

Methodology paper – BAFTA albert carbon calculator

November 2023

www.wearealbert.org

Introduction	4
Key updates in this version (Nov 2023)	4
Emission factors	5
Which gases do BAFTA albert report on?	5
Reporting Scopes.....	6
Air Travel	6
Certified Renewable Energy	6
Data Accuracy	7
How the emissions are calculated.....	7
Currency and exchange rates	7
Energy Usage	8
Filming spaces	8
Electricity, gas and heat & steam.....	8
Fuels	8
Non-Mains Energy.....	9
Non-filming spaces	9
Benchmarks	9
Filming Spaces	11
Benchmarks:.....	11
Volume/LED:.....	11
Postproduction	12
Travel and Accommodation	12
Air travel.....	12
Road travel.....	13
Taxi Travel.....	14
Rail Travel	15
Boat Travel	15
Couriers and Excess Baggage	15
Freight	16
Accommodation	16
Materials and Disposal	17
Paint.....	17
Paper.....	17
Cardboard.....	18
Timber.....	18

Textiles	18
Food.....	18
Plastics.....	19
Metals.....	19
Batteries	19
· Alkaline	20
· Lithium ion (Li-ion)	20
· Nickle Metal hydride (NiMh).....	20
Glass	20
Disposal	20
Appendix	23
Global Emission Factors Source list	23
Studios – benchmark	25
Standard Unit Conversion	25
Materials	28
Disposal.....	28
Post Production	29
References	29
Emission Factors.....	29
Currency and Exchange rates.....	29
Filming and non-filming space.....	29
Energy and Fuels	30
Travel and Transport	30
Accommodation	32
Materials	32
Disposal.....	33
Bibliography	33

Introduction

BAFTA albert is the screen industry authority on environmental sustainability. Founded in 2011, the organisation supports the industry in reducing its environmental impact as well as developing on-screen content that is compatible with a sustainable climate.

At the heart of BAFTA albert's offer to the industry lies its bespoke carbon calculator which has been designed expressly for the production community to understand the carbon footprint of making a film or TV show, and where their emissions are coming from.

This paper details the methodology behind the latest updates to the BAFTA albert calculator. This is the fifth iteration of the BAFTA albert calculator, released in November 2023.

The recent updates have been the most comprehensive to date making the BAFTA albert calculator the most specific and accurate carbon calculator tool available to the screen production industry.

The BAFTA albert calculator is available for use across the globe and as such contains emission factors from a variety of sources. For example; any measurement in the UK will be calculated using the Department for Environment, Food and Rural Affairs (DEFRA) data, for other countries the calculator uses the most reliable and accurate sources available. The calculator has a database of 309 electricity emission factors (Appendix, table 1) for different countries and states, which filter into the energy-specific benchmarks.

The emission factors, benchmarks and activities recorded will be subject to an annual audit and review internally in consultation with the BAFTA albert Directorate and Consortium, as well as third parties where appropriate. This is to ensure that the calculator continues to follow the most accurate and up to date global guidelines on emissions reporting and can continue to serve the screen industry.

Key updates in this version (Nov 2023)

Table of Changes

Restructure of the Calculator Sections:

This iteration has reduced the calculator forms from seven sections to three to improve user experience, speed of data entry, data accuracy, and an improved report output. These sections are now energy, transport & accommodation, and materials & disposal. The previous version of the calculator's seven sections was categorised as non-filming spaces, filming spaces, travel and transport, accommodation, materials, disposal and post-production. This change is designed to make the calculator easier to use without affecting the detailed data we receive when processing a certification.

Benchmark Updates

This iteration has been updated with the most recent emissions factors from 2023. We have also included new benchmarks, specifically:

- New benchmark figures for Volume LED (previously called Virtual Production)

<ul style="list-style-type: none"> Amended benchmarks for studio spaces to distinguish between electricity, gas, heat and steam (as opposed to a combination).
<p>Better Resources</p> <p>We have improved the guidance for users, including more details in help text in the toolkit, and better integration with the Tips & Tricks pages. Clicking on Tips & Tricks will now take you to the evolving Production Resources page on the BAFTA albert website.</p>
<p>Simplification of options</p> <p>To reduce the confusion surrounding the extensive list of fuels, the fuels list for this iteration of the calculator has been simplified and reduced. Biodiesel and HVO have been grouped to reflect their growing prominence within the industry, and the least frequently used fuels have been grouped into an “Other” section.</p>
<p>Energy Types</p> <p>The new iteration of the toolkit will have increased usability when inputting production office energy. Previously, a production would have to input each energy type (electricity, gas, heat and steam, water) separately, but a new functionality has been added, whereby toggle buttons can be used so that all your energy is included in one singular production office entry.</p>

Emission factors

The emission factors used for the United Kingdom have been provided by DEFRA. The current iteration of the calculator uses DEFRA factors published on 7 June 2023. Updated factors are published annually in July, the calculator will therefore be updated accordingly.

For international countries, BAFTA albert collaborated with the sustainability consultants at Building Research Solutions Ltd, who provided electricity emission factors for countries outside the UK - (Appendix, table 1). The sources for these factors are listed in the Appendix, table 1 on page 25.

For any unit conversions of activity data (km to miles, litres to US gallons, etc.) standard unit conversions have been used. Details can be found in the appendix (tables 2:5).

Which gases do BAFTA albert report on?

Emission outputs from the calculator will be given in the unit tonnes of carbon dioxide equivalent (tCO_{2e}). This is a universal unit of measurement to indicate the global warming potential (GWP) of greenhouse gases (GHGs). Using a single unit of measure expressed in tCO_{2e} allows for the incorporation of all emissions associated with the seven main GHGs that contribute to climate change covered by the Kyoto Protocol: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF₆) and nitrogen trifluoride (NF₃).

When reporting emission intensity, the unit emission per hour of broadcast has been used (tCO_{2e}/hr) as this unit provides the best representation for all TV and film regardless of genre and production method.

Reporting Scopes

All emission factors used cover Scope 1, 2 and 3 emission reporting where possible. The definitions of the scopes are:

Scope 1 (direct emissions) emissions are those from activities owned or controlled by your organisation. Examples of Scope 1 emissions include emissions from the combustion of owned or controlled boilers, vehicles, etc. as well as the leakage of refrigerant gases used in air-conditioning units in company-owned or controlled buildings and spaces.

Scope 2 (energy indirect) emissions are those released into the atmosphere that are associated with your consumption of purchased electricity, heat, steam and cooling. These indirect emissions are a consequence of your organisation's energy use but occur at sources you do not own or control.

Scope 3 (other indirect) emissions are a consequence of your actions that occur at sources you do not own or control and are not classed as Scope 2 emissions. Examples of Scope 3 emissions are business travel by means not owned or controlled by your organisation, water, waste disposal, and materials or fuels your organisation purchases.

'Outside of Scope' emissions have been removed from the emissions factor associated with burning biomass and biofuels. This had previously been included to account for the direct carbon dioxide (CO₂) impact of burning biomass and biofuels, but falls outside of Scope 1,2,3 emissions. The emissions are labelled 'outside of scope' because the Scope 1 impact of these fuels has been determined to be a net '0' (since the fuel source itself absorbs an equivalent amount of CO₂ during the growth phase as the amount of CO₂ is released through combustion).

Air Travel

Radiative forcing factors for air travel have been reintroduced into the calculator. Having previously been omitted from the fourth iteration of the calculator due to uncertainties within the calculations, they have been included as per DEFRA's advisory guidance independent audit to account for the true emissions impact from air travel. This will be in line with DEFRA recommendations of a multiplier of 1.7, in line with the latest scientific evidence.

