# Sustainability Workshop

Techbuyer

**Techbuyer are specialists in data centre technology and a leading provider of sustainable IT solutions. It is our mission to extend the life cycle of IT hardware. By refurbishing, upgrading and repairing servers, we keep quality technology in use.**

As part of today's presentation, we've put together some materials to further explain the relationship between technology and our environment.

# How does ‘tech’ tie to climate change?

Our technology is responsible for huge amounts of greenhouse gas emissions. In this article we’ll discuss where these emissions come from and what they mean for climate change.

**What is climate change?**
In short, manmade climate change refers to the increase in the planet’s average temperature due to the emissions from our activities since the industrial revolution (from 1900 onwards). The consequences of this will be felt for a long time – and some forever – but this isn’t just a problem for the future: it is already wreaking havoc across the world. From extreme weather and wildfires to drought and disease – many of today’s major issues are caused by our changing climate.

**The role of tech**
It’s not just manufacturing that creates greenhouse gas emissions, our behaviour when using tech makes a big difference too: streaming, using social media and downloading files are all powered by huge data centres and networking infrastructure with massive environmental impact.

***Data centres are responsible for:***

- **A LOT of electricity usage**
  An estimated 230-Terawatt hours in 2018, but this is predicted to rise drastically in the next 10 years (with the growing use of AI) to potentially six times this!

- **Creating piles of electronic waste**
  Replacing hardware in data centres is a significant contributor to the escalating issue of ‘e-waste’: 53.6 million tonnes of it were generated in 2019. Once it makes it into the environment, toxic heavy metals from e-waste have widespread negative impacts on both animal and human health.

- **A LOT of water usage**
  In just one year they can use enough water to fill more than 250,000 swimming pools! Servers generate a lot of heat and need to be kept at the right temperature to work properly so water is used to keep them cool. This level of water use contributes to global water scarcity that affects around 1.2 billion people.

**FACT**
Humanity has pumped out so much groundwater that it has begun to affect the Earth’s rotation!

# What can we do to combat global warming?

So we've established that climate change could have severe consequences on our planet and that data centres are part of the problem.

***So what can we do?***

**FACT**

The song Despacito was streamed 4.6 billion times in 2017, using as much electricity as five African countries yearly use*

