think • go climate conscious

atmosfair

CO_2 REPORT BUSINESS TRAVEL

FOR: .... Sample Report

REPORTING PERIOD:.............................. 01.01.2022 - 31.12.2022

This report covers the following travel activity types:

FLIGHT CAR RAIL HOTEL

Business travel sectors contained in this report.

The calculations in this report are compliant with the following standards:

VDR Verband Deutsches Reisemanagement e.V.

GRI Empowering Sustainable Decisions

GREENHOUSE GAS PROTOCOL

defra Department for Environment Food and Rural Affairs

ICAO • OACI • ИКАО

VFU

Audited by:

DNV·GL

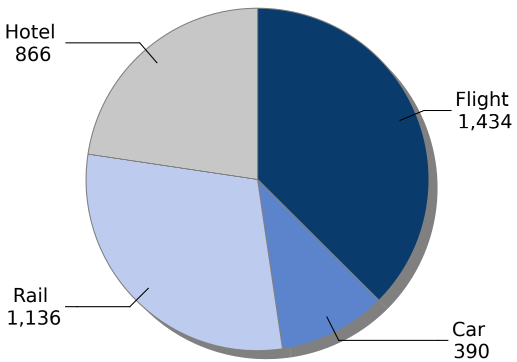
TABLE OF CONTENTS

think • go climate conscious
atmosfair

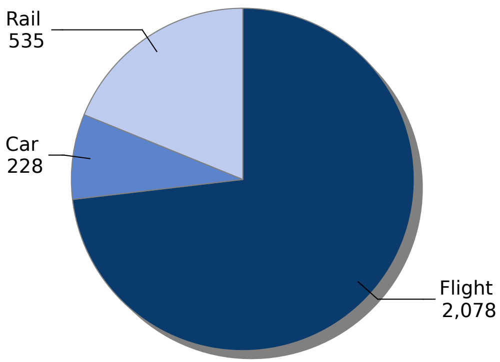
SUMMARY

think • go climate conscious
atmosfair

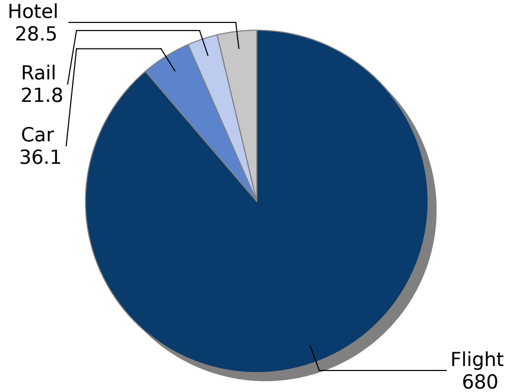
PASSENGERS (PAX) TOTAL:



DISTANCE TOTAL [1,000 KM]:



CO_2 EMISSIONS[1] TOTAL [TONS]:



This is a typical distribution: flights are claiming the biggest share of CO_2 emissions. In this exampe: 88.7% of total CO_2 emissions (see next page).
From our analyses it is common to have a flight share of 75% to 98% of total business travel emissions.

This is not surprising since air travel has a huge climatic impact compared to other business travel activities.

To express this in figures:

- 1 Business Class return flight from New York to Los Angeles = 3.2 tons CO_2 per person
- 1 Economy Class return flight from New York to Los Angeles = 1.7 tons CO_2 per person
- Emissions of one car per year (12,000 km; middle class model) = ca. 2 tons CO_2
- Emissions per capita per year in India = 1.6 tons CO_2

The climate compatible annual emissions budget for one person to achieve the 2°C target = 2.3 tons CO_2
(further information can be found here: www.atmosfair.de/en/green_travel/annual_climate_budget/)

[1] CO_2 emissions calculated according to VDR methodology. CO_2 emissions for category FLIGHT include RFI 2.7 addition.

SUMMARY

Summary of your core emissions data for all travel sectors.

think • go climate conscious
atmosfair

	Pax [total]	Pax [% of total]	Distance [1,000 km]	Distance [% of total]	CO_2 emissions[1] [tons]	CO_2 emissions[1] [% of total]
FLIGHT	1,434	37.5	2,078	73.1	680	88.7
CAR	390	10.2	228	8.0	36.1	4.7
RAIL	1,136	29.7	535	18.8	21.8	2.8
HOTEL	866	22.6			28.5	3.7
TOTAL	3,826	100	2,841	100.0	767	100

88.7% of the CO_2 emissions have been emitted by air travel

[1] CO_2 emissions calculated according to VDR methodology.
[2] Category FLIGHT includes RFI 2.7 addition.

FLIGHT

think • go climate conscious
atmosfair

Chapter 'Flight'

FLIGHT
Summary

We distinguish CO_2 equivalences that are emitted in altitudes higher or lower than 9 km. Aircraft engine exhausts at such high altitudes have a higher impact on global warming.

TRAVEL	Amount	Unit
Kilometres	2,078	1,000 km
Miles[1]	1,291	1,000 miles
Segments[2]	1,434	
City Pairs	269	
Average segment distance in km[3]	1,449	km
Average segment distance in miles[3]	901	miles

FUEL	Amount	Unit
Fuel consumption total	84.7	tons fuel
Fuel consumptions in altitudes > 9 km	65.3	tons fuel
Fuel share in altitudes > 9 km	77.2	%
Average fuel consumption (per 100 pkm[4])	6.2	litres

CO_2 EMISSIONS	Amount	Unit
According to VDR		
CO_2	268	tons CO_2
CO_2 per segment, average	0.19	tons CO_2
CO_2 per passenger kilometre, average	129	g CO_2 / pkm
CO_2 per passenger mile, average	207	g CO_2 / pm
According to other methods		
CO_2 GRI / GHG Protocol	289	tons CO_2
CO_2 DEFRA	278	tons CO_2
CO_2 ICAO	264	tons CO_2
CO_2 VFU	233	tons CO_2

GLOBAL WARMING IMPACT[5]	Amount	Unit
According to VDR		
CO_2 in altitudes < 9 km	61.2	tons CO_2
CO_2 in altitudes > 9 km	206	tons CO_2
CO_2 + RFI 2	474	tons CO_2
CO_2 + RFI 2.7	680	tons CO_2
CO_2 + RFI 4	887	tons CO_2

Different calculation methods lead to different results. All calculation methods/standards are explained on page 30.

We recommend to also regard non-CO_2 gases like Methane (CH_4) and Nitrous Oxide (N_2O) because they also have a massive impact on global warming and have a high longevity. Additionally, sulphate particles, soot and cirrostratus clouds of ice enhance global warming two to five times more than CO_2 alone. Consequently (in accordance with IPCC = International Panel on Climate Change) we use a factor of 2.7 to calculate all these effects related to global warming that air travel has on the climate.

[1] American miles
[2] One person, one way, from origin to destination
[3] Total distance of all segments divided by number of segments
[4] Product of number of passengers and kilometres travelled
[5] For further information on other methods and global warming impact see glossary.

