

KlimaLink Standard

Calculation of emissions from motor vehicles

Version 2.0

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Foreword

KlimaLink has set itself the aim of providing the tourism industry with an emissions data platform that makes the CO₂ emissions of various travel components available in one central location.

There has been a significant increase in demand within the industry for a standardised method of calculating climate emissions, and both business travellers and holidaymakers are increasingly asking about the actual emissions generated by their journeys.

Various methods for calculating greenhouse gas emissions in tourism already exist. However, these do not define CO₂e emissions in a standardised manner and determine emissions using different approaches and levels of accuracy. KlimaLink's aim is to make CO₂e emissions available to all users in the tourism sector in accordance with the following criteria, within a standard comprising various methods:

- CO₂e emissions are recorded systematically and with a high degree of accuracy.
- The CO₂e emissions from different travel components (flights, hotel stays, rail journeys, etc.) can be compared and categorised.
- The calculations are accurate enough to show travellers options for reducing greenhouse gas emissions even before they book.
- The calculations are accurate enough to enable comparisons of various types of combined travel products based on their absolute CO₂e emissions.
- The various methods rely entirely on travel input data that is available as standard within the travel industry's systems at tour operators and travel agents.
- The standard provides a unique CO₂e value for every travel component entered worldwide (flights, train journeys, hire cars, hotel stays, etc.). To this end, the individual methods specify fallback hierarchies which, in descending tiers (method variants), require increasingly less specific input data in order to always deliver the best possible result under the given circumstances.

The various calculation methods are dynamic and are updated whenever new scientific findings or improved data availability require adjustments.

This standard for calculating journeys by motor vehicle (private car, taxi, hire car, shuttle, etc.) has been drawn up in accordance with ISO 14083. The standard, which forms the basis for the 'Count Emissions' Directive coming into force in the EU, serves as a uniform standard for calculating greenhouse gas emissions in passenger and freight transport. It establishes EU-wide comparable guidelines to enable the objective assessment of the CO₂ footprint of transport.

The distinctive feature of the KlimaLink standard lies in the ex-ante calculation of emission values per person. Data from previous years enables a concrete estimate of future emission values. As a result, the emissions associated with journeys – known as 'travel carbon footprints' – are made visible even before booking, thereby serving as a potential advisory and decision-making aid for travel agents and customers within sales channels. Those in the tourism sector can access these emissions figures via the emissions data platform made freely available by KlimaLink for this purpose.

1. Description

In both the leisure and business travel sectors, cars are used for personal travel. In addition, cars are used in the form of chauffeur-driven vehicles such as taxis, private transfers, safari jeeps and so on.

The simplest and, at the same time, most accurate way to determine emissions for car journeys is based on the amount of fuel or electrical energy consumed, multiplied by the relevant emission factor (kilogrammes of CO₂e per litre or per kWh)¹. Once this information is available, precise calculations can be made. However, as KlimaLink generally calculates emissions before the journey begins (ex-ante), it can be assumed that this option can only rarely be used.²

Alternatively, emissions can be determined on the basis of the number of kilometres to be travelled. In this case, an emission factor (kilograms of CO₂e per kilometre) is applied and the total emissions are divided by the actual or assumed load factor. As the actual fuel consumption is not available in this case, average values for the vehicle type must be assumed.

2. Data availability

KlimaLink uses the publicly available dataset ‘Real-world CO₂ emissions from new cars and vans’, which was collected by the EU and published by the European Environment Agency (EEA)³, as its primary data source for real-world fuel consumption.

This dataset contains data from around 1 million vehicles newly registered in the EU in 2021 and 2022. All these vehicles are fitted with an on-board fuel consumption monitor (OBFCM), which measures actual fuel consumption and transmits the data to the manufacturer either wirelessly or during servicing at a garage.

