CSU V-CALC
User Guide v1.0

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Introduction

The Veterinary Carbon Accounting for Local Clinics (V-CALC) tool is an open access resource developed by Colorado State University (CSU) for veterinary teams in the United States to calculate their clinic's greenhouse gas (GHGs) emissions. The primary objective is to support veterinary clinics who seek to identify and implement emission reduction strategies.

Carbon accounting is the process of measuring, tracking, and reporting an organization's carbon emissions. It involves identifying sources of GHGs, quantifying emissions using standardized methods, and compiling data to assess the total carbon footprint. This practice is crucial for understanding environmental impact, setting reduction targets, and achieving sustainability goals. Carbon calculators help simplify this process by enabling users to input data related to energy consumption, transportation, waste, and other activities that generate GHGs. These calculators convert data into carbon dioxide equivalents (CO2e), providing a clear picture of emissions to assist organizations in developing strategies to reduce their carbon footprint.

Carbon accounting, which began as part of broader environmental impact assessments in the 1970s and 1980s, has evolved significantly. The 1990s saw it gain traction with the Kyoto Protocol's emission reduction targets, leading to the development of initial measurement methodologies. The early 2000s established standardized guidelines through the Greenhouse Gas Protocol. Since the 2010s, carbon accounting has advanced due to increasing regulatory requirements, the Paris Agreement, and technological innovations, becoming essential for governments, businesses, NGOs, and other organizations to effectively manage and reduce GHG emissions.

Emissions Classification

The U.S. Environmental Protection Agency (EPA) provides guidelines and categories for GHG emission reporting that align three scopes adopted from the standardized Green House Gas Protocol (Figure 1). Scope 1 emissions are direct emissions from sources owned or controlled by an organization. Such emissions include on-site fuel combustion (natural gas, diesel, or propane furnaces, water heaters, etc.), anesthetic gases, refrigerant leaks, and emissions from vehicles owned by the organization. Scope 2 emissions are indirect emissions, predominantly from the generation of purchased electricity (coal, natural gas or oil combustion power plants). These emissions occur at the facility where the energy is produced. Purchased steam, although uncommonly used, is another source. Scope 3 emissions are all other indirect emissions that occur in the organization's value chain. There are many subgroups in this category both upstream and downstream from the facility within the value chain. These include procurement (medical supplies and equipment, business services, IT, insurance, food, water, sanitation, etc.), waste, and transport (business and CE travel, staff commuting, and client visit travel). Each scope provides a distinct perspective on an organization's carbon footprint, helping to identify opportunities and priorities for emission reductions.

