primarily heated by solar gain and minimal equipment. The Passive House Institute US (PHIUS) provides a Passive House certification for projects that meet rigorous and quantifiable levels of efficiency.
- **Net-zero/zero-energy and energy positive buildings** — A net-zero or zero-energy building produces as much energy as it consumes, calculated on a net basis for one year. An energy positive building produces more energy than it consumes, sending excess back into the electricity grid.
- **Living Buildings** — A certification developed by the Cascadia Region Green Building Council, part of the International Living Future Institute. To achieve Living Building status, buildings are required to meet a series of performance requirements, including net-zero energy, waste and water, over a minimum of 12 months of continuous occupancy.
- **Architecture 2030** — A nonprofit organization working to reduce fossil fuel consumption in the built environment and promote the development of adaptive, resilient projects that can manage the impacts of climate change. It issued The 2030 Challenge to engage the global architecture and development community to construct carbon-neutral and fossil-fuel free buildings by 2030.

The lower the score, the better

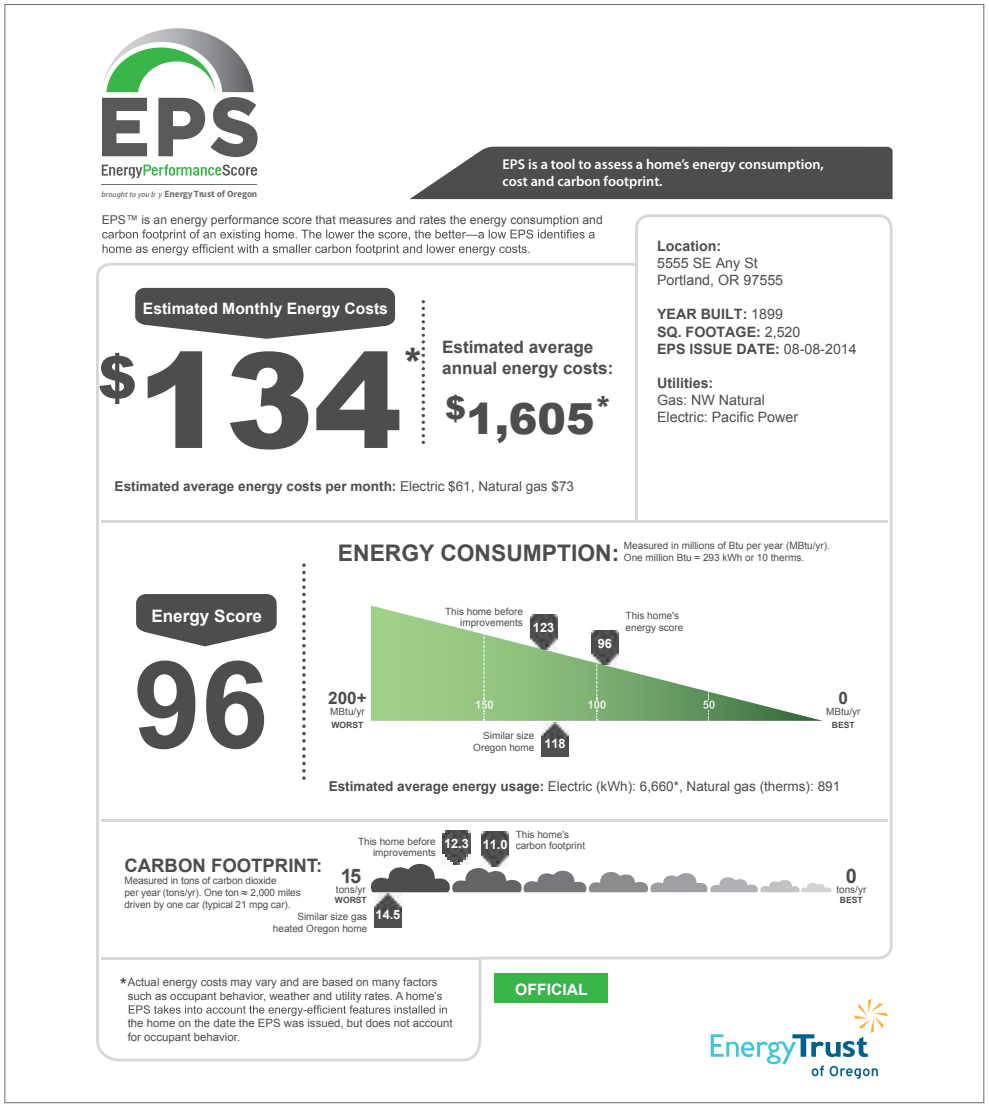


Figure 27. *Energy Performance Score (EPS) highlights energy and carbon use*

This sample residential Energy Performance Score (EPS) is the tool designated by Energy Trust for use in Oregon and considers energy efficiency and renewables.

BUILDINGS AND ENERGY

2030 OBJECTIVE 3

Supply 50 percent of all energy used in buildings from renewable resources, with 10 percent produced within Multnomah County from onsite renewable sources, such as solar.

Oregon law requires that by 2025, 25 percent of all electricity sold by Portland General Electric and Pacific Power in Oregon be generated from new renewable energy sources. Some of these sources will take the form of utility-scale solar and wind farms, often located far from population centers. Neighborhood-scale energy system and distributed generation, like onsite solar, provide an important opportunity for renewable energy generation in an urban setting.

The City and County, along with key partners like US Department of Energy, Energy Trust of Oregon, Oregon Department of Energy and Solar Oregon, have made encouraging strides in transforming the market for solar energy since 2009, adding more than 2,000 systems totaling 10 megawatts of installed capacity.

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
3A	**Electricity Supply —** a) Collaborate with Portland General Electric, Pacific Power, customers and stakeholders to reduce the carbon content in Portland's electricity mix by 3 percent per year. b) Communicate with utilities and the Oregon Public Utility Commission on the critical importance the City and County place on reducing the carbon content of electricity delivered to the City, County and other customers. c) Mitigate potential cost burdens to low-income households principally through efficiency measures that reduce energy use and cost.	C C C C $ E	**City:** BPS **County:** OS	Existing and/or ongoing
3B	**Installed Solar and Solar Access —** Add another 15 megawatts of installed solar photovoltaic capacity. Motivate and assist households and businesses throughout the community to install solar. Revisit City solar access policy and regulations, recognizing changing conditions due to the proliferation of residential rooftop solar energy systems.	C C C C $ E	**City:** BPS **County:** OS	Near-term
3C	**Community Solar —** Support the development of community solar projects that benefit all residents, particularly communities of color and low-income populations.	C C C C $ E	**City:** BPS	Existing and/or ongoing
3D	**Renewable Energy Policy —** Participate in statewide policy discussions to expand the market in Oregon for renewable energy, including solar, wind, geothermal, biogas and biomass, and remove barriers to widespread participation in renewable energy programs like community solar.	C C C C $ E	**City:** BPS **County:** OS	Existing and/or ongoing

Potential impact

- C C C C — Magnitude of carbon emissions reduction
- $ — High potential to support jobs and prosperity
- E — High potential to advance equity
- High potential to improve local environmental quality
- High potential to improve health

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
3E	**Biogas —** Continue to support development of local and regional biogas resources, including anaerobic digestion of food scraps, while minimizing disproportionate impacts on low-income populations and communities of color.	C C C C $ E	**City:** BPS	Existing and/or ongoing
3F	**District Systems —** Continue to support development and expansion of low-carbon district heating and cooling systems.	C C C C $ E	**City:** BPS	Existing and/or ongoing
3G	**Fossil Fuel Exports —** Establish a fossil fuel export policy that considers lifecycle emissions, safety, economics, neighborhood livability and the environment; at the state level, oppose exports of coal and oil through Oregon.	C C C C $ E	**City:** BPS	Near-term

COMMUNITY SOLAR

Community solar represents the next phase of Portland's solar initiatives. Solarize Portland brought rooftop solar to thousands of Portland homeowners, but many more thousands of residents don't have this opportunity. Renters, for example, are typically not able to install solar on their apartment buildings. Other common barriers include shading, roof orientation and financial constraints. Community solar programs recognize these barriers and provide an alternative to on-site solar generation for a broader segment of the population.

In its ideal form, community-shared solar is one larger-scale photovoltaic system that provides power or economic benefits to multiple customers. Unfortunately, current laws and regulations in Oregon do not allow customers to receive a credit on their

electric bill or to receive a financial return on investment from shared clean energy systems. These obstacles must be addressed soon.

The City has experimented with and piloted efforts to kickstart community solar in Portland under current market conditions. Most recently, the Bureau of Planning and Sustainability launched Solar Forward, a donation-based campaign that offers community members a way to engage in the development of solar on public buildings like community centers, schools and libraries. Solar Forward brings together solar supporters and available roof space, relying on crowd-sourcing to fund each system. With support from citizens and philanthropic and business communities, Solar Forward raised enough funds to install three solar electric systems: one at Southwest Community Center, one at Oliver P. Lent Elementary School and one at a community center owned by Hacienda Community Development Corporation.

SOLAR FORWARD
Funding Portland's Local Energy Future
TOGETHER

URBAN FORM AND TRANSPORTATION

Land use planning and transportation policies and investments represent major opportunities for the region to address carbon emissions. Three factors strongly influence carbon emissions from transportation:

- The overall urban form or shape of the community, including where jobs and housing are located, the presence of parks and open spaces and the location of stores and services.
- How people and goods move around (e.g., on foot, by bicycle, bus, car or truck).
- The fuels used to power transit, cars and trucks (e.g., electricity, biofuels, diesel, gasoline).

Transportation of goods and people accounts for nearly 40 percent of Multnomah County carbon emissions. To achieve the 2050 goal of reducing local carbon emissions by 80 percent below 1990 levels, significant transportation-related reductions must be achieved through coordinated land use policies and the development of infrastructure for low-carbon transportation (see Figure 8, page 30).

Carbon emissions from moving goods and people must continue to decline to reach our goal

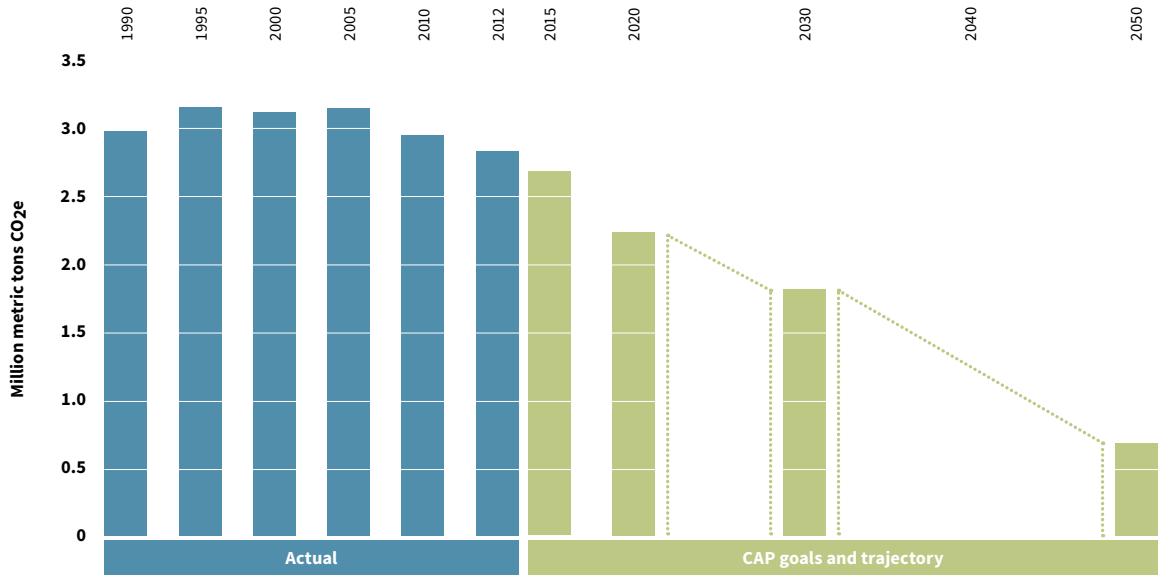


Figure 28. Transportation-related carbon emission and reduction goals trajectory (1990–2050). *Source: Portland Bureau of Planning and Sustainability*

Goals for reducing transportation-related carbon emissions below 1990 levels: 10 percent by 2015, 25 percent by 2020, 40 percent by 2030 and 80 percent by 2050.

Portland's land use plan calls for growth to be concentrated in a network of centers and corridors of different sizes, serving multiple neighborhoods. These "healthy connected neighborhoods" are places that support the health and well-being of residents. In these neighborhoods, people of all ages and abilities have safe and convenient access to more of the goods and services needed in daily life — grocery stores, schools, libraries, parks and gathering places — reachable on foot or by bike (see Figure 29). They are well-connected to jobs and the rest of the city by transit. They have a variety of housing types and prices so households of different sizes and incomes have more options.

Today, more than 60 percent of Portlanders are served by such centers, reducing carbon emissions and keeping money in the local economy that would otherwise be spent on fossil fuels. But this means that 40 percent of Portlanders do not have safe and convenient access to transit, commercial services, jobs, or in many areas, even sidewalks. This is especially critical in East Portland, which is home to many low-income households and a large youth population.

Transportation investments are essential to help maintain or create these centers. As the city grows, it also will be important to rethink the design of streets so they can serve multiple users and can be built in less expensive ways.

Some Portland neighborhoods are more complete than others

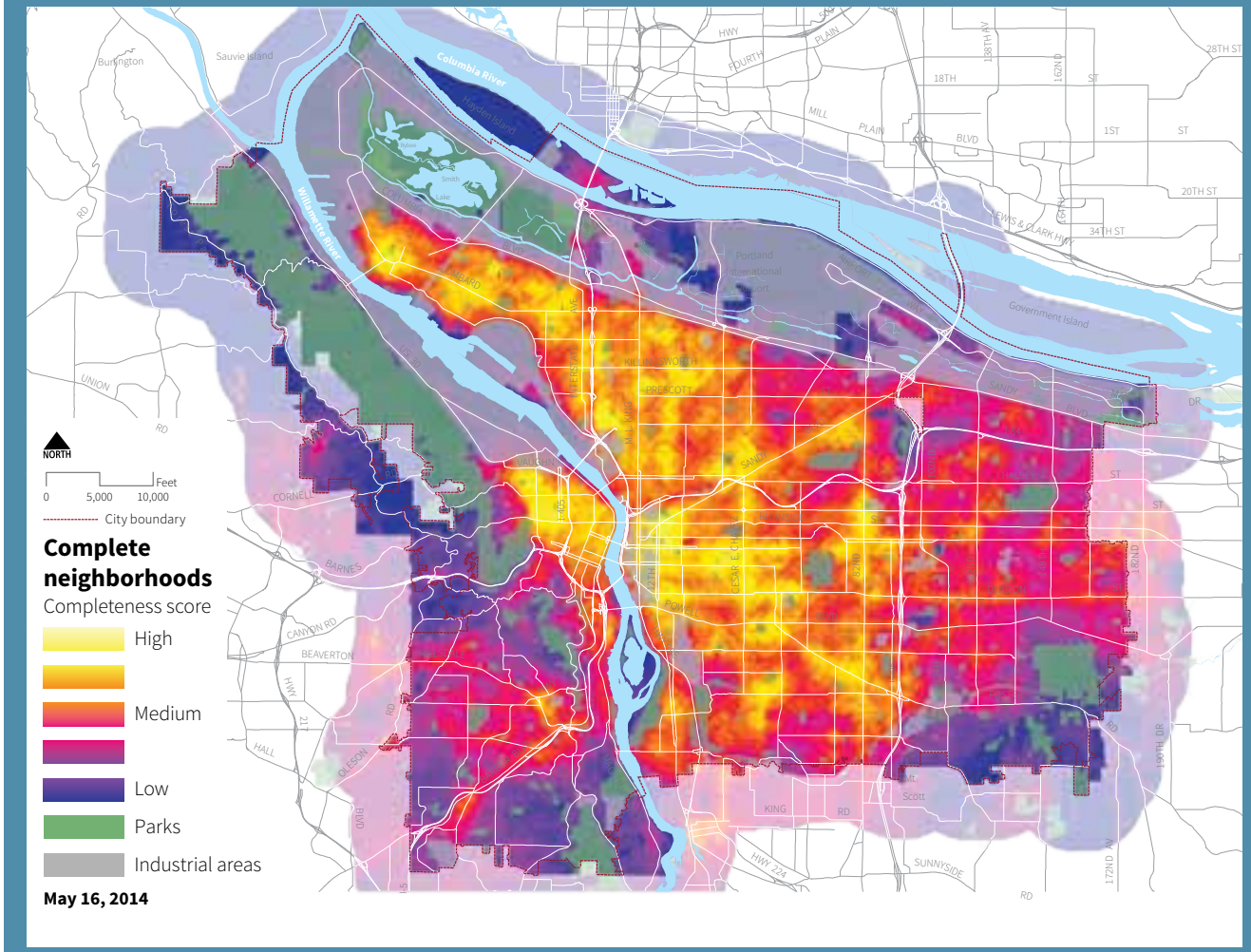


Figure 29. Complete neighborhoods. *Source: Portland Bureau of Planning and Sustainability*

The City developed the 20-minute neighborhood index to measure access to community amenities, products and services. The areas shown in yellow have the highest levels of access to services and amenities. The areas shown in purple have the lowest levels of access.

HEALTHY CONNECTED NEIGHBORHOODS IMPROVE EQUITY AND REDUCE CARBON EMISSIONS

KEY TRANSPORTATION COMPONENTS ARE NEEDED TO CREATE HEALTHY, CONNECTED NEIGHBORHOODS, INCLUDING:

Stable Funding — Portland has strategies for improving transit, bike and pedestrian networks and for preserving and increasing affordable housing options, but funding for these projects is far less than required to implement the plans.

Street and sidewalk construction are most often funded through revenues from the gas tax. However, the gas tax no longer provides enough money to fund adequate street maintenance. New funding mechanisms such as a vehicle miles traveled fee, carbon pricing or a street maintenance fee must be explored. Without a sustainable funding source, it will not be possible to build and maintain needed street improvements.

The State of Oregon does not have a dedicated and stable funding source specifically for transit, bike and pedestrian (multimodal) transportation projects. Creating a multimodal transportation funding source and refocusing state-funded transportation projects in urban areas toward multimodal projects will help improve safety and health, reduce carbon emissions, increase infrastructure equity and reduce traffic, which will help create more room for freight.

State and Regional Planning — In 2009, the Oregon Legislature adopted legislation requiring the Portland metropolitan region to implement a strategy to reduce carbon emissions from transportation to help achieve the region's share of state carbon-reduction goals. Analysis shows that without action the region will fall short of achieving these goals. To meet these goals regional jurisdictions, including Portland and Multnomah County, need to implement adopted plans fully, improve land-use policies and make investments to achieve carbon-reduction goals. Specifically, the Regional Transportation Plan will need to give priority to projects and programs that reduce carbon emissions, reduce fatalities and injuries, and improve health.

City and County Planning — City and County plans for land use and transportation include street specifications and rules for development that have a significant impact on project costs and what development will look like. To succeed at the local level, the City and County need to develop, evaluate and prioritize low-carbon land use and transportation projects and programs, making sure that plans are consistent, complementary and optimized to reduce carbon emissions.

City and County Projects — Today, some neighborhoods in Portland and Multnomah County lack infrastructure to support active transportation such as sidewalks, bikeways and access to transit. For example, some neighborhoods in East Portland lack street connections, paved local streets or complete sidewalks. Often, local street improvements and sidewalks were not required when homes and businesses were built decades ago, when these areas were unincorporated. Even though much of East Portland was annexed into the City of Portland in the 1980s and 1990s, street and sidewalk construction requirements have been inconsistently applied over time. This has resulted in a patchwork of unimproved and improved local streets and sidewalks.

COMPLETING THE TRANSPORTATION NETWORK

East Portland is growing and has a documented lack of the type of development and transportation improvements that support growth of healthy connected neighborhoods. It is also where growth in low-income households and communities of color has increased due to housing cost increases elsewhere. This heightens the need for more significant investments, innovative transportation designs and standards and improvement of the design of new development, especially multifamily development, to serve the residents living there.

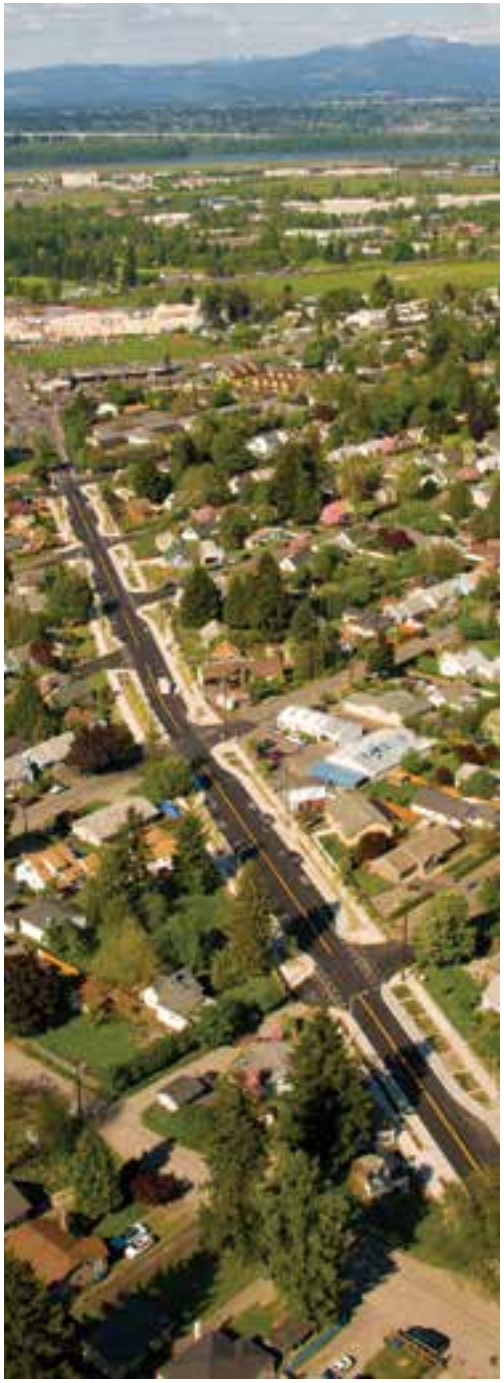
Portland currently has a "one-size-fits-all" street standard that works well in some areas of the city or when constructed as part of a larger development. However, in areas like the buttes in East Portland or in the Southwest hills, steep slopes and drainage concerns make this standard difficult and expensive to construct. The City is already working to resolve this issue through programs like the Residential Street Program and other projects, but additional work will need to be completed.

Portland's inner neighborhoods tend to have ample sidewalks and good bicycle and transit connections. However, new development in these areas is increasing the amount and range of demand for use of this space.

In these inner neighborhoods, action is needed to manage development and parking and ensure that street designs include landscaping and street trees to make sure there are green spaces throughout the city.

Improved safety is a critical component of street design. Data show safety improvements result in increases in walking and bicycling, and an active lifestyle reduces the risk of many chronic diseases such as diabetes and heart disease that disproportionately impact low-income populations and people of color (National Complete Streets Coalition, n.d.; USA.gov, 2014).

Making investments to improve a neighborhood can have many positive outcomes for current residents. However, such investments can also create upward pressure on rents and property values, leading to involuntary displacement. Through the implementation of this *Climate Action Plan* and the updated Portland Comprehensive Plan, the City and County are committed to understanding and minimizing the effects of gentrification in low-income populations and communities of color.



Improving Transportation Options in East Portland

In 2012, City Council adopted East Portland in Motion (EPIM), a five-year implementation strategy for active transportation projects east of 82nd Avenue. Since the strategy's adoption, the City has secured more than $27 million of local funds and grant resources to implement priority projects identified in EPIM. In addition, the Portland Bureau of Transportation recently submitted grant applications for over $10 million in additional funding.

Portlanders' driving has declined ahead of the national trend

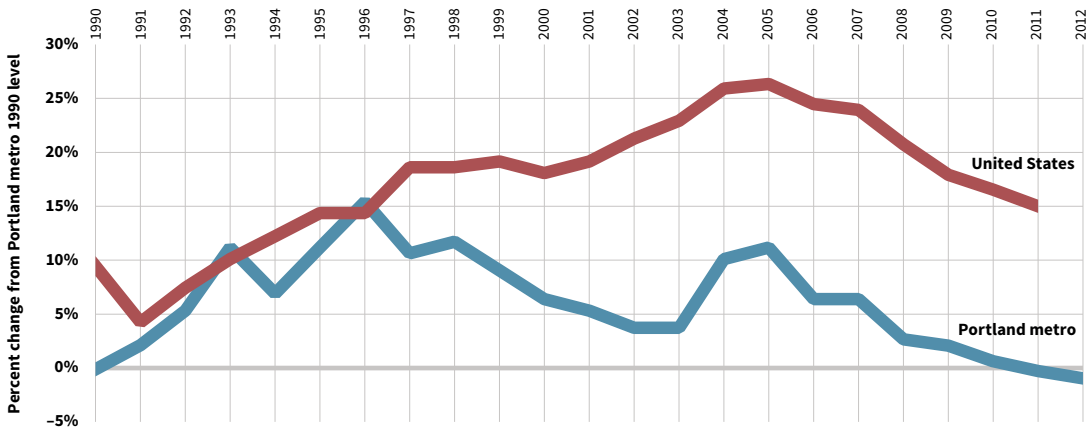


Figure 30. Daily vehicle miles of travel per person (comparing U.S. national average to Portland metro area 1990–2012). *Source: Metro*

The number of miles driven per person in the Portland region has generally declined since the peak in 1996, ahead of the national trend. As of 2012, the average miles driven per person was lower than 1990 levels.

Portland's vision of healthy connected neighborhoods, in part, means walking is the preferred method of travel for trips of one mile or less, and bicycling is the preferred mode for trips up to three miles.

In addition to reducing traffic, investing in transit, pedestrian and bicycle infrastructure provides Portlanders with significant safety, health and economic benefits. Making it easier to walk and bike for typical errands will help reduce pollution, provide everyday opportunities for healthy and stress-reducing activities and reduce the amount of money spent on gas, parking and car maintenance.

Expanding active transportation options is also a fiscally responsible strategy. Population growth is estimated to require new road capacity that is more than 20 times the volume of traffic on Powell Boulevard (Geller, 2013). Aside from the carbon impacts, developing this capacity for cars is costly and likely to degrade neighborhoods. Getting people walking, biking and taking transit will reduce the need for expanded road capacity.

To achieve carbon-reduction goals, the percent of commute trips by walking, biking, and transit will likely need to more than double by 2030.