Certified Renewable Energy

A significant change to this iteration of the calculator is the change in the certified green energy emissions factor. Previously, to affect the greatest behavioural change of those using the calculator, an emission factor of 0 kgCO₂e/kWh of electricity from Certified Renewable Energy had been used. However, following advice from our third-party consultants and to improve the tool for corporate reporting, the factor will now include the transmission and distribution emissions associated with purchased electricity from the grid. This will still be significantly less than the generation of non-renewable energy but should result in more accurate carbon accounting.

Third-party calculator and methodology audits

By recommendation of the BAFTA albert Corporate Reporting Task and Finish Group, BAFTA albert carried out a tendering process to source an independent carbon consultancy to conduct a gap analysis of the carbon calculator against criteria defined by the WRI GHG Protocol: The Product Life Cycle Accounting and Reporting Standard. Experts from Ramboll were appointed and carried out the review, completing the work in tandem with the calculator release in November 2023.

The audit recognised the importance of the tool within the film and TV industry and outlined takeaways and improvements to help the tool conform to the Product Standard and in turn, increase the competence of data outputs for corporate reporting purposes. With consultation from stakeholders, these findings will inform the next set of toolkit developments.

Data Accuracy

The accuracy of environmental data is critical to ensure that the film and TV industries can make informed decisions. The most accurate way of tracking a production's emissions is by collecting primary data, only relying on the use of benchmarks and spend data where actual data cannot be accessed. This can be done by informing suppliers of what data is needed and in which format, as well as ensuring someone senior from the production has a final review over data completeness and accuracy, especially finance departments.

BAFTA albert suppliers are strongly encouraged to accurately report primary consumption data on invoices.

How the emissions are calculated

Production users input raw consumption data into the tool (e.g., kWh usage in studio, or the number of kilometres travelled by a vehicle) which is multiplied by the relevant emission factors to quantify the GHG emissions associated with that activity.

$$GHG\ emissions = activity\ data \times emission\ factor$$

Currency and exchange rates

When given the option to measure activity by spend, the calculator provides the option to input data in British pound sterling (GBP) as this is the most common currency in the data sets used to create the benchmarks.

For fuel spend, a data set (Global Petrol Prices) with different currencies has been used, to prevent the need for currency exchange.

The option to build a live exchange calculator into the tool (EX.com) is being explored, to allow productions to use their local currency for every possible entry.

Energy Usage

All energy consumption has now been amalgamated into one section, rather than being separated by space or location. This section of the calculator gives the option to select the space where energy was used (filming spaces, non-filming spaces and post-production).

Filming spaces

Electricity, gas and heat & steam

All UK electricity factors are taken from DEFRA. For other countries, a variety of open sources have been used (please refer to the table in the appendix).

All heat and steam (domestic) heating factors applied in the carbon calculator are taken from DEFRA.

Natural gas from the grid that is used for heating in buildings uses emission factors from DEFRA. The units used for measuring grid gas consumption vary geographically, with this in mind the BAFTA albert calculator tool offers measurements in kilowatt hours (kWh), gigajoules (Gj) and cubic meters (m³). Conversion of the DEFRA emission factor from kWh to Gj and m³ has been calculated using conversion factors and fuel properties listed in the DEFRA emission conversion factor document.

Fuels

Generators:

The BAFTA albert calculator uses DEFRA emission factors for the fuel options in the calculator. When using biofuels, the emission factors were calculated by using DEFRA's suggested calculations. 'Outside of Scope' figures for fuels that have a biogenic source, e.g. biofuels, pump diesel and petrol have not been included as they do not fall under Scope 1,2,3 emissions which the calculator currently accounts for.

To calculate the emission factors for biodiesel, the below formula was used, as per DEFRA recommendations:

Emissions Factor Generation for biodiesel % blend, example – 20%

Where: WTT = well-to-tank, i.e., emissions associated with production of a fuel, including resource extraction, initial processing, transport, fuel production, distribution and marketing, and delivery.

Data used to calculate the carbon emissions by giving the fuel spend data have been taken from the global petrol prices site. The fuel price data provided is country specific and provided in the currency of use in the respective country.

To reduce the confusion surrounding the extensive list of fuels, the fuels list for this iteration of the calculator has been simplified and reduced. Biodiesel and HVO have

been grouped to reflect its growing prominence within the industry, and the least frequently used fuels have been grouped into an “Other” section.

To reflect an increase in the production and use of hydrogen fuel in the industry, we have now included this as an option for generators. DEFRA do not currently list an emission factor for this fuel type. BAFTA albert uses two conversion factors: one for green hydrogen (average of wind and solar) and one for brown/average hydrogen, which have been derived from Parkinson et al. (2019) and Ajanovic et al. (2022) academic sources.

Non-Mains Energy

Several location crews, industry caterers and SFX companies were consulted with, to make sure all the most commonly used fuels are included in the BAFTA albert calculator.

List of fuel options for non-mains energy:

Electrical	Gasoline/Petrol	Diesel
LPG	Hydrogen (green)	Hydrogen (other)
Bioethanol	Renewable Petrol	Butane
Natural Gas	Biodiesel*	Other*

*Additionally, the Biodiesel and Other fuels have been categorised further to reduce the amount of options in the original list to increase user accuracy as per findings in the gap analysis:

Biodiesel	Other
Biodiesel (5%)	CNG
Biodiesel (7%)	Propane
Biodiesel (20%)	Jet Fuel
Biodiesel (40%)	Kerosene
Biodiesel (99%)	
Biodiesel (100%)	
HVO (waste)	

Non-filming spaces

Benchmarks

Production office:

The calculator uses the Chartered Institution of Building Services Engineers (CIBSE) benchmarking tool and Guide F to calculate benchmarks (having taken an average of good practice and typical energy consumption) for the office types below, provided by CIBSE.

- Individual offices (no air-conditioning)
- Open plan (no air-conditioning)
- Air-conditioned (standard)
- Air-conditioned (prestige/HQ)

Emissions associated with Production Office (tCO₂e) = [(Benchmark x # full time equivalent employees x #number of days) x emissions factor for electricity and gas] / 1000

It was assumed that the offices have 11 m² per person (Government Office Health and Safety on Space) and the data is taken for a calendar year rather than a working year, according to the CIBSE guidance. This is then multiplied by the relevant emission factors (depending on the country) for electricity and/or gas where necessary. The calculator uses the following formula:

The new iteration of the toolkit will have increased usability when inputting production office energy. Previously, a production would have to input each energy type (electricity, gas, heat and steam, water) separately, but a new functionality has been added, whereby toggle buttons can be used so that all your energy is included in one singular production office entry.

Working from home:

The working from home benchmark is taken from EcoAct's working from home benchmarking methodology. This benchmark looks at three main areas, office equipment, heating energy and cooling energy (where relevant), and assumes 240 working days per year based on 28 days annual leave and a 40- hour working week. Other assumptions are listed in the EcoAct methodology which is provided in the appendix section below. As per DEFRA recommendations and various academic sources, the homeworking benchmark is now weighted 91% gas and 9% electricity.

All entries that select a "certified green energy" tariff are still calculated using DEFRA's transmission and distribution emissions. This option should only be selected if the electricity used in the house is meeting with the 100% renewable energy certification required.

Water

The BAFTA albert calculator has been updated to include the emissions associated with the supply and treatment of water. The calculator uses water emission factors taken from DEFRA (2023). This emission factor measures water in cubic meters (m³). To increase usability, the tool also enables productions to measure in litres (L).

An office water benchmark is also available based on the average water consumption within office facilities. This includes water used in office facilities.

