CITY OF PORTLAND AND MULTNOMAH COUNTY

CLIMATE ACTION PLAN 2009

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Planning and Sustainability
Sam Adams, Mayor | Susan Anderson, Director

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ACKNOWLEDGEMENTS

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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October 2009

Dear Friends,

Less than a decade into the 21st century, it is clear that climate change may well represent the greatest challenge to our future well-being. Residents of Portland and Multnomah County have been addressing climate change for many years now and our efforts have achieved real results, differentiating us significantly from the national trend. We have received accolades for our work, but it is high praise on a low standard. Perhaps the most important lesson learned from local climate protection work to date is the frank recognition that our good work to date is not nearly enough.

Our region's leadership is built on a long tradition of excellence in planning and a heritage of conservation and stewardship of our natural environment. The bold decisions made decades ago have given this region a head start over other cities and regions across the country. It is in this context that we must look to the bold actions needed in the coming decades. We have reduced local carbon emissions to one percent below 1990 levels, but we know we need to reduce our emissions by eighty percent. What is required is nothing short of the transformation of both our economy and our community, while strengthening the quality of life that makes the Portland area so exceptional.

Portland area residents also have a strong tradition of unparalleled public participation and engagement – actively working to find innovative solutions and taking inspiring action to improve our community. Our history prepares us well to take on the unparalleled challenge of climate change, but it will not be easy. Mounting scientific evidence of the increasingly rapid rate of climatic change demands that the City and County draw on our decades of experience and innovation, and act with a renewed sense of urgency.

However, the severity and magnitude of this problem are matched only by the opportunity – unprecedented in modern history – to rethink and improve upon every aspect of our community.

In the coming years, we must:

- Build a new generation of buildings, industry infrastructure and energy systems that both embrace and mimic nature, consuming and producing resources in a closed loop. They will be as much a part of the landscape as our rivers, mountains, and forests.
- Transform all our neighborhoods into places that provide a safe and healthy environment where all residents can meet their needs by foot, bike and public transit.
- Develop a new economy to generate thousands of local green jobs, and bring opportunity and prosperity to every part of our community.
- Ensure that natural systems are healthy, diverse and resilient in the face of a changing climate.
- Help our friends and neighbors prepare to adapt to climate change – ensuring that the most vulnerable among us are equipped to cope with rising energy prices, as well as extreme weather events.

Successfully tackling this challenge will require an unwavering commitment to the effort over the course of decades. We look forward to what our community can accomplish together.

Sam Adams
Mayor

Jeff Cogen
County Commissioner

TIMELINE

1989
Oregon legislature first establishes carbon-reduction goal

1992
Rio Earth Summit (United Nations Framework Convention on Climate Change)

1993
City of Portland Carbon Dioxide Reduction Strategy

1997
Kyoto Protocol

2001
Portland/ Multnomah Local Action Plan on Global Warming

2005
Portland signs U.S. Mayors Climate Protection Agreement

2005
Oregon Strategy for Greenhouse Gas Reductions

2007
Multnomah County joins Cool Counties Initiative

2008 – 2012 Kyoto Protocol compliance period (United States target: 7% below 1990 levels)

Metro resolution to develop regional climate change plan

2008

Portland /Multnomah goal: 10% below 1990 levels

2010

State of Oregon goal: 75% below 1990 levels

2050

2008

Carbon emissions in Multnomah County are 1% below 1990 levels

2009

Climate Action Plan

2030

Portland/ Multnomah target: 40% below 1990 levels

2050

Portland/ Multnomah goal: 80% below 1990 levels

AND GOALS

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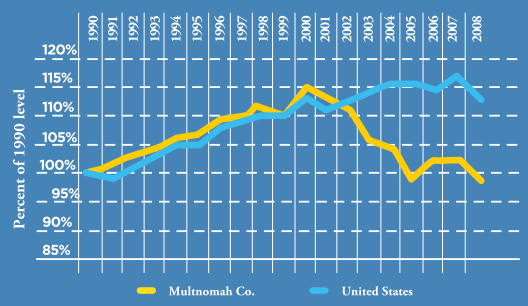
EXECUTIVE SUMMARY



Bureau of Planning and Sustainability.
U.S. Energy Information Administration

Climate change is the defining challenge of the 21st century. The world's leading scientists report that carbon emissions[1] from human activities have begun to destabilize the Earth's climate. Billions of people will experience these changes through threats to public health, national and local economies, and supplies of food, water and power.

The challenge of climate change is more urgent than ever, but it is not new. Nor is our region's response. For more than 15 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 Multnomah County-City of Portland Local Action Plan on Global Warming. These plans supported ambitious carbon-reduction efforts, like public transit expansions and new green building policies, that promise to benefit the region's long-term economic, social and environmental prosperity.

These actions helped achieve impressive results, including a reduction in local carbon emissions in 2008 to one percent below 1990 levels, despite rapid population growth. Over the same period, emissions in the United States as a whole increased 13 percent. Clearly Portland and Multnomah County are bucking the trend and heading in the right direction (see figure to the left).

While the early achievements of the Portland region are notable, the latest science suggests that dramatically more ambitious actions are required to mitigate the most extreme impacts of the changing climate. At the same time, efforts to reduce emissions must be coupled with preparations for a changing climate The physical impacts of climate change are already in evidence and will expand and intensify in the decades ahead. Because of the long time lag between changes in emissions and global climate patterns, the future climate will first reflect the past century of emissions, while ultimately reflecting our choices today.

The physical impacts of a changing climate are matched by social challenges and compounded by rising energy prices. Low-income and vulnerable citizens face disproportionate impacts of climate change — exposure to heat stroke in their homes, for example — while having fewer resources to respond to these changes. Climate change and rising energy prices have the potential to exacerbate social inequities.

In addition, the rivers, streams, wetlands, and vegetation across the Portland region's watersheds will be affected by climate change. Changes in weather and moisture patterns will affect streamflow, groundwater recharge and flooding, and may increase risks of wildfire, drought, and invasive plant and animal species. Evolving weather, air and water temperature, humidity and soil moisture will affect resident and migratory fish and wildlife species and their habitats, and may increase risks to their survival.

1 Throughout this document, the term "carbon emissions" refers to all greenhouse gas emissions.

To respond to these intertwined problems — climate change, social inequity, rising energy prices, and degraded natural systems — requires an integrated response that goes far beyond reducing carbon emissions. Climate protection must be inextricably linked with actions to create and maintain jobs, improve community livability and public health, address social equity and foster strong, resilient natural systems.

By integrating these elements, Portland and Multnomah County will:

Create Local Jobs. The past decade has proven that many of the technologies, products and services required for the shift to a low-carbon future can be provided by Portland-area companies. Dollars currently spent on fossil fuels will no longer leave our economy and will stay here to pay for home insulation, lighting retrofits, solar panels, bicycles, engineering, design and construction. City Council has adopted an economic development strategy that prioritizes sustainability as the key economic engine of the Portland region.

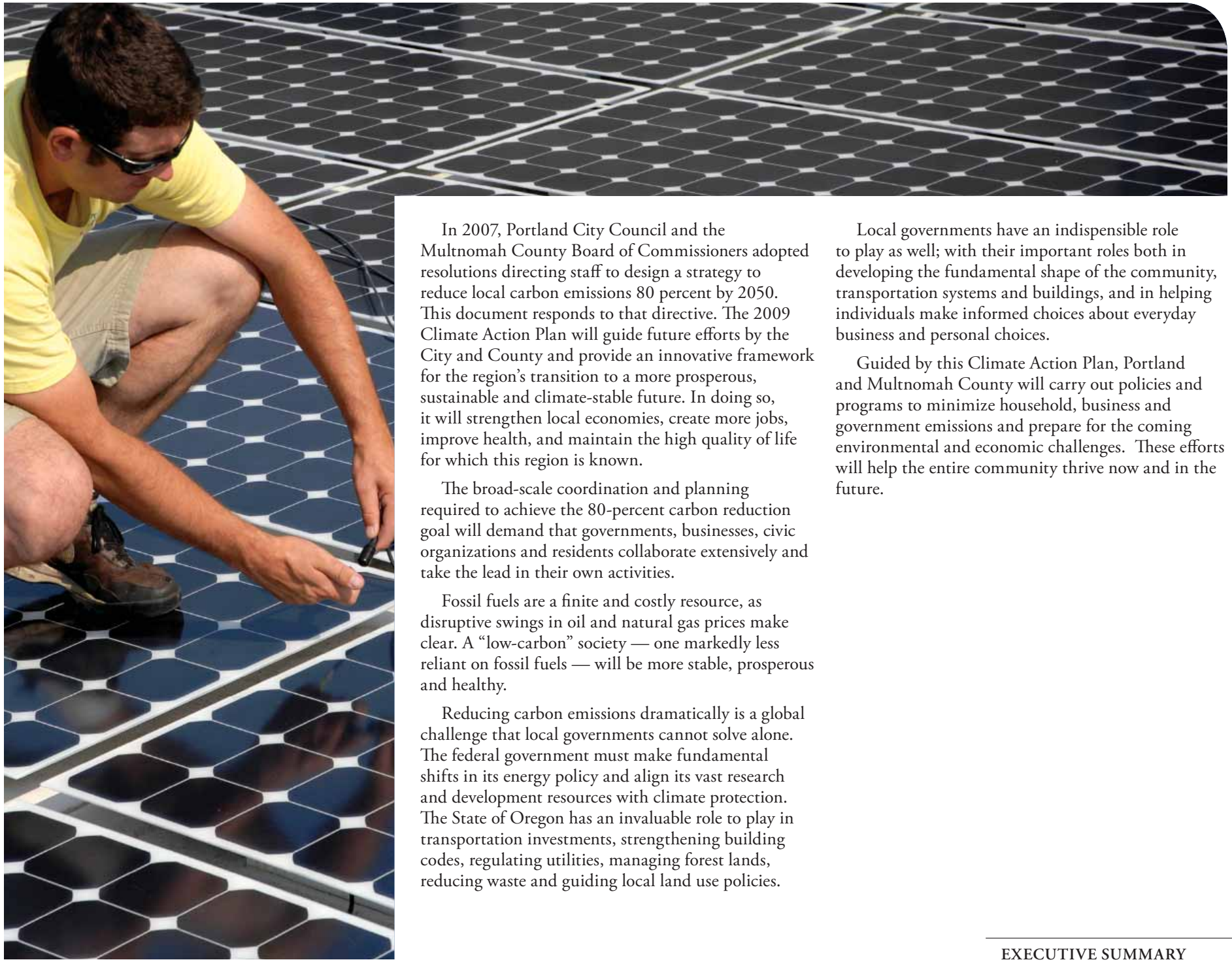
Improve Social Equity. Disparities among our residents can be reduced by ensuring that the communities most vulnerable to climate change are given priority for green jobs, healthy local food, energy-efficient homes and affordable, efficient transportation. We can also improve equity if we ensure that impacted communities are included in the implementation of the Climate Action Plan items in a meaningful and engaging way.

Create Healthier Residents. Walkable neighborhoods, fresh foods and clean air means healthier, more active residents. The "health dividend" is potentially vast in financial terms and invaluable in its contribution to quality of life.

Become More Energy Self-Sufficient. Every action in this Plan will reduce reliance on fossil fuels. As prices continue to increase in the long run and supplies become more uncertain, a reduced reliance on volatile oil supplies will diminish the risks faced by everyone.

Protect and Enhance Air Quality and Natural Systems. Sustaining the values and functions of our tree canopy, rivers, streams and wetlands is an essential strategy that can simultaneously reduce emissions, sequester carbon and strengthen our ability to adapt to a changing climate. Healthy watersheds, forests and ecosystems are an integral part of this plan.

Save Money. Using less energy in our homes, buildings and vehicles means lower energy and transportation bills for residents, business and government. Likewise, home-grown food saves on grocery bills. The savings from reduced health-care costs of a healthy, active community are potentially most significant of all.



In 2007, Portland City Council and the Multnomah County Board of Commissioners adopted resolutions directing staff to design a strategy to reduce local carbon emissions 80 percent by 2050. This document responds to that directive. The 2009 Climate Action Plan will guide future efforts by the City and County and provide an innovative framework for the region's transition to a more prosperous, sustainable and climate-stable future. In doing so, it will strengthen local economies, create more jobs, improve health, and maintain the high quality of life for which this region is known.

The broad-scale coordination and planning required to achieve the 80-percent carbon reduction goal will demand that governments, businesses, civic organizations and residents collaborate extensively and take the lead in their own activities.

Fossil fuels are a finite and costly resource, as disruptive swings in oil and natural gas prices make clear. A "low-carbon" society — one markedly less reliant on fossil fuels — will be more stable, prosperous and healthy.

Reducing carbon emissions dramatically is a global challenge that local governments cannot solve alone. The federal government must make fundamental shifts in its energy policy 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.

Local governments have an indispensible role to play as well; with their important roles both in developing the fundamental shape of the community, transportation systems and buildings, and in helping individuals make informed choices about everyday business and personal choices.

Guided by this Climate Action Plan, Portland and Multnomah County will carry out policies and programs to minimize household, business and government emissions and prepare for the coming environmental and economic challenges. These efforts will help the entire community thrive now and in the future.

GOALS AND ACTION AREAS

This Climate Action Plan identifies objectives and actions in eight categories to put Portland and Multnomah County on a path to reduce carbon emissions 80 percent from 1990 levels by 2050.

The Climate Action Plan:

- Proposes an interim goal of a 40 percent reduction in emissions by 2030.
- Establishes objectives to achieve the interim goal.
- Focuses principally on major actions to be taken in the next three years to shift Portland and Multnomah County's emissions trajectory.

To draft this Climate Action Plan, City and County staff worked with a steering committee and working groups to identify the objectives and actions most likely to foster the long-term changes necessary to achieve such ambitious goals.

Key criteria in developing the actions were the magnitude of emissions reductions, the scale of economic and community benefits, and the ability of local governments to facilitate their implementation.

Portland and Multnomah County are committed to acting decisively to implement these actions and constantly evaluate progress—adapting and revising as necessary. The City and County will report on community carbon emissions annually, evaluate progress and identify new actions every three years, and re-examine the objectives every ten years.

The 2030 Objectives and corresponding Action Areas of the Climate Action Plan are outlined on the following pages. The detailed Actions to be undertaken in the next three years are found on pages 29 through 58 of this document.

1 BUILDINGS AND ENERGY

2030 OBJECTIVES

1. Reduce the total energy use of all buildings built before 2010 by 25 percent.
2. Achieve zero net greenhouse gas emissions in all new buildings and homes.
3. Produce 10 percent of the total energy used within Multnomah County from on-site renewable sources and clean district energy systems.
4. Ensure that new buildings and major remodels can adapt to the changing climate.

2 URBAN FORM AND MOBILITY

2030 OBJECTIVES

5. Create vibrant neighborhoods where 90 percent of Portland residents and 80 percent of 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.
6. Reduce per capita daily vehicle-miles traveled (VMT) by 30 percent from 2008 levels.
7. Improve the efficiency of freight movement within and through the Portland metropolitan area.
8. Increase the average fuel efficiency of passenger vehicles to 40 miles per gallon and improve performance of the road system.
9. Reduce the lifecycle green-house gas emissions of transportation fuels by 20 percent.

3 CONSUMPTION AND SOLID WASTE

2030 OBJECTIVES

10. Reduce total solid waste generated by 25 percent.
11. Recover 90 percent of all waste generated.
12. Reduce the greenhouse gas impacts of the waste collection system by 40 percent.

4 URBAN FORESTRY AND NATURAL SYSTEMS

2030 OBJECTIVES

13. Expand the urban forest canopy to cover one-third of Portland, and at least 50 percent of total stream and river length in the city meet urban water temperature goals as an indicator of watershed health.

5 FOOD AND AGRICULTURE

2030 OBJECTIVES

14. Reduce consumption of carbon-intensive foods.
15. Significantly increase the consumption of local food.

6 COMMUNITY ENGAGEMENT

2030 OBJECTIVES

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

7 CLIMATE CHANGE PREPARATION

2030 OBJECTIVES

17. Adapt successfully to a changing climate.

8 LOCAL GOVERNMENT OPERATIONS

2030 OBJECTIVES

18. Reduce carbon emissions from City and County operations 50 percent from 1990 levels.

BUDGET FOR A LOW-CARBON FUTURE

	1990	2008	2030	Percent change from 2008	2050	Percent change from 2008
Total carbon emissions (metric tons)	8,599,508	8,495,319	5,134,000	-40%	1,704,000	-80%
Population	584,000	715,000	999,000	+40%	1,355,000	+90%
Per person carbon emissions (metric tons)	14.7	11.9	5.1	-57%	1.3	-89%
Passenger miles per day per person	17.4	18.5	13.4	-28%	6.8	-63%
Electricity (kWh per person)	13,049	12,081	7,869	-35%	3,815	-68%
Natural gas (Therms per person)	391	382	302	-21%	98	-74%

The table and graphs show carbon emissions and related energy use and miles driven in Multnomah County in 1990 and 2008.

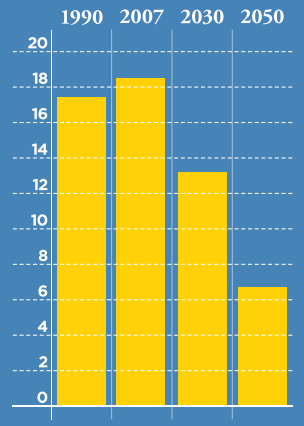
The 2030 column depicts a scenario that puts Portland and Multnomah County on track to meet the 2050 goal.

The 2050 column represents a scenario that achieves the 80 percent carbon-reduction goal. For example, residents in 2050 must be able to meet all of their needs while using only one-third of the electricity and driving only one-third of the miles they drive today.

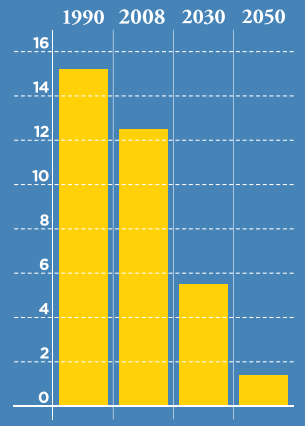
Any number of scenarios could hypothetically achieve the 2050 goal; the one described here reflects the technical committees' judgment about a probable scenario.

Key assumptions are described in Appendix 2.

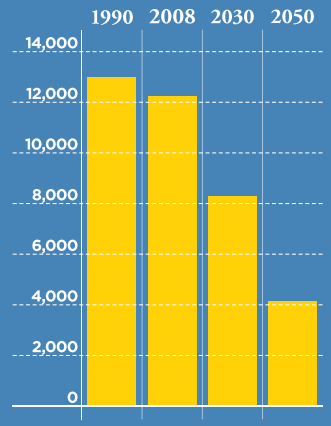
PER PERSON PASSENGER MILES PER DAY



PER PERSON CARBON EMISSIONS (METRIC TONS)

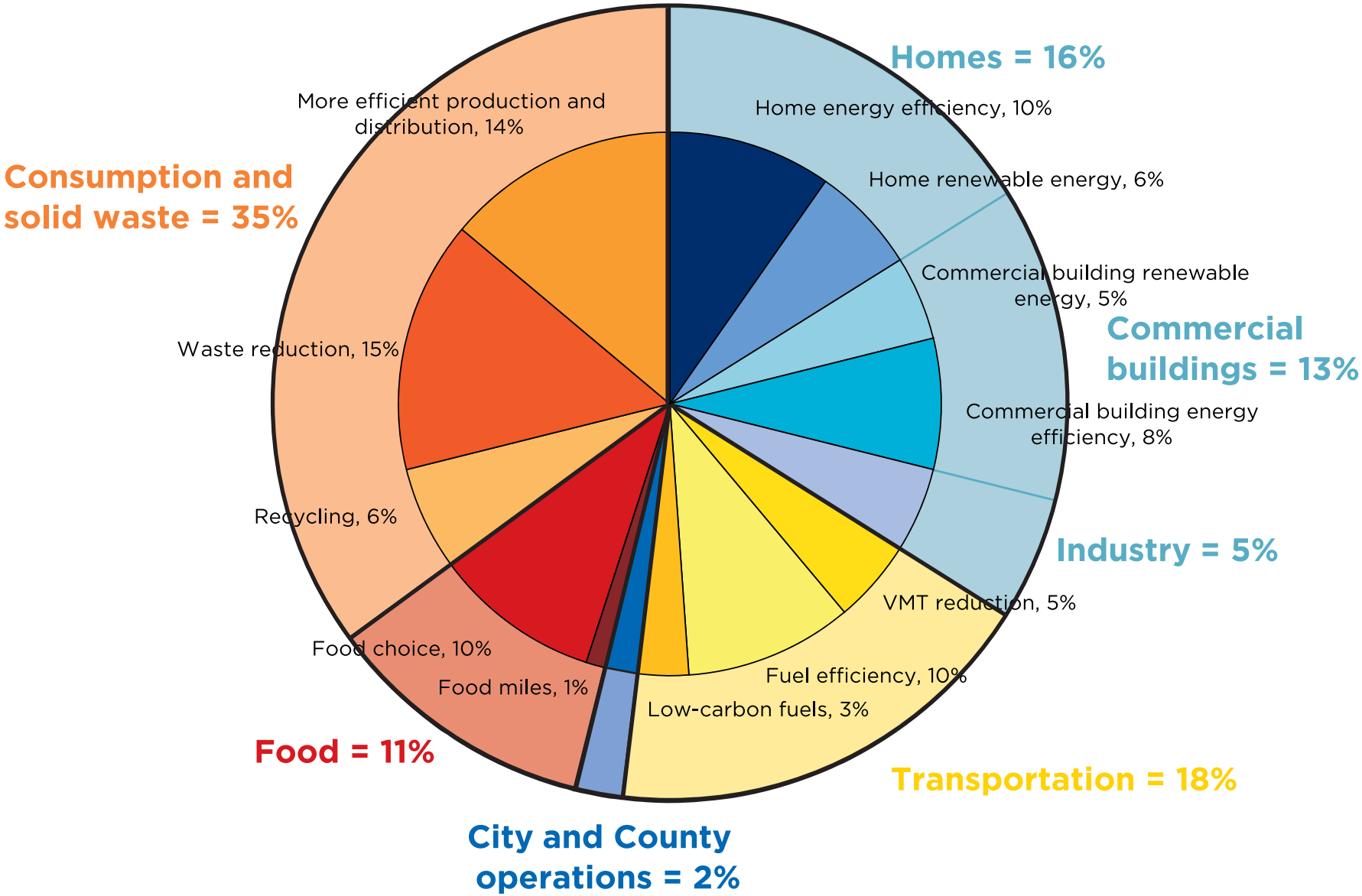


PER PERSON ELECTRICITY USAGE (KWH)

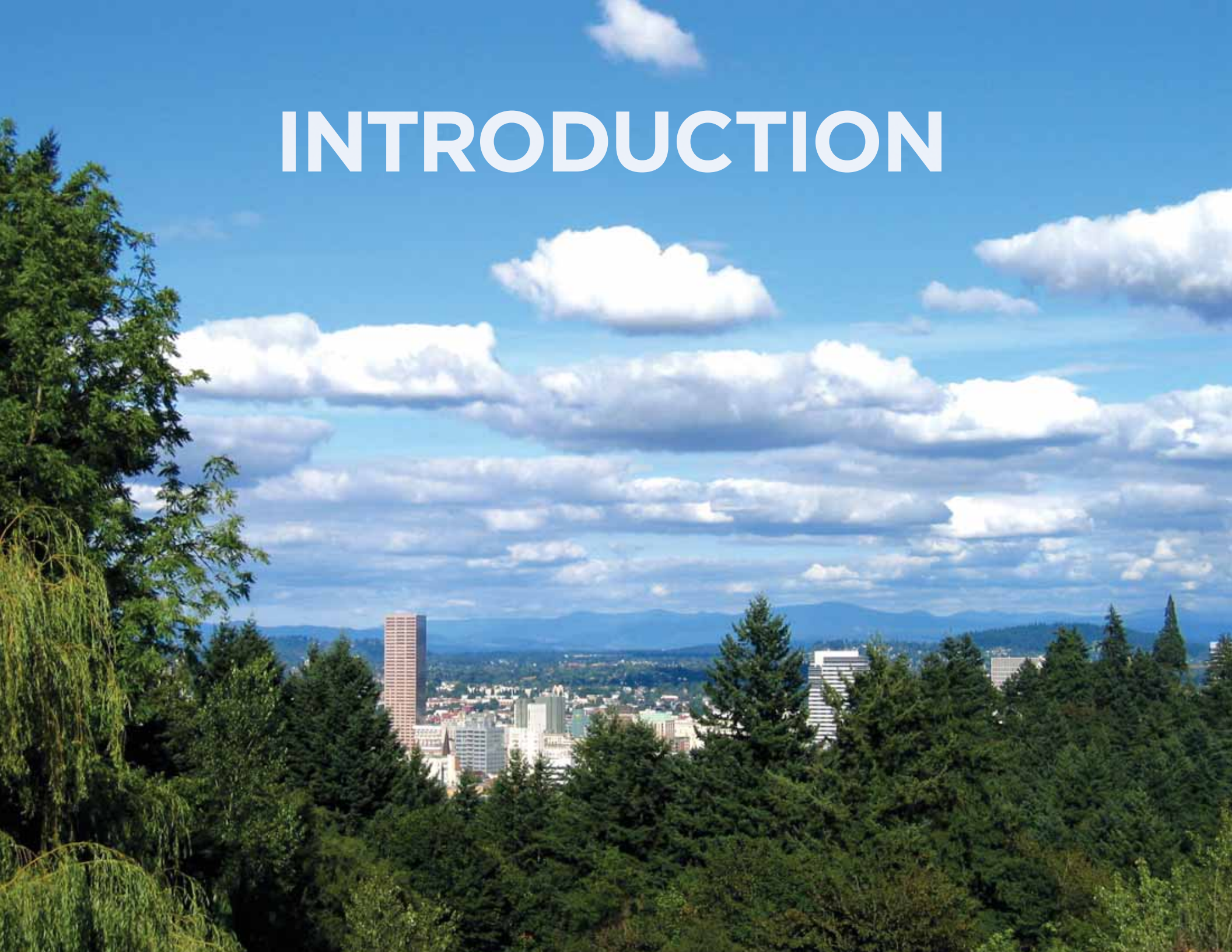


CLIMATE ACTION PLAN

(APPROXIMATE CONTRIBUTION TO 2030 EMISSION-REDUCTION GOAL)



INTRODUCTION



Climate change presents a challenge perhaps unparalleled in modern history. With increasing certainty and near unanimity, the world's leading scientists report that greenhouse gas emissions from human activities have begun to destabilize the Earth's climate. In the Pacific Northwest, these changes threaten food and water sources, power supplies, public safety and health, forests and local economies, all of which have a critical impact on the quality of residents' lives.

