2016 CORVALLIS CLIMATE ACTION PLAN ISSUE PAPER NO. 1:
BACKGROUND FOR DEVELOPMENT OF LONG-TERM AND INTERIM GREENHOUSE GAS EMISSIONS REDUCTION TARGETS FOR CORVALLIS
(*DEVELOPMENTAL DRAFT UPDATED 3-23-16 BASED ON GOOD COMPANY-CLIMATE SCIENTIST REVIEW, AND 2-2-16 ACTION BY THE CATF***)**

ISSUE:

As part of the foundation for development of a community climate action plan (CAP) for Corvallis, the City Council-appointed Climate Action Task Force (CATF) is recommending establishment of a greenhouse gas (GHG) reduction target (or targets). This issue paper provides a science-based context, as well as background on the global, national, state and other local efforts to address GHG reduction targets. Three potential frameworks for determining GHG emissions reduction targets are discussed in this paper as points of reference and a context for the CATF's consideration of a target for the Corvallis CAP. The CATF reviewed the matter at its February 2, 2016 meeting and set a recommended preliminary target and interim targets in alignment with the targets set by the State of Oregon.

BACKGROUND:

Summary of Scientific Conclusions:
According to the UN administered Intergovernmental Panel on Climate Change (IPCC)[1], which is recognized globally as the leading authority on climate change, warming of the climate system is "unequivocal," human influence is clear, and recent human-caused (anthropogenic) emissions of GHGs (primarily carbon dioxide) are the highest in history.[2] Recent unprecedented changes in the climate have had widespread observed impacts on human and natural systems, such as:

- Warming of the atmosphere and oceans, changes in weather patterns, increased drought and wildfires;
- Acidification of the oceans and resulting loss of aquatic life and damage to fisheries;
- Rising sea levels and resulting hazards to and displacements of communities; and
- Diminishing snowpack and glaciers leading to loss of fresh water supplies for drinking and irrigation.

The Industrial Revolution marked the beginning of the dramatic increase in anthropogenic GHG emissions. Between 1880 and 2012, global average temperature increased by approximately .85° centigrade (C).[3] Since the 1950s, the rate of change of anthropogenic GHG emissions has increased dramatically. Similarly, the rates of increase in global average temperature and sea level have accelerated. The IPCC estimates that over half the increase in global average temperature during this period was due to anthropogenic causes, predominantly resulting from increased fossil fuel combustion related to economic and population growth.[4]

Warming can also be accelerated by the loss of natural carbon sinks and positive feedback loops. While carbon dioxide accumulates in the atmosphere and ocean, the Earth's biome has the ability to sequester some of this carbon in soil, plants and trees. However, human and climate induced forest and wetland loss are decreasing the capacity of this type of carbon sequestration. Positive feedback loops accelerate

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[1] The Intergovernmental Panel on Climate Change (IPCC) is the leading international body for the assessment of climate change. It is a scientific body representing the collective scientific review and input of thousands of scientists world-wide, under the administration of the United Nations. IPCC assessments provide a scientific basis for governments at all levels to develop climate-related policies. See IPCC - Intergovernmental Panel on Climate Change
[2] Climate Change 2014—Synthesis Report: Summary for Policymakers; IPCC; 2014; p.2
[3] Climate Change 2014—Synthesis Report: Summary for Policymakers; IPCC; 2014; p.2
[4] Climate Change 2014—Synthesis Report: Summary for Policymakers; IPCC; 2014; pp. 3-5

warming. For example, the increase in dark surface area (which absorbs sunlight more readily) due to the loss of large areas of more reflective ice and snow leads to increased heat absorption, causing further ice and snow loss and warming.

Reducing GHG emissions now can mitigate, but will not stop significant warming from affecting natural and human systems for a long period of time. Based on existing atmospheric GHG concentrations and emissions at today's levels, a study of likely consequences of climate change in the Upper Willamette River Basin identified several important changes that are expected to affect communities in that geographic region. These include:

- Increased average annual temperatures of 6° to 8° F (~3°-4° C) by the end of the century;
- Reduced snowpack and resultant lower and warmer stream flows in summer;
- Increased demand for water for agricultural uses;
- Reduced hydroelectric power generation capacity (due to lower stream flows in summer) and increased summer demand for electricity;
- Increased storm intensity, flooding, wildfires and landslides
- Higher rates of heat-related illness, exhaustion, asthma, and respiratory diseases.[5]

While GHGs are usually expressed as Carbon dioxide (CO_2) and CO_2 equivalents (CO_2e), the following gases and groups of gases are of primary concern for their effects on global temperatures and are named in The Kyoto Protocols:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulfur hexafluoride (SF_6)
- Nitrogen trifluoride (NF_3)

