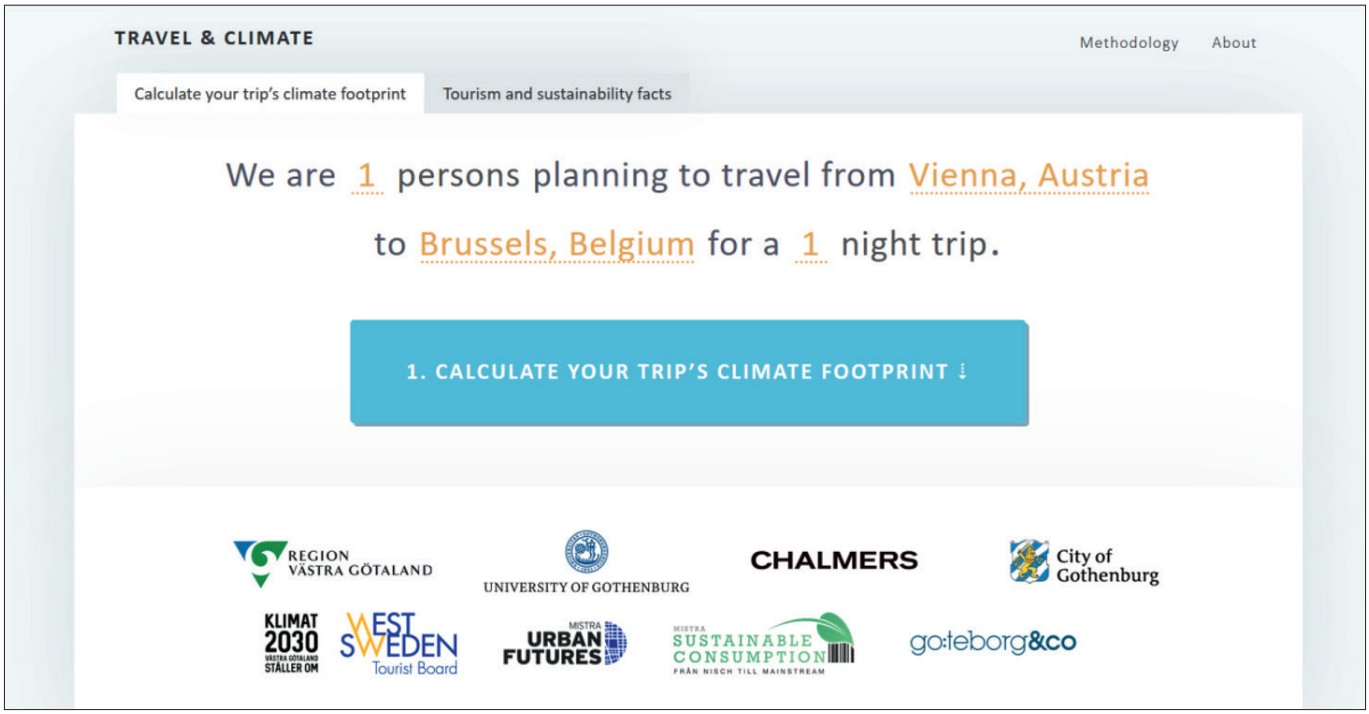
Additional Information on Carbon Calculators!

