

Oregon Global Warming Commission

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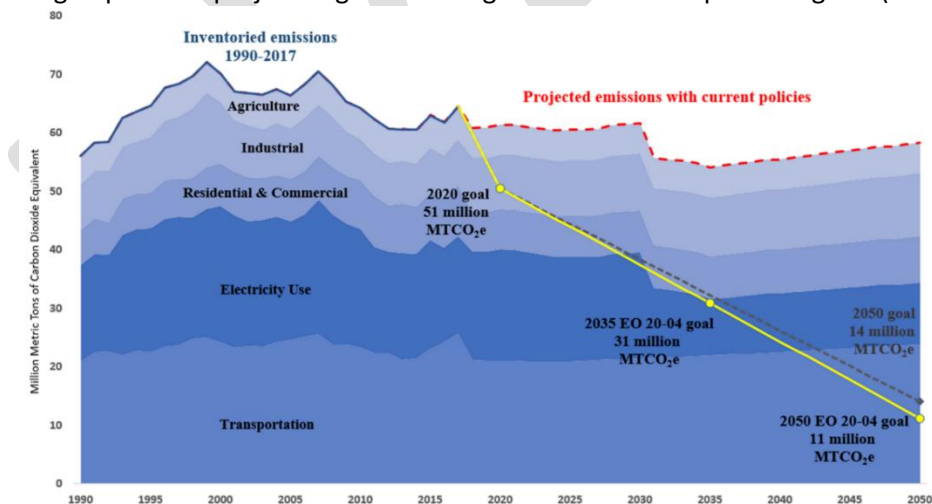
Executive Summary

The IPCC 1.5°C Report makes it clear that we are in an all hands-on deck climate crisis with a need for faster, more ambitious and sustained action across all economic sectors including how we use and manage our natural and working lands. Climate change and the secondary effects it triggers impact human health and safety, our infrastructure, economic growth, food and water supplies, the environment we love and the fish and wildlife that inspires us. The costs of inaction are significant and growing. Since the 1980's, the U.S. alone has sustained 273 weather and climate disasters; the direct cost of which have exceeded \$1.790 trillion and taken over 14,223 lives (NOAA, accessed August 2020). The number of events, costs, and deaths have increased decade over decade throughout this period. This year will be no exception to that trend.

Here in Oregon the impact of climate change could not be more evident than the tragedies experienced this year from the extreme runoff event that caused damage to and closed I-84 and flooded homes in the Pendleton area last winter to the extensive drought declarations and the devastating fires experienced this fall. Climate change is an equity issue, multiplying a series of threats—from food and housing insecurity to health hazards— that are already facing disadvantaged and vulnerable communities, including low-income, Black, Indigenous, and rural households.

To be clear and to the point, Oregon has not made the progress envisioned in the Oregon Global Warming Commission's Roadmap to 2020.¹ We are not on track to meet our 2020 emission reduction goal. Preliminary 2019 sector-based emissions data exceeds the State's 2020 emissions reduction goal by 26 percent or 13 million metric (mm) tons of CO₂e, erasing all of the gains we had made since 2010. While it needs to be updated, our current projection estimates that we will miss the 2035 and the 2050 goals set forth in Governor Brown's Executive Order 20-04 by 23 and 54 million m tons CO₂e respectively (Figure 1).

Figure 1: Oregon past and projected greenhouse gas emissions compared to goals (ODEQ 2020)



The OGWC has received a growing body of public comments from Oregonians. Most express frustrations that our actions have not kept pace with the scope of the crisis and call on the OGWC to set a tone of extreme urgency with “an unequivocal and immediate call to action.” Meeting our climate mitigation goals will require actions that have cross-cutting economic, social and cultural impacts as well as actions focused on individual sectors. Governor Brown's Executive Order (EO) 20-04 is a significant addition to the existing laws governing GHG emissions in Oregon

Over the course of the last two years, the Oregon Global Warming Commission (OGWC) has discussed a wide range of topics. We reviewed the Agency EO 20-04 response plans and gathered information on the most important elements each of the agencies have proposed. We have also looked beyond what the agencies have authority to do today to identify actions agencies need new authority to advance.

In this biennial report, the OGWCs strongly recommends that the Legislature fully fund the needed rule making and agency work plans called for in EO 20-04 and we highlight 33 additional actions that should be taken to help Oregon get back on track toward our climate mitigation goals.

Recommendations: THE RECOMMENDATIONS (FOUND IN SECTION VI OF THE REPORT) WILL BE INCLUDED WHEN THEY ARE FINALIZED

Early action to mitigate and adapt to climate change has the potential to significantly benefit Oregon's communities, our economy, and our environment. Well-designed climate mitigation actions can make our citizens healthier and our communities more resilient, especially communities that have suffered the greatest impacts from climate change as well as many other social injustices.

Increased use of energy efficiency and renewable energy produced in Oregon keeps more of our energy dollars at home, while reducing use of fossil fuels improves our air quality. Building out a clean energy system with distributed generation, renewables, microgrids, and storage, will strengthening our community resilience. Investments in soil health and forest management practices that increase sequestration can increase their productivity of natural and working lands, improve water quality and provide better wildlife habitat. Planting trees in urban areas reduces heat island effects, provides better air quality and produces health benefits and savings. Restoring coastal wetlands improves fish habitat and protects coastal communities from increasing impacts of storm surges.

Businesses can benefit too. As carbon becomes more constrained and expensive around the world, businesses that pursue innovations to reduce their GHG emissions' footprint and produce products that help others reduce theirs will have a significant market advantage. Similarly, jurisdictions that have a low-carbon, low-cost energy supply and supportive policies for reducing GHG emissions will be well positioned to attract new businesses and incite business expansion in their communities.

Avoiding the worst impacts of climate change will require "rapid, far-reaching and unprecedented changes in all aspects of society."² How quickly we act to reduce and offset GHG emissions will have profound effects on the health of our natural and working lands, communities, fish and wildlife populations and people. The longer we delay, the more climate change adaptation and mitigation will cost.

I. Introduction

The Oregon Global Warming Commission (OGWC) was established in 2007 and directed in statute to submit a biennial report to the Legislative Assembly that includes an assessment of:

- The economic, environmental, health, and social assessments of climate change impacts on Oregon;
- Greenhouse gases emitted by various sectors of the state economy;
- The state's progress toward the greenhouse gas (GHG) emissions reduction goals established by the Legislature; and
- Existing GHG emissions reduction policies and measures.

The Commission is also directed to make recommendations for new policies and actions that should be taken to meet our GHG goals.

In March 2020, Governor Brown issued Executive Order 20-04, establishing new GHG emission reduction goals for 2035 and 2050, and provided general directives to 16 state agencies. The general directives require agencies to exercise any and all authority and discretion to accelerate reductions in GHG emissions; to advance adaptation measures; and to participate in an Interagency Workgroup on Climate Impacts to Impacted Communities to inform their climate action.

The Governor's Executive Order gave specific directives to a subset of the agencies, including the OGWC. The OGWC was tasked with three new charges:

- to report on the state's progress toward the newly established goals;
- to report on the state's progress toward Zero Emissions Vehicle (ZEV) sales and installation of charging infrastructure; and
- to develop a proposal for a state goal for carbon sequestration and storage in Oregon's natural and working landscapes for Governor Brown's consideration no later than June 30, 2021.

In keeping with our statutes and directives, the OGWC's 2020 Biennial Report to the Legislative Assembly provides an overview of the climate impacts we are facing and the growing costs of inaction. It reports an update on Oregon's sectoral GHG emissions. Next, it describes nine cross-cutting and sector-based issues, including a brief overview of legislative and executive actions that have been taken since the OGWC's 2018 Biennial Report that are helping to address these issues. Finally, the Report makes recommendations for additional actions that should be taken to improve our progress toward meeting our GHG goals. In recognition that funding will be constrained during the 2021-2023 biennium the OGWC has highlighted a relatively small set of critical policies and investments we urge the Legislature, commissions and/or agencies to act on in 2021. The recommendations are intended to reinforce and compliment work identified in EO 20-

Climate Mitigation and Adaptation Information Resources

In addition to the information contained in this Report, several other resources are available to help Oregonians understand the climate mitigation and adaptation challenges and opportunities facing our state. The [Oregon Climate Change Research Institute](#) produces periodic reports to the Oregon Legislature on current and projected impacts of climate change; the fifth Oregon Climate Assessment Report (OCAR5) will be released in January 2021. The State of Oregon will be finalizing an update of its [Climate Adaptation Framework](#), including the Climate Equity Blueprint, in February 2021. The Oregon Department of Environmental Quality produces an [annual assessment of GHG emissions](#) in Oregon. The Oregon Department of Energy produces a [Biennial Energy Report](#) to the Legislature in November of even years, with information on state and local policies and actions to reduce GHG emissions, and assessment of the impact of climate change on the energy sector.

04, set a stronger foundation for governance and equity, and address issues in greatest need of attention and/or greatest opportunity for progress.

This winter the OGWC will launch a comprehensive analysis of a broader set of policies, programs, and public investments and develop a long-range plan for meeting our 2035 and 2050 goals. The analysis and planning will include a transparent and accessible public involvement process.

II. Impacts of Climate Change in Oregon

As detailed in Oregon Climate Change Research Institute’s [Fourth Oregon Climate Assessment Report](#) (2019), Oregon is already experiencing increased temperatures, changing precipitation patterns, reduced snowpack, drier summers, and more frequent and damaging fires. Average temperatures in parts of southeastern Oregon have already increased by over 5°F (2.8°C) since the late 1800s (Figure 2). These climate hazards will continue to worsen in various ways throughout the state without stronger climate action in Oregon and around the world. Key changes in Oregon’s climate as described in the Oregon Climate Change Research Institute’s (OCCRI) Fourth Assessment are summarized below.³

Increasing temperatures and their cascading impacts threaten Oregon’s natural resources, human health, and infrastructure. Depending on the extent of GHG emissions released, average temperatures in Oregon are expected to increase by 4°F to 9°F (2.2°C to 5°C) over the course of the century. Within the next three decades, most locations in Oregon are likely to have more frequent heatwaves, often measured as consecutive days above a particular high temperature threshold. Most locations in Oregon are projected to see an increase of 30 or more days over 86°F compared to recent decades, which are known to result in heat-related illnesses. While there may be benefits from longer growing seasons for agriculture and forestry in some parts of the state, warmer conditions will reduce some crop yields, impact the quality of other crops, and cause more problems from pests and weeds in many other parts of the state. Increased production may also be limited by water availability and the ability of outdoor laborers to work in rising summer temperatures for extended periods of time.

Warmer temperatures and drier conditions increase the risk of more frequent and severe wildfires. As experienced this year, the Willamette Valley and Eastern

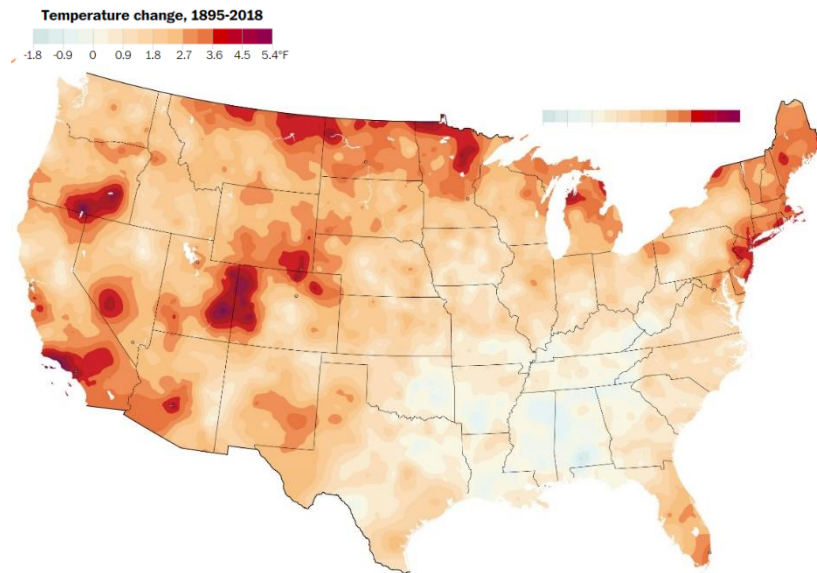
Greenhouse Gases and Climate Change

Human activities—from powering motor vehicles, generating electricity, and operating buildings to manufacturing products and consuming materials—continue to use fossil fuels that release large amounts of greenhouse gases (GHG) into the atmosphere. Once emitted into the atmosphere, GHGs persist for a very long time. Methane lasts in the atmosphere for about a decade, nitrous oxide lasts for 100 or more years, while carbon dioxide persists for thousands of years. These emissions have reached a high concentration in the earth’s atmosphere (about 410 parts per million, ppm, as of 2019) where they trap the sun’s heat.¹ As a result, global average temperatures have risen by an estimated 1°C since the industrial revolution.

Global warming has already altered the earth’s climate, making summers hotter and drier, increasing the variability in precipitation patterns, and increasing the frequency and intensity of extreme events—such as heatwaves, droughts, and floods.¹ Unless significant actions are taken to reduce emissions, leading scientists expect global average temperatures to rise by 3°C to 5°C (5.4°F to 9°F) by 2100—resulting in unprecedented risks to society. To avoid greater consequences of climate change, we need to keep the rise in global average temperatures to less than 2°C (3.6°F), and ideally less than 1.5°C (2.7°F).¹ To do so, scientists estimate that we need to keep atmospheric carbon dioxide concentrations—and the equivalent amount of other GHGs, known as CO₂e—below 450 parts per million (ppm).¹

Oregon are expected to see the largest increase in wildfires. Wildfire smoke aggravates health hazards for Oregonians, particularly for those with existing respiratory conditions, outdoor laborers, and children, who are most susceptible to poor air quality.

