

A Deep Dive into Carbon Calculators and Ways to Reduce Your Footprint....

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Greenhouse Gases and Carbon Calculators

The following is a short summary of an article written for the Spring 2020 Green Matters discussing the concept of a carbon foot print and carbon calculators. If you would like to read the full article it can be found [here](#).

Greenhouse gases are a collection of gases, including carbon, which have, over time, collected in the earth's atmosphere creating a warming trend on earth and in the oceans. The rate of increase of warming has accelerated since the industrial revolution and the invention of the plow causing great concern about the impacts of warming: melting of polar ice caps, rising of oceans, increase frequency of drought and fire to name a few concerns and threats to life on earth.

How am I warming the climate?

To combat (or reduce) warming we can take responsibility for the greenhouse gases our lifestyle generates. Yes, the way we live has an impact on the amount of greenhouse gases produced and released into the atmosphere. For example, burning fossil fuels to power our cars, trucks, planes and heat and cool our homes releases carbon, and other greenhouse gases, which exacerbate the warming issue. Eating meat products, especially beef, has a significant impact on greenhouse gases. Even your shopping habits create greenhouse gases. Is shopping on line better? Not necessarily, there are lots of factors which determine which is better. Read more about on-line versus brick and mortar shopping [here](#).

The first step to addressing the production of GHGs is to become aware. Reading this article and the linked references brings awareness and knowledge of the issue. Continuing on the theme of awareness one can look closer at the GHGs produced from your lifestyle and the opportunities for change. To do this use a Carbon Calculator to quantify the carbon equivalents of you're the GHGs you emit. This is described as a Carbon Footprint. Many calculators have recommendations and mechanisms for you to track your carbon emissions. Several sites listed below have an easy way to pledge your commitment to reducing your carbon footprint. (There is no better way to commit to something than to tell someone you trust about it and ask them to hold you to it.)

Not all carbon calculators are created equal

As described in the [Spring 2020 Green Matters](#), I recommended several carbon calculators. Different carbon calculators will produce different results. For example, the allocation of carbon based on one's expenditures and level of income is a factor factored into your carbon footprint. Calculators could use different factors. Additionally, information entered in one calculator may not be collected in another.

To fully understand carbon calculator results, one must study the methodology, factors and assumptions used by each. This requires finding the documentation on the calculator's website, rolling up the sleeves and digging into the details. This is not something the individual is likely to do. Small businesses might do this to build greater understanding of their carbon footprint. Large businesses are more likely to develop their own carbon accounting methodology which serves their sustainability vision.

To filter through some of the popular options available, I researched and developed the following criteria which, I feel, is the easiest to comprehend, lead to an understanding of how one's lifestyle effects carbon and could create behavior change.

Which on-line Carbon Calculator should I use (there are many)?

The following is a summary of the calculators with the highest ratings according to the methodology described below. Click [here](#) to see all calculators reviewed, criteria and ratings.

Individual and household

[CoolClimate: Household Carbon Footprint Calculator](#)

Travel

[TripZero](#)

Events

[Native Energy](#)

Business, including planning events

[CoolClimate: Small Business Carbon Footprint Calculator](#)

Government

[ICLEI GHG Contribution Analysis Excel Tool](#)

Basis for Carbon Calculator Recommendations

Below are the criteria I used for rating popular carbon calculators. The calculators chosen for the research were selected based on recommendations, journal articles and results from the search term "carbon calculator". Calculators selected were oriented toward the United States and with apparent popularity (determined from number of web page links). Mobile application calculators were selected from those with at least a four-star rating and more than 10 reviews. Ratings are based on my experience with the tools and published results from journal articles. Criteria identified with "*" is rated based on journal article results. For each criterion met, a score of 1 was assigned.

