

Methodological Note for

“Tool for the self-measurement of carbon footprint of citizens”



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Summary

This tool was developed by the University of Turin as part of the European project 'Green Rights for a Sustainable Future: Improving Citizens' Involvement in the EU's Climate Ambitions', to enable citizens to estimate their carbon footprint based on their main daily habits.

The tool is divided into four sections 'Food', 'Mobility', 'Waste' and 'Energy'. These four categories were chosen because they represent the main areas of daily consumption of citizens. We are aware that the outputs do not cover all the emissions generated by each citizen, since only some specific areas common to all have been considered.

The tool has an **Input** section where each field should be filled with the data and/or estimates available to the user. The data requested are monthly, except for flights, which are annual.

The following table details the required data/estimates and their units of measurement.

Section	Required Data	Units of Measurement
Food & beverages	Food and beverage consumed per month	Kg / Litres
Mobility	Fuel consumed in a month driving a car	Km / Litres
	Kilometres travelled using public transport per month	Km
	Kilometres travelled by plane in the last year	Km
Waste & Circularity	Data of kgs of waste produced in a month	Kg
Energy	Monthly electricity consumption	kWh
	Monthly heating gas consumption	m ³

The data is needed to calculate the emissions impact of each section and the total carbon footprint. This tool was developed using emission factors from open sources, namely:

Quantitative data

The following sources were used for food-related emission factors:

- Poore and Nemecek (2018): “Reducing food’s environmental impacts through producers and consumers”
- OWID (2021): Environmental Impacts of Food Production — by Hannah Ritchie, Pablo Rosado and Max Roser
- Mauro Moresi — Carbon footprint del pane (pg.2)
- Roberto Cavallo — Meno 100 chili — Edizioni Ambiente (2011)
- Coca cola (2021): Sustainability report

An open-source database was used for mobility and waste-related emission factors:

- DEFRA (2023)

It should be noted that in the section on waste, 'mixed waste' is not included because the corresponding emission factor is not available from open sources.

An open-source database was used for energy-related emission factors:

- AIB (2022)

Qualitative questions

In addition, the tool presents six qualitative questions to explore the degree of sustainability of respondents' daily habits.

Answers to each question are scored on a scale of 0 to 2, indicating thresholds for the degree of sustainability of daily habits.

Habits and Emission Impact	Score
Bad habits and high emissions impact	0
Average habits and medium emissions impact	0.5
Good habits and low emissions impact	1
Great habits and very low emissions impact	1.5

Qualitative questions

Below are the questions and their scores.

Questions	Possible Answers	Score
1) Do you consciously try to eat seasonal food?	Yes	1
	No	0
2) Do you consciously try to buy only the food you need?	I never waste food	1
	I generally try to buy only what I need to minimise food waste	0.5
	It is not a major concern for me	0
3) How do you mainly get around in the city?	Motor vehicle	0
	Electric vehicle	1
	Public transport	1.5
	Bicycle/electric scooter	1.5
	Walking	1.5
4) Over the past three years, how many times have you flown?	< 3 times	1.5
	3-5 times	1
	5-10 times	0.5
	>10 times	0
5) Do you sort your waste for recycling?	Yes	1
	No	0
6) Which of the following steps do you take to reduce your waste?	Purchase unpackaged products	1
	Plan spending such as to avoid unnecessary purchases	1
	Drink tap water	1
	Buy in bulk or in large format packs	1
	Do not waste food	1
	Reuse food scraps	1
	Composting	1
	Avoiding single-use plastics	1
	Re-use or upcycling materials	1
	None of the above	0
7) What methods do you use to reduce energy and heating fuel consumption?	Using LED lights	1
	Turning off electronics when not in use	1
	Adjusting thermostat	1
	Using energy-efficient electronics	1
	None of the above	0

The answers to the qualitative questions will provide an overall score. The scores for the qualitative questions were calculated on both a single and a weighted basis.

Your score

The weights assigned to each category were calculated using information for 2023 provided by the European Commission, the World Economic Forum and the European Environmental Agency. For the sake of completeness of the analysis, the data found and references[1] to them are given below.

In 2023, EU greenhouse gas emissions are distributed among the main sectors as follows:

1. Energy (including energy industries)

This sector accounts for approximately 53% of total EU GHG emissions. Of these, 28% are attributable to fuel combustion by end users (excluding transport), and 25% are attributable to energy production industries.
([European Commission](#)) ([World Economic Forum](#)).