Given its proximity to the Upper Willamette River Basin study area, the Corvallis community can reasonably expect similar impacts locally. "Climate Change in the Northwest—Implications for Our Landscapes, Waters, and Communities" (2013) provides a detailed analysis and conclusions about key regionally consequential risks and anticipated impacts in the Northwest.[6]

The IPCC has concluded that "the risks of abrupt or irreversible changes will increase as the magnitude of the warming increases,"[7] and that GHG concentrations must be reduced in order to stabilize climate conditions and avoid passing catastrophic tipping points. To accomplish this, dramatic reductions in human-generated GHG emissions are needed. Adaptive and risk-management measures also are necessary to address the increasing problems and risks associated with the climate changes that already have and will continue to occur.

There is scientific consensus that the global average temperature increase (above pre-industrial temperatures) must be capped at 1.5°-2.0° C in order to avoid catastrophe climate change. If no action is taken, referred to as "business as usual", global average temperature will increase at least 4°C by the year 2100. In order to cap the global temperature increase to 2.0° C, atmospheric concentrations of GHGs would have to decrease from current levels, which exceed 400 parts per million (ppm), to about 350 ppm. The longer CO_2 concentrations remain at greater than 350 ppm, the greater the risk that excessive and rapid warming will exceed levels that human social systems and infrastructure are prepared to handle.

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[5] Preparing for Climate Change in the Upper Willamette River Basin of Western Oregon: Co-Beneficial Planning for Communities and Ecosystems;" US Department of Agriculture, Climate Leadership Initiative, and National Center for Conservation Science and Policy, 2009. http://static1.1.sqspcdn.com/static/f/551504/6420038/1270512823240/willamette_report3.11FINAL.pdf

[6] Dalton, M. M., Mote, P. W., Snover, A. K., [Eds.]. 2013; "Climate Change in the Northwest—Implications for Our Landscapes, Waters, and Communities," Washington D.C: Island Press. http://cses.washington.edu/db/pdf/daltonetal678.pdf

[7] Climate Change 2014—Synthesis Report: Summary for Policymakers; IPCC; 2014; p. 16

Therefore, in addition to dramatic reduction in future GHG emissions, CO_2 currently concentrated in the atmosphere must be removed and sequestered through reforestation or yet-to-be invented technologies.

Global, National, and State Context for GHG Emissions Reduction Goals:

Nations around the world, as well as states and local governments around the U.S., began to focus on GHG emissions reduction targets over twenty years ago. In 1993 the United Nations Environment Program and the International Council for Local Environment Initiatives (ICLEI) initiated the Cities for Climate Protection Campaign to facilitate GHG emissions reductions at the local government level. The first global pact—the Kyoto Protocol—was ratified by 141 countries in 2005. The information below describes the current global, national and state context, and provides examples of targets from Oregon communities that have enacted plans to combat climate change. While not an exhaustive inventory, this information is intended to help frame a range of alternatives for consideration in setting a community target for Corvallis.

Global:

The 2015 United Nations Climate Change Conference, held in Paris, resulted in a negotiated agreement on the reduction of climate change, which was adopted by consensus on December 12, 2015 by all 195 participating nations and the European Union. The agreement is driven by a science-based limit of global warming to 2°C above pre-industrial levels. In addition, wording was added to the agreement to stress a "best effort" of participating nations to limit warming to 1.5°C. Nations around the world submitted GHG reduction commitments for interim target dates ranging from 2025 to 2030 in order to ensure they establish a reduction trajectory that can ultimately lead to achievement of the 2050 targets. While the agreement states this 2°C limit as motivation, the Intended Nationally Determined Contributions (INDC), or voluntary pledges of emissions cuts by nation, are projected to limit average global temperatures to 2.7°C warming.[8] Examples of commitments submitted by several countries to the United Nations Framework Convention on Climate Change (UNFCCC) in advance of the Paris Conference are provided in Figure 1 below.

Figure 1. Intended Nationally Determined Contribution (INDC) (to GHG reductions)—Select Countries Submittals to the UNFCCC prior to the 2015 Paris Climate Change Conference

Country	Target Emissions Reduction	Year Target Reduces Below	Year to Achieve Target
United States	--26-28%	2005	2025
European Union	40%	1990	2030
Norway	40%	1990	2030
Switzerland	50%	1990	2030
Mexico	25-40%	2013	2030
United Kingdom	50%	1990	2027
Germany	40% 55%	1990 1990	2020 2030

According to the Climate Action Tracker (CAT), the INDCs submitted to the UNFCCC by the end of 2015 represent 187 countries, which comprise 98% of the global population and about 95% of global GHGs. Another 3% of global GHG emissions come from global air travel and shipping.