Figure 2: Average temperature increase from 1895-2018 (in degrees Fahrenheit).⁴



The amount of seasonal precipitation is expected to change, resulting in increased precipitation in winter months and decreased precipitation in summer months. Meanwhile, under higher temperatures, more precipitation is expected to fall as rain instead of snow. Precipitation patterns heavily influence the amount of snowpack and streamflow, which are critical resources for hydropower production—the backbone of Oregon’s power sector. Spring snowpack has been declining across the state and will continue to decline

significantly in the coming decades, particularly in places at lower elevations. In some basins, summer flows may be reduced by up to 50 percent, reducing the amount of hydropower available while summer temperatures and demand for electricity rise. Reduced streamflows also threaten commercial and tribal fisheries.

Extreme precipitation—heavy downpours that can result in flooding—may change significantly in both Eastern Oregon (e.g., by approximately 20 percent) and Western Oregon (e.g., by about 10 percent) by 2050. Sea level rise is expected to increase by about a foot by 2050 on average across Oregon and may increase by more than 8 feet this century—increasing the frequency of coastal flooding.

Increased atmospheric concentrations of carbon dioxide are also impacting ocean conditions. Since the Industrial Revolution, the surface temperature of the ocean has increased by 5°F (2.8°C).^{5, 6} The earth’s oceans have absorbed about 30 percent of the CO₂ produced from fossil fuel combustion. Increasing adsorption of CO₂ increases ocean acidity. Increasing acidity in our oceans impact shellfish and crustaceans including Dungeness crabs—Oregon’s most important fishery. Changing wind and weather patterns are also impacting oxygen levels in the ocean. Since the 1960s, deep water and nearshore oxygen levels have decreased by 5 percent and 40 percent respectively in the northeast Pacific.⁷ These lower oxygen levels are resulting in extended periods of hypoxia. While rare in the 20th century, summer periods of hypoxia have become almost an annual event since 2002.

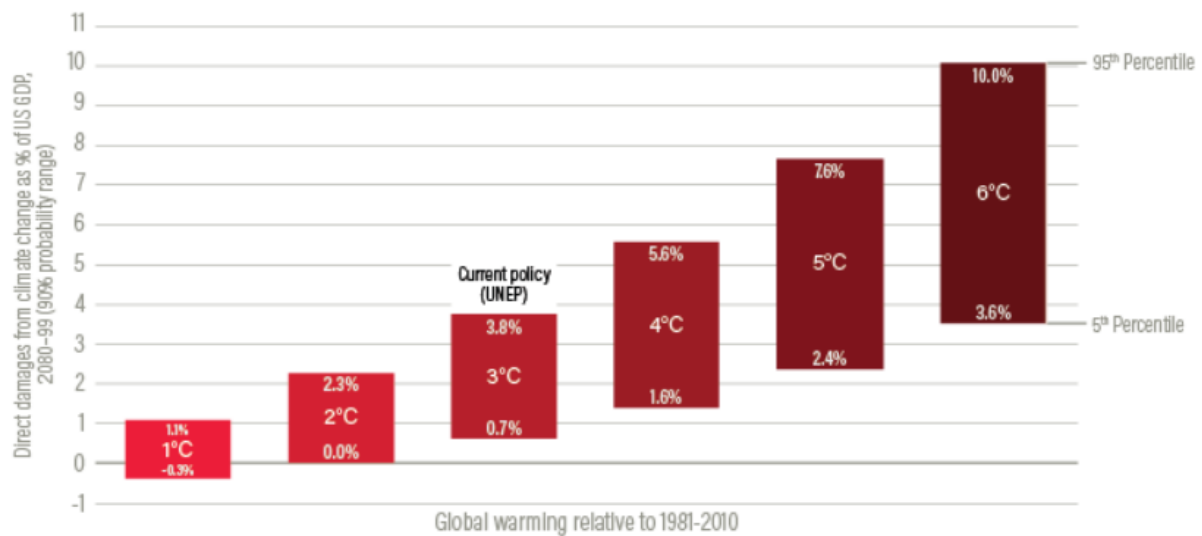
The Oregon Climate Change Research Institute plans to complete a fifth assessment of the state of physical, biological, and social climate change science as it pertains to Oregon by January 2021. When it is complete, the Commission will provide a link to the report on the [Keeping Oregon Cool](#) website.

III. Cost of Inaction

The experienced and projected effects of climate change and the secondary effects they trigger are impacting human health and safety, infrastructure, economic growth, crop production, water supplies, and fish and wildlife populations. Extreme weather events associated with climate change alone are putting pressure on our transportation, drinking water, wastewater, and energy systems by increasing maintenance costs, interrupting businesses, and putting people’s safety at risk. As will be explained in more detail in the recommendations section of this report, climate change does not impact Oregonians equally, but multiples a series of threats that vulnerable communities—including low-income, Black, Indigenous, and rural households—already face.

The costs of inaction are significant and growing. Since the 1980s the U.S. alone has sustained 273 weather and climate disasters; the total cost of these events exceeds \$1.790 trillion and has resulted in 14,223 deaths.⁸ The number of events, costs and deaths have increased decade over decade throughout this period. For each extra degree of global warming, economic damages—as measured as a percentage of the US GDP—are expected to increase (Figure 3).

Figure 3: U.S. Economic Damages at Different Levels of Global Warming⁹



In Oregon, this year alone, an extreme runoff event caused damage to and closed I-84 and flooded homes in the Pendleton area; Governor Brown issued drought declarations for fourteen counties from the coast to northeastern Oregon; and this fall we experienced devastating fires across the state—in which at least nine Oregonians lost their lives and over 40,000 had to evacuate; nearly 5,500 structures and over 1.1 million acres were burned with an estimated \$125 million in fire-fighting costs.^{10, 11, 12, 13} A 2018 Headwaters Economics study found that wildfire suppression costs may account for only nine percent of the total direct and indirect costs of major wildfires.¹⁴ By all measures the costs to Oregonians are incalculable.

Climate Change Impacts on Oregon’s Transportation System (Text box)

In 2019, the Oregon Department of Transportation identified examples of the additional funding they will need to adapt and maintain the transportation system to address the impacts of climate change.¹⁵ They flagged the need for more funding for maintenance and operations to help proactively clear blockages in drainages, reshape slopes, manage vegetation, and to react to increased occurrences of floods, landslides, wildfires. In addition to enhanced maintenance and operations, they identified that more funding is needed for transportation to armor or upgrade infrastructure in order to withstand Oregon’s changing climate. For the Coast alone, they estimated that they should be investing \$50 million more per year for resilience

improvements, \$20 million more per year to mitigate landslides and rockfalls and \$10 million more per year to upsize small culverts along coastal highways and connectors. ODOT is currently doing a comprehensive statewide roadway risk assessment. The longer we take to reduce emissions globally, the greater the impacts of climate change and the more these costs will go up.

IV. Oregon’s Greenhouse Gas Goals

The Oregon Legislature established the following GHG emission reduction goals in 2007:

- By 2010, Oregon will arrest the growth of greenhouse gas emissions and begin to reduce emissions;
- By 2020, Oregon will achieve greenhouse gas levels that are 10 percent below 1990 levels; and
- By 2050, Oregon will achieve greenhouse gas levels that are at least 75 percent below 1990 levels.

This year, through Executive Order 20-04, Governor Brown added a new interim goal and updated the 2050 goal:

- By 2035, Oregon will achieve at least a 45 percent reduction below 1990 levels.
- By 2050 Oregon will achieve at least an 80 percent reduction below 1990 levels.

The new goals are more reflective of the current thinking on what will be needed to avoid the worst impacts of climate change. To limit global warming (the rise in average global temperatures) to 1.5°C (2.7°F), the IPCC 1.5°C report calls for reaching net zero emissions by 2050 – where any remaining anthropogenic CO₂ emissions are balanced by CO₂ removals.¹⁶ However, they caution that the longer we take to start making significant reductions in GHG emissions, the sooner we would need to reach carbon neutrality to keep global warming at or under 1.5°C (2.7°F).

Over 24 countries and a growing number of U.S. states have set or are in the process of setting net zero GHG emissions goals.^{17, 18} For states in the US, the specifics of the goals vary by baseline year, the date and percent reduction of interim targets, and the 2050 goal (Table 1). Eight states have identified net zero goals and/or aspirations.

Table 1: State GHG baseline date, interim target and 2050 emissions reduction goals compared to baseline.¹⁹

State	Baseline Year	Interim Target	2050 Goal
California	1990	Reduce by 45% by 2030	Net Zero
Colorado	2005	Reduce by 26% by 2025 and by 50% by 2030	Reduce by 90%
Connecticut	2001	Reduce by 45% by 2030	Reduce by 80%
Delaware	2008	Reduce by 30% by 2030	N/A
Hawaii	N/A	N/A	Net Zero
Louisiana	2005	Reduce by 26% to 28% by 2025 and by 40% to 50% by 2030	Net Zero
Maine	1990	Reduce by 45% by 2030	Reduce by 80%/Ideally Net Zero
Maryland	2006	Reduce by 40% by 2030	Reduce by 80% to 95%
Massachusetts	1990	Reduce by 25% by 2020	Reduce by 80%
Michigan	2005	Reduce by 26% to 28% by 2025	Reduce by 80%
Minnesota	2005	Reduce by 30% by 2025	Reduce by 80%
Montana	1990	N/A	Net Zero
Nevada	2005	Reduce by 28% by 2025 and by 45% by 2030	Net Zero/Near Net Zero

New Hampshire	1990	Reduce by 20% by 2025	Reduce by 80%
New Jersey	2006	Attain 1990 levels by 2020	Reduce by 80%
New Mexico	2005	Reduce by 45% by 2030	N/A
New York	1990	Reduce by 40% by 2030	Reduce by 85%
North Carolina	2005	Reduce by 40% by 2025	N/A
Oregon	1990	Reduce by 10% by 2020; by 45% by 2035	Reduce by at least 80%
Pennsylvania	2005	Reduce by 26% to 28% by 2025	Reduce by 80%
Rhode Island	1990	Reduce by 10% by 2020 and by 45% by 2035	Reduce by 80%
Vermont	1990	Reduce by 25% by 2012 and by 50% by 2028	Net Zero
Washington	1990	Reduce by 45% by 2030 and by 70% by 2040	Reduce by 95%/Ideally Net Zero

V. Progress Toward Meeting Oregon’s Emission Reduction Goals (The text, tables and charts in this section are provisional, pending updated data from DEQ)

The Oregon Department of Environmental Quality (DEQ) maintains two GHG inventories: a sector-based inventory and a consumption-based inventory to help the OGWC track progress toward the state’s emission reductions goals and to identify important opportunities to further reducing emissions. The OGWC uses the sector-based inventory to track progress toward the state’s GHG goals. The sector-based inventory includes “emissions produced in Oregon from transportation, residential, commercial, industrial and agriculture sectors, including electricity produced elsewhere but used in the state.”²⁰ DEQ’s develops this inventory based on the internationally accepted GHG 2006 accounting protocols from the IPCC used by the Environmental Protection Agency (EPA) to generate the U.S. GHG inventory. DEQ modifies the methods slightly for application at the sub-jurisdictional level.²¹ The sector-based inventory is updated annually. DEQ strives to provide the most up to date greenhouse gas emissions data to the OGWC and the public. DEQ publishes data reported directly to the agency on an annual basis after the data has been thoroughly reviewed. However, developing the sector-based inventory requires data integration between Oregon’s Greenhouse Gas Reporting Program and the U.S. EPA’s most current inventory of modeled estimates. EPA’s models require extensive updates to different data sets and emission factors and there is often a one to two-year delay in their inventory updates. Recalculation of emissions in past years to account for updated information is a best practice in international greenhouse gas inventory management and allows DEQ to maintain a consistent time series of data. It is important to note that for this reason, historic data in the published inventory may vary from version to version of the OGWC Reports.

Oregon’s sector-based preliminary emissions for 2019 totaled an estimated 64 million metric tons of CO₂e(the carbon dioxide equivalent amount of GHG emissions), up slightly from 2018. Transportation is Oregon’s largest sector of emissions, which have remained relatively stagnant over the last 10 to 30 years (Figure 4; Tables 2). Emissions from the residential and commercial sector have declined since 2010 while industrial and agricultural emissions have remained relatively constant. Recently, there have been significant changes in how the EPA models agricultural soil carbon flux, and hence updates to agriculture’s “national adjustment factor”. This factor helps reconcile differences between the methodologies for estimating nitrogen dioxide emissions from agricultural soils in the national inventory of greenhouse gas emissions and the state’s inventory tool.²²

Emissions associated with agriculture do not include emissions or removals associated with carbon sequestration in soils and crops. Separating electrical and natural gas use from other residential, commercial,

and industrial emissions illustrates the progress being made in decarbonizing the electric sector as well as some reductions in industrial process emissions since the 1990s (Figure 5; Table 3).

Table 2. Oregon emissions by sector: 1990-2019 (in million metric TCO₂e). 2019 emissions data are preliminary numbers (Source: DEQ, 2020).

