

# Creative Climate Tools Methodology & Conversion Factors 2024

Welcome to the **Creative Climate Tools Methodology & Conversion Factors 2024** document. This resource includes information on the following areas of the CC Tools:

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## INTRODUCTION

This is a list of the emission conversion factors and methodology used on the Creative Climate Tools for the purposes of calculating an organisation's carbon footprint.

The conversion factors are updated annually. Methodology and data availability is consistently evolving and will be refined over time. As a result, please be aware that you may notice some changes in your emissions recorded. These changes are made to bring greater accuracy and a more complete picture of your organisation's impacts.

Historically, the conversion factors used in the tools have been predominantly sourced from government-published conversion factors by the Department of Energy Security and Net Zero (previously published by BEIS: the Department for Business, Energy and Industrial Strategy). In 2023, the Julie's Bicycle team worked with leading consultants to update the waste and materials underlying methodology and conversion factors – resulting in a wider range of sources used. These improvements result in a more accurate and holistic narrative around our relationship with materials. For more information on the changes made, see the file titled 'Operational Materials & Waste Methodology and Conversion Factor Update – FAQs' in the Creative Climate Tools [Resources page](#).

The platform will use the conversion factors applicable to the financial/calendar year submitted by users when creating a report, based on the "Majority approach" from best practice guidance for company reporting issued by the UK Department for Energy Security and Net Zero:

"If you are reporting on an April to March year, the factors from the calendar year in which the greatest portion of your data falls should be applied (for example, the 2024 factors should be applied to data in reporting year 01/04/24 – 31/03/25, the 2020 factors should have been applied to data in reporting year 01/04/20 – 31/03/21). Users that operate a July to June reporting year should apply the newest set of available factors."

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## **ENERGY & FUELS**

<b>Impact Name</b>	<b>Carbon Conversion Factor</b>	<b>Unit</b>	<b>Source</b>	<b>Notes</b>
<b>Electricity</b>	0.22535	kgCO <sub>2</sub> e per kWh	DESNZ (2024)	Conversion factor inclusive of transmission and distribution (T&D) losses.
<b>Gas</b>	0.1829	kgCO <sub>2</sub> e per kWh	DESNZ (2024)	Natural gas (Gross CV).
<b>Onsite Renewables</b>	0	kgCO <sub>2</sub> e per kWh	Julie's Bicycle	Julie's Bicycle zero rate all renewable electricity sources, in recognition of exclusion of life cycle emissions from fossil fuel conversion factors.
<b>District Heating</b>	0.17965	kgCO <sub>2</sub> e per kWh	DESNZ (2024)	Heat and steam > District heat and steam. Conversion factors are based on an industry average fuel mix for combined heat and power (CHP) based heat and steam.
<b>Oil</b>	3.07093	kgCO <sub>2</sub> e per litre	DESNZ (2024)	Burning oil. Conversion factor inclusive of well-to-tank emissions.
<b>Diesel</b>	3.28564	kgCO <sub>2</sub> e per litre	DESNZ (2024)	100% mineral diesel. Conversion factor inclusive of well-to-tank emissions.
<b>Petrol</b>	2.96036	kgCO <sub>2</sub> e per litre	DESNZ (2024)	100% mineral petrol. Conversion factor inclusive of well-to-tank emissions.
<b>Bottled Gas - LPG</b>	1.55713	kgCO <sub>2</sub> e per litre	DESNZ (2024)	(Liquefied Petroleum Gas).
<b>Biodiesel</b>	0.55447	kgCO <sub>2</sub> e per litre	DESNZ (2024)	Biodiesel ME (Methyl Ester) (from used cooking oil). Conversion factor inclusive of well-to-tank emissions.
<b>HVO</b>	0.59458	kgCO <sub>2</sub> e per litre	DESNZ (2024)	Bioenergy > Biofuels > Biodiesel HVO. Conversion factor inclusive of well-to-tank emissions.

NOTE: We have recently updated our methodology regarding liquid fuels (Oil, Diesel, Biodiesel and Petrol) to include both combustion emissions (Scope 1) and the emissions associated with extraction, refining and transportation of the raw fuel sources to an organisation’s site, prior to combustion (Scope 3).

Name	Unit Conversion Factor	Unit	Source	Notes
m3 to kWh	10.55	kWh per m3	Pilio Group	
GJ to kWh	277.778	kWh per GJ	Pilio Group	
kWh to litres	0.266	litres per kWh	Julie’s Bicycle	Assumed generator efficiency at 35%.

## ENERGY USE TAB

Electricity, Gas and Onsite Renewables emissions are calculated using the following formula:

$$\text{Amount (kWh)} \times \text{Conversion Factor} = \text{Emissions (kgCO2e)}$$

Gas can also be entered in m3 and GJ. For this, the following formulas are used to convert the units to kWh:

$$\text{Amount (m3)} \times 10.55 \times \text{Conversion Factor} = \text{Emissions (kgCO2e)}$$

$$\text{Amount (GJ)} \times 277.778 \times \text{Conversion Factor} = \text{Emissions (kgCO2e)}$$

Oil, Diesel, Petrol, LPG and Biodiesel are calculated using the following formula:

$$\text{Amount (litres)} \times \text{Conversion Factor} = \text{Emissions (kgCO}_2\text{e)}$$

## PERFORMANCES TAB

Show power from **Indoor performances** are assumed to be powered by mains electricity (**Electricity**). These emissions are calculated using the following formula:

$$\text{Average show power per performance (kWh)} \times \text{Number of Indoor/Venue Performances} \times \text{Conversion Factor} = \text{Emissions (kgCO}_2\text{e)}$$

Show power from **Outdoor performances** are assumed to be powered by diesel generators (**Diesel**). As the **Diesel** conversion factor is in kgCO<sub>2</sub>e per litres, the average show power per performance needs to be converted from kWh to litres before applying the conversion factor. These emissions are calculated using the following formula:

$$\text{Average show power per performance (kWh)} \times 0.266 \times \text{Number of Indoor/Venue Performances} \times \text{Conversion Factor} = \text{Emissions (kgCO}_2\text{e)}$$

Reminder: **Show power** emissions are estimates only, hence the assumptions made in this section.

## HOMEWORKING

Impact Name	Carbon Conversion Factor	Unit	Source	Notes
Home Office Equipment	0.03144	kgCO <sub>2</sub> e per FTE working hour	EcoAct (2020), DESNZ (2024)	Office Equipment includes home office workstation equipment (laptop/PC, monitor, phone and printer) and lighting for the office space. Homeworking Emissions Whitepaper 2020.

Home Heating	0.30234	kgCO2e per FTE working hour	EcoAct (2020), DESNZ (2024)	Homeworking Emissions Whitepaper 2020.
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Home Office Equipment and Home Heating emissions are calculated using the following formula:

$$\text{Amount (working hours)} \times \text{Conversion Factor} = \text{Emissions (kgCO2e)}$$

## WATER

Impact Name	Carbon Conversion Factor	Unit	Source	Notes
Water	0.15311	kgCO2e per m3	DESNZ (2024)	Water supply.
Wastewater	0.18574	kgCO2e per m3	DESNZ (2024)	Water treatment.

Water and Wastewater emissions are calculated using the following formula:

$$\text{Amount (m3)} \times \text{Conversion Factor} = \text{Emissions (kgCO2e)}$$

## OPERATIONAL MATERIALS & WASTE

Impact Name	Generation Carbon Conversion Factor	Unit	Source	Notes
General – Mixed materials	3,135	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Household and similar waste.
Comingled recyclates – Cans, plastics	4,643	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Composition: Steel cans (13.4%), Aluminium (16.0%), Plastic (65.6%), Mixed un-differentiated material (5%). <sup>1</sup>
Comingled recyclates – Cans, plastics, glass	3,067	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Composition: Steel cans (7.1%), Aluminium (8.4%), Plastic (34.7%), Glass (40.9%), Mixed un-differentiated material (8.9%). <sup>1</sup>
Comingled recyclates – Cans, plastics, paper, card	2,001	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Composition: Steel cans (3.6%), Aluminium (4.3%), Plastic (17.5%), Paper (33.9%), Card (27.9%), Mixed un-differentiated material (12.8%). <sup>1</sup>
Comingled recyclates – Cans, plastics, paper, card, glass	1,868	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Composition: Steel cans (2.8%), Aluminium (3.3%), Plastic (13.5%), Paper (26.2%), Card (21.6%), Glass (15.9%), Mixed un-differentiated material (16.7%). <sup>1</sup>
Food – Mixed food	5,736	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors	Animal and mixed food waste.

			for non-household waste	
<b>Food - Vegetables</b>	5,736	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Vegetal waste.
<b>Animal waste – Faeces (manure)</b>	0	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Animal faeces, urine and manure.
<b>Electrical &amp; electronic - Batteries</b>	12,107	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Batteries and accumulator wastes.
<b>Electrical &amp; electronic - Equipment</b>	1,754	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Discarded equipment excluding discarded vehicles, batteries and accumulator wastes.
<b>Construction materials - Rubble</b>	80	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Mineral waste from construction and demolition.
<b>Construction materials - Wood</b>	591	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Wood wastes.