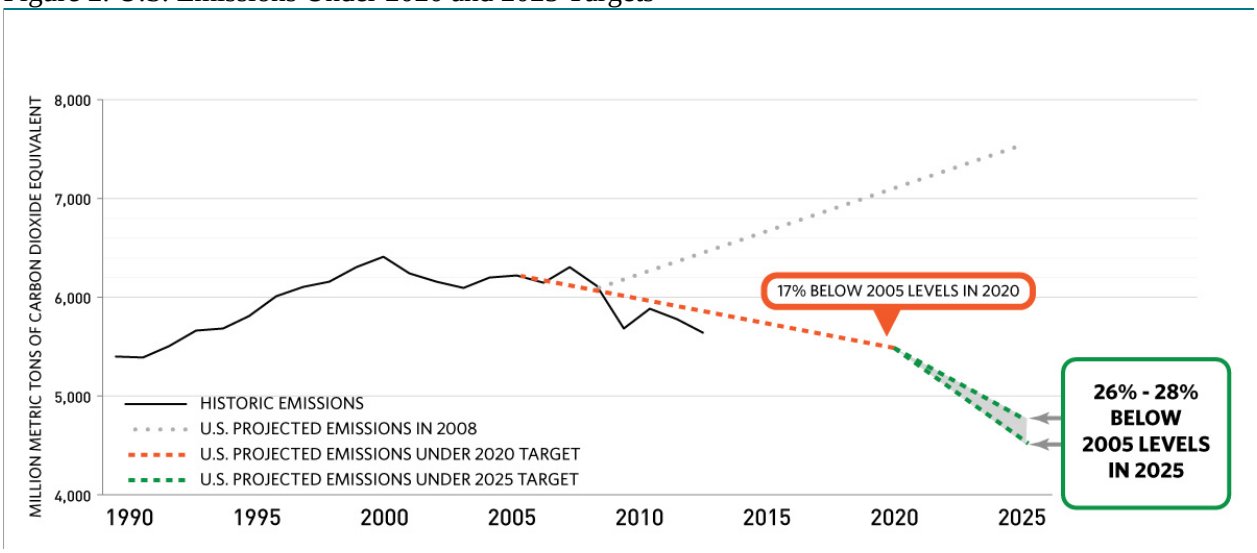
It is important to note that while the Paris Agreement represents important quantitative targets for global emissions reductions, it does not contain explicit, legally binding country specific reduction targets and it has yet to be officially ratified by enough participating countries.

[8] Climate Action Tracker is an independent scientific analysis produced by a consortium of four research organizations: Climate Analytics, ECOfys, New Climate Institute, and Potsdam Institute for Climate Impact Research; more information at https://climateactiontracker.org/

National – U.S.:

President Obama submitted the U.S. GHG reduction target commitment to the UNFCCC on March 31, 2015. The U.S. INDC submittal declared a commitment to reduce GHG emissions levels to 26-28% of 2005 levels by 2025. "The U.S. target will roughly double the pace of carbon pollution reduction in the U.S. from 1.2% per year on average during the 2005-2020 period to 2.3-2.8% per year on average between 2020 and 2025."[9] The reduction target was based on an analysis of cost-effective pollution reductions achievable under the Clean Power Plan (CPP), and establishes the path to achieve GHG emissions of 80% by 2050. The U.S. INDC GHG reduction targets are shown in Figure 2. below.

Figure 2. U.S. Emissions Under 2020 and 2025 Targets



Source: U.S. INDC, 2015

The CPP is the legal mechanism to reduce U.S. GHG emissions and is administered by the EPA. It requires individual states to meet emissions reduction targets through a variety of pathways. Currently, state level compliance begins in 2022. It is important to note that though the US Supreme Court has ruled that the EPA can regulate CO_2 as a pollutant, the specific legal framework used by the EPA to require and enforce emissions targets (as part of the CPP) has been challenged by 26 states and is currently scheduled for review by the US Supreme Court.

State Actions:

According to the Center for Climate and Energy Solutions, there are now twenty states in the U.S. that have established GHG emissions reduction targets, most of which have established targets of 75-80% below 1990 or more recent base line years by 2050. California was the first to establish a target, and has recently established the most aggressive target in the country. California and Oregon summaries are provided below. Information on the other state's targets can be found at http://www.c2es.org/us-states-regions/policy-maps/emissions-targets.