In the future, significantly more people will need to travel to work and school by taking transit or biking

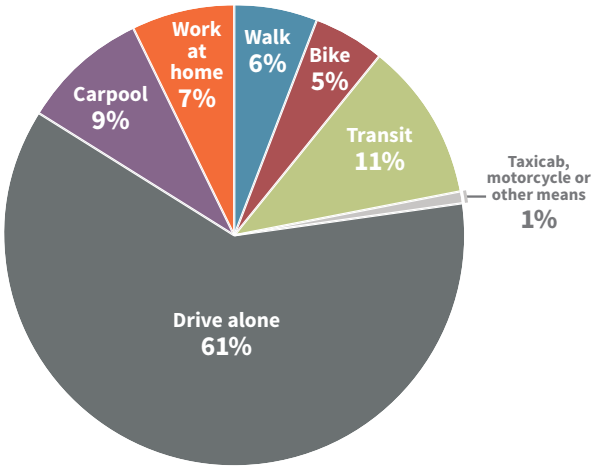


Figure 31. 2012 current work commute mode share for Multnomah County. *Source: American Community Survey*

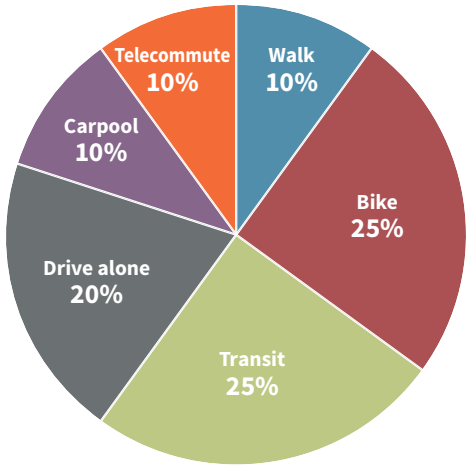


Figure 32. 2030 target work commute mode share for Multnomah County.

Active transportation is travel powered by human energy

Walking, biking and taking transit (which often involves walking) are all means of active transportation. Encouraging active travel means creating seamless networks of accessible trails, sidewalks and bikeways (see Figures 33 and 34). In addition to reducing carbon emissions, active transportation can:

- Help create safer streets.
- Promote a healthy environment.
- Improve local air quality.
- Improve physical fitness.
- Provide equitable access to convenient, affordable transportation options.
- Add vitality to neighborhood business districts.

More bikeways means more bike commuters

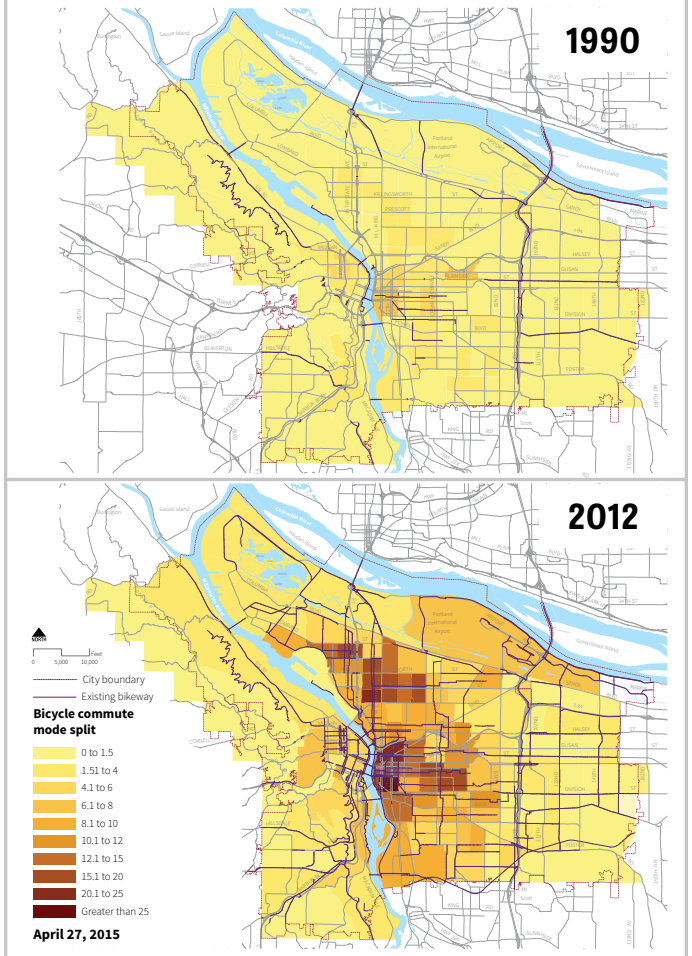


Figure 33. Bicycle commute mode split in 1990 and 2012. *Source: Portland Bureau of Planning and Sustainability*

These maps demonstrate how improving active transportation networks, in this case bicycling infrastructure, can result in shifts in the number of people choosing that transportation option.

URBAN GROWTH AND DENSITY

Integrating higher density land uses with safe active transportation and transit systems is critical in reducing the community's overall carbon emissions.

Investments in additional transit service, bike lanes and sidewalks is not enough. For example, buses often have reduced ridership in low-density single family areas and therefore require additional housing or job density to make transit operations viable. Similarly, high walking and bike mode splits depend on having a certain density of destinations within ¼ miles and 3 miles, respectively.

To achieve climate action goals, Portland must continue to support higher density land uses in downtown, centers and corridors.

New multifamily buildings are less carbon intensive than single family homes as a result of shared interior walls and lower square footage per household (U.S. Energy Information Administration, 2013). Because Portland is already urbanized with limited opportunities for single family residential development, the vast majority — 80 percent — of new housing units are expected to be multifamily units. By 2035 the supply of multifamily housing is expected to grow by 95,000 units, far exceeding the expected single family growth of 26,000 units.

FOCUSING GROWTH AND DENSITY IN CENTERS AND CORRIDORS HELPS MINIMIZE CARBON EMISSIONS

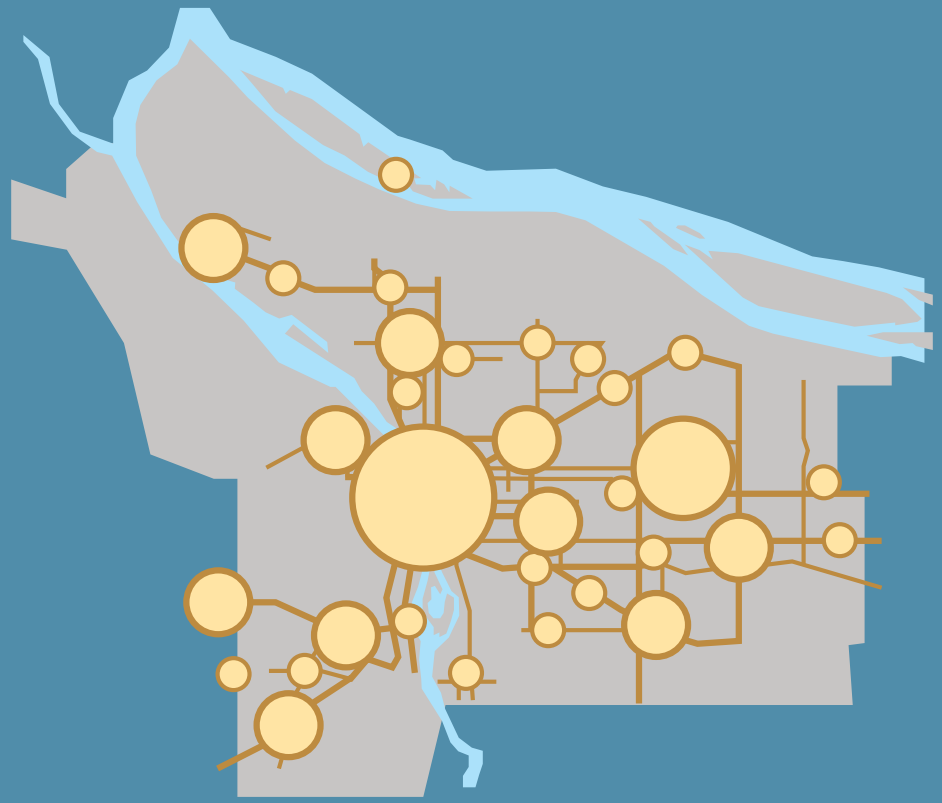


Figure 34. Draft centers and corridors map (See final adopted Comprehensive Plan, expected late 2015 for the official version). *Source: Portland Bureau of Planning and Sustainability*

Concentrating growth and density in areas with access to transit services, bike and pedestrian infrastructure helps to reduce transportation fuel use. Such development patterns have helped reduce total gasoline sales in Multnomah County by 29 percent per person below 1990.

Portland's new Comprehensive Plan and Central City Plan seek to continue this pattern of development. Between now and 2035, 30 percent of the new growth in Portland will be downtown and 50 percent will be in other centers and corridors, increasing density where there is already access to transit, bike and pedestrian infrastructure. However, some neighborhoods face gentrification risks, and growth must be encouraged in ways that also help stabilize communities for existing residents and small businesses.

Visualizing a low-carbon community. From increased tree canopy and rehabilitated buildings to improved safety for walkers, bikers and transit, to bustling neighborhood business districts, these renderings of different Portland neighborhood areas depict opportunities to achieve multiple community objectives — including reduced carbon emissions and improved resilience to climate change impacts.

URBAN FORM AND TRANSPORTATION

2030 OBJECTIVE 4

Create vibrant neighborhoods where 80 percent of Portland and Multnomah County residents can easily walk or bicycle to meet all basic daily, non-work needs and have safe pedestrian or bicycle access to transit. Reduce daily per capita vehicle miles traveled by 30 percent from 2008 levels.

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
	Funding			
4A	**Multimodal Transportation Funding —** Support a new state multimodal transportation funding source for transit, bicycle and pedestrian services and facilities. Advocate for including provisions that prioritize transit and multimodal designs for facilities.	C C C C $ E	**City:** PBOT	Near-term
4B	**State Transportation Funding —** Support adoption of a road usage and fuel efficiency charge as a long-term replacement for declining gas tax revenue.	C C C C $ E	**City:** PBOT	Near-term
4C	**City Transportation Funding —** Establish a stable funding source adequate to maintain the existing transportation system and to invest in transportation capital projects and programs that reduce carbon emissions and improve equity.	C C C C $ E	**City:** PBOT	Existing and/or ongoing
4D	**Youth Transit Pass —** Seek to provide transit passes to all youth, including securing funding for youth transit passes.	C C C C $ E	**City:** PBOT **County:** OS	Existing and/or ongoing

Potential impact

- C C C C — Magnitude of carbon emissions reduction
- $ — High potential to support jobs and prosperity
- E — High potential to advance equity
- High potential to improve local environmental quality
- High potential to improve health

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
	State and Regional Planning and Projects			
4E	**Urban Growth Boundary —** Continue to advocate for growth within the existing Urban Growth Boundary: a) Prioritize elements of the Climate Smart Communities scenarios that have the greatest potential for reducing carbon emissions. b) Give priority to state and local goals for carbon emissions reduction and climate change preparation in the Urban Growth Report and Metro's growth management decisions. c) Maximize benefits and consider impacts to communities of color and low-income populations when making Urban Growth Boundary decisions. d) Protect natural resources and increase access to nature and open space within the Urban Growth Boundary.	C C C C $ E	**City:** BPS **County:** DCS	Existing and/or ongoing
4F	**Orphan Highways —** Work with the Oregon Department of Transportation, legislators and other stakeholders to identify appropriate strategies for orphan highways (e.g., Powell, 82nd Ave., Barbur Blvd., Lombard), including changes in operations, design, management and ownership.	C C C C $ E	**City:** PBOT	Near-term
4G	**2018 Regional Transportation Plan (RTP) —** Prior to the 2018 RTP, work with Metro and other local governments to: a) Establish a method for projecting the lifecycle carbon emissions of land use and transportation investments. Include consideration of embodied energy, operations and maintenance. b) Align regional mode share targets with carbon reduction targets and encourage the development of mode share targets specific to the varying community needs and transit infrastructure around the region.	C C C C $ E	**City:** PBOT, BPS **County:** DCS	Mid-term
4H	**Regional Transportation Demand Model —** Work with Metro to refine the regional travel demand model to improve projections of vehicle demand and non-auto mode share. Utilize forecasting tools and methodologies that identify investments that minimize carbon emissions.	C C C C $ E	**City:** PBOT	Mid-term
4I	**TriMet Service Enhancement Planning —** Participate in TriMet's Service Enhancement planning project by providing technical assistance and detailed knowledge of local community development conditions and needs.	C C C C $ E	**City:** PBOT **County:** DCS	Existing and/or ongoing

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
	City and County Planning			
4J	**Decision Making —** Develop and use a transparent and inclusive decision-making framework designed to achieve climate, equity, safety, health and prosperity goals when making major infrastructure, transportation, land use, community development and project development plan and investment decisions. Consider existing systems, like STARS and MOSAIC, as models.	C C C C $ E	**City:** BPS, PBOT, PP&R, BES, Water **County:** DCS, HD, OS	Uncertain (depends on funding, etc.)
4K	**East County Transportation System Plans —** The County will advocate and provide technical support for including carbon emission reduction, health and equity criteria in local government Transportation System Plans.		**County:** DCS	Existing and/or ongoing
4L	**Portland Transportation System Plan —** In the update of Portland's Transportation System Plan, incorporate: a) Transportation-related carbon reduction and vehicle-miles-traveled reduction targets. b) A policy that supports criteria on climate, equity, economic benefit, health, safety and cost effectiveness for project evaluation, development and funding decisions and for performance monitoring. c) Improved City and regional level of service standards to reflect bicycle, pedestrian and transit needs and urban congestion thresholds.		**City:** PBOT	Existing and/or ongoing
4M	**Citywide Mode Share Targets —** Adopt mode share targets that are consistent across City bureaus and plans and that respond to differing community needs and conditions in Portland's different areas.		**City:** PBOT	Near-term
4N	**Planning Scenario Evaluations —** Include estimates of carbon emissions in evaluations of major planning scenarios, Comprehensive Plan and Transportation System Plan decisions. Partner with Metro and regional jurisdictions to develop modeling tools for evaluating emissions impacts of land use and transportation decisions and monitoring carbon emissions.		**City:** BPS, PBOT	Near-term
4O	**Healthy Connected Neighborhoods —** Continue to support the development of neighborhoods with walkable and bikeable access and connections to services, nature, transit and destinations, locally and across the city, by: a) Implementing the *Portland Plan's* Healthy Connected City strategy. b) Completing a Comprehensive Plan with supportive maps, goals, policies and projects.		**City:** BPS (PBOT, BES, PP&R)	Near-term

Potential impact

- C C C C — Magnitude of carbon emissions reduction
- $ — High potential to support jobs and prosperity
- E — High potential to advance equity
- High potential to improve local environmental quality
- High potential to improve health

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
	City and County Projects and Programs			
4P	**Affordable Housing Access to Transit —** Use regulatory and voluntary tools to promote affordable and accessible housing development along existing and planned high capacity transit lines, frequent transit routes and in opportunity areas identified by the Portland Housing Bureau. a) Identify additional affordable housing opportunities as part of the SW Corridor and Powell-Division high capacity planning projects. b) Evaluate needs for safe, direct bicycle and pedestrian access to transit in areas near affordable housing. c) Support legislation to repeal the State preemption on inclusionary zoning.	C C C C $ E	**City:** BPS, PHB **County:** HD, OS	Mid-term
4Q	**Better Multifamily Buildings —** Improve design and development standards for multifamily buildings and driveways in East Portland to create more pedestrian-friendly environments. This could include landscaping and open space standards, building design and minimum lot size.	C C C C $ E	**City:** BPS	Mid-term
4R	**Active Transportation —** Continue sidewalk and bikeway construction and education projects that promote active transportation.		**City:** PBOT **County:** DCS	Existing and/or ongoing
4S	**Bike Sharing —** Implement a large-scale public bike sharing program to support continued population and employment growth and mobility in the central city and adjacent neighborhoods. Explore opportunities to support bike sharing of cargo bikes.		**City:** PBOT	Near-term
4T	**Bike Facilities —** Invest in a network of protected bike facilities in the central city to support growing bicycle mode share and provide access to key destinations.	C C C C $ E	**City:** PBOT	Near-term
4U	**Separated Bike Facilities —** Explore establishing separated bikeway facilities, particularly on high-traffic streets without the potential for bicycle facilities on parallel streets.		**City:** PBOT	Existing and/or ongoing
4V	**Neighborhood Greenways —** Seek funding to continue building 15 miles per year of neighborhood greenways across Portland.		**City:** PBOT	Existing and/or ongoing

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
4W	**Transit Coverage and Efficiency —** Explore joint projects with TriMet to improve transit efficiency, reliability and service, including frequent service transit to the city's many employment centers, and to prioritize benefits to transit-dependent residents.	C C C C $ E	**City:** PBOT, BPS	Existing and/or ongoing
4X	**Improved Street Connections —** Identify impediments to street and sidewalk connections through private development citywide. Explore options for City-initiated development of connections. Build on research conducted by organizations like the Oregon Public Health Institute.	C C C C $ E	**City:** BPS, PBOT, BDS	Near-term
4Y	**Safe Routes to School —** Continue to support Safe Routes to Schools programs. The County will support the expansion of the Safe Routes to Schools Program in East County school districts by working closely with schools to update and develop action plans and by considering action plan needs when prioritizing capital project lists.	C C C C $ E	**City:** PBOT **County:** DCS	Existing and/or ongoing
4Z	**Street Design —** Adopt context sensitive street design standards for residential streets that make street construction less expensive and more practical, and biking and walking safer, especially in East and SW Portland.	C C C C $ E	**City:** PBOT	Existing and/or ongoing
4AA	**Transportation Demand Management —** Develop and implement comprehensive, culturally appropriate, transportation demand management (TDM) programs and best practices for new transportation capital investments, new development, schools, current and new residents, and employees. a) Integrate TDM standards into Comprehensive Plan code changes for institutional and commercial development. b) Encourage major employers, or groups of employers, with non-office work shifts and that are hard to serve by transit to develop shared van services for employees. c) Promote alternatives to personal vehicle parking, such as car sharing, bike sharing and financial incentives to reduce car ownership. d) Make data available to improve real-time information about transportation options.	C C C C $ E	**City:** PBOT **County:** DCS	Near-term
4BB	**Portland Parking Strategy —** Link parking requirements to mode share targets. Develop parking management policies and programs, including shared parking, that reduce vehicle miles traveled and promote successful density within centers and along corridors.	C C C C $ E	**City:** PBOT	Near-term
4CC	**County Bridges —** Identify opportunities for expanding pedestrian, bicycle and other multimodal transportation options on Willamette River bridges: a) Complete Greenroads certification for the Sellwood Bridge project and engage the community and industry peers on sustainability innovations and achievements on the project. b) Implement a strategy for reducing unnecessary idling during Willamette River bridge lifts.	C C C C $ E	**County:** DCS	Mid-term

Potential impact

- C C C C **Magnitude of carbon emissions reduction**
- $ **High potential to support jobs and prosperity**
- E **High potential to advance equity**
- **High potential to improve local environmental quality**
- **High potential to improve health**

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
4DD	**Car Sharing —** Partner with car sharing companies to increase access to vehicles, including electric vehicles, to all communities. Consider programs to expand use of car sharing among low-income households.	C C C C $ E	**City:** PBOT	Mid-term
4EE	**Brownfield Remediation —** Increase public investment and establish approaches to overcome financial gaps of brownfield redevelopment and strive for cleanup and redevelopment on 60 percent or more of brownfield acreage in Portland by 2035. Use health and equity criteria to inform site prioritization. Support community-led brownfield redevelopment proposals.	C C C C $ E	**City:** BES, BPS **County:** OS	Existing and/or ongoing
4FF	**Regional Rail —** Work with regional partners to continue to advocate for high speed rail, and collaborate and participate in alignment planning to improve regional connections to Seattle and Vancouver B.C. to the north and to Salem and Eugene to the south.	C C C C $ E	**City:** PBOT	Existing and/or ongoing

URBAN FORM AND TRANSPORTATION

2030 OBJECTIVE 5 Improve the efficiency of freight movement within and through the Portland metropolitan area.

One of the challenges of an increasingly dense urban area will be delivering groceries, clothing, office supplies and online products to consumers while locally manufactured products need to be shipped out. Not only will the amount of freight movement increase, but the community prefers that it move with less noise, parking needs and pollution. Accommodating freight movement requires ongoing partnerships among the business community, logistics industry, local governments and community interests.

Central to the efficiency of the freight system is the location of industrial areas and the integration with the regional transportation system. The Portland area is a major freight hub, with strong shipping, rail, barge and highway interconnections. Minimizing emissions from freight movement requires protecting these facilities and continuing to connect them to the transportation system.

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
5A	**Freight Facilities —** Protect existing intermodal freight facilities (rail, port, airport connections, etc.). Support centrally located and regionally significant industrial areas that may provide for future intermodal facilities and also enable efficient local deliveries.	C C C C $ E	**City:** BPS	Existing and/or ongoing
5B	**Freight Movement —** Identify ways to improve freight movement, including: a) Provide systems that inform drivers of existing conditions and route alternatives. b) Collect and share truck trip routing data to identify where operational or infrastructure inefficiencies exist. c) Develop strategies for reducing community impacts from freight and look for ways to balance truck movement needs with those of other transportation modes. d) Improve Portland's transportation system to better meet increased freight and goods movement demand, and recognize the role of goods delivery in supporting healthy, vibrant industrial districts, mixed-use centers and main streets. e) Improve safety for and reduce disproportionate impacts on low-income populations and communities of color.	C C C C $ E	**City:** PBOT	Existing and/or ongoing
5C	**Sustainable Freight —** Implement Portland's Central City Sustainable Freight Strategy, including actions related to truck loading and parking, street design and zoning.	C C C C $ E	**City:** PBOT	Uncertain (depends on funding, etc.)
5D	**Traffic Signals —** Implement truck priority and smart pedestrian crossing technologies at traffic signals on key routes to improve the efficiency and safety of freight movement.	C C C C $ E	**City:** PBOT	Existing and/or ongoing

Potential impact

- C C C C **Magnitude of carbon emissions reduction**
- $ **High potential to support jobs and prosperity**
- E **High potential to advance equity**
- **High potential to improve local environmental quality**
- **High potential to improve health**

CENTRAL CITY SUSTAINABLE FREIGHT STRATEGY

In 2012 the Portland Bureau of Transportation developed the Central City Sustainable Freight Strategy to prioritize actions to improve productivity and reliability while reducing environmental impacts, including emissions and noise. Recommendations from the strategy include:

- Prepare a comprehensive truck loading and parking plan to increase the efficient use of public right-of-way space.
- Develop a best practices street design guide for the safe and efficient movement of delivery vehicles.
- Identify incentives to encourage unattended delivery depots and other “last mile” delivery solutions.
- Apply zoning provisions to allow centralized freight distribution districts to freely operate and to increase industrial-based employment densities.
- Implement an off-hour delivery pilot program for the central city.
- Explore partnership opportunities to provide financial and other incentives to purchase/lease electric and hybrid delivery vehicles and install charging stations.
- Coordinate with City bureaus and outside agencies to develop strategies to increase the use of rail, barge and other multimodal freight options.

URBAN FORM AND TRANSPORTATION

2030 OBJECTIVE 6 Increase the fuel efficiency of passenger vehicles to 40 miles per gallon and manage the road system to minimize emissions.

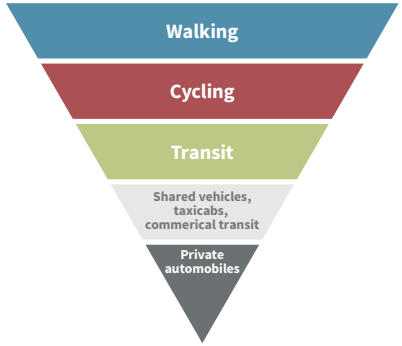
Federal standards require that the average fuel economy of new light-duty vehicles be 35.5 miles per gallon by 2016 and 54.5 miles per gallon in 2025. It is essential to continue to improve fuel efficiency across all vehicle classes and with predictable improvements to reduce uncertainty in markets for emerging technologies. It is equally important for consumers to choose the most efficient vehicle that meets their needs.

Road capacity is very expensive to build and maintain. Much of that capacity is filled with people driving alone, which is the least efficient use of valuable road capacity. Improving the efficiency and reliability of the road system will require fewer drive-alone trips.

Transportation hierarchy for people movement

The City will implement a hierarchy of modes for people movement by making transportation system decisions according to the following prioritization:

1. Walking
2. Cycling
3. Transit
4. Taxi, commercial transit, shared vehicles
5. Other private vehicles



ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
6A	**Federal Fuel Standards —** Support implementation of the federal fuel efficiency standards to achieve 54.5 miles per gallon by 2025 and strengthen standards for medium- and heavy-duty vehicles.	C C C C $ E	**City:** BPS	Existing and/or ongoing
6B	**Intelligent Transportation Systems and Freeway Management —** Explore options for managing freeways at optimum speeds and traffic flows.	C C C C $ E	**City:** PBOT	Near-term
6C	**Mobile Transportation Services —** Support and share information needed to create mobile and desktop applications to compare commute times by mode and route based on real-time traffic data. Encourage opportunities to advertise and alert people to transit options.	C C C C $ E	**City:** BPS	Existing and/or ongoing

Potential impact

- C C C C — Magnitude of carbon emissions reduction
- $ — High potential to support jobs and prosperity
- E — High potential to advance equity
- High potential to improve local environmental quality
- High potential to improve health

URBAN FORM AND TRANSPORTATION

2030 OBJECTIVE 7 Reduce lifecycle carbon emissions of transportation fuels by 20 percent.

Portland's 2007 requirement that all fuel sold in the city contain minimum amounts of biofuels, which have lower carbon emissions compared to fossil fuels, has been a success. Oregon has also supported the increased use of biofuels through the implementation of a statewide renewable fuel standard in 2011.

In 2009, the State of Oregon authorized a statewide low-carbon fuel standard that will take into account lifecycle greenhouse gas emissions. By 2020, the standard will require a 10 percent reduction in greenhouse gas emissions from transportation fuels from 2010 levels.

Electric and natural gas vehicles also provide a key opportunity to reduce the lifecycle carbon emissions of transportation fuels. As of 2015, there were over 5,600 electric vehicles registered in Oregon, with nearly 1,600 of those registered in Multnomah County. Widespread adoption of electric and natural gas vehicles will accelerate carbon emission reductions from the transportation sector.

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
7A	**Electric Vehicles —** Update the City's Electric Vehicle Strategy, with the initial goal of adding 8,000 electric vehicles and plug-in hybrids, and evaluate opportunities to: increase the number of public access fast chargers, address barriers to charging for garage-free homes, install charging infrastructure integrated into streetlights, increase use of electric vehicles in car sharing programs, and support use of electric bikes and buses.	C C C C $ E	**City:** BPS	Existing and/or ongoing
7B	**Expand Electric Car Charging Stations —** Support electric car charging stations in publicly accessible locations. Work with developers, building owners and managers and parking managers to add charging stations and consider electric-vehicle-ready guidelines and codes.	C C C C $ E	**City:** PBOT, BPS	Existing and/or ongoing
7C	**Low-Carbon Fuel Standards —** Advocate for the adoption and implementation of low-carbon fuel standards at the federal and state levels.	C C C C $ E	**City:** BPS **County:** OS	Existing and/or ongoing
7D	**Tar Sands —** Encourage petroleum refineries to provide products that are not sourced from tar sands.	C C C C $ E	**City:** BPS	Mid-term
7E	**Low-Carbon Fueling Infrastructure —** Support the development of low-carbon transportation fueling infrastructure for fleets and the general public.	C C C C $ E	**City:** BPS	Mid-term
7F	**Black Carbon —** Pursue strategies at the local and state level to reduce the climate forcing and air quality impacts from black carbon sources such as diesel engines and wood stoves. Prioritize reducing diesel particulate matter on projects near sensitive populations and that advance environmental justice such as brownfields and Superfund remediation.	C C C C $ E	**County:** OS, HD **City:** BPS	Near-term

CONSUMPTION AND SOLID WASTE

The things we buy matter. Over one-third of local consumption-based carbon emissions (see Figure 13, page 36) come from the food and goods (e.g. clothing, electronics and furniture) that we purchase.