Sector	1990	1995	2000	'05	'10	'11	'12	'13	'14	'15	'16	'17	'18	'19
Transportation	21	23	24	25	23	22	22	21	21	23	23	24	24	23
Residential & Commercial	16	20	23	22	24	22	21	22	21	22	20	21	21	22
Industrial	14	17	18	14	12	12	12	12	12	13	12	12	12	12
Agriculture	7	7	6	7	7	7	7	7	7	7	7	7	7	7
<i>Total</i>	58	66	71	68	65	63	61	62	62	64	62	64	64	64

Figure 4: Oregon emissions by sector: 1990-2019 (in million metric TCO₂e). (Source: DEQ, 2020).

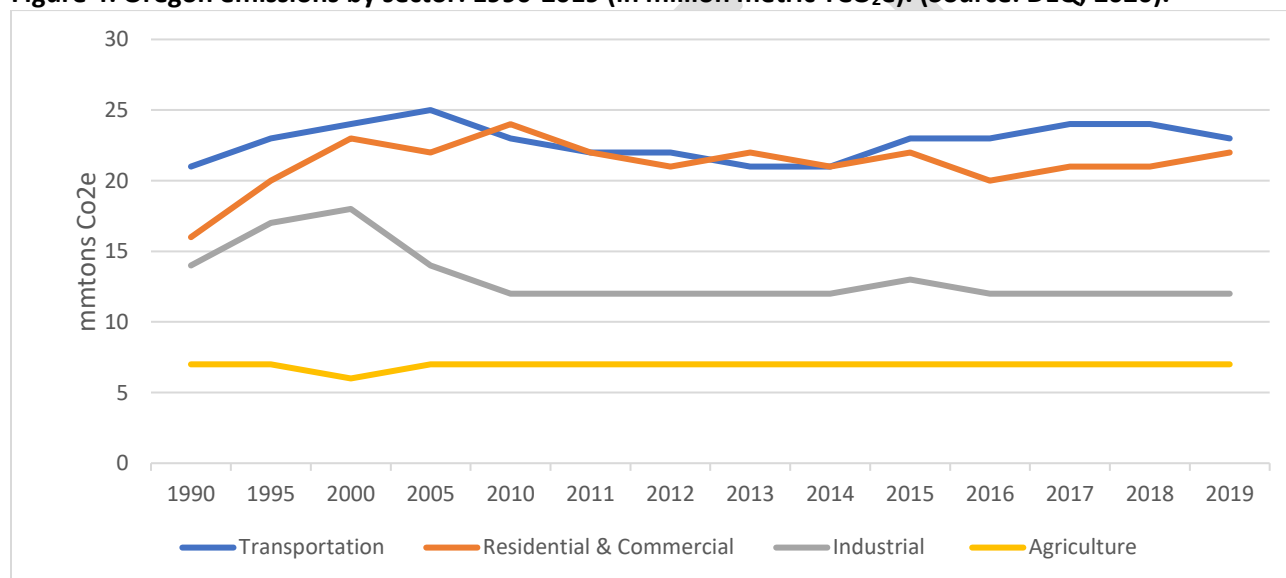
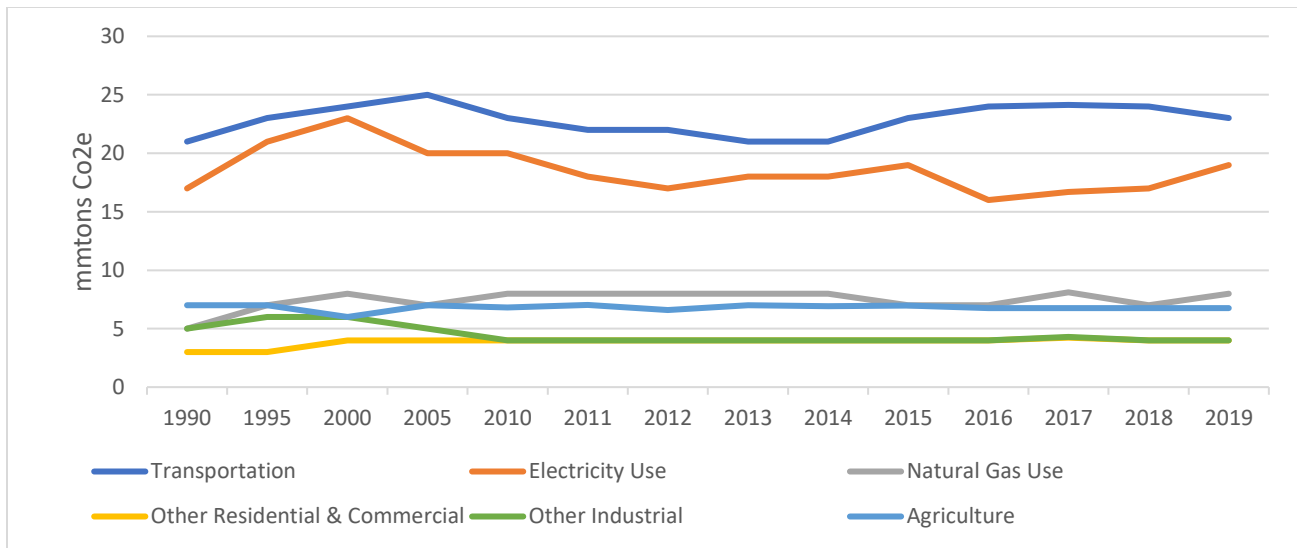


Table 3. Oregon emissions by energy source: 1990-2019 (in million metric TCO₂e). 2019 emissions data are preliminary numbers. (Source: DEQ, 2020).

Sector	1990	1995	2000	2005	'10	'11	'12	'13	'14	'15	'16	'17	'18	'19
Transportation	21	23	24	25	23	22	22	21	21	23	24	24	24	23
Electricity Use	17	21	23	20	20	18	17	18	18	19	16	17	17	19
Natural Gas Use	5	7	8	7	8	8	8	8	8	7	7	8	7	8
Other Residential & Commercial	3	3	4	4	4	4	4	4	4	4	4	4	4	4
Other Industrial	5	6	6	5	4	4	4	4	4	4	4	4	4	4
Agriculture	7	7	6	7	7	7	7	7	7	7	7	7	7	7
<i>Total</i>	58	66	71	68	65	63	61	62	62	64	62	64	64	64

Figure 5. Oregon emissions by energy source: 1990-2019 (in million metric TCO₂e). (Source: DEQ, 2020).

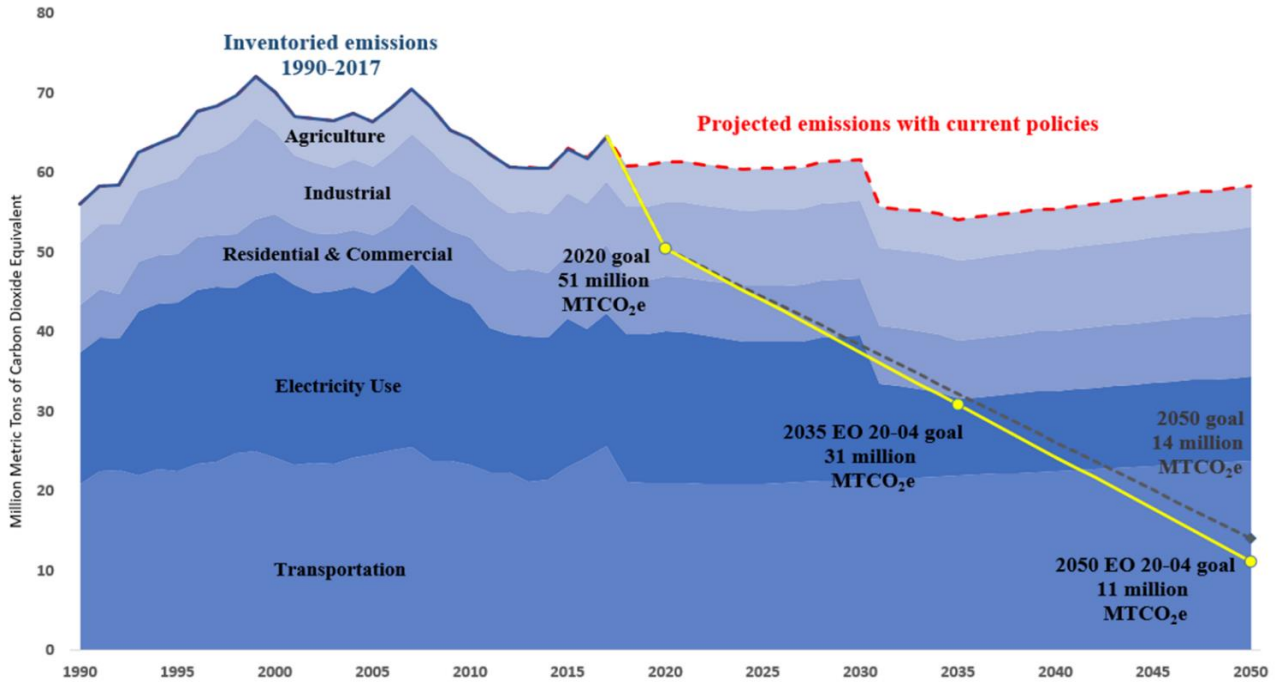


The emissions inventory demonstrates that transportation emissions remain the prominent source of emissions in Oregon. Carbon dioxide emissions largely resulting from combustion of fossil fuels has declined since 2000, while methane, nitrous oxide, and other high global warming potential gases have remained relatively constant.²³ Additional analysis of Oregon’s GHG emissions can be found in the Oregon Department of Energy’s [2020 Biennial Energy Report](#).

As described in the introduction, Governor Brown directed the OGWC to start tracking progress toward the new, more ambitious goals set forth in EO 20-04, in addition to the legislatively set goal for the year 2020. To do so, the OGWC used projected future emissions based on “current” policies, developed for DEQ in 2018 (Figure 6).²⁴ The projection includes two significant policies enacted by the Legislature in 2016—an extension of the Renewable Portfolio Standard (RPS) and suspension of imported electricity generated from coal by 2035. It also includes: GHG emissions reductions associated with reaching the Clean Fuels Program targeted use of 10.5 percent renewable- and bio-diesel; a transition to 90,000 electric vehicles (EVs) and 120,000 plug-in hybrid electric vehicles (PHEVs) by 2025; utility projected load growth; and projected industrial process emissions based on utility projected load growth. The scenario of projected GHG emissions does not include policy changes that have been enacted or established since 2016 described later in this report or the Governor’s directives to agencies in executive orders issued in 2017 (EO 17-20 and 17-21) and in 2000 (EO 20-04). DEQ and the OGWC plan to contract a firm to update GHG projections this winter.

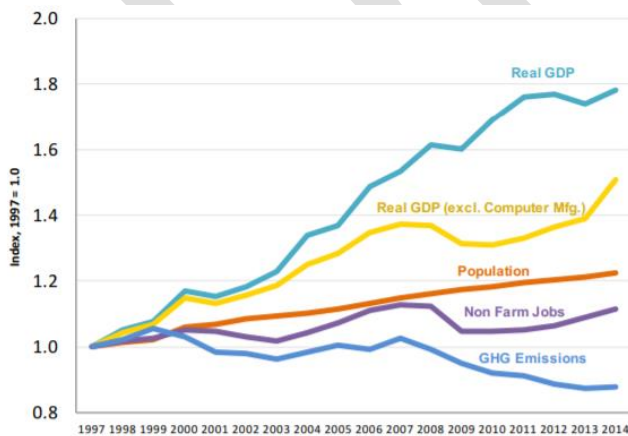
While, Oregon met the 2010 emissions reduction goal established in 2007, we are highly unlikely to meet the 2020 goal. Preliminary 2019 sector-based emissions data and the GHG emissions projection indicate that Oregon’s 2020 emissions are likely to exceed the State’s 2020 emissions reduction goal by approximately 26 percent or 13.4 million metric (mm) tons of CO₂e, erasing most of the gains we had made between 2010 and 2014. The impact of COVID-19 may likely, at least temporarily, change this outcome. An analysis by the International Energy Agency estimates that global GHG emissions in 2020 may be 8 percent lower than 2019 emissions due to the economic impacts of COVID-19.²⁵ Energy Innovations modeled the potential impact of COVID-19 and projected a 7 percent to 11 percent reduction in U.S. GHG emissions in 2020 compared to 2019.²⁶ This percent reduction in emissions would put Oregon’s estimated emissions between 57-60 million metric tons CO₂e, 6-9 million metric tons above our goal for 2020. Energy Innovations further cautions that any drop in emissions will be temporary. Without additional and significant actions, emissions are expected to return to pre-COVID-19 levels by 2025.

Figure 6. Oregon’s past and projected greenhouse gas emissions compared to goals.²⁷ (Source DEQ, 2020) **(To be updated in the final report)**



While impacts to our economy do have an impact on emissions, Oregon GDP and emissions have largely been decoupled since 1997. From example, 1997 to 2014, Oregon’s real GDP increased by almost 80 percent while total GHG emissions declined by approximately 11 percent (Figure 7), proving that economic prosperity and climate mitigation can go hand in hand.

Figure 7: Indexed measures of economic activity and GHG emissions, 1997-2014.



