

# Greenhouse Gas 101



## EPA Defines Greenhouse Gases

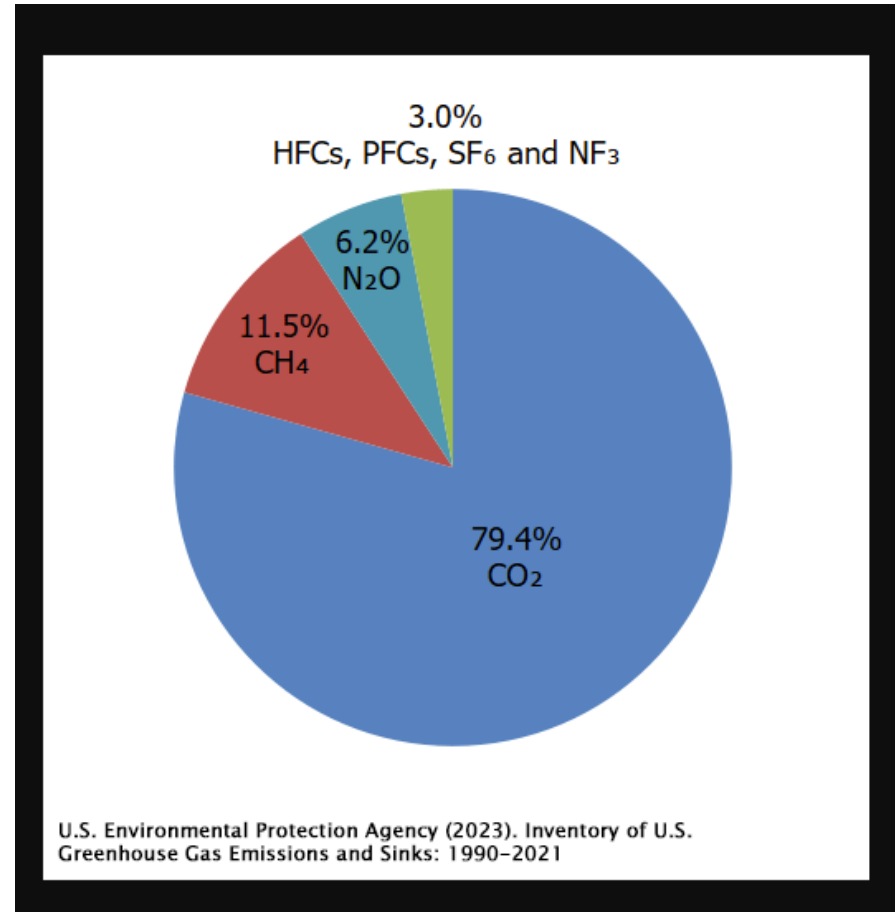
- Carbon Dioxide (CO<sub>2</sub>) – Most often from combustion of carbon in fuels. From landfills.
- Methane (CH<sub>4</sub>) – Landfills emit methane, natural gas is mostly methane (leaks)
- Nitrous Oxide (N<sub>2</sub>O) – Formed from combustion processes and off-gas from wastewater treatment. Fuel additive for racing.
- Fluorinated Hydrocarbons – Think Refrigerants



## What Makes a Gas a GHG?

- Gases that trap heat in the atmosphere are called greenhouse gases
- Greenhouse gases absorb energy that radiates upward from the Earth's surface, re-emitting heat to the lower atmosphere and warming the Earth's surface.
- Technically, water vapor ( $H_2O$ ) is also a greenhouse gas but its presence in our atmosphere is controlled by the properties of water to condense, vaporize etc.
- Think of GHGs as those gases that absorb energy in our atmosphere and those that are anthropogenic (human caused)

# GHG Breakdown



# Why Does the Fuel Burned Matter?

ENVIRONMENT

## Carbon Dioxide Emissions Coefficients

Release Date: September 7, 2023 | [XLS](#) | [METHODOLOGY](#)