50 litres/ employee/ day (South Staffordshire Water, 2012)

Filming Spaces

Benchmarks:

BAFTA albert has created energy consumption benchmarks for studios. Previously, there were two energy options for the benchmarks: 'electricity + heat & steam' and 'electricity + gas', but now these have been separated to make individual benchmarks for electricity, gas and heat and steam to reflect the growing number of studios only using electricity.

Additional studio benchmarks have been built based on annual utilities usage (electricity, gas, heat and steam where appropriate) and stage sizes (m²). Data was provided by 7 film and TV studio facilities in the UK and Ireland, thus allowing for studio benchmarks per square meter per day to be created. These benchmarks will be updated and reviewed as data from studios is received.

Future iterations of the calculator can benefit from the information productions provide us. For example, productions input data on studio floor space, LED use, air con and galleries. This is analysed by BAFTA albert and will inform future benchmark figures.

The formula below has been used to calculate the carbon emissions associated with studios using the BAFTA albert benchmarks:

$$\text{Emissions associated with studio (tCO}_2\text{e)} = [(\text{Studio benchmark} \times \text{number of days in the studio}) \times \text{emissions factor}] / 1000$$

Feedback from the BAFTA albert Toolkit working group called for the inclusion of a separate section to report on a production's use of galleries. The BAFTA albert toolkit enables productions to measure the emissions associated with this space from meter/clamp/sub meter readings.

This will provide BAFTA albert with data which can be used to create new benchmarks in future thus increasing the usability of the tool.

Volume/LED:

Volume/LED benchmarks have been implemented because of its growing prominence within the film and TV industry. These have been created in collaboration with Garden Studios, using their energy consumption data. The benchmarks will ask for the number of LED panels, the panel size, the wall size and the number of days that the studio was used. Benchmarks will continue to evolve and improve as more data becomes available from the use of this technology.

$$\text{Emissions associated with Volume LED} = [\text{Volume LED Benchmark} \times \text{number of days} \times \text{number of LED panels} \times \text{panel size (m}^2\text{)} \times \text{wall size (m}^2\text{)}] / 1000$$

Postproduction

Edit suite calculation:

<i>Emissions associated with edit suite (tCO₂e) = 2.99... x hours per day x number of days x electricity emission factors (based on country and region)</i>	
Benchmark source	Benchmark (average kWh)
Sub-metered edit suite	2.999

Source: BAFTA, Method can be found in appendix, p.29.

Travel and Accommodation

All emission factors for travel and transport have been taken from the DEFRA database. Accommodation benchmarks have been derived from benchmarks provided by the Cornell Hotel Sustainability Index.

Air travel

Commercial Air Travel:

DEFRA emission factors have been used for all air travel emissions. Air transport emission factors from DEFRA are derived from Department for Transport emissions and are based on an average of flights between different regions by a variety of aircraft types.

Following DBEI's emissions factor methodology report, distance and travel categories have been classified as follows (DEFRA, 2023):

Type of flight	Distance (km)
Short haul	<800
Medium haul	800-3700
Long haul	>3700

For ease of use, a flight distance calculator is included, based on airport codes which enables the user to enter the 3 figure IATA airport codes for 5,200 medium – large airports around the world. The BAFTA albert toolkit uses the airmilescalculator.com (2021) data set.

Chartered Planes and Helicopters:

Fuel consumption for the following aircrafts have been taken from a variety of sources specific to the aircraft from manufacturers and the European Energy Agency (EEA) and US Department of Agriculture (USDA).

These fuel consumption benchmarks are for aviation gasoline for helicopters and jet fuel for chartered planes.

To calculate the emissions using specific fuel consumption (L/hr or kg/hr, where relevant), the assumption has been made that all helicopters will be fuelled by aviation gasoline and that chartered planes are fuelled by aviation turbine fuel (jet fuel) (Gunston) using the appropriate DEFRA emission factors for these fuel types.

List of Helicopters and Chartered Planes:

Helicopters	Chartered Planes
Aerospatiale SA-315B	Boeing 737-800
Augustawestland AW139	Cessna C152, C172, C182 (single engine)
Augustawestland AW139 Koala	Cessna 50XL Citation
Augustawestland EH101	Cessna 337
Bell 206 LR	Cessna II Citation
Eurocopter AS350 B3e	Cessna Excel Citation
Eurocopter AS355	Dassault Falcon 2000
Mil Mi-17	Gulfstream G550
Augustawestland Sea King	MD-80
Bell B212	Robin (French aircraft) (single engine)
Bell 206 (Jet Ranger)	Gulfstream GIV

Source: USDA, EEA, specific manufacturers

Air travel - Benchmark:

Spend benchmarks for air travel are included. Data used to create these benchmarks was provided by the travel and accommodation comparison site, KAYAK, which is an extensive search engine with flight prices from hundreds of travel sites. This was given in the form of a random selection of around 1200 flights with the associated distance travelled and cost. This data was validated by spend and distance data provided by the BAFTA albert Consortium members in the film and TV industry.

The benchmarks created have been combined with up-to-date data provided by a group of BAFTA albert Consortium members who report on their air travel spend by distance.

Road travel

The BAFTA albert calculator uses DEFRA emission factors for all fuels listed on road travel.

Below are the different road travel options included in the BAFTA albert calculator, with the option of Biodiesel HGV and Electric Bus being added as options for this iteration of the calculator (Nov 2023):

Car - Small	Motorcycle
Car - Medium	Truck/Van (<3.5 tonnes)
Car - Large	HGV (>3.5 tonnes)

Car - unknown	Taxi – regular
Coach/Minibus	Taxi – black cab
Local bus	HGV (>17 tonne)
Biodiesel HGV	Electric Bus

The following fuel source type options are listed for all road travel (when relevant):

Gasoline/Petrol	Biodiesel (B5, B7, B20, B40, B99, B100)
Diesel	LPG
Electric	CNG
Hybrid electric	

Road travel – benchmark:

Data used to calculate the carbon emissions based on fuel spend data have been taken from the global petrol prices site. The fuel price data provided is country specific and provided in the respective currency.

Taxi Travel

DEFRA provide emission factors for 'Taxi – black cab' and 'Taxi – regular'. There is currently only one fuel type associated with 'regular taxis' through DEFRA so an additional emission factor for other fuel types has been calculated through consulting the DBEIS emission factor methodology; this states that the emission factor for regular taxis was calculated using the average emission factor for medium and large cars (average fuel type) whilst also factoring in which taxis travel and fuel

Specific Fuel Type Regular taxi emission factor (kgCO₂e/ km or mile) = average car (large/ medium) specific to fuel type emission factor x 1.4 (Uplift factor)

efficiency through an "uplift factor" of 40% (*1.4), as recommended by Transport for London (TfL).

Taxi Travel – Benchmark:

The taxi spend benchmark was calculated with data from Transport for London (TfL) and Gett taxis based on their fares, which are calculated per mile travelled on top of a baseline fare. An average fare price was taken based on iterating the fare prices for distances up to 200 miles. This spend benchmark is then used along with DEFRA emission factors for taxis to calculate the emissions associated with taxi travel.

Spend option can be used for the following taxi fuel types for regular and black taxis.

Regular - Diesel	Regular - Electric	Regular - Hybrid	Regular – Petrol
Regular – unknown (average)	Black cab - Diesel	Black cab – Electric	

This benchmark option is only available for productions in the UK. Future iterations of the calculator will include benchmarks for each country, subject to getting the relevant and accurate data.

Rail Travel

Following the DEFRA emissions factor methodology report, rail categories in the UK have been classified as: 'National Rail', 'International Rail' (Eurostar), 'Light Rail and Tram' and 'Underground/Subway' based on the train type. The metric for reporting emissions from rail travel is kgCO₂e per passenger kilometre (kgCO₂e/pkm), i.e., the emissions associated with one person per travelling 1 km.

