



Home - v - office working in the UK. How does it rate from a carbon perspective?

	Total Annual Carbon Emissions all employees (tonnesCO ₂ /yr)	Total Annual Carbon Emissions per employee (kgCO ₂ /yr) - 2019	Previous figure reported in 2007	Notes on changes in 2019
200 staff working from office	286.7	1.4	1.7	Minor adjustments on energy use profile, decrease due to electricity emission factor 25% lower
200 staff working from home, heating their whole house	505.9	2.5	2.4	Minor adjustments on energy use profile, decrease due to electricity emission factor 25% lower
200 staff working from home, and heating just their "home office"	123.9	0.6	0.9	Minor adjustments on energy use profile, decrease due to electricity emission factor 25% lower

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Our study has reviewed the carbon emissions of 200 staff, either working from a home office or from an office over the course of 12 months. It is based on current, UK data.

The calculations used in this study have been prepared using good faith. The boundaries of the study include:

The electricity and gas used by staff in offices
Staff travel to and from the office
Electricity and gas used by staff in their homes during the working day

The study excludes:

The embedded energy of the buildings
Conditions outside 'average' UK businesses
The decisions made by staff in the course of their work
Other indirect impacts, such as whether a car at home is used by others, whether staff live further away if they telecommute for part of the week,
Other, beneficial sustainability impacts of home or of office working

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Updated by	Calculation update/QA by Sabbir Sidat/Andy Marsh-Patrick - June 2019 Emission factors update provided by Mike Hardisty - June 2019
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Carbon Calculations

Scenario A - 200 staff work from office in the UK

Travel	Percentage of employees travelling by mode*	Total No. of employees	Average No. of Miles travelled per round trip (miles)*	Total No. of Miles travelled by all employees (miles)	Total No. of trips made per year per employee (travel days)***	Emissions per km (2019 BEIS emissions factors) kgCO ₂ e per mile	Carbon emissions per day (all employees) kgCO ₂ ****	Total Annual Carbon emissions per year (all employees) (kgCO ₂ /yr)	Total Annual Carbon emission per year per employee (kgCO ₂ /yr)
Car*	65%	130	19.5	2539	231	0.27901	708.3	163622.3	818.11
Bus**	9%	17	10.6	184		0.16851	31.1	7176.1	35.88
Rail***	11%	21	34.2	718		0.06622	47.5	10981.2	54.91
Walking	12%	23	1.8	42		0	0.0	0.0	0.00
Bicycle	4%	8	6.6	53		0	0.0	0.0	0.00
Office Environment	Treated floor area (m ²)*****	Energy (kWh/m ²)	Total Energy (kWh/year)	Total Carbon (kgCO ₂ /yr)	Total Carbon per employee (kgCO ₂ /yr)				
Total Gas	1800	97	174600	32100	160.5				
Total Electricity	1800	128	230400	72802	364.0				

TOTALS FOR SCENARIO A

Total Annual Carbon Emissions per employee (kgCO ₂ /yr)	Total Annual Carbon Emissions all employees (kgCO ₂ /yr)	Total Annual Carbon Emissions for Average office per Employee (kgCO ₂ /yr)
Travel by Car	286681.5	1433
Travel by Bus		
Travel by Rail		
Walk to work		
Cycle to work		

* National Travel survey NTS0412 26 July 2018
 ** National Statistics, 2006 and Transwatch UK, 2004
 *** Total No. of trips made per year per employee 231 (This figure is calculated based on no of weekdays in a year, taking into account employee annual leave)
 **** Carbon conversion factor for petrol = 2.30kgCO₂/litre
 *****Total Floor Space 2000m² (10m² per employee), assumed treated area 90% = 1800m², total floor area Assumed best practice

Scenario B - 200 staff work from home in the UK, and heat just their home office - not the whole house

Working Environment	Area of home office space (m ²)*	Energy (kWh/yr)****	Annual Carbon (kgCO ₂ /yr)
Gas**	20	2000	367.70
Electric**		500	157.99
PC***		288	91.00
Small power (printers etc)*****		9.6	3.03

TOTALS FOR SCENARIO B

Total Annual Carbon Emissions per employee (kgCO ₂ /yr)	Total Annual Carbon Emissions all employees (kgCO ₂ /yr)
619.7	123945

* Figures based on 80m² flat however this is reduced to 25m² to compensate for area utilised during the working day
 **Gas and Electricity figure include heating and lighting (Gas figures based on 80 kWh/m² and Electric figures based on 25 kWh/m²)
 ***PC Energy consumption 150W
 ****Hours of operation 1920 hrs/yr (5 days per week, 10 hour days, 48 weeks (Taking account of employee annual leave and public holidays) and a diversity factor of 0.8)
 *****Allow 5W/m² for small