California:

In 2006, the California legislature enacted the Global Warming Solutions Act (AB-32), which established statewide policies and programs to reduce GHG emissions to 1990 levels by 2020. This was the first comprehensive state-enacted set of climate change mitigation policies in the country.[10] Through adoption and statewide implementation of the 2008 Climate "Scoping Plan," tracking emissions over time, and completing a 2014 Scoping Plan update, California has demonstrated that is on track to meet the 2020

[9] Fact Sheet: U.S. Reports its 2025 Emissions Target to the UNFCCC; White House Office of the Press Secretary; March 31, 2015

target. In April, 2015, Governor Jerry Brown issued Executive Order B-30-15, which issued the most aggressive target in the nation to date—a 40% reduction below 1990 levels by 2030.[11] This interim target will put the state on track to meet the 2050 goal of 80% below 1990 levels. The Scoping Plan is currently being updated to reflect B-30-15.

Oregon:
The 2007 Oregon Legislature enacted HB3543 which established climate protection goals for the state and created the Oregon Global Warming Commission (OGWC) to coordinate state and local efforts to reduce Oregon's GHGs consistent with Oregon's goals. The HB3543 GHG reduction targets are as follows:
By 2010, arrest the growth of Oregon's GHG emissions and begin to reduce them
By 2020, achieve GHG levels that are 10% below 1990 levels
By 2050, achieve GHG levels that are at least 75% below 1990 levels.
These targets were based on the assessment of the IPPC on GHG reductions necessary to avoid dangerous interference with the climate system—60-80% below 1990 levels. That target is based on limiting CO_2 to double the level that existed prior to 1750.[12]

In its 2015 Biennial Report to the Legislature, the OGWC reported that Oregon's GHG emissions are now nearly back to 1990 levels of 61 million metric tons of CO_2 equivalent ($MMTCO_2e$) (i.e. the 2010 target). However, the state projects "Oregon's 2020 emissions to be 11 $MMTCO_2e$ above the target level set by the legislature for that year (i.e. 51 $MMTCO_2e$), with the gap between emissions and our goals widening each year to 2050 and beyond unless additional action is taken to contain and drive down emissions."[13] In order to get the state on a track that can ultimately achieve the 2050 target, the OGWC is recommending that an interim target be set for 2035, by a straight line projection between the 1990 emissions level (56.177 $MMTCO_2e$) and a 2050 goal of 14.2 $MMTCO_2e$ (i.e. 75% reduction from 1990 levels). This would create a 2035 interim target of 44% below 1990 levels (32.7 $MMTCO_2e$).[14] Oregon's GHG reduction targets will require an average annual reduction of 3.76%.

This goal would be roughly similar to California's target. It should be noted that the state also has concluded that even with the implementation of a range of measures that reduce emissions from buildings (commercial and residential), industrial processes, transportation (of people and freight), materials, agriculture, waste, and the generation of electricity, the state will likely fall short of achieving the 2035 interim target unless carbon pricing mechanisms are added to the mix.[15] Figure 3. below depicts the OGWC's projections of available and reasonably possible future emissions reductions that could be achieved and the gap between the 2035 interim target and what is achievable without placing a value or price on carbon.

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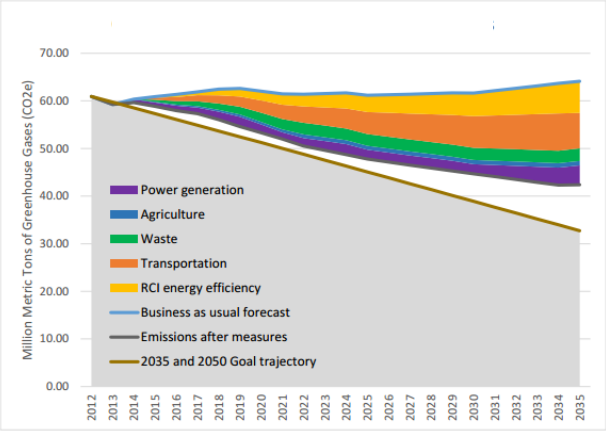
[12] Oregon Global Warming Commission website—Keep Oregon Cool; more information at http://www.keeporegoncool.org/content/goals-getting-there
[13] Oregon Global Warming Commission Biennial Report to the Legislature 2015; Oregon Global Warming Commission; September, 2015; p.6
[14] Oregon Global Warming Commission Biennial Report to the Legislature 2015; Oregon Global Warming Commission; September, 2015; p.8
[15] Oregon Global Warming Commission Biennial Report to the Legislature 2015; Oregon Global Warming Commission; September, 2015; p.6