Key findings from the data and the accompanying report:

- The dataset specifies the fuel type for each vehicle, allowing the analysis to distinguish between petrol, diesel and hybrid engines (purely electric cars are not included in the dataset).
- Real-world fuel consumption is consistently around 20 per cent higher than the WLTP (Worldwide Harmonised Light Vehicles Test Procedure) figures, meaning the latter provide a distorted estimate of actual fuel consumption.
- In the case of plug-in hybrid electric vehicles (PHEVs) – i.e. vehicles equipped with both an internal combustion engine and a battery-electric motor – the fuel savings achieved by the battery-electric motor are much lower than those stated in the WLTP data. The real-world fuel consumption of these vehicles is around 3.5 times higher than the WLTP figures and amounts to approximately 75–80 per cent of the consumption of the corresponding models with a pure internal combustion engine.

The dataset lists, amongst other things, the total fuel consumption and total mileage for each individual vehicle. Consequently, fuel efficiency, expressed in litres of fuel per 100 km, can be calculated as the ratio of these figures. The accompanying document recommends excluding all vehicles with a mileage of less than 100 km, as they systematically exhibit excessively high fuel consumption.

¹ When a vehicle burns one litre of petrol, it emits 3.11 kilograms of CO₂e. If diesel is used, the figure is 3.51 kilograms of CO₂e. When an internal combustion engine runs on liquefied petroleum gas, emissions amount to 2.5 kg of CO₂e per litre. (Figures based on <https://www.umweltbundesamt.de/themen/wirtschaft-konsum/wirtschaft-umwelt/umwelt-energiemanagement/emissionsfaktoren-zur-treibhausgasbilanzierung-von> Federal Environment Agency, “Emission factors for the greenhouse gas accounting of organisations” v 2.1, <https://www.uba.de/n120142de>)

² For example, there may be private individuals who wish to calculate the emissions from a car journey retrospectively online in their browser.

³ <https://climate-energy.eea.europa.eu/topics/transport/real-world-emissions/data>

3. ACRISS vehicle categories

The KlimaLink standard uses the first and last letters of the 4-digit ACRISS code to specify the vehicle category and fuel type. The ACRISS algorithm, which assigns codes to individual vehicle models, is not publicly available.

The first letter of the ACRISS code indicates the general vehicle category, e.g. Economy, Economy Elite, Standard, Luxury, etc. The fourth letter represents the combination of fuel type and the presence or absence of air conditioning. By searching the websites of car hire companies, a number of example vehicles were identified for each vehicle category (first letter). This information was then used to determine the actual fuel consumption figures for the petrol and diesel versions of each example vehicle (with the exception of vehicles available only with a petrol engine) by calculating the average of all matching database entries with a total mileage of more than 100 km.

As the EU dataset does not contain any information on air conditioning, it is assumed that the average fuel consumption figures determined in this way include both vehicles with and without air conditioning.

3.1 KlimaLink vehicle categories

As an alternative to the first and fourth letters of the ACRISS code, vehicles can also be specified using the KlimaLink vehicle categories:

- Small cars
- Mid-range car
- SUV/Jeep
- Luxury car/saloon

A mapping of KlimaLink vehicle categories to ACRISS vehicle categories is therefore established, with each KlimaLink category encompassing several ACRISS categories. Overlaps between categories are permitted; for example, the ACRISS category ‘Premium (P)’ includes both luxury saloons and SUV models, meaning it is included in both the KlimaLink category ‘Executive/Saloon’ and the ‘SUV’ category.

For each vehicle specified via a KlimaLink vehicle category, the average fuel consumption of the corresponding ACRISS categories must be used (e.g. the fuel consumption for ‘small cars’ is the average of the ACRISS categories Mini, MiniElite, Economy and Economy Elite).

KlimaLink	ACRISS
Small car (small)	M, N, E, H
Mid-range	C, D, I, J, S, R
SUV/Jeep	F, G, P
Luxury / saloon	P, U, L, W, X

4. Fuel types

The fourth letter of the ACRISS code covers a wide range of possible fuel types (including LPG, methanol, hydrogen and multi-fuel), which are currently considered irrelevant for leisure driving. Therefore, KlimaLink only takes petrol, diesel and electric cars into account when calculating emissions.

4.1 Electric cars

The electricity consumption of electric cars is determined via a subscription to the Electric Vehicle Database (EVDB, <https://ev-database.org>). The EVDB provides its own estimates of the electricity consumption of a wide range of electric cars, which are not based on manufacturers' figures and are higher than the official WLTP values.