Recycling and composting are helpful steps in reducing carbon emissions associated with the things we buy. These actions reduce disposal emissions, but the majority of carbon emissions are generated before we even purchase the products. Close to 70 percent of the carbon emissions from the food and goods that we buy are associated with producing, transporting and selling of those products (see Figure 35). To achieve carbon reduction goals, individuals, businesses, governments, and other organizations not only need to recycle and compost but also make more sustainable production and purchasing decisions.

While Portlanders are generally good recyclers and composters, many opportunities remain to improve existing solid waste programs. For example, more than 40 percent of all Portland households rent rather than own, and renters often do not benefit from the same access to program information and services as homeowners. Access to and use of recycling and composting programs also tends to be lower for under-served and under-represented communities, particularly linguistically isolated groups.

Identifying and remedying service and access disparities while targeting outreach to renters and households with limited English proficiency can help remove barriers to participation in recycling and waste reduction programs.

Making the goods we use generates the majority of emissions from consumption

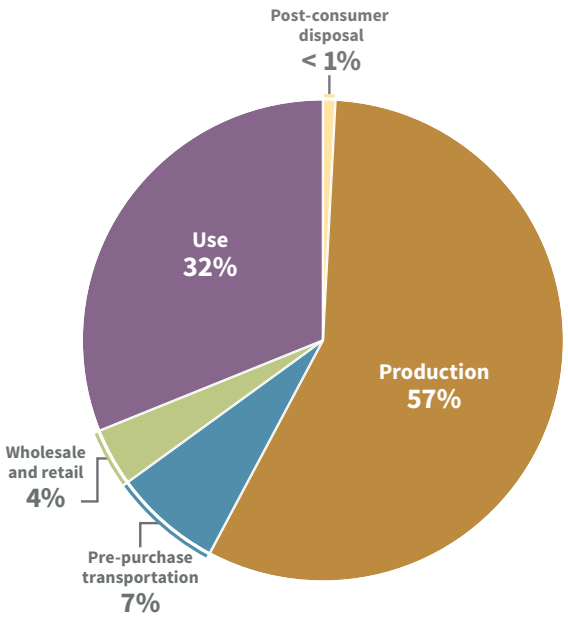


Figure 35. Multnomah County consumption-based carbon emissions by lifecycle phases (2011). *Source: Portland Bureau of Planning and Sustainability*

More than half of all consumption-based carbon emissions are generated during the production phase of the lifecycle. The transportation and sale (wholesale, retail) phase adds an additional 11 percent. On average, 68 percent of a product's lifecycle emissions are generated before a consumer begins to use it.

CONSUMPTION AND SOLID WASTE

2030 OBJECTIVE 8 Reduce consumption-related emissions by encouraging sustainable consumption and supporting Portland businesses in minimizing the carbon intensity of their supply chains.

Portland residents, businesses and other organizations can reduce the upstream carbon emissions associated with the goods they use by making simple changes in the way they choose to meet their needs. This may include renting, sharing, fixing and reusing goods as well as choosing products with lower emissions across the entire lifecycle. Portland-based manufacturers have an additional opportunity to examine their supply chains and potentially reduce the carbon emissions associated with their products.

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
8A	**Sustainable Consumption and Production —** Develop a sustainable consumption strategy to prioritize local government activities to support a shift to lower-carbon consumption patterns.	C C C C $ E	**City:** BPS	Mid-term
8B	**Be Resourceful Campaign —** Use the Be Resourceful campaign to connect residents to information and resources to get the things they need. Key strategies include: a) Buy smart (plan before purchasing, buy local, give gifts of experience, purchase durable goods). b) Reuse. c) Borrow, share and rent items. d) Fix and maintain.	C C C C $ E	**City:** BPS	Existing and/or ongoing

Potential impact

- C C C C Magnitude of carbon emissions reduction
- $ High potential to support jobs and prosperity
- E High potential to advance equity
- High potential to improve local environmental quality
- High potential to improve health

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
8C	**Product Stewardship —** Participate actively in the process to develop state and federal product stewardship programs and legislation. Support opportunities for producers to develop responsible manufacturing, product and package design and reuse of recovered materials.	C C C C $ E	**City:** BPS	Existing and/or ongoing
8D	**Materials Management —** Continue to work in partnership with public agencies including Metro and the Oregon Department of Environmental Quality to implement the Materials Management in Oregon: 2050 Vision and Framework for Action.		**City:** BPS	Existing and/or ongoing
8E	**Rehabilitation and Adaptive Reuse —** Promote rehabilitation, adaptive reuse and energy and seismic upgrades of buildings to conserve natural and historic resources, reduce waste and improve public safety.		**City:** BPS, BDS **County:** OS	Near-term
8F	**Space-Efficient Housing —** Continue to work with regional and state partners to promote space-efficient housing options such as Accessory Dwelling Units (ADUs). Review possible barriers and disincentives and identify any needed changes.		**City:** BPS, BDS	Existing and/or ongoing
8G	**Performance Metrics —** a) Partner with the Oregon Department of Environmental Quality to identify metrics to analyze and track the carbon intensity of the goods and materials produced in Multnomah County. b) Explore tools, strategies and performance measures to quantify economic, equity and environmental benefits of services that displace the need for new goods through reuse, repair and sharing. c) Continue to work with the Oregon Department of Environmental Quality on inventorying consumption-based carbon emissions for Multnomah County.		**City:** BPS	Mid-term

CONSUMPTION AND SOLID WASTE

2030 OBJECTIVE 9 Reduce food scraps sent to landfills by 90 percent.

Food scraps are the most prevalent material still heading to the landfill in Portland's garbage. Portland residents and businesses do such a great job recycling paper, cardboard and containers and composting their yard debris that food scraps now make up the biggest slice of landfill-bound waste. Food scraps are a valuable resource and can be put to better use when they are collected and turned into energy and compost. In addition, when food breaks down in the landfill, it releases harmful carbon emissions. Preventing food waste in the first place and collecting food scraps for composting and anaerobic digestion are two ways to reduce the carbon impact associated with food.

ACTIONS TO BE COMPLETED BY 2020	Impact	Lead agency	Timeframe
9A **Food Waste —** Prevent food waste: a) Encourage strategies that reduce the volume of food waste generated such as proper food storage and meal planning. b) Support gleaning and donation of unused and excess food to organizations that feed hungry people.	C C C C $ E	**City:** BPS	Existing and/or ongoing
9B **Composting —** Expand participation in Portland's composting program: a) Continue to encourage Portland residents to "Include the Food" in their green Portland Composts roll carts. b) Increase voluntary participation in commercial food scrap collection by identifying businesses that face barriers to participation and providing direct outreach and assistance. c) Implement mandatory commercial and voluntary multifamily food scrap collection. d) Ensure low-income populations and communities of color are not disproportionately burdened by localized impacts such as odor or truck trips.	C C C C $ E	**City:** BPS	Existing and/or ongoing

Potential impact

- C C C C **Magnitude of carbon emissions reduction**
- $ **High potential to support jobs and prosperity**
- E **High potential to advance equity**
- **High potential to improve local environmental quality**
- **High potential to improve health**

Waste generated by Portland businesses and residents has declined significantly in recent years

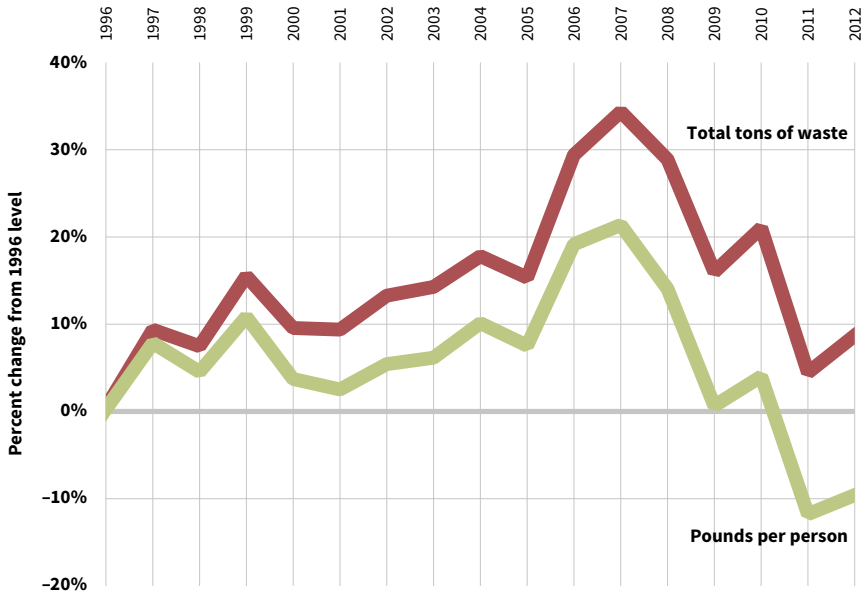


Figure 36. Percent change in waste generation in Portland (relative to 1996).
Source: Portland Bureau of Planning and Sustainability

The amount of waste generated in Portland has declined significantly since 2007.

CONSUMPTION AND SOLID WASTE

2030 OBJECTIVE 10 Reduce per capita solid waste by 33 percent.

The solid waste stream includes all materials discarded by residents and businesses – not just what goes to landfills. Significant carbon emissions were generated during the production of the discarded goods, even if they are ultimately recycled. Given current population projections, halting the growth in the materials residents and businesses discard (through landfills or recycling) means reducing the amount of solid waste generated, per capita, by one-third.

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
10A	**Waste Prevention —** Increase awareness of and participation in targeted waste-prevention practices, and research and encourage strategies for reducing use of paper, plastics and other materials.	C C C C $ E	**City:** BPS	Existing and/or ongoing
10B	**Deconstruction and Salvage —** Promote alternatives to traditional building demolition such as relocation, deconstruction and salvage, including identifying and removing barriers and disincentives.	C C C C $ E	**City:** BPS, BDS	Existing and/or ongoing

Potential impact

- C C C C Magnitude of carbon emissions reduction
- $ High potential to support jobs and prosperity
- E High potential to advance equity
- High potential to improve local environmental quality
- High potential to improve health

Capturing the methane from landfills has been key to reducing carbon emissions from the waste we generate

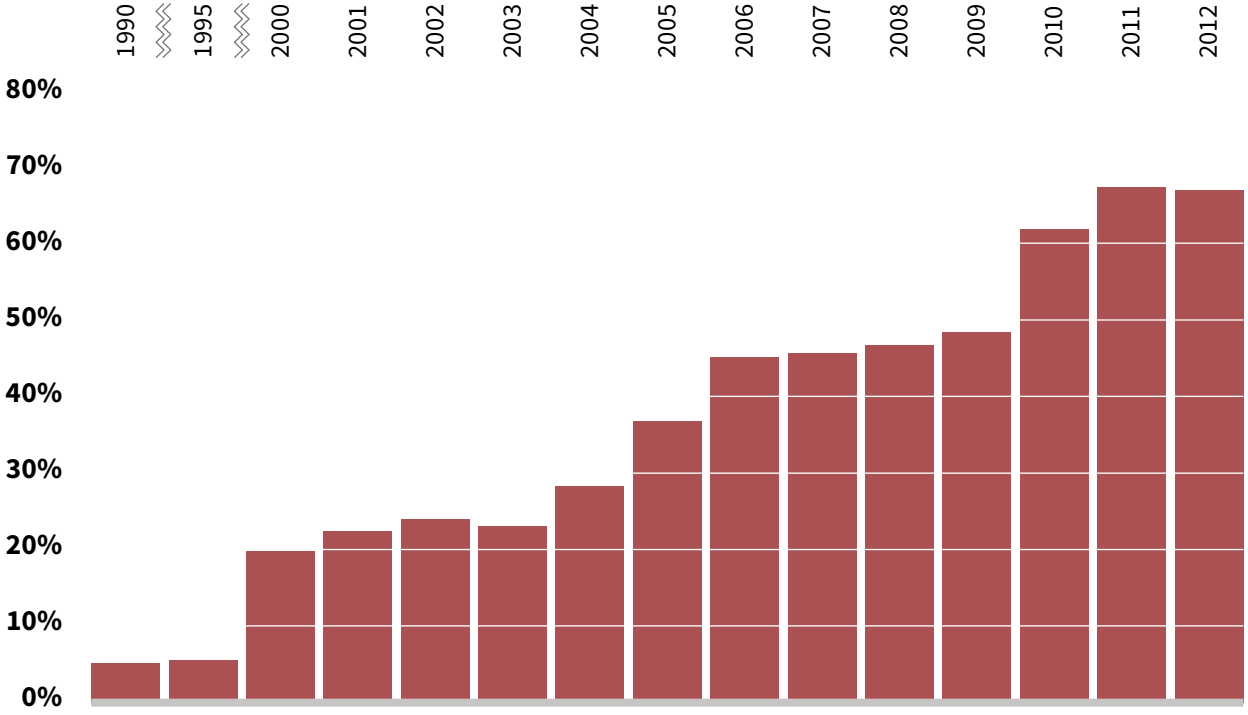


Figure 37. Percent of methane recaptured at landfills serving Multnomah County. *Source: Portland Bureau of Planning and Sustainability*

Capturing the methane generated by landfills that serve Multnomah County is an important strategy for reducing overall emissions associated with waste disposal. The capture rate has increased significantly since 1990 and is approaching 70 percent.

CONSUMPTION AND SOLID WASTE

2030 OBJECTIVE 11 Recover 90 percent of all waste generated.

Portland's recovery rate is among the highest in the U.S. with 70 percent of all waste generated in Portland recovered through recycling, composting or anaerobic digestion. Portland has established a citywide objective of recovering 75 percent of all waste by 2015, but with current technology, it is possible to recover more than 90 percent.

Because close to 80 percent of all the waste in Portland is generated in the commercial sector, including multifamily residential buildings, Portland businesses are a critical part of the solution. Since 2008 Portland businesses have been complying with a requirement to recycle all paper and containers generated in the workplace.

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
11A	**Technical Assistance —** Through the Sustainability at Work program, provide technical assistance and resources to at least 500 businesses per year to improve waste prevention and toxics reduction practices and to meet the requirement to recycle paper, metal and glass. Prioritize and customize technical assistance to benefit under-served and under-represented business owners.	C C C C $ E	**City:** BPS	Existing and/or ongoing
11B	**Construction and Demolition Debris —** Provide technical assistance and resources to contractors to meet Portland's construction and demolition debris requirements, giving priority to salvage and reuse activities.	C C C C $ E	**City:** BPS, BDS	Existing and/or ongoing
11C	**Portland Recycles Plan —** Review and update the Portland Recycles Plan, incorporating a focus on reducing the upstream impacts of the materials and goods produced and consumed locally. When developing recovery programs, consider the full lifecycle to identify the best end-of-life options for materials, particularly those with high impacts. Identify options to reduce waste and increase recovery from residential, multifamily and commercial sectors.	C C C C $ E	**City:** BPS	Near-term
11D	**Be Cart Smart —** Promote recycling and composting through the Be Cart Smart campaign. Customize communications and engagement strategies for audiences including large families, residents with limited English proficiency, renters and landlords to ensure that they have equitable access to information and services.	C C C C $ E	**City:** BPS	Existing and/or ongoing
11E	**Commercial Recycling —** Work with Metro to identify commercial garbage loads with a high level of recyclable materials and work with haulers and businesses to strengthen recovery programs.	C C C C $ E	**City:** BPS	Near-term

Potential impact

- C C C C **Magnitude of carbon emissions reduction**
- $ **High potential to support jobs and prosperity**
- E **High potential to advance equity**
- **High potential to improve local environmental quality**
- **High potential to improve health**

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
11F	**Multifamily —** Provide technical assistance and resident waste reduction resources to multifamily property owners, managers, maintenance workers and onsite staff to reach 50 percent of multifamily households annually. Prioritize and customize outreach efforts to engage under-represented and under-served populations. Evaluate onsite multifamily recycling collection setups and identify ways to increase program performance. Continue to ensure compliance with garbage and recycling and tenant education requirements.	C C C C $ E	**City:** BPS	Existing and/or ongoing
11G	**Local Recovery Infrastructure —** Support efforts to maintain and develop local markets and to improve the recovery rate at material recovery facilities. Explore options for ensuring Portland's discards are sent to facilities that have taken action to improve social equity and achieve fair labor conditions.	C C C C $ E	**City:** BPS	Mid-term

EACH CART PLAYS A PART

FOOD AND AGRICULTURE

Approximately 15 percent of local consumption-based carbon emissions come from supplying food to residents and businesses in Multnomah County. This figure may approach 30 percent when other food system impacts, such as importing, processing and agriculture-related deforestation and soil degradation are included (European Commission, 2006).

Reducing the consumption of carbon-intensive food is a key way to reduce carbon emissions related to food and agriculture. However, low-income populations and communities of color may not have equitable access to healthy and affordable food. Consequently, access to lower-carbon food choices — especially fruits, vegetables and less processed or packaged foods — may be constrained by price and accessibility.

Food buying clubs and cooperatives, farmers markets and community-supported agriculture programs that accept Supplemental Nutrition Assistance Program (SNAP), also known as Oregon Trail cards, create opportunities for low-income people to buy less processed, lower-carbon foods. Many farmers markets in the Portland area have money-match programs for SNAP benefits, enabling the food dollars of low-income people to go further at places that sell less processed and packaged food.

By choosing to eat lower-carbon foods, residents can eat a healthier diet, bolster the local economy, help preserve the agricultural land base, and in some cases, reduce emissions from transporting foods.

Eating a low-carbon diet is easier if residents have:

- Increased access to affordable fresh fruits and vegetables.
- Reduced consumption of processed and packaged foods.
- Skills to grow their own food.
- Knowledge to make healthy consumption choices.

Producing and processing food is more carbon-intensive than the emissions from transporting food

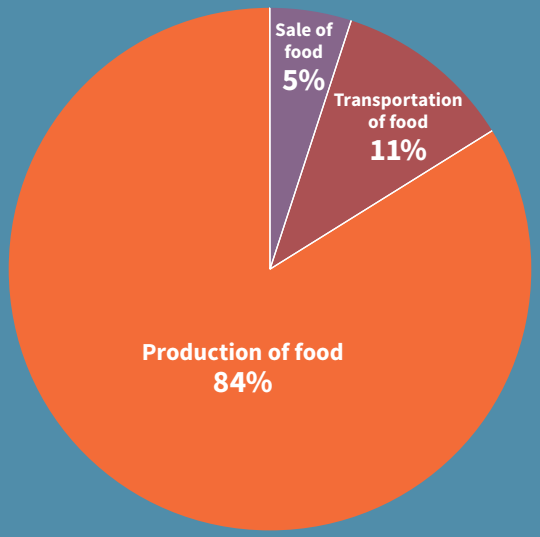


Figure 38. Carbon emissions from the food system. *Source: Weber and Matthews, 2008*

Supporting a strong local food system has many benefits, both for the economy and the community, but from a carbon perspective the type of food tends to be a much more significant factor than where it comes from.

About 83 percent of the carbon emissions from food come from production, while 11 percent come from transportation of the food (supply-chain transport, as well as final delivery transport) (Weber and Matthews, 2008).

FOOD AND AGRICULTURE

2030 OBJECTIVE 12 Reduce the consumption of carbon-intensive foods and support a community-based food system.

Residents of Multnomah County can reduce the impact of food choices on climate change — and improve personal, environmental and economic health — by choosing "low-carbon" foods. Lifecycle analysis shows that beef, cheese, pork and farmed salmon generate the most carbon emissions per ounce (Environmental Working Group, 2011).

Although eating locally produced food has a smaller impact than choosing low-carbon food, the consumption of local food can reduce local transportation emissions, strengthen the local economy, help preserve the region's agricultural land base and support a community-based food system that can reshape our relationship with food.

ACTIONS TO BE COMPLETED BY 2020	Impact	Lead agency	Timeframe
12A **Outreach and Education —** Include healthy, low-carbon food choices and food waste in public and business outreach efforts. Work with partners to support efforts to encourage plant-based diets, including Meatless Monday campaigns.	C C C C $ E	**City:** BPS **County:** HD	Existing and/or ongoing
12B **Partnerships and Engagement —** Create collaborative partnerships with community-based organizations and affinity groups, including low-income populations and communities of color, to: a) Promote healthy, low-carbon diets. b) Encourage local food productions. c) Support affordability and access through neighborhood food buying clubs and co-ops. d) Reduce food waste.		**City:** BPS **County:** HD, OS	Existing and/or ongoing
12C **Planning and Metrics —** Integrate sustainable food system issues that affect climate into land-use planning processes and, where practical, incorporate quantitative goals and metrics.		**City:** BPS **County:** OS	Existing and/or ongoing
12D **Policies and Programs —** Develop policy and equitably provide programmatic resources to: a) Increase the production and consumption of home-grown and locally sourced food by supporting farmers markets and community supported agriculture. b) Create policies and practices to encourage the purchase of low-carbon, minimally processed foods for public meetings, events and facilities. c) Expand opportunities for food production and neighborhood-scale distribution including community gardens, especially for low-income populations and communities of color. d) Increase the use of public and private land and roof-tops for growing food. e) Increase the planting of fruit and nut trees in appropriate locations. f) Leverage the purchasing power of public and private institutions to source low-carbon and local foods.		**City:** BPS, PP&R **County:** HD, OS	Existing and/or ongoing
12E **Skills Development —** Equitably promote educational opportunities for residents to gain skills in organic gardening, fruit production, food preservation and cooking and affordable, healthy eating.		**City:** BPS, PP&R **County:** HD, OS	Existing and/or ongoing

Potential impact

- C C C C — Magnitude of carbon emissions reduction
- $ — High potential to support jobs and prosperity
- E — High potential to advance equity
- High potential to improve local environmental quality
- High potential to improve health

Food choice is a key factor in carbon emissions

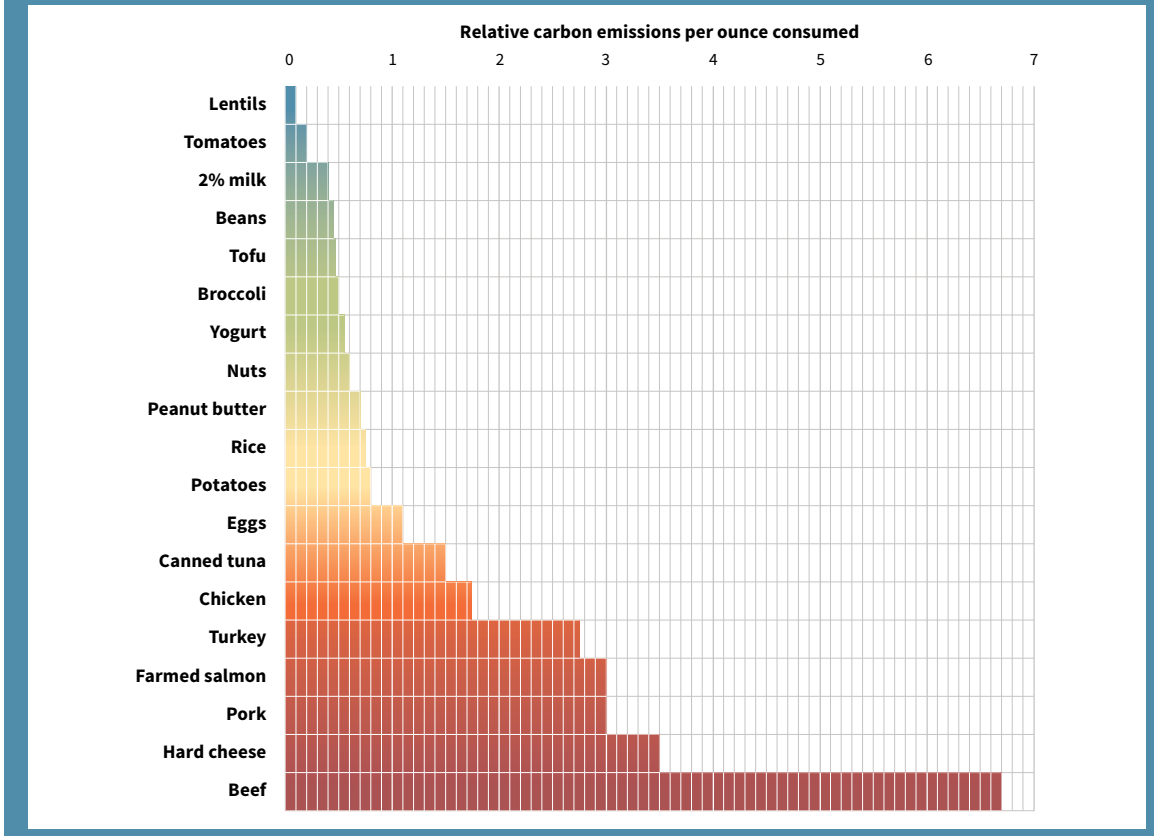


Figure 39. Adapted from *Eat Smart: Your food choices affect climate.* (www.ewg.org)

PICKING LOWER CARBON FOODS

From a carbon perspective, not all food is created equal, and what we choose to eat has more of an impact than how far that food has traveled to get to us. Beef and dairy production contribute significantly to climate change because, in part, feeding grain to livestock is resource intensive and results in a large loss of energy (Eschel et al., 2014). Figure 39 illustrates the relative carbon "foodprint" of food types.

For a typical American household, "buying local" could achieve roughly a four to five percent reduction in carbon emissions from food, about the same impact as shifting consumption of red meat and/or dairy to other protein sources just one day per week (Weber and Matthews, 2008).

URBAN FOREST, NATURAL SYSTEMS AND CARBON SEQUESTRATION

THE ROLE OF TREES AND SOIL

Trees and other vegetation are critical elements of Portland and Multnomah County's climate preparedness strategy. This natural green infrastructure also helps reduce the amount of carbon in the atmosphere by sequestering and storing carbon. The U.S. Forest Service estimates that in 2012 forests offset 16 percent of the country's annual carbon emissions (Ryan et al., 2012). Other studies of trees in cities confirm that larger trees and more extensive urban tree cover have an increased capacity to store and sequester carbon (Stephenson et al., 2014).

Moreover, while rural forests cover far more area than urban forests, urban forests can have a greater impact per area of tree canopy than non-urban forests due to faster growth rates, increased proportions of large trees and secondary effects of reduced building energy use (Nowak and Crane, 2002). Using wood in place of other building materials (e.g., cement) is another strategy to store carbon (McKinley et al., 2011).

Soil also provides important potential for additional carbon sequestration (Lal, 2004). Deeper soils and unpaved soils provide additional and more stable carbon storage, and wetlands provide a particularly high soil carbon density (Pouyat et al., 2006). Preserving and restoring the urban forest and understory, healthy soils and wetlands help slow climate change while also providing water retention, wildlife habitat and opportunities to grow food.

Acquiring, restoring and protecting natural areas is also key to preparing for the impacts of climate change, such as flooding, landslides and heat waves. See the Climate Change Preparation chapter (page 106) for more details.

ENSURING THE BENEFITS ARE SHARED BY ALL

Expanding urban forest canopy and protecting natural systems create opportunities to address disparities for low-income populations and communities of color related to tree canopy cover, access to nature, air quality and asthma rates. Low-income populations and communities of color in the Portland region are exposed to disproportionately higher levels of air pollution than predominantly White communities and moderate- and higher-income areas (State of Oregon Department of Environmental Quality, 2012). Portland's urban forest, natural areas and other green infrastructure keep ground-level air temperatures cooler and alleviate pollution from vehicles and industry.