Sources: Oregon GDP data: U.S. Bureau of Economic Analysis, 2016; Oregon Nonfarm Jobs and Population: Federal Reserve Bank of St. Louis, Federal Reserve Economic Data (FRED), 2016; Oregon Greenhouse Gas Emissions, 1990-2014, Oregon Department of Environmental Quality, accessed October 2016

To meet our 2035 goal, we will need to reduce state-wide emissions by over 50 percent, equivalent to continuously reducing GHG emissions by an average of over 2 tons per year over the next 15 years. As described earlier in the report, the longer we delay the lower our chances of avoiding the worst impacts of climate change. We only have 10 years to budget, plan, and implement significant changes to the trajectory of GHG emissions.

Greenhouse Gas Emissions and Population Growth (The next three paragraphs will be formatted in a box)

Oregon's per capita sector-based emissions are 32 percent lower than U.S. per capita emissions, having dropped by 25 percent since 1990. While this is something to celebrate, Oregon's per capita emissions are 40 percent higher than California's per capita emissions and nearly double those of the European Union.^{28, 29} A number of factors affect per capita emissions, including the available fuel mix used to generate electricity, differences in business sector profiles, population density, climate, and state policies and investments. However, these differences in per capita emissions suggest that we not only need to do better, we can do better.

The trend for reduced per capita emissions is expected to continue as more energy efficiency technologies are adopted in the future. A 2018 study commissioned by PGE projects a 25 to 33 percent decrease in overall energy demand in PGE's service territory by 2050 compared to a baseline case.³⁰ The Northwest Power and Conservation Council estimates that energy efficiency measures could meet all of the projected increases in energy demand through 2030 with implementation of cost-effective energy efficiency measures. The U.S. Mid-Century Strategy for Deep Decarbonization projects a 20 to 30 percent decrease in overall energy demand by 2050 compared to a baseline scenario for the U.S. as a whole.³¹

While understanding per capita emissions is useful, as noted in our 2018/2019 Report, solving climate change requires absolute reductions in GHGs. As a result, GHG reduction goals and targets around the world—including those for Oregon—are expressed in absolute terms.

VI. Commission Recommendations

The private sector and new technologies have and will continue to play an important role in reducing GHG emissions; however, clear, consistent, and ambitious policies at all levels of government are critical to getting us back on track toward meeting our GHG emissions reduction goals. With a new federal administration, the Oregon Legislature and the Governor Brown should work closely with the Oregon Congressional Delegation and the administration design Oregon policies and programs to take full advantage of federal policy changes. Climate mitigation policies can and should be designed to address past inequities and protect low-income Oregonians, provide for a just transition, address the different needs of rural and urban settings, create long-term certainty for businesses, include mechanisms for continuous improvement, and reward innovation. In short, they should be designed to improve environmental justice, save Oregonians money, boost the economy, and improve the resilience of Oregon's natural and working lands.

Over the course of the last two years, the OGWC has discussed a wide range of topics from climate migration, to the social cost of carbon, to materials management and beyond. We have reviewed the agencies response plans for EO 20-04 and gathered information on the most important actions that agencies have proposed. We have also looked beyond what agencies have authority to do today to identify actions for which agencies would need new authority and funding to advance. We have received a growing body of public comment from Oregonians who want to see more ambitious action on climate change (see box below). We acknowledge and appreciate the increasing public input on the important work facing us all and have tried to reflect much of that input in the recommendations outlined below. Unless otherwise stated, these recommendations are directed to the Oregon State Legislature.

Overview of Public Input on the Draft Report Outline:

The Commission received dozens of comment letters with recommendations on what should be reflected in the Commission’s 2020 Biennial Report to the Legislature. Most express concerns that our actions have not kept pace with the crisis and overwhelmingly ask the Commission to set a tone of extreme urgency with, in one commenter’s words, “an unequivocal and immediate call to action.” Another asked the Commission to “not mince words: progress on the Commission’s 2020 climate action roadmap is dismal.” More aggressive action was specifically requested in relation to transportation, forest management, building code improvements, and land use planning designed to reduce emissions and improve the resilience of our communities. Further, commenters encouraged that we urge the Legislature to fund the agencies to rapidly and comprehensively implement Governor Brown’s Executive Order 20-04 noting the importance of frontloading emissions reductions as soon as possible.

Oregonians submitted a wide range of ideas for what the OGWC, the Legislature and agencies should do to get back on track to reach our emission reduction goals. Several called on the state and/or the OGWC more specifically to do a better job of educating Oregonians on the impacts of climate change and our lack of progress toward our GHG emission reduction goals. One commenter stressed the importance of improving governance and accountability to meet our GHG mitigation goals. Several endorsed the importance of building justice, diversity, equity, and inclusion into all of our climate mitigation and adaptation actions. Others endorsed using the social cost of carbon to make climate smart decisions about state investments, investing in incentives to direct consumer behavior, and advancing creative policy measures such as establishment of a state “Green Bank” to finance energy efficiency and GHG emission reduction projects. Several suggested greater investments in worker training programs to prepare Oregonians to fill clean energy jobs. Other ideas contained in public comments included: increasing investments in the Oregon Health Authority’s climate program; increasing the state’s Renewable Portfolio standards to 100 percent; advancing hydrogen cellulose-based biofuel as a replacement for aviation fuel and hydrogen fuel for freight vehicles; requiring use of industrial carbon capture and sequestration technologies for natural gas facilities; and expanding the state’s no-idling policy.

The full set of public comments on the draft report outline can be found here [\(link to be included in the formatted report\)](#)

VI. A. Cross Cutting Issues

Serving Impacted Communities

The impacts of climate change do not hit all communities equally. Climate change multiplies a series of threats—from food and housing insecurity to health hazards—that are already facing disadvantaged and vulnerable communities, including low-income, Black, Indigenous, and rural households. Climate change disproportionately affects the physical, financial, and mental well-being of these communities.

With fewer options regarding where to live and work, and how to commute, lower-income and other disadvantaged Oregonians face greater exposure to environmental and climate-related risks. For example, several toxic air pollutants are produced when greenhouse gases are released into the atmosphere—from sources such as fossil-fueled power plants, industrial facilities, and fuel-combusting motor vehicles. Studies show that communities of color and low-income households are more likely to be exposed to these air pollutants, which have been shown to cause and amplify respiratory and cardiovascular illnesses. Oregonians with household incomes less than \$20,000 are nearly three times as likely to have a heart attack as those with incomes above \$50,000, and Black and Indigenous people have a higher prevalence of heart attacks than other racial and ethnic groups in the state.³²

Low-income and disadvantaged households also have fewer resources to plan for, and recover from, climate impacts. For example, as the 2020 fire season showed, many vulnerable populations have housing that is less resilient to wildfire smoke and jobs that require them to work/commute outdoors during wildfire events, outbreaks of which are becoming more prevalent as the number and severity of wildfires grow. Wildfire smoke poses serious health threats, including asthma attacks, breathing problems, eye/lung/throat irritation, heart disease, and premature death. These health risks are particularly dangerous for Oregonians with preexisting respiratory and cardiovascular conditions and vulnerable groups, such as children and elderly, pregnant, and disabled residents. As greenhouse gases continue to be emitted, amplifying a wide range of climate hazards—from wildfires to floods, heatwaves, and droughts—, vulnerable and disadvantaged communities face unequal damages on multiple fronts.

Several efforts led by community and advocacy groups and governmental entities have been created to address climate and racial justice in Oregon. The Environmental Justice Task Force was created by the Legislature in 2007 to advise the Governor and state natural resource agencies on environmental justice issues.³³ The Task Force meets with communities across the state and reports directly to the Governor about environmental justice concerns facing Oregonians.

In 2016, the Task Force created a best practices handbook to provide guidance to state agencies on how to comply with these obligations.³⁴ However, a 2020 survey conducted by the interagency team updating Oregon’s Climate Adaptation Framework found that fifty percent of the agencies surveyed reported they are “not yet operationalizing the Diversity, Equity and Inclusion best practices within their climate related work, and 38 percent said they were “just beginning” to do so either because they lacked capacity and expertise within their climate programming to appropriately engage with community-based organizations or because “doing so is not specifically required.”

The interagency group currently engaged in updating Oregon’s Climate Adaptation Framework has also created a Climate Equity Blueprint. Led by the Oregon Health Authority, the Blueprint incorporates the best practices identified by the Environmental Justice Task Force and recommendations gathered through discussions with community groups. The Blueprint provides guidance and recommendations on how to apply an equity lens in the design and assessment of state agency policies, processes, and programs. Specifically, it describes how to: (1) build internal capacity; (2) embed equity and accountability into the design of policies, processes, and programs; (3) lead meaningful community engagement; and (4) improve data collection and use.³⁵

In EO 20-04, Governor Brown directs 16 agencies, to participate in the Interagency Workgroup on Climate Impacts to Impacted Communities. The Workgroup convened for the first time this summer. In addition, this summer, Governor Brown created the Racial Justice Council which held its first meeting in September. The Racial Justice Council is charged with:

- Directing the collection of data from across sectors of society to support smart, data-driven policy decisions;
- Providing principles and recommendations to center racial justice and inform the 2021-2023 Governor’s Recommended Budget and Tax Expenditures Report; and
- Creating a Racial Justice Action Plan for six specific areas: criminal justice reform and police accountability; housing and homelessness; economic opportunity; health equity; environmental equity; and education.

Recommendations:

- 1) The Legislature should follow guidance from the Environmental Justice Task Force and the Racial Justice Council’s and support budget recommendations to build agency capacity to fully address climate equity in their policy and program decision-making and implementation.**
- 2) All agencies should adopt a climate equity framework and follow guidance from the Environmental Justice Task Force, the Racial Justice Council and the Oregon Health Authority’s Climate Equity Blueprint to improve their policy and program decision-making and implementation including increasing representation of traditionally underrepresented communities on all Rules Advisory Committees to inform the design of new programs.**

Governance, Accountability and Resources

The broad agenda needed to address climate change, limited funding for climate change mitigation and adaptation, and current agency authorities and structures have impacted Oregon’s ability to meet our GHG emissions reduction goals. In 2010, the OGWC developed a Roadmap to 2020.³⁶ It identified an ambitious set of policies and needed investments to stay on track to meet our emission reduction goals. However, the OGWC who has been responsible for reporting the State’s progress toward climate goals and developing policy recommendations has very limited authority, capacity, and resources to advance the Roadmap’s policies and programs.

In 2016, the Oregon Legislature’s Joint Interim Committee on Department of Energy Oversight identified climate policy as needing more attention and better coordination at the state level.³⁷ They stated that, without an effectively resourced and functioning focal point for climate policy, it has been and will continue to be extremely difficult, if not unlikely, that we will meet our GHG emissions reduction goals. Progress toward our GHG emission reduction goals reported here is evidence that their prediction was correct.

To partially address this, Governor Brown established a Carbon Policy Office in 2017 to collaborate with state agencies, legislators, researchers, and stakeholders in order to inform Governor Brown’s climate policy priorities and agenda. Governor Brown’s EO 20-04 goes further to direct all Oregon agencies to incorporate and prioritize climate mitigation into *all decision-making*. In response to the EO, more than 13 agencies, boards, and commissions developed response plans and have begun to adjust practices to meet the Governor’s direction. However, staying on track to meet the Governor’s ambition will be challenging without strong governance and the additional financial resources agencies will need to carry out those directives.

Recently, DEQ and ODOT created new climate change specific divisions: the ODOT Climate Office and the

DEQ Office of Greenhouse Gas Programs. ODOT's Climate Office works to bring additional focus, priority, staffing and resources to implement climate change mitigation and adaptation work in the transportation sector. DEQ's Office leads efforts to reduce Oregon's GHG emissions, including mandatory greenhouse gas reporting, Oregon's Clean Fuels Program and a new climate policy development team.

Opportunities for Oregonians to Advocate for Climate Action

Oregon legislators want to hear from residents of their districts on the issues they care most about. You can find your state representative and state senator, along with their contact information, [here](#). A simple phone call or email expressing your interest in climate change in general, or a specific piece of legislation you are interested in, asking their position and ultimately considering their response when you vote can make a big difference.

The [Oregon Legislative Information System](#) is a helpful tool for tracking and submitting comments on proposed laws and state agency budgets. Further information on how to engage in Oregon's legislative process can be found [here](#).

The [Oregon Carbon Policy Office's website](#) has links to the climate related Executive Orders Governor Brown has issued. The [link](#) to Executive Order 20-04 also includes the reports agencies submitted laying out their plans to meet the directives of the order.

Several agencies have or will be initiating rulemaking processes to meet the directives in EO 20-04. Effort is underway to create rulemaking processes that are more accessible and transparent to the public. To date, the following sites have been established to help the public track agency work plans and rulemaking processes.

- [ODEQ's Cap and Reduce Program Development](#)
- [ODEQ Landfill Methane Emissions Reduction Rulemaking](#)
- [ODEQ Clean Fuels Electricity Program Rulemaking](#)
- [ODOE Energy Efficiency Standards](#)

Commenting to agency Commissions and Boards is also an effective way to strengthen governance and accountability for climate action. Most agencies post information about their governance on their website.

Finally, you can also join one or more of the many climate advocacy organizations that operate in Oregon. These groups have an array of perspectives on climate policy. Find one or more that reflect your interests, your support helps them engage in both legislative and rulemaking processes.

Another critical challenge is adapting to the climate impacts that we can't avoid. The state's newly updated Climate Adaptation Framework will also require increased coordination, leadership, and accountability by the agencies.³⁸ Climate change threatens each sector and results in multiple downstream consequences that will impact all Oregonians, especially vulnerable and disadvantaged communities. As described in the 2020 Climate Adaptation Framework, the state needs a coordinated government response on climate adaptation to maximize outcomes for the state's natural resources, economy, and communities.