In due course, the calculator will offer new rail travel categories and emission factors for 52 countries offering 181 factors, associated with different rail types (light, high speed, etc.). Emission factors for the UK (i.e. from DEFRA) could not be used for all countries for several reasons: the differing fuel types used to power the trains, the different carbon intensities across countries (in the case of electric-powered trains), the passenger kilometres travelled per country (if more people use trains, more passengers are travelling per km, so the carbon intensity will be lower).

Rail travel – benchmark

The spend benchmark for rail travel was provided by the Office for Rail and Road (ORR) who release quarterly updates on fare prices per km of distance travelled. These figures will be reviewed annually.

Boat Travel

Boat travel emissions are calculated for the following types: ferry (passenger only), ferry (passengers with car), unknown ferry (average) and speed boat/small boat (other boats).

For ferry activity, the emissions are calculated using distance activity data and DEFRA emission factors which align with the ferry categories above. For speed boat/small boat the activity emissions are calculated using fuel consumption data and DEFRA emission factors for the following fuels.

Biodiesel (B5, B7, B20, B40, B99 and B100)	Marine Gas Oil (MGO)	Marine Diesel Oil (MDO)
	Diesel Fuel	Gasoline/Petrol
Renewable Diesel	Jet Fuel	

Couriers and Excess Baggage

Courier and Excess Baggage emissions are calculated for the following types: air consignment, motorcycle courier, truck/van courier. The BAFTA albert calculator collects data in relation to the package/baggage weight and distance travelled.

DEFRA emission factors are provided for activity data given in tonne/km. To improve the usability of the calculator tool standard conversion unit factors have been used (listed in the appendix – tables 1, 2, 3) to enable productions to enter courier and excess baggage data in a variety of weights (kg, lb, ton (US), tonne) and distance (km and mile) units.

Air Consignment

Air consignment emissions are broken down into travel distance (short, medium, and long haul), aligning with the DEFRA emission factors. Distance categories are in the "Commercial Air Travel" section.

Truck/Van Courier

To enable high levels of accuracy there is the option to choose from a range of fuel types that truck/van couriers can use:

Diesel Fuel	Battery Electric	LPG
CNG	Petrol/Gasoline	Unknown (average)

Motorcycle Courier

DEFRA do not provide a weight option for this courier activity, so the emissions are therefore associated with the distance travelled by a motorcycle courier and it is assumed that the motorcycle is fuelled by diesel fuel.

Freight

Freight emissions are calculated for the following types: train consignment, sea tanker and cargo ship using weight and distance data and DEFRA emission factors.

As with 'couriers and excess baggage', DEFRA emission factors are provided for activity data given in tonne/km. To improve the usability of the calculator tool standard conversion unit factors have been used (listed in the appendix) to enable productions to enter data in a variety of weight (kg, lb, ton (US), tonne) and distance (km and mile) units.

Accommodation

Accommodation emissions for hotels/apartments/houses are calculated using the average energy consumption given by the Energy Star site. The BAFTA albert calculator uses these energy consumption benchmarks based on accommodation type supplemented with the Cornell Hotel Sustainability Benchmarking Index and multiplies them by the relevant electricity carbon factor for each country.

Users have the option to select certified renewable energy if 100% Certified Green Energy is used in the BAFTA albert toolkit.

Accommodation Type	kWh/day
Economy Hotel	15.11
Midscale Hotel	29.78
Upscale Hotel	34.51
Luxury Hotel	45.08
Apartment /Condo/Flat	31.01

Average House	17.47
Large House	47.94

Materials and Disposal

DEFRA guidance has been followed when building the carbon factors for all the materials included in the BAFTA albert carbon calculator.

The DEFRA factors consist of two parts: the consumption of using the material depending on how it has been made (e.g., recycled content) and the disposal factor depending on the material and disposal method. As it is not easy to get the information on how a product has been made, it is assumed that the product is a 'new product' unless stated in the following material sections.

It is assumed that not all materials purchased for productions will be disposed of, to account for this, the calculator breaks this into a two-part process: 'material' and 'disposal'. This also enables BAFTA albert and the rest of the industry to encourage the re-use of products. The materials options offered in the calculator are below:

Paint

The November 2023 calculator update simplified paint options in the calculator. A singular paint type is now available, which is an average from a variety of different paint types derived from multiple different paint brands commonly used, including Berger Paints, Dulux and Graphenstone UK. The paint options have been simplified by recommendation of the BAFTA albert Consortium Toolkit Working Group to address confusion with the different options, and ultimately the materiality of these emissions during production. BAFTA albert independently assessed the difference in emissions between the paint types and found these to be negligible.

Paper

The following paper sizes have been included in the calculator and the associated weights of a ream (the assumption is that a ream will be 500 sheets for all paper sizes).

Paper Size (gsm)	Weight of a ream (kg)
A0 (100)	50
A1 (80)	20
A2 (80)	10
A3 (80)	5
A4 (80)	2.5
A5 (80)	1.25
Legal A4 (120)	3.75
Letter (100)	1.875

Source: Paper Sizes.

There is a 'paper from recycled content' option in this iteration of the calculator to acknowledge that 30% of paper produced globally is made from recycled content.

Cardboard

Cardboard can be recorded by weight or by its dimensions. When recording cardboard emissions by weight, this can be done using a variety of units (kg, lb, US ton, tonne). When recording by dimensions of a flat box an average density for cardboard has been assumed to be 689 tonnes/m³ (source: aqua-calc).

Timber

Average prices for timber have been taken from B&Q and Jewson as this provides a good breakdown of pricing. There is a data set of 700 timber prices and weights included in the calculator. This data is used to create a cost-weight coefficient and is combined with the DEFRA emission factor for timber (tonnes).

Cost to weight coefficient = 2412.609 (£/tonne) (source: B&Q, Jewson).

When entering timber consumption by dimensions, the calculator asks for the length, width and depth of timber and assumes an average density of the timber.

Assumed density of timber = 0.63 (tonne/m³) (source: B&Q, Jewson).

For timber the option to account for materials that are made from recycled content has been added.

Textiles

Emissions associated with the use of textiles can be recorded by weight or dimension. The calculator has the added option to record textiles made from recycled content as the assumption is made that 96% of clothing is made from virgin stock (Ellen MacArthur Foundation) and therefore wants to acknowledge those sourcing their clothing from 100% recycled content. These factors have been extracted from SimaPro with help from consultants from Building Research Solutions Ltd, except for leather, which was derived from Chen et al. (2014).

When recording dimensions, the calculator asks for width and length of textiles and the density (kg/m²) from the user filling in the calculator tool.

Food

Emission factors for different food types have been produced using information from a wide range of food LCAs from food suppliers, consultancy firms (Small World Consultancy, Carbon Smart) and food emissions resources (Our World in Data). This information was incorporated with research on human food behaviour as well as recommended daily intake. Average portion consumption was taken from National Diet and Nutrition Survey for 16-64 year old adults. The meal benchmarks assume a 2,500-calorie diet made up of the representative food groups assuming calorie intake is such that it is sufficient for maintaining weight. In order to adjust calories to portions, the benchmarks uses McCance and Widdowson so that the benchmark is associated per gram per food group based on average UK consumption.

The vegetarian option excludes all meat and fish but includes dairy, the vegan option excludes dairy as well.

Meal Type	Benchmark (kgCO ₂ e/meal)
Vegetarian	0.76076

Vegan	0.52786
Fish	2.4897
Meat - Chicken	2.8797
Meat - Pork	3.1397
Meat - Lamb	5.2197
Meat - Beef	9.8997

Source: LCAs, NDNS, McCance and Widdowson and Poore and Nemecek nutritional guidelines and human behaviour average consumption

Emissions related to food are based on assumptions but aims to show the difference that diet can make and acknowledge the lifestyle recommendations to achieve a low-carbon lifestyle from the UN.