Figure 3. Statewide Emission Reduction Measures



	2015	2020	2025	2030	2035
BAU forecast	60.9	62.0	61.2	61.6	64.1
Emissions after measures	59.0	54.0	48.7	45.8	43.4
Emission reduction measures:					
Transportation	0.5	2.7	5.0	7.2	8.7
RCI energy efficiency	0.2	1.5	2.7	3.6	4.9
Power generation	0.8	1.7	1.9	2.0	4.1
Agriculture	0.2	0.5	0.8	0.9	0.9
Waste	0.2	1.5	2.0	2.1	2.2
Total Reductions	1.9	8.0	12.4	15.8	20.8
2035 Goal Trajectory	57.3	51.2	45.1	38.9	32.7
Gap to meet goal	1.7	2.8	3.7	6.9	10.6

Note: All Units are in Million Metric Tons of Carbon Dioxide Equivalent.
Source: Staff Presentation to the Oregon Global Warming Commission; September, 2015

Local Actions:
Although the U.S. never ratified the Kyoto treaty, by 2007, 500 mayors across the country had signed the U.S. Mayors Climate Protection Agreement (Mayors Agreement) committing to strive to meet or exceed the GHG reduction targets set in the Kyoto Protocol. The Mayors Agreement established the first local GHG reduction targets at the local level—a 7% reduction over 1990 levels by 2012. Sixteen Oregon mayors have signed the Mayors Agreement. The cities of Portland and Eugene have adopted CAPs, and the City of Ashland is beginning an effort to develop a CAP as well.

Portland/Multnomah County:
The City of Portland began addressing climate change with the 1993 adoption of the Carbon Dioxide Reduction Strategy. This was followed by joint Portland and Multnomah County plans adopted in 2001 and 2009. Through these efforts, Portland and Multnomah County established a goal of reducing GHGs by 80% over 1990 levels by 2050, with an interim target of 40% by 2030 (which is the same as California's target). As a result of their collective efforts and a shrinking economy, GHG emissions in 2013 were 14% below 1990 levels while the population during the same period had increased by 31%.[16]

The Portland/Multnomah County CAP was updated in 2015, and the 2030 and 2050 GHG targets were not changed. Achieving the 2030 and 2050 targets will require an average annual decrease of 1.5% per year from 2013 to 2030, and a 1.8% decrease per year from 2030 to 2050. In order to accomplish these objectives, the Portland/Multnomah County CAP translates GHG emissions reductions to a "carbon budget," and focuses on primary generators of GHGs in the Portland/Multnomah County area, including:

- Energy used in buildings and industry--60% of total emissions;
- Fuels used in transporting people and goods--37% of total emissions; and
- Methane from the landfills that accept waste from residents and businesses--1% of total emissions.

In developing a carbon budget for these GHG emission sources, many assumptions were made about future energy sources, conversion to electric vehicles and increases in energy efficiency, among other things. Carbon emissions are allocated on a per capita basis, and population projections are used to determine future emissions due to community growth. Portland and Multnomah staff developed and modeled Scenarios to determine energy use and GHG emissions reduction targets in each sector. The

[16] Climate Action Plan 2015—Local Strategies to Address Climate Change; City of Portland and Multnomah County; 2015

resulting sector-based and per capita-based GHG emissions reduction targets are shown in Figures 4. and 5. below.

Figure 4. Portland/Multnomah County Sector-Based Reductions in GHG Emissions to Meet Targets

Sector (in metric tons CO_2e)	1990	2012	Percent Change from 1990	2030	Percent Change from 1990	2050	Percent Change from 1990
Building energy	5,512,000	4,772,000	-13%	3,707,000	-33%	1,112,000	-80%
Transportation	2,979,000	2,830,000	-5%	1,661,000	-44%	655,000	-78%
Waste disposal	498,000	93,000	-81%	40,000	-92%	10,000	-98%
Sub-total	8,989,460	7,695,000	-14.4%	7,695,000	-40%	1,777,000	-80%
Food and goods		9,400,000*					
Total		17,095,000					

Source: Portland/Multnomah CAP, 2015, pp.20, 36, 37.
*Note: This data is from 2011 and does not have associated reduction targets.

Figure 5. Portland/Multnomah County Per Capita Reductions to Meet Targets

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

Source: Portland/Multnomah CAP, 2015, p.20

These sector- and per capita-based targets are only provided for illustrative purposes to show the magnitude of change that will be necessary in a metropolitan area like Portland, which has aggressive GHG emissions reduction programs in place. They also reflect the fact that GHG reduction opportunities will vary across the sectors and that sector targets will vary accordingly. The assumptions, projections and scenarios modeled are not directly transferrable to Corvallis and Benton County.