Construction materials – Scrap metal	3,485	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Metallic wastes, mixed ferrous and non-ferrous.
Hazardous materials - Solvents	1,604	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Spent solvents.
Packaging & consumables - Glass	1,210	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Glass wastes.
Packaging & consumables – Mixed cans	3,485	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Metallic wastes, mixed ferrous and non-ferrous.
Packaging & consumables – Steel cans	2,922	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Metallic wastes, ferrous.
Packaging & consumables – Aluminium cans	12,946	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Metallic wastes, non-ferrous.
Packaging & consumables - Paper	882	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors	Paper and cardboard wastes.

			for non-household waste	
Packaging & consumables - Cardboard	882	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Paper and cardboard wastes.
Packaging & consumables - Plastic	3,185	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Plastic wastes.
Packaging & consumables - Textiles	20,444	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Textile wastes.

<sup>1</sup>Comingled recyclates composition estimated using the following sources: WRAP (2019), Enviro Consulting (2009) and Williams (2017).

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
General – Mixed materials	Incineration	388	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Household and similar waste.
General – Mixed materials	Landfill	309	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Household and similar waste.

General – Mixed materials	Mechanical biological treatment (MBT)	-89	kgCO <sub>2</sub> e per tonne	Gadaleta et al. (2022) Espinosa et al. (2021)	Household and similar waste. Gadaleta et al. (2022) used for MBT plant emissions – median selected, UK plant. Transport and transfer emission from Espinosa et al. (2021).
Comingled recyclates – Cans, plastics	Recycling	-2,480	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Composition: Steel cans (13.4%), Aluminium (16.0%), Plastic (65.6%), Mixed un-differentiated material (5%). <sup>1</sup>
Comingled recyclates – Cans, plastics, glass	Recycling	-1,617	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Composition: Steel cans (7.1%), Aluminium (8.4%), Plastic (34.7%), Glass (40.9%), Mixed un-differentiated material (8.9%). <sup>1</sup>
Comingled recyclates – Cans, plastics, paper, card	Recycling	-995	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Composition: Steel cans (3.6%), Aluminium (4.3%), Plastic (17.5%), Paper (33.9%), Card (27.9%), Mixed un-differentiated material (12.8%). <sup>1</sup>
Comingled recyclates – Cans, plastics, paper, card, glass	Recycling	-886	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Composition: Steel cans (2.8%), Aluminium (3.3%), Plastic (13.5%), Paper (26.2%), Card (21.6%), Glass (15.9%), Mixed un-differentiated material (16.7%). <sup>1</sup>
Food – Mixed food	Anaerobic Digestion	-78	kgCO <sub>2</sub> e per tonne	Harris and James (2021)	Animal and mixed food waste.

Food – Mixed food	Composting	-18	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Animal and mixed food waste.
Food - Vegetables	Anaerobic Digestion	-78	kgCO <sub>2</sub> e per tonne	Harris and James (2021)	Vegetal waste.
Food - Vegetables	Composting	-50	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Vegetal waste.
Animal waste – Faeces (manure)	Anaerobic Digestion	-78	kgCO <sub>2</sub> e per tonne	Harris and James (2021)	Animal faeces, urine and manure.
Animal waste – Faeces (manure)	Composting	-50	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Animal faeces, urine and manure.
Electrical & electronic - Batteries	Recycling	-1,436	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Batteries and accumulator wastes.
Electrical & electronic - Equipment	Recycling	-181	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Discarded equipment excluding discarded vehicles, batteries and accumulator wastes.
Construction materials - Rubble	Recycling	-76	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Mineral waste from construction and demolition.
Construction materials - Wood	Recycling	-337	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Wood wastes.

Construction materials - Wood	Incineration	-180	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Wood wastes.
Construction materials – Scrap metal	Recycling	-2,201	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Metallic wastes, mixed ferrous and non-ferrous.
Hazardous materials - Solvents	Incineration	1,521	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Spent solvents.
Hazardous materials - Solvents	Landfill	6,284	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Spent solvents.
Packaging & consumables - Glass	Recycling	-755	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Glass wastes.
Packaging & consumables – Mixed cans	Recycling	-2,201	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Metallic wastes, mixed ferrous and non-ferrous.
Packaging & consumables – Steel cans	Recycling	-1,771	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Metallic wastes, ferrous.
Packaging & consumables – Aluminium cans	Recycling	-9,964	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Metallic wastes, non-ferrous.
Packaging & consumables - Paper	Recycling	-547	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Paper and cardboard wastes.

Packaging & consumables - Cardboard	Recycling	-547	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Paper and cardboard wastes.
Packaging & consumables - Plastic	Recycling	-997	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Plastic wastes.
Packaging & consumables - Textiles	Recycling	-5,828	kgCO2e per tonne	Zero Waste Scotland (2022) – 2018 factors for non-household waste	Textile wastes.

<sup>1</sup>Comingled recyclates composition estimated using the following sources: WRAP (2019), Enviros Consulting (2009) and Williams (2017).

Unit Conversion Factor (Bulk Density & Container Size Combination)										
Name	Refuse bag	Dustbin	Skip (Mini) 2 Cubic yards	Skip (Midi)		Skip (Standard)				
				4 Cubic yards	6 Cubic yards	8 Cubic yards	10 Cubic yards	12 Cubic yards	14 Cubic yards	16 Cubic yards
General – Mixed materials	0.005	0.005	0.125	0.499	0.748	0.998	1.497	1.247	1.746	1.996
Comingled recyclates – Cans, plastics	0.002	0.002	0.046	0.092	0.138	0.184	0.275	0.229	0.321	0.367
Comingled recyclates – Cans, plastics, glass	0.003	0.004	0.103	0.205	0.308	0.410	0.615	0.513	0.718	0.820
Comingled recyclates – Cans, plastics, paper, card	0.007	0.007	0.141	0.281	0.422	0.562	0.844	0.703	0.984	1.125

<b>Comingled recyclates – Cans, plastics, paper, card, glass</b>	0.004	0.005	0.101	0.201	0.302	0.403	0.604	0.504	0.705	0.806
<b>Food – Mixed food</b>	0.019	0.021	0.420	0.840	1.260	1.680	2.520	2.100	2.940	3.360
<b>Food - Vegetables</b>	0.019	0.021	0.420	0.840	1.260	1.680	2.520	2.100	2.940	3.360
<b>Animal waste – Faeces (manure)</b>	0.081	0.091	1.543	3.086	4.630	6.173	9.259	7.716	10.803	12.346
<b>Electrical &amp; electronic - Batteries</b>	0.080	0.090	1.529	3.058	4.588	6.117	9.175	7.646	10.704	12.234
<b>Electrical &amp; electronic - Equipment</b>	0.021	0.023	0.397	0.795	1.192	1.589	2.384	1.987	2.782	3.179
<b>Construction materials - Rubble</b>	0.041	0.046	0.780	1.560	2.341	3.121	4.681	3.901	5.462	6.242
<b>Construction materials - Wood</b>	0.008	0.009	0.153	0.307	0.460	0.613	0.920	0.767	1.073	1.227
<b>Construction materials – Scrap metal</b>	0.011	0.012	0.204	0.408	0.612	0.817	1.225	1.021	1.429	1.633
<b>Hazardous materials - Solvents</b>	0.080	0.090	1.529	3.058	4.588	6.117	9.175	7.646	10.704	12.234
<b>Packaging &amp; consumables - Glass</b>	0.018	0.020	0.697	1.395	2.092	2.789	4.184	3.487	4.881	5.579
<b>Packaging &amp; consumables – Mixed cans</b>	0.003	0.004	0.096	0.193	0.289	0.385	0.578	0.482	0.674	0.771
<b>Packaging &amp; consumables – Steel cans</b>	0.005	0.006	0.096	0.193	0.289	0.385	0.578	0.482	0.674	0.771
<b>Packaging &amp; consumables – Aluminium cans</b>	0.002	0.002	0.042	0.083	0.125	0.167	0.250	0.209	0.292	0.334

Packaging & consumables - Paper	0.015	0.017	0.293	0.586	0.879	1.172	1.758	1.465	2.051	2.344
Packaging & consumables - Cardboard	0.005	0.006	0.096	0.192	0.289	0.385	0.577	0.481	0.673	0.769
Packaging & consumables - Plastic	0.002	0.002	0.038	0.076	0.115	0.153	0.229	0.191	0.268	0.306
Packaging & consumables - Textiles	0.007	0.008	0.136	0.272	0.408	0.544	0.817	0.680	0.953	1.089

Bulk density of manure is taken from Fabian (2019). All other waste bulk densities are sourced from USEPA (2016) and applied to each material and treatment profile for different container types.