Recommendations:

3) Reinforce the direction given in the EO 20-04 through legislation to require state agencies to include consideration of climate mitigation and adaptation in all decision-making. Require all agencies to develop climate mitigation and adaptation strategies, metrics, and goals. The agency goals should reflect the state

emission reduction and any established sequestration goals. Legislation should direct agencies to regularly report progress toward their goals to their commissions and boards, the Legislature, and to the OGWC. If agencies aren't meeting their goals, the progress reports should trigger steps to get them back on track.

4) Protect funding that the agencies need to advance the directives in EO 20-04. Rapid and comprehensive implementation of Oregon's Climate Action Plan as directed by Governor Brown's

EO 20-04 is needed. The Legislature should prioritize providing full funding for the expenses needed to implement Governor Brown’s EO 20-04 during the 2021-2023 Biennium.

- 5) Increase funding for the Oregon Global Warming Commission to expand staff and analytic capacity.** As described in the introduction, the OGWC is directed in statute to report to the legislature once a biennium report on the state’s progress to meet our GHG goals; and to make recommendations for statutory and administrative changes, policy measures, funding mechanisms, and other actions state and local governments, businesses, nonprofit organizations or residents should take to reduce GHG emissions. We are further directed to coordinate state and local efforts to reduce GHG emissions in Oregon; develop an outreach strategy to educate Oregonians about the scientific aspects and economic impacts of global warming; and to inform Oregonians on ways to prepare for the effects of global warming.

Currently, the OGWC has 0.3 full-time equivalent staff support from ODOE and assistance from DEQ for managing the GHG inventory. To meet the OGWC’s statutory requirements we need at least one full-time position; ideally, two full-time positions. Added capacity for the OGWC would improve our ability to track and coordinate state and local action on climate mitigation, provide input on policy proposals, and increase our ability to engage the public. In addition, the OGWC needs a budget to augment staff capacity to: (1) produce our Biennial Report; (2) maintain an updated business-as-usual forecast to better assess the state’s progress toward its 2035 and 2050 emissions reduction goals; (3) conduct research on the potential applicability of policies and programs being advanced elsewhere and how they could be customized for Oregon; and (4) meet our statutory directive to develop an outreach strategy to educate Oregonians about climate change and how the state, local governments, and individuals can prepare for the effects thereof and work to reduce GHG emissions. This would include, for example, educating Oregonians about the kinds of job opportunities that will be created; how farming practices can evolve to improve harvests while also sequestering carbon dioxide and reducing fertilizer use; and how programs can be designed to provide financial incentives to upgrade for low- or zero-emissions equipment.

- 6) Require local jurisdictions (with populations over 10,000) to conduct Climate Action Plans and establish a funding mechanism and technical assistance to support local jurisdictions execute their Climate Action Plans.** A funding mechanism and technical assistance with the Oregon Department of Energy (ODOE) should be established, in partnership with the Oregon Department of Transportation (ODOT), Oregon Department of Environmental Quality (DEQ), Oregon Department of Administrative Services (DAS), and the Department of Land Conservation and Development (DLCD). These agencies have provided information and technical assistance to local jurisdictions that have voluntarily developed Climate Action Plans (see ODOE’s 2020 Biennial Report for a summary of local jurisdictions’ plans).

Social Cost of Carbon

EO 20-04 Section 3(C) directs all agencies to consider and integrate climate change, climate change impacts, and the state’s GHG emissions reduction goals into their planning, budgets, investments, and policy-making decisions. More specifically, in Section 5(B), the Public Utility Commission is directed to “prioritize proceedings and activities, to the extent consistent with other legal requirements, that advance decarbonization in the utility sector, and exercise its board statutory authority to reduce GHG emissions, mitigate energy burden experienced by utility customers, and ensure system reliability and resource adequacy.” And in Section 10(B), the EO directs the Oregon Department of Transportation to “develop and

apply a process for evaluating the GHG emissions implications of transportation projects as part of its regular capital planning and Statewide Transportation Improvement Program planning process.”

The Social Cost of Carbon (SCC) is a tool specifically designed for these purposes. The SCC is a metric that reflects the damage to society caused by emitting carbon dioxide, and other GHGs today, effects of which will be felt globally for a long time into the future. The SCC measures the value today of the net damages avoided in the future by reducing today’s emissions by an additional ton of carbon dioxide. The SCC can be used to weigh the costs of limiting carbon dioxide pollution with the benefits of mitigating climate change impacts experienced now and in the future.³⁹ For emissions released in 2020, median estimates from the 2016 *United States government Interagency Working Group on the Social Cost of Greenhouse Gases (IWG)* range from \$15 to \$78 per metric ton of carbon dioxide (in 2020 dollars), depending on the discount rate.^{40, 41} These estimates can be considered conservative compared to emerging studies, some of which estimate a SCC as high as \$1,000 per metric ton.⁴²

The SCC can be used to incorporate the social costs of emitting GHGs into public investment decision-making—from building roads and bridges to electrifying infrastructure for electric vehicles to building new schools. The SCC can also be used to support regulatory impact analysis, for example to help utilities formulate the least-cost approaches to provide energy, while mitigating climate change. Several federal and state agencies have used the SCC to evaluate and implement various policies and investments (see Table 2 in ODOE’s SCC primer for a list of examples), most commonly for energy resource planning and acquisition or to provide credits to zero-emission facilities.^{40, 43} In Oregon, some utilities are already using the SCC in their Integrated Resource Planning to assess risks, but not to calculate resource costs or to evaluate least-cost options. Overall, nearly a dozen states are incorporating the SCC for these types of applications.

Recommendations:

- 7) **The Oregon State Legislature should pass legislation—or the Governor should issue an Executive Order—directing all state agencies in Oregon to use the Social Cost of Carbon as a metric to evaluate public investment decisions and to inform regulatory impact analyses.** At a minimum, the OGWC recommends that the state of Oregon use the SCC value corresponding to a 2.5 percent–3 percent discount rate (adjusted for inflation) developed by the recent *United States government Interagency Working Group on the Social Cost of Greenhouse Gases (IWG)*. These values are equivalent to \$53 to \$78 per ton of carbon dioxide (adjusted for the year 2020 dollars, as shown in Table 1 of ODOE’s SCC primer).⁴⁴ These estimates have been widely recommended by experts and represent conservative values for the SCC.

The SCC should be applied in avoided-cost estimates to maximize the full potential of energy efficiency standards, retrofit incentives, utility programs, and building codes, as done by Washington State (in their 2019 House Bill 1257).⁴⁵

- 8) **Amend ORS 469.503 to update the Energy Facility Siting Council’s (EFSC) carbon dioxide emissions standard.**^{46, 47} Since 1997, all new fossil fuel powered electricity generation plants are required to either displace, offset, or pay for each ton of carbon dioxide the facility is projected to emit above the standard—set at 17 percent below the most efficient natural gas-fired facility operating in the country. However, as a result of the rate-increase limit in ORS 469.503(2)(c)(C)—limiting price increases to no more than 50 percent in any two-year period—, the carbon dioxide emissions standard’s current price of carbon dioxide (\$2.85 per ton) is artificially low compared to nearly all other states, the majority of which use the IWG estimates for the social cost of carbon. The OGWC

recommends that the Oregon State Legislature remove the rate increase cap and direct the Energy Facility Siting Council to use the social cost of carbon (\$53 to \$78 per ton of carbon dioxide; see first recommendation in this subsection).

Regulating Reductions in Greenhouse Gas Emissions

The State of Oregon has been considering putting a price on carbon since 2007 when Governor Kulongoski joined the Western Climate Initiative. The issue has been visited by the Oregon State Legislature many times since, including significant research, legislative discussion, and debate during the past four legislative sessions without enactment of a program. In the absence of such a program, Governor Brown's EO 20-04 directs the Environmental Quality Commission and DEQ to cap-and-reduce GHG emissions from three sectors: large stationary sources (such as industrial facilities), transportation, and other liquid and gaseous fuels (including natural gas).

Recommendations:

- 9) **DEQ should develop a robust Cap and Reduce Program.** It should have broad coverage within the covered sectors; a stringent cap that lowers quickly; and be designed to achieve Oregon's science based GHG emissions reduction goals for emissions from the covered sectors. Acknowledging that balancing the 2021-2023 biennial budget will be extremely challenging, funding for this program should be protected and enhanced to ensure the DEQ has the resources it needs to design an effective and equitable program that protects low-income Oregonians and doesn't drive Emission Intensive Trade Exposed (EITE) businesses out of Oregon.
- 10) **Continue to pursue Cap and Trade legislation.** Putting a price on carbon corrects underlying market failures by including the external costs of GHG emissions and their contribution to climate change. Carbon pricing reduces GHG emissions at a lower cost than source- and sector-based mandates for technologies or processes while encouraging the creation of good jobs in the clean energy sector. While DEQ can cap emissions, they do not have the authority to hold auctions to generate revenue that could be used to assist low-income Oregonians, protect EITE businesses, reduce emissions in uncapped sectors, and/or address the impacts of climate change.

Finance and Economic Development

Early action to mitigate and adapt to climate change has the potential to significantly benefit Oregon's communities, our environment and our economy. Well-designed climate mitigation actions can make our citizens healthier and our communities more resilient, especially communities that have suffered the greatest impacts from climate change. Increased use of energy efficiency and renewable energy produced in Oregon keeps more of our energy dollars at home, while reducing use of fossil fuels improves our air quality. As described by the ODOE, "As Oregon builds a clean energy system that includes distributed energy generation, renewables, microgrids, and storage, we will also be strengthening our energy system's resilience to the effects of climate change" ... and "we will improve our ability to withstand and recover from other threats, like a Cascadia Subduction Zone earthquake."

Investments in soil health and forest management practices that increase sequestration can improve the productivity of the land and provide water quality and wildlife habitat benefits. Planting trees in urban areas will reduce heat island effects and provides better air quality and health benefits. Restoring coastal wetlands will improve fish habitat and protects coastal communities from increasing impacts from storm surges.

Businesses can benefit as well. As carbon becomes more constrained and expensive around the world, businesses that pursue innovations to reduce their footprint and produce products that help others reduce GHG emissions will have a significant market advantage. Similarly, jurisdictions that have a low-carbon, low-cost energy supply and supportive policies for reducing GHG emissions will be well positioned to attract new businesses and incite business expansion in their communities.

In 2016, the Risky Business Project released their Risk to Reward Report.⁴⁸ The report documents the results of modeling to assess the costs and benefits of four pathways to achieving an 80 percent reduction in US GHG emissions by 2050. Under their Mixed Resources pathway, their study estimates that the investments needed to reach this goal would be more than offset by a significant reduction in fuel costs for an overall net savings of \$150 billion between now and 2050 and would generate 330,000 net jobs by 2030 and 530,000 more net jobs by 2050.

Recommendations:

- 11) Create a state-sponsored “Green Bank” and use the state’s bonding capacity to incentivize private investment in clean technologies and natural climate solutions.** Green Banks are a specialized financial entity that can work with the private sector to create an efficient, reliable and self-sustaining mechanism to achieve GHG reduction goals. A state-sponsored Green Bank is an innovative business model that would increase the availability of capital for the deployment of green technologies as well as projects that increase sequestration on natural and working lands (NWL) by leveraging private sector capital. Unlike grant or incentive payments, Green Bank funds would be invested at or near market rates, ensuring that the organization can cover its own costs, while preserving its capital base for continued deployment.

By blending commercial, public, and philanthropic capital, a Green Bank can deliver catalytic finance solutions capable of supporting the implementation of green technologies and NWL-based projects that otherwise may not be completed. Green Banks possess local expertise on market conditions, the policy landscape, finance actors, and development partners, and leverage that expertise to support investment. Green Banks are not depository institutions.

There are over a dozen Green Banks successfully operating in states across the country, such as California, Colorado, Delaware, Hawaii, Maryland, Michigan, New York, and Rhode Island. These states mostly focus on clean energy projects; however, Oregon could focus the activities of a Green Bank on both clean energy projects and NWL-based projects as our state offers significant opportunities to achieve GHG emission reductions across its land base.

- 12) Pilot test and make early purchases to support Oregon clean energy start-ups.** The state should use its purchasing power to accelerate the growth of Oregon based energy efficiency and clean energy startups through a ‘Pilot and Early Adopter’ program. Start-up companies benefit enormously from case studies documenting successful pilot deployments of their clean technologies to large institutional customers such as state agencies. When the pilots prove the value of the products, the State can help these small companies achieve manufacturing economies of scale with volume purchases. Taxpayers will benefit from lower budgets for energy purchases and more high-paying clean tech jobs.

13) Expand clean energy training and technical assistance programs. Getting Oregon’s workforce trained and ready for a low carbon economy will pay dividends over time. Oregon already has some excellent clean energy training programs for solar and wind installation in our community and four-year colleges. These programs should be expanded. For example, the current workforce to install ZEV infrastructure is limiting . PGE reports that in some areas, “there are not enough electricians, technicians, and engineers, with the necessary skills to install, operate, and manage charging infrastructure and high voltage power,” which can cause project delays.⁴⁹ The Legislature could dedicate funding from COVID 19 stimulus packages to develop a training programs. The training programs should be developed in partnership with the Oregon State Apprentice and Training Council. Any such training programs should include union labor and give priority to diversity and equity in the workforce, including communities of color and historically underserved communities.