*Chad, Guinea-Bissau, Somalia, Sierra Leon and Central African Republic

## Change our behaviours

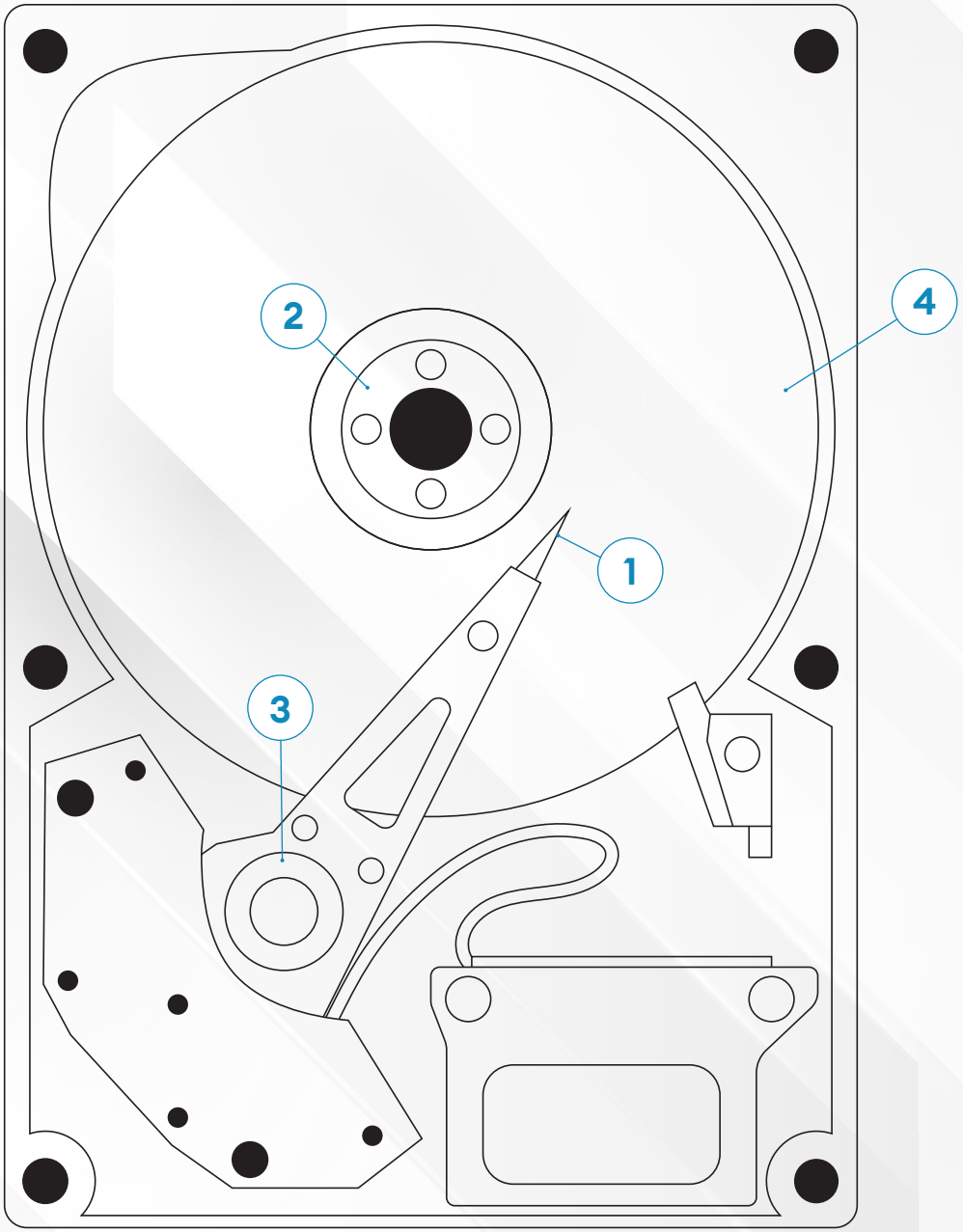
Knowing that the hardware that makes our internet 'work' is responsible for huge greenhouse gas emissions, the first step is to look at how we can reduce the amount of data we use. ***So, how do we do this in practice?***

### Save on streaming

- → Download songs you regularly stream to avoid repeated data transfer
- → Lower the quality or resolution when you do need to stream to cut the amount of data transferred
- → Use wi-fi rather than mobile data where possible to reduce network emissions

### Careful when communicating

- → Use voice calls rather than video and texting rather than instant messaging to reduce the amount of data transferred via the internet
- → Unsubscribe from email newsletters you no longer read and delete old emails in your inbox to free up data saved on servers




# What's Inside?

Taking a look at what's inside a Hard Drive – the standard for PC storage for over 30 years!

**1 Read and Write Head**
Attached to the end of the actuator arm is a tiny head held in place by 2 tiny strips of metal. This head is just 5nm (0.0000005cm) away from the platter – close enough to either 'read' (transform the magnetic field into electricity) or 'write' (transform electric signals into magnetic field).

**2 Spindle**
The electric drive that spins the platter. Different drives will spin at different speeds (RPM – revolutions per minute). Higher RPM drives are faster but create more noise and use more energy. Can you work out what speed your drive is based on the information on the front?

**3 Actuator Arm**
This automated arm is responsible for moving the head that reads and writes data to the platter. With the spindle already moving at high speed, this arm has to move precisely but also very fast: up to 100km/h relative to the platter! This movement is achieved with the help of a strong magnet made of a rare metal called Neodymium.

→ **Watch a slow motion video of the arm in action!**

**4 The Platter**
The 'Disk' in Disk Drive is properly known as a 'Platter'. They are made of glass or aluminium (formerly ceramic) coated with multiple layers of different compounds. Data is written onto the platters by magnetising 'grains' of Cobalt alloy on their surface – different regions of 'grains' will be magnetised in different directions. Depending on which direction the regions are magnetised they will be read as either a zero or a one. These zeroes and ones are in turn the basic building blocks of data.

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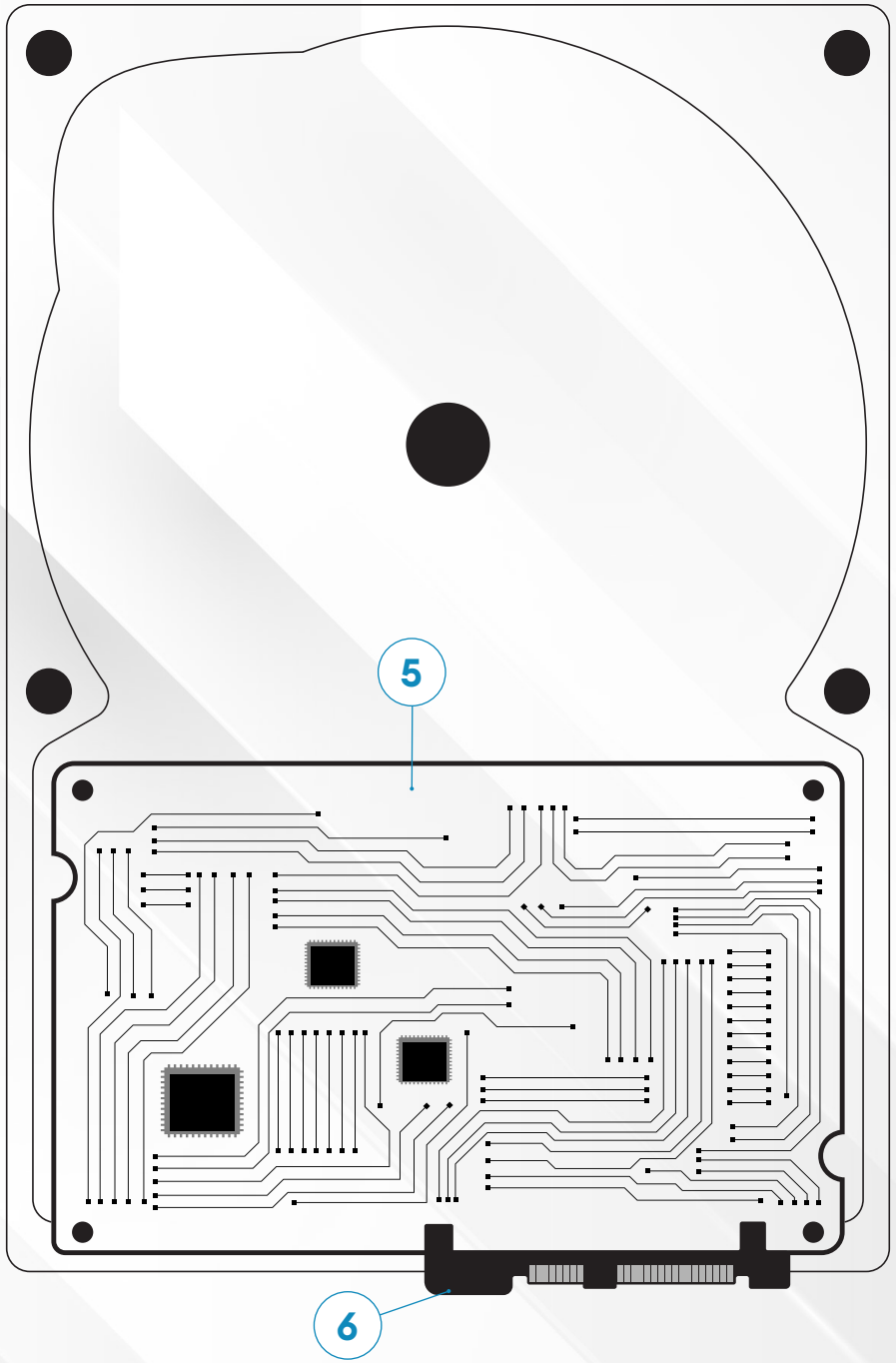



### 5 Control board

The chips on this board change by model, but the usual suspects are:

- A controller chip that handles data flow and error correction
- **A cache:** a small, quick storage device akin to RAM that is used to store the most commonly used data for quick access. Can you work out the size of your Hard Drive's cache using the information on the label?
- A chip to control the motor that spins the platter, via the spindle
- A small flash storage chip this houses the drive's firmware (basic operating software)

### 6 SATA connectors

Serial Advanced Technology Attachment or SATA (sometimes confusingly also known as Serial ATA) is an industry standard connection interface introduced in the year 2000. These represent the point of connection between the Hard drive and the device into which it is being inserted and transfer both data and power.