OTHER FOOTPRINT CALCULATORS COVERING DIFFERENT ASPECTS

1. TRAVEL & CLIMATE CALCULATOR (SWEDEN)

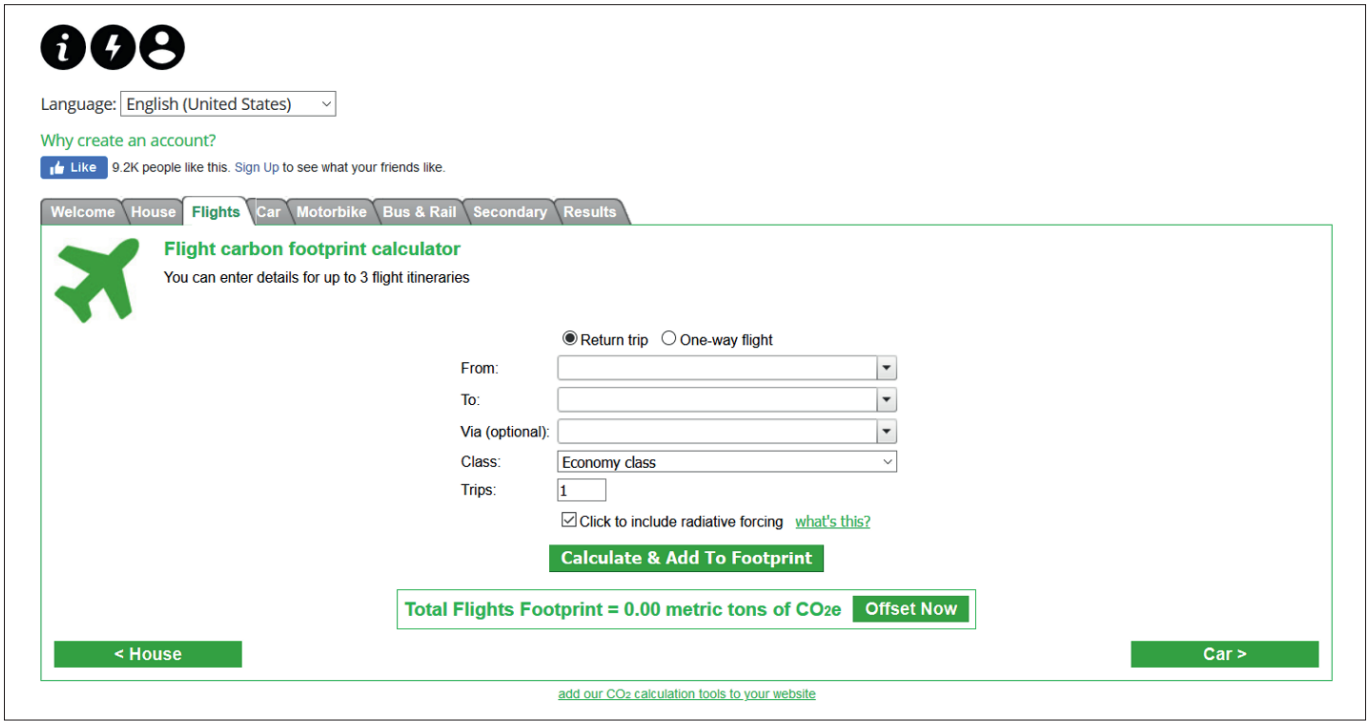
Travel & Climate is an easy-to-use webtool calculating the carbon footprint from travel to global destinations including local accommodation. It's been developed by Chalmers University (Gothenburg/Sweden) and promoted by Swedish agencies. Where applicable, different travel modes and accommodation types are compared with each other. Non-CO2 effects are roughly accounted for, but a uniform emission factor is used independent of flight type (or its load factor), aircraft type (i.e. the efficiency) and distance (i.e. potential for high-altitude effects).
The results for the trip are compared to a sustainable carbon budget and other indicators.
https://travelandclimate.org/



1.1 CARBON FOOTPRINT LTD CALCULATOR DEVELOPED ON UK DATA

One (commercial) carbon footprint calculator offers a free webtool for households. It has a separate module for air travel calculation. This includes an uplift factor for non-CO2 effects and the choice between four different classes, i.e. seating area occupation. This is a reasonable abbreviation. In addition, carbon emissions related to electricity and heating consumption ("house") can be calculated, as well as other transport means, and material consumption ("secondary") covering diet, textiles, electronic equipment, services, recreational activities, and many more.