Plastics

DEFRA emission factors for average plastics are used to provide a simple value to the end user that maintains usability and comprehension within the toolkit. For plastics there is also an option to account for materials that are made from recycled content.

Users can also record emissions associated with plastic products by quantity, as the calculator takes in to account the weights of a single unit of the following commonly used products:

Product	Weight (g)
Bottle	60
Plate	60
Cup	20
Cutlery	7

Sources: BAFTA, method of process can be found in the appendix.

Metals

The BAFTA albert calculator uses DEFRA emission factors for average metals, to provide a simple yet complete footprint while maintaining usability. A user can now account for materials that are made from recycled content.

Users can also record emissions associated with metal products by quantity, as the calculator takes in to account the weights of a single unit of the following commonly used products:

Product	Weight (g)
Drinks Can	14
Tin Can	20

Source: BAFTA, method of process can be found in the appendix.

Batteries

The BAFTA albert calculator uses DEFRA emission factors for batteries, to provide a simple yet complete footprint while maintaining usability. Users can also record emissions associated with battery products by quantity, as the calculator takes in to account the weights of a single unit of the following commonly used products:

Productions can record emissions by quantity of product, as the tool recognises the weight of a single unit of the following commonly used batteries.

The list of battery sizes will be reviewed regularly, using feedback from users.

Size	Weight (grams)
AAAA	6.5
AAA	11.5
AA	25
9V	45
C	65
4.5V	110
D	165
6V	600
18V	605

Source: BAFTA, method of process can be found in the appendix.

The most recent update of DEFRA and DBEIS emission factors has included new options to report on battery use. There are three new options:

- Alkaline
- Lithium ion (Li-ion)
- Nickle Metal hydride (NiMh)

Glass

The BAFTA albert calculator assigns an average emission factor for glass from DEFRA, and enables productions to record emissions associated with glass products by quantity of product. The tool recognises the weights of a single unit of the following:

Product Type	Weight (grams)
Bottle (wine)	70
Bottle (soda)	19.2

Source: BAFTA, method of process can be found in the appendix.

There is now the option to account for materials that are made from recycled content.

Disposal

Disposal is calculated by weight and by container size. Emission factors from DEFRA have been used for calculating the emissions associated with disposal activity. The EPA waste emission factors enable users to estimate a reduction in waste emissions depending on the treatment type rather than calculating the emissions associated with material consumption and waste disposal as these factors are frequently negative. At this time, DEFRA emission factors are being used for all countries but country specific disposal emission factors will be included in further iterations as BAFTA albert recognises that these emission factors are dependent on the energy of

waste management activities, fuel types used (thus carbon intensity) and efficiency of waste management practices, e.g., energy from waste, landfill gas utilisation, etc.

BAFTA albert actively encourages productions to calculate emissions based on weight of disposal for accuracy of emissions. In the absence of this information, however, there is the option to disclose by number of containers as well.

When recording the emissions associated with disposal through number of containers, the following formula has been used:

$$\text{Emissions associated with disposal containers (tCO}_2\text{e)} = (\text{size of container} \times \text{cubic meter conversion} \times \text{weight of waste conversion} \times \text{emission factor})$$

(material and treatment specific as listed below)

Where:

Cubic meter conversion = appendix, table 8

Weight of waste conversion = 0.1348 tonnes/ m³ (source: BAFTA, method can be found in the appendix)

BAFTA albert Material Type	BAFTA albert Disposal Type	DEFRA Material Type	DEFRA Treatment Type
Construction	Donated	Construction (Mixed)	Re-use
Construction	Landfill/Unknown	Construction (Mixed)	Unknown
Construction	Recycled	Construction (Mixed)	Recycling (Closed Loop)
Electronic waste	Incinerated/Energy recovery	WEEE* (Mixed)	Energy (Combustion)
Electronic waste	Landfill/Unknown	WEEE (Mixed)	Landfill
Electronic waste	Recycled	WEEE (Mixed)	Recycling (Closed Loop)
Electronic waste	Donated	0	
Food/Compostable	Composting	Food and Drink	Composting
Food/Compostable	Donated	0	
Food/Compostable	Incinerated/Energy recovery	Food and Drink	Energy (Combustion)

Food/Compostable	Landfill/Unknown	Food and Drink	Landfill
Food/Compostable	Anaerobic Digestion	Food and Drink	Anaerobic Digestion
General/Mixed	Incinerated/Energy recovery	Household Residual Waste	Energy (Combustion)
General/Mixed	Landfill/Unknown	Household Residual Waste	Landfill
General/Mixed	Anaerobic Digestion	Household Residual Waste	Anaerobic Digestion
Paper/Cardboard	Composted	Paper and Cardboard (Mixed)	Composted
Paper/Cardboard	Incinerated/Energy recovery	Paper and Cardboard (Mixed)	Energy (Combustion)
Paper/Cardboard	Landfill/Unknown	Paper and Cardboard (Mixed)	Landfill
Paper/Cardboard	Recycled	Paper and Cardboard (Mixed)	Recycling (Closed Loop)
Plastic	Incinerated/Energy recovery	Plastic: Average plastics	Energy (Combustion)
Plastic	Landfill/Unknown	Plastic: Average plastics	Landfill
Plastic	Recycled	Plastic: Average plastics	Recycling (Closed Loop)
Textiles	Donated	0	
Textiles	Incinerated /Energy recovery	Clothing	Energy (Combustion)
Textiles	Landfill /Unknown	Clothing	Landfill
Textiles	Recycled	Clothing	Recycling (Closed Loop)
Timber	Donated	0	

Timber	Incinerated/Energy recovery	Wood	Energy (Combustion)
Timber	Landfill/Unknown	Wood	Landfill
Timber	Recycled	Wood	Recycling (Closed Loop)
Timber	Composting	Wood	Composting
Batteries	Landfill/unknown	Batteries	Landfill/unknown
Metal	Incinerated/Energy recovery	Metals	Energy (combustion)
Metal	Landfill/unknown	Metals	Landfill
Metal	Recycled	Metals	Recycling (closed loop)
Metal	Donated	0	

*WEEE – Waste Electrical and Electronic Equipment

Appendix

Global Emission Factors Source list

Table 1: Global Emission Factors in including the source and the countries and regions that they apply.

Scope	Source	Region or state
Scope 2	DEFRA	UK
Scope 2+3	Australian Government 2021	Western Australia, New South Wales, Northern Territory, Queensland, South Australia, Tasmania, Victoria
Scope 2+3	Carbon Footprint 2022	Argentina, Austria, Belgium, Brazil, Bulgaria, Canada, Alberta (AB), British Columbia (BC), Manitoba (MT), New Brunswick (NB), Newfoundland and Labrador (NL), Nova Scotia (NS), Northwest Territories (NT), Nunavut (NU), Ontario (OB), Prince Edward Island (PE), Quebec (QC), Saskatchewan (SK), Yukon Territory (YT), Denmark, Estonia, Finland, France, Greece, Hong Kong (China), Hong Kong (CLP group), Iceland, New Zealand, Norway, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Thailand, United States, Alaska (AK), Alabama (AL), Arkansas (AR), Arizona (AZ), California (CA), Colorado (CO), Connecticut (CT), Washington DC (DC), Delaware (DE), Florida (FL), Georgia (GA), Hawaii (HI), Iowa (IA), Idaho (ID), Illinois (IL), Indiana (IN), Kansas (KS), Kentucky (KY), Louisiana (LA), Massachusetts (MA), Maryland (MD), Maine (ME), Michigan (MI), Minnesota (MN), Missouri (MO), Mississippi (MS), Montana (MT), North Carolina (NC), North Dakota (ND), Nebraska (NE), New Hampshire (NH), New Jersey

