Development of a 350ppm community carbon budget in Eugene, Oregon

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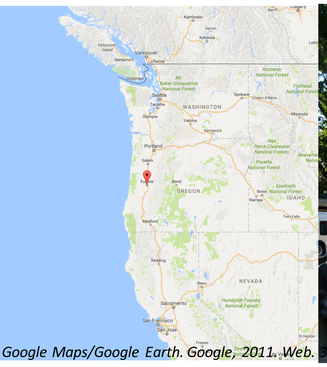
Introduction



Google Maps/Google Earth. Google, 2011. Web. 30 Nov. 2016.

Dan Rylan, Associated Press, 2016

In the absence of national greenhouse gas emissions regulations, city and county agencies across the United States have pursued a patchwork of emissions reduction targets and approaches to achieve those targeted goals. Some regions currently aim to meet efforts in mitigation with ambitious reduction targets that go beyond those pursued at national or international levels (e.g., UNFCCC, Paris, 2015 [1]).

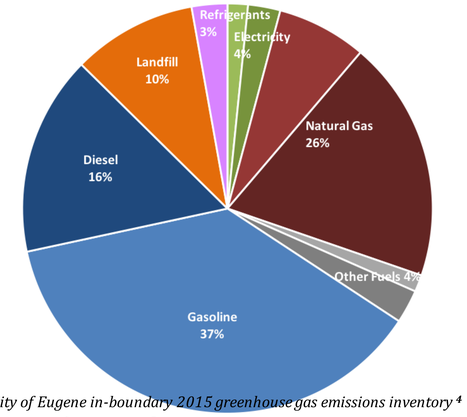
In 2014 The City of Eugene (Oregon, USA, pop. ~160k) City Council passed the Climate Recovery Ordinance that called for the development of a community-wide greenhouse gas budget that would be consistent with achieving 350 ppm CO_2 in the atmosphere [2]:

A 350ppm 2100 target, if achieved, could keep global average temperature rise to within ~1°C by century-end but would necessarily limit cumulative fossil fuel carbon emissions to ~500GtC (currently ~375GtC) [3]. In contrast to historically-based approaches to greenhouse gas mitigation targets typically established by cities, the request of a community target based on a 350ppm target required the development of new methods by the City of Eugene. Collaborating with a American Geophysical Union Thriving Earth Exchange (AGU–TEX) scientist and working with a peer review team of regional analysts (Table 1), the Eugene City Manager's Office produced a report which described a methodology for establishing a 350ppm community carbon budget and led a multi-session dialog with Eugene City Council members on policy action towards this goal.

Lane Transit District, 2016

Table 1: Eugene 350 Budget Peer Review Team	
David Allaway	Senior Policy Analyst in the Oregon Department of Environmental Quality's Materials Management Program
Kyle Diesner	Policy Analyst with the City of Portland Bureau of Planning and Sustainability,
Pete Erickson	Senior Scientist in the Climate and Energy program in Stockholm Environment Institute's Seattle office.
Dr. Pushker Kharecha	Research scientist at the NASA Goddard Institute for Space Studies and Columbia University's Center for Climate Systems Research.
Dr. Andrew Rice	Associate Professor of Physics at Portland State University
Joshua Skov	Center for Sustainable Business Practices, University of Oregon
Aaron Toneys	Senior Associate at Good Company, a Sustainability consulting firm in Eugene, Oregon.

Methodology



City of Eugene in-boundary 2015 greenhouse gas emissions inventory [4]

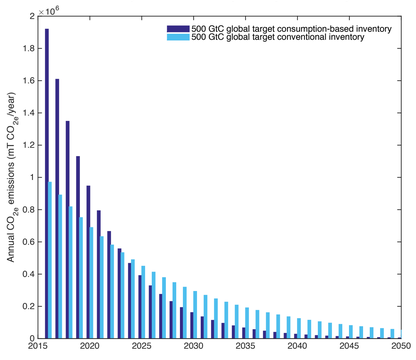
Current consumption-based (scope 1-3) greenhouse gas emissions are estimated at ~1.8MmT CO_{2e} for Eugene (in-boundary scope 1-2 ~930kmT CO_{2e})[4]. Previous Eugene greenhouse gas emissions targets were historically-based compatible with ICLEI methods and matched state of Oregon targets of 10% below 1990 levels by 2020 and 75% below 1990 levels by 2050.