Climate Migration

While climatic change poses serious risks to Oregonians, the Pacific Northwest is predicted to be less impacted by climate change than many other parts of the country and the world. More significant climate change impacts elsewhere will likely increase intra-state and inter-regional migration to Oregon. Climate migration has already occurred in several places in the United States. A significant number of people have been displaced within the last three years due to hurricanes and wildfire made more intense due to climate change, including nearly 850,000 people in Houston, Texas by Hurricane Harvey (2017); 180,000 people by the Ventura, California wildfire (2018); and another 200,000 people in Southern California by wildfire (2019).⁵⁰

Climate migrants may bring real benefits—unique skills and cultural diversity and add value to existing communities. However, waves of population growth will create new demands on infrastructure (roads, schools, utility services); housing and housing markets; maintenance of our land use laws that protection of farm and forest lands; and public services. As climate change can occur incrementally (e.g. sea level rise) it also occurs in surges (e.g. extreme weather events; wildfire), so too may the pulses of arriving migrants. Oregon should begin planning for climate-induced migration now.

Recommendation:

14) Direct and fund a state agency to solicit, from the Oregon University System or other qualified suppliers, a proposal to examine the extent to which climate migration may occur; and the demographic, emissions, and geographic consequences to Oregon of substantial population migration occasioned or amplified by the effects of climate change.

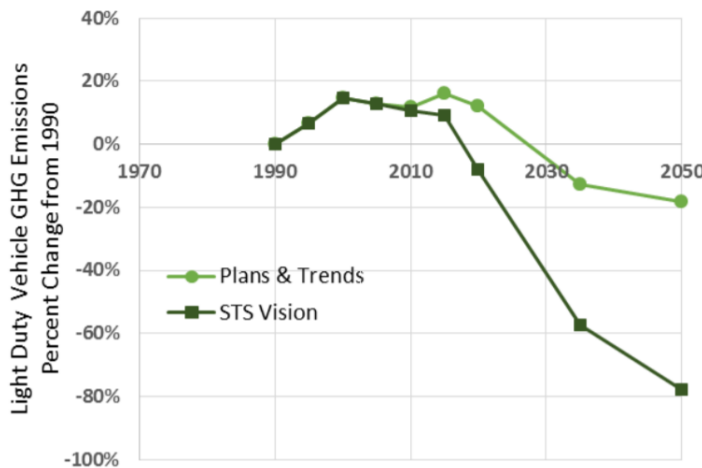
VI. B. Sector Based Recommendations

Transportation

Sound transportation policy and investments are essential for meeting Oregon’s GHG emissions reduction goals, improving air quality and safety in frontline communities, and ensuring a positive economic future for Oregon. Almost 36 percent of Oregon’s total GHG emissions derive from transportation; and almost 25 percent comes from light-duty vehicles (cars and small trucks). Oregon’s proportionate 2020 goal for transportation is approximately 19 million tons, while 2019 transportation emissions clocked in at 23 million

tons of CO₂e in 2019. That’s up from 21 million tons in 1990. As fossil fuel use goes up, so too do health impacts for people in frontline communities. While some advances have been made toward ODOT’s Oregon Statewide Transportation Strategy: A 2050 Vision For Greenhouse Gas Reduction (STS), the 2018 Report Card and growing transportation emissions demonstrate that Oregon is not on track to meet the goals set in the

Figure 8: Transportation Business as Usual projection compared to GHG emission reductions in the State Transportation Strategy vision (Source: ODOT, 2018 Monitoring Report.)



2050 Vision.^{51, 52} We are well behind where we need to be on reducing transportation emissions.

In 2019, the Legislature passed Senate Bill 1044 which established the following targets for zero-emission vehicle (ZEV) ownership in the state:

- 50,000 vehicles by 2020;
- At least 250,000 vehicles by 2025;
- At least 25 percent of registered motor vehicles, and at least 50 percent of new motor vehicles sold annually by 2030; and
- At least 90 percent of new motor vehicles sold annually by 2035.

The state agencies engaged in the ZEV Interagency Working Group report that

Oregon ranks fifth in the nation when it comes to plug-in vehicles per capita. The State of Oregon’s vehicle procurement fleet procurement policies favor acquisition of ZEV and Alternate-fuel or Hybrid vehicles as directed by Executive Order 17-21 and Oregon Fleet Management Policy.^{53 54} However, unfortunately, we are not on track to meet our 2020 goal. As of October 20, 2020, Oregon had 32,389 registered electric vehicles and 1,796 public chargers at 650 locations or stations.⁵⁵ The public can learn about the benefits of ZEV and track progress toward our goal at the [Go Electric Oregon](#) website and on ODOE’s new [Oregon Electric Vehicle Dashboard](#)—an online platform that provides data and analysis of the growing inventory and geographical spread of ZEVs.

In 2019, the Legislature also passed House Bill 2007 which established more stringent diesel standards for medium- and heavy-duty trucks and buses to reduce GHG emissions and co-pollutants in the Portland metropolitan area. The Legislature also passed House Bill 2001 which revised residential zoning to allow increased housing density which is likely to increase the use of public transportation and reduce the number of per capita vehicle miles traveled.^{56, 57}

Last fall, Governor Brown asked ODOT, DEQ, Department of Land Conservation and Development (DLCD), and ODOE to develop a work plan to accelerate implementation of the STS. Governor Brown’s Executive Order (EO) 20-04 further codified this request by directing the agencies to:

- Establish GHG emissions reduction performance metrics;
- Accelerate the generation and aggregation of clean fuels credits by utilities to help advance electrification goals in Senate Bill 1044;
- Complete a transportation electrification infrastructure needs analysis; and
- Amend the Transportation Planning Rule for metropolitan areas and provide technical assistance to incorporate Oregon’s GHG goals in metropolitan area plans.

The agencies created a two-year Every Mile Counts Work Plan in response to these directives as well as their individual agency work plans.⁵⁸ The OGWC is supportive of the agencies taking on all the actions identified in the plan. Of particular note we want to highlight the importance of the: transportation electrification infrastructure needs analysis; DEQ's proposal to adopt new emissions standards for heavy-duty trucks; the metropolitan area scenario and GHG reduction planning rulemaking; and the truck alternative fuels study.

In addition, Governor Brown's EO 20-04 directs DEQ to expand the clean fuels standard; the Oregon Department of Administrative Services (DAS) to develop a procurement model and support rapid conversion of the state fleets for zero emissions vehicles; and ODOT to develop and apply a process for evaluating the GHG emissions implications in the Statewide Transportation Improvement Program (STIP). The OGWC encourages ODOT to work in close partnership with DEQ's materials management team to evaluate how they can reduce GHG emissions associated with road construction and maintenance projects and to work with DAS to modify their procurement policies and requirements.

These are all important steps to start to turn the corner to reduce transportation emissions which should be adequately resourced and advanced as quickly as possible. It is critical that the state leverages resources to support the use of clean vehicles and fuels and reduce vehicle miles traveled per capita. Technological advancements and penetration of ZEVs alone won't be enough to meet emissions goals. We encourage the Legislature to fully fund the necessary follow-on work identified by the agencies. We also need to take steps to help people drive less by strategically redesigning our communities and transportation systems.

The Commission has identified eight actions that need new authorizing legislation, public funding, and/or agency action:

Recommendations:

15) Modify how Oregon funds transportation to increase options for increasing investment in alternative transportation options, reduce impacts on low income Oregonians and ensure adequate maintenance of our roadways. Oregon currently pays for the construction and maintenance of its roadways through three, primary revenue streams: motor fuels taxes, vehicle license/title fees, and highway charges. Use of these funds are constitutionally restricted and must be spent in road rights-of-way. Oregon's current approach to financing transportation creates two problems:

- Reliance on gas taxes as a foundation of transportation construction and maintenance will impact Oregon's ability to fund road maintenance in the future; and road maintenance costs are expected to increase with climate change while revenues will go down as people adopt more fuel-efficient vehicles.
- Second the constitutional restriction limits our ability to invest in alternative transportation options. With the 2017 Transportation Package, the Legislature took steps to improve our flexibility by creating three new funding mechanisms: a privilege tax on car sales to generate funding for ZEV rebates, a bike excise tax to generate revenue for biking and pedestrian projects and a 1/10 of one percent statewide employee payroll tax to fund transit. However, these new funding mechanisms are modest relative to the need for alternative transportation investment needs.

The Legislature will need to come up with a new approach to funding road maintenance. In doing so, the Legislature should build in ways to increase resources to support GHG reduction in the transportation sector and fund alternative transportation options. This should include consideration of a constitutional amendment to further increase flexibility for twenty-first century transportation options and ensure that new funding mechanisms do not overburden low income Oregonians.

- 16) Pass legislation to authorize utilities to increase investments in Electric Vehicle (EV) charging infrastructure.** Portland General Electric did an analysis and determined that the people in their service territory will need five times the number of EV chargers by 2025 and nearly 800 direct current ('DC') fast charging units.⁵⁹ Clarify the authority given to the PUC in Senate Bill 1547 (2016), to allow Oregon investor-owned and consumer-owned utilities to increase their investments in charging infrastructure. In addition, the PUC should allow utilities with flexibility to collaborate and support deployment of infrastructure outside their service territories to simplify their EV customers' experiences when traveling outside the utilities service territory.
- 17) Pass legislation to streamline and speed up State EV charger projects.** DAS reports that currently, "Depending on how project timing and scope change, EV projects can run afoul of regulations around fragmentation or the dollar limits for the types of procurements required, which can add considerable time to procurement timelines if the project goes from informal to formal procurement."⁶⁰ They suggest that increasing the dollar limit for EV projects for legal sufficiency review at DOJ to \$1 million would help expedite all but the largest of projects.
- 18) Expand incentives for ZEV and electric micro-mobility options.** The Oregon Clean Vehicle Rebate Program offers a cash rebate for Oregon drivers who purchase or lease electric vehicles. Managed by DEQ, the program is designed to reduce vehicle emissions by encouraging more Oregonians to purchase or lease electric vehicles rather than gas vehicles. The program provides a Standard Rebate and a Charge Ahead Rebate for the purchase or lease of a new or used battery electric vehicle. To qualify for the Charge Ahead Rebate, the purchaser or lessee must be from a low- or moderate-income household. In the near-term, the program should focus existing funds on low-income individuals and minority-owned businesses. When additional funds are available, the program should be expanded. Incentives should also be offered for electric micro-mobility options that have potential to reduce vehicle miles traveled.
- 19) In rulemaking, the Department of Environmental Quality should consider allowing certain charging infrastructure projects to receive advanced clean fuels credits as a loan to help offset the upfront capital costs.** EO-20-04 directs the EQC and DEQ to develop methods for accelerating the generation and aggregation of Clean Fuels Credits to help advance electrification goals. Typically, clean fuel credits are generated when electricity is dispensed from a charger to an electric vehicle. Under certain circumstances, DEQ should allow credits to be generated in advance to help projects that improve charging access but are less likely to otherwise be economically attractive to project developers. Those credits could be monetized towards the beginning of a project rather than later and help defray high initial capital costs. This kind of provision would provide certainty to project developers about revenue available from the sale of clean fuel credits. Special attention should be made for transit agencies and school districts who want to electrify their bus fleets.

- 20) The Building Codes Division and local jurisdictions should accelerate the process for adoption of new building codes to require all new garage structures to be pre-plumbed during construction for conduit that can support recharging at all parking spaces and develop rules for including charging infrastructure in existing building stock.** In response to EO 17-20, the Building Codes Division (BCD) has indicated they will add this requirement to residential building codes by October 1, 2022. It is much cheaper to install charging infrastructure during construction than to retrofit buildings later. The longer we wait, the greater the building retrofit burden we will face.
- 21) Track and ensure that ODOT is focused on reducing GHG emissions from project investment decisions via all mechanisms.** As directed by the Executive Order, the ODOT Climate Office is applying a GHG lens to inform all major programming and project decisions, starting with the 2024-2027 STIP that is currently being developed. The OGWC would like to see significant reductions in overall GHG emissions from past STIP performance.

Built Environment and Utilities

Today, the “built environment”—residential, commercial, and industrial buildings—are responsible for a significant amount of GHG emissions nationally and in Oregon. These emissions primarily come from energy use for heating and cooling systems, appliances, and lighting. Energy efficiency measures, which require less energy input to provide a desired service, are by far the cheapest way to reduce emissions in the built environment, as well as in other sectors. Energy efficiency measures also provide large co-benefits. For example, from 2002 to 2019, investments of \$2 billion dollars in energy efficiency programs by Oregon’s investor-owned utilities added \$8.3 billion to Oregon’s economy, supporting 1,900 local businesses.⁶¹ These investments have saved rate payers \$8.2 billion on their utility bills and reduced carbon dioxide emissions by 32.7 million metric tons, the equivalent of removing more than 7 million cars from the roads in a single year.⁶²

Recent legislation (e.g., Senate Bill 2496), EO 17-20, and EO 20-04 set a goal of putting Oregon’s residential and commercial energy codes on an energy efficiency path to reduce regulated energy loads in new buildings by 60 percent 2030, while Senate Bill 2618 provides rebates to reduce the cost of solar power/storage and Senate Bill 98 allows natural gas utilities to recover prudently incurred qualified investments in renewable natural gas purchases for distribution to retail natural gas customers.^{63,64} EO 20-04 directs ODOE to update energy efficiency standards for products equivalent to at least the most stringent standards among West Coast jurisdictions. While EO 17-20 addresses grey water, energy and water efficient building equipment, solar-readiness, and electric charging enabled spaces, industrial manufacturing and process loads are not regulated by code.

