Contents

Introduction

This book has its origins back in 2007. I was working in the nascent field of carbon footprints – working out how much everyday things contribute to carbon emissions – and agreed to walk round a supermarket with a journalist who was writing about low-carbon food. We trailed up and down the aisles with the Dictaphone running as she plied me with questions, most of which I was pitifully unable to answer. 'What about these bananas? How about this cheese? It's organic. That must be better, no? Lettuce must be harmless, right? Should we have come here by bus? How big a deal is food anyway?'

It was not at all clear what a carbon-conscious shopper should buy and on that day we couldn't fill in much of the knowledge. Indeed, the article never happened, and probably just as well. But since then, I began looking long and hard into all kinds of carbon footprints and carried out numerous studies, including one for a supermarket chain. This book – which first came out in 2010 (and has been completely revised for this new 2020 edition) – set out to answer the journalist's questions, and many more besides.

Once I began writing, it was clear that it should be more than just a book about food and travel. I wanted to give a sense of the carbon impact – that is, the climate change impact – of *everything* that we consume and do and think about, both at home and at work. I wanted to help us all to develop a *carbon instinct*.

Although I have discussed the footprint of just under a hundred items, I hope that as you read about these you will gain a sense of where carbon impacts come from, so that you will be able to guesstimate the footprint of more or less anything you come across. It won't be exact, but I hope you'll at least be able to get the number of zeros right most of the time. That, for example, you will have a good idea of how bad bananas are (plotspoiler – not bad at all; they turn out to be a fine low-carbon food, albeit with sustainability issues).

How is this new edition different?

As noted, almost all the numbers have had to be updated for this new 2020 edition. But the big difference, ten years on, is the context has moved on a long way. In 2010, climate change was just 'very serious'. Four years had passed since the *Stern Review*[1] catapulted climate change into the British media and popular consciousness, and it was clearly high time to start getting carbon awareness into daily life. But today we have a full-on climate emergency on our hands as global emissions have carried on rising as if we'd never noticed a problem.[2]

Meanwhile, the science has been getting notably scary: a temperature change of 1.5⁰C (above pre-industrial levels) is now widely acknowledged to be more dangerous than we thought 2⁰C was back then.[3] And we are getting there fast. As I write this, we are at about 1.1⁰C, compared to 0.88⁰C in 2010 (an increase of 25 per cent in ten years). And the effects of climate change are beginning to show around the world: glaciers have shrunk, plant and animal ranges have shifted and trees are flowering sooner, there's been a dramatic loss of sea ice and accelerated sea level rise. We have had more intense climate events, with longer, more intense heatwaves, wildfires and droughts. Methane has been exploding from the melting permafrost, leaving thousands of craters up to 50 metres across.

That's the bad news. But on the very positive side there is finally a sense that humans might wake up to the challenge. The last couple of years have seen Extinction Rebellion (XR) on the streets and Greta Thunberg leading a global movement of striking school kids. The 'debate' over climate change has ended, with media outlets like the BBC no longer giving equal weight to fossil-fuel-funded climate change deniers as to scientists. And climate awareness is beginning to shape decisions in politics and business. We have a long way to go and no time to lose. But compared to 2010 I feel more hope, more fear and a good deal more urgency.

Revising the entries in the book – and writing new ones on things that weren't on the radar a decade ago, like electric bikes, cryptocurrencies and the spiralling demands of ICT – I've tried to keep the tone of the original book. I've tried to keep things fun and practical, though it's harder to joke about climate these days, and I've become less shy in my messages to policymakers, both in this book and when I'm invited to talk to the media. We need to make it impossible for politicians to pretend they don't understand the essentials of the climate emergency.

At the end of this book I've added a new section on what all of us can actually *do* to help deal with climate change. A part of this is about cutting our carbon footprints. The rest has my thoughts on all the other actions we can take to push our governments, workplaces and society to make the big changes we so urgently need. I'm not trying to tell anyone what to do, but if you are asking, I've got some much more detailed suggestions than I had last time.

Some basic assumptions

The world of carbon counting has moved on slightly in recent years, though it still feels a bit like the Wild West. There's a nasty glitch called truncation error (which I discuss at the end of this book) that has led government bodies, and big companies like Apple, Dell and HP, to understate their carbon impact by up to 40 per cent.