		(NJ), New Mexico (NM), Nevada (NV), New York (NY), Ohio (OH), Oklahoma (OK), Oregon (OR), Pennsylvania (PA), Rhode Island (RI), South Carolina (SC), South Dakota (SD), Tennessee (TN), Texas (TX), Utah (UT), Virginia (VA), Vermont (VT), Washington (WA), Wisconsin (WI), West Virginia (WV), Wyoming (WY)
Scope 2 + 3	EIB 2022	Afghanistan, Algeria, American Samoa (U.S.), Andorra, Anguilla (U.K.), Antigua and Barbuda, Aruba, Azerbaijan, Azores (Portugal), Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belize, Benin, Bermuda (U.K.), Bhutan, Bosnia and Herzegovina, Botswana, British Virgin Islands (U.K.), Brunei, Burkina Faso, Burundi, Cambodia, Cameroon, Canary Islands (Spain), Cape Verde, Cayman Islands, Central African Republic, Chad, Channel Islands, Chile, China (P.R. China & Hong Kong), Taipei (Chinese), Colombia, Comoros, Congo, Republic of, Costa Rica, Côte d'Ivoire, Croatia, Cuba, Curaçao (Netherlands), Cyprus, Czech Republic, Congo, Democratic Republic of, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Falkland Islands (U.K.), Faroe Islands (Denmark), Fiji, French Guiana, French Polynesia, Gabon, Gambia, Georgia, Germany, Ghana, Gibraltar (U.K.), Greenland, Grenada, Guadeloupe (France), Guam, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hungary, India, Indonesia, Iran, Iraq, Isle of Man, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kiribati, Korea (South), Republic of, Korea (North), Dem. People's Rep. of, Kosovo, Kuwait, Kyrgyzstan, Laos, Latvia, Lebanon, Liberia, Libya, Liechtenstein, Lithuania, Luxembourg, Macao (China), Macedonia, North, Madagascar, Madeira (Portugal), Malawi, Maldives, Mali, Malta, Marshall Islands, Martinique (France), Mauritania, Mayotte (France), Mexico, Micronesia, Moldova, Monaco, Mongolia, Montenegro, Montserrat, Mozambique, Myanmar, Nauru, Nepal, Netherlands, Netherlands Antilles, New Caledonia (France), Nigeria, Niue, Northern Mariana Islands (U.S.), North Macedonia, Oman, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, Philippines, Poland, Puerto Rico (U.S.), Reunion (France), Romania, Russian Federation, Rwanda, Saint Helena (U.K.), Saint Kitts and Nevis, Saint Lucia, Saint Martin (France), Saint Pierre and Miquelon (France), Saint Vincent and Grenadines, Samoa, San Marino, Sao Tomé & Príncipe, Serbia, Seychelles, Sierra Leone, Singapore, Sint Martin (Netherlands), Solomon Islands, Somalia, South Africa, South Sudan, Sri Lanka, Sudan, Suriname, Switzerland, Syrian Arab Republic, Tajikistan, Tanzania, Timor-Leste, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Turks and Caicos Islands (U.K.), Tuvalu, Uganda, Ukraine, United Arab Emirates, Uruguay, Uzbekistan, Vanuatu, Venezuela, Vietnam, Virgin Islands (U.S.), West Bank and Gaza, Yemen, Zambia, Zanzibar (Tanzania), Zimbabwe
Scope 2	IEA 2019 - Open source	Albania, Armenia

Scope 2	SEAI - (kgCO ₂ /kWh)	Ireland
Scope 2	Electricity Maps	Peru
Scope 2	IRENA 2022	Eswatini, Kenya, Lesotho, Malaysia, Mauritius, Morocco, Namibia, Nicaragua, Niger, Qatar, Saudi Arabia, Senegal
Scope 3	Australian Government, 2021	New South Wales, Northern Territory, Queensland, South Australia, Tasmania, Victoria, Western Australia
Scope 3	DEFRA	All Countries

Studios – benchmark

Studios provided annual stage energy consumption data (kWh) broken down into the energy source (Electricity, Gas, Heat & Steam) alongside the size of each of the stages. This data was then used to calculate a benchmark with the unit kWh/ m²/ day. It is acknowledged that the energy sources are dependent on one another e.g. electricity and gas, and electricity and heat & steam so two benchmarks have therefore been provided.

Standard Unit Conversion

Table 2: Volume conversion units

Volume		L	m ³	US gallon
	Litres, L		0.001	0.264172
	Cubic meters, m ³	1000		264.1721
	US gallon	3.785412	0.003785	

Table 3: Mass Conversion units

Mass		kg	Tonne	Ton (US)	Lb
	Kilogram, kg		0.001	0.001102	2.204624
	Tonne, t (metric tonne)	1000		1.102311	2204.624
	Ton (US, short ton)	907.185	0.907185		2000.002
	Pound, lb	0.453592	0.000454	0.0005	

Table 4: Distance conversion units

Distance/ Length		m	ft	mi	Km
	Meter, m		3.28084	0.000621	0.001
	Feet, ft	0.3048		0.000189	0.000305
	Miles, mi	1609.344	5280		1.609344

	Kilometres, km	1000	3280.84	0.621371	
--	-------------------	------	---------	----------	--

Table 5: Distance conversion units

Distance/ Length		m	ft	in	Cm
	Meter, m		3.280804	39.37008	100
	Feet, ft	0.3048		12	30.48
	Inch, in	0.0254	0.0833333		2.54
	Centimeter, cm	0.01	0.032808	0.393701	

Fuel consumption of helicopters and chartered flights taken from multiple sources (USDA, EEA, Open Sources) were often provided in litres per hour of flight. To standardise the following conversion factors were used so that all fuel consumption was in kg/hr .

Table 6: Chartered and Helicopter fuel densities

Fuel Type	Density (kg/l)
Jet Fuel	0.79
Aviation Gasoline	0.7185

Table 7: Gas Fuel densities

Gas Type	Density (kg/m ³)
Propane	493
Butane	573

Table 8: Container Sizes and conversions to cubic meters

Container Size	Convert to cubic metres
Bag of rubbish/trash (20 litre)	0.02
Bin (1100 litre)	1.1
Bin (660 litre)	0.66
Bin (770 litre)	0.77
Container (1 meter)	1
Container (1 yard)	0.764555
Container (1/2 meter)	0.5
Container (1/2 yard)	0.3822775
Container (10 meter)	10

Container (10 yard)	7.64555
Container (15 meter)	15
Container (15 yard)	11.468325
Container (2 meter)	2
Container (2 yard)	1.52911
Container (20 meter)	20
Container (20 yard)	15.2911
Container (3 meter)	3
Container (3 yard)	2.293665
Container (30 meter)	30
Container (30 yard)	22.93665
Container (35 US gallon)	0.13248935
Container (4 meter)	4
Container (4 yard)	3.05822
Container (40 meter)	40
Container (40 US gallon)	0.1514164
Container (40 yard)	30.5822
Container (5 meter)	5
Container (5 yard)	3.822775
Container (6 -meter)	6
Container (6 yard)	4.58733
Container (68 US gallon)	0.25740788
Container (8 -meter)	8
Container (8 yard)	6.11644
Container (98 US gallon)	0.37097018
Wheelie bin (large - 360 litre)	0.36
Wheelie bin (medium - 240 litre)	0.24
Wheelie bin (small - 140 litre)	0.14

Source: simple skip hire <https://www.simpleskip.co.uk/>.