Green infrastructure can also provide shade and reduce flooding and landslides, helping to minimize risks for communities. Integrating green infrastructure into transportation and stormwater systems, new development and retrofits can allow streetscapes and infrastructure facilities, and other outdoor spaces, to contribute to Portland's carbon reduction and climate preparation goals.

Improved access to nature can also lead to increased physical activity and improved air quality, which positively influence health outcomes. Research has shown that when natural areas are closer to where people live, residents tend to use them for physical activity such as walking or biking, which can improve both fitness and mental health. For all of these reasons, investments in green infrastructure, reductions in impervious areas and the expansion of urban forest canopy should be targeted to reduce disparities and improve quality of life across all neighborhoods.

URBAN FOREST, NATURAL SYSTEMS AND CARBON SEQUESTRATION

2030 OBJECTIVE 13

Sequester carbon through increased green infrastructure (trees, plants, soil) and natural areas. Reduce effective impervious areas by 600 acres. Expand the urban forest canopy to cover at least one-third of the city, with a minimum canopy cover of 25 percent of each residential neighborhood and 15 percent of the central city, commercial and industrial areas.

In addition to providing a critical role in preparing for climate change, trees and other green infrastructure help the City and County reach carbon reduction goals by sequestering carbon dioxide and reducing building energy use through cooling and shading in summer and lessening heat loss in winter. Actions in this plan focus on retaining the existing tree canopy and understory, increasing planting of diverse large-species trees where appropriate, and keeping trees healthy through an active maintenance program.

As of 2010, Portland's urban forest covered 30 percent of the city and is estimated to sequester over 88,000 tons of carbon dioxide annually. Proactive tree protection and planting beyond replacement levels will help the City meet or exceed the one-third canopy cover target for the city and increase the urban forest's ability to sequester carbon. In doing so, a focus on increasing equitable tree canopy distribution across Portland neighborhoods is critical.

Reducing impervious area helps retain space for trees, vegetation, soil and other green infrastructure as the community grows. Creative site development, retrofitting existing development and proactive depaving efforts will be needed to achieve the goal of a 600-acre net reduction of effective impervious area by 2030. Community partnerships and participation are essential to achieving these goals over time.

ACTIONS TO BE COMPLETED BY 2020	Impact	Lead agency	Timeframe
13A **Tree Programs —** Continue tree planting and expand tree preservation and maintenance programs and incentives. a) Focus on low-canopy neighborhoods and neighborhoods with populations at higher risk of adverse outcomes of urban heat island effects. b) Explore options for public and private partnerships to help reduce or share the cost of tree planting and maintenance.		**City:** BES, PP&R	Existing and/or ongoing
13B **Canopy Targets —** Revisit urban forest canopy targets: a) Take into consideration goals for carbon sequestration, resiliency to climate change impacts, and equitable distribution of tree-related benefits across the city. b) Address tree age, species diversity and tree distribution, in addition to expanding overall canopy coverage.	C C C C $ E	**City:** PP&R, BES, BPS	Near-term
13C **Tree Code —** Fund and implement the new Tree Code (Title 11, Trees) and other code and customer service improvements adopted through the Citywide Tree Project to emphasize the preservation of healthy trees, sustain the urban forest over time, encourage native and climate resilient trees and increase canopy in tree-deficient areas. Monitor tree canopy changes due to development, including in infill areas, and determine if policy and rule changes are needed.		**City:** BDS, PP&R	Near-term

Potential impact

- C C C C — Magnitude of carbon emissions reduction
- $ — High potential to support jobs and prosperity
- E — High potential to advance equity
- High potential to improve local environmental quality
- High potential to improve health

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
13D	**Natural and Green Infrastructure —** Protect and enhance local natural resources that provide multiple benefits including: carbon capture; reduce flood, landslide, stormwater and heat island impacts; cool and purify water and air; and improve public health and biodiversity. These include water bodies, flood plains, healthy soils, natural areas, vegetated areas and corridors, as well as green elements of the built environment, ecoroofs and green streets.	C C C C $ E	**City:** BES, PP&R, BPS, BDS	Existing and/or ongoing
13E	**Natural and Green Infrastructure Funding —** Evaluate and pursue stable, innovative funding sources, financing strategies and incentives to accelerate and sustain green infrastructure implementation and maintenance (e.g., capital dollars, carbon credits).		**City:** BES, PP&R, BPS	Existing and/or ongoing
13F	**Designing with Nature —** Promote and require urban design and redevelopment approaches that incorporate natural systems and green infrastructure into site improvements, rights of way, green corridors and other infrastructure facilities. Consider adopting ecoroof targets in land use plans.		**City:** BPS, BES, PP&R, PWB, BDS	Existing and/or ongoing
13G	**Comprehensive Plan —** Update Portland's Comprehensive Plan to recognize the importance of natural systems and the urban forest in sequestering carbon and improving resiliency, and to call for preservation and enhancement of these resources and their functions in future land use plans, regulatory updates and infrastructure and watershed restoration investments.		**City:** BPS, BES, PP&R	Existing and/or ongoing
13H	**Public-Private Partnerships —** Explore and develop innovative, participatory outreach strategies and partnerships with public utilities, businesses and diverse community organizations to protect and enhance natural systems and green infrastructure, reduce impervious area and provide information on the human health and ecological well-being benefits of such actions.		**City:** BES, PP&R, PBOT	Existing and/or ongoing
13I	**Ecosystem Services —** Research, evaluate and integrate the economic, social and ecological benefits (ecosystem services) of natural resources and green infrastructure in land use and infrastructure planning, programs and projects. Prioritize areas with historical and current underinvestment.		**City:** BES, PP&R, BPS, PWB, OMF	Near-term

CLIMATE CHANGE PREPARATION

In the Pacific Northwest, temperatures have increased over the past century by an average of 1.3 ºF (Dalton et al., 2013) and regional precipitation has also increased, especially in the spring (Kunkel et al., 2012; Mote, 2003). In Oregon, increasing temperatures and shifts in seasonal precipitation patterns are already evident. For example, reduced mountain snowpack and earlier springtime melting of snow are decreasing summer river and stream flows, making it more difficult to meet both out-of-stream and in-stream needs (Dalton, et al., 2013). More locally, the Portland region has experienced an increase in average temperatures of 0.5 ºF to 1 ºF in the past century (Washington State Climatologist).

The average annual temperature in the Pacific Northwest is projected to increase 3.3 ºF to 9.7 ºF by 2100 (depending on future carbon emission scenarios), with greater warming happening in the summers (Dalton et al., 2013). Climate models for the Pacific Northwest region also project that, by the year 2100, summer precipitation may decrease by as much as 30 percent (Mote & Salathé, 2010). By 2050, on average, snowmelt is projected to begin earlier in the Cascades, and summer stream flows are expected to be lower (Dalton et al., 2013). In addition, winters may see an increased potential for more intense rain events (Dalton et al., 2013).

LOCAL IMPACTS FROM CLIMATE CHANGE

	Potential impacts from hotter, drier summers with more high-heat days	Potential impacts from warmer winters with the potential for more intense rain events
Human systems	■ Heat-related illness (heat stroke, heat exhaustion) and exacerbation of existing medical conditions. ■ Increased demand for cooling centers, especially for populations most vulnerable to heat. ■ Earlier and extended allergy seasons and exposure to wildfire smoke affecting those with asthma and respiratory disease. ■ Higher electricity bills due to less hydropower production and increased need for air conditioning.	■ Demands on emergency response services during flooding events. ■ Changes to mosquito populations requiring additional vector control efforts, including prevention at home. ■ Increase in mold spores, which can trigger asthma and other chronic health conditions. ■ Reduced energy use to heat buildings.
Natural systems	■ Lower summer stream flows. ■ Reduced water quality due to higher water temperatures. ■ Increased risk of wildfire. ■ Vegetation, habitat and wildlife shifts in biodiversity, fragmentation and death. ■ Increased invasive species.	■ Increased flooding and groundwater level rise. ■ Higher river levels. ■ Increased erosion and potential for channel migration and sedimentation. ■ Increased landslide risks. ■ Loss of native fish habitat.
Infrastructure and the built environment	■ Increased wastewater temperatures causing water quality changes, treatment process impacts and increased odors. ■ Pavement buckling and rail warping. ■ Increased water demand for landscape irrigation. ■ Shifting demand for indoor and outdoor recreation activities at parks. ■ Stress on green infrastructure facilities.	■ Increased erosion and the potential for turbidity events in the Bull Run water supply system. ■ Increased chance of landslides impacting transportation and pipe infrastructure. ■ Increased bridge scour and damage to docks, boat ramps and floats. ■ Increased flooding of roads, sidewalks, bikeways and trails and green infrastructure. ■ Increased pumping of treated wastewater.

PLANNING FOR THE IMPACTS

To prepare for the impacts of climate change, Portland and Multnomah County are working to reduce exposure to risks and strengthen the capacity to respond. Because of the breadth of potential impacts, preparing for climate change requires an adaptive management approach. This is an approach that monitors efforts and promotes flexible strategies that leave a range of future options available.

Preparing for climate change also requires steps to understand how impacts may affect people most vulnerable to issues such as heat, poor air quality and flooding. The City and County need to prioritize climate change preparation actions in areas facing current and historical disparities, including where low-income populations and communities of color live.

Climate change needs to be routinely considered in virtually all aspects of the City and County's work, including setting policy, making budget decisions, updating code, investing in infrastructure, delivering health services and preparing for emergencies.

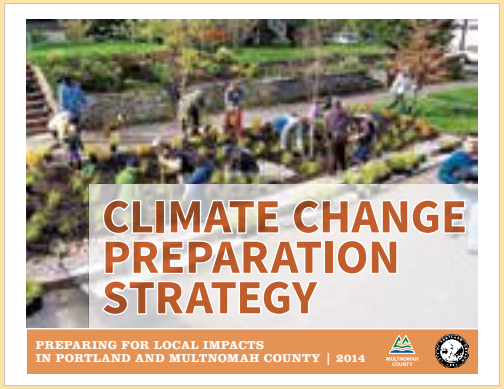
HUMAN POPULATIONS VULNERABLE TO CLIMATE CHANGE IMPACTS

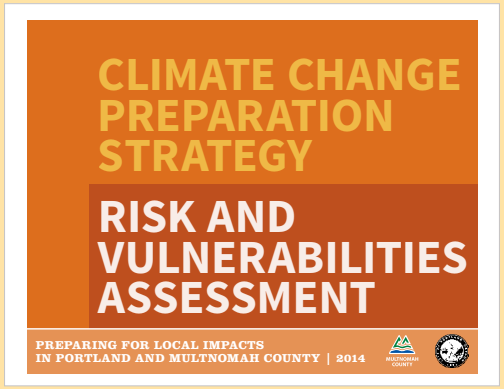
Low-income populations and communities of color may be more susceptible to climate impacts, particularly heat and associated poor air quality. Urban heat island impacts, which can cause an increased incidence of heat-related illness, can often be exacerbated in these communities. For example, many low-income people are reliant on transit, and walking to and from and waiting at transit stops can result in exposure to extreme heat conditions. Also, communities of color in Portland have historically lived in areas with poor air quality, including high concentrations of diesel particulate matter in areas along Columbia and Interstate-5 corridors (Oregon DEQ, n.d.). To deal with the unequal impacts these communities will face, this *Climate Action Plan* prioritizes actions that improve resilience in disproportionately affected communities.

A key means of dealing with these disparities is to increase vegetation and decrease the coverage of paved surfaces, especially in low-income neighborhoods and communities of color. For example, increasing tree canopy in under-served communities can provide vital shading, and ecoroofs can help reduce some of the impacts of extreme heat.

Strategies to provide culturally appropriate and highly accessible cooling spaces that are familiar to residents most vulnerable to heat (e.g., older adults who live alone with no access to air-conditioning) are also critical.

Similarly, outreach strategies and messaging about available resources and partnering with community organizations already working to reduce disparities in these impacted communities are key components to successfully preparing for the impacts of a changing climate.





The ***Climate Change Preparation Strategy*** and associated ***Risk and Vulnerabilities Assessment*** report serve as the foundation for the actions outlined in this *Climate Action Plan*.

The *Risk and Vulnerabilities Assessment* report provides an overview of the science and a more detailed review of the potential impacts to health and human systems, natural systems, infrastructure and the built environment.

The *Climate Change Preparation Strategy* outlines more detailed versions of the key actions highlighted in this section of the *Climate Action Plan*. These documents are available at www.portlandoregon.gov/bps/climate.

A FEW DEGREES OF WARMING WILL REALLY MAKE A DIFFERENCE

An average temperature increase of 1 °F per decade might not seem dramatic. However, such a shift in temperature will have significant impacts in Oregon.

For example, pinot noir grapes grow best at an average temperature of 57.2–60.8 °F, which is the temperature in the Willamette Valley during peak grape-growing season. Based on climate modeling, temperatures are predicted to increase 3.7 °F by year 2049 (Jones, White, Cooper & Storchmann, 2005). This change would mean that the Willamette Valley climate would shift to the current California wine region climate (61.7–67.1 °F), which is the optimal temperature range for cabernet sauvignon grapes rather than pinot noir.

Pacific Northwest ski areas are also at risk for negative impacts due to precipitation falling as rain rather than snow and earlier snowmelt. Data collected from 1948 to 2000 show an average 9- to 11-day earlier snowmelt in the Pacific Northwest. Scientists project a 3.6 °F increase in winter temperatures in the Cascade and Olympic ranges. This warming could have a profound impact on local winter recreational activities (Nolin & Daly, 2006).

Source: Tinsley Hunsdorfer/Audubon Society of Portland

Increased temperatures, along with associated dry spells, can result in dramatic impacts on the ecology of the region. In the fall of 2012, Smith and Bybee Lakes experienced an outbreak of avian botulism that resulted in the death of more than 4,000 birds. The Audubon Society of Portland treated over 150 birds from a variety of species. Coupled with impacts to the natural flushing mechanisms of the hydrologic system from surrounding development and invasive species, dry, hot weather created the ideal conditions for the outbreak of botulism. Hotter, drier summers could result in more of these types of events in the future.

URBAN HEAT ISLANDS AND HEAT VULNERABILITY

In July 2009, a record-breaking heat wave occurred in Portland. The event included the top two hottest three-day periods in Portland and made July 2009 the hottest month on record in Portland.

In measuring the frequency of heat waves over time, it is important to note that what constitutes an unusually hot day in one part of the country is not the same as what constitutes a hot day elsewhere. This is primarily due to the acclimation of the public to the typical climate of that region. For example, residents of Phoenix are unlikely to experience widespread heat stress from 95ºF afternoons; some Portlanders, however, are likely to experience heat-related illnesses because they are less accustomed to and prepared for managing such heat without air-conditioning, for example.

This is particularly true for populations that are disproportionately vulnerable to heat (see Figure 40), including older adults living alone, people with chronic health conditions like asthma or people who may be isolated due to language or other cultural barriers.

Some community members are more at risk from heat than others

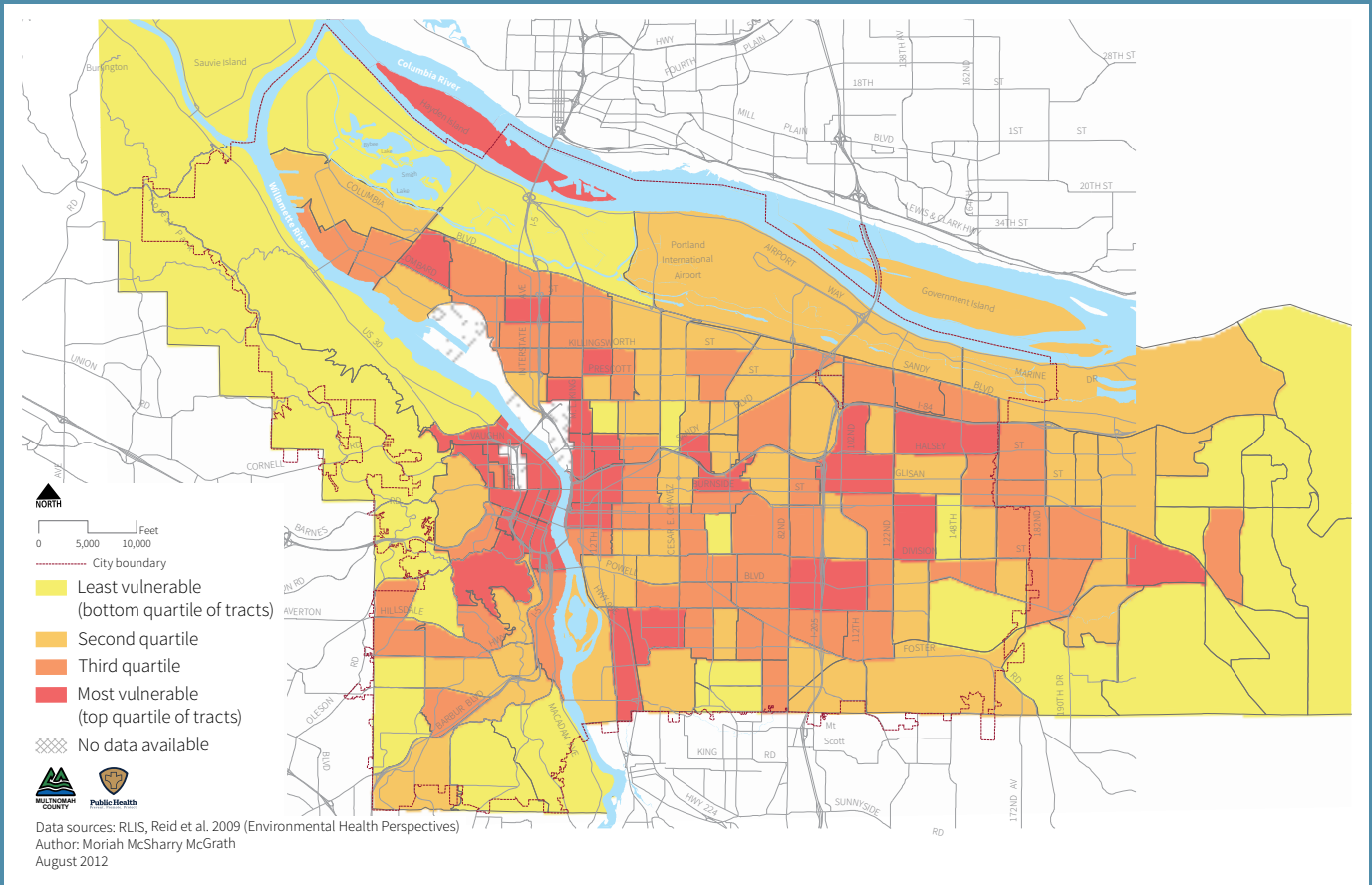


Figure 40. Multnomah County heat vulnerability index. *Source: Multnomah County Health Department*

This map identifies areas in Multnomah County with higher concentrations of people who may be disproportionately vulnerable to heat, including older adults living alone, households without air-conditioning, people with chronic health conditions like asthma or people who may be isolated due to language or other cultural barriers.

URBAN HEAT ISLANDS AND HEAT VULNERABILITY

Large urban areas experience a phenomenon known as the urban heat island effect, in which the urban area is significantly warmer than surrounding rural areas. Densely concentrated roads, sidewalks and buildings in an urban environment are made of materials that retain and re-radiate heat.

In addition to heat from these impervious surfaces, waste heat, like that radiating off a vehicle's engine or from a building's air-conditioning system, also contributes to the urban heat island. Compared to 15 other U.S. metropolitan areas, Portland ranks in the middle of the pack (along with Minneapolis, Denver and Orlando) in terms of satellite-derived measures of urban heat islands. Communities like Phoenix, Houston and Atlanta top the list (Law, 2012).

Major roads and areas with less vegetation result in "hot spots"

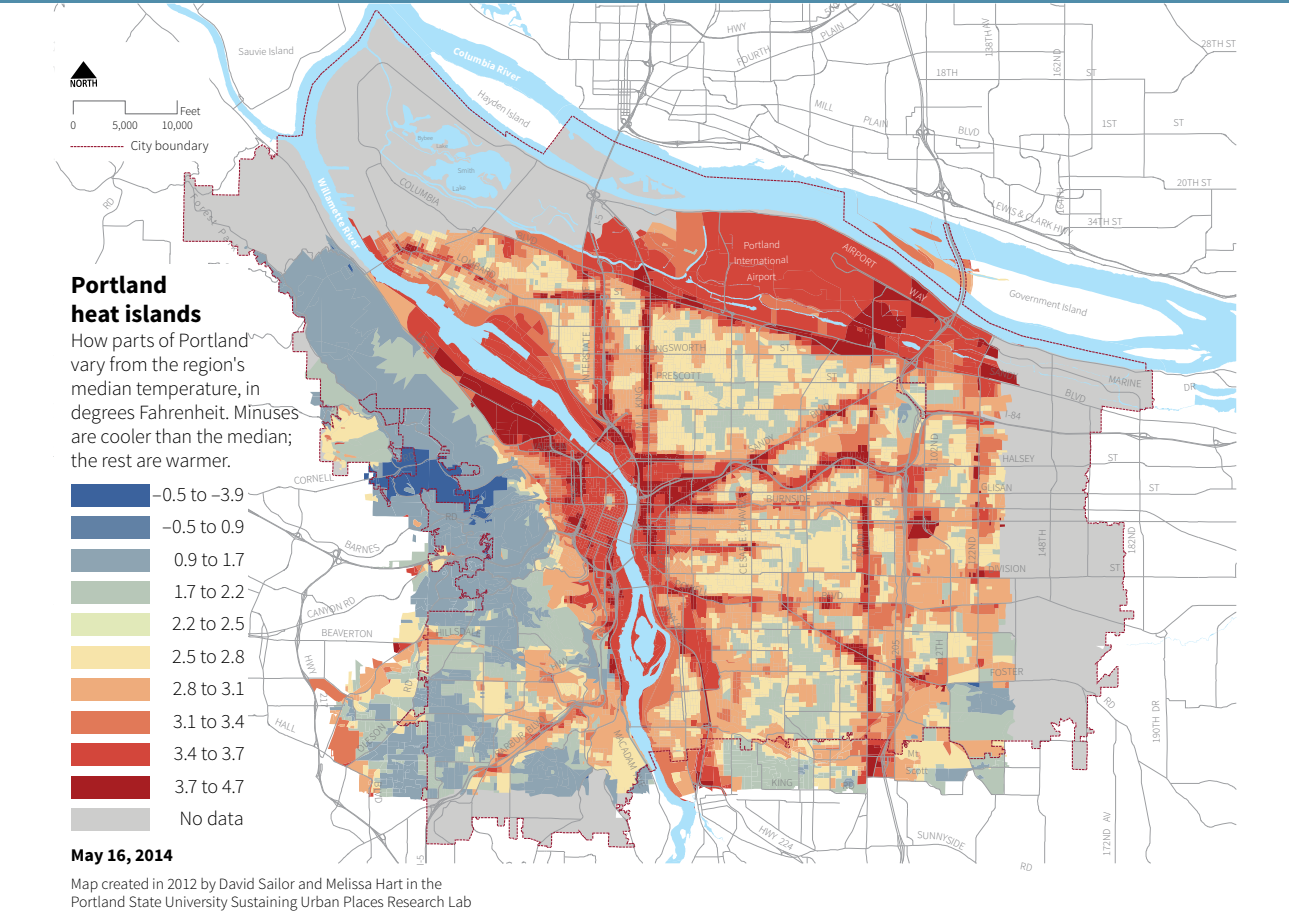


Figure 41. Urban heat islands in Portland. *Source: PSU's Sustaining Urban Places Research Lab (SUPR Lab), and David Sailor and Melissa Hart (Hart and Sailor, 2009).*

This map shows where temperatures in Portland tend to be the coolest (e.g., Forest Park and neighborhoods with high concentrations of trees and less development) and warmest, such as downtown, along freeways and busy roads (e.g., 82nd Ave., Sandy Blvd., Foster Road and Martin Luther King Jr. Blvd.) and industrial areas (e.g., central east side, northwest, and the Columbia corridor).

CLIMATE CHANGE PREPARATION

2030 OBJECTIVE 14 Reduce risks and impacts from heat, drought and wildfire by preparing for hotter, drier summers with increased incidence of extreme heat days.

Hotter, drier summers may result in several significant impacts for the Portland area. Higher temperatures result in increased air pollution, such as ground-level ozone and pollen counts, exacerbating Portland's already high incidence of respiratory illnesses and allergies. Such conditions may be further exacerbated by air quality impacts resulting from the potential of increased wildfires. Higher temperatures and shifts in precipitation patterns also lead to increased surface water temperatures, reduced flows in rivers and streams and negative impacts on aquatic habitats and the fish and wildlife they support.

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
14A	**Decrease Urban Heat Islands —** Decrease the urban heat island effect, especially in areas with populations most vulnerable to heat, through strategies such as revegetation, tree preservation planting and maintenance, depaving and porous pavement, green infrastructure like bioswales and ecoroofs and site development performance standards.	$ E	**City:** BES, PP&R, BPS **County:** HD	Mid-term
14B	**Urban Heat Island Maps —** Utilize current science, best practices and updated maps of urban heat islands and populations most vulnerable to heat to help inform decisions and priorities about projects and programs that help to cool the urban environment.	$ E	**City:** BPS, BES, PP&R **County:** HD	Near-term
14C	**Resilient Infrastructure —** In infrastructure project design, consider plantings and infrastructure specifications and materials that will be resilient to heat-related climate change impacts and be cost-effective over the lifetime of the asset.	$ E	**City:** PBOT, BES, PP&R	Long-term
14D	**Health Impacts of Extreme Heat —** Minimize health issues caused by extreme heat days and associated poor air quality, especially for populations most vulnerable to these impacts by improving the preparation for and response to heat by health, community service, public safety and emergency response staff and services.	$ E	**City:** PBEM, Fire, Police **County:** HD, OS	Existing and/or ongoing
14E	**Cooling Centers —** Coordinate operations of readily accessible and culturally appropriate cooling centers, and develop early warning and response plans and systems that alert community members, especially those most vulnerable to heat, when projected heat conditions or poor air quality days pose a health risk.	$ E	**City:** PBEM **County:** DCHS, HD, MCEM	Existing and/or ongoing
14F	**Detention Facilities —** Ensure detention facilities are capable of adequate cooling during extreme heat events and that public safety staff are properly trained to recognize and respond to physical and behavioral signs of heat-related illness.	$ E	**County:** DCJ, HD, MCSO	Mid-term
14G	**Water Supply —** Increase the resilience of Portland's water supply to drier summers by expanding the capacity of the groundwater systems and ensuring water is used efficiently by homes, businesses and in public facilities.	$ E	**City:** Water, PP&R	Existing and/or ongoing
14H	**Bull Run Watershed —** Continue to assess the potential impacts of climate change on the Bull Run watershed.	$ E	**City:** Water	Existing and/or ongoing

Potential impact $ **High potential to support jobs and prosperity** E **High potential to advance equity** **High potential to improve local environmental quality** **High potential to improve health**

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
14I	**Natural Systems and Increased Temperatures —** Increase the resilience of natural systems to respond to increased temperatures, drought conditions and shifts in seasonal precipitation by: a) Keeping natural resource areas, especially urban streams, cooler by increasing the width of vegetated areas along streams and wetlands and maintaining upland tree canopy. b) Ensuring existing and new rules support healthy riparian zones, wetlands and surface water temperature needs. c) Increasing the ability of plantings (natural areas, restoration sites, street and park trees, greenstreets, ecoroofs, etc.) to withstand drought conditions. Research and experiment with different plant palettes as appropriate.	$ E	**City:** BES, PP&R, BPS	Mid-term
14J	**Streamflow Temperature —** Evaluate the cumulative effect of actions to protect and maintain existing cool streams and demonstrate progress toward meeting temperature requirements by 2030 in at least 50 percent of rivers and streams that do not meet water quality standards.	$ E	**City:** BES	Existing and/or ongoing
14K	**Invasive Species —** Implement invasive species control programs including Integrated Pest Management, Protect the Best, Early Detection and Rapid Response and public and private invasive species control.	$ E	**City:** BES, PP&R	Existing and/or ongoing
14L	**Habitat Connectivity —** Protect and connect floodplains and other diverse habitats that support biodiversity, including birds and other wildlife species needing to alter their range.	$ E	**City:** BPS, BES, PP&R	Existing and/or ongoing
14M	**Urban-Wildland Interface Fires —** Manage the risk of wildfires as a result of drier summers, especially in areas where homes and businesses are next to natural and forested areas by: a) Reviewing the feasibility of adopting nationally recognized codes to strengthen building standards in wildfire risk areas. b) Completing an assessment to characterize high-priority wildfire risk areas and developing recommendations to reduce risks in and around these areas. c) Implementing the 2011 Multnomah County Community Wildfire Protection Plan. d) Increasing and improving the quality of vegetated corridors and buffer areas around wildfire-prone areas. e) Prepare public health agencies and health care providers to address health impacts of wildfire smoke.	$ E	**City:** PBEM, Fire, BES, PP&R, BPS, BDS **County:** DHS, HD, MCEM	Existing and/or ongoing
14N	**Bull Run Wildfire —** In a co-management role with partner agencies (Oregon Department of Forestry, U.S. Forest Service, local fire departments), respond to fires in and near Bull Run watershed.	$ E	**City:** Water	Existing and/or ongoing

CLIMATE CHANGE PREPARATION

2030 OBJECTIVE 15 Reduce risks and impacts from flooding and landslides by preparing for warmer winters with the potential for more intense rain events.