My own basic approach to carbon footprinting – which I practise in an academic capacity at Lancaster University and as a business consultant for Small World – has hardly changed, though I like to think I'm better at it now than I was in 2010. And I hope, at least, that there are three fundamental facts we can agree upon:

- We are in a climate emergency.
- It's human-made.
- And we can do something about it.

I hope, too, we can all agree on perspective. A friend once asked me whether his office should dry their hands with paper towels or with an electric hand dryer to reduce their carbon footprint. At the same time, he and his colleagues were flying across the Atlantic literally dozens of times a year. A sense of scale is required here. The flying is tens of thousands of times more important than the hand drying. So my friend was simply distracting himself from the issue.

I want to help you get a feel for roughly how *much* carbon is at stake when you make simple choices – where you travel to, how you get there, whether to buy something, whether to leave the TV on standby and so on. And, of course, where you can get the best return for your effort. This book is here to help you pick your battles. If reading it helps you to think of a few things that can improve your life while cutting a decent chunk out of your carbon, then it'll be a win.

Is carbon like money?

In a sense, yes. Most of the time we know how much things cost without looking at the price tag. We don't have an exact picture, but we know that a bottle of champagne is more expensive than a cup of tea and a lot cheaper than renting a flat. Our financial sense of proportion allows us to make good choices. If I really want champagne, I know I can have it, provided that somewhere along the line I cut out something just as expensive that is less important to me. Our carbon instinct needs to be similarly attuned.

But that's where the similarity ends. Unlike with money, we are not used to thinking about carbon costs. It's also much harder to tell how much we are spending, because we can't see it and it's not written down. Furthermore, we don't personally experience the consequences of our carbon impact because it's spread across nearly seven billion people and many years.

Dip in

All of us in the developed world – and I include myself, of course – have plenty of junk in our lives that contributes nothing to the quality of our existence. It's deep in our culture. Cutting that out makes everyone's life better, especially our own. I got a big win by swapping my solo car commutes for bike rides and lift shares. That works for me, but we are all different.

These pages will, I hope, give everyone some practical and desirable ideas as to how to cut your own carbon footprint, to live a better life through carbon awareness.

As to how to use this book – it's designed to dip in and flit around. But it's fully indexed and the endnotes will often give you further information and links, so I hope it will also work as a reference. Please talk about it with friends – and let me know how it could be improved (info@howbadarebananas.com).

Mike Berners-Lee
Lancaster, August 2020

A brief guide to carbon footprints

'Carbon footprint' is a phrase that is horribly abused.[1] I want to make my definition clear. Throughout this book, I'm using 'footprint' as a metaphor for the total impact that something has. And I'm using the word 'carbon' as shorthand for all the different global warming greenhouse gases.

So, I'm using the term 'carbon footprint' as shorthand to mean the *best estimate* that we can get of the *full climate change impact* of something. That something could be anything – an activity, an item, a lifestyle, a company, a country or even the whole world.

What's CO_2e?

Human-made climate change, also known as global warming (or global heating), is caused by the release of certain types of gas into the atmosphere. The dominant greenhouse gas is carbon dioxide (CO_2), which is emitted whenever we burn fossil fuels in homes, vehicles, factories or power stations.

But other greenhouse gases are also important. Methane (CH_4), for example, which is emitted mainly by agriculture and landfill sites, is 28 times more potent than carbon dioxide, if you compare the impact the two gases will have over a period of 100 years.

Even more potent, but emitted in smaller quantities, are nitrous oxide (N_2O), which is released mainly from industrial processes and farming and is about 265 times more potent than carbon dioxide over that timescale, and refrigerant gases, which are typically several thousand times more potent than carbon dioxide.

In the UK, the total impact on the climate breaks down like this: carbon dioxide (81 per cent), methane (11 per cent), nitrous oxide (5 per cent) and refrigerant and other gases (3 per cent).

While these are the factors to apply when you look at the effect these gases have over a 100-year period, the calculations are a bit more complicated, as gases work in different ways. Methane, for example, is much more short-lived than carbon dioxide. This means it does most of its damage in the first 10 of those 100 years, by which time the CO_2 has only had about one-tenth of the effect it will have over the course of the century. So, if you are interested in looking at shorter timescales, methane is more than 28 times more powerful than CO_2.

Given that a single item or activity can cause multiple different greenhouse gases to be emitted, each in different quantities, a carbon footprint if written out in full could get pretty confusing.

