

## Briefing Paper

### Energy Trust of Oregon Carbon Avoidance Methodology

November 2019

---

This purpose of this briefing paper is to describe Energy Trust of Oregon's carbon dioxide avoided calculations.

Energy Trust delivers energy-efficiency and renewable power programs for residential, commercial, industrial and agricultural utility customers in Oregon and Southwest Washington. Services and cash incentives are provided for cost-effective energy efficiency upgrades and to lower the above-market costs of renewable energy system installations.

Customers receive a range of benefits from these investments, including:

- Lower utility bills for program participants.
- Lower overall energy costs for all utility customers.
- Growth in local jobs and spending from customers saving money on their energy bills and businesses operating more efficiently.
- Cleaner and lower carbon methods to meet the energy needs of utility customers.

Between 2002 and 2018, Energy Trust has saved 724 average megawatts (aMW) of electricity (including self-direct savings), generated 129 aMW using renewable energy and saved 65 million annual therms of natural gas.

These combined actions cumulatively avoided 29,339,391 short tons<sup>1</sup> of carbon dioxide (CO<sub>2</sub>). Avoided carbon emissions are derived from utilities not needing to generate carbon-based energy for the equivalent amount of energy delivered by Energy Trust through energy efficiency and renewable energy generation.

#### Methodology for calculating carbon avoidance

The impact of future CO<sub>2</sub> regulation is a significant factor in long-term utility resource planning. It is represented in utility avoided costs to help show the potential impact of energy efficiency in reducing carbon costs. It is valuable for Energy Trust to account for CO<sub>2</sub> avoidance when reporting to stakeholders.

Energy Trust calculates CO<sub>2</sub> avoided in a consistent manner, as follows. The methodology determines the marginal<sup>2</sup> pounds of CO<sub>2</sub> avoided per kilowatt hour (kWh) saved or generated and per therm saved. It was last reviewed and updated by staff in 2018.

#### Carbon emissions avoided from kWh saved or generated

Energy Trust's value for carbon emissions reduction is derived primarily from analysis from the Northwest Power and Conservation Council's latest report from 2018 on avoided CO<sub>2</sub> rates per

---

<sup>1</sup> Energy Trust uses short tons in carbon avoidance calculations, equaling approximately 29,339,391 metric tons of CO<sub>2</sub> avoided.

<sup>2</sup> Marginal describes the resources that would be added or dropped from the grid if the load were to increase or decrease by 1 aMW. The marginal generation resource is often a different mix of resources than for the power system as a whole. For example, hydroelectric resources are rarely on the margin.

kWh in the Northwest<sup>3</sup>. This methodology was reviewed by the council and deemed to be a reasonable equivalency for greenhouse gas emission equivalency factors. Additionally, Energy Trust reviewed equivalency factors by the Energy Information Administration, Environmental Protection Agency and Oregon Department of Energy and found the Energy Trust value to be similar to the values each respective organization derived.

*Detail on the council’s methodology*

The council’s method for calculating avoided CO<sub>2</sub> emissions per kWh relies on a sophisticated electric market model<sup>4</sup> that simulates hourly supply and demand and determines marginal resources at a market-clearing price during the simulation period. In the 2018 report, the council ran two simulations, one as a base case and another with a reduction of 100 megawatts (MWs) in load over all hours of the year. The model also tests each simulation under 80 different scenarios to determine the effect of varying levels of hydroelectric resource. The rate of avoided emissions is then calculated using the following equation:

$$\text{Avoided Emission Rate} = \frac{\text{emissions}_0 - \text{emissions}_{100}}{\text{output}_0 - \text{output}_{100}}$$

The results of these simulations were presented for 2016, 2021, 2026 and 2031 (table 1).