### Carbon Dioxide Emissions Coefficients by Fuel

Carbon Dioxide (CO <sub>2</sub> ) Factors:	Pounds CO <sub>2</sub>	Kilograms CO <sub>2</sub>	Pounds CO <sub>2</sub>	Kilograms CO <sub>2</sub>
	Per Unit of Volume or Mass	Per Unit of Volume or Mass	Per Million Btu	Per Million Btu
<b>For homes and businesses</b>				
Propane	12.68 gallon	5.75 gallon	138.63	62.88
Diesel and Home Heating Fuel (Distillate Fuel Oil)	22.45 gallon	10.19 gallon	163.45	74.14
Kerosene	21.78 gallon	9.88 gallon	161.35	73.19
Coal (All types)	3,890.78 short ton	1,764.83 short ton	211.47	95.92
Natural Gas	120.96 thousand cubic feet	54.87 thousand cubic feet	116.65	52.91
Finished Motor Gasoline <sup>a</sup>	17.86 gallon	8.10 gallon	148.57	67.39
Motor Gasoline	19.37 gallon	8.78 gallon	155.77	70.66
Residual Heating Fuel (Businesses only)	24.78 gallon	11.24 gallon	165.55	75.09
<b>Other transportation fuels</b>				
Jet Fuel	21.50 gallon	9.75 gallon	159.25	72.23
Aviation Gas	18.32 gallon	8.31 gallon	152.46	69.15
<b>Industrial fuels and others not listed above</b>				
Petroleum coke	32.88 gallon	14.920 gallon	225.13	102.12
<b>Nonfuel uses</b>				
Asphalt and Road Oil	26.25 gallon	11.91 gallon	166.12	75.35
Lubricants	23.58 gallon	10.70 gallon	163.29	74.07
Naphthas for Petrochemical Feedstock Use	18.74 gallon	8.50 gallon	149.95	68.02
Other Oils for Petrochemical Feedstock Use	22.61 gallon	10.26 gallon	163.05	73.96
Special Naphthas (solvents)	19.94 gallon	9.04 gallon	159.57	72.38
Waxes	21.10 gallon	9.57 gallon	160.06	72.60
<b>Coals by type</b>				
Anthracite	5,735.68 short ton	2,601.67 short ton	228.60	103.69
Bituminous	4,783.52 short ton	2,169.77 short ton	205.57	93.24
Subbituminous	3,745.22 short ton	1,698.80 short ton	214.13	97.13
Lignite	2,809.83 short ton	1,274.52 short ton	216.64	98.27
Coke	7,183.46 short ton	3,258.37 short ton	250.59	113.67