FLIGHT

Top 10 city pairs by segments[1] and CO_2 emissions

Our calculations are based on city pairs, airlines, aircraft engines, seating, freight capacity and load factor.

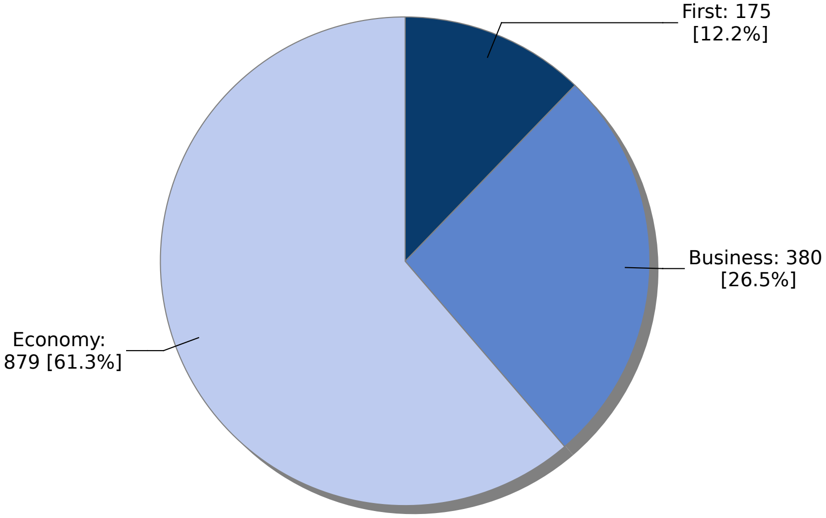
Origin	Destination	Segments	Segments % of total	Flight segment length [km]	Flight segment length [miles]	Total distance [km]	Total distance [miles]	Cruise altitude [m]	CO_2 emissions[2] [tons CO_2]	CO_2 emissions[2] + RFI 2.7 [tons CO_2]	CO_2 + RFI 2.7 % of total
TOP 10 CITY PAIRS SORTED BY SEGMENTS											
CLT	IAH	61	4.3	1,564	972	95,404	59,294	12,500	11.3	29.9	4.4
ATL	SDF	57	4.0	567	352	32,319	20,086	12,800	4.82	9.87	1.5
CLT	ORD	54	3.8	1,064	661	57,456	35,709	12,500	5.23	13.0	1.9
CLE	CLT	43	3.0	792	492	34,056	21,166	12,500	3.69	8.56	1.3
CLT	CVG	42	2.9	589	366	24,738	15,375	12,500	2.90	6.04	0.9
CLT	SDF	37	2.6	589	366	21,793	13,544	12,500	5.98	12.5	1.8
BOS	CLT	31	2.2	1,268	788	39,308	24,430	12,500	5.18	13.3	2.0
DTW	SDF	30	2.1	541	336	16,230	10,087	12,500	3.67	7.35	1.1
ABQ	PHX	29	2.0	576	358	16,704	10,382	12,500	1.90	3.92	0.6
ORD	SDF	25	1.7	510	317	12,750	7,924	12,500	3.66	7.10	1.0
Other		1,025	71.5	--	--	1,727,083	1,073,389	--	219	569	83.6
TOP 10 CITY PAIRS SORTED BY CO_2 EMISSIONS											
CLT	MUC	24	1.7	7,472	4,644	179,328	111,453	12,500	14.8	43.3	6.4
CDG	DTW	17	1.2	6,480	4,027	110,160	68,465	12,500	11.6	33.7	5.0
CLT	IAH	61	4.3	1,564	972	95,404	59,294	12,500	11.3	29.9	4.4
IAD	SDF	3	0.2	824	512	2,472	1,536	11,300	11.6	27.1	4.0
ATL	MUC	9	0.6	7,822	4,861	70,398	43,753	13,100	6.91	20.2	3.0
HND	LAX	6	0.4	8,935	5,553	53,610	33,319	13,100	6.74	19.8	2.9
LAX	ORD	19	1.3	2,900	1,802	55,100	34,245	12,800	5.61	15.8	2.3
BOS	CLT	31	2.2	1,268	788	39,308	24,430	12,500	5.18	13.3	2.0
IAH	LHR	4	0.3	7,884	4,900	31,536	19,600	13,100	4.54	13.3	2.0
CLT	ORD	54	3.8	1,064	661	57,456	35,709	12,500	5.23	13.0	1.9
Other		1,206	84.1	--	--	1,383,069	859,583	--	184	451	66.3

[1] One person, one way, from origin to destination
[2] CO_2 emissions calculated according to VDR methodology.

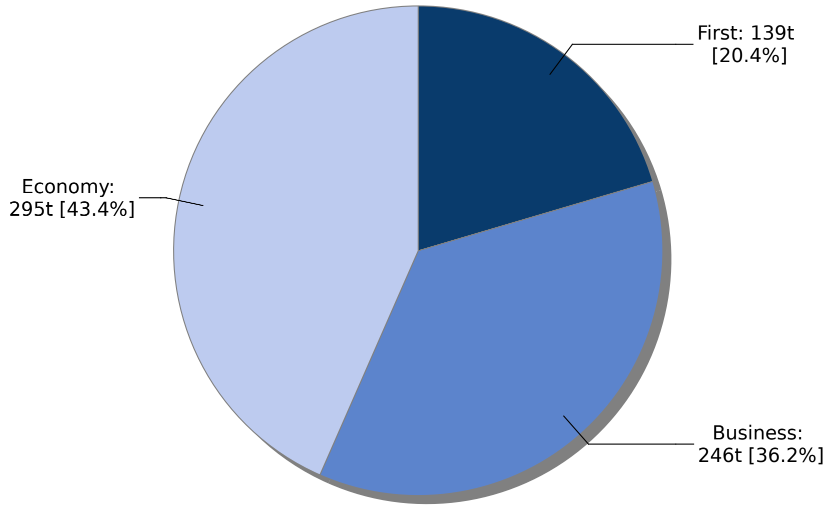
FLIGHT

Seat class compared by segments[1] and CO_2 emissions

SEGMENTS PER SEAT CLASS:



CO_2 EMISSIONS[2] PER SEAT CLASS [CO_2 + RFI 2.7]:



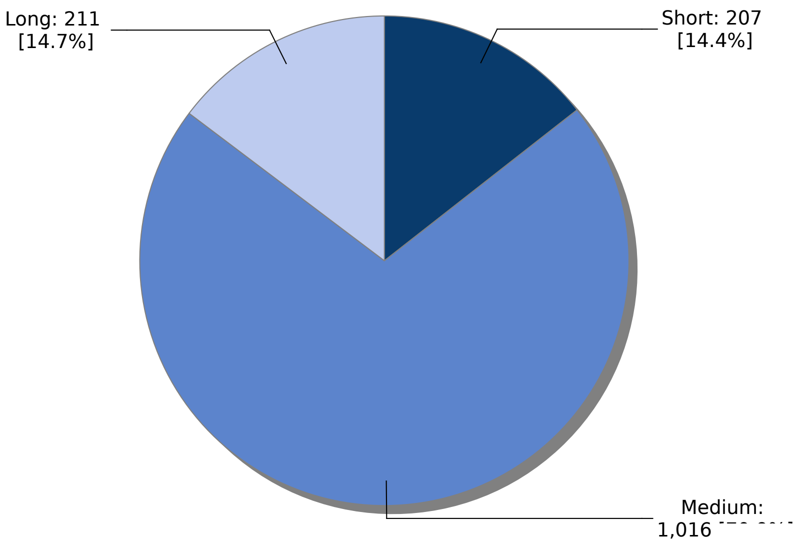
In comparison: while only one-third of the bookings are First and Business Class (38.7%), they represent more than half of all CO_2 emissions (56.6%).