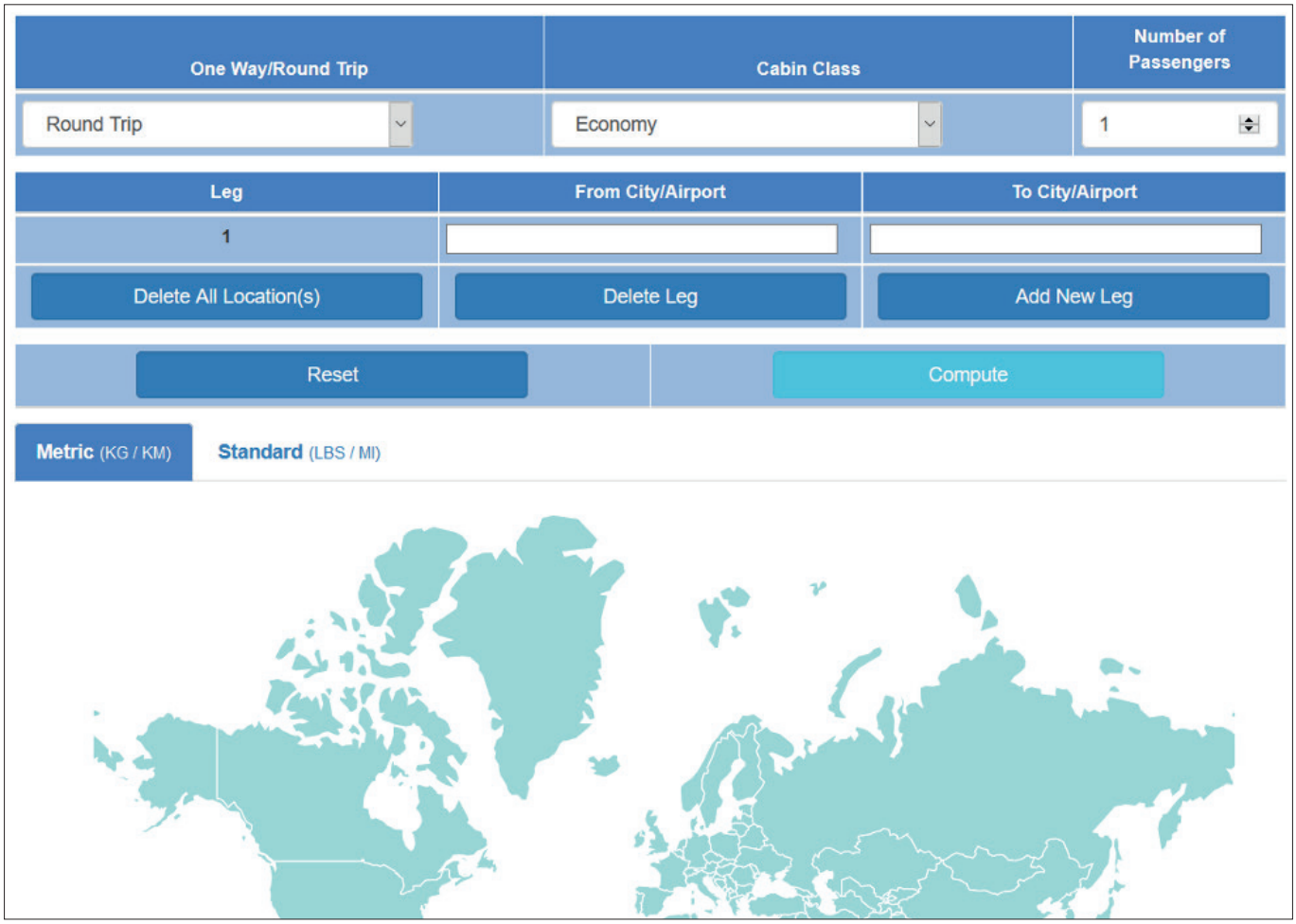
Secondary emissions are calculated based on the value of the goods or service category consumed multiplied with an upstream emission factor derived from the national consumption in the UK.
There is a commercial webtool to calculate the carbon footprint for companies.
The individual results are displayed by activity and compared to the average carbon footprint in different world regions and to a sustainable goal.
https://www.carbonfootprint.com/calculator.aspx