Assumptions

The following assumptions are made for all calculators. In some cases, the assumptions were validated by journal articles. Assumptions were not included in the rating.

| | |
|------------------------------|---|
| Methodology Documented | Assumptions, standards and sources are easy to find and documented |
| P1 Greenhouse gases | The carbon footprint results measure carbon dioxide, methane and nitrous oxide, the most prevalent and potent of the six greenhouse gases (as defined by the Kyoto Protocol) |
| P13 Emission factors | Uses up to date emission factors |
| P12 Comprehensive footprints | Allocates carbon emissions to other categories not listed as a criterion, such as: clothing, communications, culture, education, healthcare, social services, roads and waste |

Usability/User Interface

| | |
|-------------------|--|
| Access | 1=no account (favored), 0=account required |
| Saves data | Carbon footprint information is saved in account for future viewing. |
| Basic/Full Option | Basic and detailed data entry options |

Basic Information

| | |
|---------------------|---|
| Geography | Uses specific location (zip code or state) for determining cost of living and energy costs. More detail in sidebar. |
| Allows variable UOM | Information can be entered in multiple units of measure. For example, KWh or cost in US dollars. |

Home and Business Carbon Categories

| | |
|-------------------------------|--|
| P6 Household size - # people* | The carbon footprint is factored by the number of people sharing the same household. More, rather than less, people in a home produces less carbon per person since appliances, heating and cooling are shared. Footprint results are for the individual, not the household. |
| P7 Building emissions* | Emissions based on the size and type of building are considered. |
| P8 Building emissions* | Carbon emissions consider building heating and cooling in addition to emissions from appliances, building materials and furnishings |

| | |
|---------------------------------------|--|
| P9 Food emissions* | Diet preferences and purchasing habits are input. Vegetarian and vegan diets and purchasing of organic and local foods produce reduced carbon. |
| P4 Income/consumption adjustment* | Quantifies income and expenditures for non-energy related shopping versus using a national average. See below for a description on why income is an important criterion. |
| Travel: Air | Entry for domestic, international air travel trips or mileage |
| Travel: Car | Entry for commute distance(s) or annual miles driven |
| Travel: Other | Quantifies use of public transportation, walking, biking or carpooling |
| P10 Transportation emissions* | Detailed modelling of transportation including distances, vehicle type, fuel eff |
| Expenditures | Quantifies non-energy related expenditures |
| Waste | Quantifies waste (solid and gaseous) and recycling |
| Water Use | Quantifies water use |
| Behavior suggestions & Tracking Tools | Recommendations for improving carbon footprint |
| Offset Suggestions | Recommends specific organizations where carbon offsets can be purchased (see Carbon Offsets and buyer beware below) |

Business Carbon Categories

| | |
|---------------------|--|
| Events | Quantifies factors for running an event or meeting such as: number of attendees, hotel rooms, size of meeting space and travel methods |
| Number of Employees | |
| Square Feet | Square feet of company controlled facilities |

Number of
Vehicles
Revenue

Indirect
Emissions

Considered to be [scope 3 emissions](#), things such as company travel, paper use, and contractor activity not controlled directly by the company.

* Criteria measured by Birnik, A. (2013)

Why do I need to enter my zip code or country?

In the United States, our carbon footprint is twice those of other industrialized countries. This is because:

