Department for
Energy Security
& Net Zero

2023 Government Greenhouse Gas Conversion Factors for Company Reporting

Major changes to the Conversion Factors

June 2023

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1. Major Changes to the Conversion Factors

The following table summarises the major changes in conversion factors for the 2023 Greenhouse Gas (GHG) Conversion Factors, compared to the equivalent factors provided in the 2022 GHG Conversion Factors, and a short explanation for the reasons for the changes. We have considered major changes to be those greater than 5% for Scope 1 and 2 emission sources (applies to most fuel and electricity sources) and greater than 10% for Scope 3 (applies to most of the other emission sources). Please refer to the Glossary section at the end of this document for any acronyms used in the table below.

Ref. number	Emission factor	GHG	Unit (all units are kgCO_2e per "unit" of GHG, unless stated)	Magnitude of change vs 2022 update	Reason for change	For more information see relevant section in methodology report:
Fuels						
No significant changes						Section 2
Bioenergy						
1	Grass/straw	CO_2e	All	20%	Due to revised approach in estimating biomass use in power generation plants	Section 9
Refrigerants and other						
2	All	CO_2e	kg	Between -99.9% (for butane) and +275% (for HFE-356pcc3)	Almost all values have been updated to use AR5 GWPs (and where AR5 values were not available, but AR6 values were, AR6 GWPs were used). Almost all changes are less than 20%, however, given the wide range of substances considered here, and the limited science for some of the more niche products, updates to GWPs can be substantial for some individual substances. Most significantly, previously nominal estimated GWPs presented in the 2014 EU F-gas regulations for some hydrocarbons have been replaced with properly assessed IPCC assessment values, and in those cases changes, are typically from between 3 and 6 to less than 0.5	Section 4

Ref. number	Emission factor	GHG	Unit (all units are $kgCO_2e$ per "unit" of GHG, unless stated)	Magnitude of change vs 2022 update	Reason for change	For more information see relevant section in methodology report:
Passenger Vehicles						
3	Cars (by market segment) – Upper Medium, Dual purpose 4x4 - Plug-in Hybrid Electric Vehicle (PHEV)	CO_2	km and miles	-5%	General decrease expected as more recent cars with lower emissions penetrate into fleet	Section 5
4	Cars (by market segment) – Sports, MPV - Plug-in Hybrid Electric Vehicle (PHEV)	CO_2	km and miles	7% to 9%	The proportion of PHEVs with higher emissions increased in these market segments (sports and MPV (Multi purpose Vehicle)) this year	Section 5
5	Cars (by size) – Medium - Plug-in Hybrid Electric Vehicle (PHEV)	CO_2	km and miles	-5%	General decrease expected as more recent cars with lower emissions penetrate into fleet	Section 5
Delivery vehicles						
6	Petrol vans - Class I (up to 1.305 tonnes)	CO_2	km and miles	-8%	The combined result of a slight decrease in emissions from average bioethanol blend, and a more accurate representation of fuel consumption split by engine size in the NAEI	Section 6
7	Petrol vans - Average (up to 3.5 tonnes)	CO_2	km and miles	-6%	As above	Section 6
8	HGVs and HGVs refrigerated (all diesel) - Rigid (> 17 tonnes), All rigids - 0%, 50% & 100% laden	CO_2	km and miles	-4.9 to -5.5%	Decrease in the CO_2 emission factor reflects DfT data showing an increase in goods loaded per vehicle	Section 6
SECR kWh pass & delivery vehs						
9	Cars (by market segment) – Sports - Plug-in Hybrid Electric Vehicle (PHEV)	kWh	km and miles	9%	The proportion of PHEVs with higher emissions increased this year	Section 14

Ref. number	Emission factor	GHG	Unit (all units are $kgCO_2e$ per "unit" of GHG, unless stated)	Magnitude of change vs 2022 update	Reason for change	For more information see relevant section in methodology report:
10	Diesel vans - Class II (1.305 to 1.74 tonnes)	kWh	tonne.km	-6%	Combination of decreased diesel factor and increased average payload capacity	Section 14
11	HGV and HGV refrigerated (all diesel) - Rigid (>3.5 - 7.5 tonnes) – 50%, 100% & Average laden	kWh	tonne.km	-8%	Changes reflect increase in goods loaded per vehicle (tn/veh); goods moved (in billion tn/km) and distance travelled (in bvkm)	Section 14
12	HGV and HGV refrigerated (all diesel) - Rigid (>7.5 tonnes-17 tonnes) – Average laden	kWh	tonne.km	-8%	As above	Section 14
13	HGV and HGV refrigerated (all diesel) - Rigid (>17 tonnes) – Average laden	kWh	tonne.km	-17%	As above	Section 14
14	HGV and HGV refrigerated (all diesel) - All rigids – 50%, 100% & Average laden	kWh	tonne.km	-5% to -16%	As above	Section 14
15	HGV and HGV refrigerated (all diesel) - Articulated (>3.5 - 33t) – 50%, 100% & Average laden	kWh	tonne.km	-6% to -17%	As above	Section 14
16	HGV and HGV refrigerated (all diesel) - Articulated (>33t), All artics, All HGVs – Average laden	kWh	tonne.km	-7% ot -8%	As above	Section 14
UK Electricity						
17	UK Electricity	CO_2	kWh	7%	Caused by an increase in natural gas usage and decrease in renewables usage compared to last year	Section 3