More intense rain events will stress Portland's systems for managing stormwater runoff and urban flooding. Changes in the intensity of winter rains may increase the incidence of landslides, particularly following prolonged periods of precipitation that happen when the soil is already saturated with water. With more rain, groundwater levels can rise, increasing the risk of large, deep landslides.

Rains of increased intensity, combined with additional population growth and development, could also increase flooding, causing far-reaching economic, social and environmental impacts similar to those Portland has experienced in the past. These impacts include water damage to homes and businesses as well as roads, railroad tracks, levees, bridges and culverts. Additional costs of emergency response, business closures, lost productivity and cleanup costs could also be expected.

Warmer winters may also result in increased risk of disease from vectors such as mosquitoes. Actions are needed to prevent vector-borne illnesses, and reduce risks and impacts associated with flooding and landslides.

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
15A	**Floodplains —** Increase community and ecological resilience by working with local, state and federal partners to update floodplain data, maps, policies and programs to reflect climate change projections and variability and improve floodplain function.	$ E	**City:** BES, BPS, BDS, BPS	Long-term
15B	**Managing Stormwater Naturally —** Protect and restore streams, wetlands and floodplains, reduce paved surfaces, utilize green infrastructure, update stormwater plans, manuals and drainage rules and prepare to manage increased stormwater runoff.	$ E	**City:** BES	Existing and/or ongoing
15C	**Private Property —** Encourage or require private property owners and developers to implement climate change preparation measures, including limiting or reducing impervious area at site-specific and district or area scales.	$ E	**City:** BES, BDS, BPS	Long-term
15D	**Disease Risk —** Manage the increased risk of disease from vector populations like mosquitoes by managing their habitat and by working with the community to reduce health risks. Strengthen education and outreach efforts in culturally appropriate and accessible ways to help the public understand, prevent and respond to vector-borne diseases.	$ E	**City:** BES, PP&R **County:** HD	Existing and/or ongoing
15E	**Vector Control Coordination —** Enhance the coordination between local natural resource agencies and vector control programs to ensure vector populations are managed in a way that protects human health and ensures ecological integrity and vitality.	$ E	**City:** BES, PP&R **County:** HD	Near-term
15F	**Landslide Risk —** Manage the increased risk of landslides due to increased winter rainfall by: a) Incorporating landslide and hazard risk reduction polices into the updated Comprehensive Plan. b) Identifying, mapping and monitoring landslide hazard areas with agency partners. c) Incorporating landslide hazard reduction approaches into infrastructure planning projects, land use policies and city codes. d) Providing outreach and education on reducing landslide risks to private property owners.	$ E	**City:** PBEM, BES, BDS, PBOT, BPS, Water **County:** DCS, MCEM	Existing and/or ongoing

Potential impact $ **High potential to support jobs and prosperity** E **High potential to advance equity** **High potential to improve local environmental quality** **High potential to improve health**

CLIMATE CHANGE PREPARATION

2030 OBJECTIVE 16 Build City and County staff and community capacity to prepare for and respond to the impacts of climate change.

Responsible public policy must consider the impact of climate change, the vulnerabilities of public systems and risks of those impacts, and a clear intention to make the community more resilient. This is especially true in densely populated urban areas with a concentration of infrastructure and other assets.

Climate preparedness must be routinely integrated in virtually all aspects of City and County work, including setting policy, making budget decisions, updating zoning and other codes, investing in infrastructure, delivering health services and fostering emergency preparedness. The City and County must also ensure that all residents share the benefits of taking action to prepare for climate change.

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
16A	**Emergency Management —** Strengthen emergency management capacity to prepare for and respond to heat, floods, landslides and other emergencies in culturally appropriate ways. Develop response plans that minimize impacts on populations most vulnerable to weather-related emergencies. Increase the capabilities of volunteer and service organizations and safety net providers to help respond.	$ E	**City:** PBEM **County:** DCHS, HD, MCEM	Long-term
16B	**Community Resilience —** Improve community capacity, especially populations most vulnerable to climate change impacts, to understand, prepare for and respond to flooding, extreme heat, respiratory-related illnesses and mental health impacts.	$ E	**City:** PBEM, BES, Fire **County:** HD, OS, MCEM	Long-term
16C	**Vulnerable Populations —** Ensure the participation of and benefits to populations most vulnerable to priority climate change impacts such as extreme heat, floods, landslides and wildfire.	$ E	**City:** BPS, BES, PP&R, PBEM, Water, PBOT **County:** DCHS, HD, MCEM, OS	Near-term
16D	**Adaptive Building Techniques —** Support an adaptive building demonstration project that considers affordability, comfort, safety and strategies to achieve net-zero energy, water and waste.	$ E	**City:** BPS	Mid-term
16E	**Asset Management —** Recognize climate variables as a risk in how the City and County manage infrastructure, including conventional facilities and green infrastructure.	$ E	**City:** Water, BES, PBOT, PP&R, OMF	Mid-term
16F	**Monitoring and Data Collection —** Improve monitoring and data collection to track climate change-related trends in streamflows, temperature, natural resource condition, storms, river levels, landslides, condition of infrastructure, heat-related illness, air quality, recreation trends, migration and population shifts, etc. Use results in updating plans and programs as appropriate.	$ E	**City:** Water, BES, PP&R, PBOT **County:** HD	Mid-term
16G	**Climate Migrants —** Monitor migration trends and research the potential for accelerated regional population growth beyond current projections due to national or global changes in the climate.	$ E	**City:** BPS	Mid-term

Potential impact $ **High potential to support jobs and prosperity** E **High potential to advance equity** **High potential to improve local environmental quality** **High potential to improve health**

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
16H	**Improving Understanding of Local Impacts —** a) Support monitoring programs and climate research to improve the understanding of local climate change impacts and support climate change preparation efforts. b) Encourage and support new research around climate-related diseases, air quality and allergens, population shifts, food systems, economic impacts, energy systems, etc.	$ E	**City:** BPS, PBEM, BES, Water, PP&R, PBOT **County:** OS, HD	Existing and/or ongoing
16I	**Mainstreaming Climate Preparation —** Institutionalize climate preparation planning and best practices in City and County operations, land use programs and decision-making, and monitor effectiveness of climate change preparation actions.	$ E	**City:** BPS, PBEM, Water, BES, PP&R, PBOT, OMF **County:** OS	Existing and/or ongoing

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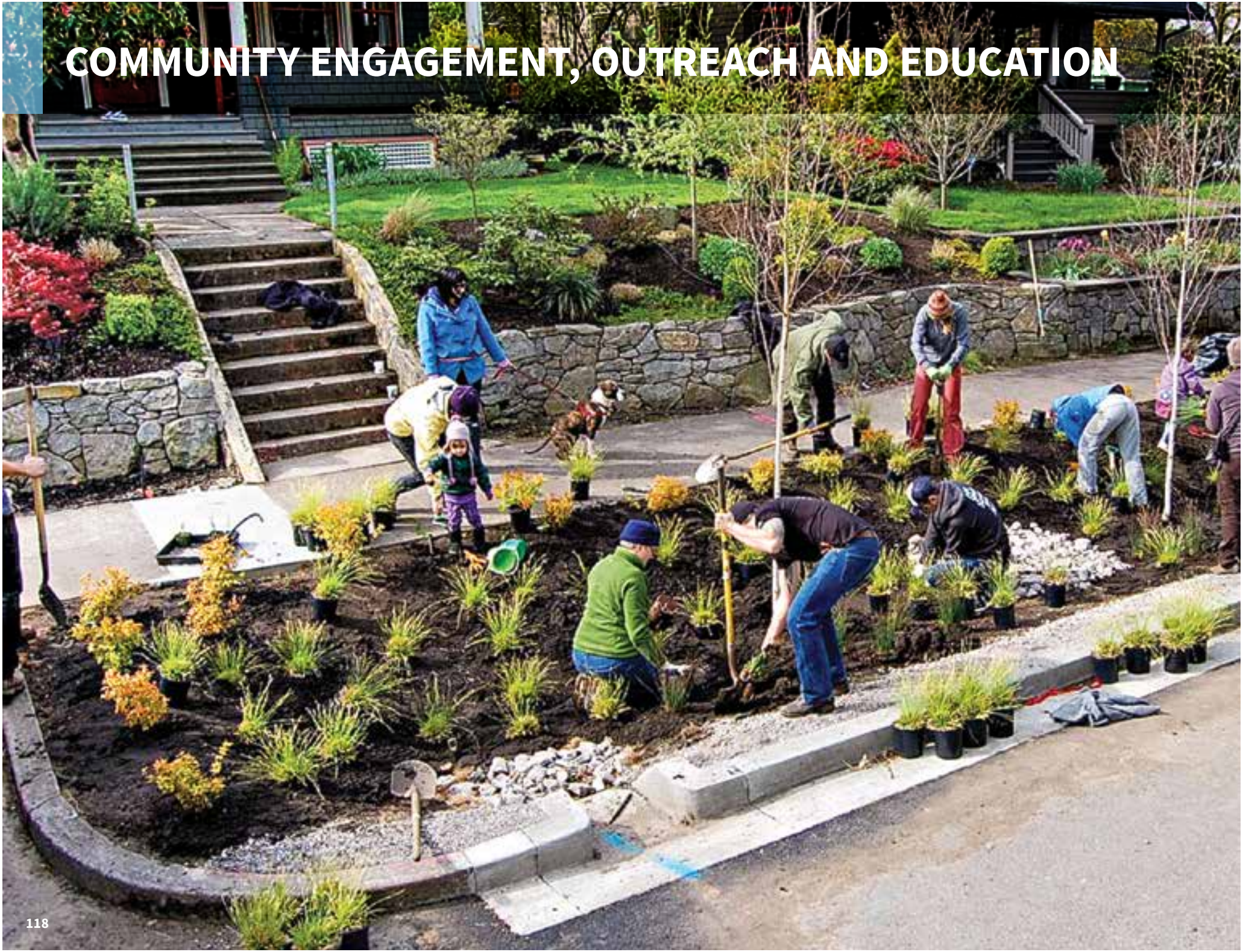
PORTLAND NET

PublicAlerts

COMMUNITY ENGAGEMENT, OUTREACH AND EDUCATION



Public policy alone will not be sufficient to mitigate and prepare for climate change. Residents, businesses, nonprofit organizations and community groups all have critical roles to play. Many businesses and organizations are improving quality of life and supporting a thriving economy while addressing climate change. Portland is home to a wide range of businesses and organizations that make resource conservation the core of their business model. Ecova, the ReBuilding Center, Free Geek, SCRAP, and GO Box, among many others, create jobs as their customers reduce carbon. Many other businesses — from Hot Lips Pizza and Elephants Delicatessen to Unico Properties and Purdy paint supplies — have prioritized carbon reduction throughout their operations.

Similarly, Portland residents have a global reputation for their green preferences, from the 80 percent participation rate in home food-scrap collection to the 1,000+ car-sharing vehicles available to the 33 library items borrowed per person each year — more than four times the national average. In addition, local voters have consistently supported investing in acquiring and restoring natural areas and expanding the region's trail network.

Local faith-based groups, neighborhood associations and community organizations have shown tremendous leadership in supporting the collective action of their members. Solarize Portland, for example, the group-purchase of solar photovoltaic systems, was initiated by SE Uplift, a neighborhood association. More than 1,000 solar installations later, the Solarize model has spread to Beaverton and Pendleton in Oregon and Massachusetts and beyond.

More than 120 nonprofit, business and community-based organizations, all partners in The Intertwine Alliance, are engaged in protecting, restoring and managing the growing system of parks, trails and natural areas.

Public policy can help individuals and businesses make low-carbon choices through a range of tools like labeling, education, regulations, incentives and public investments. Local governments and community organizations can help individuals and businesses gain access to and utilize the tools and resources they need to take action.

Opportunities to reduce emissions, prepare for climate change and influence public policy have not been distributed equitably, however.

Communities of color and low-income populations have been under-represented in policy-making and often do not have access to programs and services that may benefit them directly or help them participate in larger scale efforts.

A variety of factors, such as lack of trusted relationships with government, language barriers, and lack of inclusion in planning and policy-development processes have all served as barriers to involvement.

Leadership and membership of mainstream environmental organizations have also tended to be white and well-off, despite evidence that environmental concerns, including climate change, are broadly held by people of color and low-income populations (Bositis, 2010).

In implementing the *Climate Action Plan,* the City and County are committed to fostering relationships and deepening involvement with communities of color and low-income populations in the challenges of and solutions to climate change. Engagement strategies will take into account existing barriers and attempt to mitigate them.

Ensuring that education and outreach are culturally appropriate is also essential, and working with community-based organizations can aid in engaging these traditionally under-represented and under-served populations and businesses. In addition, the City and County will seek to support community needs, priorities and efforts already underway by diverse community organizations through the implementation of actions outlined in this *Climate Action Plan*.

COMMUNITY ENGAGEMENT, OUTREACH AND EDUCATION

2030 OBJECTIVE 17 Engage communities, especially impacted under-represented and under-served populations, in the development and implementation of climate change-related policies and programs.

The City and County must meaningfully engage all residents to achieve an 80 percent reduction in emissions. Each resident, business and institution has an opportunity to take action. Achieving broad and robust engagement is a two-way street. The City and County must do more to reach new communities, and residents must do more to engage local governments. The kind of bold policy initiatives that support deep carbon reductions require active community support. The City and County understand and value the critical role and democratic principle of community activism, and must be responsive to community priorities by leveraging public resources to advance community initiatives.

Creating the space, time, and trust to identify shared interests and opportunities for mutual benefit is essential to achieving both climate protection and equity goals. Inequity is an issue today because past decisions created deep disparities in Portland, among many other places. An essential step to addressing these inequities is to create opportunities for people most impacted to be at the table for today's decisions. That can only happen if policymakers and members of under-represented and under-served communities know each other, trust each other and work collaboratively toward common interests and priorities.

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
17A	**Alignment with Community Efforts —** Identify and seek resources to support community-based initiatives, especially from low-income areas and communities of color, that align with climate change preparation priorities, carbon emission reduction efforts and low-carbon lifestyles.	$ E	**City:** BPS, BES, PP&R, PBOT **County:** DCHS, HD, OS	Existing and/or ongoing
17B	**Healthy, Connected Communities —** Build partnerships to support community projects, campaigns and events that engage residents around healthy, connected low-carbon communities.	$ E	**City:** BPS, PBOT, BES	Near-term
17C	**Expand and Deepen Engagement —** Broaden and diversify community engagement, particularly in East Multnomah County and with public school families and students, by partnering with community organizations and leveraging community-based programs such as libraries, SUN schools, and health clinics.	$ E	**County:** HD, OS	Near-term

Potential impact $ High potential to support jobs and prosperity E High potential to advance equity High potential to improve local environmental quality High potential to improve health

COMMUNITY ENGAGEMENT, OUTREACH AND EDUCATION

2030 OBJECTIVE 18 Motivate all Multnomah County residents and businesses to change their behavior in ways that reduce carbon emissions.

Many businesses, community organizations, government leaders and residents have shown a commitment to addressing climate change while maintaining high quality of life and a thriving economy. To foster and build on this commitment, the City and County will support communitywide public engagement campaigns to educate, inspire and make accessible some of the most cost-effective, healthy and easy solutions. A fully engaged community is a key component to success in dealing with climate change. The City and County's outreach and education efforts will seek to:

- Engage diverse partners and sectors of the community.
- Create a shared community vision, goals and progress indicators of a low-carbon future.
- Connect individuals and organizations to education, tools and resources.
- Celebrate positive changes and successes.

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
18A	**Portland CAN! (Climate Action Now) —** Expand climate-related community engagement by providing individuals and community networks with quality information and how-to resources using interactive approaches that may include competition, feedback and recognition.	C C C C $ E	**City:** BPS	Existing and/or ongoing
18B	**Community Events —** Revise the Portland CAN! campaign to create a culturally relevant presence at community events and leverage the Master Recycler volunteer corp.		**City:** BPS	Existing and/or ongoing
18C	**Fix-it Fairs —** Conduct three Fix-it Fairs annually to engage under-served residents in carbon-reduction activities in the four areas of home, stuff, food and transportation choices. Provide materials and resources in commonly spoken languages of those neighborhoods and include a track of Spanish-language workshops at one of the fairs each year.		**City:** BPS	Existing and/or ongoing
18D	**Your Sustainable City —** Continue to convene sustainability programs from multiple City bureaus under the "Your Sustainable City" umbrella campaign to inform and engage diverse residents in sustainable choices.		**City:** BPS	Existing and/or ongoing

Potential impact

- C C C C — Magnitude of carbon emissions reduction
- $ — High potential to support jobs and prosperity
- E — High potential to advance equity
- High potential to improve local environmental quality
- High potential to improve health

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
18E	**Business Technical Assistance —** Increase the adoption of sustainable practices by Portland businesses: a) Provide free technical assistance and resources to 1,000 Portland businesses annually. b) Prioritize and customize technical assistance to minority-owned businesses and their property managers. c) Provide recognition for business achievements through Sustainability at Work certification.	C C C C $ E	**City:** BPS	Existing and/or ongoing
18F	**Neighborhood Metrics —** Establish climate action metrics by neighborhood, including measures such as household energy use, vehicle miles traveled, walkability and bicycle commute rates that also reflect community priorities such as safety and accessibility. Publicize metrics in culturally appropriate ways.	$ E	**City:** BPS	Mid-term

Portlanders have proven a commitment to green power

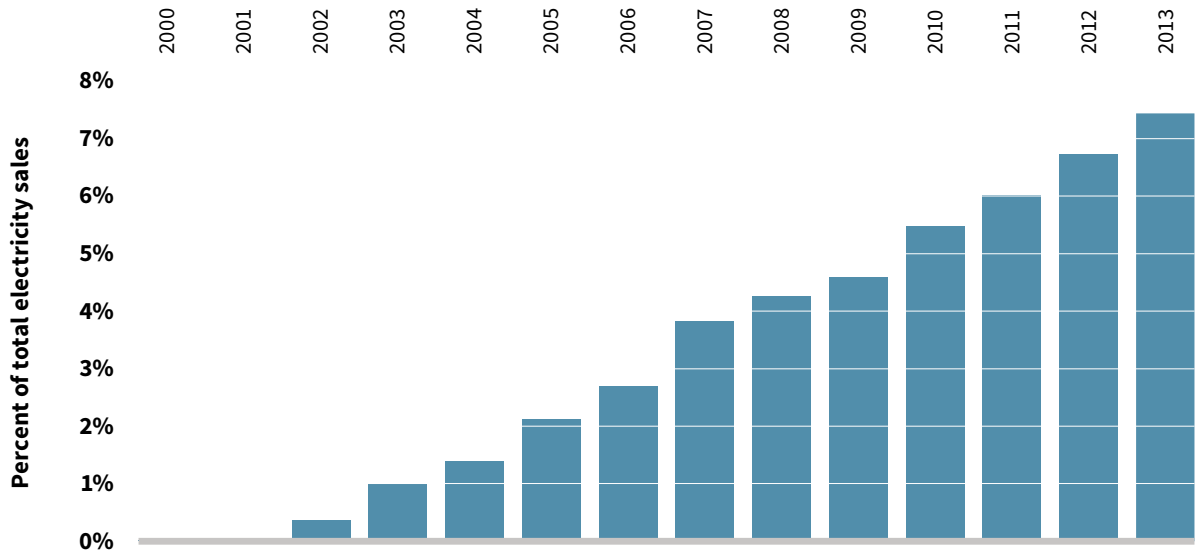


Figure 42. Voluntary green electricity purchases (2000–2013). *Source: Portland Bureau of Planning and Sustainability*

Named the U.S. Environmental Protection Agency's Green Power Community of the Year (2011), Portland residents and businesses continue to participate in voluntary green power programs in record numbers.

Sustainability at Work

These businesses are taking concrete actions to benefit our local economy, our community and our environment.

Businesses receive recognition for their achievements.

Sustainability at Work offers free assistance and certification to Portland businesses.

Contact an advisor at:

- sustainabilityatwork@portlandoregon.gov
- 503-823-7037

Gold

Apex Wellness
Artemis Foods
Ater Wynne
Bon Appetit Management at Lewis & Clark College
Bon Appétit Management at Reed College
Bonneville Power Administration
Boora Architects
Bullard Law
Canvas Dreams
cascade web//development
Celilo Group Media — Chinook Book
Childpeace Montessori School
City of Portland, Bureau of Development Services
City of Portland, Bureau of Planning and Sustainability
City of Portland, Procurement Services
CMTS
Columbia River Correctional Institution
Conservation Services Group
Courtyard by Marriott — Downtown/Convention Center
Courtyard by Marriott — Portland City Center
Crave Catering
Crowne Plaza Portland Downtown
Earth Business Network
East West College of the Healing Arts
Ecology and Environment, Inc.
Elephants Catering Kitchen
Elephants Delicatessen
Elephants in the Park
Elliott Associates, Inc.
ERM
Fluid Market Strategies
Flying Elephants @ Fox Tower
Flying Elephants @ PDX
FMYI
Food Front Hillsdale
Fortis Construction, Inc.
General Services Administration of Oregon
Glumac
Green Dog Pet Supply
GreenWood Resources, Inc.
Hawthorne Auto Clinic
Hawthorne Chiropractic
Hawthorne Wellness Center
HDR Engineering
Hopworks BikeBar
Hopworks Urban Brewery
IKEA
Indow Windows
Integral Consulting, Inc.
Interface Engineering, Inc.
Inverness Jail
JLA Public Involvement
Lensbaby
Lewis & Clark College
LNS Court Reporting
Mahlum
Markowitz Herbold Glade & Mehlhaf PC
Mazzetti Nash Lipsey Burch
Melvin Mark Companies
Mercy Corps
Murray, Smith & Associates, Inc.
North Portland Neighborhood Services
Northwest Evaluation Association
Northwest Portland International Hostel
NW Natural
Oh Planning + Design Architecture
On-the-Move Community Integration
OpenSourcery
Oregon Translation
Otak
P&C Construction
PAE Consulting Engineers Inc.
Parsons Brinckerhoff
PECI
Perkins Coie LLP
Port of Portland Headquarters
Portland General Electric
Portland Hawthorne Hostel
Portland Roasting Coffee
Portland Store Fixtures
Premier Press
Public Safety Systems Revitalization Program
Puppet Labs, Inc.
Purdy
REACH Community Development, Inc.
Realty Trust Group, Inc. — Hawthorne
Regional Arts & Culture Council
Research Into Action, Inc.
Richard Brown Architect, AIA
ROSEN
S.D. Deacon Corp. of Oregon
SAIF Corporation
Schwabe, Williamson & Wyatt PC
SERA Architects PC
Sunstone Montessori
The Nature Conservancy
Travel Portland
U.S. Fish and Wildlife Service
U.S. Senator Jeff Merkley — Portland Office
Unico Properties LLC
United Way of the Columbia-Willamette
URS Corporation
Vestas — American Wind Technology, Inc.
Waterleaf Architecture
Whole Foods Market Laurelhurst
Widmer Brothers Brewing
Yost Grube Hall Architecture

Silver

B-Line: Sustainable Urban Delivery
Brooklyn Hardware, LLC
Cardno, Inc.
Dove Lewis Emergency Animal Hospital
Dragonfly Coffee House
ecoShuttle
EarthShare Oregon
Farleigh Wada Witt
Fire on the Mountain — Burnside
Fire on the Mountain — Fremont
Flipside Hats
Friends of Trees
Infinity Images
Lead Lizard
Living Room Realty — NE
Living Room Realty — SE
LRS Architects
Mark C. Cogan, P.C.
Marquam Capital
Marshall Mediation
MIG, Inc.
Mirador Community Store
Multnomah County, 501 Building
Northwest Energy Efficiency Alliance (NEEA)
Oregon Historical Society
Pedal PT
Portland Community Media
Portland Metropolitan Association of Realtors
Portland Scottish Rite
PREM Group
R&H Construction
Rafia Dental
Realty Trust Group, Inc. — Pearl
ReRack
Resource Recycling Technologies
Siltronic Corporation
Solid Ground Consulting
Southpark Restaurant
SP+
SRG Partnership, Inc.
The Westin Portland
Trillium Family Services
Turner Construction
U of O — Academic Extension
Uroboros Glass
Zidell Marine Corporation

Certified

Applied Archaeological Research
Belmont Eco Laundry
EdgeLink
Haircolor Salon Dirk
Memento PDX
Presents of Mind
Red Shield
VanderHouwen & Associates

www.portlandoregon.gov/sustainabilityatwork

LOCAL GOVERNMENT OPERATIONS

The LED streetlight replacement project currently underway is the single largest energy-efficiency project the City has ever undertaken. When complete in 2016 it will reduce total carbon emissions from all City operations by about 10 percent.

Just as the City and County provide enabling policies, technical assistance, education and outreach, incentives and other support to help the community achieve the objectives in this *Climate Action Plan,* the City and County must also lead the way in our own operations.

Carbon emissions from City of Portland and Multnomah County operations account for about one percent of total local emissions and result from various activities and facilities, including:

- Buildings such as fire and police stations, offices, parks and community centers, detention facilities, libraries and health clinics.
- Transportation infrastructure like streetlights and traffic signals, as well as the Portland Streetcar.
- Drinking water, wastewater and stormwater systems, including treatment facilities and pump stations.
- Fleets of passenger vehicles as well as heavy-duty construction equipment.
- Purchase of goods and services.
- Extensive information technology systems, including emergency communications such as 911.