[1] One person, one way, from origin to destination
[2] CO_2 emissions calculated according to VDR methodology.

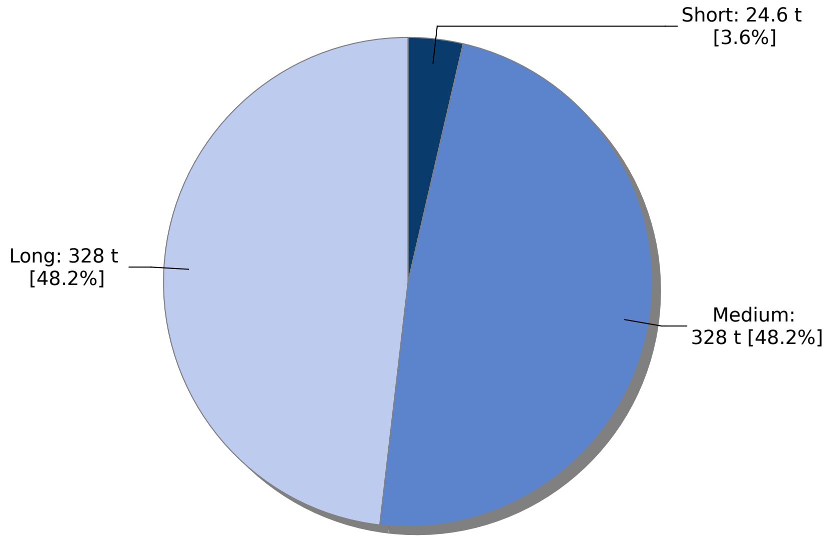
FLIGHT

Distance class[1] compared by segments[2] and CO_2 emissions

SEGMENTS PER DISTANCE CLASS:



CO_2 EMISSIONS[3] PER DISTANCE CLASS [CO_2 + RFI 2.7]:



Compared with short and medium distance flights, long distance flights emit more gases at an altitude over 9km and therefore have a much bigger impact on global warming.

[1] Short: < 500 km, < 310 miles; Medium: 500 km - 1600km, 310 - 1000 miles;
Long: > 1600 km, > 1000 miles
[2] One person, one way, from origin to destination
[3] CO_2 emissions calculated according to VDR methodology.

FLIGHT

Synopsis of different CO_2 calculation methods

think • go climate conscious
atmosfair

This comparative table of all common calculation methods and standards is what makes our CO_2 report unique.

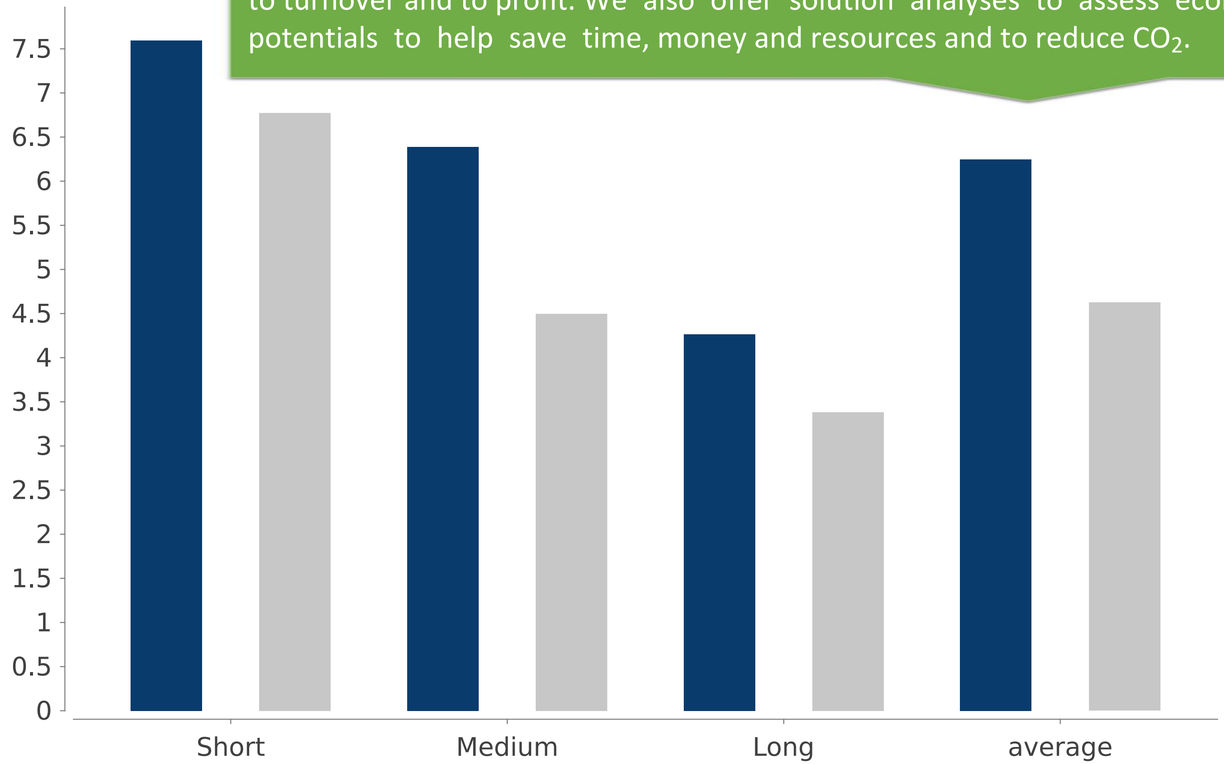
	Short Range [< 500 km] [< 310 miles]	Medium Range [500 - 1,600 km] [310 - 1,000 miles]	Long Range [> 1,600 km] [> 1,000 miles]
Segments[1]	207	1,016	211
Total distance in kilometres [1,000 km]	83	919	1,076
Total distance in miles [1,000 miles][2]	51	571	669
CO_2 EMISSIONS ACCORDING TO VDR STANDARD[3]			
CO_2 [tons CO_2]	15.2	139	113
CO_2 + RFI 2 [tons CO_2]	19.9	234	221
CO_2 + RFI 2,7 [tons CO_2]	24.6	328	328
CO_2 + RFI 4 [tons CO_2]	29.4	423	435
CO_2 EMISSIONS ACCORDING TO GRI / GHG PROTOCOL			
CO_2 [tons CO_2]	13.5	105	170
CO_2 EMISSIONS ACCORDING TO DEFRA			
CO_2 [tons CO_2]	12.5	101	164
CO_2 EMISSIONS ACCORDING TO ICAO[3]			
CO_2 [tons CO_2]	17.5	144	103
CO_2 EMISSIONS ACCORDING TO VFU[3]			
CO_2 [tons CO_2]	16.1	99.7	117

[1] One person, one way, from origin to destination
[2] American miles
[3] For further information on other methods and RFI, see glossary

FLIGHT

Fuel per 100 pkm[1] vs. international benchmarks

This slide gives you a first impression of your CO_2 footprint compared to similar companies in the same industry. Main benchmarks are CO_2 relative to FTE, to turnover and to profit. We also offer solution analyses to assess economic potentials to help save time, money and resources and to reduce CO_2.