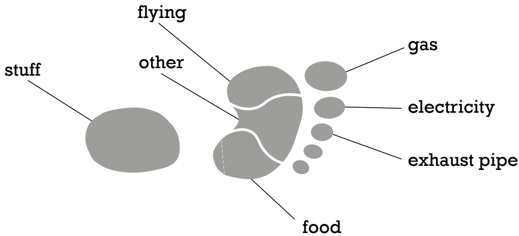
To avoid this, the convention is to express a carbon footprint in terms of **carbon dioxide equivalent (CO_2e)**. This means the total climate change impact of all the greenhouse gases caused by an item or activity expressed in terms of the amount of carbon dioxide that would have the same impact over a 100 year period.

Beware carbon toe-prints: direct and indirect emissions

The most common abuse of 'carbon footprint' is to miss out some or even most of the emissions caused. For example, many online carbon calculator websites will tell you that your carbon footprint is a certain size based purely on your home energy and personal travel habits, while ignoring all of the goods and services you purchase.

Similarly, a magazine publisher might claim to have measured its carbon footprint, but in doing so looked only at its office and cars while ignoring the much greater emissions caused by the printing house that produces the magazines themselves. And countries do this, too, in their carbon calculations, often omitting to include the footprints of imported goods (from fashion goods to steel and cement) or whole sectors like aviation and shipping.

These kinds of carbon footprint are actually more like carbon 'toe-prints' – they don't give the full picture.



The footprint of a lifestyle is bigger than its toe-print.

Much of this confusion comes down to the distinction between 'direct' and 'indirect' emissions. The true carbon footprint of a plastic toy, for example, includes not only direct emissions from manufacturing and transportation of the toy to the shop; it also includes a whole host of indirect emissions, such as those caused by the extraction and processing of the oil used to make the plastic. Tracing back all the things that have to happen to make that toy leads to an infinite (and I am using that word carefully) number of pathways, many of them tiny but important when they are all added together.

To give another example, the true carbon footprint of driving a car includes not only the emissions that come out of the exhaust pipe, but also all the emissions that take place when oil is extracted, shipped, refined into fuel and transported to the petrol station, as well as the substantial emissions caused by producing and maintaining the car.

The essential but impossible measure

The carbon footprint, as I have defined it, is the climate change metric we need to look at. The dilemma is that it is almost impossible to measure. We don't stand a hope of being able to understand how the impact of our bananas compares with the impact of all the other things we might buy instead unless we have some way of taking into account the farming, the transport, the storage and the processes that feed into those stages.

So how should we deal with a situation in which the thing we need to understand is impossibly complex?

One common response is to give up and measure something easier, even if that means losing the real figures you are after. The illusionist Derren Brown refers to one of his core techniques as the *misdirection of attention*: by focusing his audience on something irrelevant, he can make them miss the bit that matters. This is quite common among companies – or even governments – who declare their carbon footprint. For example, we may find an airport waxing lyrical about the energy efficiency of its buildings while failing to discuss the flights that it facilitates. Or a travel company boasting of its sustainable accommodation, again without mentioning flights (yes, flights are often the elephant in the room).

The approach of this book is to make the most realistic estimates that are practical, and to be honest about the uncertainty. I've tried to get the full picture, wherever possible, and above all to get the orders of magnitude clear.

However, huge uncertainty remains and, like so much science, every carbon footprint in this book is a best estimate. So when you see our number of '3.2kg CO_2e' for a cheeseburger, what it really means is 'probably between 1.5 and 5kg CO_2e and almost certainly between 1kg and 10kg CO_2e'. That is the nature of all carbon footprints. Don't let anyone tell you otherwise.

Some of the numbers are even less certain, especially where I'm trying to bring a sense of scale to important questions that are almost impossible to quantify. Examples include the footprint of having a child, sending an email, or a country going to war. These calculations and assumptions are highly debatable, but I've included them because the thought process can be a useful reflection and because they can still help us to gain overall perspective.

Let me be emphatic that the uncertainty does not negate the exercise. Real footprints are *the essential measure* and nothing short of them will do. The level of accuracy that I have described is good enough to separate out the flying from the hand drying.

And, on the subject of flying, one further note is required. For many of us in the developed world, flights represent a significant percentage of our individual carbon footprint. Even if we take a short-haul holiday flight just once a year, that can represent a tenth of our footprint. If we take a long-haul flight, say from London to New York, or London to India or Thailand, it may be as much as a half of our footprint. Anyone who takes regular business flights across the Atlantic is likely to have at least double the average UK carbon footprint.