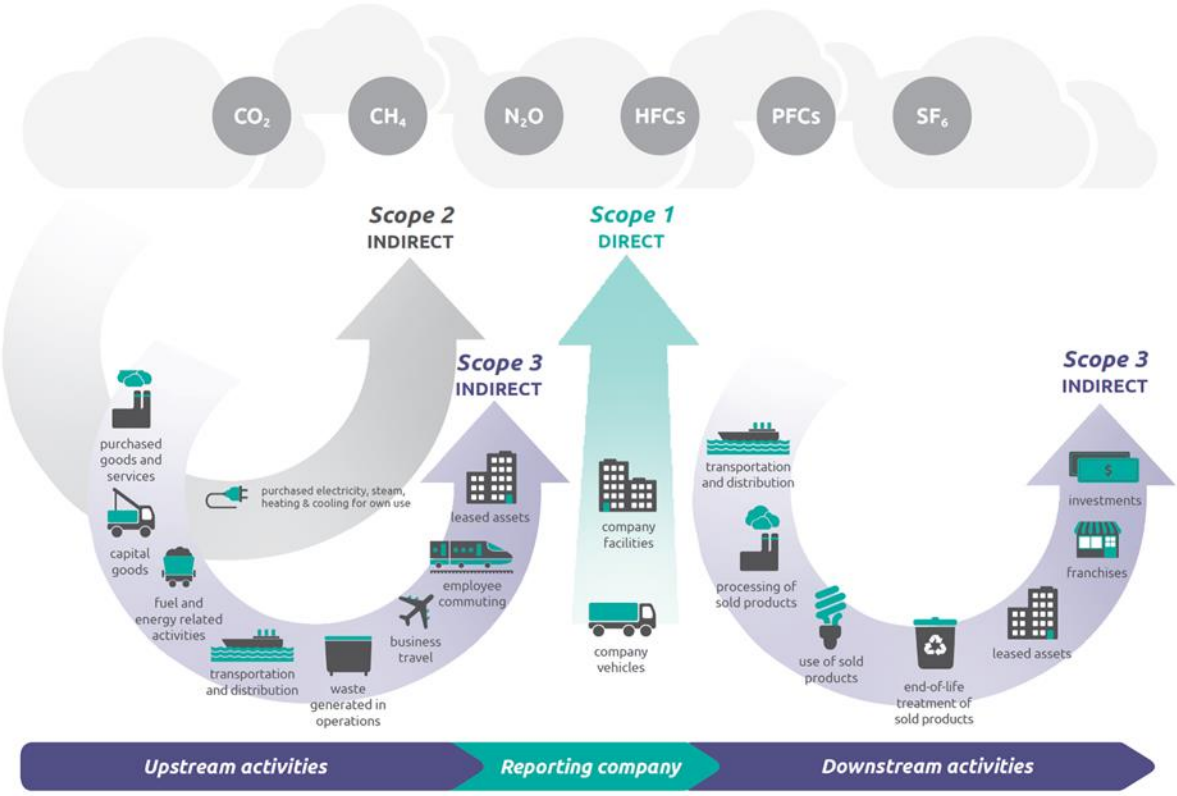

Figure 1. Overview of GHG Protocol scopes and emissions across the value chain. (Source: *EPA Center for Corporate Climate Leadership).*

Using the CSU V-CALC

Structure

The V-CALC is an Excel workbook that allows users to input information specific to their organization to receive an overall carbon footprint for their veterinary facility. The calculator is based on the EPA GHG calculator[1], modified for use in veterinary clinics. The calculator uses current EPA emission factors[1] and the US inflation rate[2].

The Excel workbook includes five sheets:

1. **Clinic Information** (pink): contains inputs about the clinic, including required data used for calculations

[1] US EPA, O. (2015, July 17). *GHG Inventory Development Process and Guidance* [Overviews and Factsheets]. https://www.epa.gov/climateleadership/ghg-inventory-development-process-and-guidance
[2] U.S. Bureau of Labor Statistics. (2024). *CPI Inflation Calculator*. Bureau of Labor Statistics. https://www.bls.gov/data/inflation_calculator.htm

2. **Scope 1** (blue): calculates direct GHG emissions from natural gas consumption and other stationary combustion sources, volatile anesthetic gas usage, and mobile combustion (transportation)

3. **Scope 2** (green): calculates indirect emissions from electricity consumed by the clinic

4. **Scope 3** (yellow): calculates indirect emissions from the clinic's supply chain

5. **Results** (red): contains a summary of calculated emissions for the clinic

Guidebook

This guide is intended as the primary resource for clinics using the CSU V-CALC. The guide follows the order and color of the tabs in the Excel workbook. Throughout the guidebook, checkboxes signify inputs while bullets provide additional information.

General Input Information

Before beginning the carbon accounting process, it may be helpful for the team to review the guidebook, and explore the calculator, such that the necessary clinic data can be aggregated for ease of input.

The following is a list of general guidelines for inputting data throughout the calculator:

- Dark pink cells are **required** input data
- Light pink shaded cells are **not** required, but helpful in informing results. These cells can be left blank if the data is unavailable
- If cells are grey shaded with black lines, they do not require data input as a different option has been selected
- Currency should be input in **US dollars**
- Data should be from a **cumulative** 12-month period (one fiscal year)

Calculations

An emission factor is a value that represents the quantity of a specific pollutant released into the atmosphere because of a particular activity. They are presented in terms of greenhouse gas emissions per unit of input. In this calculator, emission factors are CO2 emissions per input unit.

Total Greenhouse Gas Emissions= Amount of input (respective unit) * Emission factor (CO_2e/Unit of the input)

Clinic Information

This sheet contains general information about the clinic. Required inputs will be used in calculations.

☐ Clinic name: Enter the clinic's name in cell **C3.**

☐ Clinic state: Choose from the dropdown in cell **C4.** This will inform grid emissions factors further along in the calculation process and auto populate the eGRID subregion.