For each car model, the EVDB provides two estimates of electricity consumption: one for cold weather (where the heating would be used) and one for mild weather.

These consumption figures correspond to the TTW values and do not take charging losses into account. Estimates for charging losses in the literature⁴ range from 12 to 20 per cent (charging efficiency of 80–88 per cent); KlimaLink assumes a 20 per cent loss.

4.2 Plug-in hybrid electric vehicles (PHEVs)

The report on the EU dataset states that the fuel savings of PHEVs compared with identical non-hybrid vehicle models range from 15 to 20 per cent. The KlimaLink standard uses the conservative figure of 15 per cent to estimate the fuel consumption of PHEVs by reducing the fuel consumption of vehicles with pure internal combustion engines accordingly.

At present, due to insufficient data, the method does not take into account electricity emissions generated when charging PHEVs.

4.3 Full and mild hybrid vehicles

Unlike plug-in hybrids, full and mild hybrids do not have an external charging port. They can recharge their internal batteries either through regenerative braking or by using the kinetic energy of the internal combustion engine to drive an electric generator. Mild and full hybrids differ in the extent to which the internal electric motor can be used on its own. In mild hybrids, the electric motor usually serves to assist the internal combustion engine (e.g. to restart the engine at traffic lights), whilst full hybrids can travel a certain distance using only electric power, without the internal combustion engine.

Practical tests carried out by the Australian Automobile Association revealed fuel savings of between 17% and 32% compared with the corresponding petrol-only model, although one vehicle model showed higher hybrid fuel consumption (+3.2%)⁵. However, the savings are less pronounced in mild hybrids than in full hybrids. However, as the ACRIS codes do not distinguish between these two types (both are represented by the fourth code letter 'H', whilst PHEVs are represented by 'I'), they are to be treated equally. The fuel savings according to the above-mentioned source are in the same range as for PHEVs, so the same mechanism can be used for all types of hybrid vehicles.

4.4 Methane/CNG (Compressed Natural Gas)

Methane, in the form of compressed natural gas (CNG), is a fuel produced by compressing natural gas of fossil origin or processed biogas (biomethane/Bio-CNG) and stored in high-pressure tanks⁶. Although CO₂e emissions and pollutant levels for bio-CNG are usually significantly lower than those

⁴ Reick, B., Konzept, A., Kaufmann, A., Stetter, R., & Engelmann, D. (2021). Influence of charging losses on the energy consumption and CO₂ emissions of battery electric vehicles. *Vehicles 2021*, Vol. 3, pp. 736–748, 3(4), 736–748. <https://doi.org/10.3390/VEHICLES3040043>
Pasaoglu, G., Fiorello, D., Zani, L., Martino, A., Zubaryeva, A., & Thiel, C. (2013). *Projections for electric vehicle load profiles in Europe based on travel survey data*. <https://doi.org/10.2790/24108>

⁵ Test data: <https://realworld.org.au/results/>, summary article: <https://www.carexpert.com.au/car-news/real-world-testing-shows-not-all-hybrids-are-created-equal-at-saving-fuel>

⁶ <https://www.mbenergy.com/glossar/cng-compressed-natural-gas>

of petrol or diesel-powered vehicles, there are no longer any new cars available that run on CNG, and the refuelling infrastructure is currently in decline⁷.

4.5 HVO (hydro-vegetable oil)

HVO is a synthetic diesel fuel produced from biological residues and waste materials (e.g. cooking oil). In its pure form (HVO 100), it has a CO₂e emission reduction potential of more than 90 per cent. Local environmental pollution from particulate matter and nitrogen oxide (NO_x) emissions tends to decrease in vehicles without modern exhaust after-treatment systems, whereas in vehicles with modern exhaust after-treatment systems, exhaust emissions are largely independent of the engine's raw exhaust emissions.