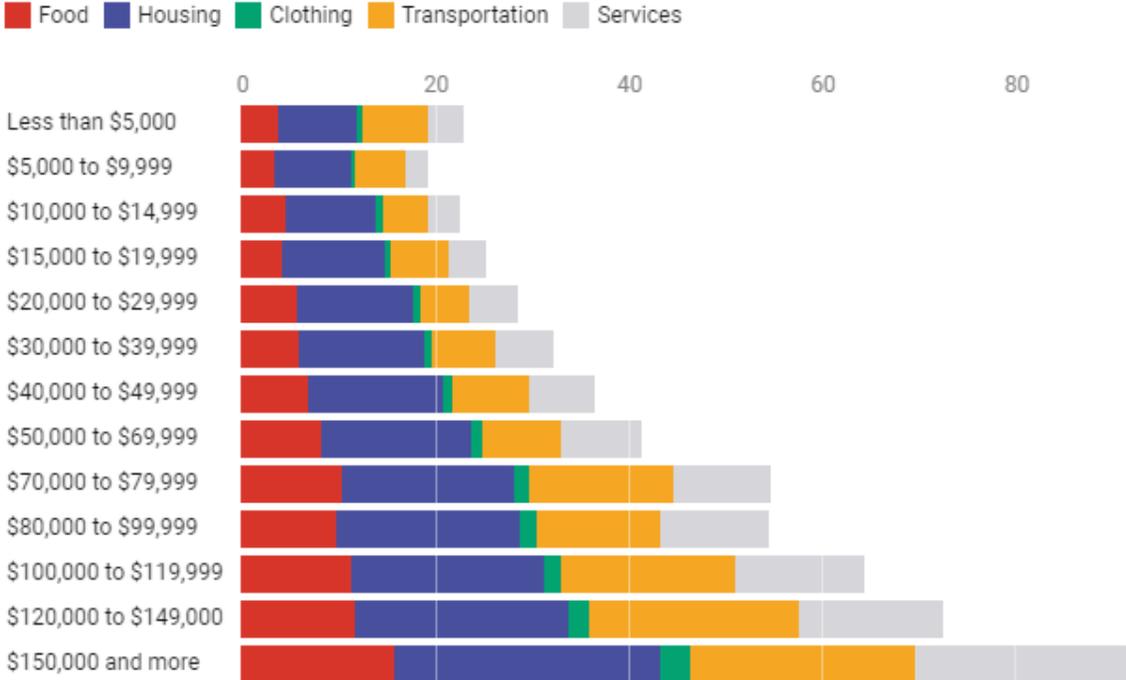
- our supply chains of food and other goods are highly evolved and efficient using trucks, ships and planes to move goods around our country to the point of consumption. This distribution network is a significant polluter, more than other industrialized nations due to distances food travels.
- We produce and consume many goods, more than other nation per person. The life cycle of products (production, consumption and disposal) generates a significant amount of GHGs.
- We depend on electricity to power our cellphones, appliances, homes and the production of goods. Sources of energy are different in the United States than in other countries. For a local example, the emissions for a resident consuming electricity in Teton County is different than a resident of Sweetwater county. Teton county electricity is produced mostly from [large hydroelectric power \(85%\)](#) which does not produce as many greenhouse gasses as in Sweetwater county where 60-80% of electricity is generated from coal or natural gas and 1% from large hydroelectric sources - Rocky Mountain Power. (2020, May 28), phone conversation.

Why is income an important criterion?

Income has been shown to be a predictor of carbon production trends. As wellbeing and necessities are attained, higher incomes tend to create greater carbon emissions. Higher income households purchase larger homes, more cars, travel more and consume more goods and services. The average carbon footprint of the wealthiest households is over five times that of the poorest. (.To read about exceptions to this rule, [read section 3.1 in The Determinants of Household Carbon Footprints](#)).