Table 9: Hydrogen emission factors

Method name	Emission Factor (kgCO ₂ e/kg)	Method
Green	1.55	Average of electrolysis wind and solar H ₂
Brown	19.78	Coal Black/Brown H ₂

Source: Parkinson et al. (2019) and Ajanovic et al. (2022)

Materials

To account for mechanical error five kitchen scales were used to measure the products (listed in the materials section of the methodology). Although object mass was provided to 2 decimal places these figures were rounded to the nearest gram to mitigate for mechanical error. The sample size for each product was five, the final figure used was an average of these weights.

Disposal

Mass of waste was measured using a number of different scales dependent on the waste.

Electronic waste, Food/ Compost, General/ Mixed, Paper/ Cardboard, Textiles, Batteries, Metals were all measured using 3 different household human scales (accounting for mechanical error) having first weighed the container (a UK council waste bin = 0.448 m³) and then added the faux/ waste materials (separated by material type). Having measured the waste for each material type the mass of the container was deducted to calculate the final mass of the waste.

Construction waste was measured at a recycling centre through first measuring the weight of a vehicle and then adding the construction waste (in containers – the mass of these were known previously) and re-weighing.

The densities of these materials were then calculated mass (kg)/ m³ and the average taken.

BAFTA albert acknowledges that this process results in a low accuracy density however BAFTA albert actively encourages users to make use of the weight measurement option in order to increase accuracy of measurement. BAFTA albert offers this option to enable usability and enable productions to gain a more complete understanding of their emissions.

Post Production

Submeters were attached downstream from the main office electricity meter to measure the energy (kWh) associated with individual edit suites. This process was repeated for a sample of 5 edit suites. The figures were then averaged. To validate these figures the energy consumption of all equipment and kit in each suite was totalled.

References

Emission Factors

Departments for Farming and Rural Affairs (DEFRA). 2022. Greenhouse gas reporting: Conversion factors 2022 – full set. [Online]. [Accessed 25 June 2022]. Available from: <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022> - UK emission factors

International Factors were provided by [Building Research Solutions Ltd](#) from a number of open academic sources

Currency and Exchange rates

XE.com Inc. 2020. Currency Exchange rate. [Online]. [Accessed 25 July 2020]. Available from: <https://bit.ly/3vOtg0R>

GlobalPetrolPrices.com. Global Fuel Prices. [Online]. [Accessed 25 July 2020]. Available from: <https://bit.ly/393Jk5g>

Filming and non-filming space

Chartered Institution of Building Services Engineers (CIBSE). 2016. Guide F: Energy Efficiency in Buildings. [Online]. [Accessed 25 July 2020]. Available from: <https://bit.ly/3sgORNq> - office benchmarks

Chartered Institution of Building Services Engineers (CIBSE). 2016. Energy Benchmarking Tool Dashboard. [Online]. [Accessed 25 July 2020]. Available from: <https://bit.ly/3tGJGq8> - office benchmarks

Field, J., Bordass, B., Bruhns, H., Delorme, L., Davies, H., Irving, S., Jones, P., Lillicrap, C., Martin, P. 2008. Energy Benchmarks CIBSE TM46: 2008. CIBSE. – guidance on benchmarks

Government Office Health and Safety on Space. 2007. Workplace Health, Safety and Welfare: A Short Guide for Managers. [Online]. [Accessed 25 July 2020]. Available from: <https://bit.ly/2Qtlect> - space in an office per person

Skillett, L. and Ventress, L. 2020. Homeworking Emissions Whitepaper. EcoAct. [Online]. [Accessed 18 December 2020]. Available from: <https://bit.ly/2NFMuEJ> - home working

Bourns, W. 2020. Email from Anne Pennock (SD Location Catering). 2 October. – cooking fuel types

Bourns, W. 2020. Email from Carmela Carrubba (Real SFX). 28 September. – SFX fuel types

Bourns, W. 2021. Email from Aran Bates (Hydrologiq). 15 March. – Hydrogen emission conversion factors

Bourns, W. 2021. Email from Henry Mills (Fuel Cell Systems). 9 April – Hydrogen emission conversion factors

Gielen, D., Taibi, Emanuele., Miranda, Raul. 2019. Hydrogen: A Renewable Energy Perspective. *International Renewable Energy Agency*. **1**(1).

Bermudez, J. M., Hasegawa, T. 2020. Hydrogen. *International Energy Agency*. **1**(1).

Bourns, W. 2021. Email from Ken Childs (AC Logic). 18 May – Refrigerant benchmark

South Staffordshire Water, 2012. Water Use in Your Business – Advice and Tips for saving water.

IBNET, 2021 – Water and Sanitisation Tariff region and country specific.

Energy and Fuels

Ajanovic, A., Sayer, M., and Haas, R. 2022. The economics and the environmental benignity of different colors of hydrogen. *International Journal of Hydrogen Energy*. 47(57), pp.24136-24514.

<https://www.sciencedirect.com/science/article/pii/S0360319922007066>

Parkinson, B., Balcombe, P., Speirs, JF., Hawkes, AD., Hellgardt, K. 2019. Levelized cost of CO2 mitigation from hydrogen production routes. *Energy & Environmental Science*. 12(1), pp.19-40.

<https://pubs.rsc.org/en/content/articlelanding/2019/ee/c8ee02079e>

Travel and Transport

Air Travel

Airmilescalculator.com. 2020. Air Miles Calculator airport coordinate data set. [Online]. [Accessed 8 April 2021]. Available from: <https://bit.ly/3ycbINX>

Gunston, B. 1999. The Development of Piston Aero Engines. Patrick Stephens Limited. 5(1), pp. 5.

Department for Business, Energy & Industrial Strategy (DBEI). 2016. 2016 Government GHG Conversion Factors for Company Reporting: Methodology Paper for Emissions Factor. [Online]. [Accessed 25 July 2020]. Available from: <https://bit.ly/3vNQUS> - radiative forcing guidance

Department for Business, Energy & Industrial Strategy (DBEI). 2020. 2020 Government Greenhouse gas conversion factors for company reporting: Methodology Paper for Conversion factors Final Report. [Online]. [Accessed 25 July 2020]. Available from: <https://bit.ly/394zeAK>

United States Department for Agriculture (USDA). 2020. Helicopter Services Hourly Flight Rates, Fuel Consumption. [Online]. [Accessed 25 July 2020]. Available from: <https://bit.ly/3vQlbsA>

Winther, M. and Rypdal, K. EMEP/EEA air pollutant emission inventory guidebook 2019. EMEP/EEA.

Aircraft Compare. 2020. Midsize Helicopter Fuel Consumption. [Online]. [Accessed 23 October 2020]. Available from: <https://bit.ly/318sUE1>

Wiskair Helicopters. 2020. Helicopter Fleet Fuel Consumption. [Online]. [Accessed 23 October 2020]. Available from: <https://bit.ly/3sdBrBz>

Bourns, W. 2020. Email from Andie Clare (Icon Films). 12 October. – helicopter types

Bourns, W. 2020. Email from Tash Dummelow (Silverback Films). 12 October. – helicopter types

Bourns, W. 2020. Email from Edward Scott-Clarke (CNN International). 12 October. – helicopter types

Bourns, W. 2020. Email from Philip Holdgate and Imelda Aspinall (ITV Studios). 21 October. – average air fares and distances.

Kayak. 2020. Flight Spend and Distance. Kayak.