# What is Montana's Carbon Footprint- According to the Energy Information Administration?

Table 3. 2021 State energy-related carbon dioxide emissions by sector

State	million metric tons of energy-related carbon dioxide						shares				
	Commercial	Electric Power	Residential	Industrial	Transportation	Total	Commercial	Electric Power	Residential	Industrial	Transportation
Alabama	2.3	47.2	2.1	19.6	37.2	108.4	2.2%	43.5%	1.9%	18.1%	34.3%
Alaska	2.3	2.8	1.7	18.4	13.7	38.9	5.9%	7.2%	4.5%	47.3%	35.1%
Arizona	3.1	34.3	2.5	4.6	38.5	83.0	3.8%	41.3%	3.0%	5.6%	46.3%
Arkansas	3.6	28.5	2.1	8.3	19.5	62.0	5.8%	46.0%	3.3%	13.4%	31.5%
California	19.4	35.3	26.2	63.9	179.1	324.0	6.0%	10.9%	8.1%	19.7%	55.3%
Colorado	4.4	30.6	8.3	13.2	28.9	85.4	5.2%	35.8%	9.7%	15.4%	33.8%
Connecticut	4.3	9.2	7.2	1.6	14.3	36.6	11.7%	25.2%	19.6%	4.4%	39.0%
Delaware	1.1	1.8	1.0	3.8	5.4	13.0	8.2%	13.6%	7.5%	29.4%	41.3%
District of Columbia	0.9	0.0	0.7	0.0	0.9	2.5	34.9%	0.0%	26.8%	1.0%	37.4%
Florida	6.8	91.2	1.5	12.3	114.6	226.3	3.0%	40.3%	0.6%	5.4%	50.6%
Georgia	4.6	40.9	7.4	12.7	58.6	124.1	3.7%	32.9%	5.9%	10.2%	47.2%
Hawaii	0.5	5.8	0.1	1.0	10.0	17.3	3.1%	33.3%	0.4%	5.6%	57.6%
Idaho	1.5	2.0	2.0	3.4	11.6	20.5	7.2%	9.8%	9.9%	16.5%	56.7%
Illinois	14.2	52.4	23.0	34.5	60.1	184.2	7.7%	28.5%	12.5%	18.8%	32.6%
Indiana	6.1	68.8	8.2	43.4	39.8	166.4	3.7%	41.4%	4.9%	26.1%	23.9%
Iowa	3.8	24.1	4.8	20.5	19.8	73.1	5.2%	33.0%	6.6%	28.1%	27.1%
Kansas	2.7	22.2	3.8	13.5	17.5	59.8	4.5%	37.2%	6.3%	22.6%	29.3%
Kentucky	2.7	56.9	3.1	14.9	33.7	111.3	2.4%	51.1%	2.8%	13.4%	30.3%
Louisiana	2.4	30.4	2.1	108.9	44.8	188.6	1.3%	16.1%	1.1%	57.7%	23.8%
Maine	1.8	1.3	2.7	1.6	7.1	14.4	12.2%	8.8%	18.5%	11.2%	49.3%
Maryland	5.2	11.2	5.7	2.8	27.6	52.6	9.9%	21.4%	10.8%	5.4%	52.5%
Massachusetts	7.4	6.1	12.5	3.3	26.7	56.1	13.2%	10.9%	22.3%	5.9%	47.6%
Michigan	10.8	52.9	19.0	17.6	47.5	147.8	7.3%	35.8%	12.8%	11.9%	32.2%
Minnesota	6.8	21.2	9.3	16.7	29.1	83.2	8.2%	25.5%	11.2%	20.1%	35.0%
Mississippi	1.6	25.2	1.5	11.3	23.4	63.1	2.5%	40.0%	2.4%	18.0%	37.2%
Missouri	4.6	60.2	6.3	8.6	37.2	117.0	4.0%	51.5%	5.4%	7.3%	31.8%
Montana	1.6	12.5	1.7	4.5	8.2	28.5	5.7%	43.7%	6.0%	15.9%	28.7%

# National Comparison

**Table 3. 2021 State energy-related carbon dioxide emissions by sector**

State	million metric tons of energy-related carbon dioxide						shares				
	Commercial	Electric Power	Residential	Industrial	Transportation	Total	Commercial	Electric Power	Residential	Industrial	Transportation
Montana	1.6	12.5	1.7	4.5	8.2	28.5	5.7%	43.7%	6.0%	15.9%	28.7%
Total <sup>1</sup>	247.9	1,542.0	326.2	980.2	1,814.9	4,911.2	5.0%	31.4%	6.6%	20.0%	37.0%

Source: U.S. Energy Information Administration (EIA), State Energy Data System and EIA calculations made for this analysis.

<sup>1</sup>For the United States as a whole see, EIA, Monthly Energy Review, Section 11: Environment. Differing methodologies between the two data series causes the total for all states to be different from the national-level estimate.



## What is this CO<sub>2</sub> Equivalent Jargon?

- CO<sub>2</sub> Equivalent (CO<sub>2</sub>e) is the method used to account for the different reactivity levels and “life in years” of the various gases in the atmosphere.
- All gases are compared to CO<sub>2</sub> which has a CO<sub>2</sub>e of “1”.
- Therefore, the mass of CO<sub>2</sub> and the CO<sub>2</sub>e is the same.
- The other greenhouse gases have different multipliers to convert their mass quantity to their equivalent CO<sub>2</sub> basis.
- Methane has a CO<sub>2</sub>e of 27-30
- Nitrous Oxide is 273. Fluorinated compounds can be in the thousands.
- These “factors” are what are called the Global Warming Potentials