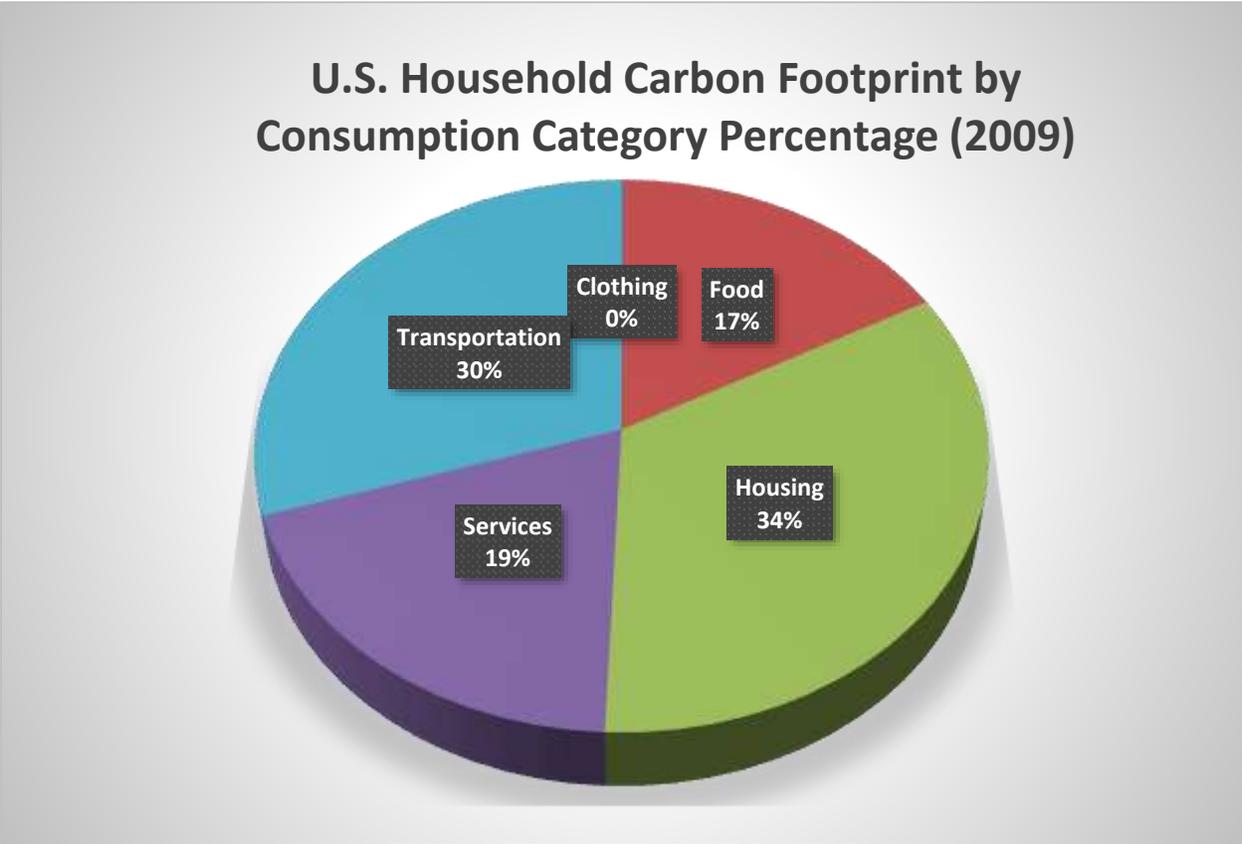
Household carbon footprints in the U.S. by income level in 2009.

Tons of CO2 equivalent per household:



Source: Song, K., et al., (2019)

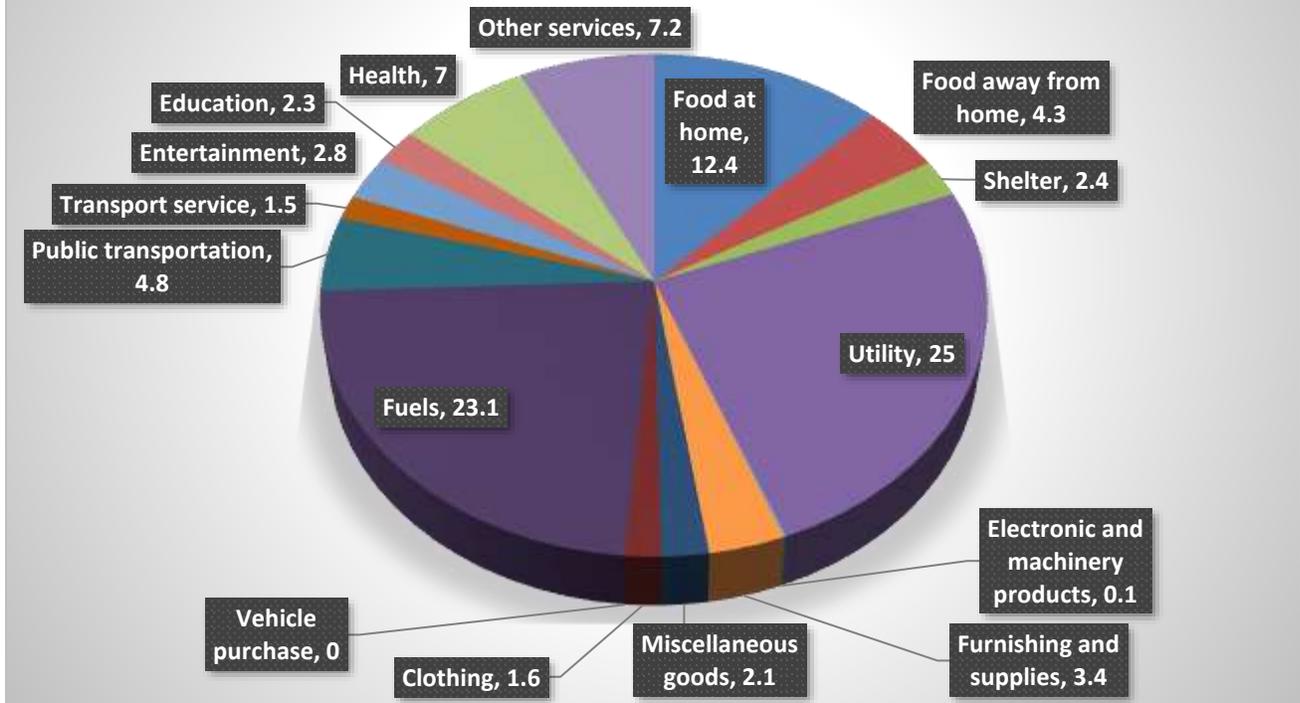
Carbon footprint of U.S. household consumption in 2009 by category