The challenge of climate change is more urgent than ever, but it is not new. For more than 15 years Portland has sought to reduce greenhouse gas emissions, starting with the City of Portland's 1993 *Carbon Dioxide Reduction Strategy* and followed, eight years later, by the joint Multnomah County–City of Portland 2001 *Local Action Plan on Global Warming*. These plans have helped the Portland region launch ambitious carbon-reduction efforts that promise to benefit the region's long-term economic, social and environmental prosperity.

Yet as the magnitude of climate change becomes clearer, so too does the need for an even more ambitious response. The world's top scientists estimate that to avoid potentially catastrophic climate change, global greenhouse gas emissions must decline 50 to 85 percent below 2000 levels by 2050. Because the United States is responsible, on a per capita basis, for more greenhouse gas emissions than any other major country, U.S. reductions likely must be at the higher end of that range.

The climate is certain to change under even the most optimistic emission reduction scenarios, however. Sea level will rise, patterns of precipitation will shift, extreme weather events will become more frequent and other unpredictable changes are likely. (The basic science of climate change and the greenhouse effect is discussed further in Appendix 1.)

The need to prepare for a changing climate points to a second fundamental problem: Our degraded natural systems are not as resilient as they once were. More than a century of urban development has diminished the capacity of our wetlands, floodplains and forests to absorb and accommodate precipitation, for example, preparing us poorly for the expected increase in the frequency and intensity of severe weather events that climate change will bring to Oregon. More generally, our natural systems were already under severe strain: trees, vegetation, and streams have been replaced by pavement and culverts, degrading air and water quality, habitat and biodiversity. These weakened natural systems absorb less carbon directly, and indirectly result in still more carbon emissions through the urban heat island effect, which raises summer temperatures in the city and increases the need for air conditioning.

Powerful social change will accompany these physical impacts. Most obviously, large numbers of people will likely move from hotter, drier regions to cooler, wetter ones. "Climate refugees" will almost certainly have a major effect on population shifts in the 21st century. The Pacific Northwest, which likely will experience less drastic initial impacts of climate change than other regions of the country, may well experience population growth significantly above current expectations.

The health of individual citizens will be affected, too. New health challenges are emerging — diseases that have previously not been prevalent in Oregon's temperate climate, for example — while at the same time many actions to reduce carbon emissions are likely to have strongly beneficial impacts on personal health. People who increase their walking and bicycling will experience direct positive benefits, and better air quality will benefit everyone who lives in, works in or visits the Portland region. Preparing for these changes, both physical and social, is essential to the long-term success of the Pacific Northwest.

In 2007, both Portland City Council and the Multnomah County Board of Commissioners adopted resolutions directing staff to design a strategy to reduce greenhouse gas emissions 80 percent by 2050.[1] Subsequently, the City and County assembled a steering committee with representatives from the Sustainable Development Commission,

1 The resolutions from both City Council and the Board of County Commissioners do not state the base year for determining emissions reductions. Because Portland and Multnomah County historically have sought to reduce emissions from 1990 levels, this Climate Action Plan uses 1990 as the base year for calculating emissions.

Peak Oil

In 2006 the Portland City Council established a citizen advisory group, the Peak Oil Task Force, to examine the region's vulnerability to rising oil and natural gas prices. The task force recommended decreasing total fossil fuel consumption by 50 percent over 25 years. By accepting that task force's report, City Council committed to considering its recommendations as part of a new climate and energy plan. For more on peak oil, see www.portlandonline.com/bps.

the Peak Oil Task Force (see text box above) and staff from eight local government agencies. The steering committee met seven times between November 2007 and March 2009. Technical working groups explored possible actions to address energy use in buildings, land use and mobility, and staff reviewed recent City planning efforts around urban forestry and natural systems, waste reduction and recycling.

This document is the result of these efforts. It identifies actions to put Portland and Multnomah County on a path to accomplish the 80 percent reduction goal, proposes an interim goal of 40 percent emissions reductions by 2030, establishes objectives to achieve the interim goal, and focuses primarily on actions to be taken in the next three years to shift Portland and Multnomah County's emissions trajectory.[2]

2 The actions highlighted in this strategy are consistent with the direction of visionPDX, a major community visioning effort completed in 2007. Likewise, they reflect and inform the development of the Portland Plan, currently underway, including a revision to the City of Portland Comprehensive Plan.

A VISION FOR 2050

An 80 percent reduction of carbon emissions by 2050 will entail re-imagining the entire community — transitioning away from fossil fuels and strengthening the local economy while shifting fundamental patterns of urban form, transportation, buildings and consumption. Important details remain to be sorted out, but in planning for climate protection the City and County are guided by the following vision:

- In 2050, Portland and Multnomah County are at the heart of a vibrant region with a thriving economy, rich cultural community and diverse, ecologically sustainable neighborhoods.
- Personal mobility and access to services has never been better. Every resident lives in a walkable and bikeable neighborhood that includes retail businesses, schools, parks and jobs. Most people rely on walking, bicycling and transit rather than driving. Pedestrians and bicyclists are prominent in the region's commercial centers, corridors and neighborhoods. Public transportation, bikeways, sidewalks and greenways connect neighborhoods. When people do need to drive, vehicles are highly efficient and run on low-carbon electricity and renewable fuels.
- Green jobs are a key component of the regional economy. Products and services related to clean energy, green building, sustainable food, green infrastructure, and waste reuse and recovery providing living-wage jobs throughout the community, and Portland is North America's hub for sustainable industry and clean technology.
- Homes, offices and other buildings deliver superb performance. They are durable and highly efficient, healthy, comfortable and powered primarily by solar, wind and other renewable resources.
- The urban forest and green roofs cover the community, reducing the urban heat island effect, sequestering carbon, providing habitat, and cleaning the air and water.
- Food and agriculture are central to the economic and cultural vitality of the community, with backyard gardens, farmers' markets and community gardens productive and thriving. A large share of food comes from farms within the region, and residents eat a healthy diet, consuming more locally grown grains, vegetables and fruits.
- The benefits of green infrastructure, walkable and bikeable neighborhoods, quality housing, and convenient, affordable transportation options and public health services are shared equitably throughout the community.
- Residents and businesses use resources extremely efficiently, minimizing and reusing solid waste, water, stormwater and energy.
- The Portland region has prepared for a changed climate, making infrastructure more resilient, developing reliable supplies of water, food and energy and improving public health services. Policies, investments and programs are in place to protect the residents most vulnerable to climate change and rising energy prices.

In a sustainable economy, people live and do business in ways that are good for the economy, the environment, and for communities. The usual tradeoffs between growth, sustainability and equity are not necessary. Businesses are more efficient, innovative and competitive internationally. The local talent pool is deeper. Business activity reinforces our commitment to sustainability and our leadership in sustainability contributes to a thriving local economy. All Portland residents have access to quality jobs and share in the growth of the economy.

— Portland Economic Development Strategy, a Five-Year Plan for Promoting Job Creation and Economic Growth (2009)

THE OPPORTUNITY FOR CLIMATE PROSPERITY

The task of achieving this vision is complicated. It is also a tremendous opportunity. Fossil fuels are a finite and costly resource, as disruptive swings in oil and natural gas prices make clear. An advanced "low-carbon" society will be more stable, prosperous and healthy than those that remain dependent on fossil fuels. The Portland region has a history of seeking innovative solutions to community challenges, and climate change presents the opportunity to respond in ways that create local jobs, improve personal health, protect and restore ecosystems and enrich the quality of life for all residents.

Green Economy

Climate protection policies and programs, if designed carefully, can strengthen the local economy by driving demand for locally provided products and services that reduce emissions. Because most routine daily activities generate carbon emissions, nearly every activity must be examined to identify cleaner and more sustainable alternatives. This fundamental reassessment presents major economic opportunity.

Already, innovative businesses and individuals have begun to take advantage of these opportunities. Multnomah County is home to some of the nation's leading developers, builders, architects, engineers and product manufacturers in the green building industry. In addition, a critical mass of clean energy firms, such as wind developers, photovoltaic manufacturers, biodiesel producers and energy efficiency consultants also call the region home. Portland is also a national leader in cutting edge bicycling products.

These businesses spread economic benefits to the community by creating "green collar" jobs — skilled and semi-skilled, well-paying jobs that contribute directly to preserving or enhancing environmental quality. For example, Oregon's rapidly growing clean energy sector is showing strong demand for trained workers, including solar installers and wind turbine technicians.[3] Bicycle manufacturers and shops contribute $90 million annually and add 850 to 1,150 jobs to the local economy.[4] These industries represent just a small sample of the potential depth and breadth of economic activity that climate protection will stimulate.[5] 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 will create many new jobs.

Beyond job creation, a shift away from fossil fuels such as coal, petroleum and natural gas will add substantial indirect economic benefits. Because Oregon has almost no fossil fuel resources, dollars spent on 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, expanding markets for locally produced products and services.

Land use policies already provide this kind of economic benefit. 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.[6] A substantial portion of those saved dollars are spent in the local economy where they have economic multiplier effects, rather than flowing to largely non-local energy companies. Dramatically expanded emissions-reduction efforts will reinforce and spread this positive economic effect.

Recognizing the economic opportunity presented by climate protection and the global shift toward sustainability, the five-year economic development strategy adopted by Portland City Council in 2009 states the City's unequivocal intent to make Portland "the most sustainable economy in the world" (see text box). By carefully 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.

3 Cylvia Hayes and David Rafkind, 3EStrategies and Barbara Byrd, Oregon AFL-CIO, "Analysis of Clean Energy Workforce Needs and Programs in Oregon." 2008.

4 "The Value of the Bicycle-Related Industry in Portland." Alta Planning & Design, September 2008.

5 "Sustainability at a Glance: The Industry." Portland Development Commission.

6 Cortright, Joe. "Portland's Green Dividend." CEOs for Cities, July 2007.

Quality of Life

Beyond its economic benefits, climate protection can fundamentally improve community wellbeing. For example, land use policies limiting sprawl have made it easier for residents to get around by bicycles and on foot instead of relying on cars. In doing so they not only reduce fuel use and therefore greenhouse gas emissions, but also benefit from the improved health that accompanies a more active lifestyle.

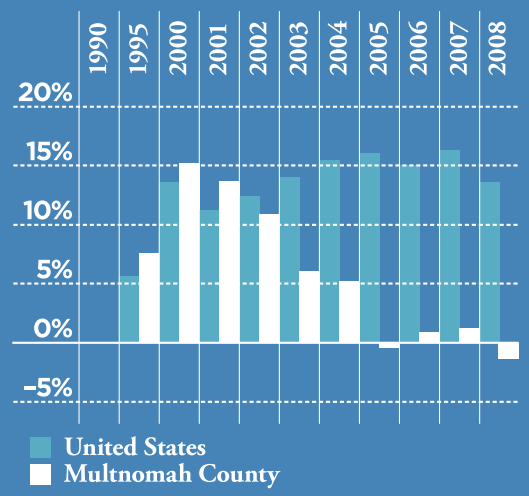
By protecting and restoring the city and county's green infrastructure, adding to trails, parks and natural areas, citizens can have easy access to nature and to recreational opportunities that are distributed equitably throughout the community. Increased urban forest canopy adds to the quality of life by improving the aesthetic appeal of neighborhoods, bringing nature into urban areas, and improving air and water quality.

Similarly, by eating locally produced, fresh food, and by choosing grains, fruits, and vegetables instead of meat, individuals both lower greenhouse gas emissions associated with food production and lay the cornerstone of a healthy diet. Living and working in spaces with natural daylight and fresh air reduces the energy needed to light, heat, and cool buildings, while also improving the health and productivity of occupants.

These are just several examples of changes in mobility choices, consumption patterns and lifestyle that do far more than protect the climate — they build a more prosperous, healthy and productive community, and all communities must benefit from these changes equitably.

CLIMATE PROTECTION IN PORTLAND AND MULTNOMAH COUNTY

FIGURE 1
AGGREGATE CARBON EMISSIONS (RELATIVE TO 1990)



United States Environmental Protection Agency, City of Portland Bureau of Planning and Sustainability

To protect the climate and achieve the 2050 vision of a thriving low-carbon society, carbon emissions must decline dramatically. This is a global problem that local governments cannot solve alone. All sectors of society, all levels of government and individual citizens must act.

Yet cities are responsible for 75 percent of the global carbon emissions. With the concentration of the world's population living in cities expected to increase from the current level of 50 percent to 60 percent by 2030, cities increasingly present the greatest opportunities to reduce global carbon emissions. Local governments have an essential role to play in:

1. Delivering policies and programs that minimize business and household emissions;
2. Working with residents and businesses to help the community prepare for the environmental, social and economic challenges that are to come; and
3. Reducing emissions from their own government operations.

Portland recognized this role early on. In 1993, it became the first local government in the United States to adopt a strategy to address global warming. In 2001, Multnomah County joined the City of Portland in adopting a revised plan, the *Local Action Plan on Global Warming,* outlining 150 short- and long-term actions to reduce community-wide carbon emissions to 10 percent below 1990 levels by 2010. For comparison, the target for the U.S. under the never-ratified Kyoto treaty is to reduce carbon emissions seven percent below 1990 levels by 2012.

The City and County have made substantial progress in carrying out the 2010 goal of the *Local Action Plan.* As Figure 1 shows, local emissions peaked in 2000 at 15 percent over 1990 levels; by 2008, emissions had fallen below 1990 levels, despite rapid population and economic growth.[7] On a per capita basis, local emissions have fallen by 19 percent since 1990.

7 All references to local emissions in this document refer to carbon or carbon emissions from sources that have been tracked. As explained in greater detail in the following pages and in Appendix 3, Multnomah County's carbon emissions historically have been tracked using a methodology that measures emissions from energy consumption and waste disposal. Because no reliable method exists to track the embodied emissions associated with all goods and materials that are purchased in Multnomah County, it is not yet possible to state to what extent such emissions would have changed over time if such emissions were to be included in the emissions inventory.

Nationally, total carbon emissions in the U.S. are now almost 13 percent above 1990 levels, and per capita emissions have decreased about six percent. From this perspective, Portland and Multnomah County are well ahead of the nation, but local achievements also underscore the magnitude of the challenge ahead. Even in Portland and Multnomah County, where "climate friendly" decisions, policies and programs have prevailed over the past 20 years, emissions have only just returned to 1990 levels. The good and sound practices to date clearly are inadequate for the challenges of climate change that must be addressed in the coming decades. To achieve the 2030 and 2050 goals, efforts must expand and accelerate dramatically.

TABLE 1

MULTNOMAH COUNTY CARBON EMISSIONS, BY SECTOR

(Metric Tons, CO_2-equivalent)

	1990	1995	2000	2005	2006	2007	2008
Residential Energy Use	1,756,863	1,792,324	2,049,236	1,712,546	1,754,530	1,751,466	1,781,146
Commercial Energy Use	1,877,120	2,063,068	2,415,421	2,047,206	2,104,637	2,119,381	2,120,201
Industrial Energy Use	1,540,504	1,774,535	1,974,958	1,332,354	1,387,821	1,338,034	1,309,380
Transportation Fuel	3,187,331	3,375,032	3,319,857	3,368,051	3,471,606	3,521,977	3,266,884
Waste Disposal	237,691	226,778	147,349	82,954	29,990	26,067	17,708
Total	**8,599,508**	**9,231,737**	**9,906,820**	**8,543,111**	**8,748,585**	**8,756,924**	**8,495,319**
(Relative to 1990)		**(+7.4%)**	**(+15.2%)**	**(-0.7%)**	**(+1.7%)**	**(+1.8%)**	**(-1.2%)**

SOURCES OF CARBON EMISSIONS

In Portland and Multnomah County, most emissions result from energy consumption in homes and buildings, transportation and waste disposal. The City of Portland and Multnomah County maintain an annual inventory of county-wide carbon emissions, shown in Table 1.

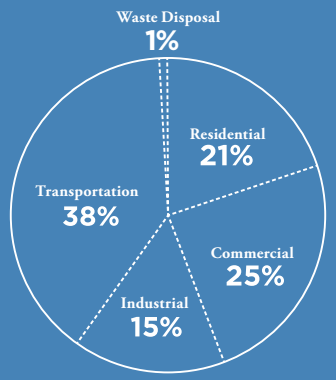
The inventory estimates emissions by sector based on transportation fuel sales and energy use by residential buildings, commercial buildings and industry (see Figures 2 and 3). The emissions attributed to waste disposal are based on the methane emissions from landfills that receive waste from Multnomah County, regardless of where those landfills are located. The 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.[8]

As Table 1 shows, local emissions increased during the 1990s and then declined significantly from 2000

8 For example, the City of Portland has worked with owners of multifamily properties throughout Oregon, including Multnomah County, to improve the energy efficiency of their buildings; in exchange for this assistance, the participating property owners transferred legal title of the resulting carbon offsets to the Climate Trust. The projects in Multnomah County achieved offsets of about 3,000 metric tons in 2008, and these offsets are owned by the Climate Trust or by parties who bought them from the Climate Trust. At the same time, many businesses, organizations and residents in Multnomah County have purchased offsets from the Climate Trust and other offset providers, and no data are available as to the volume of these offsets.

FIGURE 2

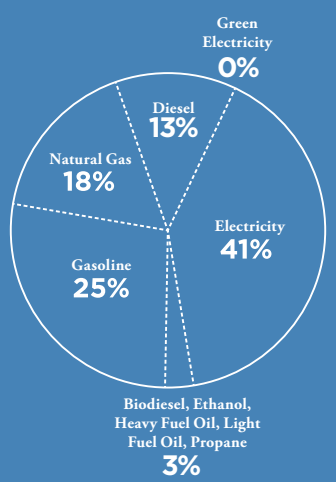
2008 MULTNOMAH COUNTY GREENHOUSE GAS EMISSIONS BY SECTOR



City of Portland Bureau of Planning and Sustainability

FIGURE 3

2008 MULTNOMAH COUNTY GREENHOUSE GAS EMISSIONS BY FUEL SOURCE



City of Portland Bureau of Planning and Sustainability

to 2005. Among the many factors that contribute to these trends, several stand out:

- Long-standing land-use policies and investments in mixed-use buildings, transit-oriented development and transportation options have resulted in almost no increase in emissions from transportation, despite population growth of more than 18 percent since 1990.
- The local economy has shifted from heavier industry to lighter commercial activities.
- The "energy crisis" of 2000-01 and resulting steep increases in electricity costs — as much as 50 percent for some customers — led to sustained reductions in industrial, commercial and residential energy use.
- The carbon intensity of the electricity grid in the Pacific Northwest has declined by approximately 10 percent from 2000 to 2008 as a result of adding lower-carbon power plants, including wind and natural gas.
- Emissions from waste disposal have declined significantly as a result of increased recycling and improved methane capture at landfills receiving local solid waste.

This inventory method allocates carbon emissions among the residential, commercial,[9] industrial and transportation sectors according to how much energy is used in each, and among waste disposal activities according to methane emissions. This method, referred to here as the "sector method" of inventorying emissions, has been widely used by state and local governments throughout the United States, including Oregon and Portland. Because this approach does not explicitly capture emissions associated with the consumption of goods, the Oregon Department of Environmental Quality (DEQ) is developing a complementary method, the "systems method," to consolidate carbon emissions from the full life cycle of a product, including manufacturing, distribution and disposal. Whereas the sector method allocates emissions based on the production of goods — the supply side of the economy — the systems method seeks to attribute emissions to the consumption of goods — the demand side of the economy.

Taken together, the traditional and complementary approaches to inventorying emissions offer insight into the underlying causes of — and therefore the opportunities to reduce — carbon emissions. Both approaches are needed because the businesses and industries located in Multnomah County produce different kinds and quantities of goods than what local

9 Due to limitations on the available data, emissions attributable to large, multi-family buildings (i.e., apartment and condominium buildings) are included in the commercial sector.

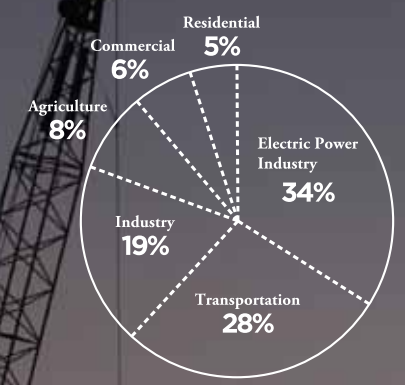
residents consume.[10] Examining carbon emissions through both methods therefore provides a more complete picture of the total emissions for which Portland and Multnomah County bear some responsibility.[11]

To illustrate the insights from considering both methods, Figure 4 shows how the traditional method apportions 2006 U.S. carbon emissions among the sectors that currently are tracked by Portland and Multnomah County. The emissions sources not tracked by Portland and Multnomah County (e.g., emissions from industrial processes and methane emissions from raising livestock) are listed as "other." Figure 5 shows how 2006 U.S. carbon emissions might be apportioned according to the systems method.

Viewing the data from the two different perspectives yields important insights into what causes carbon emissions. As consumers, for example, our decisions to acquire goods, including certain foods, result in nearly half of all carbon emissions. As producers, our decisions about the entire supply chain — extraction, production, packaging, distribution, retail and disposal — affect carbon emissions. Since both consumers and producers of goods generate carbon emissions, both parties have an opportunity to reduce those emissions.[12] This climate action plan seeks to address both halves of this equation.