According to <https://www.refuels.de/english/563.php>, most vehicles with diesel engines can be fuelled with diesel fuels containing HVO blends, up to and including pure HVO. However, not every petrol station offers fuel options containing HVO. For this reason, it is unlikely that vehicles will be operated on pure HVO in the tourism sector, as fossil diesel – which is also cheaper – can be used as an alternative at any time. Particularly in ex-ante calculations, it is therefore impossible to predict whether a journey will use pure HVO, fossil diesel with an HVO blend, or pure fossil diesel. For this reason, HVO is not currently taken into account in the KlimaLink standard.

According to the ACEA report “Vehicles on European Roads” (Jan. 2026, https://www.acea.auto/files/ACEA_Report-%E2%80%93Vehicles_on_European_roads_2026.pdf), over 96 per cent of registered passenger cars in the EU27 are powered by petrol, diesel, electric or hybrid systems. Against this background, limiting the analysis to the three fuel types mentioned is sufficient for the vast majority of tourist car journeys. The remaining journeys using alternative fuels (LPG, HVO, CNG) have lower emission factors than fossil fuels; if petrol or diesel is used as the basis for calculation in these cases, the resulting emissions tend to be overestimated in accordance with ISO 14083.

5. Emission factors

The KlimaLink standard specifies the emission factors for petrol and diesel – which serve as the basis for calculations in the emissions data platform – as follows, based on the table ‘Emission factors for the greenhouse gas accounting of organisations’ published by the Federal Environment Agency (UBA)⁸:

- Petrol: 3.11 kg CO₂e per litre of fuel (UBA ID: 08_32_02_001_02)
- Diesel: 3.51 kg CO₂e per litre of diesel (UBA-ID: 08_32_02_005_02)

(The UBA ID identifies the respective emission factors in the table above.)

These emission factors cover the entire fuel production chain (well-to-wheel).

For electricity consumption, country-specific emission factors for electrical energy should be used. A source with good global coverage is Our World in Data, based on data from Ember and the Energy Institute (<https://ourworldindata.org/grapher/carbon-intensity-electricity>). Until this feature is fully implemented, an EU average value of 210 g CO₂e/kWh is used.⁹

⁷ <https://www.adac.de/verkehr/tanken-kraftstoff-antrieb/alternative-antriebe/>

⁸ Source: Version 2.1 dated 28 February 2026, <https://www.uba.de/n120142de>

⁹ Source: https://ourworldindata.org/grapher/carbon-intensity-electricity?mapSelect=~OWID_EU27 (data for 2025)

5.1 Air conditioning

The EU fuel consumption database does not provide information on the presence or absence of air conditioning; therefore, the average fuel consumption figures per ACRIS or KlimaLink vehicle class include a mix of journeys with and without air conditioning. We assume that this mix is also representative of the tourist use of vehicles.

6. System boundary

ISO 14083, on which the standard is based, stipulates that empty journeys resulting from, for example, the delivery of a hire car to the hirer's address, the return of a vehicle to the hire station, or the common practice of transferring hire cars at short notice from less to more heavily frequented hire stations, are to be included in the calculation. However, there is no publicly available data on the number of such empty journeys, meaning they are not taken into account in the standard.

7. Calculation formula

Depending on the input, KlimaLink maps emission data in the emission data platform at various levels of accuracy, Tiers 1–3.

- **Tier 1:** Ex-post determination based on actual fuel consumption multiplied by the emission factor, including emissions from the upstream supply chain.
- **Tier 2:** Emissions factor for the vehicle categories multiplied by the estimated distance (preferably in descending order):
 - Actual distance of the route (e.g. determined via Google Maps)
 - Number of days multiplied by an assumed distance travelled of 50 km/day
- **Tier 3:** Emission factor for the vehicle category mentioned above multiplied by a standardised distance.