Source: Song, K., et al., (2019)

Carbon footprint of U.S. household consumption in 2009 by sub category

U.S. Household Carbon Footprint by Consumption Sub Category Percentage (2009)



Data sourced from Song, K, et al., (2019)

[Additional details on carbon emissions for food, household and transportation](#)

What to do with carbon calculator results:

Make a commitment to reducing your carbon footprint and share on social media

Describe the behaviors you expect to change and when you expect to make them. Be specific, describing how you will make the change and the date by which you will do it.

Remeasure your carbon footprint on a regular basis.

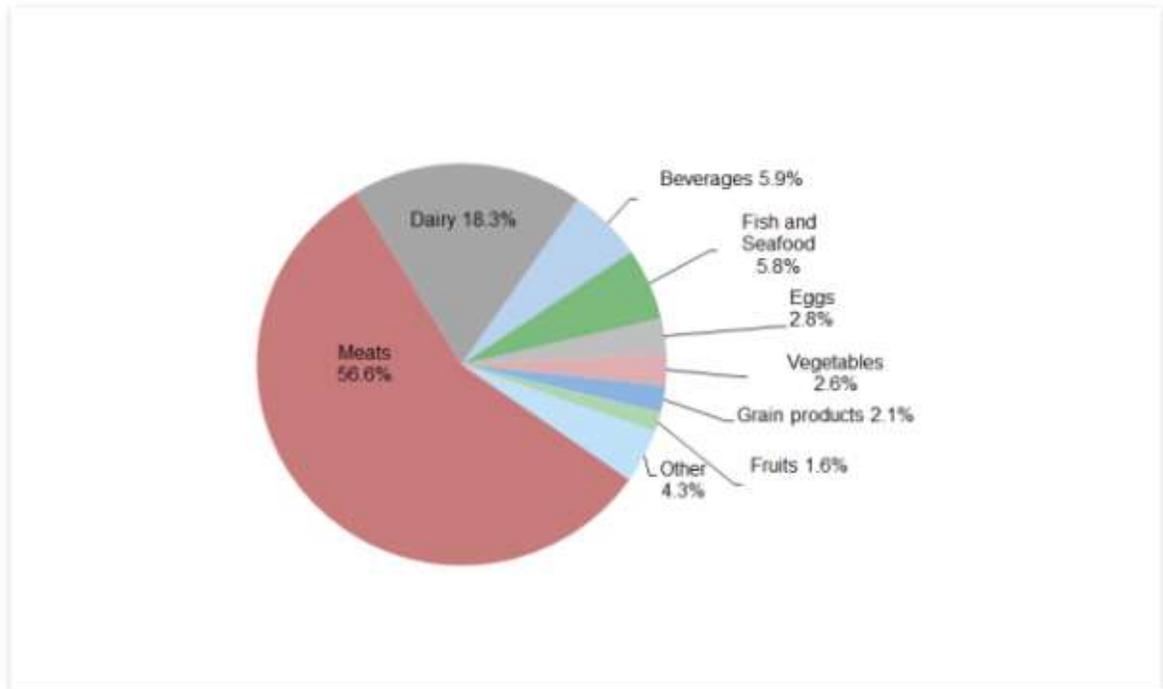
The first measurement of your footprint is the basis to measure progress in the future. Keep a log of the progress you make over time.