FIGURE 4

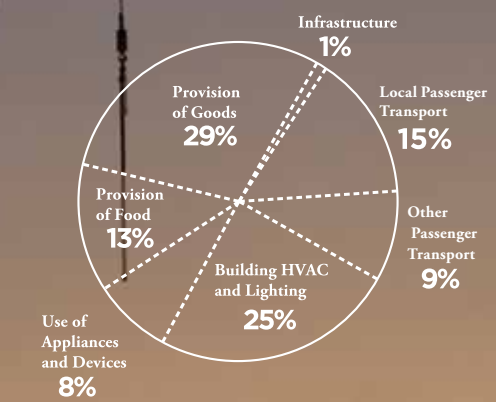
U.S. GREENHOUSE GAS EMISSIONS (2006): ECONOMIC SECTORS VIEW



U.S. Environmental Protection Agency

FIGURE 5

U.S. GREENHOUSE GAS EMISSIONS (2006): SYSTEMS VIEW



U.S. Environmental Protection Agency

10 With the exception of emissions from waste disposal, the traditional method measures emissions from the use of energy in Multnomah County, including the emissions related to producing goods in Multnomah County, without regard to where those goods are consumed. The systems method, by contrast, seeks to measure emissions attributable to end use activities by Multnomah County residents, including emissions that are produced outside of the county in connection with goods that are purchased by county residents.

11 A lack of adequate data has been the primary barrier to conducting a carbon inventory for Portland and Multnomah County using the complementary method. The Oregon Department of Environmental Quality (DEQ) and EPA are working to develop complementary methods to help expand this type of analysis to the state level, and Portland and Multnomah County will continue to work with DEQ and EPA to gain access to increasingly more accurate and insightful local data to guide policy.

12 A report released by the United Kingdom in 2008 illustrates the importance of utilizing both perspectives. The report observes that although the UK's carbon emissions under the traditional method declined five percent between 1992 and 2004, the emissions under the complementary method for this same period increased 18 percent during this same period, reflecting the importance of the embedded emissions intensity of UK imports. *Development of an Embedded Carbon Emissions Indicator – Producing a Time Series of Input-Output Tables and Embedded Carbon Dioxide Emissions for the UK by Using a MRIO Data Optimisation System,* Report to the UK Department for Environment, Food and Rural Affairs, June 2008.

THE FRAMEWORK FOR LOCAL CLIMATE PROTECTION

Portland's success to date in reducing carbon emissions rests on a foundation of sound land use and transportation planning. Since 1973, state law has required every city and county in Oregon to have a Comprehensive Plan, which controls land use decisions in that area. Metro, Portland's regional government, together with TriMet, the provider of public transportation for the Portland region, has guided investment in light-rail, mixed-use development and an integrated multi-modal transportation system. These efforts are a large part of local progress to date in reducing emissions and are fundamental to long-term success in achieving the 2050 goal.

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

Cities and counties nationwide are connecting through venues such as the U.S. Conference of Mayors, ICLEI — Local Governments for Sustainability, and informal peer networking among cities like Portland, Austin, Chicago, Denver, New York, San Francisco and Seattle.

In Oregon, explicit climate protection efforts date back 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 dioxide emissions 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 to 75 percent below 1990 levels by 2050.

In 2005, Governor Kulongoski issued the Greenhouse Gas Emissions Reduction Strategy, which identifies actions for the state to reach this 75 percent emissions reduction target. In 2007, legislation established the Global Warming Commission to guide Oregon's work on climate change. The state has already acted on several major pieces of the governor's strategy, including requiring large electric utilities to source 25 percent of their power from new renewable resources by 2025, and requiring major emitters of carbon emissions to report their emissions. A key component of the plan is participation in the Western Climate Initiative, a partnership among seven states and three Canadian provinces to reduce emissions under a cap-and-trade system. Legislation and regulatory proceedings necessary to establish this cap-and-trade system were introduced in the various state legislatures and agencies in 2009.

In the Portland metropolitan region, eight local governments have adopted resolutions committing to reduce carbon emissions. Multnomah and Clackamas Counties have joined the Cool Counties Initiative, and Portland, Beaverton, Gresham, Oregon City, Lake Oswego and Hillsboro have signed the U.S. Mayors Climate Protection Agreement. Several Oregon universities have developed carbon reduction plans. In April 2008, Metro, the regional government, adopted a resolution committing to collaborate regionally on climate change mitigation efforts. This work began in the fall of 2008 and will continue with a scan of best practices, policies, programs and goals to help frame regional opportunities. Metro plans to convene local stakeholders in the process of identifying regional strategies and initiatives to reduce carbon emissions.

Most recently, in early 2009 a public-private partnership emerged to establish the Portland region as a pilot of the Climate Prosperity Project. Developed by the non-profit Global Urban Development, this initiative seeks to establish a framework to align and coordinate economic development and climate protection activities. In the Portland region, the Portland Sustainability Institute, Metro, Greenlight Greater Portland, the Portland Development Commission, Nike and the City of Portland are developing a shared agenda to create jobs, cultivate talent and deliver social benefits while dramatically reducing carbon emissions.

> "This Plan is ambitious but well worth the effort. . . .As Oregon's largest utility, PGE will have an important role in helping achieve the goals outlined in the Climate Action Plan and we look forward to collaborating with the City, County, business community and local residents on many of these actions."
>
> —Carol Dillin, Vice-President, Public Policy, Portland General Electric

CLIMATE ACTION PLAN DEVELOPMENT

This Climate Action Plan is the result of collaboration among members of the public, businesses, non-profit organizations and public agencies. The Plan builds directly on the work of prior climate-protection plans, adopted in 1993 and 2001, and on the 2007 recommendations of the Peak Oil Task Force. Beginning in late 2007, a steering committee guided the development of this plan, and technical working groups and steering committee meetings continued through 2008.

A draft plan was released for public comment in April 2009, and eight town hall meetings were held to discuss the draft plan with residents, businesses and community organizations. More than 400 people participated in the public meetings, and an additional 175 sets of comments were received through an on-line comment form, by email or in letters, totaling more than 2,600 comments and suggestions. Figures 6 and 7 summarize quantitative results of some of the on-line comments.

City and County staff and the Steering Committee reviewed the comments, which tended to be supportive of the overall direction of the plan while suggesting modifications to nearly every action. In particular, respondents urged the City and County to be more attentive to four areas: social equity, public health, the larger regional context of the proposed actions, and adaptation, especially with respect to the role of natural systems. Many comments pointed to the need to scrutinize the costs and benefits of many of the actions, as well as the costs of inaction, and urged the City and County to identify specific sources of funding to carry out the proposed actions. Finally, commentors also emphasized the talent, resources and commitment of neighborhoods, businesses, non-governmental organizations and residents to working with the City and County to address climate change.

This plan is fundamentally intended to respond to climate change, reducing emissions and preparing for rapid changes in the climate, but it will only be successful if does so in ways that create jobs, improve social equity, strengthen natural systems, and enhance quality of life. Comments overwhelmingly expressed confidence that this is achievable.

"The Plan rightly acknowledges the past efforts of the City, County, and the Metro region to reduce emissions over the past 20 years. However, the Plan also provides a sobering assessment of how far this region must go to curb significant climate change. The good news is that the Plan provides clear goals and a variety of choices for the citizens of Portland and Multnomah County to meet these goals."

—David Bragdon, Metro Council President

The most important innovation in our planning now should be to anticipate an increased capacity for planning itself, for flexibility, for allowing — even enabling — rapid, adaptive and widespread change, social as well as material, in the light of changing circumstances.

—Transition PDX

FIGURE 6

WHICH STATEMENT MOST ACCURATELY REFLECTS YOUR OVERALL OPINION ABOUT THE PROPOSED ACTIONS AND OBJECTIVES OF THE CLIMATE ACTION PLAN?

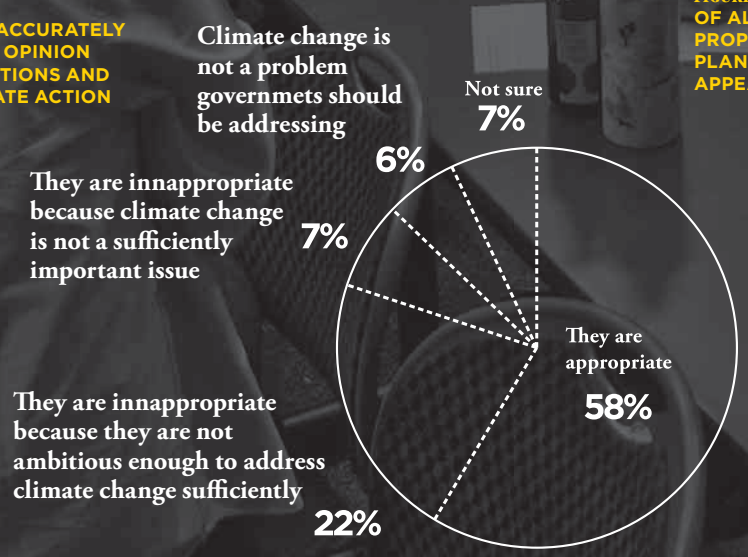
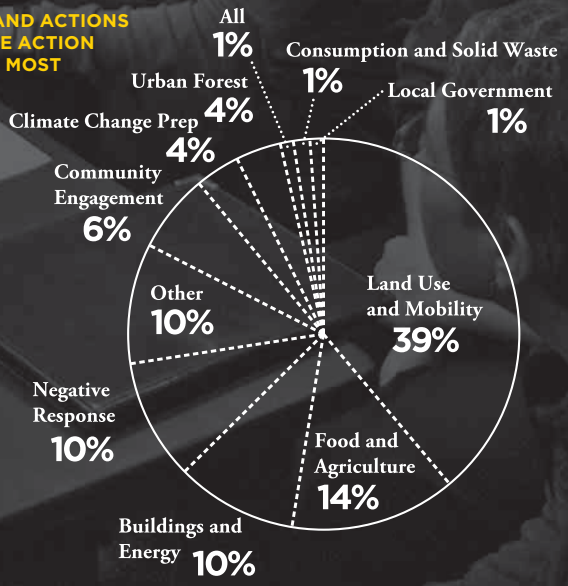


FIGURE 7

OF ALL THE OBJECTIVES AND ACTIONS PROPOSED IN THE CLIMATE ACTION PLAN, IS THERE ONE THAT MOST APPEALS TO YOU?



PORTLAND AND MULTNOMAH COUNTY'S CURRENT PLANNING PROCESS

With this document, the City of Portland and Multnomah County seek to identify the actions the City and County can take that have the greatest potential to reduce emissions and adapt to a changing climate.

Individual bureaus, departments and programs, including the Multnomah County Sustainability Program, the Multnomah County Health Department, the Portland Bureaus of Planning and Sustainability, Transportation, Development Services, Parks and Recreation, Environmental Services and Water and the Portland Development Commission, among many others, will lead many of the City and County's efforts. At the same time, the City and County will coordinate and collaborate with Metro, the State of Oregon, other local governments, businesses, academia and the religious and non-profit communities wherever possible.

The Climate Action Plan enumerated in this document is an iterative process, incorporating and building on lessons learned, as follows:

Every Year: The Community Inventory

The Bureau of Planning and Sustainability and the Multnomah County Sustainability Program will report annually to the Portland City Council and the Multnomah County Board of Commissioners on local carbon emission trends, fossil fuel use and progress in implementing the actions in this Climate Action Plan. Additional data on consumption will be included in the report as it becomes available.

Every Three Years: New Actions

Every three years, the Portland City Council and the Multnomah County Board of Commissioners will revise the actions in this plan and identify new ones as necessary. During this periodic review, the City and County will determine whether actions that have not been implemented nonetheless remain effective ways to achieve the objectives of this plan and will develop new actions to be implemented in the subsequent three years. This revision process will include a review and analysis of the opportunities and challenges to achieving the 2030 objectives and goal.

2020: Revise Plan

In 2020, the City of Portland and Multnomah County will re-examine the Climate Action Plan based on the latest science and the successes and challenges of implementing policies and programs. A new climate action plan will be developed, with a new 2040 interim goal and 2040 objectives to keep Portland and Multnomah County on a path to achieve the 80 percent reduction in carbon emissions by 2050 and to meet the challenges of preparing for a changing climate.

THE PLAN: OBJECTIVES AND ACTIONS

Terminology

In this document, "plan" refers to the entire climate protection effort. The 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 three years. This plan thus refers to a 2050 goal, 2030 objectives and 2012 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 18 specific objectives and related actions intended to achieve the interim goal of a 40 percent reduction in emissions by 2030.

The accompanying actions — to be pursued in the next three years — are not intended to be an exhaustive list of every effort that Portland and Multnomah County will undertake to achieve the 2030 objectives; the City and County may do much more. Rather, the actions identified here are the highest priority, *all* of which must be pursued by the end of 2012. Moreover, while the City or County will have a major, direct role in carrying out many of the following objectives and actions, successful implementation will require many diverse partners, from non-profit organizations to business leaders to neighborhood associations to individual residents.

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

- **Buildings and Energy**
- **Urban Form and Mobility**
- **Consumption and Solid Waste**
- **Urban Forestry and Natural Systems**
- **Food and Agriculture**
- **Community Engagement**
- **Climate Change Preparation**
- **Local Government Operations**

The objectives and actions were given priority based on three criteria: (1) emission reductions, (2) sphere of influence and (3) community benefits.

(1) Emissions reductions. Implementing the 2012 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 have little chance of achieving the necessary long-term reductions. Where possible, the reductions are quantified. Quantitative measures are generally available in the categories of

TABLE 2

COMPOSITION OF MULTNOMAH COUNTY CARBON EMISSIONS

(Thousand metric tons)

	1990	2008	Percent change from 1990	2030	Percent change from 1990	2050	Percent change from 1990
Building energy	5,174	5,211	+ 1%	3,265	– 37%	933	– 82%
Transportation	3,187	3,267	+ 2%	1,859	– 42%	766	– 76%
Waste disposal	238	18	– 93%	10	– 96%	5	– 98%
Total	**8,560**	**8,495**	**– 1%**	**5,134**	**– 40%**	**1,704**	**– 80%**

BUDGET FOR A LOW-CARBON FUTURE

	1990	2008	2030	Percent change from 2008	2050	Percent change from 2008
Population	584,000	715,000	999,000	+40%	1,355,000	+90%
Per person carbon emissions (metric tons)	14.7	11.9	5.1	-57%	1.3	-89%
Passenger miles per day per person	17.4	18.5	13.4	-28%	6.8	-63%
Electricity (kWh per person)	13,049	12,081	7,869	-35%	3,815	-68%
Natural gas (Therms per person)	391	382	302	-21%	98	-74%

Key assumptions are described in Appendix 2.

Buildings and Energy, Urban Form and Mobility and Consumption and Solid Waste. The diagram on page 13 shows the approximate contribution of the sets of actions to achieving the 2030 emissions-reduction target. These numbers are based on the "systems approach" to inventorying emissions, described on page 21, and are therefore estimates, since data are not yet available to produce a precise a local "systems" inventory. The complexity of the figure makes clear that no single category of actions will achieve the 2030 goal: Aggressive action is required in all areas.

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

(2) **Sphere of influence.** The objectives and actions of this plan are those through which the City of Portland or Multnomah County can materially impact emissions. Although action must be taken at all levels of government and the private sector to address climate change, this plan focuses exclusively on actions that the City and County are positioned to carry out.

(3) **Community benefits.** Many of the actions that reduce emissions also deliver substantial community benefits, including creating local jobs, supporting vibrant neighborhoods and improving personal health. Although the City and County must take some actions almost exclusively because they reduce emissions, actions that also generate strong community benefits are prioritized.

While it is easier to quantify the first of these three criteria — emissions reductions — than sphere of influence or community benefits, and easier to measure reductions in certain categories than in others, the less quantifiable actions in the plan are every bit as necessary to achieve the 2050 goal. Many of these, such as the community engagement campaign, are difficult to measure precisely because they reflect long-term, structural or cultural changes. In other words, they are the fundamental, enduring changes that will ultimately ensure success in addressing climate change.

2030 OBJECTIVES
2012 ACTIONS

BUILDINGS AND ENERGY

Buildings are the single largest contributor to carbon emissions in Multnomah County, accounting for more than 40 percent of total emissions. Reducing carbon emissions from building energy use requires two changes: improve energy efficiency and reduce the carbon intensity of energy supplies, primarily by increasing renewable sources of electricity such as solar and wind power.

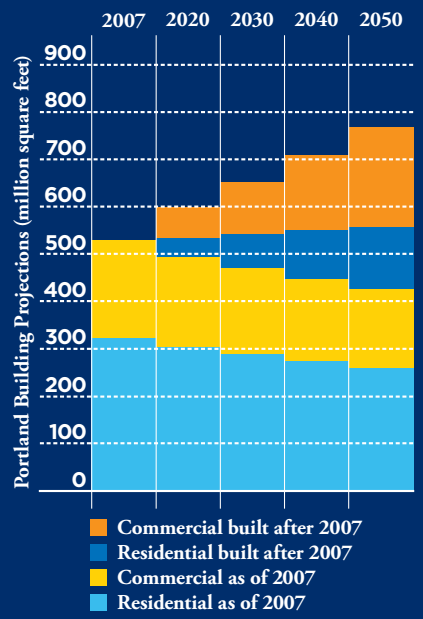
In the Pacific Northwest, despite relatively abundant hydropower, nearly half of all electricity is from coal, natural gas and nuclear power plants (Figure 9 on page 42). Wind power has spread rapidly in recent years, but in 2008 wind still provided less than three percent of all electricity, and solar-generated electricity represented well under one percent.[13]

The Energy Trust of Oregon, the Oregon Department of Energy, the Northwest Energy Efficiency Alliance, utilities and other organizations, together with the City of Portland and Multnomah County, already have undertaken significant work to increase energy efficiency and decrease energy-related carbon emissions. Much work remains to be done, and it will be important to leverage existing efforts and expertise to accelerate this work.

Because buildings last for many decades, efforts to reduce emissions from buildings need to address both existing structures and new construction. More than half the building stock that will exist in 2050 already exists today (Figure 8). For that reason, Objective 1 seeks to improve the energy efficiency of existing buildings, while Objective 2 calls for new buildings to maximize energy performance. In parallel with the improvements to the building stock, Objective 3 seeks to increase the amount of energy provided by clean renewable sources and efficient district-scale systems. Objective 4 seeks to ensure that new buildings can adapt to a changing climate.

FIGURE 8

PORTLAND BUILDING PROJECTIONS (MILLION SQUARE FEET)



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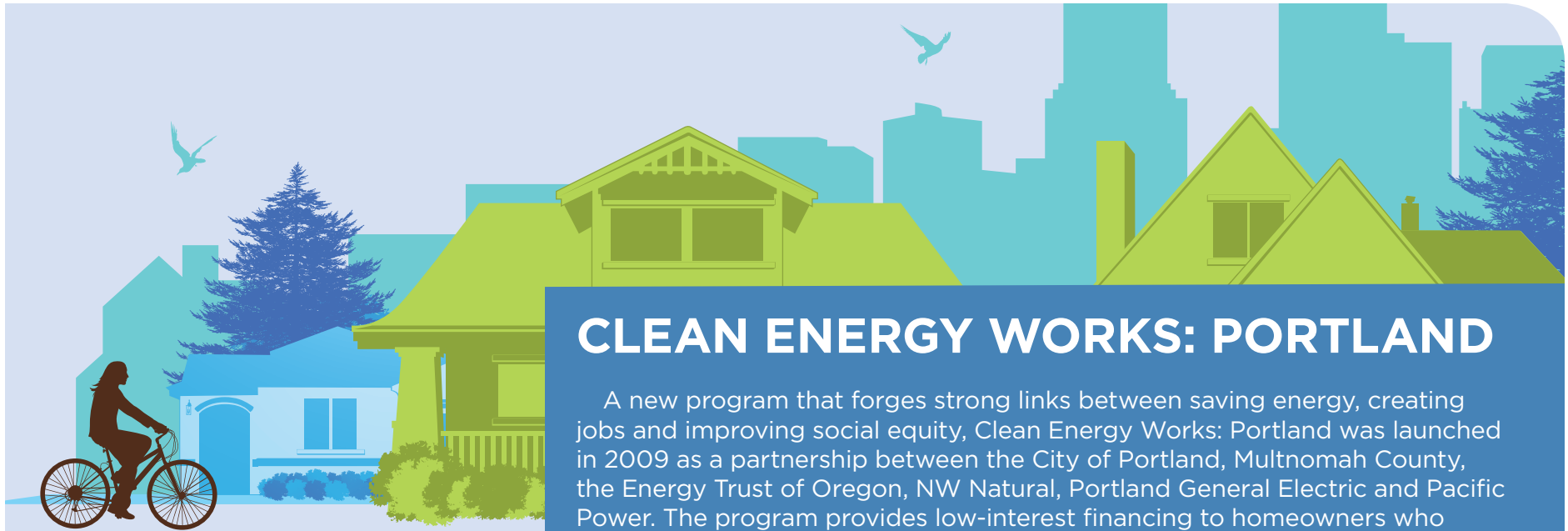
13 U.S. Department of Energy, *Annual Energy Outlook 2009,* Supplemental Tables 82 and 98.



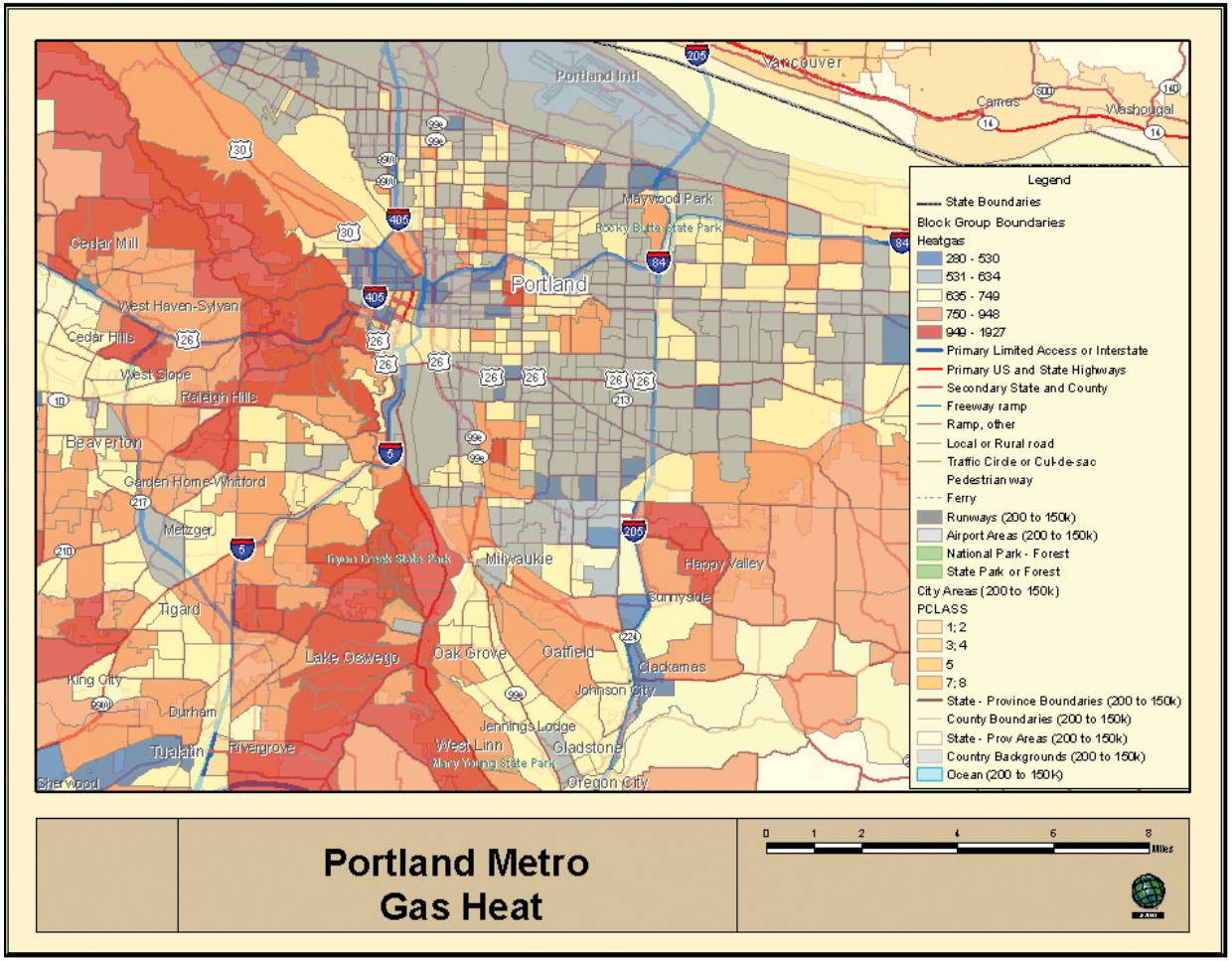
CLEAN ENERGY WORKS: PORTLAND

A new program that forges strong links between saving energy, creating jobs and improving social equity, Clean Energy Works: Portland was launched in 2009 as a partnership between the City of Portland, Multnomah County, the Energy Trust of Oregon, NW Natural, Portland General Electric and Pacific Power. The program provides low-interest financing to homeowners who improve the energy efficiency of their homes (See Objective 1, Action (i) on page 34). The loan is then repaid on the homeowner's utility bill over 15 to 20 years. Low-income households pay the lowest interest rate, with higher-income households able to lower their interest rate by electing more comprehensive energy retrofits. A core component of the program is its commitment to creating quality jobs and advancing social equity.