Current fuel usage: Calculated for flights contained in this report

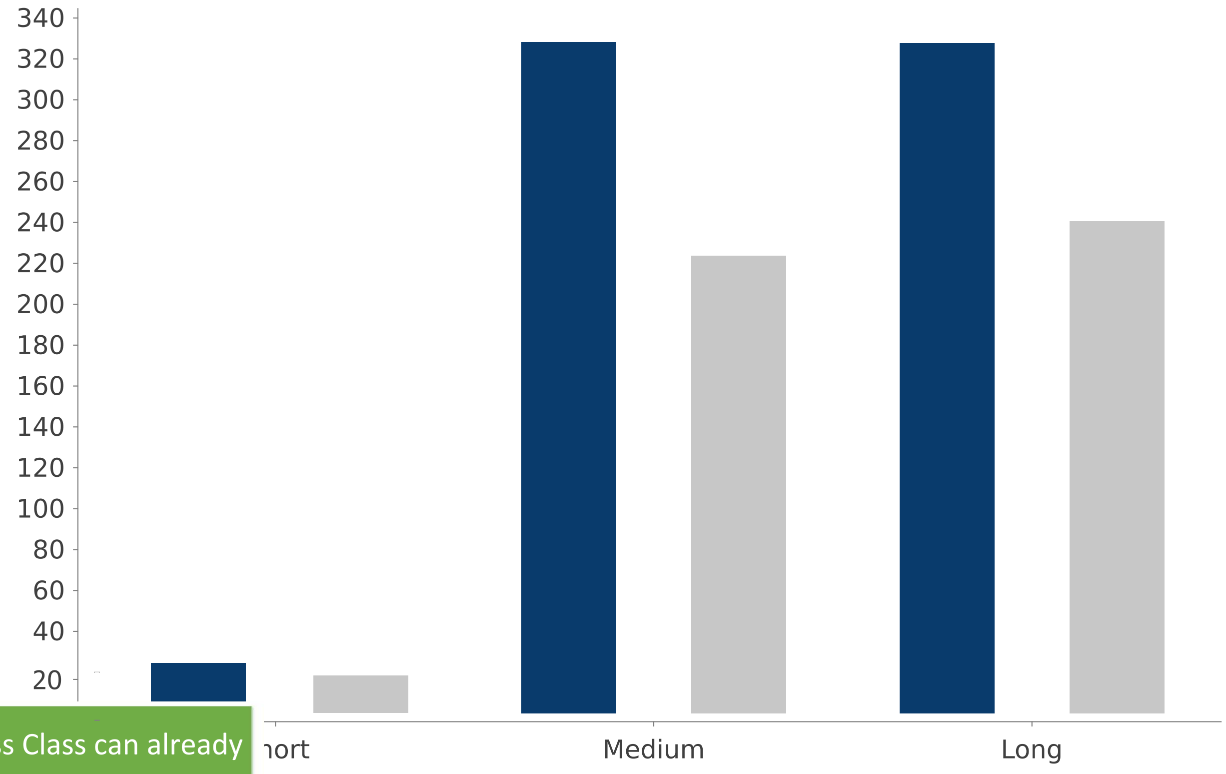
Worldwide average[2]

[1] Product of number of passengers and kilometres travelled

[2] According to atmosfair Airline Index;
More informationen on the AAI: www.atmosfair.de/en/atmosfair_airline_index

FLIGHT

CO_2 reduction potential by switching to economy class



Choosing Economy over Business Class can already help you save up to 30-60% of CO_2 emissions.

Current CO_2 emissions[1]: Calculated for flights contained in this report

Reduced CO_2 emissions[1]: All flights changed to Economy Class

[1] CO_2 emissions calculated according to VDR methodology.

FLIGHT

Applying the atmosfair Airline Index: Effects from selecting more climate efficient airlines

Flight selected from your upload data: DL1205, 21.03.2019, ATL-SDF, First Class

Airline[1] of your choice	Aircraft your staff flew with	Resulting CO_2 emissions[1,2] in tons (CO_2 + RFI 2.7)
Delta Air Lines	Boeing 737-800 (winglets) Passenger	0. 52

Alternative airlines	Aircraft that would have been used	Alternative CO_2 emissions[2] in tons (CO_2 + RFI 2.7)
Southwest Airlines	Boeing 737-500 Passenger Canadair	0.36
Delta Connection	Regional Jet 900	0.36

The atmosfair Airline Index compares airlines based on their climate efficiency. This allows us to identify more climate efficient carriers on any specific connection as shown in the example above.

For obvious reasons we would focus on your company's most emission intensive citypairs in a full analysis. But we don't stop there. We also compare the price structure of the most climate efficient carriers to show you real win-win-potentials: a reduction of emissions while saving travel expenses at the same time. This cost saving effect can of course be even enhanced further if your company limits the number of airlines to achieve additional quantity rebates with cleaner and cheaper carriers.

Are you interested in assessing the CO_2 efficiency of airlines serving your top city pairs? Contact us at airlineindex@atmosfair.de

Our statistics show that choosing more efficient airlines can save 20%-30% CO_2 without affecting travel habits.
For more details check our AAI (atmosfair Airline Index):
www.atmosfair.de/en/air_travel_and_climate/atmosfair_airline_index/

[1] Code share partner are not listed. They appear in detailed atmosfair airline reportings.
[2] CO_2 emissions calculated according to VDR methodology.