2. Transport

The transport sector contributes 24% of total greenhouse gas emissions. This sector saw a 7% increase in emissions between 1990 and 2020, despite reductions in other sectors.
([World Economic Forum](#)).

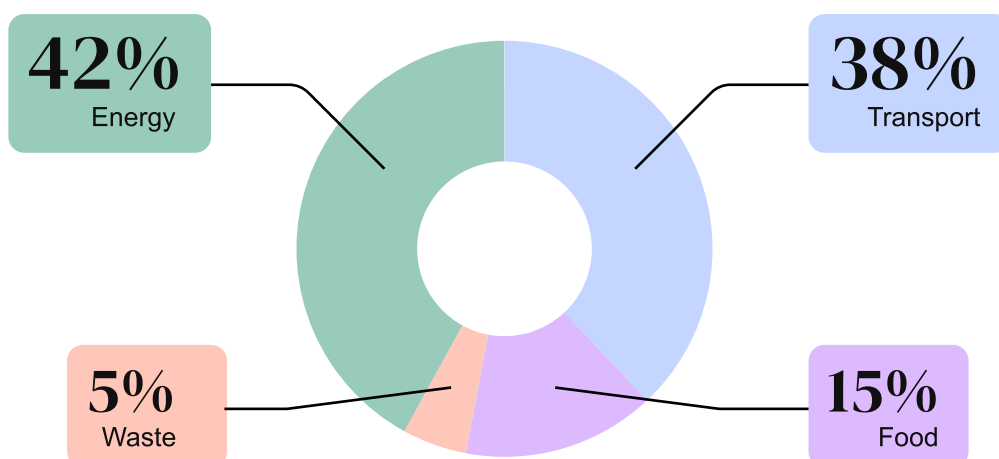
3. Food consumption (agricultural sector)

Emissions from food consumption, mainly from agriculture, account for about 10% of total emissions. The main sources are methane (CH₄) from enteric fermentation and nitrous oxide (N₂O) from agricultural soils.
([European Environment Agency's home page](#))

4. Waste

The waste sector contributes about 3% of total greenhouse gas emissions, mainly from waste treatment and disposal.
([European Environment Agency's home page](#))

Based on this information, these percentages of the total were calculated, and the result is as follows:



[1] <https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer>

https://climate.ec.europa.eu/news-your-voice/news/climate-action-progress-report-2023-2023-10-24_en

<https://www.eea.europa.eu/en/analysis/indicators/greenhouse-gas-emissions-from-transport>

<https://www.eea.europa.eu/data-and-maps/daviz/ghg-emissions-by-aggregated-sector-5#tab-dashboard-02>

https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Greenhouse_gas_emission_statistics_-_emission_inventories

The score ranges are shown in the table below.

Description	Score	Weighted score	Multiplier
Great habits and very low emissions impact	9-12	2-3	0.8
Good habits and medium/low emissions impact	8-5	1.9-0.0	1.5
Bad habits and high emissions impact	4-0	0.8-0	3

In addition, multipliers have been applied to each score to link the qualitative scores to the carbon footprint output. In this way, the output in terms of CO₂e emissions also takes into account the goodness of the habits.

The quantitative choice of multipliers was arbitrary, but the logic applied was to 'amplify' the negative/positive impact in terms of emissions resulting from the answers on habits.

The Output section shows the calculation of emissions for each of the sections presented and the total carbon footprint.

The scores for the qualitative questions and their score ranges are also available.

To provide a tangible benchmark for assessing one's carbon footprint, it was suggested that the total carbon output could be compared to the emissions generated by driving around the world in a car. In this example, we assume a final carbon footprint of 99 tonnes. The calculation is based on the average CO₂ emissions per kilometre travelled in a car.

Average CO₂ emissions of a car per kilometre (g/km):

The average may vary, but for a gasoline car we can estimate about 120-150 g/km. We use an average value of 135 g/km.

1 ton of CO₂ = 1,000,000 grams of CO₂

Convert 99 tons of CO₂ to grams:

99 tons × 1,000,000 g/ton = 99,000,000 g CO₂

Divide the total amount of CO₂ in grams by the average emissions per kilometre:

99,000,000 g CO₂ /135 g/km = 733,333.33 km

Since the circumference of the Earth is 40,075 km, the number of km (733,333.33) was divided by the circumference of the Earth to calculate how many times it is travelled. The result is about 18 times.