GREEN JOBS GOALS

- 80% of employees are hired from local work force
- 30% of total project hours are performed by historically disadvantaged people, including people of color, women, and low-income residents
- 20% of all contractors and subs are businesses owned by historically disadvantaged people, including people of color and women
- 180% of minimum wage or better paid to all contractors and subs
- 100% of new hires come from qualified training programs
- 20% of the pilot project work to contractors who demonstrate particular focus on creating pathways out of poverty and into green jobs for local residents, including through employing social enterprise models and/or partnering with nonprofit community-based organizations

www.cleanenergyworksportland.org



THERMS OF NATURAL GAS USED PER HOUSE IN 2008, FOR SINGLE-FAMILY HOUSES WITH GAS SPACE HEAT, BY CENSUS TRACT.

SOURCE: ENERGY TRUST OF OREGON

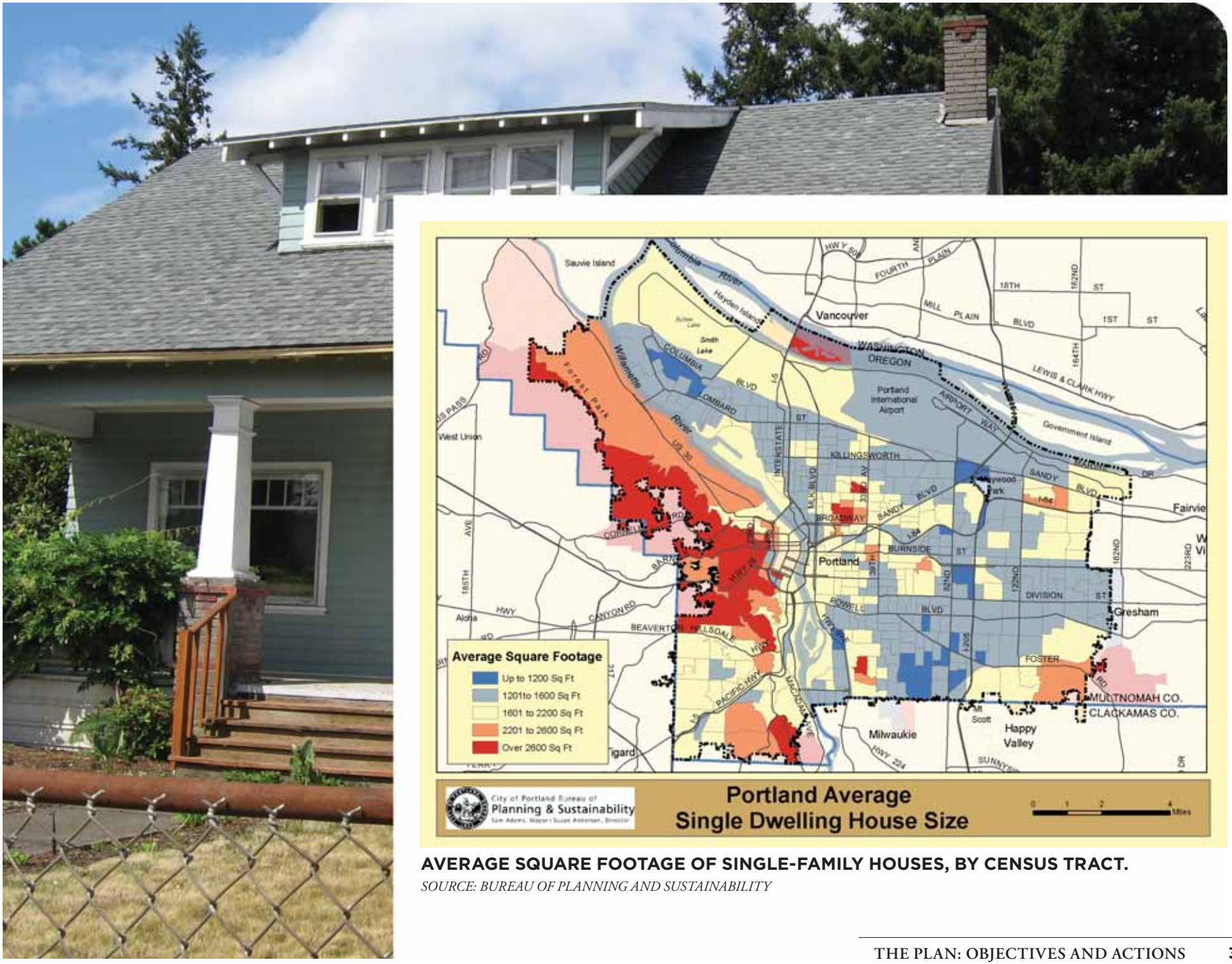
These maps are an initial step in gathering neighborhood-level data on metrics related to climate action by enabling residents to see how their neighborhood compares to others.

Many factors influence household energy use, including:

- type of residence (single family or multifamily)
- size of dwelling
- age of structure
- level of insulation
- size and type of windows
- efficiency of lighting and appliances
- number and behavior of occupants

A simple visual comparison of the two maps suggests a rough correlation between home size and natural gas use. While this makes intuitive sense, it is also notable that the smaller homes tend to be older homes and less likely to be well insulated.

We plan to continue making comparative data available to inform and motivate neighborhood scale carbon reduction action.



AVERAGE SQUARE FOOTAGE OF SINGLE-FAMILY HOUSES, BY CENSUS TRACT.

SOURCE: BUREAU OF PLANNING AND SUSTAINABILITY

2030 OBJECTIVE 1.

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

To be on track to reach the 2050 emissions reduction target, all buildings must consume 25 percent less energy than today. By 2030, many new and highly efficient buildings will have been built that will consume less than half the energy of today's buildings. However, because over two-thirds of the buildings that will exist in 2030 are in place today, existing buildings must be retrofitted with energy-saving measures to achieve the necessary aggregate building efficiency improvements.

Actions to be completed before 2012

(i) Establish an investment fund of at least $50 million in public and private capital to provide easy access to low-cost financing to residents and businesses for energy performance improvements.

(ii) Require energy performance ratings for all homes so that owners, tenants and prospective buyers can make informed decisions.

(iii) Require energy performance benchmarking for all commercial and multi-family buildings.

(iv) Provide resources and incentives to residents and businesses on carbon-reduction actions in existing buildings, including energy efficiency, renewable energy, choice of materials and building re-use.

(v) Work with partner organizations to promote improved operation and maintenance practices in all commercial buildings.

(vi) Establish a City business tax credit for installing solar panels and ecoroofs together.

2030 OBJECTIVE 2.

Achieve zero net greenhouse gas emissions in all new buildings and homes.

The optimal 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.

Actions to be completed before 2012

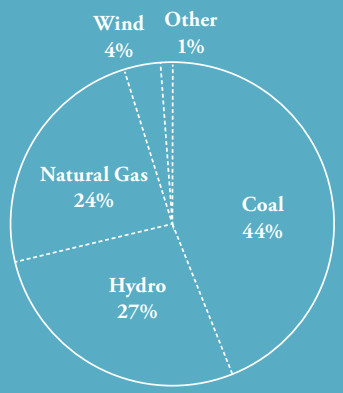
(i) Participate actively in the process to revise the Oregon building code to codify the performance targets of Architecture 2030.

(ii) Adopt incentives for high performance new construction projects that consider life-cycle carbon emissions impacts.

(iii) Accelerate existing efforts to provide green building design assistance, education and technical resources to residents, developers, designers and builders.

FIGURE 9

2008 SOURCES OF ELECTRICITY FOR UTILITIES SUPPLYING CUSTOMERS IN MULTNOMAH COUNTY



Oregon Department of Energy for overall resource mix of each utility; *Bureau of Planning and Sustainability* for weighted average mix based on electricity supplied by Portland General Electric and Pacific Power to customers in Multnomah County

Coal plays a significant role in providing electricity to the Northwest. Year-to-year variability in hydropower supplies changes the mix, but coal and natural gas typically supply over half of all power to the Northwest, despite the extensive hydropower system. In Multnomah County, the power mix is even more dependent on coal, since Pacific Power, which provides about one-fourth of all electricity used in the county, relies on coal for about 70 percent of its energy.

Financing Energy Efficiency

Over time, energy efficiency improvements in buildings generally save more money than they cost. These improvements have not been widely adopted, however, in part due to the "sticker shock" people experience when considering extensive efficiency improvements. An energy investment fund helps remove this barrier by providing up-front financing through programs such as Clean Energy Works Portland (see page 31). Homeowners and businesses pay back the investment over an extended period of time, with monthly energy savings matching or exceeding the monthly finance payments.

Architecture 2030

Architecture 2030 is a non-profit organization that seeks to transform the buildings sector from a major contributor of carbon emissions to a central part of the solution to climate change. The Architecture 2030 performance targets specify that new buildings built after 2010 use no more than 50 percent of the fossil fuel used, on average, by similar types of buildings. This target decreases by 10 percent every five years, such that buildings built after 2030 will consume no fossil fuels to operate.

2030 OBJECTIVE 3.

Produce 10 percent of the total energy used within Multnomah County from on-site renewable sources and clean district energy systems.

Current projections anticipate that the population of Multnomah County will increase by more than 30 percent by 2030, with a corresponding increase in demand for energy. State law requires that by 2025, 25 percent of all electricity sold in Oregon be generated from clean renewable sources. Some of these sources will take the form of utility-scale wind farms or solar facilities located far from population centers. District- and neighborhood-scale energy systems, as well as on-site renewables and distributed generation sources, also provide opportunities for efficiency gains by reducing transmission losses.

Actions to be completed before 2012

(i) Make the investment fund referenced in Objective 1 (page 34) available to finance distributed generation and district energy systems.

(ii) Establish at least one new district heating and cooling system.

(iii) Facilitate the installation of at least ten megawatts of on-site renewable energy, such as solar energy.

(iv) Collaborate to reduce the role of carbon – including from coal and natural gas sources – in Portland's electricity mix.

2030 OBJECTIVE 4.

Ensure that new buildings and major remodels can adapt to the changing climate.

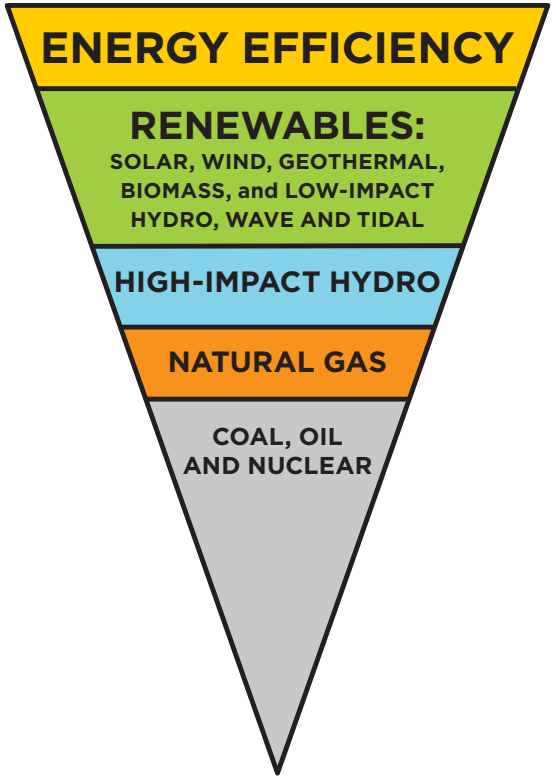
A building constructed today will likely be in place for a century or more, and the climate will change considerably over the building's life. Buildings need to anticipate and be able to adapt to physical changes — higher temperatures, for example, and more severe rainstorms — as well as economic changes, like higher energy prices. Strategies to prepare for these changes include fundamental design elements, like the orientation of the building to allow for cross-breezes and minimize west-facing window area; structural changes, like stronger roofs to withstand windstorms; and specific technologies, like whole-house fans to enable low-cost cooling.[14]

Actions to be completed before 2012

(i) Participate actively in state of Oregon code-development processes to ensure that building codes support buildings that can adapt to higher temperatures, stronger storms, and other physical impacts of climate change.

14 Wilson, Alex and Andrea Ward. "Design for Adaptation: Living in a Climate-Changing World," Environmental Building News, September 1, 2009.

ENERGY HIERARCHY

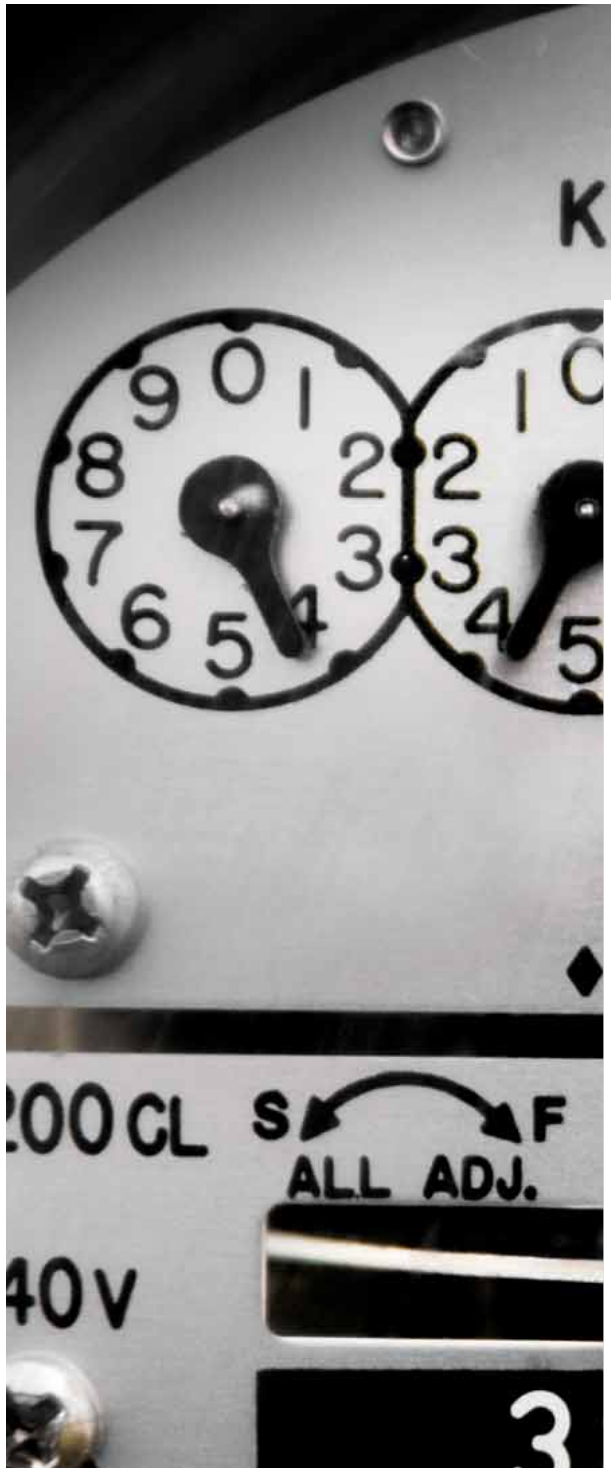


Energy is essential to nearly every element of our everyday lives, from the heat that warms a morning shower, to the diesel in a bus engine, to the calorie content of a midnight snack. Almost all energy ultimately derives from the sun, either directly, such as in solar photovoltaics, or indirectly, such as in fossil fuel, which is made of fossilized plants that grew millions of years ago.

Some things we think of as energy – electricity, for example, or hydrogen – are, in fact, carriers of energy, which move energy from one place to another. Energy carriers can be extraordinarily useful in allowing energy to move rapidly and conveniently from one place to another, but changing energy from one form to another also requires energy, reducing the overall efficiency. When natural gas is used to generate electricity, for example, the most efficient new power plants convert about 60 percent of the original energy content of the natural gas to electricity.

As technologies to carry and store energy improve — through better batteries, for example, or thermal strategies (think of the air conditioning potential of a giant popsicle) — the potential to rely increasingly on renewable energy sources also improves.

The decisions we make about our sources of energy have enormous economic and environmental implications. Energy sources vary widely in availability, cost, convenience and environmental impacts. In prioritizing among energy sources, Portland and Multnomah County are guided by the hierarchy to the left.



District Energy

District energy is a cooperative effort to provide heating, cooling and hot water for buildings in a given area. District energy systems have significantly reduced consumption of fossil fuel in many countries around the world and are emerging as a key strategy for reducing greenhouse gas emissions among local governments in the U.S.

District energy offers two principal benefits.

First, building developers and owners do not have to determine specific heating and cooling equipment, nor do they need to dedicate significant space within their buildings for boilers or cooling equipment. This difference can lead to big improvements in efficiency, as individual developers and building owners often oversize their equipment and are reluctant to consider investments that have payback periods of more than three years.

Second, district energy systems are much more capable of improving on energy technology over time. For instance, a district energy system need only change equipment at the central energy plant rather than expensive retrofits within each building.

The City of Portland has completed a feasibility analysis of district energy in the North Pearl, and the results suggest that a district energy system could reduce carbon emissions by 10 to 70 percent, depending on fuel source.

URBAN FORM AND MOBILITY

Portland and Multnomah County have achieved considerable success in limiting emissions growth from transportation. Urban form and mobility policies have resulted in almost no increase in emissions from transportation since 1990.

- TriMet ridership has doubled since 1990, with increases every year. The regional light-rail system continues to expand; it now connects Portland to Clackamas Town Center, coinciding with the new rail loop through downtown Portland along the transit mall.
- Portland has a higher percentage of bicycle commuters than any other major U.S. city with a bicycle commute rate that is eight times the national average. The number of riders crossing bridges into downtown Portland has increased by double-digit percentages in each of the past four years.
- The Portland Streetcar now connects the new South Waterfront neighborhood with the central city, and ridership on the streetcar line continues to grow faster than anticipated.
- Each new person moving into the Portland metro area uses one-fourth the amount of living space that is used by each new person moving into the Washington, D.C metro area.[15]
- Portland adopted a renewable fuel standard requiring that all diesel sold in the city include at least five percent biodiesel and all gasoline 10 percent ethanol.
- The Portland region leads the nation in the number of hybrid cars purchased per household.[16]

Reducing vehicle miles traveled by increasing active forms of transportation — walking, bicycling and taking transit — produces significant community health and economic benefits as well. Portland-area residents and businesses reap a "green dividend" of more than $1 billion annually in reduced transportation costs as a result of driving less than residents of other American cities.[17] Similarly, evidence is increasingly emerging of the health benefits of reducing vehicle miles traveled, both in terms of improved air quality and increased levels of physical activity.[18]

Nevertheless, transportation of goods and people accounts for 40 percent of Multnomah County carbon emissions. Land use planning and transportation funding decisions greatly influence transportation-related emissions. Similarly, commercial transportation is strongly influenced by the location and availability of inter-modal options. For that reason, transportation

15 LandSat Research by Jeffrey Masek and Francis Lindsay, University of Maryland, 2000.

16 www.hybridcars.com, Dashboard — June 2009.

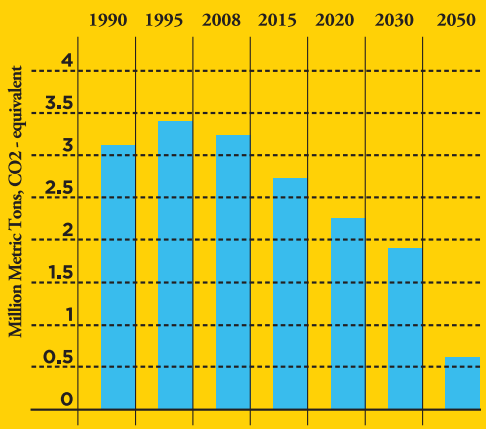
17 Cortright, Joe. "Portland's Green Dividend." CEOs for Cities, July 2007.

18 Health Impact Assessment on Policies Reducing Vehicle Miles Traveled in Oregon Metropolitan Areas, Upstream Public Health, 2009.

Two interim goals for reducing transportation related carbon emissions are established through this plan–a 10 percent reduction by 2015 and a 25 percent reduction by 2020.

FIGURE 10

TRANSPORTATION-RELATED CARBON EMISSIONS REDUCTION GOALS



emissions reduction depends critically on coordinated land use policies and the development of infrastructure for low-carbon modes of transportation.

Along with infrastructure, individuals will make daily choices to walk, bicycle, take transit or carpool whenever these options are practical. Planning, infrastructure and technology are essential, but they are not enough.

This plan takes a three-pronged approach to reducing transportation emissions: Objectives five and six seek to reduce the number of miles that people and goods must travel using vehicles, Objective seven seeks to improve the efficient movement of freight, and Objectives eight and nine seek to reduce the amount of emissions that are emitted when vehicles are used.

2030 OBJECTIVE 5.

Create vibrant neighborhoods where 90 percent of Portland residents and 80 percent of 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.

Despite thoughtful land-use planning and quality transportation options, residents of Multnomah County are more dependent on automobiles than are the residents of more compact cities on the East Coast and in much of the rest of the world. A critical and basic step to reduce automobile dependence is to ensure that residents live in "20-minute neighborhoods," meaning that they can comfortably fulfill their daily needs within a 20-minute walk from home.

Actions to be completed before 2012

(i) The City and County both recognize the critical role of the Urban Growth Boundary in guiding the region's growth while meeting economic, environmental and social needs.

a. The City will advocate for accommodating all population and business growth within the existing Urban Growth Boundary, with the possible exception of industrial needs.

b. The County will advocate for accommodating substantially all population and business growth within the existing Urban Growth Boundary.

(ii) In the Metro Urban/Rural Reserves program, the City will advocate for adopting the low end of Urban Reserve Designations to reflect the trends in demographics, climate change, energy supply and infrastructure costs.

(iii) Make 20-minute complete neighborhoods a core component of the Portland Plan.

(iv) For each type of urban neighborhood, identify the land use planning changes and infrastructure investments, including public-private partnerships, that are needed to achieve a highly walkable and bikeable neighborhood and develop an implementation action plan.

Vibrant, active neighborhoods are the foundation of a sustainable city. Neighborhoods are one of the clearest physical intersections of people, commerce and nature, bringing together the built and natural environment and strongly shaping the experience and impact of residents and businesses. They also provide one of the keenest senses of belonging, shared experiences, community connections and equal stake—or lack thereof.

In Portland, residents have shown strong interest in cultivating "20-minute complete neighborhoods"—places where residents can safely walk a relatively short distance from home to most of the destinations and services they use every day. Fundamentally, the 20-minute neighborhood concept is another way to talk about or describe walkable, bikable environments and vibrant, human-scale neighborhoods—in essence, complete neighborhood communities.

The 20-minute complete neighborhood concept map (opposite page) represents the range of accessibility by walking in different parts of the city. The data underlying the map take into account the following factors that typically affect a person's choice to walk from home to a desired destination[19]:

DESTINATIONS

Research suggests that people would most likely walk to the following destinations from home.

- **Grocery stores**
- **Neighborhood-oriented commercial**
  - → *Restaurants, neighborhood eateries*
  - → *Pubs*
  - → *Drug stores*
  - → *Convenient stores/ corner stores*
  - → *Laundromats*
- **Transit stops**
- **Parks (access points)**
- **Schools**

DISTANCE

Proximity to destinations, not as the crow flies, but by actual street network.