1.2 AIRLINE/ICAO CALCULATOR

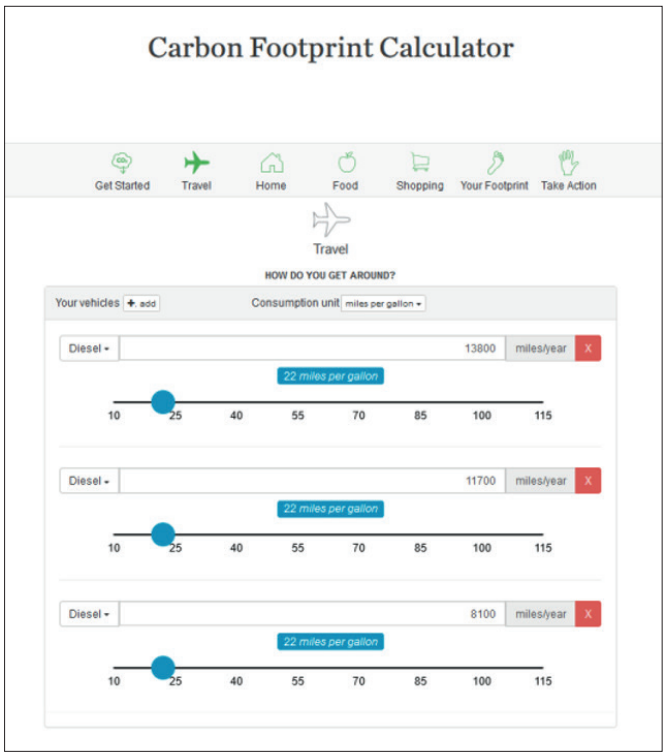
Airlines widely use the ICAO calculator; it is often used for flight emission offsetting. The calculator is easy to use by entering origin and destination. However, its key deficit is that it only counts carbon dioxide (CO2) emissions, and omits half or even two-thirds of the climate footprint by not accounting for and not even mentioning indirect and non-CO2 effects. Moreover, the calculator assumes a full economy seating arrangement. This means that a flight's emissions are distributed on the maximum number of passengers, and thus become minimal on a per passenger basis. However, airlines do have diverse seating arrangements with various seating classes and occupying spaces. Therefore, in reality, emission per capita will almost always be higher than assumed here.

WE DO NOT RECOMMEND USING THE ICAO CALCULATOR as its results are misleading.
https://www.icao.int/environmental-protection/CarbonOffset/Pages/default.aspx



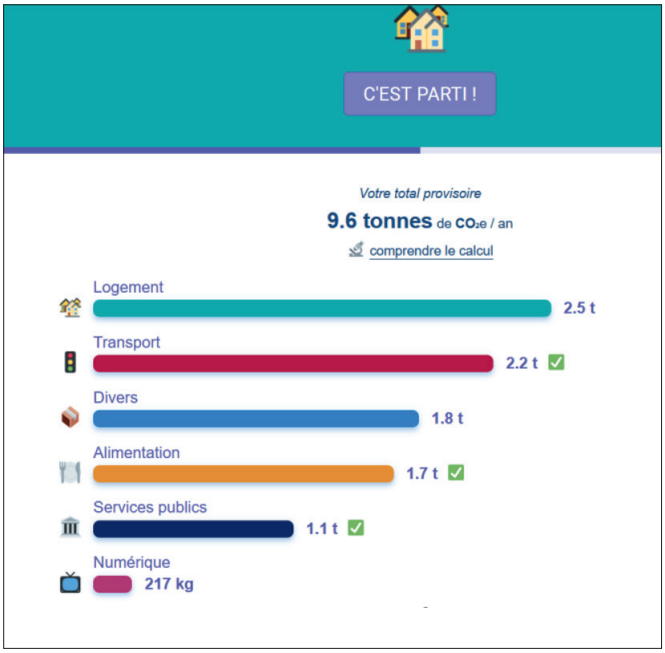
1.3 CARBON FOOTPRINT CALCULATOR FROM THE NATURE CONSERVANCY, DEVELOPED ON USA

A carbon footprint calculator developed by The Nature Conservancy offers a similar scope with default data specific for the USA. It is useful for this country but hard to use outside. https://www.nature.org/en-us/get-involved/how-to-help/carbon-footprint-calculator/