The aviation figures may even be worse than that, as emissions from planes in the sky have a greater impact than those from burning the same amount of fuel at ground level. In this book I have multiplied all aviation emissions by 1.9.[2] This is possibly a conservative estimate. Some experts believe the true impact of high-altitude emissions could be as much as four times that of regular emissions. (There is more technical discussion of the methodologies I have used for this on p216.)

Making sense of the numbers

So far we've established what we need to try and measure, but a tonne of carbon is still a highly abstract concept.

What does a tonne of CO_2e look like?

Well, if you filled a couple of standard-sized garden water butts to the brim with petrol and set fire to them, about a tonne of carbon dioxide would be directly released into the atmosphere. (The carbon footprint of burning that petrol by driving is a bit more than that, for reasons explained later). If you did the same with a pint milk bottle, that would release just over a kilogram of CO_2, and if you burned a blob the size of a chickpea, that would release about a gram.

1000grams (g) = 1 kilogram (kg)

1000 kilograms = 1 tonne

To give some sense of scale, the average UK person currently has an annual carbon footprint of around **13 tonnes** (down from 15 tonnes ten years ago due mainly to more renewable electricity generation).

This is about the average in western Europe. The Americans and Australians have a higher footprint, as do many of the oil-producing countries in the Arabian Gulf. The less developed world has a far lower footprint. It takes the average American just a couple of days to clock up the annual footprint of the average Nigerian or Malian. The global average Is just over 7 tonnes per person.

As mentioned earlier, international figures can vary enormously according to the methodology. You get smaller numbers (toe-prints) if you only include the obvious bits of your footprint such as household energy and travel or you miss out emissions on goods you buy that are manufactured overseas, and omit aviation and shipping.

A 5-tonne lifestyle?

To offfer a sense of perspective, I have adopted a **5-tonne lifestyle** as another unit of measure for this book. In 2009, I used a 10-tonne lifestyle but things have moved on since then and a 5-tonne lifestyle now feels more appropriate and both possible and necessary. I refer to it from time to time because it gives an alternative and sometimes clearer way of conceiving of those abstract kilograms and tonnes of CO_2e.

There is not much that is particularly magic about a 5-tonne lifestyle – that is, a lifestyle causing 5 tonnes of CO_2e per year. It's certainly not a long-term sustainable target for everyone in the world, but if everyone in Europe cut to 5 tonnes right now, it would be a big step forward on the journey to a low-carbon world.

One way of thinking about the footprint of an object or activity is to put it in the context of a year's worth of 5-tonne living. For example, a large cheeseburger (3.2kg CO_2e) represents about 6 hours' worth of a 5-tonne year. If you drive a fairly thirsty petrol car for 1000 miles (1.3 tonnes CO_2e), that is just over three months' ration. If you leave a couple of the (now old-fashioned) 100-watt incandescent light bulbs on for a year, that would be 44 days used up. One premium economy return flight from London to Hong Kong burns up around 4.5 tonnes CO_2e. That is nearly a whole year of the 5 tonne lifestyle used up in one go, leaving just 500kg CO_2e left in the budget for *everything* else that year: food, heat, buying stuff, healthcare, use of public services, your contribution to the maintenance of roads, any wars around the world that your government is involved in (like it or not) – *the lot*.

You might be wondering whether there are better ways of spending this or any other sized budget than blowing it on burgers, driving or flying. If that question is of interest, this book is for you.

The world's remaining CO_2 budget

Since, unlike the other greenhouse gases, CO_2 lasts more or less forever in the atmosphere, it is possible to estimate a *total overall budget* for the stuff we can burn in order to stay within any particular temperature limit. This gives us another important comparator to help with that sense of perspective.

Estimates vary, but as of 2018, the *remaining budget* for keeping the world to within 1.5 degrees of warming, is about 400 billion tonnes CO_2 . This is a frighteningly small figure, representing a tiny fraction of the emissions we have burned to date and only just over *ten years*' of CO_2 emissions at today's levels.

(Remember, too, that it is important to remember that a CO_2 budget is not the only calculation. We need simultaneously to take strong action on all the other greenhouse gases. This is why I've used the wider CO_2e metric for this book.)