- **¼-mile, ½-mile, 1-mile gradient to…**
  - → *grocery stores*
  - → *neighborhood-oriented commercial*
  - → *parks access points*
  - → *elementary schools*

WALK QUALITY

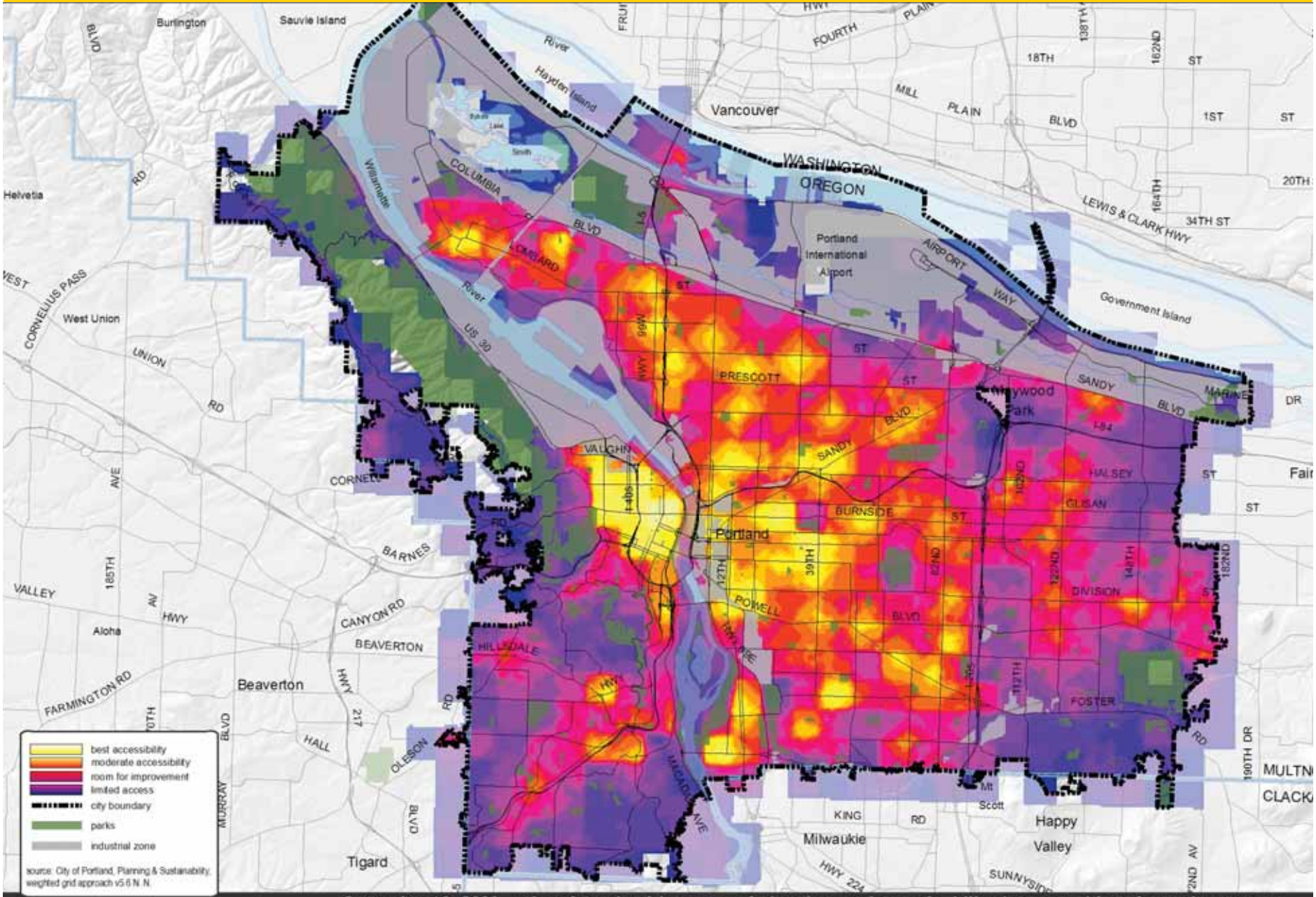
The characteristics of the physical walking environment, pedestrian-oriented network.

- **Sidewalks (presence or absence of)**
- **Intersection density (a proxy for connectivity or block length)**
- **Slope (greater than 20% were considered less likely to attract walking on a day-to-day basis)**

Taking these elements together, the resulting map allows for general comparison and contrast of "walkability" in different parts of the city. It is based on the proximity of destinations, the clusters of destinations, and the quality of the physical environment. The map shows the "hot spot" areas that tend to have more integrated qualities that would qualify it as a "20-minute neighborhood" and which parts of the city are less so. The 20-minute neighborhood concept map can help spur exploration of creative solutions that suit the different qualities of different parts of the city. Approaches to change should meet the needs of these areas on their own terms, while generally supporting more short distance travel by walking, bicycling, or transit.

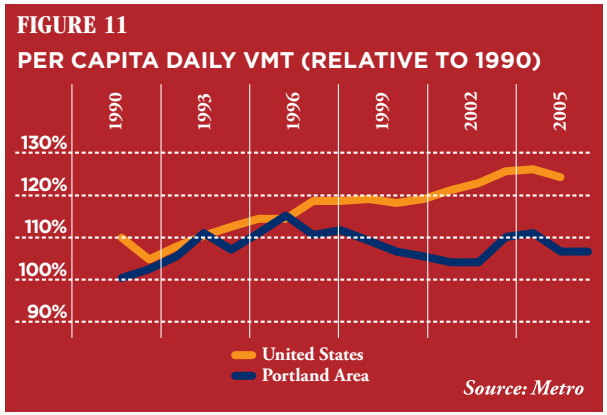
19 The selection of destination types to include in the analysis is based on discussions with the public and by research conducted by experts walkable neighborhoods. See "Operational Definitions of Walkable Neighborhood: Theoretical and Empirical Insights." Journal of Physical Activity and Health 2006, 3. Suppl 1, S99-S117, by Anne Vernez Moudon, et. al.

20-MINUTE COMPLETE NEIGHBORHOOD CONCEPT



September 10, 2009 **City of Portland | Bureau of Planning and Sustainability | Geographic Information System**

The information on the map was derived from digital data-bases on the City of Portland, Bureau of Planning and Sustainability GIS. Care was taken in the creation of this map but it is provided "as is". The City of Portland cannot accept any responsibility for error, omissions, or positional accuracy, and therefore, there are no warranties which accompany this product. However, notification of any errors will be appreciated.



(v) Require evaluations of major planning scenarios, Comprehensive Plan and Transportation System Plan decisions to include estimates of carbon emissions. Partner with Metro and regional jurisdictions to develop modeling tools for evaluating emissions impacts of land-use and transportation decisions and monitoring carbon emissions.

(vi) Develop a more balanced funding mechanism and adopt a schedule for public investments to make neighborhoods highly walkable and bikeable, including sidewalks and improved access to transit for reaching destinations beyond a reasonable walking or biking distance.

(vii) Partner with federal agencies, including Housing and Urban Development, the Environmental Protection Agency, and the Department of Transportation, on efforts like the joint Interagency Partnership for Sustainable Communities to apply new federal priorities around sustainable development in Portland and Multnomah County.

(viii) Seek funding to accelerate remediation of brownfields in the city and county to accommodate growth within the current Urban Growth Boundary.

(ix) Work with Metro and other local governments to make reducing carbon emissions and adapting to climate change impacts a funding criteria for the Metro Policy Advisory Committee and the Joint Policy Advisory Committee on Transportation.

(x) Coordinate decisions about future streetcar investments with Portland Plan land use decisions.

(xi) Facilitate the aggregation of smaller land parcels which, when aggregated, provide opportunities for industrial development.

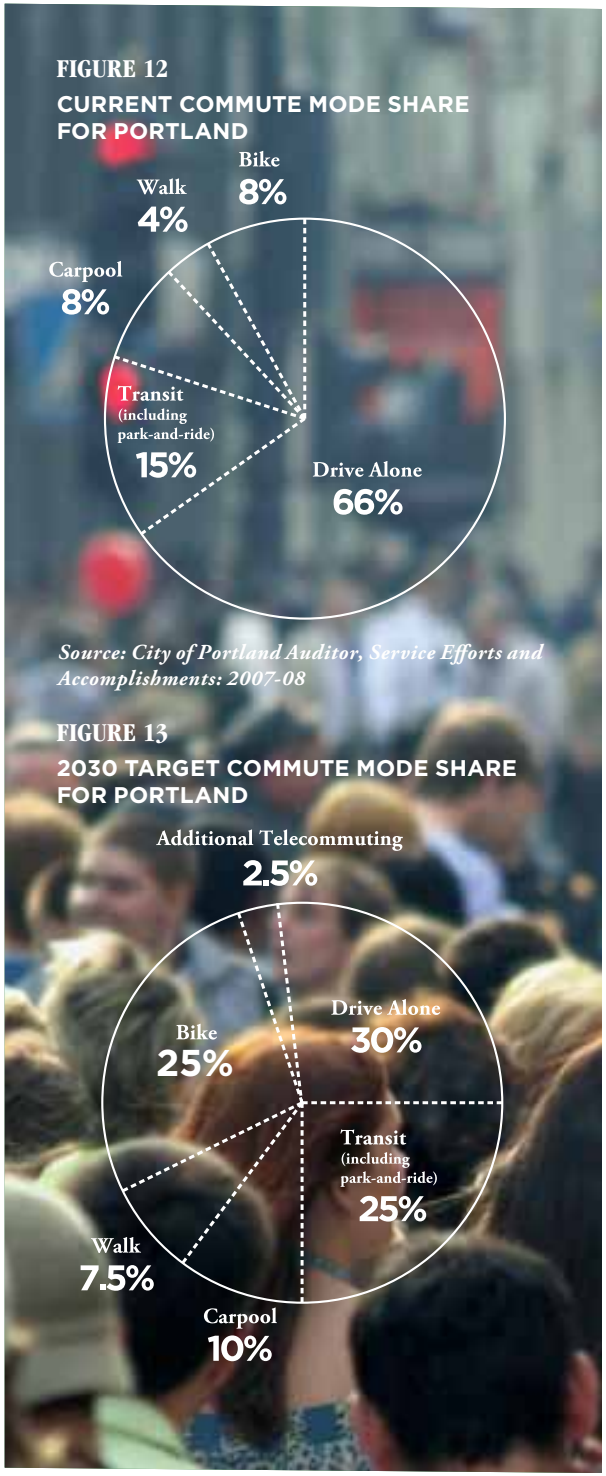
2030 OBJECTIVE 6.

Reduce per capita daily vehicle-miles traveled (VMT) by 30 percent from 2008 levels.

As of 2005, the per capita daily passenger vehicle-miles traveled (VMT) in the Portland region are about eight percent above 1990 levels. (Figure 11). To be on target for the 2050 goals, per capita daily passenger VMT must decline by about 30 percent from today's by 2030. This reduction must occur in addition to vehicle fuel efficiency improvements and the development of cleaner fuels. Reducing per capita VMT while maintaining the mobility of, and access to services for, Portland and Multnomah County residents will require significant growth in walking, bicycling and transit (Figures 12 and 13).

The current Transportation System Plan projects that drive-alone trips will decrease from 62 percent in 1994 to 57 percent in 2020 (Figure 14). To achieve the 2030 objective, VMT reductions will need to accelerate dramatically from the current trajectory. The benefits of this shift will do more than protect the climate because the average Portland household spends about 20 percent of household income on transportation, reductions in VMT can significantly increase disposable income.[20]

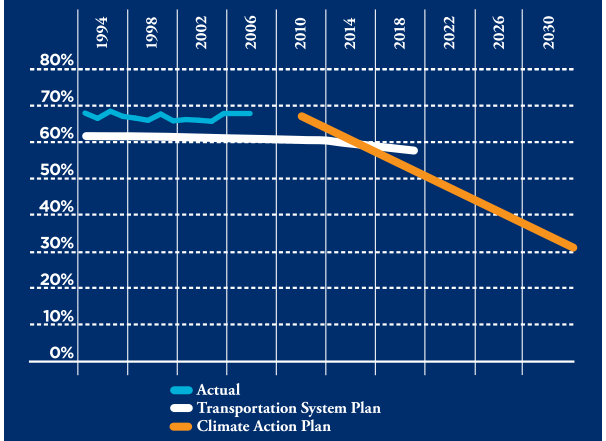
20 See, for example, "The Affordability Index: A New Tool for Measuring the True Affordability of a Housing Choice." Center for Transit Oriented Development and Center for Neighborhood Technology, January 2006.



VMT

Vehicle-miles traveled (VMT) measures the total amount of miles driven in a given area. It is an indicator of how reliant people and businesses are on motor vehicles to meet their mobility needs. Although some residents drive more and some residents drive less than the average, all residents will need to optimize the efficiency of their driving trips and reduce their total amount of driving in order to achieve the necessary VMT reductions.

FIGURE 14
DRIVE ALONE COMMUTE MODE SHARE IN PORTLAND: ACTUAL CENSUS, TSP 2020 TARGETS, AND CLIMATE STRATEGY GOALS



Portland Bureau of Transportation

Actions to be completed before 2012

(i) Establish a sustainable funding source adequate to maintain the existing transportation system and to invest in transportation capital projects and programs that reduce carbon emissions.

(ii) Account for greenhouse gas emissions from investments in and the performance of the transportation system.

a. Establish a method for projecting the life cycle carbon footprint of transportation investments, including embodied energy, operations (VMT and flow) and maintenance.

b. Develop a reporting mechanism for tracking transportation carbon emissions. The report will include key performance measures and will document progress toward emission reduction goals. Key measures include commute mode share, VMT by vehicle type, traffic flow on major arterials and highways, fuel efficiency of vehicles and total carbon emissions from the transportation system.

(iii) Support investments to provide high-performance broadband connectivity to every business and residence to enable widespread e-commerce, telecommuting and improved emergency response.

(iv) Work with regional partners including the Oregon Department of Transportation, Metro, local cities and counties, and TriMet to reduce VMT through strategic investments and policies.

a. Work with metro-area, state, regional, and federal agencies to develop a strategy for high-speed rail from Eugene to Vancouver, B.C.

b. Participate in developing least cost planning methodologies to achieve mobility greenhouse gas emission reduction goals.

c. Work with Metro and the Oregon Department of Transportation to support investments and policies that help the region meet the carbon emission, VMT-reduction and mode-share goals.

d. Work with TriMet and Metro to revise the system service plan to reflect the mode-share goals of this plan and to develop an investment strategy that includes infrastructure to support connectivity and safe routes to transit.

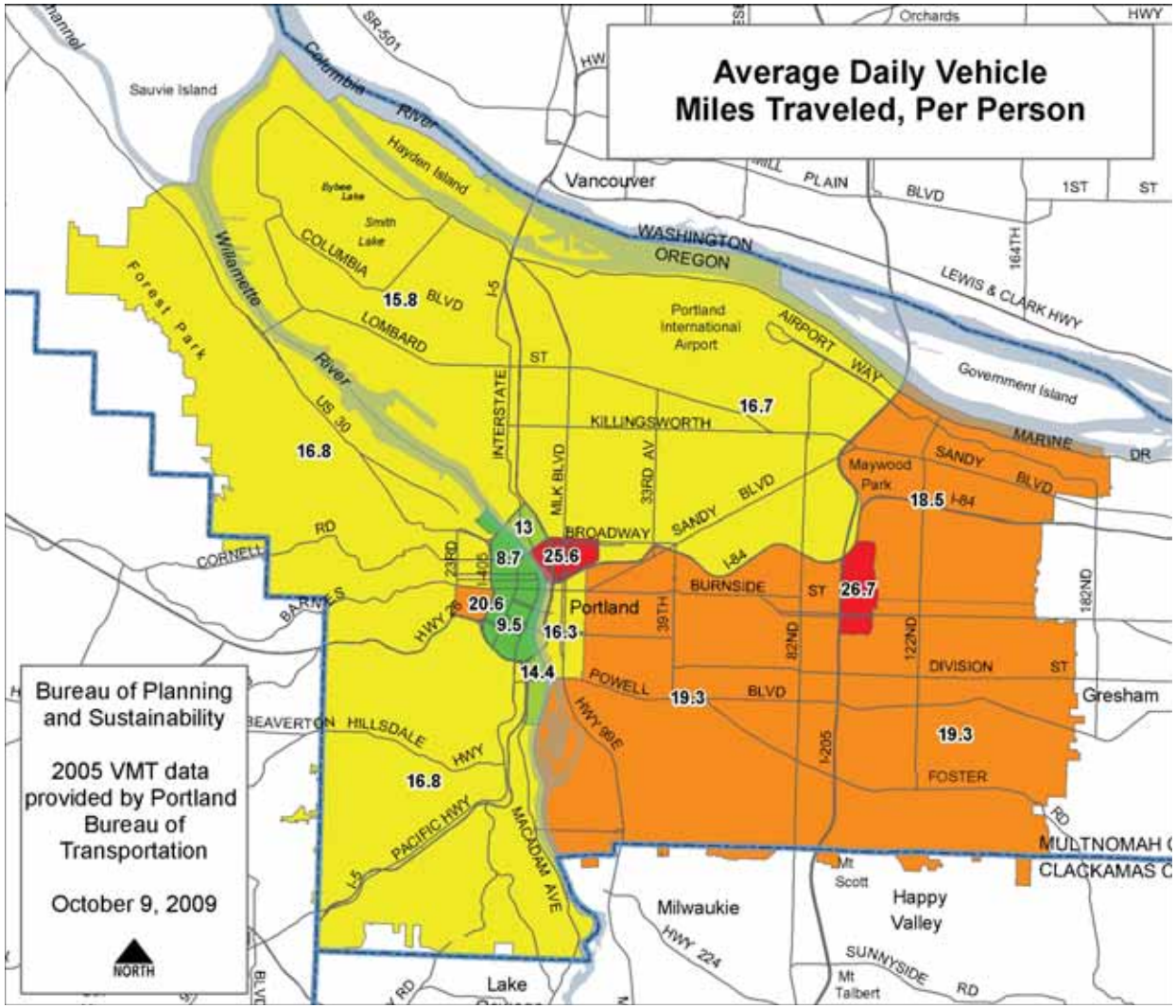
e. Partner with Metro to implement the Household Activity Survey in 2010 and beyond.

(v) Update the Transportation System Plan to incorporate mode-share goals that will result in a 40 percent reduction in transportation-related carbon emissions by 2030.

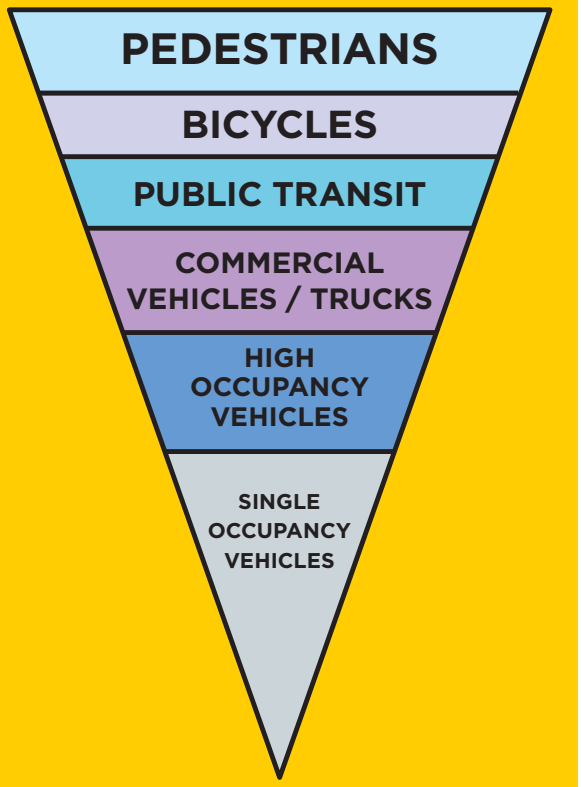
(vi) Prioritize funding for low-carbon transportation and access projects, policies and programs

Vehicle Miles Traveled

The vehicle-miles traveled numbers shown in the map below reflect a weighted average of different auto trip purposes (commute, shopping, business related, etc.) to or from a district divided by the number of residents and workers in the district. This measure was calculated using a transportation model developed by the Portland Bureau of Transportation.



TRANSPORTATION HIERARCHY



that will achieve emission reduction goals while also balancing safety, maintenance and freight movement. Efforts already underway include:

a. Build the Eastside Streetcar (3.3 miles of track) and complete the analysis of the next streetcar corridor.

b. Implement SmartTrips Portland to 30,000 households each year.

c. Expand Safe Routes to School to serve all schools in Portland.

d. Provide TriMet passes to all high-school students in Portland.

e. Build 15 miles of bicycle boulevards before 2010 and aggressively implement the City's Bicycle Master Plan.

f. Complete the design of the Green Line to Milwaukee and participate in a regional lightrail system plan.

g. Construct two miles of sidewalks on arterials (SE 122nd Avenue, NE/SE 82nd Avenue, and SW Barbur Boulevard).

h. Incorporate improved bicycle and pedestrian infrastructure in the redesign of the Sellwood Bridge.

i. Require a minimum amount of long-term bicycle parking spaces for multi-dwelling development in areas other than the dwelling unit.

(vii) Help establish at least two new transportation management associations and two new parking management districts.

2030 OBJECTIVE 7.

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

Many of the policies to reduce vehicle miles traveled described above will benefit freight movement, relieving congestion and improving traffic flow for all vehicles. The benefits to commercial vehicles are particularly promising, since vehicles tend to be larger and require more fuel to accelerate and idle, increasing the benefits from improved traffic flow. In addition to reducing fuel use, improved efficiency in the movement of diesel-powered vehicles also creates opportunities to reduce emissions of soot, which contributes to the greenhouse effect.

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 before 2012

(i) Protect existing intermodal freight facilities and support centrally located and regionally significant industrial areas that may provide for future intermodal facilities and provide for efficient local deliveries.

(ii) Work with the Portland Freight Committee and other regional partners to develop a plan for reducing greenhouse gas emissions related to freight movement within and through the Portland region.

2030 OBJECTIVE 8.

Increase the average fuel efficiency of passenger vehicles to 40 miles per gallon and improve performance of the road system.

With the 2009 announcement of proposed uniform federal standards for both vehicle fuel efficiency and greenhouse gas standards, the pace of fleet-wide fuel-efficiency improvements in new vehicles appears likely to accelerate. Current federal standards require that the average fuel economy of new vehicles must be 35 miles per gallon by 2020; if implemented successfully, the new federal standards would achieve the same performance by 2016. 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.

Actions to be completed before 2012

(i) Support progressive strengthening of federal fuel efficiency standards.

(ii) Work with Oregon Department of Transportation to identify and fund the system and demand management projects that

have the greatest potential to reduce emissions related to congestion, idling, and system performance.

(iii) Work with Oregon Department of Transportation and Metro to implement a congestion-pricing pilot program that prioritizes movement of freight and non-single-occupancy vehicles.

2030 OBJECTIVE 9.

Reduce the lifecycle green-house gas emissions of transportation fuels by 20 percent.

Portland's 2007 requirement that all fuel sold in the city contain minimum amounts of biofuels has already been a success. Biofuels have become widely accepted in Portland and Multnomah County, and manufacturers are beginning to design engines to accept higher blends of biofuels. Additional fuel-related emissions reductions will be possible as a new generation of more sustainable alternative transportation fuels (e.g., cellulosic ethanol and electricity) becomes commercially available. In 2009, the state of Oregon enabled the establishment of 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.

Actions to be completed before 2012

(i) Accelerate the transition to plug-in hybrids and electric vehicles by supporting the installation of a network of electric car charging stations.

(ii) Implement the second phase of the City's renewable fuels standard to require that diesel fuel sold in Portland include at least 10 percent biodiesel, half of which must be made from sources that can be produced in Oregon.

