

# Information paper – 6

## CO<sub>2</sub>e emissions due to office waste

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### WHAT COLOUR is YOUR BUILDING?

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This information paper is one of a series of papers written during the preparation of the book **What Colour is Your Building?** ([www.whatcolourisyourbuilding.com](http://www.whatcolourisyourbuilding.com)). The papers do not form part of the book and have not been peer reviewed. They provide further technical detail, analysis and information to support statements made in the book. All of the papers can be downloaded from [www.wholecarbonfootprint.com](http://www.wholecarbonfootprint.com).

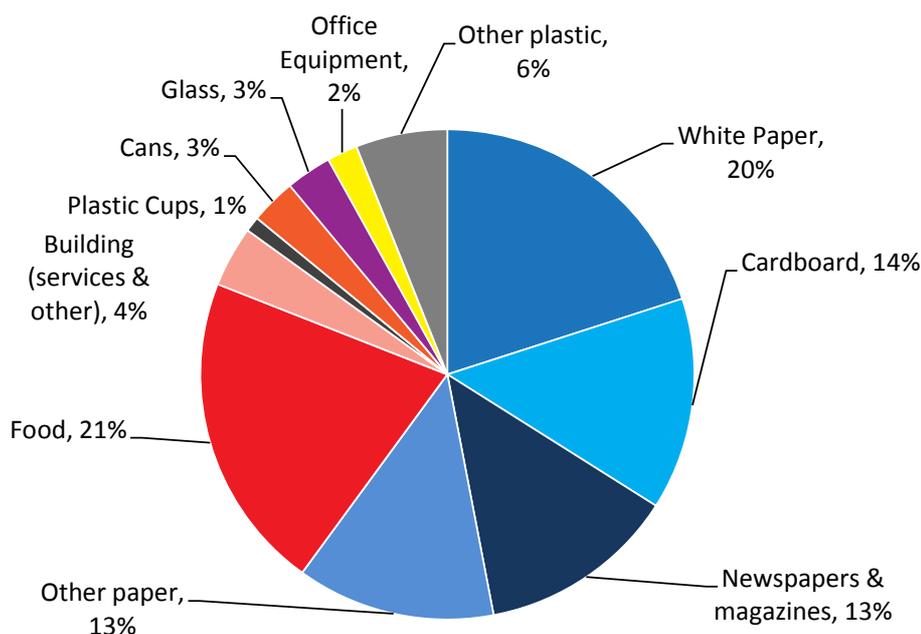
## CO<sub>2</sub>e emissions due to office waste

This information paper provides an estimate of the CO<sub>2</sub>e emissions due to the production of waste annually in typical UK office buildings.

### 1. AMOUNT OF WASTE GENERATED IN OFFICES

Waste from the commercial sector accounts for 12% of all UK waste.<sup>1</sup> Commercial offices occupied by large financial sector companies typically produce around 500 kg of waste per employee each year, 60% of which is paper and cardboard. In 2000 a study found that almost 70% of all waste was disposed of to landfill.<sup>2</sup> Data for 2013 is not available but is likely to be much less due to the widespread recycling of paper, plastics, glass and metals.

Figure 1 shows typical waste generated by weight in offices. Best practice for the generation of office waste is around 200 kg of waste per employee, with 70% diverted away from landfill.



**Fig 1** Typical waste generated in a UK office (source: Waste Watch)

The waste produced and its method of disposal in an office building can be determined from a waste audit. Various audits in Cundall's UK offices between 2010 and 2013 show an average around 130 kg of waste per person per year is generated (with a range of 100 to 175 kg), with over half due to paper and 30% due to food waste.

## 2. CO<sub>2</sub>e EMISSION FACTORS FOR WASTE STREAMS

Table 1 shows emission factors for consumption of materials typically used in offices and their disposal.<sup>3</sup> Depending on the type of waste it can be recycled, used in waste to energy plant, composted or sent to landfill. Open loop recycling is the process of recycling material into other products and closed loop is the process of recycling material back into the same product. Waste sent to landfill slowly decays and produces methane. Some of this methane may be captured to produce energy (heat and/or electricity). The reduction in emissions associated with recycling are attributed to the user of the recycled materials.

	Material consumption (kgCO <sub>2</sub> e/tonne)				Waste disposal (kgCO <sub>2</sub> e/tonne)			
	Primary material	Recycled open loop	Recycled closed loop	Recycled open loop	Recycled closed loop	Waste to energy	Compost	Landfill
Paper	955		680		21	21	21	553
Cardboard	1038		680		21	21	21	553
Food & Drink	3590					21	6	570
Metal cans (mixed)	4964		1,054		21	21		21
Glass	895		508	21	21	21		26
Plastic (average)	3179	693	1,977	21	21	21		34
Plastic - Film	2591	599	1,528	21	21	21		34
Plastic - Rigid	3281	599	2,138	21	21	21		34
Mixed Electrical	1149			21		21		17