CAR

think • go climate conscious
atmosfair

Chapter 'Car'

think • go climate conscious
atmosfair

TRAVEL	Amount	Unit
Kilometres	228	1,000 km
Miles[1]	142	1,000 miles
Days of use	906	days
Average kilometres per rental day	252	km
Average miles per rental day	157	miles

CO_2 EMISSIONS[2]	Amount	Unit
CO_2	36.1	tons CO_2
CO_2 per day, average	39.8	kg CO_2
CO_2 per kilometre, average	158	g CO_2/km
CO_2 per mile, average	254	g CO_2/mile

DAYS OF USE AS % OF TOTAL PER CATEGORY	Share
Economy	9.2
Compact	36.8
Intermediate	0
Special	0
Other	54.1

CO_2 EMISSIONS[2] PER CATEGORY	CO_2	Unit	Share
Economy	3.26	tons CO_2	9.0
Compact	14.3	tons CO_2	39.8
Intermediate	0	tons CO_2	0
Special	0	tons CO_2	0
Other	18.4	tons CO_2	51.2

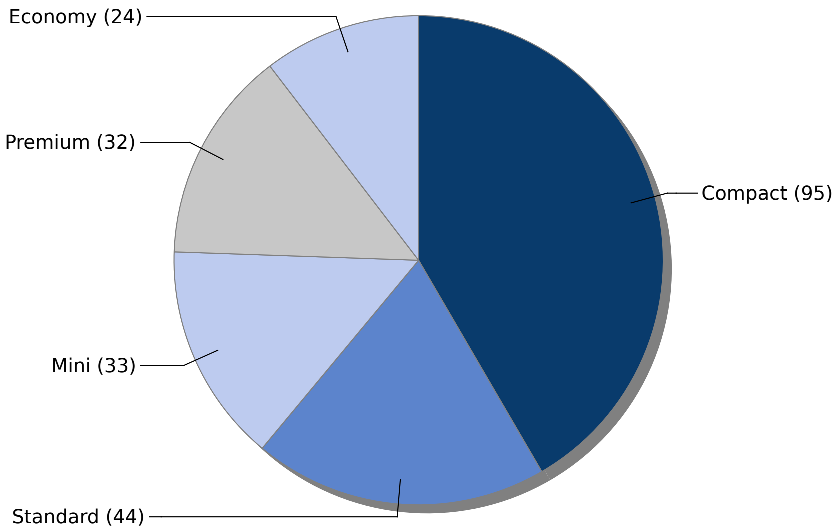
The easiest way to calculate the CO_2 emissions of a car would be by adding together all petrol receipts. However those are not always kept and available. Using data like rental car ACRISS Codes, locations and days of use, as provided by TMCs (Travel Management Companies, eg. AMEX GBT), we can calculate CO_2 emissions based on car types.

[1] American miles
[2] CO_2 emissions calculated according to VDR methodology.

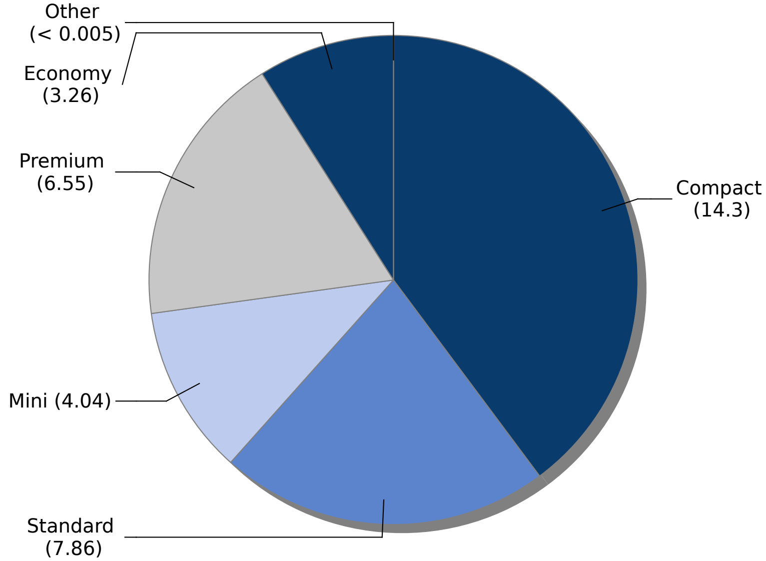
CAR

Category compared by kilometres and CO_2 emissions

KILOMETRES PER CATEGORY (1000 KM):



CO_2 EMISSIONS[1] BY CATEGORY (TONS):



[1] CO_2 emissions calculated according to VDR methodology.

CAR

Top 10 cars sorted by kilometres and CO_2 emissions

think • go climate conscious
atmosfair

ACRISS Members utilise an industry standard vehicle matrix to define car models, ensuring a comprehensive comparison of vehicles.

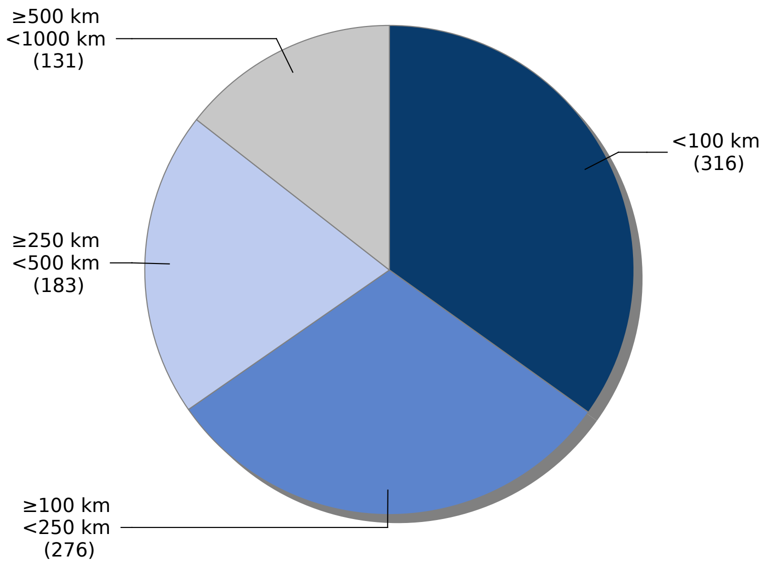
ACRISS	Total distance [km]	Days of rent	Average km per day	CO_2 emissions[1] [tons]	Share of CO_2 emissions[1] [%]
TOP 10 – SORTED BY KILOMETRES					
CDMR	95,028	333	285	14.3	39.8
SDMR	44,411	224	198	7.86	21.8
MDMR	33,122	104	318	4.04	11.2
PDMR	32,090	162	198	6.55	18.2
EDMR	23,764	83	286	3.26	9.0
TOP 10 – SORTED BY CO_2 EMISSIONS					
CDMR	95,028	333	285	14.3	39.8
SDMR	44,411	224	198	7.86	21.8
PDMR	32,090	162	198	6.55	18.2
MDMR	33,122	104	318	4.04	11.2
EDMR	23,764	83	286	3.26	9.0

[1] CO_2 emissions calculated according to VDR methodology.

