

Climate Change Resources: Social Justice Hackathon

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CO₂ vs CO₂eq

- Global warming is caused by the accumulation of greenhouse gases that are emitted into the atmosphere. Three common greenhouse gases are CO₂, Methane (CH₄), and Nitrous Oxide (N₂O), with CO₂ being by far the most dominant greenhouse gas emitted by human activities. Methane and Nitrous Oxide cause more warming per unit of mass than CO₂, but because so much CO₂ is emitted compared to the other two, emissions are often expressed as CO₂ “equivalent” (CO₂eq), which expresses the emissions in terms of an equivalent mass of CO₂ released.
- 1 metric ton of methane = the same global warming as 25 metric tons of CO₂
- 1 metric ton of nitrous oxide = the same global warming as 298 metric tons of CO₂
- Mass of CO₂eq emissions = mass of CO₂ emissions + (25 * mass of methane emissions) + (298 * mass of nitrous oxide emissions)
- Sources: Table 8 in [EPA GHG Emissions Factors Document](#) and [Useful Summary](#)

Climate Impact of Individuals

- Calculating carbon emissions from **home energy consumption** (most likely your power bills)
 - The EPA frequently publishes emissions factors for different fuel sources and for electricity based on region within the United States. See Tables 1 and 6 [in the EPA document](#).
 - **Electricity**
 - Electrical energy is measured in kilowatt-hours (kWh) on your power bill
 - For every kWh used, greenhouse gases are emitted by power plants, but the amount depends on the region (and the time of day, but that is likely beyond the scope of a residential power bill analysis)
 - Example emissions calculation for NYC using the EPA factors:

Electricity consumed for month of November (My ConEd Bill) (kWh)	100
CO ₂ factor for NYC Region (NYCW) (lb/MWh)	596.4
CH ₄ factor for NYC Region (NYCW) (lb/MWh)	.022
N ₂ O factor for NYC Region (NYCW) (lb/MWh)	.002
Conversion factor (kg/lb)	.454
Conversion factor (Metric tons/kg) or (MT/kg)	.001
Conversion factor (MWh/kWh)	.001

$100 \text{ kWh} * .001 \text{ MWh/kWh} * (596.4 \text{ lb/MWh} + 25 * .022 \text{ lb/MWh} + 298 * .002 \text{ lb/MWh}) * .454 \text{ kg/lb} * .001 \text{ MT/kg} =$

.027 MT CO₂eq. So 1 (estimated) month of electricity in a New York City apartment emits .027 metric tons of CO₂ eq. Assuming the same monthly quantity, that would be .324 metric tons annually from electricity consumption.

- **Gas**
 - Gas is often measured on energy bills in therms.
 - 1 therm of gas = 97.25 scf (standard cubic foot)
 - For every therm of gas burned on your stove, in your furnace, in your building's boiler, or in your hot water heater, emissions enter the atmosphere from combustion. This does not vary by region.
 - Example gas calculation:

Gas consumed for month of November (My ConEd Bill) (therms)	5
CO2 factor for natural gas (kg/scf)	.05444
CH4 factor for natural gas (g/scf)	.00103
N2O factor for natural gas (g/scf)	.00010
Conversion factor (kg/g)	.001
Conversion factor (MT/kg)	.001
Conversion factor (scf/therm)	97.25

5 therms * 97.25 scf/therm * (.05444 kg/scf + (25 * .00103 g/scf + 298 * .00010 g/scf) * .001 kg/g) * .001 MT/kg
 = **.026 MT CO2eq.**

- **Fuel Oil** (for heating)
 - Use the same process for gas, but look up the emissions per gallon from distillate fuel oil No. 2 or No. 4 and calculate based on gallons.
- If heating is not included on a power bill
 - Estimating heating fuel emissions when heat is paid for by the building (not billed to individual units) can be difficult, but New York City has tabulated energy consumption data per square foot for many building sizes in the Local Law 84 Reports:
https://www1.nyc.gov/html/gbee/html/plan/ll84_scores.shtml
- Calculating emissions from **food**
 - The graphic on [this page](#) (Our World in Data) breaks down the estimated total life cycle CO2eq emissions from different foods. This includes transportation, land use change, and other impacts. Beef is the worst by far.
- Planting Trees
 - Estimated carbon captured by planting an urban tree: 36.4 lbs (see EPA calculator section on [urban tree](#) seedlings).
- Other Methods of offsetting emissions
 - Personal carbon offsets: Tradewater, BURN, Cool Earth

Climate Impact of Larger Systems

- Project Drawdown
 - [Estimates of global emissions avoided](#) through various solutions, often on the scale of tens of gigatons of CO2eq
- Emissions from corporations
 - Carbon Disclosure Project: [Carbon Majors Report 2017](#)

- Emissions by country
 - <https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions#global-emissions-have-not-yet-peaked>
- Policy advocacy
 - Example Organization: [Clean Air Task Force](#)
- Organizing for political/systemic change
 - Example Organization: [Sunrise Movement](#)

Background Resources on Climate Change

- Some of the best sources of current, consensus-based information on the science of climate change are the **Intergovernmental Panel on Climate Change (IPCC) Reports**.
 - The 2018 [Special Report: Global Warming of 1.5 °C](#) illustrates the severity of the climate crisis by outlining the actions needed to contain global warming to a total of 1.5 °C and avoid the worst risks of heat waves, agricultural disruptions, coastal damage, and ocean acidification, among other disruptions
 - An update to the report is expected in 2021, but you can find the most recent IPCC Synthesis Report [here](#) (this is very dense, but it draws on the work of thousands of scientists across the globe, and the United Nations uses this report as a basis for climate policy).
- Intersection of Climate Change and Social Justice
- TL;DR

Existing Calculator Apps for Reference/Inspiration

- EPA
 - <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>
- Joro
 - Mobile app that calculates carbon from financial transactions