Unit Conversion Factor (Bulk Density & Container Size Combination)											
Name	Rollonoff			Wheeled bin			Wheeled bin (4 wheels)				Paladin
	20 Cubic yards	30 Cubic yards	40 Cubic yards	120 litres	240 litres	360 litres	500 litres	660 litres	820 litres	1100 litres	
General – Mixed materials	2.495	3.742	4.990	0.007	0.014	0.020	0.041	0.054	0.067	0.090	0.125
Comingled recyclates – Cans, plastics	0.459	0.688	0.918	0.004	0.007	0.011	0.015	0.020	0.025	0.033	0.046
Comingled recyclates – Cans, plastics, glass	1.025	1.538	2.050	0.008	0.016	0.024	0.034	0.044	0.055	0.074	0.103
Comingled recyclates – Cans, plastics, paper, card	1.406	2.109	2.812	0.010	0.020	0.030	0.046	0.061	0.075	0.101	0.141

Comingled recyclates – Cans, plastics, paper, card, glass	1.007	1.511	2.014	0.007	0.013	0.020	0.033	0.043	0.054	0.072	0.101
Food – Mixed food	4.201	6.301	8.401	0.033	0.066	0.099	0.137	0.181	0.225	0.302	0.420
Food - Vegetables	4.201	6.301	8.401	0.033	0.066	0.099	0.137	0.181	0.225	0.302	0.420
Animal waste – Faeces (manure)	15.432	23.148	30.864	0.121	0.242	0.363	0.505	0.666	0.828	1.110	1.543
Electrical & electronic - Batteries	15.292	22.938	30.584	0.120	0.240	0.360	0.500	0.660	0.820	1.100	1.529
Electrical & electronic - Equipment	3.974	5.961	7.947	0.031	0.062	0.094	0.130	0.172	0.213	0.286	0.397
Construction materials - Rubble	7.802	11.703	15.604	0.061	0.122	0.184	0.255	0.337	0.418	0.561	0.780
Construction materials - Wood	1.533	2.300	3.066	0.012	0.024	0.036	0.050	0.066	0.082	0.110	0.153
Construction materials – Scrap metal	2.041	3.062	4.083	0.016	0.032	0.048	0.067	0.088	0.109	0.147	0.204
Hazardous materials - Solvents	15.292	22.938	30.584	0.120	0.240	0.360	0.500	0.660	0.820	1.100	1.529
Packaging & consumables - Glass	6.973	10.460	13.946	0.033	0.066	0.099	0.138	0.182	0.226	0.304	0.697
Packaging & consumables – Mixed cans	0.963	1.445	1.927	0.007	0.013	0.020	0.028	0.037	0.046	0.062	0.096
Packaging & consumables – Steel cans	0.963	1.445	1.927	0.008	0.015	0.023	0.032	0.042	0.052	0.069	0.096
Packaging & consumables – Aluminium cans	0.417	0.626	0.835	0.003	0.007	0.010	0.014	0.018	0.022	0.030	0.042

Packaging & consumables - Paper	2.930	4.396	5.861	0.023	0.046	0.069	0.096	0.126	0.157	0.211	0.293
Packaging & consumables - Cardboard	0.962	1.443	1.923	0.008	0.015	0.023	0.031	0.042	0.052	0.069	0.096
Packaging & consumables - Plastic	0.382	0.573	0.765	0.002	0.005	0.007	0.013	0.017	0.021	0.028	0.038
Packaging & consumables - Textiles	1.361	2.041	2.722	0.011	0.021	0.032	0.044	0.059	0.073	0.098	0.136

Bulk density of manure is taken from Fabian (2019). All other waste bulk densities are sourced from USEPA (2016) and applied to each material and treatment profile for different container types.

**Generation** emissions are calculated using the following formula:

$$( \text{Amount} \times \text{Unit Conversion Factor} ) \times \text{Generation Conversion Factor} = \text{Emissions (kgCO}_2\text{e)}$$

**Treatment** emissions are calculated using the following formula:

$$( \text{Amount} \times \text{Unit Conversion Factor} ) \times \text{Treatment Conversion Factor} = \text{Emissions (kgCO}_2\text{e)}$$

**Total Emissions** are calculated using the following formula:

$$\text{Generation Emissions} + \text{Treatment Emissions} = \text{Emissions (kgCO}_2\text{e)}$$

## PROJECT MATERIALS - GENERATION

### PLASTIC - GENERATION (Direct Use / Reuse)

Impact Name	Generation Carbon Conversion Factor	Unit	Source	Notes
Acrylic	3,185	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Adhesives	4,400	kgCO2e per tonne	One Click LCA	Polymer Emulsion Polyurethane (PEP). Selected because it was the broadest category for adhesives.
Average plastic	3,185	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Bubble wrap	1,870	kgCO2e per tonne	Hestin et al. (2015)	LDPE.
Plastic film (gels)	2,150	kgCO2e per tonne	Hestin et al. (2015)	PET.
Polycarbonate	4,800	kgCO2e per tonne	Hestin et al. (2015)	Other.
Polystyrene - expanded	3,300	kgCO2e per tonne	Hestin et al. (2015)	PS.
Polystyrene - general	3,300	kgCO2e per tonne	Hestin et al. (2015)	PS.
Polyurethane	2127	kgCO2e per tonne	Cook (2023)	see table*

Impact Name	Generation Carbon Conversion Factor	Unit	Source	Notes
Polyvinyl chloride	1,900	kgCO2e per tonne	Hestin et al. (2015)	PVC
Rigid plastic	3,185	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes
Tyres	5,300	kgCO2e per tonne	One Click LCA	The main material used in tyres is rubber, so we have selected Rubber, general. Factor used in absence of better data. Will be reviewed during next review.

\*Cook (2023) - <https://docs.google.com/spreadsheets/d/e/2PACX-1vRNZ4XnyjBh1OcAdVMkHxNhOoI46VH72aN0J598ZbkYuZAZJR3BkNRw6sSEHXTAQsj6QxFY6QuhHhv7/pubhtml#>

#### TIMBER - GENERATION (Direct Use / Reuse)

Impact Name	Generation Carbon Conversion Factor	Unit	Source	Notes
Hardboard	990	kgCO2e per tonne	One Click LCA	
Hardwood	390	kgCO2e per tonne	One Click LCA	
Laminate	290	kgCO2e per tonne	One Click LCA	
MDF	1,000	kgCO2e per tonne	One Click LCA	

Impact Name	Generation Carbon Conversion Factor	Unit	Source	Notes
OSB	440	kgCO2e per tonne	One Click LCA	
Particleboard / pressed wood	620	kgCO2e per tonne	One Click LCA	
Plywood	630	kgCO2e per tonne	One Click LCA	
Softwood	340	kgCO2e per tonne	One Click LCA	
Wood miscellaneous	591	kgCO2e per tonne	Zero Waste Scotland (2022)	Wood Waste.

#### METALS - GENERATION (Direct Use / Reuse)

Impact Name	Generation Carbon Conversion Factor	Unit	Source	Notes
Metallic wastes, ferrous	2,922	kgCO2e per tonne	Zero Waste Scotland (2022)	Incl. alloy steel, carbon steel, cast iron and wrought iron.
Metallic wastes, non-ferrous	12,946	kgCO2e per tonne	Zero Waste Scotland (2022)	Incl. Aluminium, copper, lead, nickel, tin, titanium, zinc, brass and bronze.
Metallic wastes, mixed ferrous & non-ferrous	3,485	kgCO2e per tonne	Zero Waste Scotland (2022)	Metallic wastes, mixed ferrous and non-ferrous.

### PAPER & CARD - GENERATION (Direct Use / Reuse)

Impact Name	Generation Carbon Conversion Factor	Unit	Source	Notes
Paper (A4 Office)	882	kgCO2e per tonne	Zero Waste Scotland (2022)	Paper & card wastes.
Cardboard	882	kgCO2e per tonne	Zero Waste Scotland (2022)	Paper & card wastes.