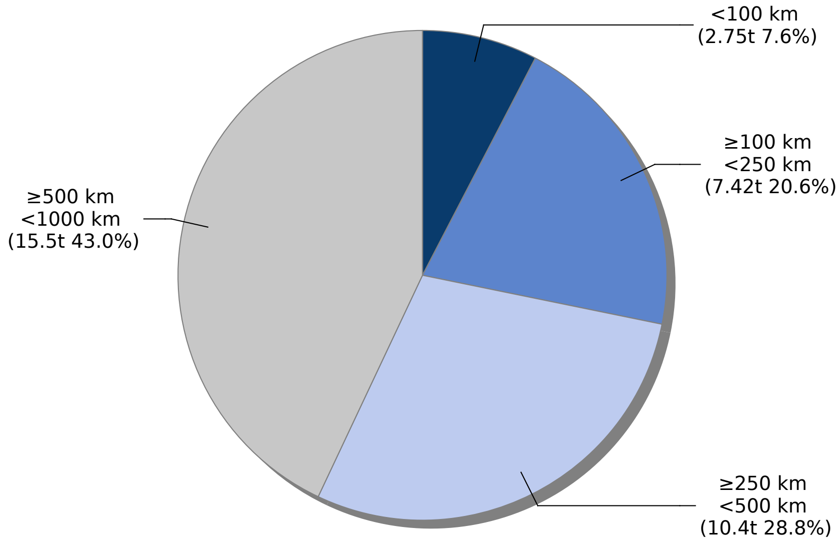
CAR

Distance class[1] compared by rental days and CO_2 emissions

RENTAL DAYS PER DISTANCE CLASS:



CO_2 EMISSIONS[2] PER DISTANCE CLASS:



[1] Average kilometre per rental day
[2] CO_2 emissions calculated according to VDR methodology.

RAIL

think • go climate conscious
atmosfair

Chapter 'Rail'

RAIL
Summary

TRAVEL	Amount	Unit
Kilometres	535	1,000 km
Miles[1]	332	1,000 miles
Segments[2]	1,136	
City Pairs	212	
Average segment distance in km[3]	471	km
Average segment distance in miles[3]	293	miles

CO_2 EMISSIONS[4]	Amount	Unit
CO_2	21.8	tons CO_2
CO_2 per segment, average	19,216	g CO_2
CO_2 per passenger kilometre, average	40.8	g CO_2/ km
CO_2 per passenger mile, average	65.7	g CO_2/ mile

[1] American miles
[2] One person, one way, from origin to destination
[3] Total distance of all segments divided by number of segments
[4] CO_2 emissions calculated according to VDR methodology.

RAIL

Top 10 city pairs by segments[1] and CO_2 emissions

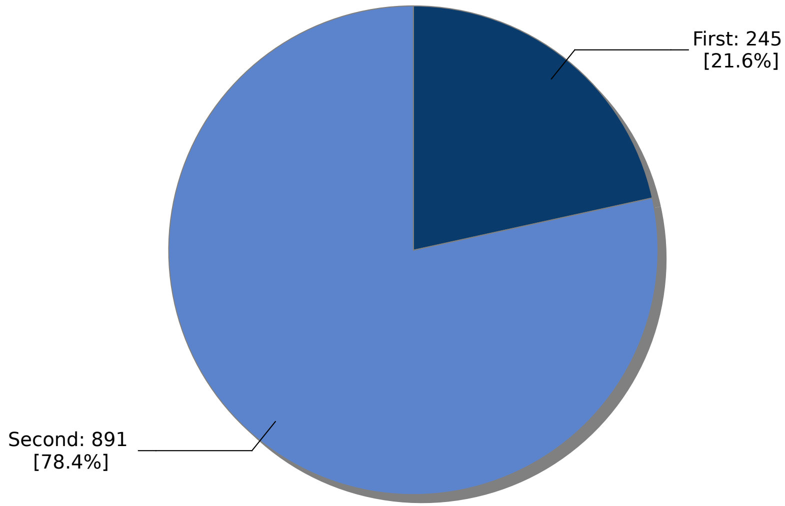
Routing	Segments	Segment length [km]	Segment length [miles]	Total distance [km]	Total distance [miles]	CO_2 emissions[2] [tons]	% of CO_2 emissions[2]
TOP 10 - SORTED BY KILOMETRES							
Baden-Baden - Frankfurt(Main) Hbf	67	207	129	13,869	8,620	0.69	3.2
Köln Hbf - Frankfurt(Main)	59	207	129	12,213	7,590	0.63	2.9
Frankfurt(Main) - Basel Hbf	58	397	247	23,026	14,311	0.63	2.9
Frankfurt(Main) - München Hbf	58	409	254	23,722	14,743	1.28	5.9
Freiburg Hbf - Frankfurt(Main)	50	328	204	16,400	10,193	0.90	4.1
Banteln Hbf - Frankfurt(Main)	42	311	193	13,062	8,118	0.64	2.9
Baden-Baden Hbf- Mannheim Hbf	39	110	68	4,290	2,666	0.21	1.0
Mannheim Hbf - Frankfurt(Main)	34	97	60	3,298	2,050	0.16	0.7
Hbf Frankfurt(Main) Hbf - Basel Hbf	32	397	247	12,704	7,896	0.36	1.6
Hamburg Hbf - Koblenz Hbf	31	531	330	16,461	10,231	0.81	3.7
TOP 10 – SORTED BY CO_2 EMISSIONS							
Frankfurt(Main) - München Hbf	58	409	254	23,722	14,743	1.28	5.9
Freiburg Hbf - Frankfurt(Main) Hbf	50	328	204	16,400	10,193	0.90	4.1
Parchim - Valence TGV	17	1,434	891	24,378	15,151	0.83	3.8
Hamburg Hbf - Koblenz Hbf	31	531	330	16,461	10,231	0.81	3.7
Münchsmünster - Hull	10	1,354	842	13,540	8,415	0.71	3.2
Baden-Baden - Frankfurt(Main) Hbf	67	207	129	13,869	8,620	0.69	3.2
Banteln - Frankfurt(Main) Hbf	42	311	193	13,062	8,118	0.64	2.9
Frankfurt(Main) Hbf - Basel Hbf	58	397	247	23,026	14,311	0.63	2.9
Köln Hbf - Frankfurt(Main) Hbf	59	207	129	12,213	7,590	0.63	2.9
Düsseldorf Hbf - Kermen	4	2,380	1,479	9,520	5,917	0.60	2.7

[1] One person, one way, from origin to destination
[2] CO_2 emissions calculated according to VDR methodology.

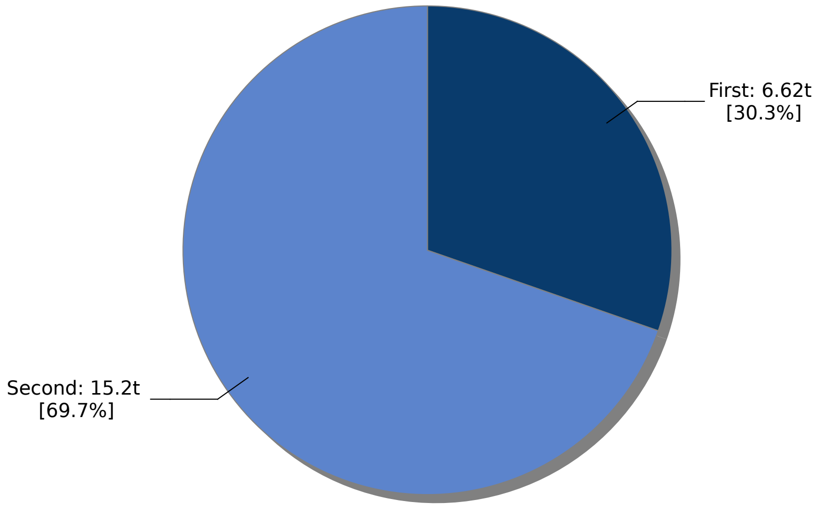
RAIL

Seat class compared by segments[1] and CO_2 emissions

SEGMENTS PER SEAT CLASS:



CO_2 EMISSIONS[2] PER SEAT CLASS:



As with flights, first class seats in trains (21.6%) have an overproportionate effect on CO2 emissions (30.3%).