Scenario A - 200 staff work from office in the UK

Building Type	Office type 3 Air-conditioned Standard (CIBSE, 2000)						
Floor Area	Total 2000m ²		Assumed treated[1] area 1800m²				
Gas Consumption	97	kWh/m ²	CIBSE Guide F (Good Practice)				
Electricity Consumption	128	kWh/m ²	CIBSE Guide F (Good Practice)				
Gas/CO ₂ Conversion factor	0.18385	kgCO ₂ /kWh	GHG Reporting Factors 2019				
Electricity/CO ₂ Conversion	0.31598	kgCO ₂ /kWh	GHG Reporting Factors 2019 (elec + T&D + WTT)				
Petrol/CO ₂ Conversion	2.20904	kgCO ₂ /litre	GHG Reporting Factors 2019				
Travel modes	Car	Car - passenger	Bus	Rail	Underground	Walking	Bicycle
No. of trips per person per year	159	21	24	20	9	32	11
Share of trips	58%	8%	9%	7%	3%	12%	4%
No. of miles per commuting journey	10	7.7	5.3	20.4	9.7	0.9	3.3
No. of miles per commuting journey(return)	20	15.4	10.6	40.8	19.4	1.8	6.6
Weighted	19.46333333			34.15862069			

[1] The treated floor area is the gross areas less plant rooms and other areas (e.g. stores, covered car parking, and roof spaces) not directly heated, cooled or lighted.

The Building

The calculations used in this study have drawn upon accepted energy demand benchmarks set out in the Energy Consumption Guide: Energy use in Offices[1] a document produced by the Chartered Institution of Building Services Engineers (from this point onwards this document will be referred to as ECON, 19). This guide sets energy consumption benchmark figures in relation to four generic types of offices. These range from naturally ventilated cellular offices to prestige air-conditioned spaces. For the purposes of this study the 'air-conditioned, standard' office type was chosen which is managed using good practice. Good practice means that the energy consumption is being managed well however there is still scope for further cost-effective savings.

ECON 19 provides the best snapshot of the energy requirements of a typical air-conditioned building. These figures take into consideration energy demand for heating, cooling, fans, pumps, humidification, lighting, office equipment, and catering therefore providing an accurate estimation of the total annual energy demand per square meter.

Staff Travel

These figures represent national average commuting figures as compiled by National Statistics and the Department for Transport, 2003[1]. The average miles per gallon figures were taken from studies produced by the Department for Transport and National Statistics[2]. In the absence of actual data national average data represents the most accurate way of modelling the travel carbon emissions. The total number of travel days made annually per employee was calculated to be 231. This figure takes into consideration weekends, annual leave and public holidays.

Finally the carbon dioxide figures, in relation employee travel were also calculated using DEFRA 2005[3] figures

[1] National Statistics and Department for Transport. Travel to Work in GB Available at <http://www.dft.gov.uk/>

[2] National Statistics and Department for Transport (2006). Energy and the Environment. Available at <http://www.dft.gov.uk/>

[3] The Department for Environment, Food and Rural Affairs (2005) Guidelines for Company Reporting on Green House Gas Emissions. Available at <http://www.defra.gov.uk>

Scenario B - 200 staff work from home in the UK, and heat just their home office - not the whole house

Building Type	2 bed flat, with two external walls	
Floor Area	80m ² average flat size	25m ² space occupied during the working day[1]
Gas Consumption	100	kWh/m ²
Electricity Consumption	25	kWh/m ²
Gas/CO ₂ Conversion factor	0.18385	kgCO ₂ /kWh
Electricity/CO ₂ Conversion	0.31598	kgCO ₂ /kWh
PC Energy consumption	150	W
Small Power Energy Consumption	5	W
Hours of Operation	1920	hours per annum

(Calculated based on a 5 day working week, 10 hour working day, 48 working weeks per year)

The floor area, gas and electricity consumption figures are based on best practice guidelines. Best practice consumption guidelines give outline annual energy consumption figures. These figures, which are taken from large studies, reflect summer and winter conditions.

The floor area under consideration was reduced from 80m² to 25m² to reflect the area for the home actually used during the working day. This is important as considering the whole flat area would inflate the carbon dioxide figures therefore reducing the accuracy of the study. The number of operational hours was calculated based on employees working 48 weeks per year, 5 days per week and 10 hour days, to reflect employee annual leave and public holidays. PC and small power energy consumption figure are based on benchmark values calculated by the Chartered Institution of Building Services Engineers. Gas and Electricity conversion factors are the same as those utilised in the Scenario A

Scenario C - 200 staff work from home, and heat their whole house in winter

Building Type	2 bed flat, with two external walls	
Floor Area	80m ² average flat size	
Gas Consumption	100	kWh/m ²
Electricity Consumption	25	kWh/m ²
Gas/CO ₂ Conversion factor	0.18385	kgCO ₂ /kWh
Electricity/CO ₂ Conversion	0.31598	kgCO ₂ /kWh
PC Energy consumption	150	W
Small Power Energy Consumption	5	W
Hours of Operation	1920	hours per annum

This scenario uses the same input data and assumptions as Scenario B. The only difference is the entire floor area (80m²) of the two bedroom flat is assumed to be 'treated' (i.e. total floor area which is cooled, heated and lighted). Scenario C therefore represents the CO₂ footprint of homeworking employees who heat and light their entire flat during their working day and not just the rooms in which they occupy.