### TEXTILES - GENERATION (Direct Use / Reuse)

Impact Name	Generation Carbon Conversion Factor	Unit	Source	Notes
Mixed textiles	20,444	kgCO2e per tonne	Zero Waste Scotland (2022)	Textile wastes.
Polyester	2,050	kgCO2e per tonne	Hestin et al. (2015)	PET fibre.

### GLASS - GENERATION (Direct Use / Reuse)

Impact Name	Generation Carbon Conversion Factor	Unit	Source	Notes
Mixed glass	1,210	kgCO2e per tonne	Zero Waste Scotland (2022)	Glass wastes.

### OTHER BUILDING MATERIALS - GENERATION (Direct Use / Reuse)

Impact Name	Generation Carbon Conversion Factor	Unit	Source	Notes
Bricks	190	kgCO2e per tonne	One Click LCA	Common clay brick. NMD program :EN15804+A1, year 2019.
Ceramic	780	kgCO2e per tonne	One Click LCA	ICE/ year 2011.
Concrete	120	kgCO2e per tonne	One Click LCA	ICE/ year 2019.
Insulation (wool)	699	kgCO2e per tonne	Cook (2023)	see table*
Insulation (glass)	1094	kgCO2e per tonne	Cook (2023)	see table*
Plasterboard	2000	kgCO2e per tonne	Cook (2023)	see table*

\*Cook (2023) - <https://docs.google.com/spreadsheets/d/e/2PACX-1vRNZ4XnyjBh1OcAdVMkHxNhOoI46VH72aN0J598ZbkYuZAzjR3BkNRw6sSEHXTAQsj6QxFY6QuhHhv7/pubhtml#>

### PAINTS - GENERATION (Direct Use / Reuse)

Impact Name	Generation Carbon Conversion Factor	Unit	Source	Notes
Alkyd, oil	1,900	kgCO2e per tonne	One Click LCA	

Impact Name	Generation Carbon Conversion Factor	Unit	Source	Notes
Emulsion, vinyl	1,600	kgCO2e per tonne	One Click LCA	
Emulsion: acrylic	2,300	kgCO2e per tonne	One Click LCA	
Epoxy-based	6,100	kgCO2e per tonne	One Click LCA	
Latex paint	1,400	kgCO2e per tonne	One Click LCA	
Polyurethane	3,100	kgCO2e per tonne	One Click LCA	
Solvent:acrylic	1,400	kgCO2e per tonne	One Click LCA	

#### FLOORING - GENERATION (Direct Use / Reuse)

Impact Name	Generation Carbon Conversion Factor	Unit	Source	Notes
Carpet (PP, Nylon, PET & wool)	2,122	kgCO2e per tonne	Cook (2023)	see table*
Vinyl flooring	5,300	kgCO2e per tonne	One Click LCA	(resilient polyvinyl chloride flooring coverings).

\*Cook (2023) - <https://docs.google.com/spreadsheets/d/e/2PACX->

**FOOD - GENERATION (Direct Use / Reuse)**

Impact Name	Generation Carbon Conversion Factor	Unit	Source	Notes
Mixed food	5,736	kgCO2e per tonne	Zero Waste Scotland (2022)	Animal and mixed food waste.

**MISCELLANEOUS - GENERATION (Direct Use / Reuse)**

Impact Name	Generation Carbon Conversion Factor	Unit	Source	Notes
Batteries (non-automotive)	12,107	kgCO2e per tonne	Zero Waste Scotland (2022)	Batteries and accumulators wastes.
Electrical and electronic waste	1,754	kgCO2e per tonne	Zero Waste Scotland (2022)	Discarded equipment*

\*excluding discarded vehicles, batteries and accumulators wastes

## PROJECT WASTE - TREATMENTS

### PLASTIC - TREATMENTS

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Acrylic	Recycling	-997	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Acrylic	Landfill	4	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Acrylic	Incineration	1,824	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Adhesives	Landfill	4	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Adhesives	Incineration	1,824	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Average plastic	Recycling	-997	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Average plastic	Landfill	4	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Average plastic	Incineration	1,824	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Bubble wrap	Recycling	-972	kgCO2e per tonne	Turner et al. (2015)	LDPE.
Bubble wrap	Landfill	9	kgCO2e per tonne	Harris and James (2021)	Film.

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Bubble wrap	Incineration	1,475	kgCO2e per tonne	Harris and James (2021)	Film.
Plastic film (gels)	Recycling	-2,192	kgCO2e per tonne	Turner et al. (2015)	PET.
Plastic film (gels)	Landfill	9	kgCO2e per tonne	Harris and James (2021)	Film.
Plastic film (gels)	Incineration	1,579	kgCO2e per tonne	DEFRA (2022)	PET.
Polycarbonate	Recycling	-2,946	kgCO2e per tonne	Hestin et al. (2015)	Other.
Polycarbonate	Landfill	4	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Polycarbonate	Incineration	1,824	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Polystyrene - expanded	Recycling	-1,896	kgCO2e per tonne	Hestin et al. (2015)	PS.
Polystyrene - expanded	Landfill	4	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Polystyrene - expanded	Incineration	1,824	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Polystyrene - general	Recycling	-1,896	kgCO2e per tonne	Hestin et al. (2015)	PS.

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Polystyrene - general	Landfill	4	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Polystyrene - general	Incineration	1,824	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Polyurethane	Recycling	-2,946	kgCO2e per tonne	Hestin et al. (2015)	Other.
Polyurethane	Landfill	4	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Polyurethane	Incineration	1,824	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Polyvinyl chloride	Recycling	-1,549	kgCO2e per tonne	Turner et al. (2015)	PVC.
Polyvinyl chloride	Landfill	4	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Polyvinyl chloride	Incineration	1,824	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Rigid plastic	Recycling	-590	kgCO2e per tonne	Harris and James (2021)	Dense plastics.
Rigid plastic	Landfill	9	kgCO2e per tonne	Harris and James (2021)	Dense plastics.
Rigid plastic	Incineration	1,691	kgCO2e per tonne	Harris and James (2021)	Dense plastics.

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Tyres	Recycling	-636	kgCO2e per tonne	Turner et al. (2015)	Mixed tyres.
Tyres	Landfill	4	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Tyres	Incineration	1,824	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.

#### TIMBER - TREATMENTS

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Hardboard	Recycling	-444	kgCO2e per tonne	Turner et al. (2015)	Composite wood materials.
Hardboard	Landfill	828	kgCO2e per tonne	Harris and James (2021)	Wood.
Hardboard	Incineration	-268	kgCO2e per tonne	Harris and James (2021)	Wood.
Hardwood	Recycling	-444	kgCO2e per tonne	Turner et al. (2015)	Wood.
Hardwood	Landfill	828	kgCO2e per tonne	Harris and James (2021)	Wood.
Hardwood	Incineration	-268	kgCO2e per tonne	Harris and James (2021)	Wood.

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Laminate	Recycling	-444	kgCO2e per tonne	Turner et al. (2015)	Composite wood materials.
Laminate	Landfill	828	kgCO2e per tonne	Harris and James (2021)	Wood.
Laminate	Incineration	-268	kgCO2e per tonne	Harris and James (2021)	Wood.
MDF	Recycling	-444	kgCO2e per tonne	Turner et al. (2015)	Chipboard & MDF.
MDF	Landfill	828	kgCO2e per tonne	Harris and James (2021)	Wood.
MDF	Incineration	-268	kgCO2e per tonne	Harris and James (2021)	Wood.
OSB	Recycling	-444	kgCO2e per tonne	Turner et al. (2015)	Chipboard & MDF.
OSB	Landfill	828	kgCO2e per tonne	Harris and James (2021)	Wood.
OSB	Incineration	-268	kgCO2e per tonne	Harris and James (2021)	Wood.
Particleboard / pressed wood	Recycling	-444	kgCO2e per tonne	Turner et al. (2015)	Composite wood materials.
Particleboard / pressed wood	Landfill	828	kgCO2e per tonne	Harris and James (2021)	Wood.