Although Oregon’s energy code sets energy efficiency standards that help reduce emissions, Oregon does not have specific goals or codes to reduce the carbon intensity of buildings, as strongly recommended by C40 and the World Green Building Council. Currently, GHG emissions embodied in building materials—released during the production, use, and/or disposal of materials—are responsible for a significant amount of emissions (11 percent of annual global emissions and 8 percent of Oregon’s emissions). Addressing the embodied carbon of building materials is critically important, because these emissions are already produced before a building begins operation. Utilizing data from the United Nations and U.S. Energy Information Administration, a study by Architecture 2030 indicates that 49 percent of total carbon emissions from new construction by 2050 will be attributed to the embodied carbon of building materials. Between 2020 and 2030, this proportion rises to 74 percent, highlighting the urgency in addressing near-term GHG emissions through measurement, disclosure, and ultimately, restrictions to draw down the carbon intensity of the built environment.⁶⁵

Although DEQ has taken some actions to reduce embodied GHG emissions in new construction of state buildings on select state projects (associated with the directive from EO 17-20), a state-wide goal and supporting incentive programs are needed.

Finally, utilities play an important role in decarbonizing the built environment. Programs and investments—supporting large renewable resources, community solar, microgrids, and demand response, among others—are needed to support our state’s transition to a clean energy future.

Recommendations:

22) Establish stronger codes and incentives to reduce GHG emissions in new and existing buildings.

Exponentially increasing the number of low- and zero-emissions buildings is time-sensitive. The longer we wait, the fewer such buildings will populate our communities in the coming decades. An estimated 80 percent of the buildings that will be using energy in 2050 are already in place today; and every new high-emitting building will hamper our ability to reach the state’s 2035 and 2050 greenhouse gas reduction goals. (Also see the Waste and Materials Management section below).

The state should establish a goal for achieving a certain percentage of new buildings to be ‘net-zero’ carbon buildings, meaning that the operation (and ideally construction) thereof is responsible for minimal carbon dioxide emissions, and any remaining emissions are offset by carbon sequestration. Net-zero buildings are designed and equipped so that all their energy use (e.g., for heating, cooling, lighting, appliances, vehicles charging, etc.) is highly efficient and comes from renewable (non-carbon dioxide emitting) energy sources. A statewide definition of zero-emissions building should be developed along with the state goal (e.g., to distinguish if offsets from onsite generation of electricity are allowable).

More incentive programs should be established for both existing and new buildings to minimize GHG emissions resulting from operations (e.g., appliances) and building materials. Equipment installed in existing buildings that is failing or near end-of-life should be replaced with “smart”/grid-connected equipment, like heat pumps and water heaters, which can be used to integrate renewable resources. Meanwhile, supporting programs, such as net metering and community solar, should be advanced to help increase the number of low- and zero-emissions buildings in the state.

23) Establish a framework for measuring embodied carbon for both whole building and specific building materials.

A consistent reporting framework should be set for measuring and disclosing the amount of embodied carbon in building materials. Developing a framework would create consistent and comparable information that can be used in the development of a carbon intensity standard (CIS), which would then set limits and reduction standards for embodied carbon of building materials. The implications are significant due to the high proportion of building GHG emissions attributed to the embodied carbon of building materials. One material, concrete, is the second most used substance in the world and cement (concrete binder), alone, accounts for 5 percent to 6 percent of global GHG emissions. Less carbon-intensive alternatives to cement, like fly ash and slag, can significantly reduce the amount of emissions released in the production of concrete. These alternative materials are already widely available on the market. Additionally, due to market demand, manufacturers of all types of building materials are providing Environmental Product Declarations (EPDs) making the environmental impacts of their products transparent. EPDs

enable building design and construction teams to select less carbon intensive building materials and draw down the embodied carbon intensity of their products.

24) Codify the new appliance energy efficiency standards developed by ODOE. In August 2020, as directed in EO 20-04, ODOE submitted final rules for appliance energy efficiency standards. Notably, these include the requirement that all electric water heaters manufactured on or after January 1, 2022 and sold in Oregon include a common communication port to enable grid-connectivity. Grid-connected devices—such as water heaters, that customers can voluntarily enroll into demand response programs—are critical tools that will help achieve Oregon’s GHG reduction targets because they promote smarter energy use and support integrating variable renewable resources onto the electric system. The Oregon State Legislature should pass legislation putting the new appliance energy efficiency standards in statute in the 2021 Legislative Assembly. The Legislature and the ODOE should continue to update appliance standards and building codes to maximize energy efficiency and reduce GHG emissions.

25) Mandate that 100 percent of the state’s electricity comes from carbon neutral energy sources by 2045 or 2050. There is growing interest in transforming electrical generation to be 100 percent emissions free. Since 2018, California, Colorado, Maine, Nevada, New Mexico, New York, Puerto Rico, and Washington legislatures have all passed bills aimed at making their state's electricity sector carbon free by 2045-2050. A 100 percent clean electricity grid can help build a clean energy system through electrification of end-use demand (e.g., heating and transportation), and producing fuels from electricity like hydrogen and synthetic natural gas.

Achieving 100 percent carbon free or an ambitious carbon neutral goal will require a strong eye toward maintaining resource adequacy, reliability, and affordability. Diverse strategies that include continuing energy efficiency; increased deployment of clean electricity generation, storage, and transmission infrastructure; market reforms, and significant investment in emerging technologies like carbon capture and sequestration for natural gas-powered facilities, long term storage, and zero carbon fuels such as renewable hydrogen.

The Commission supports legislation aimed at getting Oregon’s electrical supply to as close to a 100 percent zero-carbon as feasible recognizing that the last 10 to 20 percent will be challenging. This may require the use of resources that are sometimes identified as carbon neutral, but are not carbon free such as biomass, renewable natural gas and renewable hydrogen. If the legislature allows some resources that are carbon neutral, it will be important that the carbon neutral resources be determined on scientifically sound life cycle analyses.

Legislators, ODOE and/or the Northwest Power and Conservation Council will also need to consider and adaptively manage environmental, economic, and community factors that should be considered in determining how much new renewable generation can and should be built in state; barriers to building new transmission facilities; and challenges associated with modernizing smart grid with non-wire alternatives, including distributed energy.

26) In partnership with the PUC, utilities should design and deploy smart grid-enabled neighborhood-located microgrids to increase grid resilience. A network of well-planned microgrids is an important part of a reliable clean energy future as it supports decarbonization, makes the region more resilient against disruption, and supports communities during an emergency. Microgrids

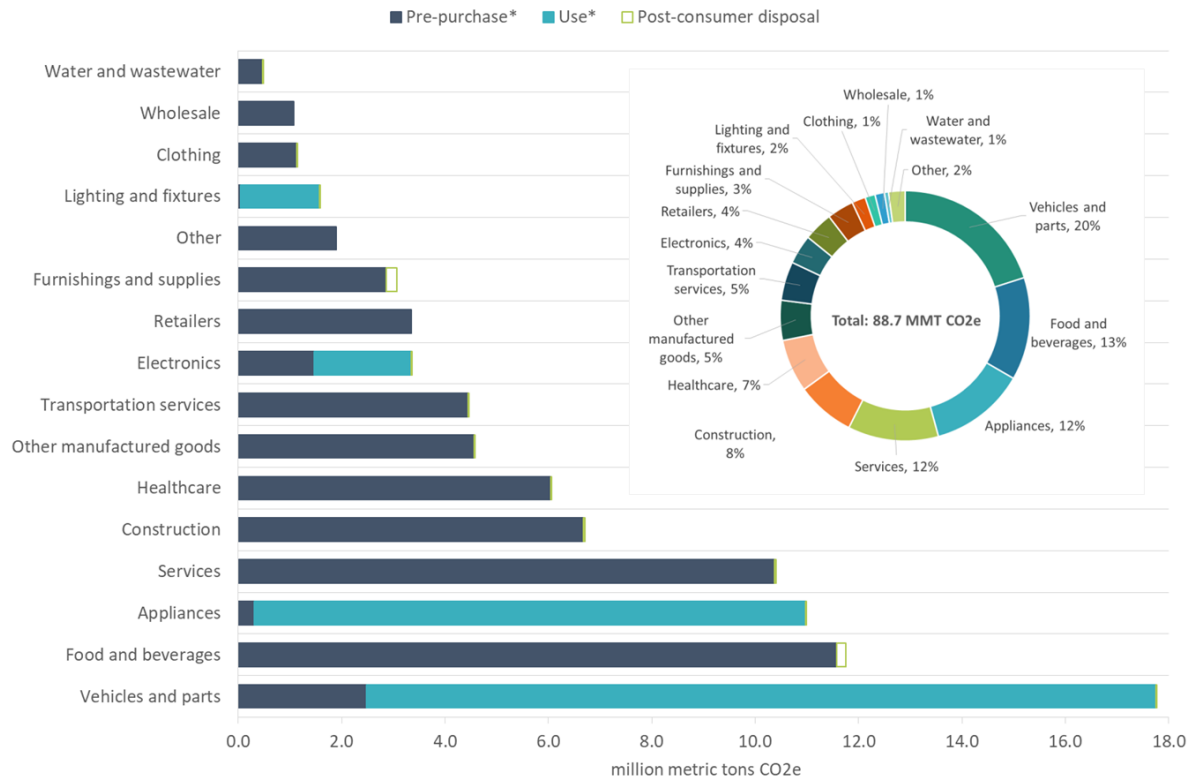
should be designed to be grid connected, which supports the integration of renewable energy sources, and be able to self-supply as an island during emergencies or outages to provide local resiliency. This technology can help manage the grid more efficiently and integrate more renewable resources. Utilities should increase the number of microgrids with smart design features and prioritize their implementation in areas with disadvantaged and rural communities, locations susceptible to outages, and locations of public significance. The PUC should work with utilities to identify avenues to rate-base this resilience investment. As described in the proposed Senate Bill 1537 from the 2020 Legislative Session, the Oregon Office of Emergency Management should also identify critical staging areas for emergency response; this would allow other partners to help provide these key locations with necessary resources for electric power in an emergency.

- 27) Support efforts to eliminate coal from the electricity supply before 2027.** The Oregon Clean Electricity and Coal Transition Plan (Senate Bill 1547), which passed during the 2016 Legislative Assembly, mandated that Oregon utilities eliminate coal fired resources from electricity they supply by 2030. In 2020, PGE closed the only coal plant in Oregon. Despite the closure, coal will continue to be a prominent resource in Oregon’s electricity mix for a decade without further action. To facilitate this transition, the Legislature and PUC should take any appropriate steps needed should adopt legislation to help support and smooth the costs of the transition for utility customers.
- 28) Authorize the Public Utility Commission to consider differential energy burden and other inequities in setting rates.** In 2017, the legislature passed Senate Bill 978 to examine investor-owned utilities regulation and trends. In 2020, House Bill 4067 was introduced to implement the equity and affordability recommendations developed by community advocates with support from PUC staff, utilities, and traditional regulatory stakeholders engaged in the process established by Senate Bill 978. The bill would have allowed the PUC to design different rate structures, such as discounts, for low-income customers. The legislature should pass a similar bill in 2021.

Materials Management

Oregon was the first state in the nation to develop a consumption-based GHG emissions inventory.⁶⁶ Led by DEQ’s Materials Management Program, this inventory reports the full life cycle emissions from resource extraction to the end-of-life management, including solid waste disposal and recovery –for the products and services Oregonians consume (Figure 9). The consumption-based inventory is updated every five years. A detailed description of DEQ’s methodology for both inventories can be found in [Appendix A&B](#) of their 2018 report on Oregon’s [Greenhouse Gas Emissions though 2015](#).^{67, 68}

Figure 9: 2015 Oregon- consumption-based greenhouse gas emission by category and life-cycle stage.



* "Pre-purchase" are all emissions that occur prior to final purchase, including production, supply chain, transport, retail and wholesale. "Use" refers to emissions resulting from the use of vehicles, appliances, electronics and lighting. Other categories (e.g., food and clothing) have use phase emissions that are accounted for elsewhere. For example, emissions from cooking and laundering are both assigned to the category of "appliances", which include ranges and clothes dryers.

The consumption-based emissions inventory highlights additional important areas Oregon needs to address to reduce our carbon footprint. The top five categories in Oregon’s consumption-based emissions inventory include: Vehicles, Food and Beverages, Appliances, Services (e.g. Legal, Real Estate and Insurance; Entertainment and Media, Education and Daycare), and Construction. For vehicles and appliances most of the emissions come from their use emphasizing the importance of transitioning to zero emission vehicles and improving appliance energy efficiency standards discussed elsewhere in this report. For food and beverage and construction most of the emissions come from their production, supply chain, and transport.

DEQ created a [2017 Food Waste Reduction Strategy](#) that includes activities such as partnering with the Oregon Green Schools, the Oregon Restaurant and Lodging Association and the Pacific Coast Collaborative to reduce systemic and institutional waste and advancing residential campaigns to elevate awareness of impacts of food waste. The Governor built on this strategy in EO 20-04 by setting a state goal of reducing food waste by 50 percent by 2030. The EO directs DEQ to work with state agencies, local jurisdictions, industry, food retailers, and brand manufacturers to develop and implement strategies to prevent and recover food waste. EO 20-04 also directs DEQ to develop rules for regulating landfill methane emissions; it further directs DEQ to design the new rules to be as stringent as standards in states bordering Oregon.