Ref. number	Emission factor	GHG	Unit (all units are $kgCO_2e$ per "unit" of GHG, unless stated)	Magnitude of change vs 2022 update	Reason for change	For more information see relevant section in methodology report:
UK electricity for EVs						
18	Cars (by market segment) – Mini, Supermini, Lower medium, Upper medium, Executive, Luxury, Sports, MPV - Battery Electric Vehicle (BEV)	CO_2	km and miles	7% to 16%	Mainly due to an increase in the UK electricity generation factor. Some market segments show higher increases because newly registered vehicles are more energy intensive (higher watt-hour per km)	Section 5
19	Cars (by market segment) – Supermini, Lower medium, Upper medium, Executive, Luxury, Sports, Dual purpose 4X4, MPV- Plug-in Hybrid Electric Vehicle (PHEV)	CO_2	km and miles	7% to 13%	As above	Section 5
20	Cars (by size) – All sizes - Battery Electric Vehicle (BEV)	CO_2	km and miles	5% to 10%	As above	Section 5
21	Cars (by size) – All sizes - Plug-in Hybrid Electric Vehicle (PHEV)	CO_2	km and miles	7% to 13%	As above	Section 5
22	Vans – Class I (up to 1.305 tonnes), Class II (1.305 to 1.74 tonnes) - Battery Electric Vehicle (BEV)	CO_2	tonne.km, km and miles	6% to 7%	Mainly due to an increase in the UK electricity generation factor	Section 6
23	Vans – Average (up to 3.5 tonnes) - Battery Electric Vehicle (BEV)	CO_2	tonne.km, km and miles	5% to 19%	Due to an increase in the UK electricity generation factor, and an increase in number of newly registered Class III vans which are heavier and more energy intensive	Section 6

Ref. number	Emission factor	GHG	Unit (all units are $kgCO_2e$ per "unit" of GHG, unless stated)	Magnitude of change vs 2022 update	Reason for change	For more information see relevant section in methodology report:
SECR kWh UK electricity for EVs						
24	Cars (by market segment) – Upper Medium, MPV – Battery Electric Vehicle (BEV)	kWh	km and miles	7% to 8%	Newly registered vehicles in these market segments are more energy intensive than before (higher watt-hour per km)	Section 14
25	Cars (by market segment) – Lower medium - Plug-in Hybrid Electric Vehicle (PHEV)	kWh	km and miles	5%	As above	Section 14
26	Cars (by size) – Large car - Plug-in Hybrid Electric Vehicle (PHEV)	kWh	km and miles	6%	As above	Section 14
27	Vans – Class III (1.74 to 3.5 tonnes) - Battery Electric Vehicle (BEV)	kWh	tonne.km, km and miles	-6% to -10%	Newly registered vehicles are less energy intensive than before (lower watt-hour per km)	Section 14
28	Vans – Average (up to 3.5 tonnes) - Battery Electric Vehicle (BEV)	kWh	km and miles	11%	Increase in number of newly registered Class III vans which are heavier and more energy intensive	Section 14
Heat and Steam						
29	Onsite and district heating	CO_2	kWh	5%	Due to changes in the fuel mix	Section 3
WTT - fuels						
30	Lubricants	CO_2e	tonnes, kWh (Net CV) and kWh (Gross CV)	35% to 36%	Corrected an inconsistency in the lubricants WTT factor calculations and due to alignment to AR5 GWPs	Section 2
31	Processed fuel oils - distillate oil	CO_2e	All	34% to 36%	Based on lubricants WTT factor	Section 2
32	Processed fuel oils - residual oil	CO_2e	All	34% to 35%	Based on lubricants WTT factor	Section 2