Both the City and County have aggressive policies and continuous improvement practices in place to reduce energy use throughout operations. As a result, the City's annual energy bill is now over $5.7 million less than it would have been, and carbon emissions from City operations are 17 percent below FY06–07 levels (see Figure 42).

Similarly, Multnomah County's annual energy bill is now $500,000 less than it would have been, and carbon emissions from County operations are 15 percent below 2001 levels.

East Multnomah County Courthouse

The City and County have pioneered sustainable procurement policies, and green building policies for both the City and County that require all new buildings and major renovations to achieve LEED Gold certification. The City now has 11 LEED-certified buildings, and the County's East County Courthouse achieved LEED Gold status.

In 2015 the City furthered its commitment by adopting a renewed set of Sustainable City Government Principles and Environmental Performance Objectives, as well as an update to the Green Building Policy for City-owned facilities.

LOCAL GOVERNMENT OPERATIONS

2030 OBJECTIVE 19 Reduce carbon emissions from City and County operations by 53 percent from FY 2006–07 levels.

The City and County own and operate hundreds of buildings, tens of thousands of streetlights and traffic signals and large-scale industrial plants. As public entities, the City and County can invest in capital projects with relatively long payback periods and, like all businesses, need to examine every facet of operations for emission reduction opportunities.

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
19A	**Financing Energy Efficiency —** Identify internal and external funding sources to finance energy-efficiency upgrades in City and County facilities. Explore "climate bonds" as one funding mechanism.	C C C C $ E	**City:** BPS **County:** DCA	Existing and/or ongoing
19B	**Efficiency Projects —** Improve energy efficiency of City and County operations: a) Implement all cost-effective (simple payback of ten years or less) resource-efficiency projects in City-owned buildings and facilities. b) Reduce energy use from City and County operations by 2 percent each year through capital projects and operational improvements.	C C C C $ E	**City:** OMF, BES, PP&R, Water, BPS **County:** DCA, OS	Existing and/or ongoing
19C	**Equipment Upgrades —** Continue converting water pumps, water treatment and other energy-intensive operations to more efficient technologies and change operational practices to improve efficiency.	C C C C $ E	**City:** BES, Water, PP&R	Existing and/or ongoing
19D	**Resource Management —** Develop and implement utility performance tracking for all City- and County-owned buildings and facilities. Develop and implement a Countywide Strategic Energy Plan.	C C C C $ E	**City:** OMF, BPS, BES, PP&R, Water **County:** DCA, OS	Mid-term
19E	**Lighting Upgrades —** Implement energy-efficient outdoor lighting, including light emitting diodes (LED) and dimming technologies when appropriate. Complete the conversion of all streetlights to LEDs. Use Dark Skies best practices when possible, to reduce light pollution and minimize bird strike hazards.	C C C C $ E	**City:** PBOT, PP&R **County:** DCA, DCS	Existing and/or ongoing

Potential impact

- C C C C — Magnitude of carbon emissions reduction
- $ — High potential to support jobs and prosperity
- E — High potential to advance equity
- High potential to improve local environmental quality
- High potential to improve health

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
19F	**Renewable Energy —** Purchase or generate 100 percent of all electricity required for City operations from renewable sources, with at least 15 percent of all electricity for City operations from onsite or district renewable energy sources such as solar, biogas, in-pipe microhydro and biomass. a) Expand recovery and use of biogas at the City's wastewater treatment plant. b) Investigate third-party ownership and alternate financing models to expand the number of solar electric systems at City-owned facilities.	C C C C $ E	**City:** BPS, OMF, BES, PP&R, Water	Existing and/or ongoing
19G	**Waste Prevention and Recovery —** a) Reduce total waste from City operations 12.5 percent below FY 09–10 levels. The County continues to reduce waste. b) Recover 76 percent of all waste generated by City operations. c) Increase material salvage for City-owned full and partial building demolitions.	C C C C $ E	**City:** BPS, OMF, PP&R, BES, Water, Fire **County:** OS, DCA	Long-term
19H	**Green Building —** Target net-zero energy use by implementing the City and County's green building policies for new buildings and major retrofits. Support this work with dedicated staff time, and consider project location and contracting practices where the benefits are shared by low-income populations and communities of color.	C C C C $ E	**City:** OMF, PP&R, Water, Fire, BES **County:** OS, DCA	Existing and/or ongoing
19I	**Energy Performance Tracking —** All City and County-owned buildings greater than 20,000 square feet will annually calculate energy-use intensity (kBtu per gross square foot) and eligible City and County-owned buildings will calculate an Energy Star score using the U.S. Environmental Protection Agency's Portfolio Manager.	C C C C $ E	**City:** BPS (OMF, PP&R, BES, Water, PBOT) **County:** DCA	Existing and/or ongoing
19J	**Low-Carbon Fuels —** Prioritize low-carbon fuels for fleet vehicles, including biodiesel, compressed natural gas, liquid natural gas, propane and electricity where appropriate.		**City:** CityFleet **County:** DCA	Existing and/or ongoing
19K	**Fleet Fuel Efficiency —** Reduce carbon emissions from City and County fleet vehicles and equipment. a) Ensure that the average age of the City's fleet is less than 10 years old. b) Develop a County fleet strategy that incorporates carbon emission reduction, electric vehicle and low-carbon transportation fuel goals.	C C C C $ E	**City:** CityFleet **County:** DCA	Existing and/or ongoing
19L	**Electric and Hybrid Vehicles —** Purchase electric, plug-in hybrid and hybrid vehicles whenever they meet the user's needs. Include installation of electric charging stations where appropriate.		**City:** CityFleet **County:** DCA	Existing and/or ongoing

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
19M	**Low-Carbon Purchasing —** Conduct a carbon emissions inventory of City purchases. Based on the results, prioritize efforts to reduce carbon emissions associated with City procurement decisions.	C C C C $ E	**City:** Purchasing	Near-term
19N	**Sustainable Procurement —** Advance the practice of including the sustainable practices of prospective vendors, contractors and service providers as evaluation criteria in procurement decisions.		**City:** Purchasing **County:** DCA, DCM	Existing and/or ongoing
19O	**Emerging Technology —** Accelerate use of emerging low-carbon products and services by City bureaus through an "early adopter" program.		**City:** PDC	Near-term
19P	**Sustainable Wood —** Support the use of regional, sustainably sourced wood products for City-owned building and landscape projects, including training design contractors.	C C C C $ E	**City:** Purchasing, PP&R, BES, OMF	Mid-term
19Q	**Teleconferencing —** Establish video and/or web conferencing capability in all major City and County facilities and train staff to leverage these tools to reduce travel.	C C C C $ E	**City:** BTS **County:** DCA	Existing and/or ongoing
19R	**Sustainable Jails Project —** The County will continue to implement the Sustainable Jails Project to maximize energy and resource efficiencies.	C C C C $ E	**County:** MCSO, OS	Existing and/or ongoing
19S	**Telecommuting —** Update the City's telecommuting policy to foster increased utilization of this commute option whenever it meets City business needs.	C C C C $ E	**City:** BHR	Near-term
19T	**Divestment —** Establish City policies to hold no financial stake in fossil fuel companies and encourage the State of Oregon to do the same.	C C C C $ E	**City:** OMF	Mid-term
19U	**Sustainable Stormwater —** Make progress on managing 50 percent of stormwater from City-controlled impervious surfaces with sustainable stormwater strategies by 2030.	C C C C $ E	**City:** BES	Existing and/or ongoing

Potential impact

- C C C C — **Magnitude of carbon emissions reduction**
- $ — **High potential to support jobs and prosperity**
- E — **High potential to advance equity**
- **High potential to improve local environmental quality**
- **High potential to improve health**

The City has walked the talk by reducing emissions

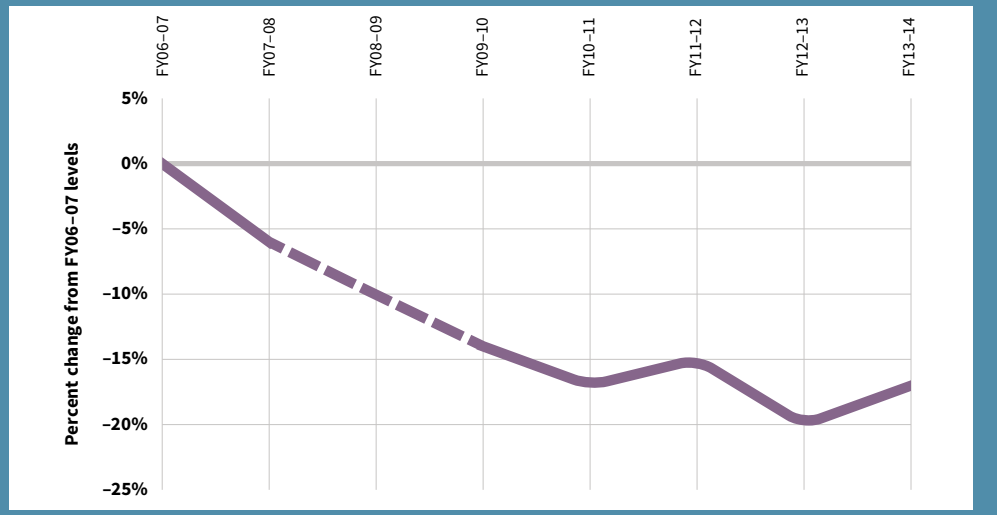
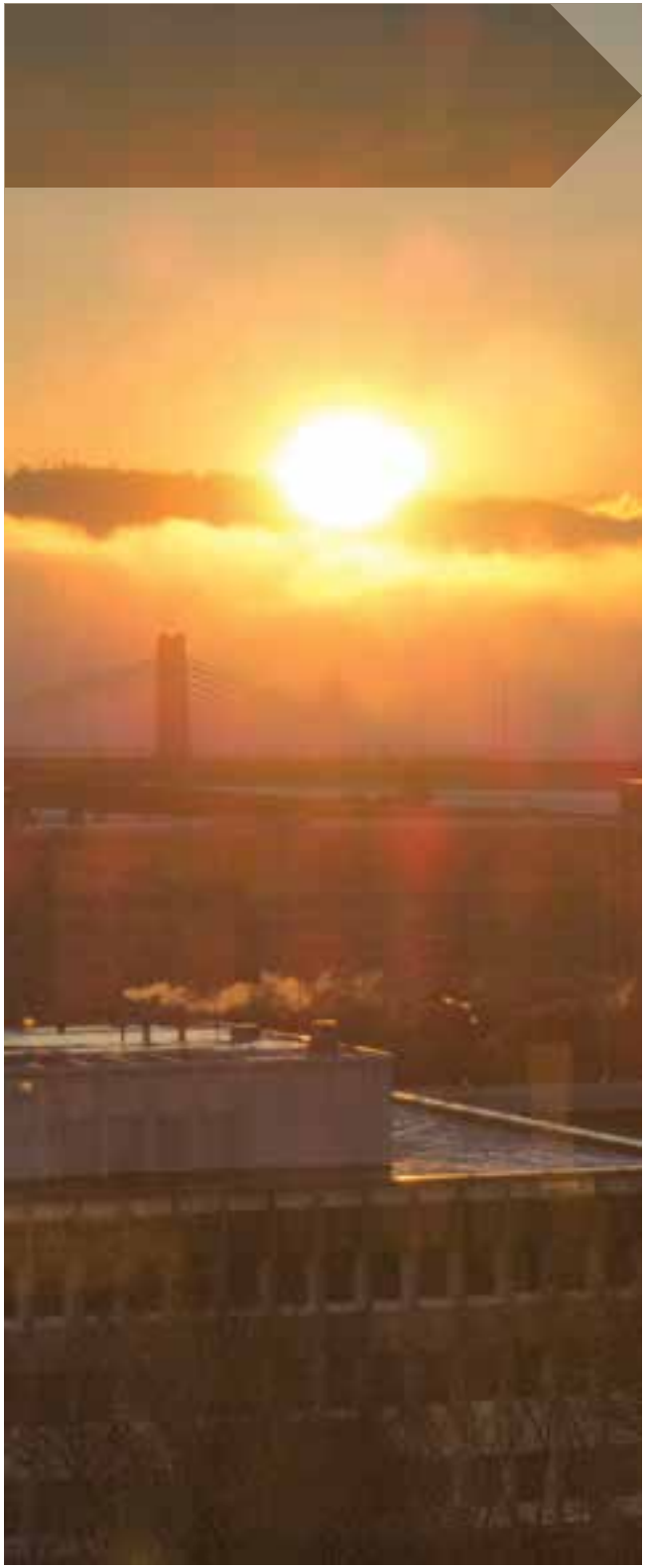


Figure 43. City of Portland carbon emissions trend. *Source: Portland Bureau of Planning and Sustainability*

Emissions from City of Portland operations have declined to 17 percent below FY06–07 levels. To reduce emissions from City operations by 50 percent by 2030, the City will need to maintain the pace at which emissions have declined.

IMPLEMENTATION



Building the capacity of staff and the community to implement and evaluate actions to reduce carbon emissions and prepare for climate change is critical to achieving the vision and goals outlined in this plan. To that end, City and County staff will work collaboratively across bureaus, departments and jurisdictions to:

- Review climate research, trends, regulations and best practices.
- Foster cross-disciplinary collaboration between agencies and program areas, as well as with academia, the private sector, nonprofits and community organizations that serve communities of color and low-income populations.
- Ensure the actions are implemented equitably.
- Follow an adaptive management approach to allow continual improvements and reprioritize when necessary.
- Implement actions that (1) benefit under-served and under-represented communities and (2) benefit the communities and natural systems most vulnerable to climate change impacts.
- Reexamine and update the key findings and actions of this strategy every five years.
- Report on progress toward implementing the actions outlined in this Plan annually, as well as on progress toward more equitable outcomes.

THE BENEFITS OF CLIMATE ACTION SHOULD BE SHARED BY ALL

The City and County want to ensure that the benefits of taking action to reduce carbon emissions and prepare for climate change are shared by all residents. Many of the actions outlined in this *Climate Action Plan* present opportunities to implement existing policies and efforts to increase the utilization of firms owned by people of color.

A 2009 disparity study of contracting by the City of Portland and Portland Development Commission found quantitative and qualitative evidence that businesses owned by people of color face barriers to working as prime contractors and as subcontractors on local public sector contracts (City of Portland Procurement Services, 2011). The study also found that the current availability of contractors of color to perform City construction and construction-related professional services contracts is less than what might be expected if people of color had the same opportunities as white people to enter and advance within these industries and form and grow their businesses.

The City and County are working to lessen the barriers to Minority, Women and Emerging Small Businesses (MWESB) through targeted outreach to ensure that businesses are aware of contracting opportunities as well as providing business support assistance to these firms. More broadly, many of the actions in this *Climate Action Plan* also support expanding workforce development opportunities (e.g., contracting, trainings, internships) for people of color that will help provide underserved communities with valuable tools necessary for future success. Working with community organizations and strengthening partnerships are key.

CLIMATE EQUITY COMMITMENTS

The City and County's vision of equitable climate action is reflected in the Vision for 2050 (see page 2). In the near term, the City and County are committed to equitably implementing the actions in the *Climate Action Plan* in ways that address health, safety and livability, access, prosperity and inclusive engagement. Specifically, the City and County will seek to meet commitments in these areas:

Health: Address factors leading to health disparities such as barriers to active lifestyles and transportation, pollution exposure and unequal access to green space, healthy food and other natural resources.

Safety and Livability: Promote investments in housing energy efficiency that make housing safer, more comfortable and affordable and in community infrastructure that increases pedestrian and bike safety and accessibility and other elements of livability.

Access: Invest in neighborhood accessibility by bringing services to underserved neighborhoods and supporting equitable expansions of public transit and active transportation infrastructure.

Prosperity: Promote entrepreneurial and established business opportunities to employ and empower low-income households and communities of color, and maximize those opportunities through equitable hiring and contracting policies that target under-represented populations.

Inclusive Engagement: Include communities of color and other under-represented populations in every step of the *Climate Action Plan* process, from the definition of goals to implementation. Proactive, culturally appropriate strategies will be undertaken to involve and empower these populations through the implementation of climate protection-related actions and programs.

MEASURING PROGRESS

The *Portland Plan* outlines several measures of success that are relevant to the *Climate Action Plan* including (1) resident satisfaction, (2) transit and active transportation, (3) reduced carbon emissions, (4) complete neighborhoods, (5) healthier people, and (6) healthy watersheds. The City and County will use these Portland Plan indicators of success as well as the 2030 Objectives outlined in this *Climate Action Plan* for long-term benchmarking metrics of progress.

The City and County will track and report on the degree to which the Climate Equity Objectives outlined in Appendix 1 are integrated into the decision-making processes and implementation of the *Climate Action Plan*.

In addition, the accompanying *Climate Action Plan Implementation Guide* (separate document) provides support for City and County staff on best practices of these considerations and tools for integrating equity in their work.

IMPLEMENTATION

2030 OBJECTIVE 20 — Build City and County staff and community capacity to ensure effective implementation and equitable outcomes of climate action efforts.

Opportunities to reduce carbon emissions and consider the risks of climate variability and change need to be routinely integrated in virtually all aspects of City and County work, including:

- Setting policy.
- Making budget decisions.
- Creating market incentives.
- Developing education and outreach strategies.
- Updating zoning and other codes.
- Making public investments, including infrastructure.
- Delivering health services.
- Fostering emergency preparedness.

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
20A	**Community Capacity —** Foster ongoing and deep community engagement, with additional emphasis on communities of color and low-income populations, to advise on equitable policy development, program design and implementation of climate-related actions.	E	**City:** BPS, BES, PP&R, PBOT, PBEM **County:** OS	Existing and/or ongoing
20B	**Collaboration —** Facilitate cross-agency and cross-disciplinary collaboration, engagement, information exchange and peer-to-peer learning related to climate action efforts.	E	**City:** BPS, BES, PP&R, PBOT, PBEM, Water, OMF **County:** OS	Existing and/or ongoing
20C	**Staff Capacity —** Support the development of data, tools, best practices and training for innovative, effective and equitable implementation of climate-related policies and projects.	E	**City:** BPS, BES, PP&R, PBEM, Water, OMF **County:** OS	Existing and/or ongoing
20D	**Workforce Development —** Create cross-bureau initiatives to support workforce development that build upon existing social equity contracting programs, policies, and resources to strengthen the capacity of firms owned by people of color and nonprofits serving under-represented and under-served adults and youth to help implement *Climate Action Plan* actions.	$ E	**City:** BPS, BES, PP&R, PBOT, PBEM, Water, OMF, Purchasing, PDC **County:** DCM, OS	Mid-term
20E	**Career Development —** Maximize career development opportunities, especially for low-income populations, communities of color and youth, in the fields of energy, green building, transportation, brownfield and Superfund remediation and redevelopment, planning and natural resources.	$ E	**City:** BPS, BES, PP&R **County:** DCM	Mid-term
20F	**Budget Performance Measure —** Explore options for a climate action performance measure to be incorporated into the City's annual budgeting process where appropriate.		**City:** CBO, BPS	Mid-term

Potential impact — $ High potential to support jobs and prosperity; E High potential to advance equity; High potential to improve local environmental quality; High potential to improve health

ACTIONS TO BE COMPLETED BY 2020		Impact	Lead agency	Timeframe
20G	**Community Benefits —** Support use of tools and strategies to engage impacted communities, minimize harms and hazards and ensure economic, social and environmental benefits are shared by low-income populations and communities of color.	$ E	**City:** BPS, PDC **County:** OS	Long-term
20H	**Government Partnerships —** Partner with other local, regional and tribal governments to inform local, state and federal climate policy activities.		**City:** BPS, BES, PBEM, PBOT, Water **County:** OS, DCS, HD	Existing and/or ongoing
20I	**Regional Partnerships —** Encourage Metro to: a) Update and maintain a regional carbon emission inventory and b) Include a focus on climate change preparation in its climate-related planning, policy and program work.		**City:** BPS, BES **County:** DCS, OS	Mid-term
20J	**Academic Partnerships —** Partner with Portland State University and other universities and local colleges to apply emerging research and innovative approaches to preparing for climate change and reducing carbon emissions.		**City:** BPS, BES, PBEM, PP&R, PBOT, Water **County:** OS, HD, DCS	Existing and/or ongoing
20K	**Nonprofit Partnerships —** Partner with nonprofit organizations, such as the Intertwine Alliance, to advance the Regional Conservation Strategy.		**City:** BES, PP&R, BPS **County:** OS	Existing and/or ongoing
20L	**Metrics —** Develop comprehensive qualitative and quantitative climate action metrics to measure progress in the areas of consumption, food and agriculture, climate change preparation and others that incorporate an evaluation of benefits and burdens to low-income populations and communities of color.		**City:** BPS **County:** OS, HD	Near-term
20M	**Progress Reports —** Provide annual progress reports on the implementation of the *Climate Action Plan,* including an updated emissions inventory and progress toward broader environmental, health and equity goals.		**City:** BPS **County:** OS	Near-term
20N	**Plan Updates —** Update or modify the actions in the *Climate Action Plan* every five years.		**City:** BPS **County:** OS	Long-term

CLIMATE ACTION PLAN DEVELOPMENT PROCESS

Advisory Groups

In 1993, Portland became the first U.S. city to adopt a climate action plan, prioritizing a compact urban form, multimodal transportation choices, walkable neighborhoods, efficient buildings, renewable energy resources, and urban forestry. Two decades later, Portland and Multnomah County have achieved real results: In 2013, per person carbon emissions were 35 percent below 1990 levels, and total emissions had declined 14 percent. Moreover, many of the same efforts that led to lower carbon emissions have made Portland a more desirable place to live and work.

In addition, the City and County have made progress on climate change preparation and carbon sequestration through protecting stream corridors and acquiring and restoring natural areas and floodplains. More recently, The Intertwine Alliance has developed a Regional Conservation Strategy and Biodiversity Guide for the Portland-Vancouver region that includes strategies to address climate change.

Key advisory groups

To develop this *Climate Action Plan,* Portland and Multnomah County established two key advisory groups, a Steering Committee and an Equity Working Group, in addition to several ad hoc technical workshops. (See inside front cover for a list of Steering Committee and Equity Working Group members.)

The Steering Committee was made up of 20 members with a wide range of experiences and expertise representing a cross-section of community interests. Steering Committee meetings began in June 2013, and the group met five times throughout the development of the *Climate Action Plan*.

Portland's previous climate plans acknowledged the importance of equity, but did not establish specific metrics or actions to prioritize more equitable outcomes. Three years after the 2009 climate plan was adopted, the City of Portland completed the *Portland Plan,* which identified equity as the overarching strategy of the City's 25-year strategic plan.

To elevate equity as a key outcome of the *Climate Action Plan,* Portland and Multnomah County engaged community partners to convene the Equity Working Group. The Equity Working Group comprised participants from six local community organizations focused on advancing equity, each with a different constituency and focus. The Equity Working Group provided recommendations on the draft proposed *Climate Action Plan* objectives and actions as well as overarching priorities and guidance for implementation. In addition, a scan of the 2009 *Climate Action Plan* was conducted to assess equity gaps and missed opportunities, suggest metrics and summarize best practices for integrating equity into climate plans from around the country.

The combined feedback from the Equity Working Group and the equity scan of the 2009 *Climate Action Plan* resulted in this *Climate Action Plan's* Equity Commitments (see Implementation Chapter, page 132) and Climate Equity Objectives (see Appendix 1, page 148) and helped to shape the 2050 Vision (pages 2–3). In consultation with the Equity Working Group, City and County staff used the Equity Objectives to evaluate opportunities and unintended consequences for the proposed objectives and actions and to develop an implementation guide.

Climate Action Considerations

The objectives and actions contained in this *Climate Action Plan* were prioritized based on several considerations, including the action's potential to:

Reduce carbon emissions. Implementing the actions and achieving the 2030 objectives must result in significant progress toward the goal of an 80 percent emissions reduction. The purpose of this filter is to screen out measures that may lead to short- or medium-term reductions but contribute little to achieving the necessary long-term reductions. See discussion of emissions reductions needed to achieve the 2050 goal (page 19) for more details.

Prepare for and minimize the risks of projected climate change impacts. Many actions in this plan help advance the City and County's resiliency to projected climate change impacts and reduce vulnerabilities to risks such as heat, drought, wildfire, flooding, landslides and ecosystem degradation.

Reduce existing disparities, address community needs and achieve more equitable outcomes. Many of the objectives and actions strive to improve equity in ways that reduce existing disparities and address community needs and priorities for low-income populations and communities of color. The City and County's success in achieving more equitable outcomes through climate action relies on careful attention to the Equity Objectives outlined in Appendix 1, page 148.

Deliver co-benefits such as improved public health, thriving natural systems and economic prosperity. To the greatest extent practical, actions are designed to maximize health, safety and economic benefits to local residents or businesses, make wise use of City and County operating budgets and strengthen natural systems.

Acquire funding through existing or potential financial resources. Except where otherwise indicated, the actions included in the plan can be funded through existing programs or can reasonably receive the funding required for implementation from other internal or external sources, including grants.

Deliver results within the City or County's sphere of influence. Although action must be taken at all levels of government and the private sector to address climate change, this plan focuses on actions that the City and County are positioned to carry out and that will encourage or mandate change in all sectors of the community.

Climate Action Plan Management Process

The City and County recognize that the *Climate Action Plan* must chart a course while allowing for adaptive management, incorporating and building on lessons learned as it is implemented.

This process includes:

Progress reports: The Bureau of Planning and Sustainability and the Multnomah County Office of Sustainability will report annually on local carbon emission trends, fossil fuel use and progress in implementing the actions in this *Climate Action Plan*. Annual progress reports will include updates on the integration of the Equity Objectives (see page 148) in the implementation of the actions. Data on consumption will be included in the reports as it becomes available.

Plan updates: Every five years, Portland and Multnomah County will revise the actions in this plan and identify new ones. As part of this review, the City and County will identify and update actions that have not yet been implemented but remain effective ways to achieve the objectives of the Plan. New actions will be identified for implementation in the subsequent five years. This revision process will include a review and analysis of the opportunities and challenges to achieving the 2030 objectives and the interim goal of reducing local carbon emissions by 40 percent below 1990 levels.

I STAND FOR CLIMATE ACTION

Related Planning Efforts

The *Climate Action Plan* has close links to a number of local and regional plans. These plans work together toward creating a vibrant, prosperous, healthy, equitable, resilient and low-carbon community.