CONSUMPTION AND SOLID WASTE

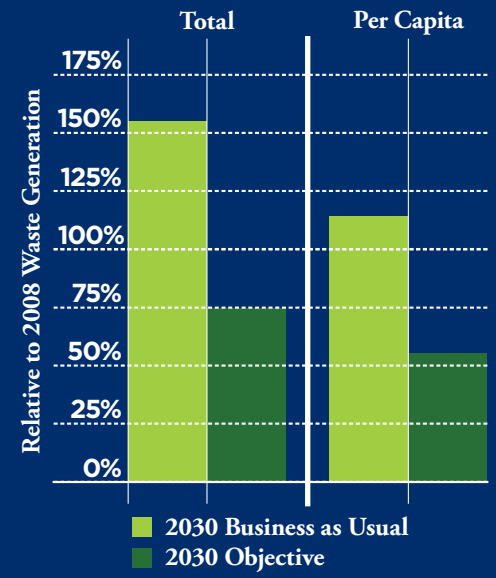
3

Decisions about what goods to consume and how to dispose of them heavily influence Portland and Multnomah County's carbon emissions. Recent data from the Environmental Protection Agency indicates that almost 30 percent of carbon emissions can be attributed to the lifecycle of goods other than food (see Figure 5 on page 22). These emissions occur at multiple stages of a product's life cycle, from extraction and processing of raw materials to manufacture, distribution, storage and disposal.

Similar goods may differ dramatically in their lifecycle emissions. On one end of the spectrum are goods manufactured using energy-intensive processes, packaged with excessive materials, transported long distances and ultimately discarded after a short usable life. On the other end of the spectrum are goods manufactured using minimal energy and packaging, transported short distances and used for a long time because they are highly durable. By choosing products on the low-emission end of this spectrum, and reusing and recycling them appropriately, residents and businesses can substantially reduce emissions.

Objective ten focuses on fostering better consumption choices; Objectives eleven and twelve address recycling and garbage collection.

FIGURE 15
2030 WASTE GENERATION



City of Portland Bureau of Planning and Sustainability

2030 OBJECTIVE 10.

Reduce total solid waste generated by 25 percent.

Portland's recycling rate is among the highest in the U.S., reaching 64 percent in 2007, almost twice the national average of 33 percent. Total solid waste generated, however, refers to both the amount of materials sent to landfills and the amount of materials recovered (i.e., recycled, composted, converted to energy or otherwise put to a use other than the original intended purpose). At the current growth rate for solid waste generation, the Portland area in 2030 will generate over one and a half times the amount of waste it generates today (Figure 16). Given expected population growth, a 25 percent reduction in total waste from current levels means that, on a per capita basis, residents and businesses must generate about half the waste in 2030 that they do today.

The Portland Recycles Plan, adopted by Portland City Council in 2007, establishes an objective of reducing per capita waste generation to 2005 levels by 2015. This objective is consistent with the statewide goal of limiting per capita waste generation to 2005 levels and limiting total waste generation to 2009 levels.

Actions to be completed before 2012

(i) Work with partner organizations to encourage businesses and residents to purchase durable, repairable and reusable goods; to reduce the amount of materials that go to waste, including food; and to reduce consumption of carbon-intensive consumer goods and services.

(ii) Develop a measurement and evaluation mechanism to track waste prevented through preservation, re-use and thoughtful consumption.

2030 OBJECTIVE 11.

Recover 90 percent of all waste generated.

As noted above, in 2007, 64 percent of all waste generated in Portland was diverted from landfill disposal. Given available technology, only nine percent of the total amount of waste generated cannot readily be recycled. This means more than 90 percent can be recovered. Portland has established a city-wide objective of recovering 75 percent of all waste by 2015. In 2008 it adopted a detailed plan to help businesses comply with that requirement.

Actions to be completed before 2012

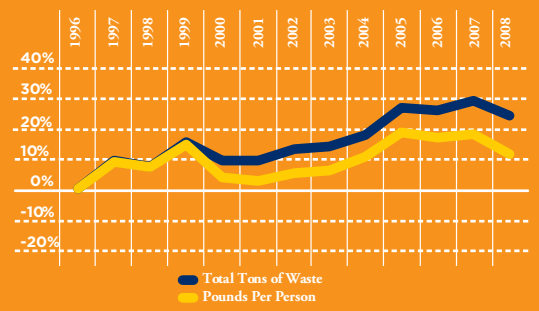
(i) Complete the implementation of mandatory commercial food waste collection in Portland and begin collection of residential food waste.

(ii) Assist 1,000 businesses per year to improve compliance with Portland's requirement of paper, metal and glass recycling.

(iii) Together with Metro and Department of Environmental Quality, create and periodically update a regional waste management hierarchy that reflects energy and greenhouse gas emissions as key factors in prioritizing such technologies as commercial composting,

FIGURE 16

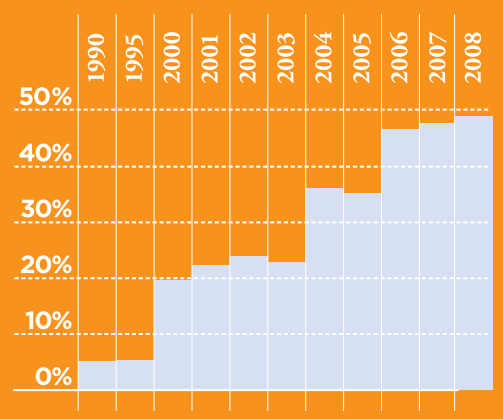
WASTE GENERATION IN MULTNOMAH COUNTY (RELATIVE TO 1990)



City of Portland Bureau of Planning and Sustainability

FIGURE 17

PERCENT OF METHANE RECAPTURED AT LANDFILLS SERVING MULTNOMAH COUNTY



Oregon Department of Environmental Quality

digestors, plasmafication and waste-to-energy systems.

(iv) Regulate solid waste collection for unincorporated Multnomah County.

(v) Provide technical assistance to contractors and construction firms to meet Portland's new requirement to recycle 75 percent of construction and demolition debris, giving priority to salvage and reuse activities.

(vi) Institute post-collection sorting for municipal solid waste, particularly for waste coming from sectors like multifamily housing that are typically underperforming on recycling.

(vii) Participate actively in the process to develop state and federal product stewardship legislation.

(viii) Explore mandatory residential recycling.

(ix) Clearly label trash cans and other garbage receptacles as "landfill."

(x) Establish public place recycling in Central Portland.

2030 OBJECTIVE 12.

Reduce the greenhouse gas impacts of the waste collection system by 40 percent.

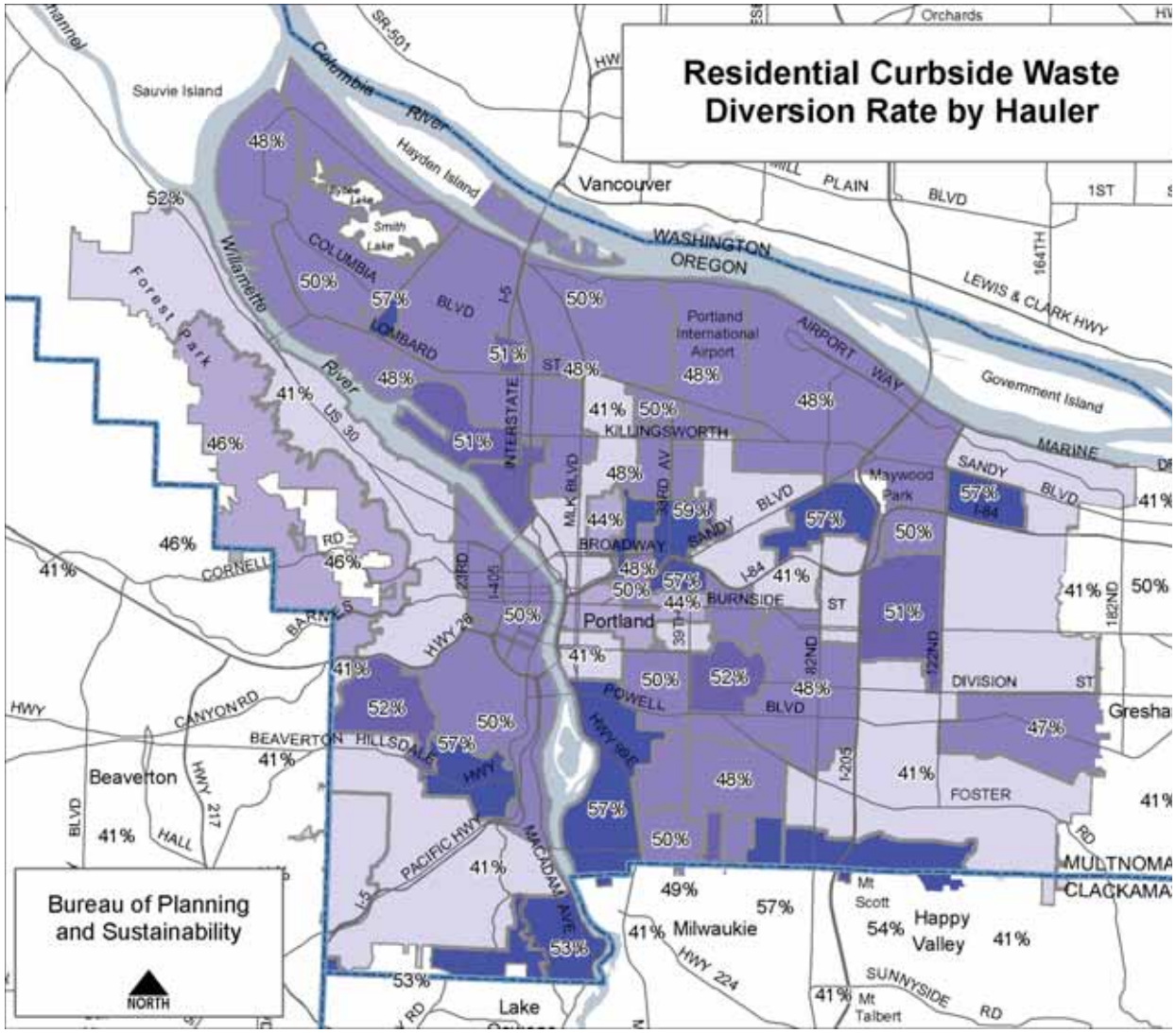
As of 2007, haulers in Portland are required to use at least 20 percent biodiesel in trucks used to collect waste in Portland. Waste collection-related carbon emissions can be further reduced by reducing the miles driven by garbage and recycling trucks and by utilizing even cleaner transportation fuels and emission-control technologies.

Actions to be completed before 2012

(i) Provide weekly curbside collection of food waste, other compostable materials and recycling. Shift standard residential garbage collection to every other week.

(ii) Complete the installation of particulate filters on pre-2007 waste collection vehicles to reduce particulate emissions. Older trucks that are not good candidates for retrofit should be phased out of operation.

(iii) Evaluate actions under the Portland Recycles! Plan and consider additional regulatory options to improve the efficiency of commercial collection service.



Residential Recycling in Portland

Garbage and recycling haulers in Portland serve geographic areas that do not correspond to neighborhood boundaries, and in some cases haulers serve multiple areas that are not contiguous. The percentages for each area on the map reflect the residential curbside recycling rate for the entire service territory of each hauler.

In addition, the residential diversion rates on this map are calculated based only on materials set out at curbside and do not take into account material diverted from the landfill by recycling through the bottle bill, independent recyclers or other means. Thus, the diversion rates shown on this map are lower than the actual residential diversion rate calculated for the city.

4 URBAN FORESTRY AND NATURAL SYSTEMS

Trees offer a wide array of benefits: improving watershed health, habitat and air quality, providing recreation, refreshment and revitalization, enhancing the aesthetics of neighborhoods and increasing property values. Trees are just one example of the important role natural systems play in addressing climate change — by sequestering carbon dioxide, by reducing building energy use through cooling and shading in summer and lessening heat loss in winter.

Without strong safeguards, population growth in Multnomah County will cause the amount of impervious surfaces to increase, displacing vegetation and habitat. To maximize the benefits of the natural systems and protect against losses, efforts should focus on retaining the existing canopy, planting large-species trees where appropriate and keeping trees healthy.

2030 OBJECTIVE 13.

Expand the urban forest canopy to cover one-third of Portland, and at least 50 percent of total stream and river length in the city meet urban water temperature goals as an indicator of watershed health.

Currently, the Portland urban forest covers 26 percent of Portland and removes 88,000 metric tons of carbon dioxide from the atmosphere per year, equal to about one percent of all local carbon emissions. Should the urban forest's capacity to sequester carbon dioxide be compromised, Portland will have to reduce emissions beyond the 80 percent goal to compensate.

Resilient watersheds are a key response to a changing climate, and water temperature is a primary indicator of watershed health. This plan seeks to reduce urban stream temperatures so that at least 50 percent of the total stream and river length in the city has a 7-day average daily maximum less than 64 degrees F in the tributaries and 68 degrees F for the Willamette. The City of Portland's "Grey to Green" initiative is an example of the kinds of programs and actions that must be implemented to achieve this objective.

Actions to be completed before 2012

(i) Expand public and private programs to encourage planting, preserving and maintaining trees and shrubs, controlling invasive species, and reducing and cooling impervious areas, including removing regulatory obstacles and exploring incentives.

(ii) Acquire, restore and protect natural resources to promote functional watersheds and forest ecosystems, reduce the urban heat island effect, improve air and water quality, connect habitats, and contribute to regional health, biodiversity, and resiliency.

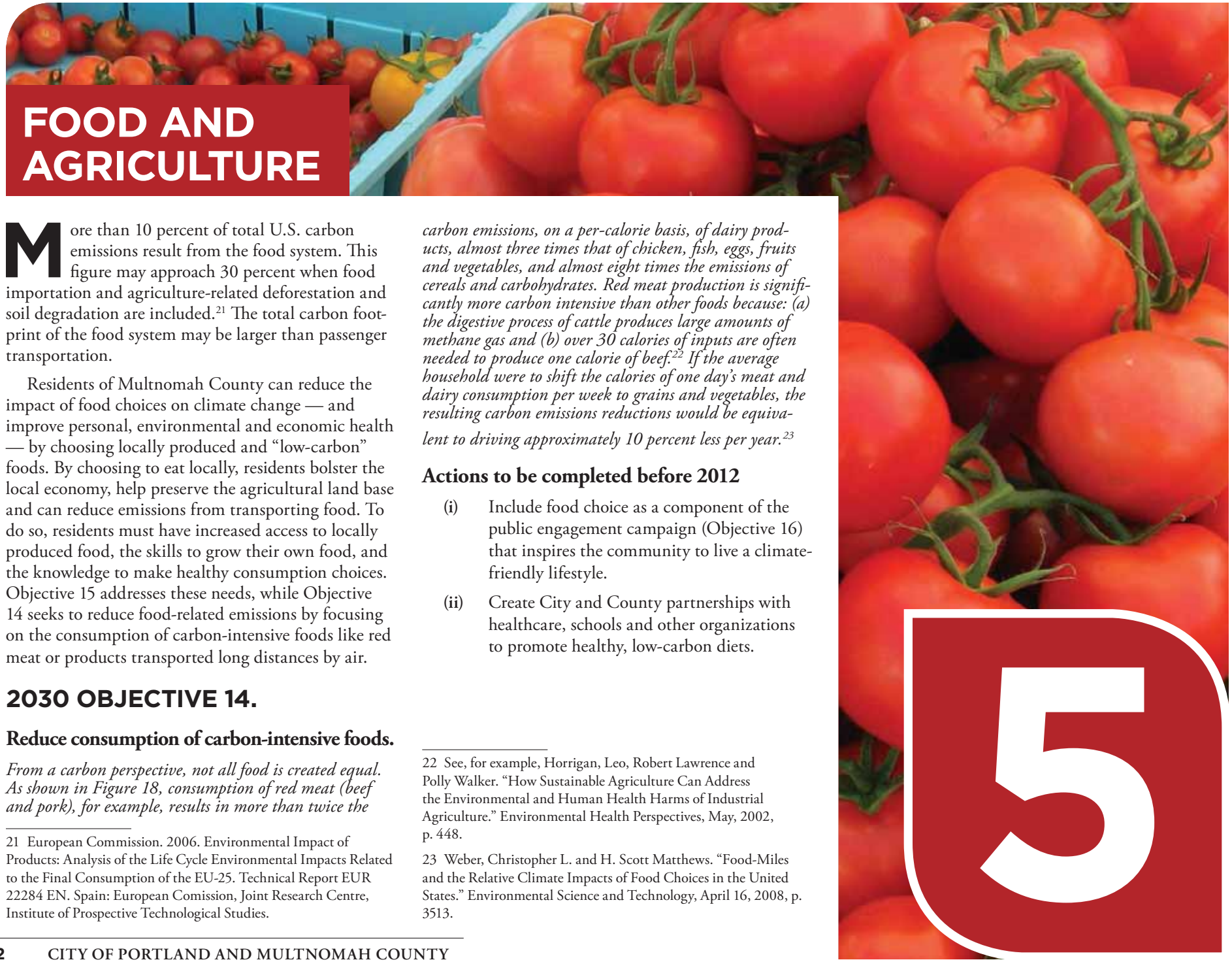
(iii) Develop and implement an outreach campaign to provide educational resources to residents about the benefits of trees, watershed health, and green infrastructure.

(iv) Recognize trees, shrubs, vegetation and natural landscapes as assets of the City and County infrastructure. Advocate for similar recognition by state and federal agencies. Explore the feasibility of managing street trees and other public trees as capital assets.

(v) Clarify codes and policies to maximize the preservation of the largest, longest-living trees, and ensure expansion of the urban forest over time. Encourage tree species and age diversity and increase canopy in tree-deficient areas.

(vi) Evaluate both green and traditional grey alternatives for public infrastructure projects. Develop final designs that support the restoration, enhancement, and protection of Portland's urban forest and watershed health.

FOOD AND AGRICULTURE



More than 10 percent of total U.S. carbon emissions result from the food system. This figure may approach 30 percent when food importation and agriculture-related deforestation and soil degradation are included.[21] The total carbon footprint of the food system may be larger than passenger transportation.

Residents of Multnomah County can reduce the impact of food choices on climate change — and improve personal, environmental and economic health — by choosing locally produced and "low-carbon" foods. By choosing to eat locally, residents bolster the local economy, help preserve the agricultural land base and can reduce emissions from transporting food. To do so, residents must have increased access to locally produced food, the skills to grow their own food, and the knowledge to make healthy consumption choices. Objective 15 addresses these needs, while Objective 14 seeks to reduce food-related emissions by focusing on the consumption of carbon-intensive foods like red meat or products transported long distances by air.

2030 OBJECTIVE 14.

Reduce consumption of carbon-intensive foods.

From a carbon perspective, not all food is created equal. As shown in Figure 18, consumption of red meat (beef and pork), for example, results in more than twice the carbon emissions, on a per-calorie basis, of dairy products, almost three times that of chicken, fish, eggs, fruits and vegetables, and almost eight times the emissions of cereals and carbohydrates. Red meat production is significantly more carbon intensive than other foods because: (a) the digestive process of cattle produces large amounts of methane gas and (b) over 30 calories of inputs are often needed to produce one calorie of beef.[22] If the average household were to shift the calories of one day's meat and dairy consumption per week to grains and vegetables, the resulting carbon emissions reductions would be equivalent to driving approximately 10 percent less per year.[23]

Actions to be completed before 2012

(i) Include food choice as a component of the public engagement campaign (Objective 16) that inspires the community to live a climate-friendly lifestyle.

(ii) Create City and County partnerships with healthcare, schools and other organizations to promote healthy, low-carbon diets.

21 European Commission. 2006. Environmental Impact of Products: Analysis of the Life Cycle Environmental Impacts Related to the Final Consumption of the EU-25. Technical Report EUR 22284 EN. Spain: European Comission, Joint Research Centre, Institute of Prospective Technological Studies.

22 See, for example, Horrigan, Leo, Robert Lawrence and Polly Walker. "How Sustainable Agriculture Can Address the Environmental and Human Health Harms of Industrial Agriculture." Environmental Health Perspectives, May, 2002, p. 448.

23 Weber, Christopher L. and H. Scott Matthews. "Food-Miles and the Relative Climate Impacts of Food Choices in the United States." Environmental Science and Technology, April 16, 2008, p. 3513.

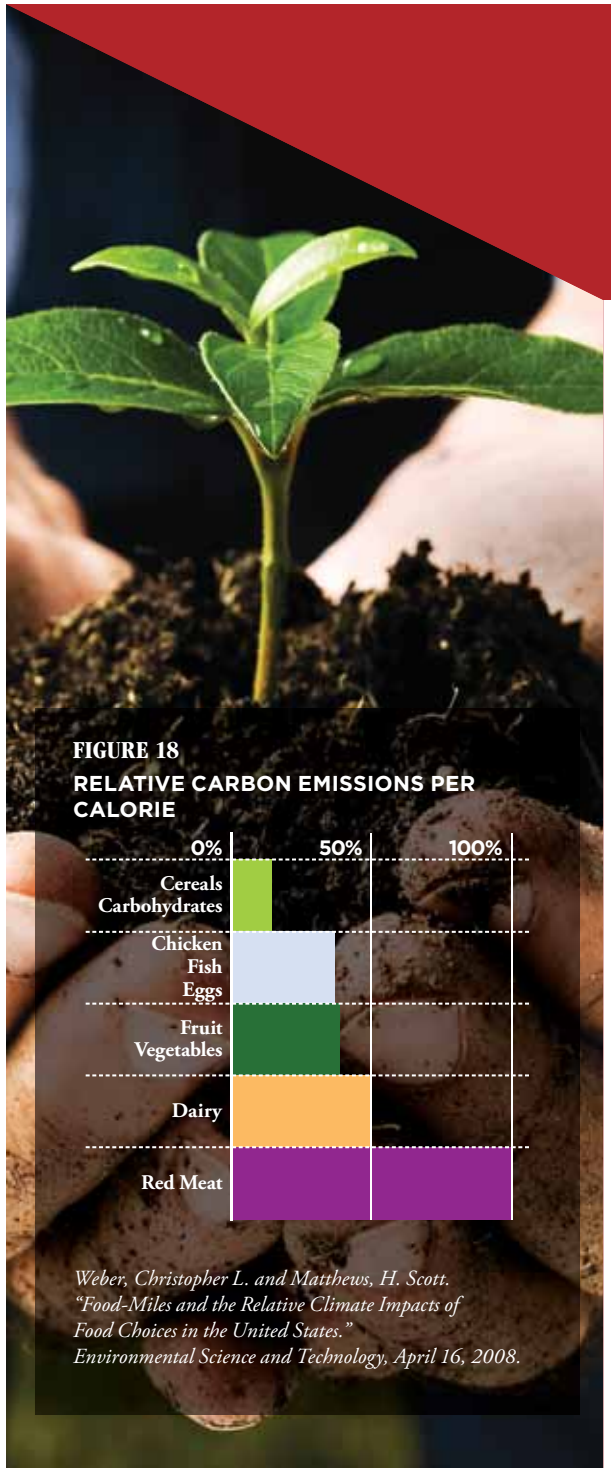


FIGURE 18

RELATIVE CARBON EMISSIONS PER CALORIE

Weber, Christopher L. and Matthews, H. Scott. "Food-Miles and the Relative Climate Impacts of Food Choices in the United States." Environmental Science and Technology, April 16, 2008.

2030 OBJECTIVE 15.

Significantly increase the consumption of local food.

A county-wide urban food and agriculture initiative promotes a long-term vision of a city and county that can grow a significant portion of its food. A community-based, local food system can reshape the community's relationship to food and provide substantial environmental, economic, social and health benefits. A public-private initiative can significantly increase the amount of home-grown food and reduce the carbon intensity of the food chain.

Actions to be completed before 2012

(i) Integrate sustainable food system issues, and where practical, quantitative goals and metrics, into planning processes, including the City's Portland Plan and the Multnomah Food Initiative.

(ii) Identify and implement City and County strategies to encourage local food production and distribution, including providing incentives and removing regulatory obstacles.

(iii) Develop policy and provide programmatic resources to significantly increase the percentage of home-grown and locally sourced food, including the support of farmers markets and community supported agriculture; the use of public and private land and rooftops for growing food; promoting fruit and nut trees as options for the 33,000 yard trees to be planted as part of the Grey to Green initiative; and develop or facilitate 1,000 new community garden plots.

(iv) Provide educational opportunities for residents to gain skills in organic gardening, fruit production, animal husbandry, food preservation and cooking, and affordable, healthy eating.

(v) Multnomah County to work to reestablish funding to the Oregon State University Extension Service.

(vi) Establish quantitative metrics for consumption of regionally sourced food.