In all tiers, the energy source must be included in the emission factor (diesel or petrol, including the upstream supply chain, or electric). For Tiers 2 and 3, average emission factors are used.

$$CO_2e = F * f_F$$

The calculation of the fuel quantity or electrical energy F depends on the Tier used:

- Tier 1: Direct user input
- Tier 2/3: $F = d * c_{cat}$

Variable	Description	Units	Source
CO ₂ e	Symbol for the specific CO ₂ e for a journey divided by the number of passengers.	kg CO ₂ e/passenger	-
F	Fuel capacity or consumption	L, or kWh	User
f _B	CO ₂ e-emission factor per km based on a vehicle category	g CO ₂ e/km	UBA, DIN EN 16258, KlimaLink search ¹⁰
f _F	Emissions factor in CO ₂ e based on the fuel consumed	kg CO ₂ e/L or kg CO ₂ e/kWh	DIN EN 16258
d	Distance (actual/planned/flat rate)	km	User-provided data, or calculated using Mapbox ¹¹
c _{cat}	Fuel or electricity consumption for the vehicle category	L/km or kWh/km	Real World Emission Data, European Energy Agency ¹²

¹⁰ including <https://www.billiger-mietwagen.de/faq/mietwagen-klassen.html>; <https://www.sixt.com/rental-guide/acriiss-code/>

¹¹ <https://www.mapbox.com>

¹² <https://climate-energy.eea.europa.eu/topics/transport/real-world-emissions/data>

This document was produced as part of the 'Climate-Conscious Travel' project, in which all companies, associations and organisations within the tourism sector are invited to participate. The project is funded and implemented by KlimaLink e.V. The KlimaLink emissions data platform is available to all tourism businesses.

In preparation for the EU 'Count Emissions' Regulation, KlimaLink has successfully had the 2026 calculation standard for air, rail and car/bus transport verified by GUTCert¹³, an accredited certification body in Berlin, to ensure compliance with ISO 14083. The certificate is included in the appendix.

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¹³ <https://www.gut-cert.de/en/home-en>

8. Appendix

Acriss codes¹⁴

Vehicle Matrix- Car Classification Codes

CATEGORY		TYPE		TRANSMISSION / DRIVE		FUEL/AIR COND.	
M	Mini	B	2-3 Door	M	Manual Unspecified Drive	R	Unspecified Fuel/Power With Air
N	Mini Elite	C	2/4 Door	N	Manual 4WD	N	Unspecified Fuel/Power Without Air
E	Economy	D	4-5 Door	C	Manual AWD	D	Diesel Air
H	Economy Elite	W	Wagon/Estate	A	Auto Unspecified Drive	Q	Diesel No Air
C	Compact	V	Passenger Van	B	Auto 4WD	H	Hybrid
D	Compact Elite	L	Limousine/Sedan	D	Auto AWD	I	Hybrid Plug in
I	Intermediate	S	Sport			E	Electric
J	Intermediate Elite	T	Convertible			C	Electric
S	Standard	F	SUV			L	LPG/Compressed Gas Air
R	Standard Elite	J	Open Air All Terrain			S	LPG/Compressed Gas No Air
F	Fullsize	X	Special			A	Hydrogen Air
G	Fullsize Elite	P	Pick up (single/extended cab) 2 door			B	Hydrogen No Air
P	Premium	Q	Pick up (double cab) 4 door			M	Multi Fuel/Power Air
U	Premium Elite	Z	Special Offer Car			F	Multi fuel/power No Air
L	Luxury	E	Coupe			V	Petrol Air
W	Luxury Elite	M	Monospace			Z	Petrol No Air
O	Oversize	R	Recreational Vehicle			U	Ethanol Air
X	Special	H	Motor Home			X	Ethanol No Air
		Y	2 Wheel Vehicle				
		N	Roadster				
		G	Crossover				
		K	Commercial Van/Truck				

¹⁴ ACRIS codes <https://www.acriss.org/car-codes/>

Version changes

Date	Version	Chapter	Change [...]	Responsible
22 July 2026	2.0	Foreword	Added: Introductory text	SA/SH
22 July 2026	2.0	2	Added: new section on adjusting the data source for assumed consumption data for certain vehicle categories https://climate-energy.eea.europa.eu/topics/transport/real-world-emissions/data	SH
22 July 2026	2.0	3.1	Added: Table showing the mapping of ACRISS codes to vehicle categories	SA
22 July 2026	2.0	4.1	Amended: KlimaLink estimates a 20 per cent loss.	SH
22 July 2026	2.0	4.2	Amended: The KlimaLink standard [...] value of 15 per cent , by which [...]	SH
22 July 2026	2.0	4.4	Added: Methane/CNG (compressed natural gas)	SA/SH
22 July 2026	2.0	4.5	Added: HVO (hydro-vegetable oil)	SA/SH
22 July 2026	2.0	5	Amended: [...], an EU average value of 210 g CO_e/kWh is used.	SH
22 July 2026	2.0	5	Added: Source https://ourworldindata.org/grapher/carbon-intensity-electricity	SH
22 July 2026	2.0	6	Added: Reason why empty runs are not taken into account	SA/SH
18 September 2023	1.0	All	Initial version	HZ/SL