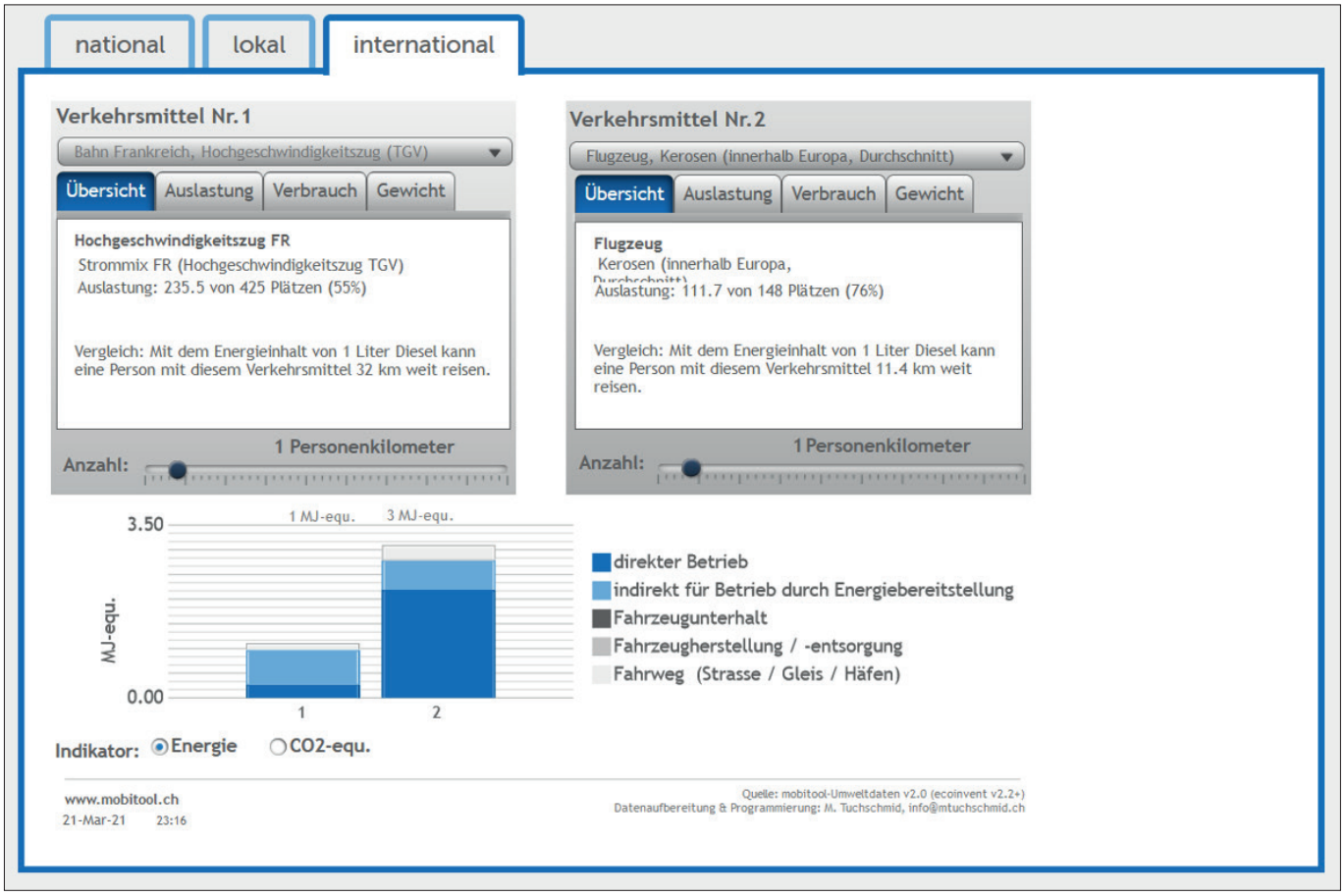
1.4 NOS GESTES CLIMAT: CARBON FOOTPRINT CALCULATOR FOR FRANCE

~~nos_GEStes_climat~~ is a household footprint calculator developed by Avenir climatique and TaCa (a member of Stay Grounded) and now proposed by the French Agency for Environment and Energy savings (ADEME) and based on default values for France. It comprises air travel (short-, medium- and long-haul) as part of the mobility assessment. Air travel includes a non-CO2 uplift factor.
https://nosgestesclimat.fr/simulateur/bilan