☐ Data year: Select the year for which you are calculating emissions in cell **C5.**

☐ Full-time equivalent veterinarians: Enter the number in cell **C7.**

☐ Full-time equivalent other employees: Enter the number of non-veterinary, full-time employees in cell **C8.**

☐ Square footage of clinic building: Enter the square footage of the clinic building in cell **C9.**

☐ Hours of operation: Enter the number of hours the clinic operates in a week in cell **C10.**

☐ Type of veterinary clinic**:** This is an **open cell** where you describe the type of veterinary clinic (e.g., companion/small animal, large animal, mixed practice, emergency, specialty, general, other). You may use a combination of terms for most accurate description. Enter cell **C11.**

☐ Total annual patient visits: Enter the number of patient visits per year in cell **C12.** For convenience this can be estimated based on average daily visits. Collect data from 10 -20 randomly selected, representative open clinic days in a year. Determine average client visits per day and multiply by number of days open a year. This information will be used in scope 3 for client(patient) travel.

Scope 1

Stationary Combustion

Stationary combustion refers to the on-site combustion of fuels to produce energy for various applications, including generating electricity and heating. They are typically associated with facilities such as power plants, or appliances such as boilers, furnaces, and other heating systems.

Input data can be found on invoices and/or receipts from the providers of fuel or utility bills. Note that if invoices are monthly, an annual amount must be summed so that data input is for a cumulative 12-month period.

☐ Natural gas: Enter the annual amount of natural gas consumed in therms in cell **B4.**

☐ Liquified Petroleum Gases (LPG): Enter the amount of LPG used annually in gallons at cell **B5.**

☐ Propane: Enter the amount of propane used annually in gallons in cell **B6.**

☐ Wood and wood residuals: Enter the amount of wood used annually in short tons in cell **B7.**

☐ Biodiesel: Enter the amount of biodiesel in gallons used annually in cell **B8.**

☐ Gasoline: Enter the amount of gasoline used annually in gallons in cell **B9.**

☐ Other oil: Enter the amount of other oil consumed annually in gallons in cell **B10.**[3]

Anesthetic Gas

Anesthetic gases are inhaled anesthetics administered predominantly as adjunctive anesthesia maintenance to intravenous anesthetic agents in the perioperative setting. As each agent has a different global warming potential (GWP),[4] the volume of each must be entered separately.

Input data can be found on invoices, receipts, and medical equipment logs or suppliers' data. If an anesthetic agent listed is not used in the clinic, leave it blank.

☐ Isoflurane: Enter the amount of isoflurane gas consumed annually in milliliters (mls) in cell **B15.**

☐ Sevoflurane: Enter the amount of sevoflurane gas consumed annually in mls in cell **B16.**

☐ Nitrous oxide: Enter the amount of nitrous oxide gas consumed annually in mls in cell **B17.**

☐ Desflurane: Enter the amount of desflurane gas consumed annually in mls in cell **B18.**

Mobile Combustion

Mobile combustion refers to the combustion of fuels in mobile sources, such as vehicles and machinery, which move from one location to another. In Scope 1, this includes fleet vehicles owned by the clinic and grey fleet vehicles that are owned by employees (or leased/rented) but are used for clinic work and typically reimbursed according to miles travelled.

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[3] US EPA, O. (2015, July 27). *GHG Emission Factors Hub* [Overviews and Factsheets]. https://www.epa.gov/climateleadership/ghg-emission-factors-hub

[4] Jones, R. S., & West, E. (2019). Environmental sustainability in veterinary anaesthesia. *Veterinary Anaesthesia and Analgesia*, *46*(4), 409–420. https://doi.org/10.1016/j.vaa.2018.12.008

Inputs are the annual mileage for both fleet and grey fleet vehicles. Vehicle logs or serial odometer readings are usually the repository of this information. This can also be estimated based on destination distances and frequency of travel.

☐ Vehicle Type: Enter the annual miles travelled for each **fleet** vehicle type in cells **B24:B29.**

☐ Vehicle Type: Enter the annual miles travelled for each **grey fleet** vehicle type **B34:B39**

Fugitive Emissions

Fugitive emissions refer to unintentional release of gases used in refrigeration, air conditioning, heat pump systems, and fire extinguishers. These emissions occur due to leaks, improper handling, servicing, and disposal of equipment containing refrigerants. In most cases, this data is not tracked and therefore may not be available. This information may be found on servicing receipts under gas recharge.