Ref. number	Emission factor	GHG	Unit (all units are $kgCO_2e$ per "unit" of GHG, unless stated)	Magnitude of change vs 2022 update	Reason for change	For more information see relevant section in methodology report:
33	Waste oils	CO_2e	All	36%	Based on lubricants WTT factor	Section 2
WTT - bioenergy						
34	Bioethanol	CO_2e	All	38%	Year on year revisions reflect real changes in the RTFO statistics and are in line with changes in the market; increase in ethanol due to introduction of E10	Section 9
35	Biodiesel HVO	CO_2e	All	-21%	WTT EFs reported under RTFO are very specific to the feedstock and the source. If the mix of them changes year on year, the average WTT can change significantly. So despite the increased use of HVO, the Scope 3 emissions have gone down significantly; should be related to the emissions from the production plants	Section 9
36	Biodiesel ME, biomethane (compressed), biodiesel ME (from Tallow), off road biodiesel, methanol (bio), biomethane (liquified)	CO_2e	All	12% to 110%	Year on year revisions reflect real changes in the RTFO statistics	Section 9
Transmission and distribution (T&D)						
No major changes this year.						Section 3
UK electricity T&D for EVs						
37	Cars (by market segment) – MPV - Battery Electric Vehicle (BEV)	CO_2	km and miles	10%	The newly registered vehicles are more energy intensive (higher watt-hour per km) than before. Also, increase partly due to an increase in the UK electricity T&D factor	Section 5
38	Vans – Average - Battery Electric Vehicle (BEV)	CO_2	km and miles	12%	Increase in number of newly registered Class III vans which are heavier and more energy intensive	Section 6
WTT- UK & overseas elec						
No major changes this year.						Section 3 & 10

Ref. number	Emission factor	GHG	Unit (all units are $kgCO_2e$ per "unit" of GHG, unless stated)	Magnitude of change vs 2022 update	Reason for change	For more information see relevant section in methodology report:
WTT- heat and steam						
No major changes this year.						Section 3
Water supply						
39	Water supply	CO_2e	All	19%	Improved methodology using a weighted average of the actual volume of waste water treated and drinking water supplied by companies rather than using proxy data (for sewage sludge) as in previous years	Section 9
Water treatment						
40	Water treatment	CO_2e	All	-26%	Improved methodology using a weighted average of the actual volume of waste water treated and drinking water supplied by companies rather than using proxy data (for sewage sludge) as in previous years	Section 9
Material use						
No major changes this year.						Section 12
Waste disposal						
41	Construction - Soils, Wood - Landfill	CO_2e	tonnes	11% to 12%	(1) Landfill factors for biodegradable materials are revised due to updated values for methane capture and oxidation in the MELMod model based on the most up-to-date empirical data, to ensure that the model more accurately reflects the actual emissions from landfills. (2) Smaller changes caused by changes to the transport factors	Section 12
42	Paper - All - Landfill	CO_2e	tonnes	12%	As above	Section 12
43	Refuse - All - Landfill	CO_2e	tonnes	11% to 12%	As above	Section 12
44	Other - Books, Clothing - Landfill	CO_2e	tonnes	12%	As above	Section 12

Ref. number	Emission factor	GHG	Unit (all units are $kgCO_2e$ per "unit" of GHG, unless stated)	Magnitude of change vs 2022 update	Reason for change	For more information see relevant section in methodology report:
Business travel- air						
45	Domestic - Average passenger	CO_2e	passenger.km	11% with RF (radiative forcing) (24% without RF)	Reduced load factors, which are a consequence of the COVID-19 pandemic; RF factor reduced to 1.7	Section 8
46	Short-haul - Average passenger, Economy class, Business class	CO_2e	passenger.km	21% with RF (35% without RF)	Reduced load factors, which are a consequence of the COVID-19 pandemic; RF factor reduced to 1.7	Section 8
47	Long-haul - Average passenger, Economy class, Premium economy class, Business class First class	CO_2e	passenger.km	35% with RF (51% without RF)	Reduced load factors, which are a consequence of the COVID-19 pandemic; RF factor reduced to 1.7	Section 8
WTT- Business travel- air						
48	Domestic - Average passenger	CO_2e	passenger.km	25%	Reduced load factors, which are a consequence of the COVID-19 pandemic	Section 8
49	Short-haul - Average passenger, Economy class, Business class	CO_2e	passenger.km	36%	Reduced load factors, which are a consequence of the COVID-19 pandemic	Section 8
50	Long-haul - Average passenger, Economy class, Premium economy class, Business class First class	CO_2e	passenger.km	52%	Reduced load factors, which are a consequence of the COVID-19 pandemic	Section 8
Business travel- sea						
Factors remained constant from the 2021 update but were aligned to the AR5 GWPs						Section 7
WTT- Business travel- sea						
Factors remained constant from the 2021 update but were aligned to the AR5 GWPs						Section 7