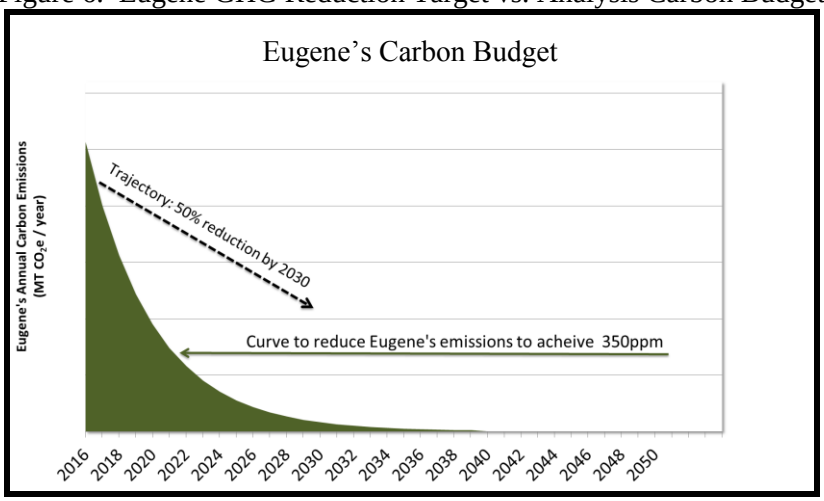
Eugene:
The City of Eugene adopted the Community Climate and Energy Action Plan for Eugene in 2010. In that plan, the City set GHG emissions reduction goals as they were previously established by the state of Oregon---10% below 1990 levels by 2020, and 75% below 1990 levels by 2050.[17] Eugene tracks community fossil fuel use and emissions annually. The City has reduced fuel consumption by an average of 2% annually, and is on a trajectory that, if sustained, will meet its goal of a 50% reduction in fossil fuel consumption by 2030. In 2014, the Eugene City Council passed a Climate Recovery Ordinance, which, among other things, calls for the City to develop a carbon budget for GHG emissions reductions consistent with achieving 350 ppm of CO2 in the atmosphere.

[17] Community Climate and Energy Action Plan, 2010; City of Eugene; p.7

The City is in the process of developing a localized community carbon budget, based on what has been declared to be *scientifically necessary* as opposed to what may be *feasible* given resource allocation and cultural acceptance. Eugene developed the carbon budget by downscaling the global carbon budget developed by climate scientists at NASA's Goddard Institute for Space Studies and Columbia University.[18] Based on Eugene's preliminary calculations, annual GHG emissions reductions will need to be well beyond those required to meet the current community goal of reducing fossil fuel use 50% by 2030.

This magnitude of reductions will not be possible for Eugene to achieve on its own. Federal and state policies and programs, and the implementation of new technologies not readily available today would have to complement Eugene community efforts to reduce GHG emissions. In addition, reducing atmospheric concentrations to 350 ppm will require drawing CO2 out of the atmosphere through reforestation. Therefore, an amount of carbon sequestration through reforestation will be included in the carbon budget. Eugene's preliminary projections of emissions reductions needed to meet the 350 ppm target is shown in Figure 6. below. Please note that this graph is based on preliminary information and the estimated numeric data and annual percentage reductions necessary to meet the 350 ppm scenario are not available. Matt McRae, Climate and Energy Analyst for the City of Eugene will provide additional background and a current status of Eugene's carbon budget development process.

Figure 6. Eugene GHG Reduction Target vs. Analysis Carbon Budget



Source: City of Eugene

DISCUSSION:

What does this all mean for Corvallis?

The CATF set the following goal to guide development and implementation of a CAP that can achieve a fair share of GHG emissions mitigation.

> *The CAP will establish and monitor GHG emissions reduction targets for the Corvallis community that guide short-, medium-, and long-term priority strategies and actions the City and community partners will undertake to achieve at least Corvallis' proportionate share*

[18] Hansen J, Kharecha P, Sato M, Masson-Delmotte V, Ackerman F, Beerling DJ, et al., 2013; Assessing "Dangerous Climate Change": Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature. PLoS ONE 8(12): e81648. Doi:10.1371/journal.pone.0081648. (Source of citation—City of Eugene staff)

(or some other expression of commitment) of GHG mitigation. Periodic reporting and updates to the CAP will enable the City to respond to changing conditions and needs.

Determining a "proportionate share" reduction target for Corvallis is an imprecise analytical exercise. Differences in GHG emissions reporting methods, assumptions, baseline years, and other factors across national, state and local governments make it difficult to evaluate where Corvallis' GHG emissions can be placed on the continuum from 1990 to 2050 relative to others. A complicating factor is that Corvallis' first year of community energy consumption and GHG emissions data—2012—is a baseline that cannot accurately be correlated with the historical and projected GHG emissions reduction curves generated by the City of Portland and to the State of Oregon, for example. Therefore, determining what a GHG reduction target similar to the state (i.e. 75% below 1990 levels) or Portland (i.e. 80% below 1990 levels) with reasonable accuracy is not possible.