[1] One person, one way, from origin to destination
[2] CO_2 emissions calculated according to VDR methodology.

HOTEL

think • go climate conscious
atmosfair

Chapter 'Hotel'

HOTEL

Summary

HOTEL CLASS	Overnight stays [nights]
all hotel classes	866
1 star hotel	0
2 star hotel	60
3 star hotel	318
4 star hotel	294
5 star hotel	194
hotel class unknown	0

EMISSIONS	CO_2 emissions[1] [tons]
from all overnight stays, all hotel classes	28.5
per overnight stay, 1 star hotel	0
per overnight stay, 2 star hotel	1.22
per overnight stay, 3 star hotel	8.76
per overnight stay, 4 star hotel	10.2
per overnight stay, 5 star hotel	8.29
per overnight stay, hotel class unknown	0

Hotel class, country code and number of overnight stays give us a valid database to calculate CO_2 emissions. Our database contains information about more than 40.000 business hotels worldwide.

[1] CO_2 emissions calculated according to VDR methodology.

HOTEL

CO_2 emissions and overnight stays per country and hotel category

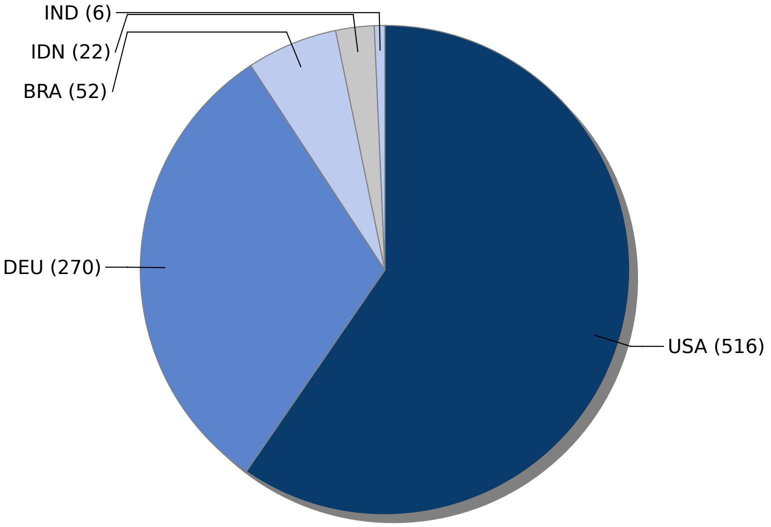
Country	1 star hotel	2 star hotel	3 star hotel	4 star hotel	5 star hotel	unknown
OVERNIGHT STAYS PER COUNTRY AND HOTEL CATEGORY						
USA	0	32	191	178	115	0
DEU	0	15	100	87	68	0
BRA	0	9	17	15	11	0
IDN	0	0	8	14	0	0
IND	0	4	2	0	0	0
CO_2 EMISSIONS[1] [TONS] PER COUNTRY AND HOTEL CATEGORY						
USA	0	0.60	4.71	6.26	5.19	0
DEU	0	0.46	3.66	3.32	2.87	0
BRA	0	0.08	0.18	0.22	0.23	0
IDN	0	0	0.17	0.43	0	0
IND	0	0.08	0.05	0	0	0

[1] CO_2 emissions calculated according to VDR methodology.

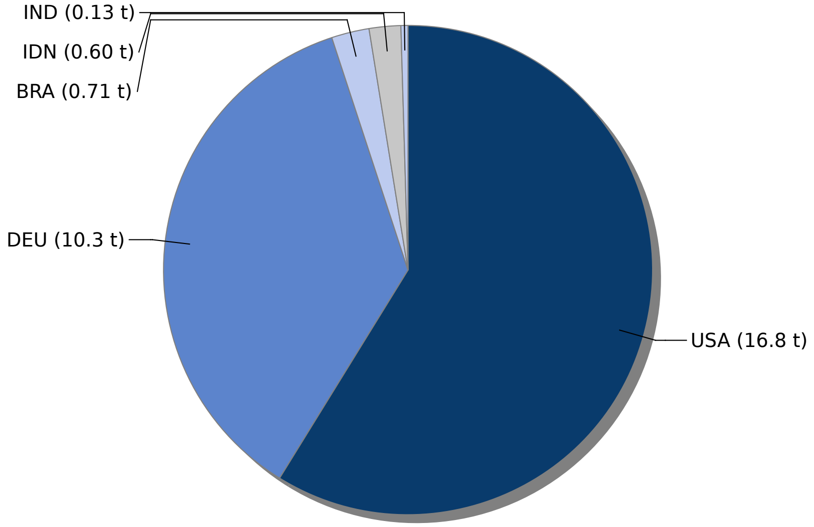
HOTEL

Countries compared by overnight stays and CO_2 emissions

OVERNIGHT STAYS PER COUNTRY:



CO_2 EMISSIONS[1] PER COUNTRY:



[1] CO_2 emissions calculated according to VDR methodology.

CARBON OFFSETTING WITH ATMOSFAIR

think • go climate conscious
atmosfair

Summarized CO_2 emissions of all business travel activities of this company.

Offsetting costs of all CO_2 on a 23 EUR/ton CO_2 basis.

This is absolutely worth reading: it explains why offsetting is an effective measure for emissions that can't be avoided or reduced in other ways.

DEALING WITH CO_2 EMISSIONS THAT CAN'T BE AVOIDED OR REDUCED

Travel activity type	CO_2 emissions[1] [tons]	Offsetting costs in EUR
FLIGHT[2]	680	15,651
CAR	36.1	829
RAIL	21.8	502
HOTEL	28.5	656

ATMOSFAIR OFFSET PROJECT EXAMPLES

Biogas from cow dung (Kenya): The project supplies small biogas units to dairy farmers which produce regenerative biogas.

Efficient fuel wood stoves (Nigeria): The efficient stoves save about 80% of energy and help to reduce deforestation and indoor air pollution.

[1] CO_2 emissions calculated according to VDR methodology.
[2] Category FLIGHT includes RFI 2.7 addition.

WHY OFFSETTING?

Offsetting is an essential part of a comprehensive carbon strategy that aims at reducing your company's climate impact. It is an effective way to deal with those emissions that can't be avoided or further reduced through other measures. As a flexible instrument that is always available, offsetting minimises uncertainties within your carbon strategy and supports your organisation in reaching your self-set emission reduction targets. Furthermore, offsetting is a highly visible climate protection measure that can easily be communicated not only to your emplo-yees, customers and rating agencies but to all your stakeholders.

