



Staff / Citizen Calculator

Citizen / Staff Carbon CO₂e Calculator

Methodology, Assumptions & Data Sources

Overview

This calculator provides an estimate of an individual's annual greenhouse gas emissions (tCO₂e), designed for use in carbon audits, staff engagement, and baseline footprinting.

It follows principles set out in the GHG Protocol / ISO 14064, and aligns with UK emissions reporting practices using Department for Environment, Food & Rural Affairs datasets.

The model balances:

- **Credibility** (aligned with published datasets)
- **Simplicity** (user-friendly inputs)
- **Consistency** (repeatable methodology)

Scope & Boundaries

This calculator captures key elements of personal emissions, combining direct energy use with major Scope 3 categories.

Included:

- Home energy (electricity and heating fuels)
- Personal transport (car, public transport, flights)
- Diet (food consumption patterns)
- Purchased goods (clothing, furniture, electrical items)

Excluded:

- Public services (healthcare, infrastructure)
- Detailed product-level lifecycle assessments
- Business-specific supply chain emissions beyond personal consumption

These exclusions are intentional to maintain usability while focusing on the most significant and influenceable emission sources.

Methodological Approach

All emissions are calculated using the standard formula:

$$\text{Activity Data} \times \text{Emission Factor} = \text{Emissions (kgCO}_2\text{e)}$$

Emission factors are primarily sourced from:

- Department for Environment, Food & Rural Affairs
- Peer-reviewed lifecycle assessment (LCA) studies
- Aggregated global datasets where UK-specific values are unavailable

1. Home Energy

Inputs:

- Annual electricity consumption (kWh)
- Heating type (e.g. gas, oil, electricity)

Factors:

- UK grid electricity factors (DEFRA / DESNZ)
- Fuel-specific combustion factors

Assumptions:

- Grid average used unless a renewable tariff is specified
- Renewable electricity may be treated as zero emissions (market-based approach)

Notes:

- Exported solar energy is not credited
- Estimated values / industry averages may be used where actual data is unavailable

2. Transport

Inputs:

- Annual distance travelled by mode:
 - Car
 - Motorbike
 - Rail
 - Bus
 - Flights

Factors:

- DEFRA passenger transport conversion factors
- Includes well-to-tank (WTT) emissions where applicable

Assumptions:

- Average vehicle occupancy applied where not specified
- Typical UK fleet efficiency used

Notes:

- Air travel may include radiative forcing uplift
- Distances may be estimated by the user

3. Diet (Food Emissions)

Overview

Food production accounts for approximately 25–30% of global greenhouse gas emissions. The climate impact of diet varies significantly depending on food type.

Key Drivers of Food Emissions

- **Red meat (beef and lamb)**
High emissions due to methane and land use change (can exceed 100 kgCO₂e/kg)
- **Dairy products**
Moderate-to-high emissions, particularly for cheese and butter
- **Other animal proteins**
Lower than red meat but higher than plant-based foods

- **Plant-based foods**
Typically lowest emissions (<1–2 kgCO₂e/kg)

Dietary Categories Used

To balance accuracy and usability, diets are grouped into simplified categories:

- High meat
- Average diet
- Low meat
- No red meat
- No dairy / low meat
- Vegetarian / vegan

Methodology

Values are derived from:

- Our World in Data
- Reducing food's environmental impacts through producers and consumers
- Environmental impacts of dietary groups in the UK

Categories are scaled to reflect:

- High impact of beef and lamb
- Moderate contribution of dairy
- Lower emissions from plant-based diets

Interpretation

- Moving from a high meat diet to a vegan diet can reduce emissions by approximately 70–75%
- Eliminating beef alone delivers a significant reduction
- Diet is one of the most effective personal carbon reduction levers

Limitations

- Represents average dietary patterns
- Does not account for:
 - food waste
 - sourcing (local vs imported)
 - farming method

4. Goods, Furniture & Equipment (Spend-Based Scope 3)

Overview

This category captures emissions associated with:

- Clothing
- Furniture
- Electrical goods
- Other purchased items

These fall under Scope 3: Purchased Goods and Services.

Methodological Approach

Where detailed product data is unavailable, emissions are calculated using a spend-based approach:

$$\text{£ Spend} \times \text{Emission Factor (kgCO}_2\text{e/£)} = \text{Emissions}$$

Emission factors are sourced from:

- CarbonSaver Scope 3 factors (UK-aligned datasets)

These factors represent average lifecycle emissions, including:

- raw material extraction
- manufacturing
- transport
- packaging

Why This Approach Is Used

Most individuals and SMEs do not have access to detailed product-level emissions data.

Spend-based factors provide:

- A practical and scalable method
- Broad coverage of otherwise unaccounted emissions
- Alignment with accepted carbon accounting practices
- Accounts for emissions associated with the individual's spending within each sector.

Limitations

- Based on sector averages, not specific products
- Does not reflect supplier differences or product lifespan
- Spend does not always directly correlate with emissions
- Not suitable if the spend based factor is the focus of the audit.

These values are therefore indicative and suitable for baseline assessments.

Data Quality & Hierarchy

The calculator follows a recognised hierarchy:

1. **Actual data** (e.g. energy bills, measured usage)
2. **Estimated data** (user approximations)
3. **Default values** (standard assumptions)
4. **Spend-based estimates** (for goods and services)

Rounding & Reporting

- Results are presented in tonnes CO₂e per year
- Values may be rounded for clarity
- Underlying calculations retain higher precision

Limitations of the Model

- Not a full lifecycle assessment
- Not suitable for product-level carbon auditing.