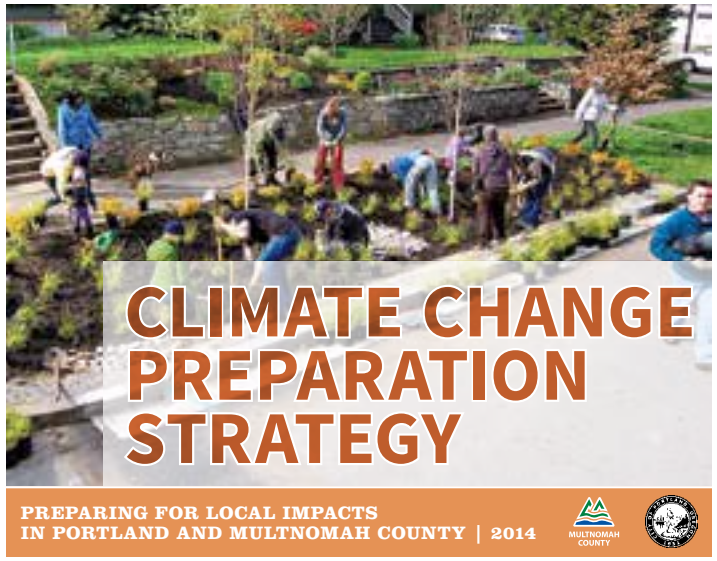
Climate Change Preparation Strategy and *Risk and Vulnerabilities Assessment*

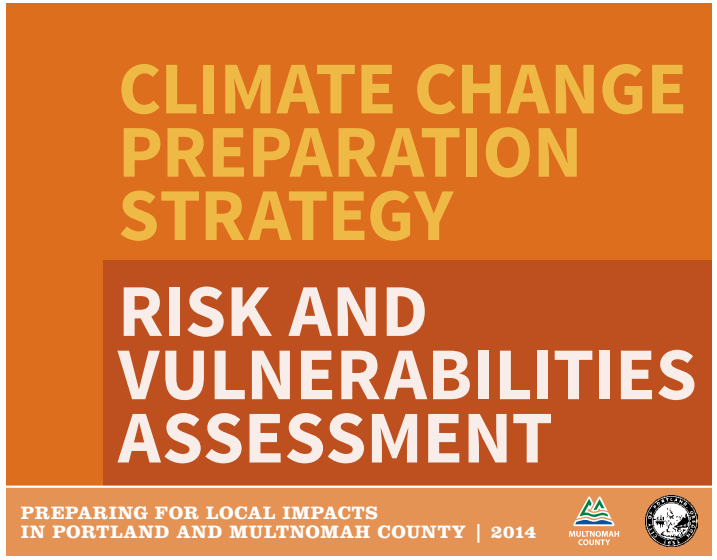
These documents serve as the City and County's shared foundation for the climate change preparation-related actions outlined in this *Climate Action Plan* and seek to: (1) reduce climate-related vulnerabilities for residents and businesses, and (2) respond to impacts when they do occur.

The *Risk and Vulnerabilities Assessment* provides an overview of the science and a more detailed review of the potential impacts to health and human systems, natural systems, infrastructure and the built environment.

The climate change preparation actions outlined in this *Climate Action Plan* (see page 106) build on the existing work of these two documents to understand how climate affects the community today, how those effects are expected to change in the coming century, and what can be done to prepare.

Climate variability and change need to be routinely considered in virtually all aspects of the City and County's work, including setting policy, making budget decisions, updating code, investing in infrastructure, delivering health services, and preparing for emergencies.

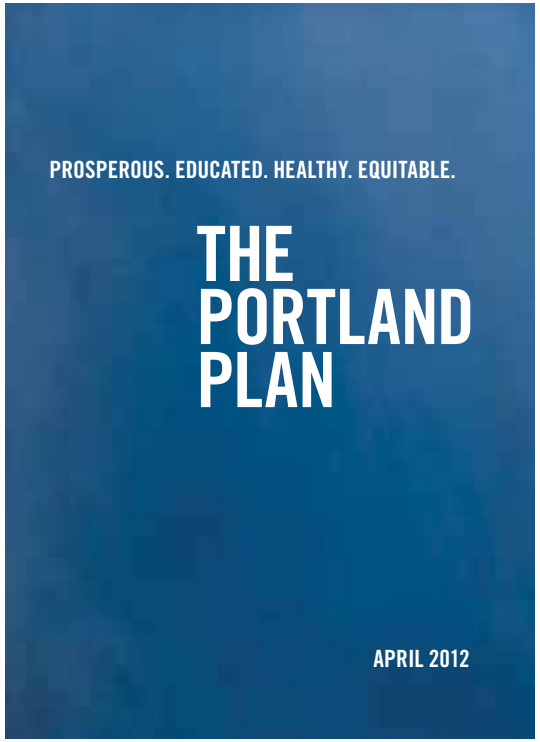


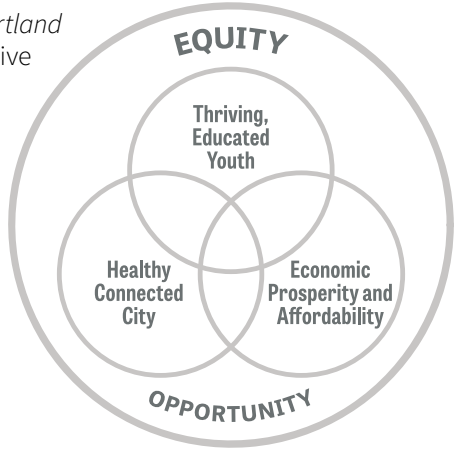


Portland Plan

The *Portland Plan* (2012) is the City of Portland's overarching strategic plan. It includes four strategies designed to improve prosperity, education, health and equity throughout the city and for all Portlanders:

- A Framework for Equity
- Thriving Educated Youth
- Economic Prosperity and Affordability
- Healthy Connected City



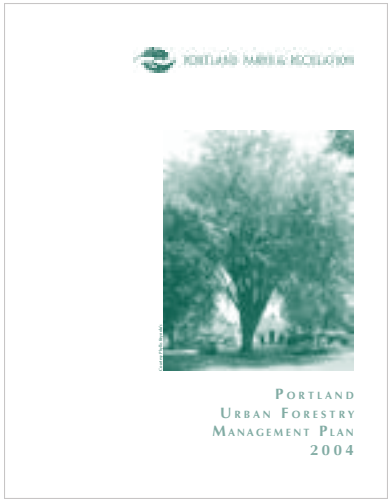


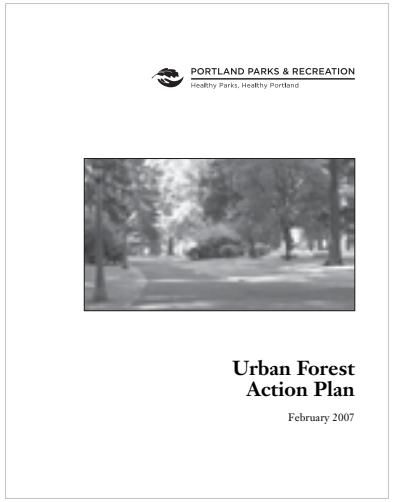
Through goals, guiding policies and near-term actions, the *Portland Plan* strategies provide a foundation for alignment and collective action across agencies and organizations. The strategies also provide a framework for meeting Portland's 12 measures of success, many of which relate directly to the goals and objectives in this *Climate Action Plan,* including reduced carbon emissions, complete neighborhoods, transit and active transportation, equity and inclusion, healthier people and growing businesses.

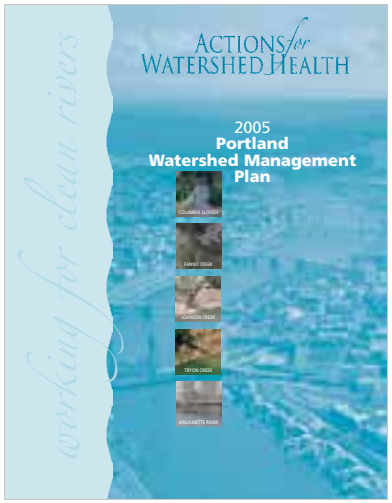
A Framework for Equity represents a change in the way Portland works — how the City government and partners make decisions, invest and engage with Portlanders and each other to measure success. The framework includes "We will" statements that are policies that set the ground rules for how the City of Portland and its partners act. The framework also outlines the outcomes Portlanders would like to achieve and the means that should be used to create a more equitable city. The *Climate Action Plan's* development process and content reflects the goals of the *Portland Plan's* equity framework.

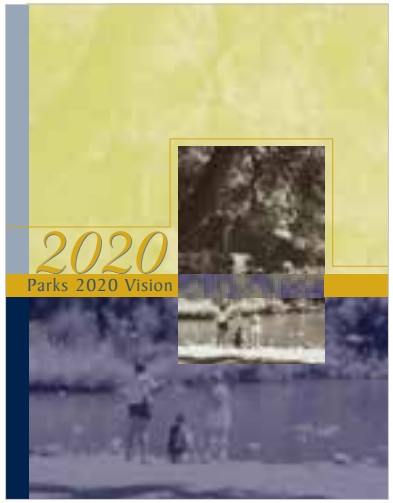
The Healthy Connected City Strategy introduces the concept of "complete neighborhoods" to Portland. A complete neighborhood provides safe and convenient access to the goods and services needed in daily life. This includes a variety of housing options, grocery stores and other commercial services, quality public schools, public open spaces and recreational facilities, affordable active transportation options and civic amenities. Creating complete neighborhoods will help Portland meet its climate action and preparedness objectives. The Urban Form and Transportation chapter of this plan (see page 72) helps to implement aspects of the complete neighborhoods concept.

The Economic Prosperity and Affordability Strategy recognizes that climate action is an economic asset. Portland has served as an international model of an urban laboratory for innovation in sustainability. The City has valuable experience built on rethinking investments; examples include programs such as Clean Energy Works and Solarize Portland that have contributed to growing the market for technologies and practices that have demonstrated how job creation can accompany reducing energy use and resource consumption. This strategy and *Climate Action Plan* align to build on Portland's position and role as a sustainability leader and to bring prosperity to all residents.









Related City and County plans

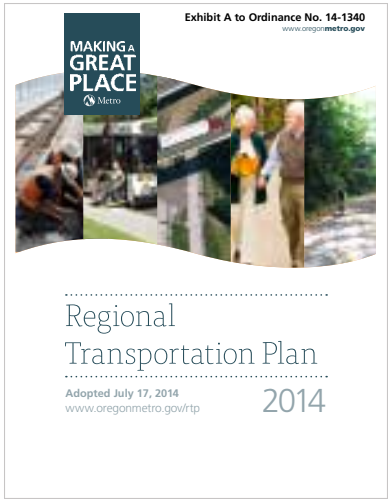
***Portland Comprehensive Plan* —** Portland's long-range plan for the growth and development of Portland through 2035, the *Comprehensive Plan* guides the location of population and job growth and codifies where different types of buildings can be constructed, what types of uses are allowed, which areas should be protected from development and where the City will invest in infrastructure. The *Comprehensive Plan* also establishes guidelines for community involvement in future plans and decisions. The updated *Comprehensive Plan* (currently in draft form) has been developed with the intention of achieving climate goals outlined in this *Climate Action Plan* in addition to other community priorities.

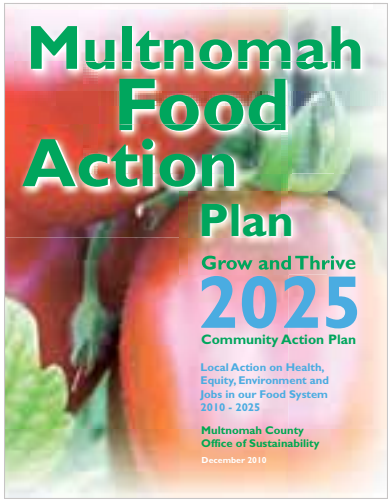
***Portland Transportation System Plan* (*TSP*) —** Portland's long-range plan to guide transportation investments, the *TSP* meets state and regional planning requirements and addresses local transportation needs for street, transit, freight, bicycle and pedestrian improvements. This links to several of this *Climate Action Plan's* Urban Form and Transportation chapter goals (see page 70).

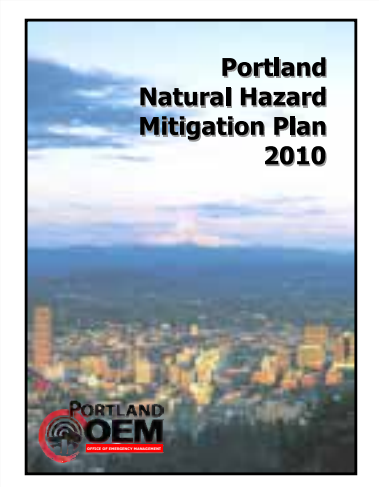
***Portland Urban Forestry Management Plan* and *Urban Forest Action Plan* —** These plans focus on protecting and restoring the urban canopy, supporting the urban canopy and urban forest, and maximizing the benefits of the urban forest for all residents. These plans include many of the same goals that are in the Urban Forest, Natural Systems and Carbon Sequestration chapter of this *Climate Action Plan* (see page 102).

***Portland Watershed Management Plan* (*PWMP*) —** A citywide plan to protect and restore Portland's natural systems, the *PWMP* lays out an integrated, system-wide approach to improving watershed health. Several actions in the Climate Change Preparation chapter reinforce the *PWMP* goals (see page 106).

***Portland Parks & Recreation 2020 Vision* —** A plan to provide a wide variety of high-quality recreation services and opportunities for all residents and to preserve, protect and restore Portland's natural resources. Several actions in the Urban Forest, Natural Systems and Carbon Sequestration chapter of this *Climate Action Plan* connect to the Parks 2020 Vision plan and actions (see page 102).







***Metro 2040 Growth Concept* and the *Urban Growth Management Functional Plan* —** Metro's long-range plans for the future growth and development of the Portland metropolitan area establish an underlying framework for many of the actions in the *Climate Action Plan's* Urban Form and Transportation chapter (see page 70).

Metro *Regional Transportation Plan* (*RTP*) — Part of the implementation of the 2040 Growth Concept, Metro's *RTP* guides transportation investments to protect the livability of the region's communities and sustain the region's well-being and economic prosperity. This also links to several actions within the Urban Form and Transportation chapter of the *Climate Action Plan* (see page 70).

Portland *Economic Development Strategy* — Adopted by City Council and the Portland Development Commission in 2009, the *Economic Development Strategy* articulates a goal of building a sustainable economy and identifies the investments necessary to grow employment in the city by 10,000 jobs in five years. The Strategy has a three-fold focus that integrates job growth, innovation in sustainability and equality of opportunity.

***Multnomah Food Action Plan* —** The *Multnomah Food Action Plan* was finalized and launched by the community in January 2011. The Multnomah County Board of Commissioners adopted the plan, and over 500 organizations and individuals signed the Declaration of Support, including the City of Portland. The 15-year action plan identifies 65 communitywide collaborative actions for local government, businesses, nonprofit organizations, faith communities and learning institutions in support of a local, healthy, equitable and regionally prosperous food system. Many of these actions are linked closely with actions in the *Climate Action Plan's* Food and Agriculture chapter (see page 98).

Multnomah County and City of Portland Natural Hazard Mitigation Plans — The City and County's hazard mitigation plans address hazards such as wind storms and localized stormwater drainage flooding that occur in some locations almost every year. The plans also addresses less frequent hazard events including earthquakes, wildland-urban interface fires, landslides and major floods. Many of the recommendations in these plans are linked closely with actions in the *Climate Action Plan's* Climate Change Preparation chapter (see page 106).

COLLABORATION AND PARTNERSHIPS

Portland's success to date in reducing carbon emissions rests on a foundation of sound land use and transportation planning, consistent investment in energy efficiency and supportive state and regional policies. Since 1973, state law has required every city and county in Oregon to have a Comprehensive Plan to guide land use decisions.

Metro, Portland's regional government, together with TriMet, the provider of public transportation for the Portland region, has guided investment in light-rail, mixed-used development and an integrated multimodal transportation system. These efforts are a large part of the local progress to date in reducing emissions and are fundamental to the long-term success in achieving the 2050 goal.

In the 20 years since Portland first began to address climate change, efforts at the regional, state and national levels have taken shape. These provide new opportunities — and a new imperative — for coordination.

State action

In Oregon, explicit climate protection efforts date to 1989, when the Oregon legislature first adopted a carbon reduction goal. In 1997, the legislature granted the Oregon Energy Facility Siting Council authority to set carbon emission standards for new power plants, thereby enacting the first state or federal law in the U.S. explicitly designed to reduce carbon emissions. Ten years later, the legislature established a new goal to reduce emissions by 75 percent below 1990 levels by 2050.

In 2005, Governor Kulongoski issued the Greenhouse Gas Emissions Reduction Strategy, which identifies actions to help the state to reach this 75 percent emission reduction target. In 2007 legislation established the Global Warming Commission to guide Oregon's work on climate change, and in 2010 the Commission adopted its Interim Roadmap to 2020 identifying key strategies for the state to pursue. The current state strategy continues to prioritize policies, programs and investments to accelerate the transition to clean energy.

Oregon has already acted on several major pieces of these collective strategies, including requiring large electric utilities to source 25 percent of their power from new renewable resources by 2025, and requiring major emitters to report their carbon emissions. State law also directed Metro to assess options for achieving carbon reduction goals from the transportation sector. Metro's Climate Smart Communities project has concluded that full implementation of existing plans can come close to realizing these goals, highlighting the need for the region to identify financial resources sufficient to implement its plans.

Federal action

At the federal level, both Congress and executive agencies have critical roles. The U.S. Department of Transportation substantially strengthened vehicle fuel efficiency standards in 2011, and the new regulations are already reducing transportation fuel use. When fully implemented in 2025, the standards require that new cars achieve an average of 54 miles per gallon, significantly reducing carbon emissions while saving drivers billions of dollars.

Equally important, in 2014 the U.S. Environmental Protection Agency proposed two sets of rules covering carbon dioxide emissions from power plants: One for new plants and a second for existing plants. The latter rules establish carbon reduction targets for each state while providing considerable flexibility to states to determine how they will meet their targets.

Establishing a national price on carbon, a policy recommended by many economists for addressing climate change, would require Congressional action. On several occasions Congress has taken up legislation to establish a carbon tax or a cap-and-trade system, and will likely continue to introduce carbon pricing proposals.

Portland has also worked with other cities to accelerate climate activities. In 2007 Portland was one of the original signatories to the U.S. Mayors Climate Protection Agreement, initiated by Seattle and ultimately resulting in more than 1,000 cities making commitments to reduce carbon emissions. Portland continues to work closely with cities across North America through the Urban Sustainability Directors Network, a peer network of city sustainability officials, the U.S. Conference of Mayors, and internationally as part of C40, a global network of cities working together to respond to climate change, and the Carbon Neutral Cities Alliance.

Local action

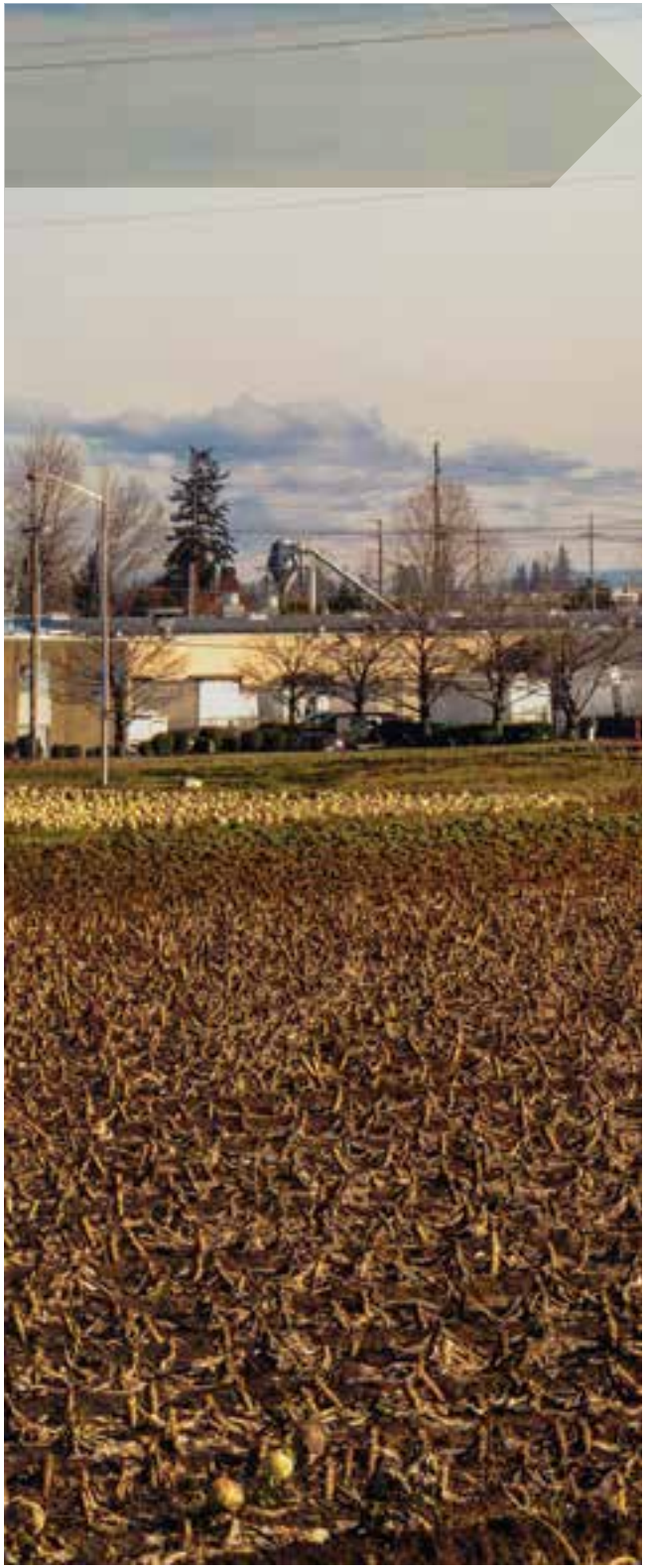
Locally, the City and County work with Portland State University (PSU) through joint projects with the Institute for Sustainable Solutions and College of Urban and Public Affairs, among many others. PSU President Wiewel is the current chair of the American College and University Presidents' Climate Commitment, which also includes Lewis and Clark College and Portland Community College.

Equally important, the City and County work with a wide array of community organizations. Neighborhood associations have pioneered innovative approaches to climate protection like the Solarize campaigns. Together with business districts and community organizations, these institutions are critical partners in generating new ideas, providing community perspectives and helping inform businesses and residents of climate-related issues and opportunities.

Individual bureaus, departments and programs will lead many of the City and County's efforts. These include the Multnomah County Office of Sustainability, Department of County Assets and Health Department, as well as the Portland Bureaus of Planning and Sustainability, Transportation, Development Services, Parks and Recreation, Environmental Services, Water, Emergency Management and the Portland Development Commission, among many others.

At the same time, the City and County will coordinate and collaborate with Metro, the State of Oregon, other local governments, TriMet, local utilities, businesses, academia and local religious and nonprofit organizations wherever possible.

APPENDICES



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Appendix 1: Climate Equity Objectives

Achieving the City and County's climate equity goals requires intentionally addressing disparate experiences and outcomes by understanding and undoing institutional bias and racism. Efforts towards achieving equity can be separated into three broad categories:

- **Procedural:** Ensuring that processes are fair and inclusive in developing and implementing any program or policy.
- **Distributional:** Ensuring that resources, benefits and burdens of a policy or program are distributed fairly and prioritize those with the highest need.
- **Structural:** Commitment and action to correct past harms and prevent future negative consequences through accountability measures and institutionalizing decision-making structures that support transparency and continual improvement.

Measuring equity

Distributional equity can be measured with outcome metrics such as the demographics of participation rates or investment of resources in dollar amounts. These metrics measure "who," "where" and "what." Structural and procedural equity are different constructs that result in behavior change; metrics must track "how" and "to what end."

The City and County are committed to developing climate-equity metrics and transparently reporting on progress through the *Climate Action Plan* reporting process. In addition to using the *Portland Plan* indicators of success for long-term benchmarking and individual program level metrics, the City and County will also track the degree to which the following equity objectives are integrated into the decision-making processes and implementation of this *Climate Action Plan*.

Equity Objectives

When implementing any *Climate Action Plan* actions, a combination of the following equity objectives should be achieved. The Climate Equity Implementation Guide (companion document) provides a framework for evaluating actions in relation to these objectives.

Equity Objectives		Why is this important?	What does this look like in practice?
Information Gathering	**Know the community to understand the opportunity**	Different communities (i.e., geographic, racial, socio-economic class) experience different outcomes, and what works for one group will not work for everyone. This is due to cultural factors and existing disparities. Understanding underserved and under-represented communities is essential to foster greater understanding and informed decision-making in a manner that will maximize benefits, and minimize burdens for those communities.	■ Research on community history and current events including interviews, community mapping, or review of documentation. ■ Demographic analysis of the experience of under-served and underrepresented communities to understand current and historic trends. ■ Assessment of vulnerability to socio-economic and environmental factors (involuntary displacement/gentrification, hazard risk, etc.). ■ Familiarity with government initiatives and community reports, such as plans or investment strategies to understand cumulative impacts and/or collaborative opportunities of policy.
Meaningful Involvement	**Be accessible to diverse communities**	Government programs and policies have historically been designed for a dominant culture, which can inhibit successful participation by other cultural communities. Programs and policies need to be designed with a culturally responsive and community needs or community assets-based approach.	■ Use people-friendly and culturally responsive strategies such as translated materials, childcare and food. ■ Partner with and support cultural liaisons. ■ Coordinate administrative processes to simplify community interaction. ■ Adapt program delivery to meet a community where it is.
	Resource communities to build their capacity	Investing in impacted communities and youth through education, staff support and financial resources increases the startup and long-term independence of community-driven solutions.	■ Training and education, especially popular education workshops facilitated by community members in community gathering places. ■ Technical assistance based on community need and priorities. ■ Avoid duplication of community initiatives. ■ Funding community-based initiatives.
	Build effective partnerships	Effective partnerships and collaborations are essential to achieve equitable outcomes. Built on trust and accountability, they should also openly acknowledge and work to balance inherent power dynamics. They require clear and purposeful roles, consistency and honest communication to mutually respect and build power.	■ Clarify roles and expectations at the start ■ Institutionalize representation from impacted communities in decision-making and processes leading to decisions. ■ Staff trained on power, privilege and institutional racism and bias ■ Transparent and proactive communication to impacted communities.
Equitable impacts	**Equitably distribute costs and benefits**	Though programs and policies may attempt to deliver benefits equally, the impact across individuals and communities may not be equitable based on the cumulative experience of current and past inequitable policies and investments. If this context is not considered, such policies and programs may do more harm than good. Therefore, programs and policies must be implemented in progressive ways and mitigate costs/burdens for communities of color and low-income populations to reduce disparity.	■ Use demographic data to target progressive action. ■ Avoid income-blind assessments and goals. ■ Redistribute revenue from taxes or fees toward the direct benefit of impacted communities. ■ Create subsidies or waivers based on need. ■ Adjust fee scales based on need ■ Integrate impact criteria for communities of color and low-income communities in decision-making
	Create opportunities for community wealth building	Public projects have the potential to ensure economic development opportunities are shared across the entire community. Good jobs and local businesses are critical to the regional economy and essential for individuals to develop wealth and assets. In addition, infrastructure investment will impact the value of physical investments like homes. Strategies that address climate change and equitable economic opportunity can be important regional economic drivers that bring everyone into the solution for carbon reductions.	■ Creation of jobs or internships, with attention paid to family wages and healthcare. ■ Business startup support or financing opportunities. ■ Attention to workforce practices; not just diversity in contracting and hiring, but also fair payment practices and retention. ■ Use of community benefit agreements.

Appendix 2: Glossary

Adaptive management: A dynamic planning and implementation process that applies scientific principles, methods, and tools to improve management activities incrementally. Management strategies change as decision-makers learn from experience and better information and as new analytical tools become available. Adaptive management can involve frequent modification of planning and management strategies, goals, objectives and benchmarks.