ATMOSFAIR – AWARD WINNING OFFSET PROJECTS

Atmosfair is a non-profit organisation. We offer to offset the CO_2 emissions from your business travel activities through atmosfair projects, for example the ins-tallation of renewable energies in developing countries. atmosfair projects are UN-certified (CDM) and additionally comply with the Gold Standard. If you decide to offset with atmosfair you will receive a tax-deductible donation receipt (valid with the German tax office; other national regulation may apply).

atmosfair has been ranked No. 1 quality offset provider in international compa-rative studies since 2005. The assessed criteria were the quality of the offsetting projects and organisational as well as financial transparency.

ANNEXES

think • go climate conscious
atmosfair

WHO IS BEHIND VDR?

The German Business Travel Association VDR advocates efficient, economical and safe worldwide travel for companies. It represents the interest of German business regarding conditions for corporate travel and supports its members as a competence center for political activities.

WHAT ARE THE BENEFITS OF USING THE VDR STANDARD?

The VDR standard for the CO_2 calculation of corporate travel is a standardised method to determine CO_2 emissions created by business travel worldwide. Although previous approaches made it possible to estimate CO_2 emissions from business travel, none of them took the specific characteristics of business trips into account. The VDR standard covers all relevant business travel activities (flights, hotel, rental cars, rail) and meets the requirements for worldwide application, accuracy, comparability and independence. The standard is exact enough to highlight the potential for CO_2 reductions. Companies that generate their CO_2 reports using this standard are entitled to label them with the VDR logo and seal reading „produced according to the VDR standard."

For full methodology details, please visit:
https://www.atmosfair.de/en/standards/emissions_calculation/co2_reporting_for_companies/

Disclaimer: *For maximum accuracy in calculating CO_2-emissions, we update our VDR database every year. For the travel activity flight for example these updates includes elements such as the most current flight plans, new airport locations, new aircraft types and most importantly new scientific findings if available.*

Due to inaccurate or incomplete customer travel data it can happen that the most precise calculation method suggested by the VDR standard can not be applied. In these cases fallback calculation methods are used which achieve the maximum precision that can be achieved with the provided data. In any case the calculations which this report is based on are compliant with the VDR standard.

VDR Verband Deutsches Reisemanagement e.V.

„... in atmosfair, the VDR has gained an experienced partner for creating their standard. The quality of atmosfair's calculation methods has often been proven, including by the Federal Environmental Agency."

Dr. Norbert Röttgen,
Former federal minister for the Environment, Nature Conservation and Nuclear Safety

OTHER CALCULATION METHODS

think • go climate conscious atmosfair

GHG: The Greenhouse Gas (GHG) Protocol, developed by World Resources Institute (WRI) and World Business Council on Sustainable Development (WBCSD), sets the global standard for how to measure, manage, and report greenhouse gas emissions.The GHG Protocol simplifes the calculation of specific CO_2 per passenger in comparison to the VDR standard. Only the following factors are considered:

- Flight distance (great circle distance between the airports, multiplied by a blanket uplift factor for detours).
- Flight class: domestic, short-haul international, long-haul international.
- Booking class: A distinction is made between economy, premium economy, business and first class.

GRI: The Global Reporting Initiative (GRI) is an international independent organisation that helps businesses, governments and other organisations understand and communicate the impact of business operations on critical sustainability issues. GRI's approach for calculating emissions is based on the method of the GHG Protocol.

DEFRA: The UK Department for Environment, Food and Rural Affairs (DEFRA) has developed a tool for calculating the CO_2 emissions of travel activities such as flight, train journeys and car rides, among others. DEFRA's approach is based on the calculation method of the GHG Protocol but uses slightly different emission factors. From 2018 these include an uplift factor of 1.9 for considering non-CO2 effects of air travel, as recommended by DEFRA.

ICAO: The International Civil Aviation Organization (ICAO) has developed an online calculator for its website which calculates CO_2 emissions from air travel. The associated method uses flight profiles with ascend and descend phases, distinguishes between different types of aircrafts and also considers factors such as passenger load and co-loaded freight. Nonetheless, the ICAO calculator also has disadvantages:

- If the city pair for which the CO_2 is to be calculated is not in the ICAO data base, the ICAO calculator yields no result.
- The ICAO calculator considers CO_2 emissions only. It does not take other climate effects such as condensation trails into account.
- There are only two seat classes: economy and premium.
- The ICAO calculator assumes a full-economy seat configuration of all aircrafts.

VFU: The German Verein für Umweltmanagement und Nachhaltigkeit in Finanzinstituten e.V. (VFU) has developed a systemof performance indicators to evaluate 'environmental performance'. Transportation is a sub-item and includestrain journeys, air travel as well as road trafic. Just like the GHG Protocol and DEFRA methods the VFU tool simplifes the CO_2 calculation with their own emission factors.

Disclaimer: For maximum accuracy in calculating CO_2 emissions we update the databases of each reporting standard every year.

GLOSSARY

think • go climate conscious
atmosfair

GENERAL TERMS

MILES	American miles; 1 american mile = 1.609 kilometres
PKM	Passenger kilometre; product of number of passengers and kilometres travelled
SEGMENT	one person, one way, from origin to destination

FLIGHT TERMS

AVERAGE SEGMENT DISTANCE	Total distance of all flights divided by number of flights
CO_2 VDR	CO_2 emissions according to VDR methodology
CO_2 GRI / GHG	CO_2 emissions according to GRI / GHG methodology
CO_2 DEFRA	CO_2 emissions according to DEFRA methodology
CO_2 ICAO	CO_2 emissions according to ICAO methodology
CO_2 VFU	CO_2 emissions according to VFU methodology
CO_2 EMISSIONS IN ALTITUDES > 9 KM	CO_2 emissions from fuel burned above 9 kilometres altitude (RFI applied, see RFI)
CO_2 + RFI	Sum of CO_2 and NON CO_2 emissions converted into CO_2 emissions following the RFI logic (see RFI)
CRUISE ALTITUDE	Cruise altitude of an airplane. Above 9,000 metres the atmosphere is far more sensitive for exhaust emissions (see RFI)
RFI	Radiative forcing index, metrics established by the Intergovernmental Panel on Climate Change (IPCC) to measure the impact of effects such as condensation trails or ozone formation. The RFI was established by the IPCC in 1999. It measures the total climate impact, including contrails, ozone formation, etc. compared to the pure CO_2 emissions. An RFI of 2 means that the warming impact of the part of a flight that is conducted above 9 km altitude is twice as big as its CO_2 effect alone. The range of the RFI is between 2-4 with 2.7 being the best estimate of the IPCC.

GLOSSARY

CAR TERMS

CO_2	CO_2 emissions according to VDR methodology
DAYS OF USE	Total number of car rental days
DISTANCE CLASS	Average kilometre per rental day

RAIL TERMS

CO_2	CO_2 emissions according to VDR methodology
AVERAGE SEGMENT DISTANCE	Total distance of all train rides divided by number of train rides

HOTEL TERMS

CO_2	CO_2 emissions according to VDR methodology
OVERNIGHT STAYS	Total number of overnight stays