Can carbon be offset?

'Offsetting' is a seductive concept, especially when it is offered at prices as low as £3 per tonne CO_2e – which would work out at £40 per year for the average UK person to 'offset' and salve their entire carbon conscience. At that rate, the whole climate crisis could be solved for a trivial 0.2 per cent of world GDP. If only that were true. Sadly, it is nonsense.

All such cheap 'offset' options turn out to be fatally flawed and/or fundamentally limited in scope. They are often about things like solar power or tree planting that we need anyway to reach carbon zero – and we can't just use them to counterbalance our emissions.

The only genuine offset is removal of CO_2 or other greenhouse gases – taking them out of the atmosphere and storing them permanently. These 'negative emissions' are expensive and their technologies are mainly in their infancy. But they will be needed in our response to climate change and they are covered in a final section (see p.185).

But there is no substitute for cutting our carbon footprints.

Less than 10 grams

A pint of tap water

0.2g CO_2e one pint of tap water
18kg CO_2e a year's tap water for a typical UK citizen

A year's water for one person is the same as a 35-mile drive in an average car.[1] That includes drinking, washing, cleaning – the lot

Unlike the bottled alternative, which has over 1000 times the impact (see *A litre-bottle of water*, p.54), cold tap water is not a major carbon concern for most people. In the UK, the provision of household water accounts for about 0.15 per cent of the country's carbon footprint.[2] Interestingly, if a pint of tap water is poured down the drain, its footprint triples to 0.6g because it is more carbon intensive to treat waste water than to supply the water in the first place.[3] If the eventual fate of the drink is to be flushed down the loo along with another 6 litres, that takes the total to about 7g CO_2e.

Whilst tap water doesn't have a huge footprint, climate change is now causing serious water stress in many places. After three years of drought, Cape Town only avoided running out in 2018 by restricting water use to just 50 litres per person per day (the UK has an average of 140 litres per day, the US 375 litres). In the UK as a whole, it looks unlikely that we will face shortages of water, even though some redistribution might be called for.

Tap water itself is one thing, but heating it up is another matter, accounting for a decent chunk of the typical person's emissions (see *A shower* p.46, and *Desalinating water* p.90).

An email

0.03g CO_2e spam email picked up by your filters
0.2g CO_2e short email going from phone to phone
0.3g CO_2e short email sent from laptop to laptop
17g CO_2e long email that takes 10 minutes to write and 3 minutes to read, sent from laptop to laptop
26g CO_2e an email that takes you 10 minutes to write, sent to 100 people, 99 of whom take 3 seconds to realise they should ignore it and one of whom reads it[4]

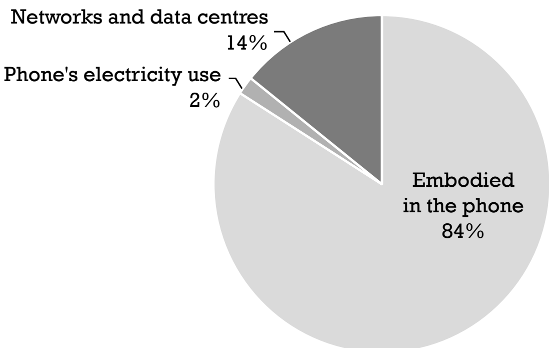
Our average email traffic is equivalent to driving 10–128 miles in a small petrol car

The footprint of an email comes from the electricity needed to power the kit used at each stage of the process: the device it is written on, the network that sends it, the data centre it is stored on and finally the device that you read it on. The devices at each end are the dominant factors, even if you send big attachments. As the pie chart opposite shows, the embodied emissions of a smartphone represent 84 per cent of a short email's carbon footprint. That percentage would be higher still for a laptop, and a step up again for a desktop computer. (For more on the footprint of buying and using a smartphone, see p.116, and, for a computer, p.129).

In 2019, the world's 3.9 billion email users sent 294 billion emails each day, of which 55 per cent were spam.[5] So the average email user received about 75 emails per day (of which 41 were spam). If you received this number, with all the non-spam being emails that take the sender just 10 seconds to write and you a mere 5 seconds to read, then the carbon footprint of writing, sending and reading would be around 3kg CO_2e per year, or 12 million tonnes CO_2e globally. On the other hand, if they were all more thoughtful emails, taking the sender 3 minutes to write and you a full minute to read, it would come to 37kg per year, or 150 million tonnes globally.[6] This would mean that email accounts for about 0.3 per cent of the world carbon footprint. Luckily this is not the case.