**Table 1. Annual average avoided CO<sub>2</sub> emissions rate from the Northwest Power and Conservation Council**

Test year	Annual average avoided emissions rate (pounds of CO <sub>2</sub> per kWh)
2016	1.83
2021	0.91
2026	0.93
2031	0.97

The decreasing avoided emissions from 2016-2021 are largely driven by the retirement of coal plants in the Western Electricity Coordinating Council territory<sup>5</sup>. After 2021, coal plants are likely to continue to be retired within the territory. However, the coal plants scheduled to be retired are not on the margin. While the average carbon intensity of the Western Electricity Coordinating Council may decrease, the avoided carbon emissions rate goes up slightly between 2021 and 2031 with increased reliance on combined cycle natural gas turbines on the margin.

*Determining Energy Trust’s avoided emissions rate per kWh*

To derive a single value that accounts for changing marginal resources, Energy Trust extrapolated avoided carbon emissions from the Northwest Power and Conservation Council’s recent analysis and the council’s prior analysis provided in the 7th Power Plan<sup>6</sup>. Energy Trust

<sup>3</sup> Ollis, J. (2018, March 13). Avoided Carbon Dioxide Rates in the Northwest Power System (Tech.). Retrieved <https://www.nwcouncil.org/media/7491603/2018-1.pdf>

<sup>4</sup> AURORAxmp®

<sup>5</sup> The council notes that approximately 6,100 MW of coal are expected to be retired before 2021 including PGE’s Boardman in Oregon and the Centralia 1 unit run in part by PacifiCorp and Avista.

<sup>6</sup> The pounds of CO<sub>2</sub> averages for electricity reflect the council’s old Oregon specific values for 2013-2015 and the WECC region values for 2016-2031. The council did not retroactively forecast the WECC values backwards. The 7<sup>th</sup> Power Plan is available at <https://www.nwcouncil.org/reports/seventh-power-plan>

took the avoided emissions from 2013 to 2031 and calculated the average avoided emission rate across that timeframe: **1.09 pounds of CO<sub>2</sub> per kWh hour saved**. Averaging across these years provides a single value that can be used to estimate emissions reductions per kWh for any given year or collection of years between 2013-2031.

### **Carbon emissions avoided from therms saved**

Energy Trust's natural gas savings are converted to CO<sub>2</sub> savings using information provided by the U.S. Energy Information Administration<sup>7</sup>. The marginal CO<sub>2</sub> rate is 11.70 pounds per therm saved.

The assumptions and calculation for pounds of CO<sub>2</sub> emitted per million British thermal units (BTU) of energy are as follows:

- There are 117.0 pounds of CO<sub>2</sub> per million BTU of natural gas; therefore,
- 1 therm saved = 100,000 BTU saved = 11.7 pounds CO<sub>2</sub> saved.

### **Summary**

These two rates, marginal CO<sub>2</sub> rate per therm saved and marginal CO<sub>2</sub> rate per kWh saved or generated by renewable resources, are reviewed annually by Energy Trust. For public reporting and general communications purposes, Energy Trust then multiplies the rate by the therms saved, kWh saved or kWh generated to calculate the CO<sub>2</sub> avoided in short tons or pounds.

Energy Trust also converts energy saved or generated into equivalent reductions in cars on Oregon's roads using the following assumptions:

- 1 gallon of gasoline = 19.6<sup>8</sup> pounds of CO<sub>2</sub> = 23.4 miles driven (weighted average mileage of cars and light trucks)<sup>9</sup>
- Average mileage driven per year by cars and light trucks = 11,244 miles

Quarterly and annual reports to the Oregon Public Utility Commission detail Energy Trust's energy savings and generation results and benefits, including the quarterly and cumulative CO<sub>2</sub> avoided. All reports are available at [www.energytrust.org/reports](http://www.energytrust.org/reports).

---

<sup>7</sup> <http://www.eia.gov/tools/faqs/faq.cfm?id=73&t=11>; <http://www.eia.gov/tools/faqs/faq.cfm?id=45&t=8>

<sup>8</sup> U.S. Energy Information Administration - Eia - Independent Statistics and Analysis  
[https://www.eia.gov/environment/emissions/co2\\_vol\\_mass.php](https://www.eia.gov/environment/emissions/co2_vol_mass.php)

<sup>9</sup> Maps and Data - Average Fuel Economy Of Major Vehicle Categories  
<https://afdc.energy.gov/data/10310>