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Particleboard / pressed wood	Incineration	-268	kgCO2e per tonne	Harris and James (2021)	Wood.
Plywood	Recycling	-444	kgCO2e per tonne	Turner et al. (2015)	Composite wood materials.
Plywood	Landfill	828	kgCO2e per tonne	Harris and James (2021)	Wood.
Plywood	Incineration	-268	kgCO2e per tonne	Harris and James (2021)	Wood.
Softwood	Recycling	-444	kgCO2e per tonne	Turner et al. (2015)	Wood.
Softwood	Landfill	828	kgCO2e per tonne	Harris and James (2021)	Wood.
Softwood	Incineration	-268	kgCO2e per tonne	Harris and James (2021)	Wood.
Wood miscellaneous	Recycling	-444	kgCO2e per tonne	Turner et al. (2015)	Wood.
Wood miscellaneous	Landfill	828	kgCO2e per tonne	Harris and James (2021)	Wood.
Wood miscellaneous	Incineration	-268	kgCO2e per tonne	Harris and James (2021)	Wood.

## METALS - TREATMENTS

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Metallic wastes, ferrous	Recycling	-1771	kgCO2e per tonne	Zero Waste Scotland (2022)	Incl. alloy steel, carbon steel, cast iron and wrought iron.
Metallic wastes, ferrous	Landfill	4	kgCO2e per tonne	Zero Waste Scotland (2022)	Incl. alloy steel, carbon steel, cast iron and wrought iron.
Metallic wastes, ferrous	Incineration	15	kgCO2e per tonne	Zero Waste Scotland (2022)	Incl. alloy steel, carbon steel, cast iron and wrought iron.
Metallic wastes, non-ferrous	Recycling	-9,964	kgCO2e per tonne	Zero Waste Scotland (2022)	Incl. Aluminium, copper, lead, nickel, tin, titanium, zinc, brass and bronze.
Metallic wastes, non-ferrous	Landfill	4	kgCO2e per tonne	Zero Waste Scotland (2022)	Incl. Aluminium, copper, lead, nickel, tin, titanium, zinc, brass and bronze.
Metallic wastes, non-ferrous	Incineration	47	kgCO2e per tonne	Zero Waste Scotland (2022)	Incl. Aluminium, copper, lead, nickel, tin, titanium, zinc, brass and bronze.
Metallic wastes, mixed ferrous & non-ferrous	Recycling	-2,201	kgCO2e per tonne	Zero Waste Scotland (2022)	Metallic wastes, mixed ferrous and non-ferrous.
Metallic wastes, mixed ferrous & non-ferrous	Landfill	4	kgCO2e per tonne	Zero Waste Scotland (2022)	Metallic wastes, mixed ferrous and non-ferrous.

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Metallic wastes, mixed ferrous & non-ferrous	Incineration	47	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022)	Metallic wastes, mixed ferrous and non-ferrous.

#### PAPER & CARD - TREATMENTS

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Paper (A4 Office)	Recycling	-459	kgCO <sub>2</sub> e per tonne	Turner et al. (2015)	Paper.
Paper (A4 Office)	Landfill	1,042	kgCO <sub>2</sub> e per tonne	DEFRA (2022)	Paper.
Paper (A4 Office)	Incineration	-214	kgCO <sub>2</sub> e per tonne	DEFRA (2022)	Paper.
Cardboard	Recycling	-120	kgCO <sub>2</sub> e per tonne	Turner et al. (2015)	Card.
Cardboard	Landfill	1,042	kgCO <sub>2</sub> e per tonne	DEFRA (2022)	Cardboard.
Cardboard	Incineration	-219	kgCO <sub>2</sub> e per tonne	DEFRA (2022)	Cardboard.

## TEXTILES - TREATMENTS

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Mixed textiles	Recycling	-3,376	kgCO2e per tonne	Turner et al. (2015)	Textiles only.
Mixed textiles	Landfill	445	kgCO2e per tonne	Harris and James (2021)	Textiles.
Mixed textiles	Incineration	438	kgCO2e per tonne	Harris and James (2021)	Textiles.
Polyester	Recycling	-654	kgCO2e per tonne	DEFRA (2022)	PET.
Polyester	Landfill	9	kgCO2e per tonne	DEFRA (2022)	PET.
Polyester	Incineration	1579	kgCO2e per tonne	DEFRA (2022)	PET.

## GLASS - TREATMENTS

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Mixed glass	Recycling	-314	kgCO2e per tonne	Turner et al. (2015)	Mixed glass
Mixed glass	Landfill	9	kgCO2e per tonne	DEFRA (2022)	Glass

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Mixed glass	Incineration	21	kgCO2e per tonne	DEFRA (2022)	Glass

#### OTHER BUILDING MATERIALS - TREATMENTS

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Bricks	Recycling	-76	kgCO2e per tonne	Zero Waste Scotland (2022)	Mineral waste from construction & demolition.
Bricks	Landfill	2	kgCO2e per tonne	Zero Waste Scotland (2022)	Mineral waste from construction & demolition.
Bricks	Incineration	47	kgCO2e per tonne	Zero Waste Scotland (2022)	Mineral waste from construction & demolition.
Ceramic	Recycling	-76	kgCO2e per tonne	Zero Waste Scotland (2022)	Mineral waste from construction & demolition.
Ceramic	Landfill	2	kgCO2e per tonne	Zero Waste Scotland (2022)	Mineral waste from construction & demolition.
Ceramic	Incineration	47	kgCO2e per tonne	Zero Waste Scotland (2022)	Mineral waste from construction & demolition.
Concrete	Recycling	-76	kgCO2e per tonne	Zero Waste Scotland (2022)	Mineral waste from construction & demolition.

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Concrete	Landfill	2	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022)	Mineral waste from construction & demolition.
Concrete	Incineration	47	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022)	Mineral waste from construction & demolition.
Insulation (wool)	Recycling	-314	kgCO <sub>2</sub> e per tonne	Turner et al. (2015)	Mixed glass.
Insulation (wool)	Landfill	9	kgCO <sub>2</sub> e per tonne	DEFRA (2022)	Glass.
Insulation (wool)	Incineration	21	kgCO <sub>2</sub> e per tonne	DEFRA (2022)	Glass.
Insulation (glass)	Recycling	-314	kgCO <sub>2</sub> e per tonne	Turner et al. (2015)	Mixed glass.
Insulation (glass)	Landfill	9	kgCO <sub>2</sub> e per tonne	DEFRA (2022)	Glass.
Insulation (glass)	Incineration	21	kgCO <sub>2</sub> e per tonne	DEFRA (2022)	Glass.
Plasterboard	Recycling	4	kgCO <sub>2</sub> e per tonne	Turner et al. (2015)	Plasterboard.
Plasterboard	Landfill	72 <sup>a</sup>	kgCO <sub>2</sub> e per tonne	Fisher (2008)	Plasterboard.
Plasterboard	Incineration	47	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022)	Mineral waste from construction & demolition.

<sup>a</sup>This assumed monocell storage as per regulations – this may not be applicable in countries outside Europe or the US.

## PAINTS - TREATMENTS

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Alkyd, oil	Recycling	4,039	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.
Alkyd, oil	Landfill	7	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.
Alkyd, oil	Incineration	388	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.
Emulsion, vinyl	Recycling	4,039	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.
Emulsion, vinyl	Landfill	7	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.
Emulsion, vinyl	Incineration	388	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.
Emulsion: acrylic	Recycling	4,039	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.
Emulsion: acrylic	Landfill	7	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.
Emulsion: acrylic	Incineration	388	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.
Epoxy-based	Recycling	4,039	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Epoxy-based	Landfill	7	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.
Epoxy-based	Incineration	388	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.
Latex paint	Recycling	4,039	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.
Latex paint	Landfill	7	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.
Latex paint	Incineration	388	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.
Polyurethane	Recycling	4,039	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.
Polyurethane	Landfill	7	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.
Polyurethane	Incineration	388	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.
Solvent:acrylic	Recycling	4,039	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.
Solvent:acrylic	Landfill	7	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.
Solvent:acrylic	Incineration	388	kgCO2e per tonne	Zero Waste Scotland (2022)	Chemical wastes.

NB: Paints (generally EWC Chapter 08) are listed under 'chemical wastes' according to the EUROSTAT Guidance on EWC-Stat Waste Categories.

## FLOORING - TREATMENTS

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Carpet (PP, Nylon, PET & wool)	Recycling	-10	kgCO2e per tonne	Turner et al. (2015)	Carpet.
Carpet (PP, Nylon, PET & wool)	Landfill	4	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Carpet (PP, Nylon, PET & wool)	Incineration	1,824	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Vinyl flooring	Recycling	-1,549	kgCO2e per tonne	Turner et al. (2015)	PVC.
Vinyl flooring	Landfill	4	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.
Vinyl flooring	Incineration	1,824	kgCO2e per tonne	Zero Waste Scotland (2022)	Plastic wastes.