Although the majority of incoming emails sent are spam, these messages account for only around 2 per cent of the total footprint of your email account because, although they are a pain, you deal with them quickly. In fact, you never even see most of them if you have decent filters installed. A genuine email has a bigger carbon footprint simply because it takes more time to deal with. So, if you are someone who needlessly copies people in on messages just to cover your own back, the carbon footprint is one more good reason for changing your ways. You may find that after a while everyone at work starts to like you more, too.

The long email sent from a laptop has one-twentieth the footprint of a letter (see p.49). That looks like a carbon saving unless you end up sending 30 times more emails than the number of letters you would have posted in days gone by. Lots of people do – and perhaps still send the occasional letter as well. This is a good example of the *rebound effect* – how a more efficient technology typically results in higher-carbon living because our usage generally goes up by even more than the efficiency improvement.



Total carbon footprint of a short email sent from phone to phone over WiFi and taking 10 seconds to write and 5 seconds to read

If the great quest is for ways in which we can improve our lives while effortlessly cutting carbon, surely spam and unnecessary email have to be very high on the hit list, along with old-fashioned junk paper post. In 2019, Ovo Energy ran a campaign to stop people sending needless 'Thank you' emails. I supported it as a great way into bigger conversations about our climate emergency, with the realisation that there is carbon in everything and the benefits of cutting every kind of junk out of our lives. But of course the actual carbon to be saved from reducing the smallest emails of all is tiny – and it can also be wonderfully important to say thank you!

If only email were taxed. Just a penny per message would surely kill most spam. The funds could go to tackling world poverty, or even renewable energy. The world's carbon footprint would go down by 2.4 million tonnes,[7] the average user would be saved a couple of minutes of time every day and there would be a £480 billion annual fund. If 1p turned out to be enough to push us into a more disciplined email culture – with perhaps half the emails sent – the anti-poverty fund would be cut in half, but our lives would still be significantly better. The (small) carbon saving would be an additional bonus.

A Google search

0.5g CO_2e one simple search
5.6g CO_2e 5 minutes web browsing from a smartphone
8.2g CO_2e 5 minutes web browsing from a laptop[8]

It's good to stay informed

Based on Google's estimate for the energy used at their end (and adding a bit for your phone or computer and the network), a simple web search is about 3 seconds' worth of a 5-tonne footprint, while a 5-minute browse on your laptop is around 50 seconds' worth.

To get these figures, I started off with Google's estimate from 2009 of 0.2g CO_2e for the electricity they use at their end when you put in a single search and guesstimated this is now twice as efficient.[9] I added

30 seconds use of a smartphone while you tap in the search, wait for the result and scan it for what you want, including the energy used and the embodied carbon; the network (assuming you use mobile data) adds another 0.4g, bringing the total to 0.5g. for the high-end figure, I assumed use of a reasonably efficient laptop, which uses more power than the phone and (more importantly) has a much higher embodied footprint in its manufacture. Almost a quarter of the laptop search comes from the WiFi.

If you search for information about the footprint of web searches, you'll find blogs and articles all coming up with different figures based on different assumptions. Researchers don't always agree, but the figures here should be in the right ballpark.

Google is estimated to deal with 3.5 billion enquiries per day (up from 200-500 million in 2010).[10] If we go with the figure for the footprint of a single search on your smartphone over mobile data, Google-searching accounts for almost 630 thousand tonnes CO_2e per year. That sounds like a big number, but is less than 0.0001 per cent of humanity's carbon footprint. We can probably relax about it. Reading the stuff we find, however, is an altogether more carbon-hungry activity – see *A computer and using it*, p.129.

A text message

0.8g CO_2e single text message[11]

A text is no big deal – the world's 9.5 trillion texts account for just 0.01 of global emissions

Around the world, about 9.5 trillion texts are sent every year.[12] The most obvious part of a text message's carbon footprint is the power used by your phone while you type – and by your contact's phone while they read what you've written. If you take a minute between you to type and then read the message, and you each have phones that consume 2 watts of power when in use, the footprint of the electricity used will be about one fiftieth of a gram. However, this is only about 2 per cent of the story. Again, the main part of the footprint is the embodied carbon in the phones themselves, and the fact that you wear them out a little bit every time you use them (see p.116). The transmission of a 140-character message across the network turns out to be tiny – about 0.001grammes.