In addition to reducing food waste, some significant opportunities exist to reduce emissions from other materials and services purchased by households and government, such as building materials, travel, electronics, furniture, and clothing. As a large institutional purchaser, the state can reduce emissions associated with the goods and services it purchases through modification of procurement policies and

programs. DAS recently submitted a plan for reducing emissions through improved state procurement procedures.⁶⁹ Given the state's purchasing power, changing state procurement policies can help drive changes in product design and formulation. DAS proposes to align the state's procurement goals with the emission reduction goals in EO 20-04. They have identified a specific set of metrics to help track progress to these goals.

Recommendations:

- 29) Pass legislation to restrict the use of Hydrofluorocarbons (HFCs) in new products sold in Oregon. When funds are available, establish a comprehensive inspection and enforcement program to reduce leaks in refrigeration and heating and cooling systems.** HFCs used in refrigeration and heating and cooling systems are extremely potent greenhouse gases that last in the atmosphere for 10-20 years. The U.S. Climate Alliance, a bipartisan group of 25 Governors have committed to reducing short-lived climate pollutants, including HFCs.⁷⁰ In the past year, eight U.S. Climate Alliance states have passed legislation or committed to issue new regulations to curb specific HFC uses. In 2020, Representative Fahey introduced legislation to prohibit products that use or contain hydrofluorocarbons from sale in Oregon. The OGWC supports passage of legislation in the 2021 session banning the sale of new products in Oregon that use certain HFCs. DEQ reports that "many types of existing systems that use these chemicals release an estimated 25-35 percent of their capacity to the atmosphere annually." The Legislature should dedicate funding from any COVID 19 stimulus package or create other funding mechanisms to develop a comprehensive inspection and enforcement program for both mobile and stationary sources to reduce leaks in refrigeration and heating and cooling systems.
- 30) Expand DEQ's grant program to support and expand reuse and repair businesses and non-profit organizations in Oregon.** The rapid turnover in manufactured goods represents a growing source of emissions. The Legislature should dedicate state funds or federal funding from any COVID 19 stimulus package to expand DEQ's grants to support reuse and repair businesses. DEQ reports that, "making repair and reuse convenient and cost-effective for households will help to rebuild the repair economy, provide access to affordable goods, and preserve important capacity for resilience in times of supply chain disruption." Any grant-supported projects should include union labor and give priority to diversity and equity in the workforce including communities of color and historically underserved communities. The Legislature should also pass a "Right to Repair" policy to remove barriers to consumer repair of the products they own.
- 31) Support Department of Administrative Service's (DAS) efforts to include GHG emission reduction measures in Oregon Buys, the state's procurement process.** Government procurement comprises approximately 10 percent of Oregon's statewide consumption-based GHG emissions.⁷¹ In their September report to the Governor, DAS catalogued the existing laws and EOs already in place in Oregon to encourage more sustainable procurement, however they report that "it is not clear to what extent these directives have been implemented by state agencies, and to what degree of impact."⁷² DAS proposed a set of outcome and activity measures they will use to evaluate progress toward improving procurement procedures to reduce GHG emissions. The OGWC supports DAS's identified need for increased capacity to implement the procurement recommendations in a timely manner and funding for a consultant to assist with development of new sustainable design guidelines for carbon neutral-ready buildings. DAS also recommends establishing a centralized program to fund and assist agencies with installation of chargers to improve the state's ability to meet fleet electrification goals. DAS reports that they are evaluating legislative concepts and

administrative rules to support further GHG reductions in procurement including requiring use of Environmental Product Declarations (EPDs) to lower the GHG impacts of purchased building materials as California has done through the Buy Clean Act (AB 262); and new statutes to give preference to lower carbon products. The Legislature should work with DAS to identify the best legislative approaches to reduce emissions from governmental procurement in Oregon.

Natural and Working Lands

The IPCC's Global Warming of 1.5°C Special Report emphasized the urgency of climate action and the important role the land sector can and must play as part of a comprehensive climate mitigation strategy. The land sector already reduces total U.S. emissions by 12 percent.⁷³ Recently published research estimates that we could reduce total U.S. emissions by an additional 18 percent through policies and programs that help avoid conversion of natural and working lands (NWL) to development, restore native habitats, and modify management practices on working lands to store more carbon.⁷⁴ With Oregon's carbon dense westside forests, diverse and productive agricultural and range lands, and high-carbon tidal wetlands, we have the potential to make a significant contribution to climate mitigation through these NWL pathways—many of which provide a wide array of complimentary economic, health, and environmental benefits.

In EO 20-04, Governor Brown directed the OGWC to submit a proposal for the Governor's consideration regarding the adoption of state goals for carbon sequestration and storage in Oregon's NWL in coordination with the Oregon Departments of Forestry (ODF) and Agriculture (ODA) and the Oregon Watershed Enhancement Board. The OGWC has also requested assistance from DEQ and DLCD. Our report is due no later than June 30th, 2021.

In July 2020, the Commission adopted the following principles and scope of work for the development of recommendations for Governor Brown:

Principles:

- The process will be inclusive and transparent and provide opportunities for broad public engagement and coordination with other Boards and Commissions.
- The inventory, baseline and projection methods will be based on guidance from the Intergovernmental Panel on Climate Change (IPCC) and the best available science.
- The proposed goals and practice, program and policy recommendations will:
 - Prioritize consideration of benefits to Climate Impacted Communities,
 - Consider landowner, land manager, and community interests in policies, practices, and programs,
 - Include provisions to ensure a diversity of landowners and managers can participate in any potential market and incentive-based programs and provide meaningful climate benefits, and
 - Consider co-benefits—additional societal benefits occurring from an action—that may be relevant for other state goals.

Scope of Work:

- **Create a technical and public engagement work plan.** The Commission will engage carbon accounting, inventory methodology, and policy and practice experts both inside and outside the agencies to advise the OGWC on best practices for reducing emissions and increasing sequestration in the land sector. In addition, as we have already seen in public comment, increasing sequestration in

NWL is of interest to a diverse set of stakeholders. Creating both a technical and robust public engagement work plan will be important to developing a well-rounded proposal for Governor Brown.

- **Identify existing land sector GHG emissions and sequestration data (i.e., an inventory of the sector’s various contributing emissions sources and sinks), priority inventory improvements, and methods for setting a baseline, developing a business-as-usual projection and monitoring progress against the business-as-usual projection.** Currently, the state’s two GHG inventories (sector- and consumption-based) provide a more comprehensive understanding of the state’s contributions to climate change and of the actions Oregon takes to reduce state-wide emissions. However, neither inventory includes biogenic emissions and removals from, and in, vegetation and soils.

Including NWL in Oregon’s GHG inventory and reporting will complete the picture of Oregon’s emissions inventory and allow us to inform policies and programs to reduce emissions. The IPCC has developed methods for inventorying emissions and removals from what they refer to as “Land Use, Land-Use Change and Forestry (LULUCF).”⁷⁵ The EPA follows the IPCC’s methods to assess the U.S. land sector emissions annually. These methods can be applied at the state level as well.

Key to the quality of any inventory is the quality of the available data. Data for carbon dioxide emissions and removals in forests in Oregon are fairly well-developed through the U.S. Forest Services Forest Inventory and Analysis (FIA) program. Data on emissions and removals from agricultural lands, rangelands, and wetlands are much more limited. However, the Natural Resources Conservation Service, Oregon State University, and the American Farmland Trust, among others, have data and tools to improve estimates of emissions and removals on agricultural lands. The Pacific NW Blue Carbon Working Group also recently published a paper on coastal and marine carbon stocks.⁷⁶ All of these resources will be used to aid us in developing an improved baseline, projections, and identify additional inventory needs.

- **Identify potential policies, programs, and practices that could be advanced to reduce emissions and increase carbon storage and sequestration on natural and working lands.** Reducing emissions and increasing sequestration in the land sector can be achieved through a variety of policies and programs that help support the prevention of land conversion, incentivize changes in management practices, and the support the restoration of ecosystem carbon. In 2018, the Oregon Carbon Policy Office convened a NWL Workgroup to identify potential practice, program, and policy options for increasing sequestration in the land sector. The Carbon Policy Office provided a report to the Legislature’s Joint Committee on Carbon Reduction in December 2018 on the Workgroup’s findings.⁷⁷ The Department of Agriculture and the Oregon Watershed Enhancement Board provided a framework for agricultural incentive programs that could be adopted.⁷⁸ The recommendations in these reports provide a starting point for identification of practice, policy, and program options. In addition, several states in the US Climate Alliance have or are in the process of developing action plans for increasing sequestration in NWL. The OGWC will evaluate these plans to identify additional options for reducing emissions and increasing sequestration in natural and working lands.
- **Develop and finalizing a proposed goal and a process for including Natural and Working Lands into Oregon’s climate mitigation plans.** Several existing resources are available to assist the Commission with the development of a proposed NWL carbon sequestration goal. In 2018, the OGWC produced a Forest Carbon Accounting Project Report working with the U.S. Forest Service and Oregon State University scientists.⁷⁹ The report was based on FIA data managed by the Pacific Northwest Research Station. ODF built on the OGWC’s report and completed the Forest Ecosystem Carbon Inventory

report in 2018.⁸⁰ ODF is nearing completion of a second study focused on assessing carbon stocks in harvested wood products and an evaluation of sawmill energy use. Both can help inform our assessment of potential goals. In 2018, the OGWC asked ODF to provide an assessment of the overall carbon consequences of timber harvest by synthesizing information in both reports to analyze stocks and flux changes in the forest ecosystem as well as the GHG emissions from the transport and manufacturing as well as carbon storage in wood products, implications of different disposal methods and the substitution benefits compared to use of other materials.

Several additional research projects have estimated the emissions reduction and removal benefits that have, or would, result from policies and land management practices, including:

- [Cathcart et al. 2007](#) (regarding Oregon land use laws and forests);⁸¹
- [Latta et al. 2016](#), [Diaz et al. 2018](#), [Franklin, Johnson and Johnson 2018](#), and [Law et al. 2018](#) (all regarding forest management practices); and ^{82 83 84 85}
- [Graves et al. 2020](#) (regarding twelve practices across all natural and working land types).⁸⁶

Tools the Natural Resources Conservation Service and the American Farmland Trust have developed will also be used to help develop a proposed emission reduction and removal goal for NWL.

In addition to developing a proposed goal, the OGWC will propose how the NWL goal should be managed in relation to the state's other GHG emission reduction goals. There are added complexities to consider in managing to a NWL goal. The land sector can be a carbon storage reservoir or "sink" as well as a carbon emissions source. In addition, carbon "stocks" (the total amount of carbon stored at any point in time) and "fluxes" (the change in carbon storage between time A and time B) can be affected by natural processes as well as changes in land use and management. Both factors need to be considered in setting a goal and in determining how to manage toward the goal.

A preliminary outline and timeline for the work plan was presented at the OGWC's July 28th, 2020 meeting. The OGWC will post information about the process, how to engage in it, as well as technical and policy resources on our [Keep Oregon Cool](#) website.

Recommendations:

- 32) Support a package of funding to enhance Oregon's NWL Inventory.** The current inventory data needs to be augmented to adequately track emissions and removals from NWL. While FIA data provide a good start for assessing carbon stocks and fluxes in Oregon's forests, currently these data are not adequate enough on private and state lands to assess carbon flux very precisely. ODA has proposed a Policy Option Package for the 2021-2023 budget to fund OSU to complete soil health datasets for the rest of the state (datasets already exist for agricultural soils in several regions of the state). Building a soil health data set for agricultural soils in Oregon would assist with NWL goal setting and refinements. Additional analysis of blue carbon potential is also needed. The Commission will have an assessment of costs for such improvements early in the 2021 Legislative Session.
- 33) Prioritize advocating for federal action to improve NWL carbon accounting and implementation in states.** Added federal investments are also needed to improve NWL data and inventories. Complimentary federal investment in NWL data and inventories would reduce state by state costs and maintain greater consistency in NWL reporting across the country. Such investments could include investments in remote sensing tools, including LiDAR, expansion of the FIA program, and

reinstitution of soil carbon sampling in the National Resources Inventory field plots. The state should also advocate for including NWL implementation investments in any COVID 19 stimulus package including boosting technical and financial resources provided to states to develop and implement state programs for NWL practices.

VII. Conclusions

As demonstrated in this report, the experienced and projected effects of climate change and the secondary effects they trigger are impacting Oregon—undermining human health and safety, hindering economic growth, and damaging natural resources. Extreme weather events associated with climate change alone are putting pressure on our transportation, drinking water, wastewater, and energy systems by increasing maintenance costs, interrupting businesses, and putting people’s safety at risk. Our recommendations for action aim to reduce the disproportionate impacts that climate change has on communities—particularly including low-income, Black, Indigenous, and rural households.

Oregon is highly unlikely to meet the state’s 2020 emissions reduction goal, let alone the 2035 and 2050 goals without it. The IPCC has made it abundantly clear that ambitious action is an urgent need. To avoid the worst impacts of climate change and achieve the benefits, Oregon needs to take more aggressive climate mitigation action. Governor Brown’s EO 20-04 is an important start, but new policy advances and constant vigilance are needed to ensure that the agencies have the resources and authority to achieve the state’s greenhouse gas reduction goals.

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