Switch to poultry or eat more veggies and less beef.

Eating 8 oz or a ½ pound of beef daily produces .8 metric tons of carbon per year or a ## per meal. Poultry, eggs and vegetables have a much smaller carbon footprint due to the resources required to produce beef.

[Watch a short 4-minute video](#) introducing the impact of foods on greenhouse gases and the research depicted below.

GREENHOUSE GASES CONTRIBUTION BY FOOD TYPE IN AVERAGE DIET³



Source: Heller, M. C., et al., (2018)

Eat local

Buying food produced locally eliminates the supply chain used to deliver foods to local grocery stores. Eating lettuce produced locally produces few carbon emissions than lettuce shipped from California. Eating with the seasons is a form of eating locally. For example, grapes supplied found in the grocery stores in the winter could come from Chile, a hemisphere away! Wait until the season when fruits and vegetables are available locally or, at least, within the United States.

Bike to work

Assuming a 30-mile commute (typical for US commuters) in a car getting 22 mpg produces 4.3 metric tons of carbon per year.

Video conference versus flying across the country

A trip across the US and back produces 2.23 tons or .45 tons for every 1000 miles. If you must fly, offset your miles by buying carbon offsets.

Purchase carbon offsets

Carbon offsets are an easy and inexpensive way to offset your carbon footprint. They can be purchased directly from some carbon calculators and from a number of organizations. For example, the option to purchase offsets might appear during checkout when buying

an airline ticket. Some “green travel” websites advertise sourcing carbon neutral accommodations and transportation based on your travel requirements. These are all great options to use if you are not motivated or are challenged to change your lifestyle.

Carbon offsets: Buyer beware

Carbon offsets may not completely offset the carbon you produce. Some providers might advertise offsets which fund tree planting to carbon from the atmosphere and “sink” it into the soil. Planting trees does sequester carbon (and turn CO2 into oxygen and water). Yet, trees die, rot and burn. These natural processes at the end of a tree’s life release carbon into the atmosphere. While planting trees is a great option, it is not a permanent carbon sink. I recommend looking for offsets which support [regenerative agriculture](#) to offset greenhouse gasses from farming.

Check the background of nonprofits claiming to invest in projects which sequester carbon. Read their website critically to learn about projects they are funding and the published statistics on carbon sequestered. Also, consider how much of each dollar paid to a non-profit goes to the projects described versus the administration of the program and operating costs of the organization. Check other organizations to see who else is doing the same type of project with a greater benefit or lower cost. I use [Charity Navigator](#) or [Guidestar](#) to review the percentage of the budget allocated to administrative costs. The lower the percentage the greater the amount allocated to beneficial projects.

Read more about selecting a carbon offset provider from [Sustainable Travel International](#)

Other carbon reduction tips:

[Simple ways to cut your carbon](#)

[Tips to Help You Reduce Your Footprint \(technological tips too!\)](#)

[Carbon Footprint Fact Sheet and ways to reduce carbon](#)

[Tips for adults and kids from the Sierra Club including: home, garden, office and more](#)

Many of the following come from the [BEST Library sustainability guides](#).