If data is known:

☐ Equipment Type: Enter the amount of quantity recharged annually in pounds[5] in cells **B44:51**

☐ Gas Type: Choose the gas type from the dropdown in cells **D44:51** for each equipment type. This information may be found on servicing receipts under gas recharge.

Scope 2

Electricity

There are three different methods for calculating Scope 2 emissions using electricity data.

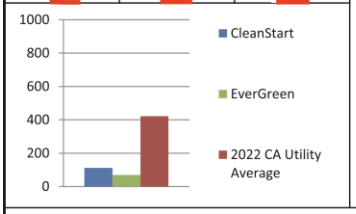
The first method uses actual consumed electricity data in kWh, provided on utility bills/receipts. This uses US eGrid average regional/state electricity emissions factors comprised of various sources (i.e. fossil fuel vs renewables).

The second method also uses the actual consumed data, but the user must also input the known power content emission factor (lbsCO2/MWh). In California this information is provided on the Power Content Label under the Greenhouse Gas Emissions Intensity column (figure 2, red underlines). The power content emission factor varies depending on the % and type of renewables comprising the purchased electricity, s Outside California, this information may appear on utility bills or could be available from the utility company upon request.

[5] US EPA, O. (2015, July 27). *GHG Emission Factors Hub* [Overviews and Factsheets]. https://www.epa.gov/climateleadership/ghg-emission-factors-hub

2022 POWER CONTENT LABEL
Sonoma Clean Power Authority
sonomacleanpower.org

Greenhouse Gas Emissions Intensity (lbs CO_2e/MWh)		
CleanStart	EverGreen	2022 CA Utility Average
112	70	422



Energy Resources	CleanStart	EverGreen	2022 CA Power Mix
Eligible Renewable[1]	**50.3%**	**100.0%**	**35.8%**
Biomass & Biowaste	16.4%	0.0%	2.1%
Geothermal	17.0%	86.5%	4.7%
Eligible Hydroelectric	0.4%	0.0%	1.1%
Solar	9.0%	13.5%	17.0%
Wind	7.5%	0.0%	10.8%
Coal	**0.0%**	**0.0%**	**2.1%**
Large Hydroelectric	**40.0%**	**0.0%**	**9.2%**
Natural Gas	**0.0%**	**0.0%**	**36.4%**
Nuclear	**0.9%**	**0.0%**	**9.2%**
Other	**0.1%**	**0.0%**	**0.1%**
Unspecified Power[2]	**8.7%**	**0.0%**	**7.1%**
TOTAL	**100.0%**	**100.0%**	**100.0%**
Percentage of Retail Sales Covered by Retired Unbundled RECs[3]**:**	**0%**	**0%**	

[1]The eligible renewable percentage above does not reflect RPS compliance, which is determined using a different methodology.
[2]Unspecified power is electricity that has been purchased through open market transactions and is not traceable to a specific generation source.
[3]Renewable energy credits (RECs) are tracking instruments issued for renewable generation. Unbundled renewable energy credits (RECs) represent renewable generation that was not delivered to serve retail sales. Unbundled RECs are not reflected in the power mix or GHG emissions intensities above.

For specific information about this electricity portfolio, contact:	**Sonoma Clean Power Authority (855) 202-2139**
For general information about the Power Content Label, visit:	https://www.energy.ca.gov/programs-and-topics/programs/power-source-disclosure-program

Figure 2: Example of Power Content Label and GHG Emissions Intensity in California

The third method uses estimated data based on the clinic square footage with no data entry required. This method can be used if you do not have monthly or annual electricity consumption information available.

A dropdown menu in **B2** will allow you to select the appropriate electricity data type. The appropriate data table for inputs will be selected. Greyed out tables do not require data input.

If electricity data type selected is "**Electricity Actual Data**":

☐ Electricity consumed (KWh): Enter the amount of electricity consumed annually in cell **B8.**

If electricity data type selected is "**Electricity Actual Data (known power content emission factor)**":

☐ Electricity consumed (KWh): Enter the amount of electricity consumed annually in cell **B12.**

☐ Known power content emission factor (lbsCO2/MWh): Enter in cell **D12**.

If electricity data type selected is "**Electricity Estimated Data (No data entry required)**":

☐ No data entry is required: fields will be auto populated based on the indoor square footage of the facility from clinic information.

Steam

If applicable, steam and heat data can be entered to contribute to Scope 2 emissions.