## FOOD - TREATMENTS

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Mixed food	Composting	16	kgCO2e per tonne	DEFRA (2022)	Food
Mixed food	AD	-78	kgCO2e per tonne	DEFRA (2022)	Food

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Mixed food	Landfill	627	kgCO <sub>2</sub> e per tonne	DEFRA (2022)	Food
Mixed food	Incineration	-37	kgCO <sub>2</sub> e per tonne	DEFRA (2022)	Food

#### MISCELLANEOUS - TREATMENTS

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Batteries (non-automotive)	Recycling	-1,436	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022)	Batteries and accumulators wastes
Batteries (non-automotive)	Landfill	-205	kgCO <sub>2</sub> e per tonne	Turner et al. (2015)	Post-consumer, non-automotive batteries
Batteries (non-automotive)	Incineration	402	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022)	Batteries and accumulators wastes
Electrical and electronic waste	Recycling	-181	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022)	Discarded equipment (excluding discarded vehicles, batteries and accumulators wastes)
Electrical and electronic waste	Landfill	4	kgCO <sub>2</sub> e per tonne	Zero Waste Scotland (2022)	Discarded equipment (excluding discarded vehicles, batteries and accumulators wastes)

Impact Name	Treatment type	Treatment Carbon Conversion Factor	Unit	Source	Notes
Electrical and electronic waste	Incineration	47	kgCO2e per tonne	Zero Waste Scotland (2022)	Discarded equipment (excluding discarded vehicles, batteries and accumulators wastes)

**Generation** emissions are calculated using the following formula:

$$\text{Amount} \times \text{Generation Conversion Factor} = \text{Emissions (kgCO2e)}$$

**Treatment** emissions are calculated using the following formula:

$$\text{Amount} \times \text{Treatment Conversion Factor} = \text{Emissions (kgCO2e)}$$

**Total Emissions** are calculated using the following formula:

$$\text{Generation Emissions} + \text{Treatment Emissions} = \text{Emissions (kgCO2e)}$$

Please note:

- If **Direct Use** or **Reuse** treatments are selected, the Total Emissions will be Generation Emissions only.
- If **New** is selected as the "Source", Generation emissions are included in the Total Emissions. If **Reused** is selected as the "Source", the Total Emissions will be Treatment Emissions only

## TRAVEL

### LAND TRAVEL

Impact Name	Measured by	Carbon Conversion Factor	Unit	Source	Notes
Bus (Average local bus)	Distance travelled	0.10846	kgCO2e per passenger km	DESNZ (2024)	Bus > Average local bus.
Bus (Coach) - Vehicle	Distance travelled	0.47711	kgCO2e per vehicle km	DESNZ (2024)	Bus > Coach factor multiplied by average passenger occupancy stated in DESNZ methodology paper (17.56 passengers).
Bus (Coach) - Passenger	Distance travelled	0.02717	kgCO2e per passenger km	DESNZ (2024)	Bus > Coach.
Bus (London bus)	Distance travelled	0.07447	kgCO2e per passenger km	DESNZ (2024)	Bus > Local London bus. London bus factor to takes account of vehicle being more full than national local average.
Bus (Single decker tour bus (diesel))	See calculation explanation below Land Tavel section.				
Bus (Double decker tour bus (diesel))	See calculation explanation below Land Tavel section.				
Bus (Public)	Distance travelled	0.10846	kgCO2e per passenger km	DESNZ (2024)	Bus > Average local bus.

Car (Diesel)	Distance travelled	0.16984	kgCO <sub>2</sub> e per vehicle km	DESNZ (2024)	Average car > Petrol.
Car (Diesel)	Total fuel used	3.28564	kgCO <sub>2</sub> e per litre	DESNZ (2024)	100% mineral diesel.
Car (Electric)	Distance travelled	0.04745	kgCO <sub>2</sub> e per vehicle km	DESNZ (2024)	Average car > Battery Electric Vehicle.
Car (Electric)	Total electricity used	0.22535	kgCO <sub>2</sub> e per kWh	DESNZ (2024)	Conversion factor inclusive of transmission and distribution (T&D) losses.
Car (Hybrid)	Distance travelled	0.12607	kgCO <sub>2</sub> e per vehicle km	DESNZ (2024)	Average car > Hybrid.
Car (LPG)	Distance travelled	0.19718	kgCO <sub>2</sub> e per vehicle km	DESNZ (2024)	Average car > LPG.
Car (LPG)	Total fuel used	1.55713	kgCO <sub>2</sub> e per litre	DESNZ (2024)	(Liquefied Petroleum Gas).
Car (Petrol)	Distance travelled	0.1645	kgCO <sub>2</sub> e per vehicle km	DESNZ (2024)	Average car > Petrol.
Car (Petrol)	Total fuel used	2.96036	kgCO <sub>2</sub> e per litre	DESNZ (2024)	100% mineral petrol.
Minibus (Biodiesel)	Total fuel used	0.55447	kgCO <sub>2</sub> e per litre	DESNZ (2024)	Biodiesel ME (Methyl Ester) (from used cooking oil).
Minibus (Diesel)	Distance travelled	0.25023	kgCO <sub>2</sub> e per vehicle km	DESNZ (2024)	Managed vans > Average (up to 3.5 tonnes) > Diesel.
Minibus (Diesel)	Total fuel used	3.28564	kgCO <sub>2</sub> e per litre	DESNZ (2024)	100% mineral diesel.
Minibus (LPG)	Distance travelled	0.27617	kgCO <sub>2</sub> e per vehicle km	DESNZ (2024)	Managed vans > Average (up to 3.5 tonnes) > LPG.

Minibus (LPG)	Total fuel used	1.55713	kgCO <sub>2</sub> e per litre	DESNZ (2024)	(Liquefied Petroleum Gas).
Minibus (Petrol)	Distance travelled	0.22095	kgCO <sub>2</sub> e per vehicle km	DESNZ (2024)	Managed vans > Average (up to 3.5 tonnes) > Petrol.
Minibus (Petrol)	Total fuel used	2.96036	kgCO <sub>2</sub> e per litre	DESNZ (2024)	100% mineral petrol.
Motorbike (Petrol)	Distance travelled	0.11367	kgCO <sub>2</sub> e per vehicle km	DESNZ (2024)	Motorbike > Average.
Motorbike (Petrol)	Total fuel used	2.96036	kgCO <sub>2</sub> e per litre	DESNZ (2024)	100% mineral petrol.
People Carrier (Biodiesel)	Total fuel used	0.55447	kgCO <sub>2</sub> e per litre	DESNZ (2024)	Biodiesel ME (Methyl Ester) (from used cooking oil).
People Carrier (Diesel)	Distance travelled	0.17751	kgCO <sub>2</sub> e per vehicle km	DESNZ (2024)	Cars (by market segment) > MPV > Diesel.
People Carrier (Diesel)	Total fuel used	3.28564	kgCO <sub>2</sub> e per litre	DESNZ (2024)	100% mineral diesel.
People Carrier (Petrol)	Distance travelled	0.18287	kgCO <sub>2</sub> e per vehicle km	DESNZ (2024)	Cars (by market segment) > MPV > Petrol.
People Carrier (Petrol)	Total fuel used	2.96036	kgCO <sub>2</sub> e per litre	DESNZ (2024)	100% mineral petrol.
Public coach or long-distance bus	Distance travelled	0.02717	kgCO <sub>2</sub> e per passenger km	DESNZ (2024)	Bus > Coach.
Public local bus	Distance travelled	0.10846	kgCO <sub>2</sub> e per passenger km	DESNZ (2024)	Bus > Average local bus.
Taxi (Black cab)	Distance travelled	0.30603	kgCO <sub>2</sub> e per vehicle km	DESNZ (2024)	Taxis > Black cab.