As described above, there are three readily available frameworks Corvallis could use to set interim and long-term GHG emissions reduction targets that would roughly approximately Corvallis' proportionate or "fair" share. At this stage, Corvallis' CAP development process is focused on total community GHG emissions. Additional analysis will be needed to identify sector-based reduction potentials. A description and review of these options is provided below.

1) National framework: Corvallis could set targets based on the national reduction commitments expressed in the U.S. INDC: 1.2% per year on average through 2020, then doubling to 2.3-2.8% per year on average between 2020 and 2025 as an interim target. The U.S. INDC states that this trajectory would result in an 80% reduction by 2050. We were unable to locate information that would provide an indication of how GHG emissions from cities (which vary greatly across the nation in terms of efforts to reduce fossil fuel consumption and GHG emissions) would fit into the federal picture, so selecting this option as a proxy for Corvallis' proportionate share would require judgment that the reductions could and should be distributed equally across the country.

2) State framework: Corvallis could set targets based on the Oregon statewide model. This requires estimating where Corvallis is on the state GHG reduction trajectory between the baseline of 1990 levels and the state target (75% reduction of 1990 levels), and determining the reductions needed from Corvallis' baseline of 2012 GHG emissions to what Corvallis' 2050 reduction target would be. This analysis is shown in Figures 7. and 8. below. To estimate this, we used historic population data and State of Oregon population projections to correlate the Oregon GHG emissions estimates with Corvallis. The relevance of this framework to Corvallis requires an assumption that the Corvallis community is similar to the rest of the state regarding per capita GHG emissions.

   Using the estimated emissions based on Oregon per capita emissions, Corvallis would need to reduce GHG emissions by 3.52% annually from 2013 to 2050 to meet the state target. Using Corvallis actual inventoried GHG emissions in 2012, the average annual GHG emissions reduction percentage would be reduced to 3.175%. As with the state target, and based on the state's modeling of projected feasible GHG reduction assumptions, this reduction target is not considered possible without significant state and federal policy and program changes including carbon pricing at $60 per ton of CO_2e.[19]

[19] Oregon Global Warming Commission Biennial Report to the Legislature 2015; Oregon Global Warming Commission; September, 2015; p.9

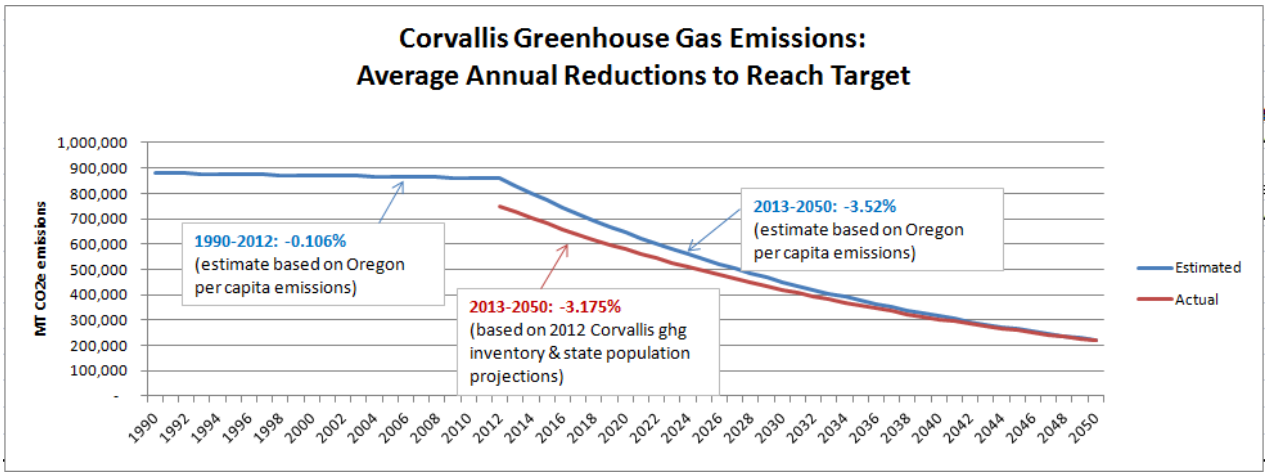
Figure 7. Corvallis GHG Emissions and Reductions Needed to Meet a 75% Reduction Target.