**Table 1** CO<sub>2</sub>e emission factors for material consumption and waste disposal (source: DEFRA)

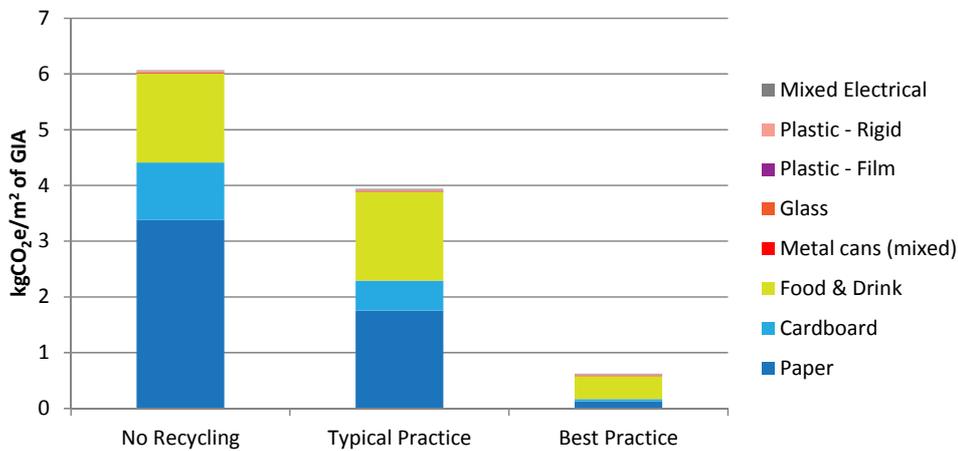
## 3. CO<sub>2</sub>e EMISSIONS DUE TO WASTE IN TYPICAL OFFICES

To put the CO<sub>2</sub>e emissions from material consumption and waste into perspective in a typical office, consider an occupancy density of 1 person per 15 m<sup>2</sup> of GIA, with each person generating 200 kg of waste per annum. The emissions generated will vary depending on how the waste is disposed. Three scenarios are considered:

- **No recycling** – all waste goes to landfill.
- **Typical practice** – 50% of paper, cardboard, plastics, glass and cans are recycled, the remainder goes to landfill.
- **Best practice** – 100% of paper, cardboard, glass and cans are recycled, 75% of plastic is recycled and 75% of food waste is composted.

Figure 2 shows the CO<sub>2</sub>e emissions for the three scenarios. Paper, cardboard and food waste dominate the emissions. Based on the assumptions made, an office that sends all waste to landfill would have emissions of 6 kgCO<sub>2</sub>e/m<sup>2</sup>, which is equivalent to 6% of the emissions due to energy

consumption in a typical office building (100 kgCO<sub>2</sub>e/m<sup>2</sup>). Putting half of the recyclables in the right bins reduces the emissions by a third to 4 kgCO<sub>2</sub>e/m<sup>2</sup>. An office which recycles all its paper, cardboard, plastics and cans, and sends 75% of its food waste to compost has waste emissions of under 1 kgCO<sub>2</sub>e/m<sup>2</sup>.



**Fig 2** CO<sub>2</sub>e emissions in a typical office (200 kg of waste per person) for different recycling scenarios

The analysis has not considered the benefit of reducing the amount of waste generated. Halving waste from 200 kg to 100 kg per person will halve the waste emissions under each scenario above, as well as the emissions to produce the materials in the first place.

Since the total and type of waste generated, and how this is disposed of, can vary so widely between different occupants of the same building, it was not practical to include emissions from waste in the whole carbon footprint benchmarking in the book. If reasonable purchasing policies and waste management practices are implemented then the net emissions from waste disposal could be fairly small in the overall footprint.

However, this simple analysis does show the importance of reducing the amount of materials consumed, and then diverting as much of the waste as possible away from landfill to reduce total greenhouse gas emissions.

**CO<sub>2</sub>e EMISSIONS DUE TO MATERIAL CONSUMPTION IN TYPICAL OFFICES**

The emissions due to producing the materials before throwing them away are much larger than the emissions associated with disposing of them. Using the same assumptions above (200 kg per person), if all the materials were purchased using primary materials (ie. no recycled content) then the emissions per annum are 24 kgCO<sub>2</sub>e/m<sup>2</sup> which is roughly a quarter of the emissions due to energy consumption in a typical office building (100 kgCO<sub>2</sub>e/m<sup>2</sup>). The emissions associated with purchasing uneaten food are 10 kgCO<sub>2</sub>e/m<sup>2</sup>

Paper with no recycled content accounts for 6 kgCO<sub>2</sub>e/m<sup>2</sup>. Purchasing 100% recycled paper reduces this to 4 kgCO<sub>2</sub>e/m<sup>2</sup>.

## Notes

All websites were accessed on 15 June 2013 unless noted otherwise.

1. UK waste statistic from [www.defra.gov.uk/evidence/statistics/environment/waste/kf/wrkf02.htm](http://www.defra.gov.uk/evidence/statistics/environment/waste/kf/wrkf02.htm).
2. Breakdown of waste in financial sector offices from the Waste Watch report *Rethinking waste management to reap rewards - minimising waste for business benefit* published in 2004 based on a site audit of 14 office buildings in 2000. [www.massbalance.org/downloads/projectfiles/1536a-00282.pdf](http://www.massbalance.org/downloads/projectfiles/1536a-00282.pdf)
3. *2012 Guidelines to DEFRA / DECC's GHG Conversion Factors for Company Reporting*, produced by AEA for the Department of Energy and Climate Change (DECC) and the Department for Environment, Food and Rural Affairs (DEFRA). [www.gov.uk/government/publications/2012-greenhouse-gas-conversion-factors-for-company-reporting](http://www.gov.uk/government/publications/2012-greenhouse-gas-conversion-factors-for-company-reporting)

### **The inevitable legal bit**

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