1.5 MOBITOOL: LIFE CYCLE TRANSPORTATION FOOTPRINT FOR COMPANIES (SWITZERLAND)

Mobitool has been developed for the travel management of companies notably in Switzerland (languages: German and French). Interestingly, this calculator not only includes emissions from the vehicles' operation, i.e. fuel consumption, but also from the production of the vehicle and infrastructure used. This is a unique life cycle approach.
https://www.mobitool.ch/de/tools/vergleichsrechner-v2-0-15.html



COMPARING RESULTS BETWEEN DIFFERENT CALCULATORS

The different calculators reviewed here operate on different assumptions. Important parameters are:

- The fuel consumption for the trip; here ICAO is often regarded as an authoritative source. **Atmosfair** and ICAO agree well for the medium haul flight. For the long-haul flight ICAO just assumes an unrealistically high seating density, ignoring anything else by economy seats. **Atmosfair** would return the same result with this same assumption; however, assuming an average seating arrangement with a mix of economy, business and first class seats results in almost twice as high emissions.
- Ignoring the non-CO2 effects (as ICAO) leads to very low and potentially misleading results. This is particularly relevant for long-haul flights. The CO2 emissions as calculated by ICAO are almost four times lower than the CO2 plus non-CO2 emissions as calculated by **atmosfair**. All but the ICAO calculator use an uplift factor of 1.9 to include non-CO2 effects (in particular ozone and contrail formations) from high altitude flights.
- The load assumption is crucial. This is related to the assumed seating arrangement, i.e. the mix between economy and business class seats. In consequence it determines the number of passengers on which the flight's impact is distributed.
- Other assumptions refer to a prolongation of the flight distance due to detour from the great circle distance and possible holdings; there might be an add-on to account for emissions from the provision of fuels; assumptions between cargo and passenger loads. These effects typically affect the results by about 10% to 20%.

SUMMARY COMPARISON BETWEEN ATMOSFAIR AND ICAO CALCULATORS

	Atmosfair	ICAO
Destinations	Global	Global
One-way | return	Yes | yes	Yes | yes
Intermediate stops	Yes	Up to 2
Non-CO2 effects	Yes	No
Choice of classes	4: first business premium economy economy	2: premium economy
Occupancy | load factor	Seating & load factors differentiated by airline	Only economy seating; industry wide load average
Type of flight	Scheduled | charter	Scheduled
Choice of aircraft type	Yes, >120	Default mix
Airline	Comparison of results	n.a.

COMPARISON OF RESULTS OF DIFFERENT CALCULATORS

	Medium haul: Frankfurt | Rome	Long haul: London | New York
km/nm (great circle)	2000 | 1250 kg CO2 | kg CO2-eq	11200 | 7000 kg CO2 | kg CO2-eq
atmosfair	214 | 529	1233 | 2346
ICAO	207 | na[a]	671[b] | na[a]
ecopassenger (UIC)	158 | 273	na[c] | na[c]
Carbon Footprint (UK)	140 | 270	860 | 1620
CO2-Rechner (UBA DE)	na[d] | 390	na[d] | 2450
Travel & Climate (SE)	na[d] | 313	na[d] | 1816

Comparison of CO2 and CO2-eq emissions from a medium- and a long-haul flight between different footprint calculators.
Remarks: Direct CO2 emissions stem from the combustion of the aviation kerosene. CO2-eq emissions account for non-CO2 effects contributing to global warming, notably through the formation of ozone, contrails and cirrus clouds.
a: ICAO does not consider other than direct CO2 emissions.
b: ICAO assumes maximum seating and therefore returns least emissions per passenger. This result is the absolute minimum. All other calculators assume seating mixed between economy and premium class, and therefore have higher emissions per passenger.
c: Out of scope for **ecopassenger** which focuses on destinations in Europe.
d: Results only available with non-CO2 effects included.

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