Taxi (Regular taxi)	Distance travelled	0.20805	kgCO <sub>2</sub> e per vehicle km	DESNZ (2024)	Taxis > Regular taxi.
Train (National)	Distance travelled	0.03546	kgCO <sub>2</sub> e per passenger km	DESNZ (2024)	Rail > National rail.
Train (International)	Distance travelled	0.00446	kgCO <sub>2</sub> e per passenger km	DESNZ (2024)	Rail > International rail.
Tram	Distance travelled	0.0286	kgCO <sub>2</sub> e per passenger km	DESNZ (2024)	Rail > Light rail and tram.
Tube	Distance travelled	0.0278	kgCO <sub>2</sub> e per passenger km	DESNZ (2024)	Rail > London Underground.
Van (Large diesel van)	Distance travelled	0.48733	kgCO <sub>2</sub> e per vehicle km	DESNZ (2024)	Managed HGV (all diesel) > Rigid (>3.5t - 7.5t) > Average laden
Van (Large diesel van)	Total fuel used	3.28564	kgCO <sub>2</sub> e per litre	DESNZ (2024)	100% mineral diesel.
Van (Small diesel van)	Distance travelled	0.25023	kgCO <sub>2</sub> e per vehicle km	DESNZ (2024)	Managed vans > Average (up to 3.5 tonnes) > Diesel.
Van (Small diesel van)	Total fuel used	3.28564	kgCO <sub>2</sub> e per litre	DESNZ (2024)	100% mineral diesel.
Van (Small electric van)	Distance travelled	0.07922	kgCO <sub>2</sub> e per vehicle km	DESNZ (2024)	Managed vans > Average (up to 3.5 tonnes) > Battery Electric
Van (Small electric van)	Total electricity used	0.22535	kgCO <sub>2</sub> e per kWh	DESNZ (2024)	Conversion factor inclusive of transmission and distribution (T&D) losses.
Van (Small LPG van)	Distance travelled	0.27617	kgCO <sub>2</sub> e per vehicle km	DESNZ (2024)	Managed vans > Average (up to 3.5 tonnes) > LPG.
Van (Small LPG van)	Total fuel used	1.55713	kgCO <sub>2</sub> e per litre	DESNZ (2024)	(Liquefied Petroleum Gas).

Van (Small petrol van)	Distance travelled	0.22095	kgCO <sub>2</sub> e per vehicle km	DESNZ (2024)	Managed vans > Average (up to 3.5 tonnes) > Petrol.
Van (Small petrol van)	Total fuel used	2.96036	kgCO <sub>2</sub> e per litre	DESNZ (2024)	100% mineral petrol.

When the user enters **Distance travelled (vehicle-kilometre context)** data, then the travel emissions are calculated using the following formula:

$$\text{Amount (km)} \times \text{Conversion Factor} = \text{Emissions (kgCO}_2\text{e)}$$

When the user enters **Distance travelled (passenger-kilometre context)** data, then the travel emissions are calculated using the following formula:

$$\text{Amount (km)} \times \text{No. of People} \times \text{Conversion Factor} = \text{Emissions (kgCO}_2\text{e)}$$

When the user enters **Total fuel used** data, then the travel emissions are calculated using the following formula:

$$\text{Amount (litres)} \times \text{Conversion Factor} = \text{Emissions (kgCO}_2\text{e)}$$

When the user enters **Total electricity used** data, then the travel emissions are calculated using the following formula:

$$\text{Amount (kWh)} \times \text{Conversion Factor} = \text{Emissions (kgCO}_2\text{e)}$$

For **Single decker tour bus** and **Double decker tour bus**, it is assumed that the vehicle runs on diesel fuel and that the user has data available in a vehicle-kilometre context rather than the passenger-kilometre. The tour bus travel emissions using **Distance travelled** are calculated using the following formula:

$$\text{Amount (km)} \times \text{Unit Conversion} \times \text{Diesel Conversion Factor} = \text{Emissions (kgCO}_2\text{e)}$$

Name	Unit Conversion	Unit	Source
Single decker tour bus (diesel)	0.282482	litres per km	Private correspondence - music tour bus operator
Double decker tour bus (diesel)	0.353102	litres per km	Private correspondence - music tour bus operator

For the tour bus emissions using **Total fuel used**, please use the formula listed above for regular Land Travel. The Diesel Conversion Factor can be found in the [Energy & Fuels](#) section.

## SEA TRAVEL

Impact Name	Measured by	Carbon Conversion Factor	Unit	Source	Notes
Ferry	Distance travelled	0.1127	kgCO <sub>2</sub> e per passenger km	DESNZ (2024)	Ferry > Average (all passengers).

When the user enters **Distance travelled (passenger-kilometre context)** data, then the travel emissions are calculated using the following formula:

$$\text{Distance travelled (km)} \times \text{No. of people} \times \text{Conversion Factor} = \text{Emissions (kgCO}_2\text{e)}$$

## AIR TRAVEL

Impact Name	Measured by	Carbon Conversion Factor	Unit	Source	Notes
Domestic flight	Distance travelled	0.27257	kgCO <sub>2</sub> e per passenger km	DESNZ (2024)	Flights > Domestic, to/from UK > Average passenger > With RF (radiative forcing).
Shorthaul flight (Average)	Distance travelled	0.18592	kgCO <sub>2</sub> e per passenger km	DESNZ (2024)	Flights > Short-haul, to/from UK > Average passenger > With RF (radiative forcing).
Shorthaul flight (Economy)	Distance travelled	0.18287	kgCO <sub>2</sub> e per passenger km	DESNZ (2024)	Flights > Short-haul, to/from UK > Economy class > With RF (radiative forcing).
Shorthaul flight (Business)	Distance travelled	0.2743	kgCO <sub>2</sub> e per passenger km	DESNZ (2024)	Flights > Short-haul, to/from UK > Business class > With RF (radiative forcing).
Longhaul flight (Average)	Distance travelled	0.26128	kgCO <sub>2</sub> e per passenger km	DESNZ (2024)	Flights > Long-haul, to/from UK > Average passenger > With RF (radiative forcing).
Longhaul flight (Economy)	Distance travelled	0.20011	kgCO <sub>2</sub> e per passenger km	DESNZ (2024)	Flights > Long-haul, to/from UK > Economy class > With RF (radiative forcing).
Longhaul flight (Economy Plus)	Distance travelled	0.32015	kgCO <sub>2</sub> e per passenger km	DESNZ (2024)	Flights > Long-haul, to/from UK > Premium economy

					class > With RF (radiative forcing).
Longhaul flight (Business)	Distance travelled	0.58028	kgCO2e per passenger km	DESNZ (2024)	Flights > Long-haul, to/from UK > Business class > With RF (radiative forcing).
Longhaul flight (First Class)	Distance travelled	0.8004	kgCO2e per passenger km	DESNZ (2024)	Flights > Long-haul, to/from UK > First class > With RF (radiative forcing).
Chartered flight (Small jet)	Distance travelled	2.85	kgCO2e per passenger km	Personal correspondence , Dr. Graham Sinden, Carbon Trust	
Chartered flight (Large jet)	Distance travelled	7.03	kgCO2e per passenger km	Personal correspondence , Dr. Graham Sinden, Carbon Trust	

Name	Average Distance	Unit	Source	Notes
Domestic flight	463	km	Defra and DECC (2012)	Average one-way distance for domestic flight under 1.5 hours. Assumed within the UK.
Shorthaul flight	1108	km	Defra and DECC (2012)	Average one-way distance for shorthaul flight between 1.5 and 5 hours. Assumed from the UK to a European county (or vice versa).
Longhaul flight	6482	km	Defra and DECC (2012)	Average one-way distance for longhaul flight over 5 hours. Assumed from the UK to a non-European county (or vice versa).

For **Domestic, Shorthaul** and **Longhaul flights**, when the user enters **Distance travelled** data, then the travel emissions are calculated using the following formula:

$$\text{Distance (km)} \times \text{No. of passengers} \times \text{Conversion Factor} = \text{Emissions (kgCO}_2\text{e)}$$

For **Domestic, Shorthaul and Longhaul flights**, when the user enters **No. of journeys** data, then the travel emissions are calculated using the following formula:

$$(\text{No. of Journeys} \times \text{Average Distance (km)} \times 2) \times \text{No. of passengers} \times \text{Conversion Factor} = \text{Emissions (kgCO}_2\text{e)}$$

Note: A journey is defined as a return trip which is why the Average Distance is multiplied by 2.

For **Chartered flights**, the travel emissions are calculated using the following formula:

$$\text{Distance travelled (km)} \times \text{No. of passengers} \times \text{Conversion Factor} = \text{Emissions (kgCO}_2\text{e)}$$

## ACCOMMODATION

Impact Name	Carbon Conversion Factor	Unit	Source	Notes
Accommodation	10.4	kgCO <sub>2</sub> e per room per night	DESNZ (2024)	Hotel stay > UK.

Accommodation emissions are calculated using the following formula:

$$\text{No. of nights per room} \times \text{Conversion Factor} = \text{Emissions (kgCO}_2\text{e)}$$

## AUDIENCE TRAVEL

Audience Travel emissions are estimated using the **Total known attendance** at the venue/event, the **percentage** of the audience using a particular travel mode and the **Average return distance** using this mode of travel.

For **Walking** and **Cycling**, the emissions are assumed to be 0 kgCO<sub>2</sub>e.