COMMUNITY ENGAGEMENT

Multnomah County residents and businesses are an essential part of the solution to the climate crisis. Over one-third of all carbon emissions result directly from household energy use and personal vehicles, while non-industrial businesses account for another third. Many businesses, civic organizations, government leaders and citizens have shown a commitment to addressing climate change while maintaining high quality of life and a thriving economy. For example, the increase in green energy purchases, shown in Figure 19, is one indicator of such a commitment. To foster and build on this commitment, the City and County will support community-wide public engagement campaigns to educate, inspire and offer some of the most cost-effective, healthy and easy solutions. The campaign 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; and celebrate positive changes and successes. A fully engaged community is the key to success in dealing with climate change.

2030 OBJECTIVE 16.

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

A successful community engagement campaign must tie together existing efforts, develop new initiatives and forge a partnership between government and the community. Reaching this objective requires cooperation among governments, neighborhoods, schools, non-profit organizations, faith communities, businesses, civic organizations and individual community members.

Actions to be completed before 2012

(i) In partnership with businesses, universities, schools, non-profit organizations, community groups, public agencies, and existing efforts, develop a community-wide public engagement campaign to promote carbon emission reductions.

(ii) Establish a business leadership council to catalyze the business community to create a prosperous low-carbon economy.

(iii) Establish and publicize climate action metrics by neighborhood, including measures such as household energy use, vehicle miles traveled, walkability and bicycle commute rates.

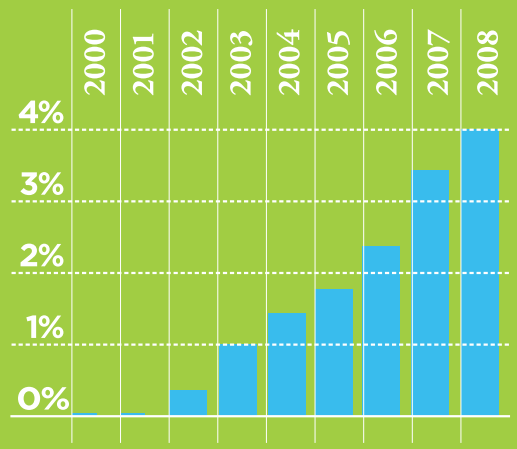
(iv) Partner with the Portland Sustainability Institute to bring together academia, businesses and government to foster policy development, best practices and collaboration to address climate change.

(v) Expand opportunities for residents and business, especially in historically underserved areas, to learn how to track and manage energy use, improve efficiency and adapt to a changing climate.

(vi) Seek funding to support neighborhood and community groups in the implementation of carbon-reduction projects and programs.

FIGURE 19

VOLUNTARY GREEN ELECTRICITY PURCHASES (PERCENT OF TOTAL ELECTRICITY PURCHASES)



Pacific Power, Portland General Electric

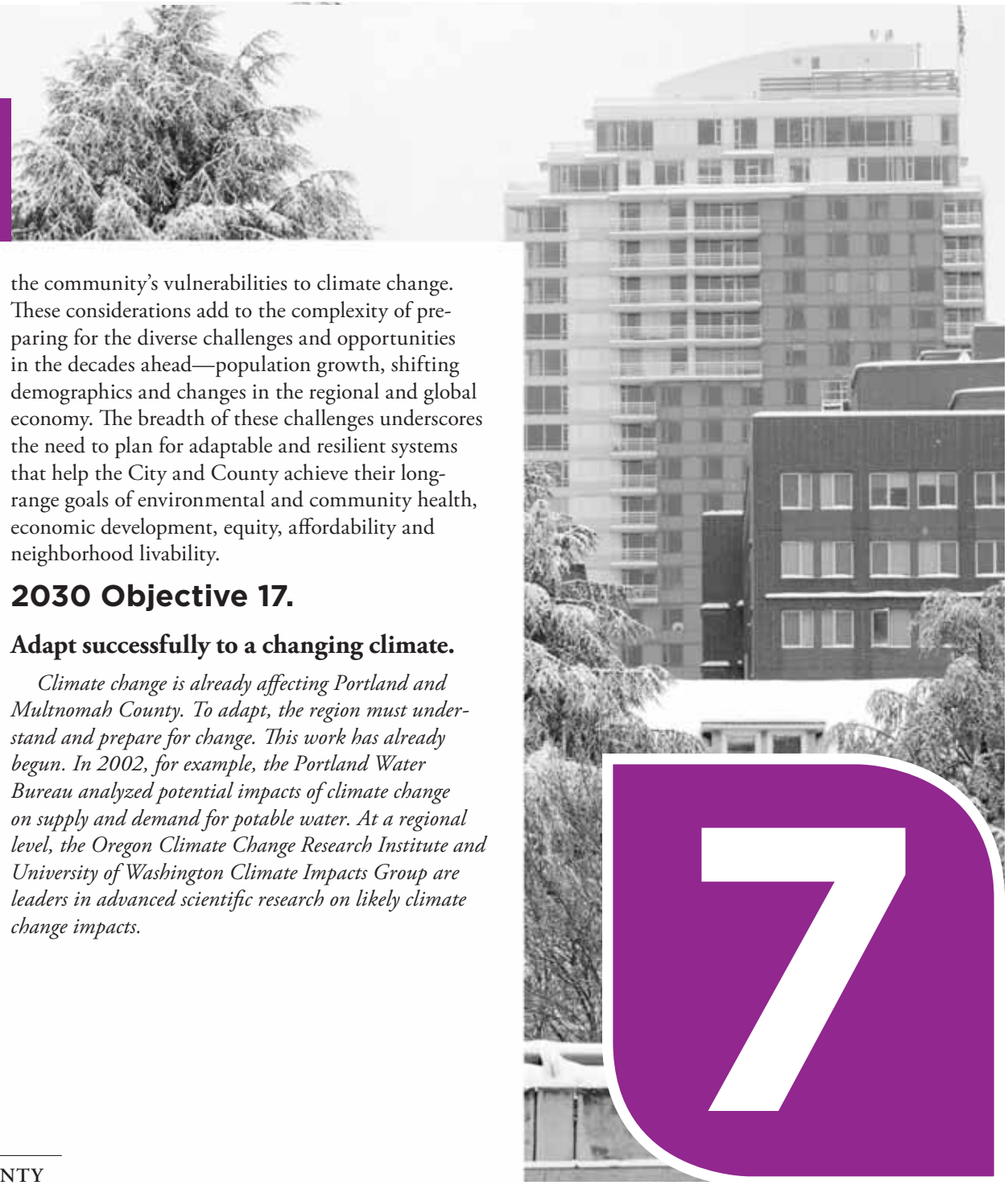
6

HERE ARE SOME ACTIONS INDIVIDUALS CAN TAKE RIGHT NOW

Between heating, cooling and powering our homes, and driving, Portland residents are responsible for about 50 percent of all local carbon emissions — and that's without counting the contribution of all the things we buy. At a national level, the production and distribution of goods amounts to another 38 percent of carbon emissions.

	TAKE ACTION TODAY!	NEXT STEPS...	START PLANNING FOR CHANGE.
	Most of these actions can be done in less than 20 minutes, for less than $20. Why wait?	With just a little set up time, you can get your household on the right track.	Some changes take time and planning. Start thinking about these goals now.
GETTING STARTED	Calculate your carbon footprint. **Quick:** www.footprintnetwork.org **Thorough:** www.epa.gov/climatechange/emissions/ind_calculator.html	Create a "carbon budget" for your household: identify areas where you can cut back.	Make a plan to reduce your carbon emissions by 5 percent every year.
BUILDINGS & ENERGY	Save energy and costs: Replace incandescent light bulbs with efficient compact fluorescent light bulbs (CFL). www.18seconds.org Plug your microwave, stereo, chargers, television and computer equipment into power strips that can be shut off when not in use. Turn down your thermostat three degrees (or 66°F daytime and 55°F night time). If you have air conditioning, turn up your air conditioner three degrees.	Set up a free home energy review with Energy Trust of Oregon: 866-968-7878 www.energytrust.org Get a free water conservation kit from the Portland Water Bureau: 503-823-7439 www.portlandonline.com/water/conservationkits Buy clean energy from your utilities: PGE: 503-228-6322 www.portlandgeneral.com Pacific Power: 1-800-869-3717 www.pacificpower.net NW Natural: 1-800-422-4012 www.nwnatural.com	Fully insulate your home and seal ducts. Replace your furnace and home appliances with ENERGY STAR models that qualify for Oregon tax credits: www.oregon.gov/ENERGY When planning a home renovation project, call the Green Building Hotline for expert advice. 503-823-5431 www.buildgreen411.com Install solar water heating or a solar electric system on your home: 1-877-546-8769 www.solarnoworegon.org
MOBILITY	Maintain your car: properly inflate tires and keep it tuned up for efficient driving.	Shift daily trips to walking, bicycling, transit and carpooling to reduce driving. www.portlandonline.com/transportation	Buy the most fuel-efficient vehicle that meets your needs. If your household has more than one car, try to eliminate a car and borrow or share a second vehicle when you need one.
CONSUMPTION & SOLID WASTE	Recycle right: recycle all paper, metal and glass, as well as yogurt tubs and other plastics accepted at curbside: 503-823-7202 www.portlandonline.com/bps/carts Paper or plastic? No thanks! Take reusable bags with you every time you go shopping.	Compost food scraps in your backyard: www.oregonmetro.gov Shop Local: visit neighborhood shops and keep your dollars in Portland: www.portlandisbettertogether.com	Be a smart consumer: • Make a list. • Cross off any items that can be rented, purchased used or borrowed instead. • Buy long-lasting, durable goods.
FOOD, AGRICULTURE & URBAN FORESTRY	Visit a local farmers market to purchase fresh, local produce: www.portlandfarmersmarket.org	Reduce the number of times you eat beef and pork each week. Use native species and wildlife attracting plants in landscaping your yard.	Plant a vegetable garden or more trees: Portland Parks and Recreation, Community Gardens: 503-823-1612 www.portlandonline.com/parks Friends of Trees: 503-282-8846 www.friendsoftrees.org

CLIMATE CHANGE PREPARATION



Climate change impacts are already evident, both globally and in Oregon. More impacts are inevitable. In Oregon, rainstorms and snowstorms could increase in severity, but less snow would build up in the mountains; coast towns could experience more flooding, causing increased damage to roads, buildings, bridges, and water and sewer systems; crops and livestock could face warmer temperatures, less water for drinking and irrigation, and drier soils; and heat waves could increase, causing a rise in heat-related illnesses and deaths.

Preparing for climate change must be understood broadly and as an integral component of Portland and Multnomah County's Climate Action Plan. Buildings, for example, must be designed to accommodate a changing climate — comfortable in higher temperatures, for example, and resilient to stronger storms and other physical impacts of climate change — while also highly energy efficient. The public health field must simultaneously help prevent climate change — for example, by encouraging walking—and prepare for it, by anticipating changing disease patterns and more intense heat waves, among many other changes. Natural systems have an equally integral role. Protecting wetlands, for example, both sequesters carbon emissions and prepares Portland to handle the expected increase in severe rainstorms.

The City and County must accelerate efforts to protect and improve watershed health, strengthen the linkages between public health and climate change, and comprehensively evaluate the respond to the community's vulnerabilities to climate change. These considerations add to the complexity of preparing for the diverse challenges and opportunities in the decades ahead—population growth, shifting demographics and changes in the regional and global economy. The breadth of these challenges underscores the need to plan for adaptable and resilient systems that help the City and County achieve their long-range goals of environmental and community health, economic development, equity, affordability and neighborhood livability.

2030 Objective 17.

Adapt successfully to a changing climate.

Climate change is already affecting Portland and Multnomah County. To adapt, the region must understand and prepare for change. This work has already begun. In 2002, for example, the Portland Water Bureau analyzed potential impacts of climate change on supply and demand for potable water. At a regional level, the Oregon Climate Change Research Institute and University of Washington Climate Impacts Group are leaders in advanced scientific research on likely climate change impacts.

7

Green Infrastructure

Green infrastructure uses natural processes, systems or features to provide traditional infrastructure services. There are two primary types of green infrastructure:

- Natural networks of streams, rivers, and open spaces that naturally manage stormwater, provide habitat, improve air and water quality, reduce flooding risk, and provide areas for human recreation and respite; and
- Engineered facilities, such as green street treatments or eco-roofs, which use natural processes in an infrastructure setting.

A comprehensive review should be undertaken to better understand the likely impacts of climate change. Because of the long lead time necessary for some of the adaptive actions that may be required, it is key that this review and resulting recommendations take place soon, and include:

- *Impact areas such as infrastructure, energy, economy, transportation, water, food, stormwater management, social and health services, public safety, environment and biodiversity, population migrations and emergency preparedness.*
- *Planning arenas that the City or County manages or for which they set policy.*
- *Co-benefits of preparation efforts.*

Actions to be completed before 2012

(i) Prepare an assessment of climate-related vulnerabilities, strengths and resiliency of local food, water and energy supplies, infrastructure, transportation and freight movement, floodplains, watershed health, public health, public safety, social services and emergency preparedness.

(ii) Develop a climate change preparation plan that analyzes and prioritizes preparation actions to manage risks and increase overall flexibility and resiliency, assigns responsibility to appropriate bureaus or departments and ensures that disproportionate impacts on vulnerable populations are addressed.

(iii) Monitor implementation of climate change preparation actions and emerging data on risks. If necessary, revise adaptation plans more frequently than the three-year revision cycle for the overall plan.

(iv) Protect and restore wetlands, floodplains, wildlife habitat and corridors to strengthen the capacity of natural systems to respond to more severe weather events, streamflow changes, and flooding.

(v) Collaborate with Metro and state agencies to update and ensure continued accuracy of land hazard mapping and inventories, including landslide hazards, floodplains and areas subject to wildfire risk.

(vi) Integrate climate adaptation and natural hazard mitigation strategies into major planning efforts and consider the potential for substantial numbers of "climate refugees" in contemplating future growth scenarios.

(vii) When planning public infrastructure investments and service delivery strategies, consider the physical, social, environmental, economic, and regulatory impacts of mitigating and adapting to climate change. This may necessitate developing and using forecasts and models that account for potential climate changes and evaluating investment alternatives based on triple bottom line and climate change impacts over the lifespan of the infrastructure.

LOCAL GOVERNMENT OPERATIONS

Carbon emissions from Portland and Multnomah County operations account for about one percent of total local emissions. This presents a modest opportunity to reduce emissions directly and an essential obligation to lead by example. Just as the City and County must provide enabling policies, technical assistance, education, incentives and other support to help the community achieve the objectives of this Climate Action Plan, the City and County must also lead the way in their own operations.

2030 OBJECTIVE 18.

18. Reduce carbon emissions from City and County operations 50 percent from 1990 levels.

The City and County own and operate hundreds of buildings, thousands of streetlights and traffic signals and several 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 before 2012

(i) Identify funding sources to finance energy-efficiency upgrades in City and County facilities.

(ii) Require that all new City and County buildings achieve Architecture 2030 performance targets.

(iii) Convert street lighting, water pumps, water treatment and other energy intensive operations to more efficient technologies.

(iv) Adopt and implement green building policies that include third-party certification of energy, water and waste conservation strategies.

(v) Purchase or generate 100 percent of all electricity required for City operations from renewable sources, with at least 15 percent from on-site or district renewable energy sources such as solar and biogas.

(vi) Require that local government fleets, regulated fleets (e.g., taxis and waste/recycling haulers), and the fleets of local government contractors meet minimum fleet fuel efficiency standards and use low-carbon fuels.

(vii) Buy electric and plug-in hybrid vehicles for City and County fleets as they become commercially available.

(viii) Stop the growth of waste generation and recover 75 percent of all waste generated in City and County operations.

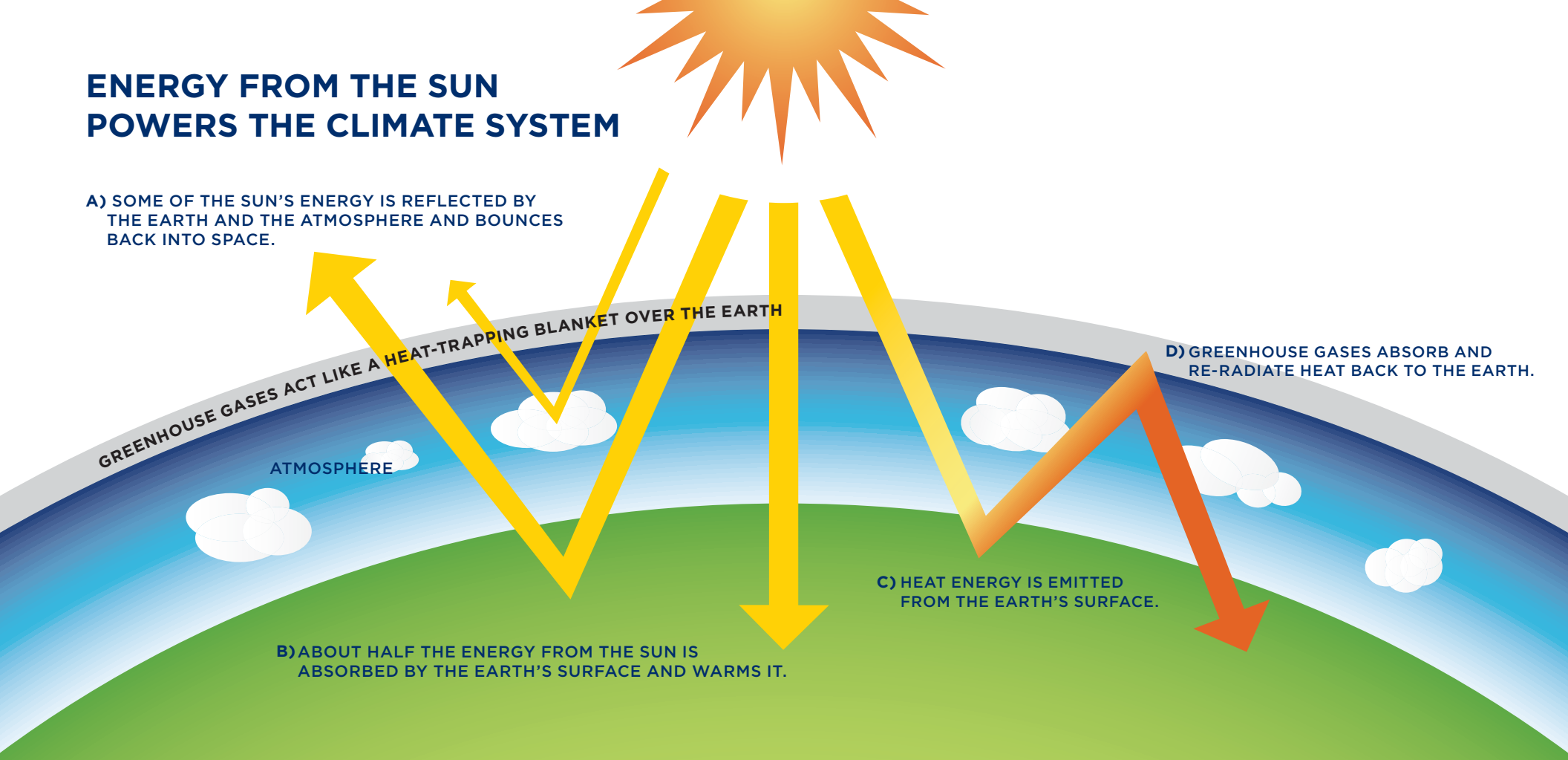
(ix) As standardized carbon emissions data becomes publicly available, consider carbon emissions from the production, transportation, use and disposal of goods, including food, as a criterion in City and County purchasing decisions. Where practical, include the sustainable practices of prospective vendors, contractors and service providers as evaluation criteria.

(x) Establish video and/or web conferencing capability in all major City and County facilities.

(xi) Establish interbureau and interdepartmental teams to implement the Climate Action Plan and report on progress.

8

ENERGY FROM THE SUN POWERS THE CLIMATE SYSTEM



THE GREENHOUSE EFFECT

About half of the Sun's energy passes through the atmosphere and is absorbed by the Earth's surface. The Earth's surface then radiates the heat energy back toward space. Along the way, much of this heat energy is absorbed by the "blanket" of greenhouse gas molecules and clouds in the atmosphere, and is then re-radiated back toward the Earth's surface. The effect of this is to warm the Earth's surface and the lower atmosphere, creating the climate system that has allowed life to exist on Earth. High levels of carbon emissions in the atmosphere essentially make the "blanket" of greenhouse gases thicker, trapping too much of the sun's heat around the Earth. The rise in average global temperatures cause many negative changes to the Earth's natural systems.

CLIMATE CHANGE OVERVIEW

THE GREENHOUSE EFFECT

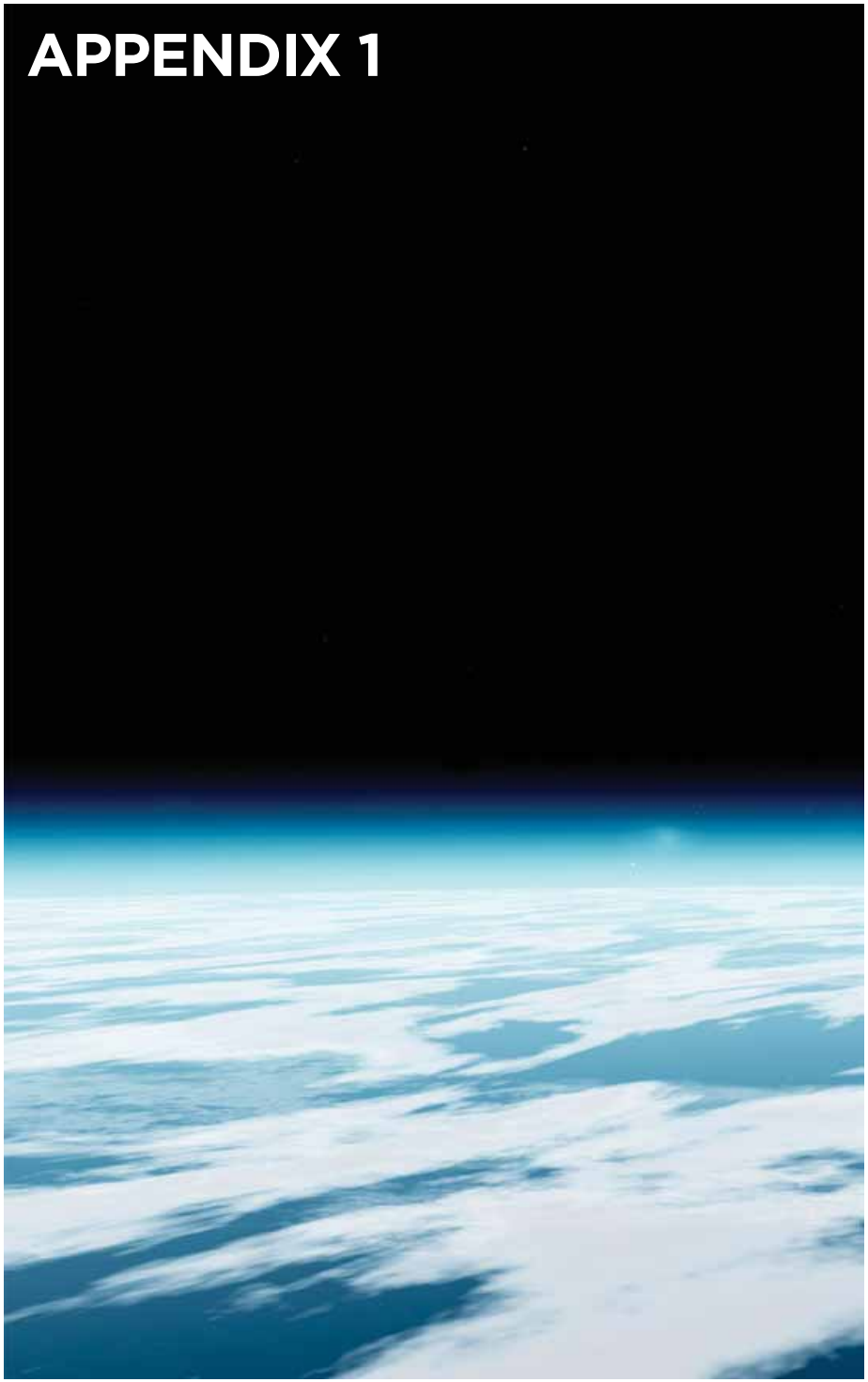
Climate change is driven by the greenhouse effect, a natural phenomenon essential to life as we know it. Without the greenhouse effect, the Earth would be permanently icy and inhospitable. Water vapor, carbon dioxide and other gases in the Earth's atmosphere act like a blanket over the Earth, absorbing some of the heat from the sunlight-warmed surface of the Earth instead of allowing it to escape into space (see graphic on page 48). Increasing the amount of these gases, called carbon emissions, in the atmosphere essentially makes the blanket thicker — and warmer. This warming is accompanied by changes in precipitation patterns, increased frequency and intensity of storms, wildfires, droughts and floods, rising sea level, changes in water quality and substantial changes in habitats, including the range of pests and diseases.