Road Travel

California Air Resources Board. 2020. LCFS Pathway Certified Carbon Intensities. [Online]. [Accessed 8 September 2020]. Available here: <https://bit.ly/3f2MppO>

Neste. 2020. Neste Renewable Diesel Handbook. [Online]. [Accessed 8 September 2020]. Available from: <https://bit.ly/3c9yWL7>

Bourns, W. 2020. Email from Tom Cooke (OnBio), 8 September.

Bourns, W. 2020. Conversation with Crowne Oil, 8 September.

Department for Business, Energy & Industrial Strategy (DBEI). 2020. 2020 Government Greenhouse gas conversion factors for company reporting: Methodology Paper for Conversion factors Final Report. [Online]. [Accessed 25 July 2020]. Available from: <https://bit.ly/394zeAK> - taxi emissions factor methodology

Transport For London. 2020. Taxi Fares. [Online]. [Accessed 9 September 2020]. Available from: <https://bit.ly/2NFCL13>

Bourn, W. 2021. Email from Tom Baker (Gett Taxis), Passenger Rail Usage 2020-21 Quarter 3. [Online]. [Accessed 11 March 2021]. Available from: <https://bit.ly/3d0H9AB>

Boat Travel

Bourns, W. 2020. Email from Emma Peddie (NHU, BBC), 9 November 2020.

Accommodation

Jagarajan, R. and Ricaurte, E. 2021. Hotel Sustainability Benchmarking Index 2020: Carbon, Energy and Water. Cornell center for hospitality research cornell hospitality indices. 1 (1) Available from: <https://bit.ly/3dOgc3P>

Energy Star. 2008. Facility Type: Hotels and Motels. [Online]. [Accessed 9 September 2020]. Available from: <https://bit.ly/3lHC6sK>

Materials

Paint

Dulux. 2020. Environmental Product Declaration for Preparation Paints. [Online]. [Accessed 26 July 2020]. Available from: <https://bit.ly/3vO5eTw>

Kim, J.M. 2022. Email from Ben Sturges (Graphenstone UK), 15 September 2022

Paper

Paper Sizes. 2020. Table of Theoretical and Actual Areas of A Paper Sizes. [Online]. [Accessed 14 April 2020]. Available from: <https://bit.ly/3cQqHTi>

Cardboard

Aqua-Calc. 2020. Density of Cardboard (Material). [Online]. [Accessed 20 November 2020]. Available from: <https://bit.ly/3tlbFFP>

89% of cardboard made from recycled source - <https://www.packaging-gateway.com/features/is-there-a-cardboard-shortage-in-the-uk/>

Timber

B&Q. 2020. Timber Cost, Mass, Dimensions Data. B&Q.

Jewson. 2020. Timber Cost, Mass, Dimensions Data. Jewson

Textiles

Ellen MacArthur Foundation. 2020. A New Textiles Economy Redesigning Fashions Future. [Online]. [Accessed 20 November 2020]. Available from: <https://bit.ly/3tOOsSF>

Chen, K-W., Lin, L-C., and Lee, W-S. 2014. Analyzing the Carbon Footprint of the Finished Bovine Leather: A Case Study of Aniline Leather. Energy Procedia. 61, pp.1063-1066.

<https://www.sciencedirect.com/science/article/pii/S1876610214028537>

Food

Public Health England and Food Standards Agency. 2017. National Diet and Nutrition Survey. [Online]. [Accessed 14 September 2020]. Available from: <https://bit.ly/3r553zK>

Office for National Statistics. 2016. A Government Statistical Service perspective on official estimates of calorie consumption. [Online]. [Accessed 14 September 2020]. Available from: <https://bit.ly/3rchnOy>

Public Health England. 2020. McCance and Widdowson's The Composition of Foods Integrated Dataset 2021. [Online]. [Accessed 14 September 2020]. Available from: <https://bit.ly/3vR1ctO>

Poore, J. and Nemecek, T. 2018. Reducing Food's Environmental Impacts through producers and consumers. *Science*. 360(6392), pp.987-992. <https://bit.ly/314m2Yf>

Clune, S., Crosson, E. and Verghese, K. 2017. Systematic review of greenhouse gas emissions for different fresh food categories. *Journal of Cleaner Production*. 140(2),pp.766-783. <https://bit.ly/2PI6TPE>

Our World in Data. 2020. Environmental Impacts of Food productions. [Online]. [Accessed 14 September 2020]. Available from: <https://bit.ly/3tHAWA4>

Plastics, Metal, Batteries, Glass – maybe this should include method in appendix including the models of scales etc.

BAFTA. 2020. Mass of Plastic, Metal, Glass products and Batteries. albert

Disposal

Simple Skip Hire. 2020. Skip Sizes and Capacities. [Online]. [Accessed 26 October 2020]. Available from: <https://bit.ly/3llzged>

Mr Clean Up. 2020. Skip Bins Sizes. [Online]. [Accessed 26 October 2020]. Available from: <https://bit.ly/3rb9CbL>

Wheelie Bins. 2013. How to Choose the Right Wheelie Bin Size. [Online]. [Accessed 26 October 2020]. Available from: <https://bit.ly/3vRknDA>

BAFTA. 2020. Mass of Waste. albert

Bibliography

Sources that ultimately weren't used but helped the process.

Energy, Fuels

Independent Commodity Intelligence Services (ICIS). 2021. Commodity prices for fuel prices. [Online]. [Accessed 24 March 2021]. Available from: <https://bit.ly/31ehpLs>

Textiles

Periyasamy A.P., Duraisamy G. (2019) Carbon Footprint on Denim Manufacturing. In: Martínez L., Kharissova O., Kharisov B. (eds) *Handbook of Ecomaterials*. Springer, Cham, pp. 1581-1598 available from: <https://bit.ly/3rc5OHm>

Berners-Lee, M. 2020. *How Bad Are Bananas? : the Carbon Footprint of Everything*. London :Profile.

MISTRA Future Fashion. 2015. Environmental Assessment of Swedish Fashion Consumption. [Online]. [Accessed 23 March 2020]. Available from: <https://bit.ly/2QByvRq>

WRAP. 2019. Emission Changes with Disposal. [Online]. [Accessed 22 March 2020]. Available from: <https://bit.ly/3d4OOh4>

Cardboard

Packaging Gateway. 2020. Is there a cardboard shortage in the UK?. [Online]. [Accessed 19 February 2020]. Available from: <https://bit.ly/3rdE0Cx>

Food

Hsu, K., Kazer, J. and Cumberlege, T. 2018. Quorn Footprint Comparison Report. Carbon Trust. 1 (1). Available from: <https://bit.ly/3fTKesG>

Heller, M. C. and Keoleian, G. A. 2018. BEYOND MEAT'S BEYOND BURGER LIFE CYCLE ASSESSMENT: A DETAILED COMPARISON BETWEEN A PLANT-BASED AND AN ANIMAL-BASED PROTEIN SOURCE. Centre For Sustainable Systems University of Michigan. 1 (1). Available from: <https://bit.ly/3f7ramQ>

Accommodation

Hotel footprinting Tool. 2020. Hotel Foot printing Tool. [Online]. [Accessed 15 February 2020]. Available from: <https://bit.ly/2QACUUJ>

Lambert Smith Hampton. 2020. Do Disturb Disruption & Innovation in the Hotel Market. [Online]. [Accessed 16 August 2020]. Available from: <https://bit.ly/3vX9New>

The Hotel Carbon Index – Carpare – Email chain with Richard Smith at BBC subject “Hotel Source 2010” & “Hotel info” assuming similar percentage decrease as referenced in DEFRA hotel emissions.

Budget Hotel /Lodge: 12.25 kg

Mid Range Hotel: 28.45 kg

Country House: 33.55 kg

Deluxe Hotel 30.90 kg

Version Log:

The latest version of this paper was released on 09/01/2024.

Previous version was released in October 2022.