For **Public transport bus urban, Public transport bus local, Train, Taxi travel** and **Tube**, the travel emissions are calculated using the following formula:

$$\begin{aligned} & ( \text{Total known attendance} \times \text{Travel mode \%} ) \times \text{Average return distance (km)} \times \text{Conversion Factor} \\ & = \text{Emissions (kgCO}_2\text{e)} \end{aligned}$$

For **Dedicated coaches**, it is assumed that the average occupancy of a coach chartered to deliver people directly to the venue is 50 passengers. For this calculation, the coach conversion factor used is the “Bus (Coach) – Vehicle” factor. The travel emissions are calculated using the following formula:

$$\begin{aligned} & ( ( \text{Total known attendance} \times \text{Travel mode \%} ) / 50 ) \times \text{Average return distance (km)} \times \text{Conversion Factor} \\ & = \text{Emissions (kgCO}_2\text{e)} \end{aligned}$$

For **Car travel**, users are also required to enter the **Average car occupancy** recorded by their audience. If this field is left blank, the default car occupancy for Outdoor Events is assumed to be 2.6 passengers and 2 passengers for all other footprint types. The travel emissions are calculated using the following formula:

$$\begin{aligned} & ( ( \text{Total known attendance} \times \text{Travel mode \%} ) / \text{Average car occupancy} ) \times \text{Average return distance (km)} \times \text{Conversion} \\ & \text{Factor} = \text{Emissions (kgCO}_2\text{e)} \end{aligned}$$

For **Domestic, Shorthaul** and **Longhaul flights**, the average journey distances in the table Air Travel table above are used. The travel emissions are calculated using the following formula:

$$(( \text{Total known attendance} \times \text{Travel mode \%} ) \times ( \text{Average Distance (km)} \times 2 ) \times \text{Conversion Factor} = \text{Emissions (kgCO2e)})$$

## **FREIGHT**

Impact Name	Carbon Conversion Factor	Unit	Source	Notes
Trucking (Average HGV)	0.09752	kgCO2e per tonne km	DESNZ (2024)	HGV (all diesel) > All HGVs > Average laden.
Trucking (Medium diesel rigid)	0.38023	kgCO2e per tonne km	DESNZ (2024)	HGV (all diesel) > Rigid (>7.5 tonnes - 17 tonnes) > Average laden.
Trucking (Heavy diesel rigid)	0.15398	kgCO2e per tonne km	DESNZ (2024)	HGV (all diesel) > Rigid (>17 tonnes) > Average laden.
Trucking (Light diesel rigid)	0.50546	kgCO2e per tonne km	DESNZ (2024)	HGV (all diesel) > Rigid (>3.5 - 7.5 tonnes) > Average laden
Trucking (Light diesel articulated)	0.11311	kgCO2e per tonne km	DESNZ (2024)	HGV (all diesel) > Articulated (>3.5 - 33t) > Average laden.
Trucking (Heavy diesel articulated)	0.07447	kgCO2e per tonne km	DESNZ (2024)	HGV (all diesel) > Articulated (>33t) > Average laden.
Van (Small electric van)	0.25438	kgCO2e per tonne km	DESNZ (2024)	Vans > Average (up to 3.5 tonnes) > Battery Electric Vehicle.
Van (Small LPG van)	0.68376	kgCO2e per tonne km	DESNZ (2024)	Vans > Average (up to 3.5 tonnes) > LPG.
Van (Small petrol van)	0.81972	kgCO2e per tonne km	DESNZ (2024)	Vans > Average (up to 3.5 tonnes) > Petrol.
Van (Large diesel van)	0.50546	kgCO2e per tonne km	DESNZ (2024)	HGV (all diesel) > Rigid (>3.5 - 7.5) > Average laden.

Van (Small diesel van)	0.61643	kgCO2e per tonne km	DESNZ (2024)	Vans > Average (up to 3.5 tonnes) > Diesel.
Air (Domestic)	4.6734	kgCO2e per tonne km	DESNZ (2024)	Freight flights > Domestic, to/from UK > With RF (radiative forcing).
Air (Shorthaul)	1.66816	kgCO2e per tonne km	DESNZ (2024)	Freight flights > Short-haul, to/from UK > With RF (radiative forcing).
Air (Longhaul)	1.09904	kgCO2e per tonne km	DESNZ (2024)	Freight flights > Long-haul, to/from UK > With RF (radiative forcing).
Sea (Container freight)	0.01612	kgCO2e per tonne km	DESNZ (2024)	Cargo ship > Container ship > Average.
Sea (Large RoPax Ferry)	0.37612	kgCO2e per tonne km	DESNZ (2024)	Cargo ship > Large RoPax ferry > Average.
Rail	0.02779	kgCO2e per tonne km	DESNZ (2024)	Rail > Freight train.

Freight emissions are calculated using the following formula:

$$\text{Distance travelled (km)} \times \text{Weight transported (tonnes)} \times \text{Conversion Factor} = \text{Emissions (kgCO2e)}$$

## INTERNATIONAL ELECTRICITY

Any countries not listed in the table below will use the United Kingdom Electricity carbon emissions factor which can be found under the [Energy & Fuels section](#).

Country Name	Carbon Conversion Factor	Unit	Source	Notes
<b>Argentina</b>	0.45120	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Australia</b>	0.70000	kgCO <sub>2</sub> e per kWh	Department of Climate Change, Energy, the Environment and Water (DCCEEW), Australian Government (2024)	Total Production fuel mix factor inc. Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2023)
<b>Austria</b>	0.12425	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Belgium</b>	0.13161	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)

<b>Brazil</b>	0.08887	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Bulgaria</b>	0.52241	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Canada</b>	0.10000	kgCO <sub>2</sub> e per kWh	Environment and Climate Change Canada, Government of Canada (2024)	Generation only (Transmission & Distribution marked as 0, Negligible). (Base data year: 2022)
<b>Chile</b>	0.43361	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>China</b>	0.70716	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Colombia</b>	0.21217	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission &

				Distribution (Scope 3). (Base data year: 2022)
<b>Croatia</b>	0.26992	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Cuba</b>	0.80750	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Cyprus</b>	0.66225	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Czech Republic</b>	0.53993	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Denmark</b>	0.14927	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)

<b>Egypt</b>	0.53448	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Estonia</b>	0.59742	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Finland</b>	0.09845	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>France</b>	0.07669	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Germany</b>	0.39770	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Greece</b>	0.34827	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate

				electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Hong Kong</b>	0.78441	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Hungary</b>	0.25862	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Iceland</b>	0.00000	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>India</b>	1.14049	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Indonesia</b>	0.77909	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission &

				Distribution (Scope 3). (Base data year: 2022)
<b>Ireland</b>	0.34042	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Israel</b>	0.58395	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Italy</b>	0.33656	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Jamaica</b>	0.58391	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Japan</b>	0.48025	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)

<b>Latvia</b>	0.13964	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Lithuania</b>	0.18051	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Luxembourg</b>	0.08877	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Malaysia</b>	0.65715	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Malta</b>	0.52213	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Mexico</b>	0.48378	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate

				electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Netherlands</b>	0.32204	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>New Zealand</b>	0.08612	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Norway</b>	0.00931	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Pakistan</b>	0.52452	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Peru</b>	0.24068	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission &

				Distribution (Scope 3). (Base data year: 2022)
<b>Philippines</b>	0.77883	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Poland</b>	0.77076	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Portugal</b>	0.18332	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Romania</b>	0.32455	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Russia</b>	0.53095	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)

<b>Saudi Arabia</b>	0.65633	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Singapore</b>	0.51104	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Slovakia</b>	0.17524	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Slovenia</b>	0.27038	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>South Africa</b>	0.86118	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>South Korea</b>	0.50506	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate

				electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Spain</b>	0.20046	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Sweden</b>	0.01649	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Switzerland</b>	0.02553	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Thailand</b>	0.55895	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Trinidad &amp; Tobago</b>	0.57952	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission &

				Distribution (Scope 3). (Base data year: 2022)
<b>Turkey</b>	0.5022	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>Ukraine</b>	0.29131	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)
<b>United States</b>	0.39553	kgCO <sub>2</sub> e per kWh	USEPA (2024)	Total Production fuel mix factor. Generation (Scope 2) and Transmission & Distribution (Scope 3) derived using Grid Gross Loss (%) from EPA eGrid Summary Tables. – US Average. (Base data year: 2022)
<b>Venezuela</b>	0.15742	kgCO <sub>2</sub> e per kWh	Carbon Footprint Ltd (2024)	Calculated from fuel mix used to generate electricity in the country. Includes Generation (Scope 2) and Transmission & Distribution (Scope 3). (Base data year: 2022)

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