CARBON DIOXIDE AND OTHER CARBON EMISSIONS

Fossil fuels such as coal, gasoline, diesel, fuel oil and natural gas are made of carbon that has been stored underground for millions of years. Burning fossil fuels to generate electricity, manufacture goods, grow food, heat our homes and power our vehicles transforms this stored carbon into the gas carbon dioxide, which is then released into the atmosphere. Changing patterns of land use and land cover, primarily the burning and destroying of forests and the conversion of wildlands to farmland or housing, also release carbon dioxide from carbon stored in plant matter and soil. Further, by reducing the number of trees and plants that otherwise would remove carbon dioxide from the atmosphere through photosynthesis, such land use changes reduce the planet's capacity to absorb carbon dioxide. As a result of these activities, global atmospheric concentrations of carbon dioxide have increased by more than 30 percent over the past 150 years.

Carbon dioxide comprises almost 85 percent of U.S. carbon emissions, but it is not the only greenhouse gas of concern. Methane, nitrous oxide and halocarbons are also increasing in the atmosphere as a direct result of human activities. Methane

APPENDIX 1



emissions, which account for eight percent of U.S. emissions, result primarily from raising livestock and waste disposal in landfills, where putrescible — rotting — waste generates methane. Soil management practices and application of fertilizers are the principal cause of nitrous oxide emissions, which represents five percent of U.S. emissions. Halocarbons, which include chlorofluorocarbons, hydrochlorofluorocarbons and perfluorocarbons, are synthetic gases produced during industrial processes such as cement manufacturing and aluminum smelting. These carbon emissions, though a smaller percentage of total emissions, all exert a more powerful greenhouse effect than carbon dioxide. (See "Units of Measurement for Carbon Emissions" in Appendix 3 for more information.) Reducing emissions of these gases is thus a critical component of climate protection.

SCIENTIFIC AUTHORITY

The United Nations Environment Programme and the World Meteorological Organization established the Intergovernmental Panel on Climate Change (IPCC) in 1988. The IPCC remains the primary authority on global climate change, receiving the 2007 Nobel Peace Prize for its work in the field.

The latest IPCC report, released in 2007, concludes that:[1]

- Human activity has increased atmospheric concentrations of carbon dioxide, methane and nitrous oxide to levels not seen in the past 650,000 years.
- There is over 90 percent certainty that most of the warming of the climate is due to human activity.
- Humans have set in motion a warming of the climate and rising of sea levels that will continue for centuries, but the amount of warming and sea level rise will be determined by human activity in the coming years.
- To minimize the extent of climate change, global carbon emissions must peak no later than 2015 and decline 50 to 85 percent from 2000 levels by 2050.

In January of 2008, the IPCC Chair, Rajendra Pachauri, suggested that the world had just seven years to stabilize carbon emissions.[2]

IMPACTS

Portland, Multnomah County and the entire Pacific Northwest will feel the impacts of global climate broadly and deeply. Since 1900, the average temperature in the Pacific Northwest has increased by 1.5 degrees Fahrenheit. In the next century, the warming is expected to accelerate and increase at least three times as quickly.[3] In the last century, glaciers on Mt. Hood shrank by more than one-third.[4] Melting ice on this iconic mountain, while one of the more visible impacts of climate change, will not impact Portlander's daily lives in the way that will other, less immediately apparent changes.

The Pacific Northwest will experience more warming in summer, and nights will cool off less than they do today. Increased urbanization and population growth, with their related roads and rooftops, will exacerbate the urban heat island effect, increasing local temperatures even more. Winters will likely be wetter and summers drier. As shown in Figure 19, these changes, coupled with higher temperatures, will likely mean higher river flows in the spring, when water is already abundant, and lower flows in the summer, when surface water is badly needed for drinking, irrigation, hydropower and salmon.

The region's landscapes are at risk. Forests, a cornerstone of the economy and environment, are particularly vulnerable. Drought, fire, pests and disease are likely to increase. Oregon's beaches are threatened by rising sea levels, stronger storms and increased coastal flooding and erosion.

1 Intergovernmental Panel on Climate Change, Climate Change 2007: Synthesis Report.

2 Pachauri, Rajendra K. "How Would Climate Change Influence Society in the 21st Century?" Lecture delivered at Massachusetts Institute of Technology, January 29, 2008.

3 University of Washington Climate Impacts Group, http://cses.washington.edu/cig/pnwc/cc.shtml.

4 Jackson, K. M. and A. G. Fountain. "Spatial and morphological change on Eliot Glacier, Mount Hood, Oregon , USA." Annals of Glaciology, 46, 222-226.

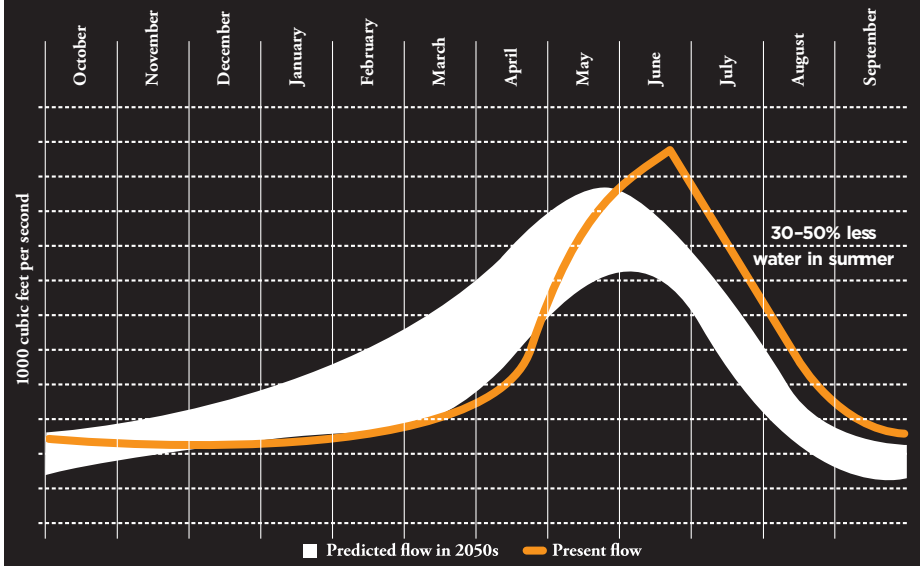
Climate change also poses a significant challenge to public health. Rising temperatures may be accompanied by increased incidents of diseases such as cholera and weather-related mortalities. Rising temperatures are a specific concern for seniors, who are particularly vulnerable to heat stroke — especially in this region, where most homes do not have air conditioning. Additionally, mental health problems such as anxiety and post-traumatic stress syndrome may increase to the extent that people migrate from increasingly inhospitable climates to the temperate Northwest.

This summary is by no means an exhaustive survey of potential climate impacts. Additional information can be found at the following:

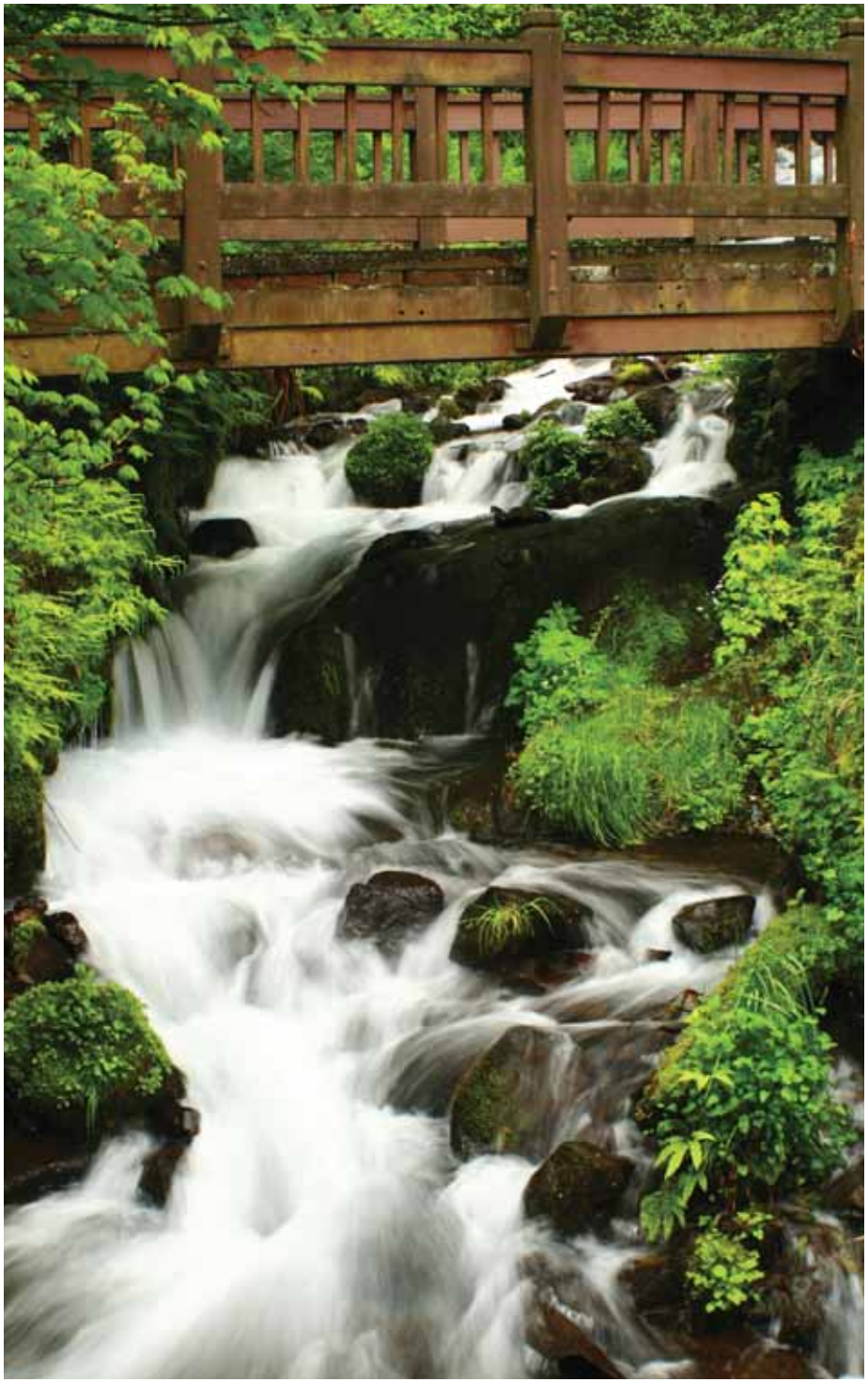
- Intergovernmental Panel on Climate change (IPCC) — www.ipcc.ch
- U.S. Climate Change Science Program — www.climatescience.gov
- Oregon Climate Change Research Institute — oregonstate.edu/groups/geco/pages/OCCRI.html
- University of Oregon Climate Leadership Initiative — climlead.uoregon.edu
- State of Oregon Climate Change Portal — www.oregon.gov/ENERGY/GBLWRM/Portal.shtml
- University of Washington Climate Impacts Group — cses.washington.edu/cig

FIGURE 20

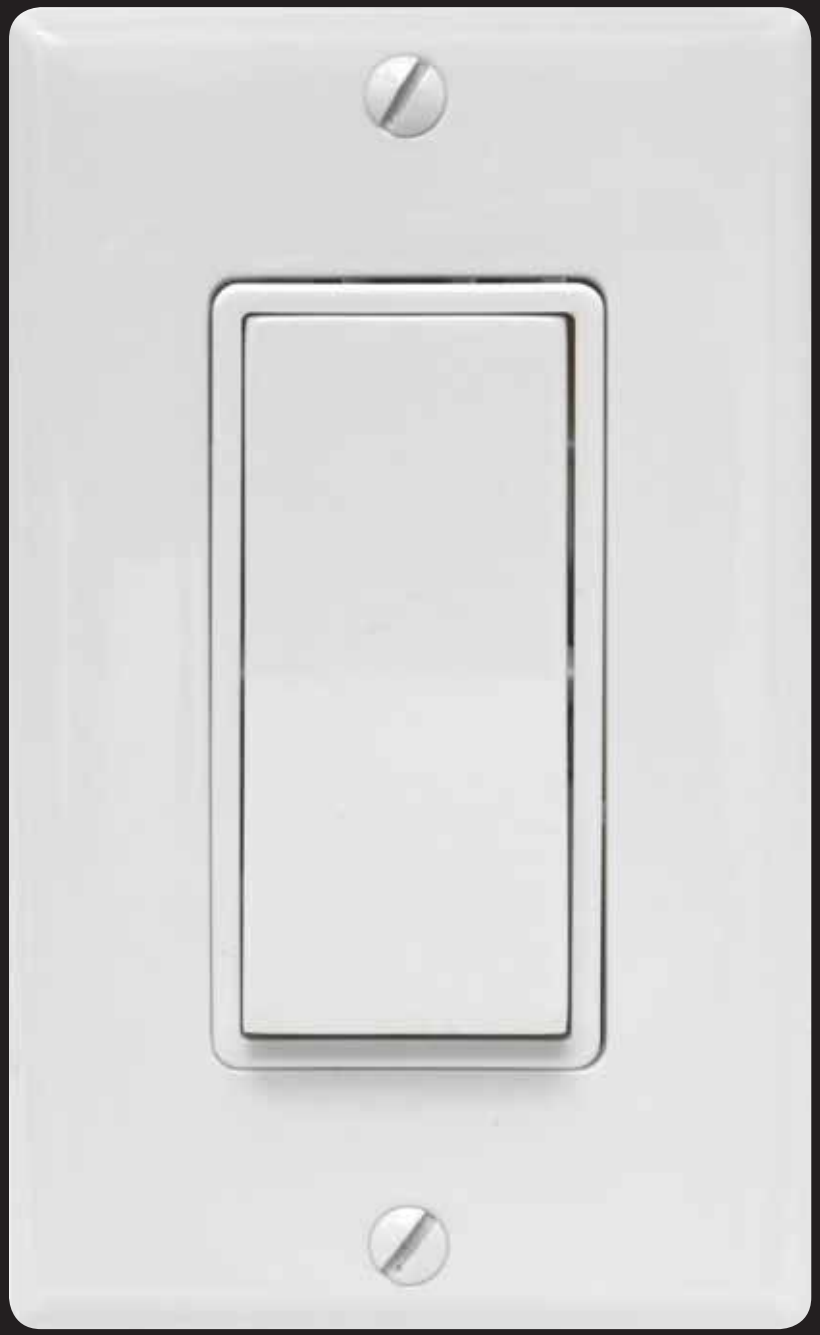
PACIFIC NORTHWEST RIVER FLOWS



University of Washington Climate Impacts Group



APPENDIX 2



ASSUMPTIONS IN CALCULATING EXPECTED EMISSIONS

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 strong renewable energy standard (RES) for electricity, requiring that 25 percent of all electricity sold in Oregon 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 30 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 30 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 Land Use and Mobility and Buildings and Energy.

Key assumptions related to Urban Form and Mobility:

- Automakers will meet the federal requirement that the corporate average fuel efficiency (CAFE) achieve 35 miles per gallon by 2016.
- 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. By 2050, they will generate 25 percent fewer emissions.
- Electric vehicles will account for 10 percent of all miles driven by 2030 and 25 percent of all miles driven by 2050.

Key assumptions related to Buildings and Energy include:

- 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 do not account for the possibility of "climate refugees." A climate refugee is a person displaced from his or her home as a result 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.

Quantifying Carbon Reductions

The 2030 Objectives related to Buildings and Energy and Urban Form and Mobility were developed by quantitatively modeling the interactive effects of each objective. This analysis highlights the importance of pursuing a broad portfolio of actions and objectives. Examining the first objective, retrofitting existing buildings to reduce their energy consumption, illustrates these interactive effects. Carbon emissions from building energy use are a function of two factors: how much energy the building uses and the quantity of emissions generated per unit of energy consumed.

The first factor, energy use, is difficult to estimate because building improvements are only one component of energy use; the behavior of the building occupants also is a significant determinant. The second factor, emissions intensity of energy generation, depends critically on the extent to which the increase in energy generation from renewable sources displaces high-carbon coal, medium-carbon natural gas, or carbon-free hydropower or nuclear. Thus, as a result of variables such as occupant behavior and unpredictable shifts in the carbon-intensity of the electricity grid, it is difficult to isolate and attribute a specific amount of reductions to a particular action such as retrofitting buildings for efficiency. Reductions that can be achieved by the other objectives in this plan require similar sets of assumptions, because they involve multiple variables fluctuating independently from one another and from the plan objectives.

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 and uses the Clean Air and Climate Protection software developed jointly by ICLEI and STAPPA/ALAPCO. 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)
- Propane
- Gasoline
- Diesel
- Solid waste disposal

These sources are discussed in further detail below.

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 measurement of emissions from industrial processes,

though this will change as Oregon Department of Environmental Quality regulations requiring reporting of carbon emissions take effect.

- 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. Because historical sequestration information is not available, however, forestry is not included in the emissions inventory.
- Airplane, locomotive and shipping fuel. Fuel use from Portland International Airport is gathered as part of the annual data collection process for review, but, as recommended by ICLEI, it is not included in the inventory presented here.
- Emissions arising from the production of goods consumed in Multnomah County but manufactured elsewhere. For example, the process of producing cement is both energy-intensive and results in direct emissions of carbon dioxide, but the emissions inventory does not attempt to estimate the amount of cement used in Multnomah County and assign upstream carbon emissions. The same is true for all other goods brought into Multnomah County.
- Offsets. As noted above, 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. A case in point is work conducted by The Climate Trust to implement two carbon emission reduction projects with the City of Portland. For the first, the City of Portland has worked with owners of multifamily properties throughout Oregon, including Multnomah County, to improve the energy efficiency of their buildings. For the second, the Portland Bureau of Transportation optimized traffic signals to improve traffic flow and reduce idling time. In exchange for funding assistance, The Climate Trust took legal title to the resulting carbon offsets. These two projects in Multnomah County achieved reductions of about 20,000 metric tons in 2008, generating offsets now owned by The Climate Trust. At the same time, many businesses, organizations and residents in Multnomah County have purchased offsets from other offset providers. No data are available at this time as to the volume of such offsets.

Units of Measurement for Carbon Emissions

The greenhouse gas 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. For example, the 100-year GWP of methane is 23, which means that one ton of methane in the atmosphere would have the same impact on global warming over a 100-year period as 23 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 CO_2-e or CO_2-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 emissions) to customers who have 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 provide data on the kWh of green power sold to customers in Oregon. To estimate the kWh of green power sold in Multnomah County, the kWh of green power sold in Oregon is multiplied by the percentage of the utility's sales that are to customers in Multnomah County.

$$\text{kWh of green power sold in Oregon} \times \frac{\text{kWh sales to customers in Multnomah Co.}}{\text{Total kWh sales to Oregon customers}} = \text{Estimated kWh of green power sold in Multnomah Co.}$$

The product of this calculation, 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.

$$\text{Total kWh sold in Multnomah Co.} - \text{Estimated kWh of green power sold in Multnomah Co.} = \text{kWh from standard sources sold in Multnomah Co.}$$

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 ICLEI 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 for converting therms to CO_2-e. 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 taken from the U.S. Energy Information Administration's "Annual Fuel Oil and Kerosene Sales Report" contained in the Petroleum Supply Annual (EIA Report), which publishes data on the sales in Oregon of heating oil, propane and kerosene. 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.

$$\text{Gallons of oil sold to customers in Oregon} \times \frac{\text{Population of Multnomah Co.}}{\text{Population of Oregon}} = \text{Estimated gallons of oil sold to customers in Multnomah Co.}$$

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

*Total Energy (electricity, fuel oil, natural gas, propane)

RESIDENTIAL AND COMMERCIAL BUILDING ENERGY CONSUMPTION

	Total Electricity (kWh)	Green Electricity (% of Total)	Natural Gas (Therms)	Total Energy* (MMBTU)
RESIDENTIAL				
1990	2,648,501,220	0.0%	70,186,733	18,338,158
1995	2,656,288,808	0.0%	80,271,983	19,054,707
2000	2,787,706,505	0.0%	100,653,199	21,402,034
2001	2,706,881,610	0.1%	100,301,898	21,171,803
2002	2,667,299,058	0.9%	100,208,767	20,968,866
2003	2,654,243,780	2.5%	95,373,320	20,392,089
2004	2,706,910,320	3.5%	95,772,992	20,030,176
2005	2,700,637,203	4.6%	95,492,494	20,095,644
2006	2,805,336,350	5.6%	99,318,246	20,713,773
2007	2,836,542,171	8.1%	103,687,027	21,112,796
2008	2,886,406,428	9.5%	108,402,645	21,770,650
COMMERCIAL				
1990	2,968,831,041	0.0%	70,781,264	19,091,605
1995	3,398,180,636	0.0%	74,707,710	20,553,520
2000	3,834,588,942	0.0%	80,756,988	22,526,616
2001	3,748,552,802	0.0%	79,310,694	22,352,396
2002	3,644,283,201	0.2%	76,871,980	21,549,602
2003	3,684,594,873	0.4%	72,230,103	20,615,670
2004	3,768,353,073	0.6%	74,621,018	21,130,492
2005	3,766,481,231	0.8%	74,824,308	21,116,598
2006	3,872,932,825	1.0%	79,275,728	21,826,754
2007	3,902,256,393	1.6%	82,156,842	22,168,797
2008	3,880,015,005	1.8%	84,383,842	22,320,222
INDUSTRIAL				
1990	2,001,811,581		87,315,289	17,549,032
1995	2,396,895,913		99,871,589	19,980,751
2000	2,735,383,151		91,260,620	20,301,573
2001	2,571,484,196		82,047,847	18,752,243
2002	2,214,752,762		78,007,041	17,142,971
2003	2,035,540,602		77,590,865	15,794,690
2004	1,917,708,393		82,116,292	16,040,233
2005	1,915,076,497		81,965,777	15,621,116
2006	1,953,864,313		85,624,278	16,353,657
2007	1,895,563,159		82,986,391	15,755,364
2008	1,866,384,990		79,982,277	15,328,720

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 quarterly 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.[1] 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 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.

	Gasoline Sales in Multnomah County (Thousands of Gallons)	Estimated On-Highway and Construction Diesel Use in Multnomah County (Thousand Gallons)
1990	243,345	68,807
1995	259,713	70,495
2000	249,147	82,819
2001	252,678	79,964
2002	265,264	88,119
2003	261,104	85,698
2004	245,281	98,145
2005	238,066	99,557
2006	246,505	100,972
2007	251,519	104,928
2008	237,402	105,694

1 2006 Oregon County and State Agriculture Estimates, Oregon State University, updated as of May, 2007.

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.

$$\text{Total tonnage sent to Metro landfills} \times \frac{\text{Population of Multnomah Co.}}{\text{Population of Metro}} = \text{Total landfill tonnage Attributable to Multnomah Co.}$$

$$\text{Total landfill tonnage attributable to Multnomah Co.} \times \text{\% of waste in Oregon landfills that is attributable to a certain type of material} = \text{Tonnage of certain material in landfills attributable to Multnomah Co.}$$

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. Using ICLEI's Clean Air and Climate Protection software, and based on the Metro tonnage data, DEQ waste composition studies and estimates of methane recapture rates, the inventory estimates the total amount of methane generated at landfills that is released into the atmosphere.

Methane emissions from landfills, as 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 as 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, etc.) 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.

CLIMATE ACTION PLAN 2009

CITY OF PORTLAND AND MULTNOMAH COUNTY

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