The average UK mobile phone user sends out two and a half text messages per day and all of the UK sends 74 billion texts per year; the average American adult sends 15 text messages per day.[13] People are also increasingly shifting to online messaging apps like WhatsApp, Facebook Messenger and WeChat, which have very similar footprints to text messages, although the network footprint is a tiny bit bigger. But overall they also come to 0.8g per message if each one takes you 30 seconds to write and the receiver 30 seconds to read.

And what does this all add up to? A 7-million-tonne global footprint. Which sounds a lot, but is just over 0.01 per cent of the world's carbon footprint. In other words, texting is not a big deal.

A plastic carrier bag

3g CO_2e very lightweight variety
10g CO_2e heavier supermarket bag[14]
50g CO_2e heavyweight 'bag for life'

Plastic bags are bad for many reasons – but carbon isn't chief among them

Plastic is a dazzling example of how we humans invent things and start using them without really understanding the impacts. But at last we seem to have woken up to the hideous plastic pollution problem that we have unthinkingly inflicted on the world over the last fifty years. Since the first edition of *Bananas*, the UK government (and many others) have applied a mandatory plastic bag levy, and this has sent such a signal that everyone is cutting down on plastic bags – even people who are not worried about either the cost or the environment.

All this is good, but has it helped us get to grips with our climate emergency? Not really.

Plastic bags have a pretty low-carbon footprint. If you use six old-fashioned bags per week, it works out at about 3kg per year – the carbon footprint of eating just one beefburger. Or, to put it another way, when you carry your shopping home in a disposable plastic bag, the bag is typically responsible for about one-thousandth of the footprint of the food it contains. (Note that if you get less than five uses out of a heavy reusable bag, you'd be better off, in carbon terms, with disposables.)

Of course, there are other good reasons to ditch single-use plastic bags. Plastic has a habit of hanging around in the ecosystem, where it can sit for hundreds of years, killing fish and being ugly. When we talk about it degrading over time, all we really mean is that it falls into smaller and smaller pieces; as far we know, we are stuck with it forever. And we use an awful lot of it. If all the world's discarded plastic were cling film, you could wrap the world up one and a half times.[15]

How to get rid of plastic, then? Burning releases nasty toxins – as well as carbon – although the technology is improving. From a purely climate change perspective, landfill is not too bad. The bags won't degrade, so all those hydrocarbons are returned to the ground where they came from for fairly long-term storage. But landfill is nasty for other reasons (see *1kg of rubbish to landfill,* p.66).

Drying your hands

0 CO_2e letting them drip
2g CO_2e Dyson Airblade
10g CO_2e one paper towel
11g CO_2e standard electric dryer

If you use office toilets six times per day, your hand drying could produce 3–24kg per year

'What's the greenest way to dry my hands?' is a frequently asked question, so I'll answer it – even though (as I mentioned in the Introduction) if you want a lower-carbon lifestyle you really should be asking about something more important.

At the low-carbon end of the scale is drying your hands with a Dyson Airblade. This dryer does the job in about 15 seconds with 1.6 kW of power.[16] Its secret is that it doesn't heat the air, it just blows hard. This makes it far more efficient than conventional hand dryers.

At the high end are paper towels and conventional heated hand dryers. The paper towels are based on 10g of low-quality recycled paper per sheet and only one towel used each time.[17] (Of course, if you use two towels the footprint doubles.) Conventional hand dryers are around four times worse than the Dyson because they take a shade longer and use around 6 kW of power (it takes a lot of energy to create heat). Despite this, the conventional hand dryers are now almost as good as a single paper towel due to the UK grid being far less carbon intensive than it was 10 years ago (see *A Unit of Electricity*, p.51).

Right at the bottom of the scale comes not drying your hands at all, or indeed using a small hand towel that is reused many times in between low-temperature washes. I am not a hygiene expert but I'm told that neither option is good from that point of view, and certainly not in multi-user washrooms at times of pandemics. They may even end up adding to the already substantial footprint of the health service (see p.135).

Finally, drying hands usually follows washing them. For this, warm water is higher carbon but useful for hygiene reasons, and mixer taps are vastly superior to the traditional British twin taps that involve you filling the whole sink or dancing your hands between the two and trying not to get scolded.