Oregon and Corvallis Emissions Estimates in $MTCO_2e$	1990	2012	Percent Change from 1990	2035	Percent Change from 1990	2050	Percent Change from 1990
Oregon emissions	56,177,000	60,900,000	8.4%	32,700,000	-44%	14,200,000	-75%
Oregon per capita emissions	19.6	15.6	-20.4%	6.6	-66.3%	2.5	-87.2%
Corvallis emissions (estimated based on state per capita)	880,186	859,959	-2.3%	377,137	-57.2%	220,047	-75%
Corvallis emissions (2012 inventory)	Unavailable	749,845	-14.8%	357,013*	-59.4%	220,047*	-75%
Corvallis per capita emissions (based on 2012 inventory)	-	13.6	-	5.5	-	3.11	-

Sources: State of Oregon GHG inventory data and population projections; Corvallis Community GHG Inventory, 2012

*Based on Corvallis population projections and the estimated 1990 Corvallis emissions.

Figure 8. Average Annual Corvallis GHG Emissions Reductions Needed to Meet a 75% Reduction Target.



3) Carbon budget framework: Corvallis could calculate theoretical targets based on Corvallis' share of a theoretical global per capita carbon budget, which, combined with reforestation and other carbon sequestration efforts, would achieve an atmospheric concentration of 350 ppm. This would entail using the City of Eugene's peer-reviewed methodology and equations for assigning a per capita-based carbon budget to the population of Corvallis. It is safe to assume that the resulting GHG emissions reduction curve would look similar to the Eugene curve shown in Figure 6. Above. While the carbon budget framework illustrates what will be needed at a global scale to restore the atmosphere to 350 ppm of CO_2e, applying this framework to Corvallis will result in a purely aspirational goal at this time.

As noted above, Matt McRae will provide a more detailed review of the carbon budget framework and how Eugene is considering incorporating it into its community Climate and Energy Action Plan strategies.

CONCLUSIONS:

Given that Corvallis GHG emissions data begins at 2012, and given the differences across GHG emissions inventory methods, it makes it difficult to determine how much progress Corvallis has made relative to other cities, states and the nation. We have insufficient data to accurately benchmark emissions reduction targets to 1990, which leaves a span of 22 years of unknown energy consumption and GHG emissions data. And, differences in inventory methods make it difficult/expensive to correlate Corvallis to other communities. However, we can conclude that Corvallis has been actively pursuing energy efficiency improvements and decreased reliance on fossil fuels for many years.

For example, a 2008 partnership of the Energy Trust of Oregon and the Corvallis Sustainability Coalition implemented $112,000 of residential energy efficiency improvements. The Corvallis City Council adopted a "Community Energy Strategy: A 2020 Framework" in 2010, which recognized Corvallis' long-term efforts and incorporated many strategies and actions to significantly reduce energy consumption by 2020. Over the years, many solar installations have occurred, offsetting fossil fuel generated GHG emissions. Corvallis was recognized for its accomplishments by becoming the first city to be named the EPA's Green Power Community of the Year. Finally, the "Take Charge Corvallis" project that is being implemented as part of the City of Corvallis' climate action goal, also is a strong indicator the Corvallis is making steady and substantial progress toward GHG emissions reductions.

Therefore, it is safe to assume that the community has made steady progress in reducing GHG emissions, and that on a per capita basis, Corvallis is more similar to the "deep carbon" reducing cities like Portland, and less similar to cities and states across the country that have not made increased resource efficiency and decreased fossil fuel consumption a priority. However, no specific targets have ever been established and the results of the community's efforts have not been measured over time. Based on the assumptions made in setting the national and statewide GHG emissions reductions, it is important to recognize that achieving targets of 75% or 80% GHG emissions reductions (from 1990 levels), as contemplated in Oregon and across the country, will require new state and federal programs and policies to be successfully implemented. In other words, Corvallis cannot achieve this level of GHG emission reductions without an enabling state and federal policy context. For example, the U.S. target assumes dramatic reductions will be achieved through the wide-spread reduction in GHGs generated by coal plants. The regulations that will drive this change are currently tied up in the courts. In Oregon, the Global Warming Commission has recognized that new state and federal policies would need to be adopted, as well as a carbon pricing strategy, in order to realize the energy efficiency gains and fuel source transitions needed to meet the state target.

CORVALLIS CATF ACTIONS:

On February 2, 2016, the CATF heard presentations on this topic from Jessica Shipley, staff to the Oregon Global Warming Commission, and Matt McCrae, Project Manager for the City of Eugene Climate and Energy Action Plan. After reviewing this material and considering the presentations, the CATF decided by consensus to recommend a preliminary target and interim targets for Corvallis that align the community's targets with the State of Oregon's.