Asset management: The continuous cycle of asset inventory, condition and performance assessment that aims to provide cost-effective provision of a desired level of service for physical assets. Asset management includes planning, design, construction, maintenance, operation, rehabilitation and replacing assets on a sustainable basis while considering social, economic and environmental impacts.

Best practice: An activity that has proven its effectiveness in multiple situations and may have applicability in other situations.

Carbon emissions: Carbon dioxide and other greenhouse gas equivalents from the extraction and use of fossil fuels in homes, industry, business, transportation and electricity generation, among other uses.

Carbon intensity: A measure of the carbon emissions per unit of energy.

Communities of color: See definition for people of color.

Community benefit agreement: A government-enforceable agreement between an organized community and a developer or financial investor (either private or public sector) that outlines specific benefits to be afforded by that community as an outcome of the program or development. Examples of benefits may include mitigation of environmental hazards, sourcing of materials, job opportunities or access to facilities.

Complete neighborhoods: A neighborhood where people have safe and convenient access to the goods and services needed in daily life, which include a variety of housing options, grocery stores and other commercial services, high-quality public schools, public open spaces and recreational facilities like parks. Complete neighborhoods are also easily accessible by foot, wheelchair, bike and transit for people of all ages and abilities.

Consumption-based carbon emissions: Global carbon emissions based on spending by Multnomah County households, government entities and business capital and inventory formation.

Ecodistricts: Areas where energy, water and resource efficiency approaches are undertaken at a district scale, sometimes including district energy systems or other shared systems.

Equity: Equity is when all individuals have access to the opportunities necessary to satisfy their essential needs, advance their well-being and achieve their full potential. We have a shared fate as individuals within a community and communities within society. All communities need the ability to shape their own present and future. Equity is both the means to healthy communities and an end that benefits us all.

Fossil fuels: Hydrocarbon-based deposits such as coal, oil and natural gas derived from the remains of prehistoric plants and animals.

Gentrification: The process of an under-valued neighborhood becoming desirable, resulting in rising property values and changes to demographic and economic conditions of the neighborhood. These changes include a shift from lower-income to higher-income households, and often there is a change in racial and ethnic make-up of the neighborhoods residents and businesses.

Green infrastructure: Public or private assets — either natural resources or engineered green facilities — that protect, support or mimic natural systems to provide stormwater management, water quality, public health and safety, open space or other complementary ecosystem services. Examples include trees, ecoroofs, green street facilities, wetlands, natural areas and natural waterways.

Lifecycle emissions: Net carbon emissions produced throughout the life of individual products — "cradle to grave." Lifecycle emissions include upstream emissions from extraction of raw materials, processing and production of final goods, and the delivery of goods to wholesale and retail stores. The use of some goods produce lifecycle emissions, as do biodegradable products that decompose in landfills.

Low-income: Typically based on annual Median Family Income (MFI) limits published by the U.S. Department of Housing and Urban Development. Households earning: 0–30 percent MFI are "extremely low-income"; 31–50 percent MFI are "very low-income"; 51–80 percent MFI are "low-income."

Low-income populations: People, families, households and neighborhoods with low average incomes. Because of current socioeconomic status patterns, "low-income" also overlaps with people of color; however, a focus on low-income individuals/households does not substitute for a racial/ethnic justice focus.

Mitigate or mitigation: To moderate a quality or condition in force or intensity. "Climate Change Mitigation" typically references efforts to reduce carbon emissions in order to slow climate change.

Net-zero/zero-energy and energy-positive buildings: A net-zero or zero-energy building produces as much energy as it consumes, calculated on a net basis for one year. An energy-positive building produces more energy than it consumes, sending excess back into the electricity grid.

People/Communities of color: Individuals or groups who identify as African and African-American, Native American/Indigenous Nation/Native Hawaiian, Asian-American or Asian/Pacific Islander, and/or Latino/Hispanic/Chicano descent.

Sector-based carbon emissions: Emissions generated by electricity, natural gas and other fossil fuels consumed within Multnomah County.

Short lived climate pollutants (SLCP): A class of compounds that have significantly higher global warming potential than the main greenhouse gas, carbon dioxide. They include methane, tropospheric ozone, hydrofluorocarbons, black carbon and other compounds. However, unlike carbon dioxide which lasts in the atmosphere for centuries, SLCP's only last from a few days to a few years. Their high global warming potential and short lifetime means reducing SLCP's can help limit near term climate impacts, while we continue to focus on reducing long lasting greenhouse gas emissions.

Under-represented: Communities that have historically and currently not had equal voice in institutions and policy-making, or inequitable participation in programs and services.

Under-served: People and places that historically and currently have not have equitable resources, access to infrastructure, healthy environments, housing choice, etc. Disparities may be recognized in both services and in outcomes.

Urban heat island effect: A measureable increase in ambient urban air temperature resulting primarily from the replacement of vegetation with buildings, roads and other heat-absorbing infrastructure. The urban heat island effect can result in significant temperature differences between rural and urban areas.

Appendix 3: Sector-Based Emissions Inventory Methodology

Portland and Multnomah County gather data on carbon emissions to inform policy and programmatic decisions and to monitor overall progress toward emission goals. In general, the methodology follows guidelines developed by ICLEI — Local Governments for Sustainability U.S.A. and uses the U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions (version 1.1, July 2013). The inventory uses ICLEI's ClearPath software. The inventory presented here is not intended to account for or assert ownership of emissions or emissions reductions, but rather to serve as an aggregate indicator of emissions trends. As best practices for community emissions inventories evolve, Portland and Multnomah County expect to participate in these discussions and strive to apply the most credible methodology possible given the available data.

WHAT'S IN

The Multnomah County inventory includes emissions associated with:

- Electricity
- Natural gas
- Fuel oil (distillate and residual)
- Kerosene
- Propane
- Petroleum coke
- Gasoline
- Diesel
- Biodiesel
- Ethanol
- Landfilled solid waste
- Wastewater treatment

These sources are discussed in further detail on the following pages.

WHAT'S OUT

Significant categories of emissions not included in the inventory are:

- Industrial processes other than energy use. Examples of this type of emission include perfluorocarbons emitted from aluminum smelting and during the semiconductor manufacturing process. Currently, available information does not permit accurate tracking of emissions from industrial processes back to 1990, though the Oregon Department of Environmental Quality now collects data on carbon emissions from large industrial facilities.
- The agriculture sector, other than emissions from energy use. Examples of this type of emission include carbon emissions from soil as a result of crop and land management practices, methane emissions from livestock and manure and nitrous oxide emissions resulting from application of nitrogen fertilizer. Because Multnomah County contains only a small amount of farmland and no large-scale agricultural operations, local carbon emissions from agriculture do not comprise a material portion of Multnomah County's total carbon emissions inventory.
- Sequestration by the urban forest and other biological processes. Portland Parks and Recreation estimates that Portland's urban forest currently sequesters 88,000 metric tons of CO_2 annually, just over 1 percent of total local emissions. Because historical sequestration information is not available, however, forestry is not included in the emissions inventory.
- Offsets. The inventory of carbon emissions is intended to monitor emission trends to inform Portland and Multnomah County policy decisions. The data are not an accounting of emissions and do not represent any claim of ownership. The City of Portland and many businesses, organizations and residents in Multnomah County have purchased offsets from offset providers. No data are available at this time as to the volume of such offsets.

- Consumption-based emissions. As discussed on pages 36-41, these emissions are included in the consumption-based inventory, but not in the sector-based inventory. Due to the availability of data, certain categories of emissions are better accounted for based on spending as a result of local consumer demand, these include:
  a. Airplane, locomotive and shipping fuel. As an example, fuel use from Portland International Airport is gathered as part of the annual data collection process for review, but, is only included in the consumption-based inventory. The City and County don't have data to show how much fuel use is attributable to Multnomah County residents, businesses and institutions. Travel distance for those passengers and freight is also unavailable.
  b. Emissions arising from the production of goods consumed in Multnomah County but manufactured elsewhere.

Units of measurement for carbon emissions

The sector-based inventory reports emissions in metric tons of carbon dioxide equivalent. Each greenhouse gas — chiefly carbon dioxide, methane, nitrous oxide, sulfur hexafluoride, hydrofluorocarbons and perfluorocarbons — contributes to the greenhouse effect, but each of these gases has a different global warming potential ("GWP"). The GWP of a given gas is expressed as a measurement of how much carbon dioxide would be needed to have the same impact on global warming as a given gas over a period of time. The Sector-based carbon inventory utilizes the GWP from table 2.14, IPCC Fourth Assessment Report, 2007. For example, the 100-year GWP of methane is 25, which means that one ton of methane in the atmosphere would have the same impact on global warming over a 100-year period as 25 tons of carbon dioxide over the same period. For purposes of the calculations in the inventory, all carbon emissions are expressed in terms of the number of tons of carbon dioxide that would have an equivalent GWP over a 100-year period. These units are referred to as CO2-e or CO2-equivalents.

Electricity generation

Electricity is distributed to customers in Multnomah County by Portland General Electric (PGE) and Pacific Power (PP). Both PGE and PP provide data on the number of kilowatt-hours (kWh) sold to their distribution customers in each of three sectors: residential, commercial and industrial. Because these total numbers include sales of "green power" (i.e., power generated from sources that do not emit carbon) to customers who have voluntarily elected to purchase such power, these numbers are adjusted to determine how many kWh were sold to customers in Multnomah County from the utilities' standard sources. Both PGE and PP also provide data on the kWh of green power sold to customers in Multnomah County. The kWh of green power sold in Multnomah County is subtracted from the total sales of kWh sold in Multnomah County to determine the total kWh sold in Multnomah County from the utilities' standard sources.

Total kWh sold in Multnomah County – **Estimated kWh of green power sold in Multnomah County** = **kWh from standard sources sold in Multnomah County**

To calculate the carbon emissions from grid power (i.e., everything except the green power purchased voluntarily by customers), the inventory uses emission factors provided by the U.S. Environmental Protection Agency Emission & Generation Resource Integrated Database (eGRID) for the Northwest Power Pool of the Western Electricity Coordinating Council.

Natural gas

NW Natural, the sole natural gas utility for Multnomah County, provides data on the total therms used in the county by the residential, commercial and industrial sectors. The carbon emissions attributable to natural gas usage are calculated by multiplying the total number of therms by the conversion factor provided by ICLEI's ClearPath software for converting therms to CO_2e. In 2008, NW Natural began offering customers the ability to obtain carbon-neutral natural gas through the purchase of offsets, eventually in connection with the use of digesters to capture methane from decomposing cow manure. In the future, the data on total therms will be adjusted to take into account the carbon-neutral nature of some sales, as is done with electricity generation.

Fuel oil, propane, and kerosene

Fuel oil data are from the U.S. Energy Information Administration's State Energy Consumption Estimates, which publishes data on the sales in Oregon of heating oil, propane, kerosene and other fuels. Figures are broken down in the three residential, commercial, and industrial customer classes. In the absence of more specific information about usage in Multnomah County, the inventory assigns the county a share based on the percent of Oregon's population living in Multnomah County.

Gallons of oil sold to customers in Oregon X **(Population of Multnomah County / Population of Oregon)** = **Estimated gallons of oil sold to customers in Multnomah County**

ICLEI's ClearPath software provides conversion factors for carbon emissions associated with each of these fuels. The carbon emissions from these fuels attributable to Multnomah County are calculated by multiplying the total amount of each fuel used by the applicable conversion factor.

TRANSPORTATION

Gasoline

Emissions from gasoline are calculated based on the number of gallons of gasoline sold in Multnomah County. The State of Oregon, which collects a county gas tax on behalf of Multnomah County, issues monthly reports detailing the total gallons of gasoline sold in the county. Gasoline sales provide an imperfect measure, since clearly some people who drive in Multnomah County purchase gasoline outside of the county while others purchase it in the county but drive elsewhere. An alternative way of estimating fuel usage is described below, but the emissions figures used in the Portland and Multnomah County inventory are based on the sales data.

Diesel and other transportation fuel

The EIA Report contains data for the sales in Oregon of diesel fuel and certain other transportation fuels used for rail, shipping, on-highway use, military uses and off-highway use. The Port of Portland, which operates Portland International Airport (PDX), the major airport in Multnomah County, provides data for the total amount of jet fuel used at PDX. As noted above, because of the interstate and international character of air, rail and shipping, ICLEI recommends not attributing fuel used by these modes to a given locality, and the inventory excludes these.

The inventory allocates to Multnomah County a share of Oregon's total sales of diesel for on-highway and construction use according to population. Off-highway distillate fuel is divided into two categories: construction and other. A share of the fuel used for construction is assigned to Multnomah County based on the county share of the state's population. The distillate fuel sold for other uses is mostly used for agricultural equipment. Multnomah County, with 10,017 acres dedicated to agriculture, contains 0.3% of the 2,935,164 total acres of agricultural land in Oregon. Because Multnomah County does not account for a material amount of the distillate fuel used for agriculture equipment, the inventory does not include distillate fuel sold for other uses in Oregon.

An alternative for gasoline and diesel: Vehicle miles traveled

Many communities rely on vehicle miles traveled (VMT) data to estimate transportation fuel use. This provides an alternative method of estimating emissions from gasoline and diesel for Multnomah County. Metro, the government for the approximately three-county region that includes Portland and Multnomah County, maintains a model of vehicle miles traveled for the Portland metropolitan region. A share of the VMT could be assigned to Multnomah County based on population or a combination of population and commercial activity to account for business VMT.

Reliable local estimates of vehicle fuel efficiency are not available, however, and we are reluctant to apply national figures for fleet fuel efficiency, which may not reflect local traffic patterns, congestion and vehicle characteristics. Because the Metro VMT data are region-wide, they may also not accurately capture trends in transportation fuel use in Multnomah County alone, since Multnomah County is significantly more compact and offers more transportation options than the region as a whole.

In short, calculations of carbon emissions based on VMT rely on difficult assumptions, such as the composition of vehicles on the road using a certain type of fuel or the average fuel efficiency for all vehicles in a region. For this reason, the inventory calculates emissions based on the fuel sales methodology rather than the VMT methodology.

SOLID WASTE DISPOSAL

Metro operates the solid waste transfer stations serving Multnomah County and provides data on the total tonnage of materials landfilled each year from the Metro region. The inventory assigns a share of the total tonnage to Multnomah County based on the percent of Metro population that is in Multnomah County. The Oregon Department of Environmental Quality (DEQ) conducts studies to determine the composition of waste in Oregon landfills. Thus, it is possible to estimate the composition of waste buried in landfills that are attributable to Multnomah County.

Total tonnage sent to Metro landfills	**X**	**(Population of Multnomah County/ Population of Metro)**	**=**	**Total landfill tonnage attributable to Multnomah County**
Total landfill tonnage attributable to Multnomah County	**X**	**Percent of waste in Oregon landfills that is attributable to a certain type of material**	**=**	**Tonnage of certain material in landfills attributable to Multnomah County**

As materials in landfills decompose, they produce methane. Some landfills capture methane gas and flare it, converting it to carbon dioxide and water vapor. For each landfill that receives waste from Metro, DEQ provides an estimate of the percentage of methane captured.

Methane emissions from landfills, tracked in this inventory, differ from the carbon emissions from energy consumption in a significant respect. All emissions from energy use occur at the same time the energy is consumed. Methane emissions from landfilled solid waste, on the other hand, can occur over a period of many years because conditions (e.g., heat, presence of oxygen, moisture) among landfills differ, as do the conditions in different parts of a single landfill, and because different materials decompose and thus emit methane at different rates.

As a result, the methane emissions from a landfill in a given year result from waste disposed at that landfill over a number of prior years. Similarly, landfill emissions reflected in the inventory for a given year will not occur over that year but instead will take place over the course of the subsequent years. Landfill emissions included in the inventory reflect the cumulative future methane emissions that can be expected from waste disposed in a given year. They are not intended to represent the amount of actual methane emissions from landfills in that year.

WASTEWATER TREATMENT

The treatment of wastewater is a significant contributor to local carbon emissions. Emissions are produced from the generation of electricity required to pump wastewater to treatment plants, from energy used in the wastewater treatment process, and from fugitive emissions from both wastewater, septic tanks, and effluent discharged to local rivers.

The Multnomah County inventory follows the ICLEI's U.S. Community Protocol for calculating emissions from the wastewater treatment process. Emissions have been calculated based on actual electricity use and combustion of biogas in the treatment process when data are available.

Other aspects of wastewater treatment are calculated based on population served using ICLEI's ClearPath software. N_2O process emissions from wastewater treatment and N_2O emissions from effluent discharged to local rivers have been estimated based on treatment processes and population served. Emissions have been estimated for Gresham and Troutdale wastewater treatment plants, based on the populations served and their specific treatment processes. Fugitive emissions from septic tanks in Multnomah County have been estimated by population for those not served by Portland, Gresham, or Troutdale's wastewater treatment plants. The Multnomah County inventory attributes emissions from wastewater treatment to the industrial sector.

Appendix 4: Consumption-Based Emissions Inventory Methodology

Overview of methodology for Multnomah County

Prepared by David Allaway, Oregon Department of Environmental Quality, July 11, 2013

This appendix summarizes the methods used to estimate Multnomah County's consumption-based greenhouse gas emissions for 2011.

The estimate of consumption-based emissions is derived from a model that was first developed by Stockholm Environment Institute's US Center, under contract to the Oregon Department of Environmental Quality (DEQ), as part of estimating Oregon's 2005 consumption-based greenhouse gas emissions. This model then underwent a series of revisions as DEQ updated it to calendar year 2010. The Oregon 2010 model was then revised again to estimate Multnomah County's 2011 consumption-based emissions.

This appendix addresses only the revisions that were made to convert the Oregon 2010 model to a Multnomah County 2011 model. The original 2005 model is described in detail in a technical report that can be downloaded at http://www.deq.state.or.us/lq/pubs/docs/ConsumptionBasedGHGEmissionsInventoryORTechnicalReport.pdf. Revisions to the 2005 model (to create the Oregon 2010 model) are described in Appendix B of the report *Oregon's Greenhouse Gas Emissions through 2010: In-Boundary, Consumption-Based and Expanded Transportation Sector Inventories* (Oregon Departments of Environmental Quality, Energy, and Transportation, 2013).

Changes made to convert the Oregon 2010 model to a Multnomah County 2011 model are discussed in the following sections.

Final demand

Final (institutional) demand was provided by City of Portland for all of Multnomah County from the IMPLAN 2011 dataset.

DEQ maintained the original model's structure of estimating gross demand for three regions of the world: Oregon, the rest of the U.S. and other countries. No effort was made to estimate gross demand just inside Multnomah County. DEQ made the simplifying assumption that Multnomah County's relative percentages of final demand produced inside vs. outside of Oregon would be the same as for final demand from the state as a whole.

In converting final demand to gross demand, DEQ used 2010 Oregon and U.S. interindustry matrices from IMPLAN. While this reflects the supply chains of different producing industries for 2010 vs. 2011, the 2010 values are assumed to be a reasonable proxy for 2011.

Greenhouse gas coefficients

Because the Multnomah County model operates using 2011 purchases, greenhouse gas coefficients should also be expressed in 2011 dollars. DEQ did not calculate new greenhouse gas coefficients for 2011, as the data required to do so for both Oregon and the U.S. is not currently available. Rather, emissions factors for 2010 were converted to 2011 dollars using the Consumer Price Index for All Urban Consumers.

Greenhouse gas emissions

No substantive changes were made in this element of the model.

Lifestyle analysis processing

No substantive changes were made in this element of the model.

Use

Direct emissions associated with residential and commercial (nontransportation) petroleum use were provided by the City of Portland. Government's share of commercial emissions was derived as a ratio, consistent with the 2010 Oregon model. Indirect emissions were estimated consistent with the method used in the 2010 Oregon model (but using 2011 data when available).

Similar adjustments were made to model the emissions associated with use of (nontransportation) natural gas and electricity.

Emissions estimates provided by the City of Portland included combustion byproducts, so no separate estimate was made of those emissions.

Emissions associated with vehicle fuel use were estimated using a multistep process:

- Multnomah County's estimate of CO_2 emissions from transportation use of gasoline and ethanol were allocated 74 percent to households and 2 percent to government, consistent with the results of the Oregon statewide allocation model. (The remaining 24 percent represent business use and are not part of direct consumption.)
- Similar allocations were performed for CO_2 emissions from transportation use of diesel (9 percent household, 4 percent government) and liquified petroleum gas (LPG) (55 percent household, 2 percent government). The LPG allocation factor is based on very limited data, but is also almost insignificant due to the small emissions involved.

- Multnomah County's estimates of all methane emissions from transportation use of fuels were allocated 60 percent to households and 2 percent to government, consistent with the results of the Oregon statewide allocation model.
- A similar allocation was performed for N_2O, with 70 percent allocated to households and 2 percent to government.
- 2010 statewide emissions associated with electricity use for transportation (in 2011, dominated by light rail and streetcar) were allocated 80% to Multnomah County, as a rough estimate.
- Indirect ("well to pump") emissions for transportation fuels were estimated and allocated in a manner consistent with the 2010 Oregon model (again, using 2011 data when available).

Direct emissions associated with residential use of vehicle refrigerants, household refrigerants and vehicle lubricants were estimated by taking the 2010 residential emissions for Oregon, dividing by Oregon's 2010 population, and multiplying by Multnomah County's 2011 population. Indirect emissions for lubricant production were estimated using the three-phase emissions module, consistent with the Oregon 2010 model.

Direct emissions associated with governmental use of vehicle refrigerants and lubricants were estimated by taking the 2010 government emissions for Oregon, dividing by Oregon's overall 2010 final demand for IMPLAN sectors 11000 and 12000 (federal and state/local government) (converted to 2011$), and multiplying by Multnomah County's 2011 final demand for the same government sectors. Indirect emissions for lubricant production were estimated using the three-phase emissions module, consistent with the Oregon 2010 model.

Disposal

For emissions from household and government postconsumer waste sent to disposal facilities, DEQ started with a 2011 disposal estimate (in tons) provided by the City of Portland. This was then divided between waste sent to landfills versus the Marion County waste incinerator. Landfill-specific disposal tonnage was combined with DEQ's estimates of current and future year gas collection efficiencies to estimate a site-weighted average lifetime gas capture rate for Multnomah County's waste sent to landfills.

Statewide waste composition data was used to estimate the tons of waste by waste type.

Emissions from all waste sent to landfills and incinerators were allocated to households and governments (and the remainder allocated out of the consumption-based results) using estimates of these sectors' contribution to overall waste disposal. Waste disposal for households was estimated by starting with the estimate used in the Oregon 2005 model, dividing by 2005 household total final demand (in 2011 dollars) and multiplying by Multnomah County 2011 household total final demand. This simple adjustment assumes that the relationship between disposal and final demand is static over time. As a crude reflection of potential "delinking" between waste disposal and final demand that may have occurred during this period, DEQ then compared the tons of solid waste disposed statewide per total (economywide) final demand (in 2010$) for 2005 and 2010. This value was found to be 19 percent lower in 2010 than in 2005 (or an average 4.2 percent reduction per year), perhaps partially a result of improved waste recovery and reduced waste generation. Estimated Multnomah County 2011 waste disposal from households was then adjusted downward by $(1–0.042)^6$. A similar process was performed for the estimate of government waste disposal, except that separate calculations were performed for federal versus state/local governments.

Separate calculations estimated the emissions resulting from onsite combustion of wastes in fireplaces and backyards. Drawing on prior research conducted by DEQ (see Sections 7.6 and 7.7 of http://www.deq.state.or.us/lq/pubs/docs/sw/WPSBkgd01.pdf), DEQ estimates that Multnomah County residents directly burned approximately 4,000 tons of mixed waste and another 12,000 tons of yard debris (mostly woody material) in 2011. On a per-person basis, this is significantly lower than the estimate of statewide onsite residential combustion used in the Oregon inventory, as it accounts for significantly lower rates of at-home outdoor burning in the Metro area generally (based on survey data) and lower rates of home indoor burning in Multnomah County. The lower rates of indoor burning are based on previous findings that indoor burning of garbage correlates closely with the use of wood as a primary heat source. According to the 2010 Census, only 1.5 percent of Multnomah County residents rely on wood as their primary heat source, compared to 7.0 percent of all Oregonians.

Model reconciliation

No substantive changes were made to this element of the model. Unlike the Oregon 2010 model, there was no final demand associated with petroleum purchases as part of capital/inventory formation.

Lifestyle analysis demand modeler

No substantive changes were made to this element of the model.

Appendix 5: Carbon Budget Assumptions

The objectives in this Plan that can be measured quantitatively rely on a set of assumptions about population growth, technological improvements and actions by governments other than the City of Portland and Multnomah County. To the extent actual population growth, technology advances or state and federal policies differ from the assumptions underlying this analysis, Portland and Multnomah County may need to pursue objectives that are more or less aggressive than those contained in this Plan. The interplay of assumptions can be complex. For example, the State of Oregon has adopted a renewable energy standard (RES) for electricity, requiring that 25 percent of all electricity sold by Portland General Electric and Pacific Power after 2025 be generated by new renewable resources. However, the RES alone will not result in a 25 percent reduction in carbon emissions because Multnomah County's population is projected to grow by 14 percent from current numbers by 2025. As a result, if each person consumes the same amount of electricity in 2025 as he or she does today, Multnomah County will consume 14 percent more electricity. Total carbon emissions from electricity will therefore remain virtually unchanged from current levels. Thus the RES, by itself, will help slow growth in electricity emissions but will not achieve the needed emissions reductions. Similar analyses of policies addressing building energy use and transportation fuels make clear that an 80 percent emissions reduction will not result merely from the currently anticipated technology advances and federal and state regulations.

The City of Portland and Multnomah County must therefore act — building on and exceeding national, regional or state efforts — to achieve the 2050 goal. In planning for local climate protection, however, this Plan assumes that certain actions will take place at the national, regional and state levels, and that these actions will help Portland and Multnomah County achieve the 2050 goal. These assumptions focus on the categories of Urban Form and Transportation and Buildings and Energy.

Key assumptions related to Urban Form and Transportation:

- Automakers will meet the federal requirement that the corporate average fuel efficiency (CAFE) achieve 54.5 miles per gallon by 2025.
- The federal government will raise CAFE standards to 55 miles per gallon before 2050.
- As a result of the commercial availability of advanced, low-carbon fuels, by 2030 transportation fuels will generate 10 percent fewer lifecycle carbon emissions than today's fuels.
- Electric vehicles will displace 10 percent of all miles driven by 2030 and an additional 15 percent of all miles driven by 2050.

Key assumptions related to Buildings and Energy:

- Electric utilities will meet Oregon's requirement to acquire 25 percent of their electricity from new renewable sources by 2025.
- By 2050, technological advances will reduce the amount of electricity lost during transmission by one-fourth.
- Coal-fired power plants serving the Pacific Northwest do not employ carbon capture and sequestration technologies.

Finally, assumptions about population growth are aligned with Metro's current estimate of an annual growth rate of 1.1 percent. This does not account for the possibility of "climate refugees" beyond the current population growth forecast. A climate refugee is a person displaced from his or her home because of an environmental event that has been brought on by climate change. Although some believe that many climate refugees will settle in the relatively water-rich and temperate climate of Pacific Northwest, it is difficult to estimate the extent to which this will change population growth in Multnomah County.

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2015 LOCAL STRATEGIES TO ADDRESS CLIMATE CHANGE

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