Local, regional and sustainable food:

- [Slow Food in the Tetons](#)- Slow Food in the Tetons promotes and celebrates good, clean, and fair food in our community through educational programming, events, and initiatives.
- [People’s Market](#)- a farmer’s market that sells local produce, meats, breads and Assorted clothing and goods. Every Wednesday in the summer.
- [Jackson Hole Farmer’s Market](#)- a farmer’s market that sells local produce, meats, breads and assorted clothing and goods. Every Saturday in the summer.
- [Jackson Hole Yellowstone Food Guide](#)- a guide to finding local food all year long, from Slow Food in the Tetons.

- [*Vertical Harvest*](#)- sells year-round to sell fresh, locally grown produce to the community through multiple venues at a competitive, consistent price.

Waste diversion:

- [*Teton County Integrated Solid Waste and Recycling*](#)- Community recycling and trash transfer facility for Teton County, WY. Offering recycling collection for: general recycling items, electronic waste, textiles, books, household hazardous waste, batteries, and scrap metal. Manage, divert and transport municipal solid waste produced in Teton County.
- [*Teton Valley Community Recycling*](#)-Community recycling facility for Teton County, ID.
- [*Jackson Curbside Recycling*](#)- A private recycling service in Teton County, WY.
- *R.A.D. Recycling* (Victor, Idaho)-A private recycling service in Teton County, WY.
- [*Hole Food Rescue*](#)- sources and distributes excess edible food to local organizations that provide nutrition to those that need it most in the Jackson community.
- [*Terra Firma Organics*](#)- Takes Jackson Hole’s organic waste—trees, shrubs, lawn clippings, etc.—and makes it into products that help your lawn and garden thrive.

Energy:

- [*Energy Conservation Works*](#)- provides leadership, implementation, and education specific to energy conservation, energy sustainability, and energy efficiency. A major part of the program is to incentivize energy conservation through zero to low interest loans for projects that result in energy savings.
- [*Lower Valley Energy*](#)- offers energy audits and works with ECW to incentivize energy conservation.

Transportation:

- [*Yellowstone Teton Clean Energy Coalition*](#)- offers programs to help with transportation and fleet improvements, and works to displace the use of petroleum in the regional transportation sector, improve air quality through reduced harmful exhaust emissions, and increase energy security and sustainability.
- [*START Bus*](#)- offers public transportation services in Jackson Hole and beyond.
- [*Community Pathways map*](#)- all over Jackson Hole allow for non-motorized vehicle travel.

Community Leadership through Local Business programs:

[*RRR Business Leaders*](#) - designed to recognize local business sustainability efforts, incentivize those efforts, and to build a community and culture around sustainable business in Jackson Hole. A program of Teton County Integrated Solid Waste and Recycling (ISWR).

[*BEST certification*](#) - offers workshops and consulting, community capacity building, summary of community stakeholders and tools for calculating energy, transportation, greenhouse gas emissions and food waste. A program of the Riverwind Foundation.

What does a ton of carbon look like?

I have a hard time visualizing what a ton of carbon looks like. (While we often don't think of gas as having weight, it does!) A metric ton of carbon takes up the space of a 27'x27'x27' cube (at sea level) or a balloon 10 yards (30') in diameter. In either case, this "cube" of carbon is the average amount of carbon emitted by citizens in industrialized countries in a month. In the US, this is the amount of carbon emitted every two weeks! (See the [Why do I need to enter my zip code or country](#) section for more information on why this is the case.)

I found some resources which might help visualize a ton of carbon. Check out the following:

[A visualization in New York City](#)

[A world-wide visualization](#)

[What makes a ton of carbon in a Canadian home?](#)

Artists created the [CO2 Cube project](#) for the Copenhagen 15 conference (the fifteenth meeting of the United Nations Framework Convention on Climate Change) in 2009.

The [EPA has a nice tool](#) which lets you visualize a variety of ways to visualize carbon produced. I found the results interesting for the equivalent emissions of 1-ton CO₂e, a tank of gas, a kilowatt hour and owning a car.

Consider this..

If we could see and touch the carbon we produce (think black powder, or something like that), would we be motivated to eliminate it? Why or why not?

What do you think? Let me know, twcrowell@comcast.net.

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