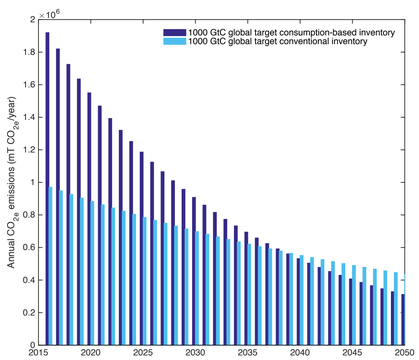
The 500GtC global emissions target for 350ppm atmospheric CO_2 by 2100 was based on Hansen et al. [3] and requires global emissions reductions of ~7.6% per year beginning in 2016 (updated from 2012 [3]). To downscale these emissions reductions to a local level, two methods were considered [5]:
(1) A population-based allocation of Eugene community emissions based on remaining ~125GtC global cumulative carbon emissions (CCE), i.e.:

$$CCE_{Eugene} = \frac{P_{Eugene}}{P_{global}} CCE_{global} = \sum_{t=2016}^{2100} E_{2016} e^{-\alpha t}$$

for population P, year t, annual emissions E, and decay constant α.
(2) A 7.6% annual reduction in Eugene community-wide greenhouse gas emissions requiring commensurate reductions throughout the globe.

Accounting for non-CO_2 GHG, scenario (1) yields a total cumulative carbon budget of 9.3MmT CO_2 for the Eugene community (~5 times annual emissions). Needed reductions to achieve this goal are ~16% per year. In scenarios (1) and (2), 75% reduction in emissions (from 2016) would be achieved in years 2024 and 2033, respectively. Applying a conventional in-boundary greenhouse gas inventory (scope 1-2 emissions) results in emissions reductions of ~8% per year for scenario (1). Finally, for comparison, a 1000GtC global target (450ppm CO2, ~2°C) was also analyzed using approach (1) and annual emissions reductions were 5% (scope 1-3 emissions) and 2% (scope 1-2).



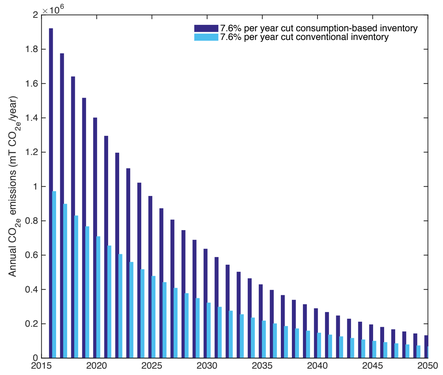


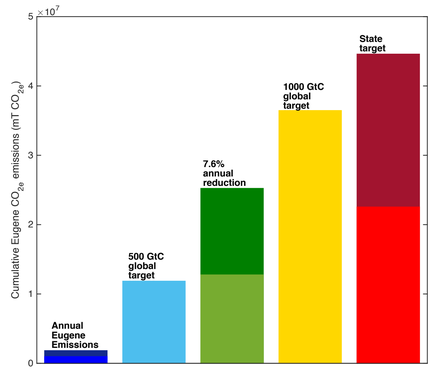
Reductions in Eugene emissions needed to hit targets using scenario (1) towards 500GtC (left) and 1000GtC (right) cumulative carbon emissions global targets. Dark blue includes emissions inventories scope 1-3; light blue scope 1-2.

Public Policy Results

Results of this work were presented to the Eugene City Council in a technical report in Feb.–Mar. 2015 [4]. Following this, a series of three City Council workgroup sessions were held during 2016 which connected the global perspective of climate change to the Climate Recovery Ordinance and efforts in mitigation at regional scales. These included presentation and discussion with council members of: global climate change forcings; regional climate impacts; mitigation efforts in the United States and globally; Eugene's current greenhouse gas emission inventory, trajectory and emission targets; methodology and results of this work; and testimony from experts and Eugene citizens.

The primary outcome of this work was an amendment by the Eugene City Council (vote 7:0) on July 27, 2016 to the Climate Recovery Ordinance [2]:
6.675 (4) By the year 2100, total community greenhouse gas emissions shall be reduced to an amount that is no more than the city of Eugene's average share of a global atmospheric greenhouse gas level of 350ppm, which is estimated in 2016 to require an annual average emission reduction level of 7.6%.





Left – Eugene emission reductions established by Climate Recovery Ordinance; Right – Comparison of Eugene Annual CO_{2e} emissions (dark blue) with: cumulative carbon emissions 2016-2100 (scenario (1)) towards 500GtC (light blue) and 1000GtC (yellow) global targets; 7.6% annual reductions (green, adopted); Oregon State target (red). Dark colors emissions scope 1-3; light blue scope 1-2.

Adoption of approach (2) sets ambitious goals for Eugene emissions reductions compatible with global cuts needed for a global 500Gt cumulative carbon emissions target and on-track to exceed Oregon state 2050 goals and those established by the UNFCC in Paris [1]. The Climate Recovery Ordinance also updated mitigation benchmarks including: carbon neutrality in city-owned facilities and city operations by 2020 (15% reduction per year); reduction of fossil fuel use 50% by 2030 for city organization, business and individuals living or working in Eugene (relative to 2010, 2.5% reduction per year). The update to the Climate Recovery Ordinance was signed on July 28. Next steps by the City are to update the 2010 Climate Action Plan in ongoing and planned mitigation.

Acknowledgements

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Citations

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4. McRae et al., Methodolgy for establishing a community carbon budget for Eugene, Eugene Sustainability Office, 2015.
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