☐ Steam and heat: Enter the amount of steam and heat purchased annually in mmBtu at cell **A20.**

Scope 3

Purchase of Goods and Services

There are two methods used to calculate indirect emissions from a clinic's purchase of goods and payment of services.

The first method allows the user to input a total amount of their annual clinic expenses, excluding salaries and wages.

The second method allows the user to refine the input into specific categories (if available), which may help to better inform reduction planning. Purchasing data is typically found in the clinic's financial statement(s)[6].

A dropdown menu in **B3** will allow you to select the expense data table type. The appropriate data table for inputs will be selected. Greyed out tables do not require data input.

If the expense data table type selected is "**Total Amount Spent**":

☐ Hospital expenditure amount (excluding salaries and wages): Enter the total amount of expenses (USD) the clinic incurs annually, excluding salaries and wages, in cell **B7.**

If the expense data table type chosen is "**Categorized Amount**":

☐ Expense classification: Enter the individual amount of expenses (USD) the clinic incurs annually in cells **B10:B21.**

Waste

If a clinic knows the expense amount for waste disposal, the data can be entered to contribute to Scope 3 emissions. Data can be found in receipts or invoices for waste handling companies.

[6] (U.S. Bureau of Labor Statistics, 2024) U.S. Bureau of Labor Statistics. (2024). *CPI Inflation Calculator*. Bureau of Labor Statistics. https://www.bls.gov/data/inflation_calculator.htm

☐ Waste expenditure amount: Enter the total amount of waste expenses (USD) the clinic incurs annually in cell **B25.**

Business Travel

If applicable, clinics can enter business travel data. Business travel involves an organization's travel for business-related activities such as to conferences, seminars or training. Emissions are calculated based on estimated miles travelled and vehicle type. Approximated return distance for each individual trip can be determined to a general destination point (i.e. city for air or inter-city/state travel). Estimated miles must then be summed for each vehicle type.

☐ Vehicle type: Enter total miles travelled for each vehicle type annually in cells **B29:B36.**

Employee Commuting

Employee commuting emissions are calculated based on miles travelled in different vehicle types. Inputs here could be actual data obtained through an employee commuting survey, or estimated data by multiplying the usual number of days an employee works each week, the expected number of weeks worked a year, the approximate return distance, and the vehicle type.

☐ Vehicle type: Enter miles travelled annually in cells **B41:B48.**

Client (Patient) Travel

Client (patient) travel emissions are calculated based on the average number of roundtrip miles travelled per patient for each client visit. Actual miles driven by clients could be obtained through a client survey. An estimation can be made by calculating the average roundtrip miles per visit per client. This can be done by collecting data from at least 10 and preferably 20 randomly selected representative open clinic days in a year. Determine the roundtrip distance directly traveled for all clients over those days, assuming one roundtrip, and average client miles traveled. The emission factor is based on average personal use US vehicle type.

☐ Miles per year: Enter average miles driven annually (roundtrip) for a patient coming to the clinic in cell **B53.**

Results

The calculator will produce a GHG inventory pie chart, tabulated results, a bar graph, and an emissions equivalent link in the results tab.

Greenhouse Gas Inventory

The Greenhouse Gas Inventory has two parts. The outer rings represent the percentage of total emissions attributed to each scope (Scope 1: blue, Scope 2: green, Scope 3: yellow). The outer ring breaks down each scope into the percentages that each individual category contributes to the total emissions of the scope. This data is also summarized in the table below the graph. A bar graph summarizing individual categories contributing to each scope is also provided.

Greenhouse Gas Equivalencies

To help understand your results in more concrete terms, a link has been provided to an external website[7] managed by the US EPA that converts your emissions to equivalencies.

An overview of the EPA process is provided below using the data from the calculator:

- Select emissions data as the data type to convert. Enter the total emissions (CO2e) provided in the results tab in the appropriate box. Scroll down and click "Convert data" to view your results.
- In its results section, you will have your equivalent emissions from GHGs, CO2 emissions, and a greener way of expressing your emissions in terms of "GHG emissions avoided by."

About this Project

The CSU V-CALC was developed by Terryann Kirui in partial fulfillment of the requirements for the CSU Impact MBA program. She was supported by a team of CSU faculty, resident veterinarians, students, and private veterinary practitioners.

[7] *Greenhouse Gas Equivalencies Calculator | US EPA*. (n.d.). Retrieved July 29, 2024, from https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator