THE CARBON FOOTPRINT OF INFORMATION AND COMMUNICATION TECHNOLOGY

Electronic messaging, as clean and green as it seems, actually has a carbon footprint. But are some methods of electronic communication less 'carbon heavy' than others? Should we use SMS text messages, an instant message via an app or send an email? Do these methods of communication share the same environmental impact? Whilst SMS texts use the frequencies of conventional telephony, instant messages and emails use internet data flows. These different ways of processing data expend different amounts of energy.[1]

The ICT sector is constantly evolving in terms of usage, equipment and improvements in energy efficiency meaning it can be challenging to keep information about its carbon footprint information up to date.[2] This can result in conflicting and contradictory information being published on line and in the media.[2] This article is based on the most up-to-date information I can find, although it may be out of date by the time you read it!

What contributes to the carbon footprint of ICT?

There are four main areas that contribute CO_2 emissions from ICT:

- Hardware – smartphones, computers, monitors, printers, modems, routers, and cables. To produce this equipment requires electricity and raw material extraction (often rare earth metals), manufacturing, transportation, and distribution.[6] The environmental cost of electronic equipment is high, as it wears out quickly, requiring end-of-life treatment, often ending up in landfills and forcing consumers to buy more (the production-disposal cycle). Currently, user devices account for the largest chunk of the sector's overall carbon footprint.[2]

- Use of equipment – electricity needed to charge phones or laptops, and to use routers or modems.[6]

- Data transfer – 4G and 5G network transmitters, as well as cable internet and wi-fi.[6]

ALISON JONES
York and Scarborough Teaching Hospitals NHS Foundation Trust

- Data storage – servers that store terabytes of data consume huge amounts of electricity.[6] The cloud and all data available on the internet contribute to ICT's overall carbon footprint but is ultimately only a small share.[2]

The carbon footprint of emails*

The carbon impact of an email is extremely variable depending on the configuration in which the email is written and read, to how many people, with or without attachment, and what type of device is used. But to give you an idea of scale see the table below.[5]

The higher carbon footprint associated with the PC/wi-fi model is overwhelmingly due to the depreciation of the devices used to write and read the email (92%). The electricity consumption of reading and writing the email contributes only 7% of the total CO_2 emitted, whilst the transport and storage of the data contributes only 1% to the total carbon footprint. But wi-fi actually consumes 20-times less energy than 4G, so when using a smartphone, you can reduce energy consumed by connecting to wi-fi to read and write your emails, and especially to download attachments.[5]

Excluding the hardware contribution, the carbon impact of each individual email sent is actually minuscule. But consider how many emails are sent and received each day.

And even a tiny amount of CO_2 becomes significant when multiplied up by the number of emails sent every year.

The carbon footprint of SMS and instant messages

So if you just want to send someone a short message, how does the carbon footprint of e-mail compare to SMS text messages? Two recent calculations estimate an SMS text to emit 0.014 gCO_2[3] and 0.00215 gCO_2[4] (and suggests an average email emits 4 g CO_2[3]). Although the SMS calculations are quite different, this does suggest that SMS uses less energy and emits less CO_2 than emails.[1]

Regarding instant messages, this has been less well studied. However, since messaging systems such as MS Teams use internet networks, it's reasonable to think that their carbon footprint is closer to the one of an email than to an SMS.[1]

The carbon footprint of downloads and streaming

Stepping outside of the office (or lab) for a moment, a 2020 article published by telecommunications company Ericsson[2] provides some interesting figures to help us understand the differing electricity requirements of digital activities undertaken on different devices.

The electricity required for streaming videos and downloading music varies widely

The carbon footprint of emails*

Attachment (Email size)	Device / Connection	Recipients	Carbon footprint
No (10 KB)	Smartphone / 4G	1	0.4 gCO_2
Yes (10 MB)	Smartphone / 4G	1	1.8 gCO_2 (x4.5)
Yes (1 MB)	PC / Wi-Fi	1	*3.3 gCO_2 (x8.25)
No (10 KB)	PC / Wi-Fi	10	4.9 gCO_2 (x12.25)

depending on your device: phone, tablet, computer or screen. The electricity required is not directly related to usage, as the connection to networks and data centres is fairly constant. In a rough comparison, streaming 400 two-hour movies on a laptop connected to an external screen would consume as much electricity as a modern fridge does in a year. If the streaming was on a smartphone, 2,900 films could be streamed using the same amount of electricity.[2]

How to reduce your ICT carbon footprint[2, 5, 7]

The most significant contributor to your ICT carbon footprint is the production-disposal cycle. Therefore, the most important thing you can do to reduce this is to take care of your device so it can be used for many years.

- Use your smartphone or other ICT devices longer before upgrading
- Recycle or reuse ICT equipment
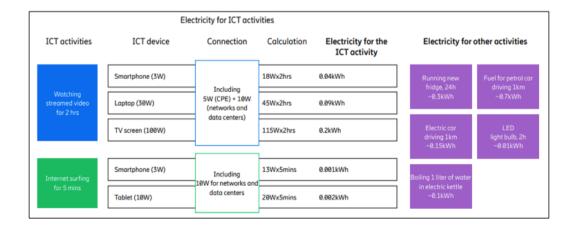- Consider buying reconditioned devices, instead of new

The electricity consumed whilst using your device is the most significant day-to-day contributor to CO_2 emissions. Where possible, source your electricity from renewable sources, and consider ways you can reduce your electricity usage by:

- Consuming digital services on smaller devices

- Charge batteries with electricity from renewable sources
- Ensure power-saving or sleep mode is enabled on your devices, and turn them off when not in use (don't leave in stand-by)
- Make your searches green: "Green" search engines (e.g. Ecosia) use the profits generated from your searches to plant trees around the world!
- Save commonly visited websites in your favourites – avoid going via a search engine

Data transfer and storage emits relatively very little CO_2 when calculating the overall carbon footprint, but there are still good habits you can get into to reduce your impact:

- Use Wi-Fi instead of 4G/5G for downloads and streaming
- Be rational about sending e-mails
    o "Think before you thank"
    o Limit recipients and avoid "reply to all"
    o Consider sending an SMS instead
    o Walk up the corridor or pick up the phone!
    o Unsubscribe from irrelevant e-mail lists
- Reduce the carbon weight of your e-mails:

Electricity for ICT activities

ICT activities	ICT device	Connection	Calculation	Electricity for the ICT activity	Electricity for other activities	
Watching streamed video for 2 hrs	Smartphone (3W)	Including 5W (CPE) + 10W (networks and data centers)	18Wx2hrs	0.04kWh	Running new fridge, 24h ~0.3kWh	Fuel for petrol car driving 1km ~0.7kWh
	Laptop (30W)		45Wx2hrs	0.09kWh	Electric car driving 1km ~0.15kWh	LED light bulb, 2h ~0.01kWh
	TV screen (100W)		115Wx2hrs	0.2kWh		
Internet surfing for 5 mins	Smartphone (3W)	Including 10W for networks and data centers	13Wx5mins	0.001kWh	Boiling 1 liter of water in electric kettle ~0.1kWh	
	Tablet (10W)		20Wx5mins	0.002kWh		

- o Lighten your signature: choose a light image, or even go logo-free
- o Avoid attachments or compress them as much as possible. Use a file-sharing platform such as One-Drive, or just include a link
- o Set your emails to use Plain Text by default. Use Rich Text if you need italics or bold. Reserve HTML for e-mails that require extra formatting. Plain Text is up to 12 times lighter than HTML
- Store data in a cloud, rather than on hardware.
  - o Choose a "conscious" cloud: check whether your provider is using renewable electricity to power their data centres. All of the Big Three providers (Google, Amazon and Microsoft) have pledged to decarbonise their clouds.

References

1 What is more sustainable: an email or an instant message? – ATRIUM (atrium-sofia.com)

2 A quick guide to your digital carbon footprint – Ericsson (2020)

3 Mike Berners-Lee, "How bad are bananas"

4   Frédéric Bordage from GreenIt.fr

5 Email Carbon Footprint: Myths, Realities, and Solutions (sami.eco) (2023)

6 What is the digital carbon footprint? – Plan Be Eco

7 What is Your Online Carbon Footprint and How to Reduce it? | OVO Energy