Level of Accuracy & Use

This model is designed to provide **robust, evidence-based estimates of personal emissions**, suitable for:

- Carbon footprinting
- Internal / External reporting
- Carbon offsetting

The methodology applies recognised emission factors and transparent assumptions to ensure results are:

- **Consistent**
- **Traceable**
- **Proportionate to available data**

While some elements rely on estimated or spend-based inputs, this approach reflects standard practice in carbon accounting, particularly for Scope 3 emissions where primary data is not available.

Results should be interpreted as **credible estimates rather than precise measurements**, but are suitable for use in carbon offsetting and decision-making when applied consistently.

Appropriate Use

The calculator is suitable for:

- Establishing a baseline carbon footprint at an individual level.
- Identifying key emission hotspots across staff and teams.
- Informing behavioural and operational carbon reduction strategies.
- Supporting carbon offsetting decisions.
- Quantifying emissions for the purpose of voluntary carbon offsetting.

The tool is designed to be scalable across organisations, enabling businesses to:

- Engage employees in carbon awareness and responsibility.
- Aggregate staff-level data to build a broader understanding of organisational emissions.
- Identify patterns and opportunities for reduction across travel, energy use, and consumption.

When applied consistently and supported by appropriate underlying data, results may be used to determine the volume of carbon credits required to offset quantified emissions.

Outputs can contribute to carbon reporting aligned with recognised standards such as ISO 14064, where used as part of a wider documented methodology.

References

[UK Government Emissions Conversion Factors \(DEFRA / DESNZ\)](#)

[Our World in Data – Environmental Impacts of Food](#)

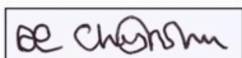
[Our World in Data – Food Emissions Overview \(25–30%\)](#)

[Poore & Nemecek \(2018\) – Reducing food’s environmental impacts \(Science\)](#)

[Scarborough et al. \(2023\) – Environmental impacts of dietary groups \(Nature Food\)](#)

[CarbonSaver Scope 3 Emission Factors](#)

[Food and Agriculture Organization \(FAO\) – Food system emissions context](#)



Alistair . P . H . Chisholm

APPENDIX

Dietary Emissions – Methodology & Assumptions

Food production is a major contributor to global greenhouse gas emissions, accounting for approximately 25–30% of total emissions worldwide. The climate impact of diet varies significantly depending on the types of food consumed, with animal-based products—particularly red meat and dairy—being the most carbon-intensive.

This calculator uses a simplified set of dietary categories to estimate annual emissions per person, based on robust, peer-reviewed research and global lifecycle assessment data.

Key Drivers of Food Emissions

The primary factors influencing dietary emissions are:

- **Red meat (beef and lamb)**
These are the most carbon-intensive foods, largely due to methane emissions from enteric fermentation and land use change. Beef can exceed 100 kgCO₂e per kg of product.
- **Dairy products**
Emissions from dairy are lower than beef but still significant, particularly for cheese and butter due to processing intensity.
- **Other animal proteins (chicken, pork, fish)**
These have substantially lower emissions than red meat but remain higher than most plant-based foods.
- **Plant-based foods**
Typically have the lowest emissions, often below 1–2 kgCO₂e per kg.

Dietary Categories Used

To balance accuracy and usability, the calculator groups diets into six categories:

Diet Type	Description	Annual Emissions (kgCO ₂ e)
High meat diet	Frequent consumption of red meat and animal products	2,800
Moderate meat diet	Regular meat consumption	2,000
No beef	Meat consumption excluding beef/lamb	1,700
No dairy / red meat	No beef, lamb, or dairy; may include poultry/fish	1,300
Vegetarian	No meat; includes dairy and eggs	1,000
Vegan	No animal products	700

Methodology

These values are derived by combining:

- Lifecycle emissions data by food type**
From Our World in Data, based on global meta-analyses of food supply chains, including land use change, farming, processing, transport, and retail.
- Observed dietary patterns and emissions**
From peer-reviewed studies published in journals such as *Nature Food*, which estimate real-world dietary emissions across different eating habits.
- Relative impact scaling**
Categories are positioned to reflect:
 - The disproportionately high impact of beef and lamb
 - Moderate contributions from dairy
 - Lower emissions from poultry and plant-based diets

Values are rounded to provide clarity while remaining within realistic and defensible ranges for UK and comparable diets.

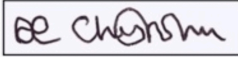
Interpretation

- Moving from a **high meat diet to a vegan diet** can reduce dietary emissions by approximately **70–75%**.
- Eliminating **beef alone** delivers a significant reduction, often greater than cutting all dairy.
- Diet changes represent one of the most effective personal actions to reduce carbon footprint.

Limitations

- Values represent **typical averages**, not precise individual footprints.
- Portion sizes, food waste, sourcing, and production methods can all influence actual emissions.

- This model does not account for organic vs conventional farming or specific supply chains.
- Transport emissions (“food miles”) usually contribute 5–15% of total food emissions, with a higher proportional impact for lower-emission foods such as plant-based products. Average food transport emissions are embedded in the total emissions.



Alistair . P . H . Chisholm