Ref. number	Emission factor	GHG	Unit (all units are kgCO_2e per "unit" of GHG, unless stated)	Magnitude of change vs 2022 update	Reason for change	For more information see relevant section in methodology report:
Business travel - land						
51	Cars (by market segment) – Mini, Supermini, Upper Medium, MPV – Battery Electric Vehicle (BEV)	CO_2	passenger.km	10% to 15%	As seen in UK electricity for EVs and UK electricity T&D for EVs	Section 5
52	Local bus (not London)	CO_2	passenger.km	10%	Due to using the 2019 instead of 2018 occupancy levels	Section 5
WTT – pass vehs & travel- land						
53	Cars (by market segment) – Mini, Lower medium, Upper medium, Executive, Luxury, Dual purpose 4X4 – Battery Electric Vehicle (BEV)	CO_2e	passenger.km	-24% to 20%	Combination of the changes to the direct CO_2 transport and CO_2 electricity/fuel factors, as well as changes due to alignment to AR5 GWPs of the electricity/fuel WTT factors	Section 5
54	Cars (by market segment) – Supermini, Lower medium, Upper medium, Executive – Plug-in Hybrid Electric Vehicle (PHEV)	CO_2e	passenger.km	-10% to -12%	As above	Section 5
55	WTT - Local bus (not London)	CO_2e	passenger.km	12%	Combination of the changes to the direct CO_2 transport and CO_2 fuel factors, as well as changes due to alignment to AR5 GWPs of the fuel WTT factors	Section 5
Freighting goods						
56	Vans – Average (up to 3.5 tonnes) - Battery Electric Vehicle (BEV)	CO_2	km and miles	18%	Due to an increase in the UK electricity generation factor, and an increase in newly registered Class III vans which are heavier and more energy intensive	Section 6

Ref. number	Emission factor	GHG	Unit (all units are $kgCO_2e$ per "unit" of GHG, unless stated)	Magnitude of change vs 2022 update	Reason for change	For more information see relevant section in methodology report:
57	HGV & HGV refrigerated (all diesel) - Rigid (>17 tonnes), All Rigids, Artics (>3.5 - 33t) - Average laden	CO_2	tonne.km	-17%	Changes reflect increase in goods loaded per vehicle (tn/veh); goods moved (in billion tn/km) and distance travelled (in bvkm)	Section 6
58	Freight flights - Domestic	CO_2	tonne.km	16% without RF (radiative forcing)	Calculations now even more dominated by dedicated cargo, which is a consequence of there being fewer passenger flights due to the COVID-19 pandemic; Revisions for the B752 in the latest Small Emitter Toolkit	Section 8
59	Freight flights - Short-haul	CO_2	tonne.km	-19% without RF (-28% with RF)	Calculations now dominated by dedicated cargo, which is a consequence of there being fewer passenger flights due to the COVID-19 pandemic; RF factor reduced to 1.7	Section 8
60	Freight flights - Long-haul	CO_2	tonne.km	21% without RF	Higher fraction of dedicated cargo, which is a consequence of there being fewer passenger flights due to the COVID-19 pandemic; Phasing out of the B748	Section 8
61	Freight flights - International	CO_2	tonne.km	21% without RF	As above	Section 8
WTT – delivery vehs & freight						
62	Petrol vans - Class I (up to 1.305 tonnes)	CO_2e	km and miles	-10%	Combination of the changes to the direct CO_2 transport and CO_2 fuel factors, as well as changes due to alignment to AR5 GWPs of the fuel WTT factors	Section 6
63	Diesel vans - Class II (1.305 to 1.74 tonnes)	CO_2e	tonne.km	-10%	As above	Section 6
64	Vans – Class I (up to 1.305 tonnes), Average (up to 3.5 tonnes) - Battery Electric Vehicle (BEV)	CO_2e	tonne.km, km and miles	-17% to 15%	As above	Section 6