HZ Prof. Dr Harald Zeiss, Institute for Sustainable Tourism GmbH

SL Swantje Lehnert, Futouris e.V.

SH Dr Sebastian Hirsch, atmosfair gGmbH

SA Saskia Sánchez, KlimaLink e.V.

Resultat

In Rahmen eines vereinbarten Verfahrens wurden die folgenden Berechnungsstandards der Organisation

KlimaLink e.V.

am Standort Lietzenburger Straße 99, 10707 Berlin

geprüft:

„KlimaLink Standard KFZ“

„KlimaLink Standard Bus“

„KlimaLink Standard Bahn“

„KlimaLink Standard Flug“

Die Berechnungsstandards für Transport „KlimaLink Standard KFZ“, „KlimaLink Standard Bus“, „KlimaLink Standard Bahn“ und „KlimaLink Standard Flug“ erfüllen die Anforderungen der für den Berechnungszweck relevanten Normkapitel aus den Kapiteln 3, 5, 6, 7, 8, Anhang A, E, F der ISO 14083:2023.

Die Einzelheiten zum Umfang der Prüfung sind im Anhang dargelegt. Die Berechnungsstandards erfüllen alle relevanten Anforderungen gemäß den im Anhang aufgeführten Normkapiteln. Die für die Berechnung verwendeten Emissionsfaktoren basieren auf veröffentlichten Informationen oder anerkannten, glaubwürdigen Quellen. Die angewandte Berechnungsmethode wurde auf Eignung und Plausibilität überprüft.

Die für die Prüfung erforderlichen Informationen wurden in den Dokumenten „2027_07 KFZ KlimaLink Standard V2.0.pdf“, „2027_07 Bus KlimaLink Standard V2.0.pdf“, „2027_07 Bahn KlimaLink Standard V2.0.pdf“ und „2027_07 Flug KlimaLink Standard V1.1.pdf“ vom 22.07.2026 klar dargelegt.

Die Prüfung wurde gemäß eines geeigneten Verfahrens entsprechend den Vorgaben der ISO 14064-3:2020-05 Anhang C durchgeführt.

Basis des Ergebnisses ist der Prüfbericht mit der Nr. C-26-25274-Tool.

Berlin, 26.08.2026



Prof. Dr.-Ing. Jan Uwe Lieback
Geschäftsführer

Nr. C-26-25274-Tool

Annex zu C-26-25274-Tool

Details zu Prüfungsinhalten

ISO 14083:2023 mit folgenden Kapiteln:

3.1.1, 3.1.2, 3.1.3, 3.1.5, 3.1.6, 3.1.7, 3.1.8, 3.1.11, 3.1.12, 3.1.14, 3.1.16, 3.1.17, 3.1.18,
3.1.19, 3.1.20, 3.1.22, 3.1.23, 3.1.24, 3.1.25, 3.1.27, 3.1.30, 3.1.31, 3.2.1, 3.2.2, 3.2.3,
3.2.4, 3.2.5, 3.2.7, 3.2.9, 3.3.1, 3.3.2, 3.3.3.2, 3.3.3.3, 3.3.3.4, 3.3.4, 3.3.8, 5.3.2, 5.4.1,
5.4.2, 5.4.3, 5.4.4, 5.6.2, 5.6.4, 6.1, 6.3.2, 7.2, 7.3, 8.3.2, 8.3.3, 8.4.2, 8.4.3, 8.4.5.2, 8.4.7,
A, A 3.1, A 3.2, A 4.2, A 5, E, E 2, E 3.1, E 3.2, E 5, F, F 2, F 3.1, F 4.5.