The long pins next to the SATA connector are 'jumper pins' used to limit data transfer speed when using the drive with older machines.

**Facts about HDDS:**

- IBM released the first commercially available Hard Drive in 1956 – with 3.75 Megabytes of storage
- In 1987 a 20 Megabyte Hard Drive would cost you about £280, today that would buy you 14 Terabytes: 700,000 times more space!
- Platters are INCREDIBLY flat: no part of the disk deviates more than 250nm (0.000025cm) from the base.
- If you scaled it up the distance between the read/write head and the platter would be the equivalent of a 747 jet flying 0.14mm above the ground!

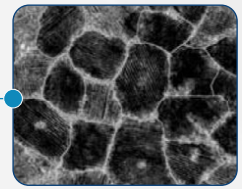
### Why do we use Cobalt?

Cobalt is a Critical Raw Material (CRM) – it's in high demand and an important part of the world's energy transition away from fossil fuels. So why is it used in hard drives?

It all comes down to its **hexagonal** shape.

With hard drives the most important property is density – the more grains you can fit into a surface area, the more data can be stored. Other metals present themselves in a cubic structure. Cobalt grains on the other hand look like this...

**Think about how many squares, compared to hexagons you can fit into a circle...**



# The Circular Economy

Just like the Cobalt in our hard drives, many of the materials used in our tech are in short supply, difficult to get hold of or need to be used in our development of greener technologies (such as electric vehicles).

Some of the non-renewable materials include a group of precious metals and minerals known as Critical Raw Materials (or CRMs).

Using the current model of consumption – **'take, make, waste'** we are mining these resources, manufacturing them into equipment and then throwing them away (and at every stage these materials are being transported around the planet). Once something is seen as obsolete, more often than not it ends up in landfill and any of the materials used to make it are lost.

***Have a look at your Hard Drive and try and answer the following questions...***

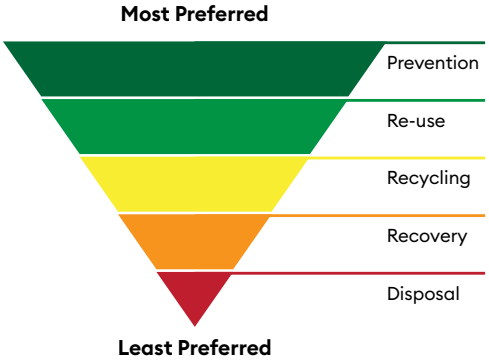
| | |
|---|---|
| Where was it made? | How do you think it got to the UK? |
| Where did the materials that made it come from? | What will happen to it when it breaks, or is replaced? |

*continued...*


# What can we do to improve?

**Instead of 'take → make → waste' we should move towards using the 'circular economy', a more sustainable model.**

As opposed to making more technology we reuse, remanufacture and recycle what we have. Imagine you run a company that makes video games, in order to make them you need high spec, powerful computers. Eventually there will come a time where you need to meet the demands of new hardware, how can you do this within the circular economy?




### The Waste Hierarchy

One of the principles behind the circular economy is that we should always be looking at the least wasteful option first, before considering other outcomes.

This is illustrated in the 'waste hierarchy' opposite, take a look and think about possible solutions.

## Solutions offered by the circular economy...

1. Consider upgrading the components rather than replacing the entire machine. Replacing a processor or a graphics card creates far less waste and consumes less materials than a total replacement – without compromising on performance.

2. When replacing machines is the only option, think about what you can do with the old ones... could an old machine benefit another department, or could it be sold or even donated?

3. When there is no other viable option don't just throw it away. There are many ways to recycle tech that can safely reclaim materials that would otherwise be lost to landfill. One of the latest innovations, known as Bioleaching, uses bacteria to break down circuit boards and isolate the rare metals in order for them to be reused later.