Ref. number	Emission factor	GHG	Unit (all units are $kgCO_2e$ per "unit" of GHG, unless stated)	Magnitude of change vs 2022 update	Reason for change	For more information see relevant section in methodology report:
65	HGV and HGV refrigerated (all diesel) - Rigid (>17 tonnes), All Rigids, All HGVs - Average laden	CO_2e	tonne.km	-10% to - 15%	Combination of the changes to the direct CO_2 transport and CO_2 fuel factors, as well as changes due to alignment to AR5 GWPs of the fuel WTT factors	Section 6
66	Freight flights - Domestic	CO_2e	tonne.km	17%	Calculations now even more dominated by dedicated cargo, which is a consequence of there being fewer passenger flights due to the COVID-19 pandemic; Revisions for the B752 in the latest Small Emitter Toolkit	Section 8
67	Freight flights - Short-haul	CO_2e	tonne.km	-19%	Calculations now dominated by dedicated cargo, which is a consequence of there being fewer passenger flights due to the COVID-19 pandemic	Section 8
68	Freight flights - Long-haul	CO_2e	tonne.km	21%	Higher fraction of dedicated cargo, which is a consequence of there being fewer passenger flights due to the COVID-19 pandemic; phasing out of the B748	Section 8
69	Freight flights - International	CO_2e	tonne.km	21%	As above	Section 8
Hotel Stay						
Factors remained constant from the 2022 update						Section 11
Managed assets- electricity						
No major changes this year						Section 3
Managed assets- vehicles						
70	Managed cars (by market segment) - Mini, Supermini, Upper medium, MPV – Battery Electric Vehicles (BEV)	CO_2	km and miles	10% to 15%	Mostly because of the increase in electricity generation factor, and also there are more energy intensive car models in the fleet	Section 5

Ref. number	Emission factor	GHG	Unit (all units are kgCO_2e per "unit" of GHG, unless stated)	Magnitude of change vs 2022 update	Reason for change	For more information see relevant section in methodology report:
71	Managed cars (by market segment) - MPV – Plug-in Hybrid Electric Vehicle (PHEV)	CO_2	km and miles	10%	Mostly because of the increase in electricity generation factor	Section 5
72	Vans – Average - Battery Electric Vehicle (BEV)	CO_2	km and miles	18%	Due to an increase in the UK electricity generation factor, and an increase in newly registered Class III vans which are heavier and more energy intensive	Section 6
Homeworking						
Factors remained constant from the 2022 update but aligned to AR5 GWPs						Section 15
Outside of scopes						
73	Forecourt fuels containing biofuel - Diesel (average biofuel blend)	CO_2e	tonnes and litres	25% to 27%	Due to increased use of biodiesel ME as shown in DfT's RTFO statistics	Section 9
74	Forecourt fuels containing biofuel - Petrol (average biofuel blend)	CO_2e	tonnes and litres	30 to 45%	Due to increased use of bioethanol as shown in DfT's RTFO statistics	Section 9

Glossary

Abbreviation	Definition
ANPR	Automatic Number Plate Recognition
BEV	Battery electric vehicle
CAA	Civil Aviation Authority
CBS	National Bureau for Statistics in the Netherlands
CEF	Carbon emission factor
CH_4	Methane
CHP	Combined Heat and Power
CHPQA	Combined Heat and Power Quality Assurance
CNG	Compressed natural gas
CO_2	Carbon dioxide
DfT	Department for Transport
DUKES	Digest of UK Energy Statistics
EEA	European Environment Agency
EF	Emission factor
ETS	Emissions Trading System
FAME	Fatty Acid Methyl Ester
GCV	Gross calorific value
GHG	Greenhouse gas
GVW	Gross vehicle weight
GWP	Global Warming Potential
HGVs	Heavy goods vehicles
IPCC	Intergovernmental Panel on Climate Change
LCA	Life cycle assessment
LGVs	Light goods vehicles
LPG	Liquefied petroleum gas
MTBE	Methyl tert-butyl ether
NAEI	National Atmospheric Emissions Inventory
NCV	Net calorific value
NEDC	New European Driving Cycle
N_2O	Nitrous oxide

ORR	Office of Rail and Road
PHEV	Plug-in hybrid electric vehicle
RF	Radiative forcing
RoPax	Roll on/roll off a passenger
RTE	French transmission system operator
RTFO	Renewable Transport Fuel Obligation
RW	Real-world
SEAI	Sustainable Energy Authority of Ireland
SECR	Streamlined Energy and Carbon Reporting
SMMT	Society of Motor Manufacturers and Traders
T&D	Transmission & Distribution
TfL	Transport for London
TTW	Tank-To-Wheel (i.e. direct emissions at the point of use)
UK GHGI	UK's Greenhouse Gas Inventory
UNFCCC	United Nations Framework Convention on Climate Change
WLTP	Worldwide Harmonised Light Vehicle Test Procedure
WTT	Well-To-Tank (i.e. upstream emissions from the production of fuel or electricity)
WTW	Well-To-Wheel (= Well-To-Tank + Tank-To-Wheel)
xEV	Generic term for battery electric vehicles (BEV), plug-in hybrid electric vehicles (PHEV), range-extended electric vehicles (REEV) and fuel cell electric vehicles (FCEV)

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