Sustainable IT for Digital Startups

Playbook

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Remission

SparkIT

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Carmen is a Cloud and Sustainable IT expert with over a decade of experience leading product and commercial strategy in the energy software sector. She spent nine years in renewable energy tech, including as **Product Director** at Utopus Insights (a Vestas company), where she led teams across engineering, data science, and operations. During this time, she saw firsthand how quickly cloud costs can spiral and how energy-intensive cloud infrastructure has become. That insight led her to found **Remission**, a climate-tech startup **helping companies reduce both cloud costs and emissions.**

She holds a **Mechanical Engineering degree from ETH Zurich**, a **Master's in Big Data & Business Analytics**, and completed the **Oxford Climate Emergency Programme.** She is also certified by **AWS**, the **FinOps Foundation**, and the Green Software Foundation.

With a strong background in **energy systems, digital infrastructure, and cloud operations**, Carmen combines strategic vision with technical depth, making her a trusted voice in driving sustainable transformation across modern tech organizations.

Fiona is a digital sustainability expert with a passion for driving impact through technology. With a background in advising corporates on **reducing their technology footprint**, Fiona combines strategic insight with a commitment to **building communities** and raising awareness around **sustainable digital practices.** Her work focuses on aligning technological innovation with environmental responsibility, helping organizations make meaningful progress toward greener digital ecosystems. Fiona is the founder and lead advisor at SparkIT.

"In SparkIT we help businesses in establishing and implementing their **sustainable IT strategies.** We empower organizations to make smarter, **data driven choices that are efficient, innovative, and low-impact**—without sacrificing business priorities.

Besides our consulting services, we are fostering communities, connecting people, organisations and regions. **We know that sustainability shouldn't be complicated.**"

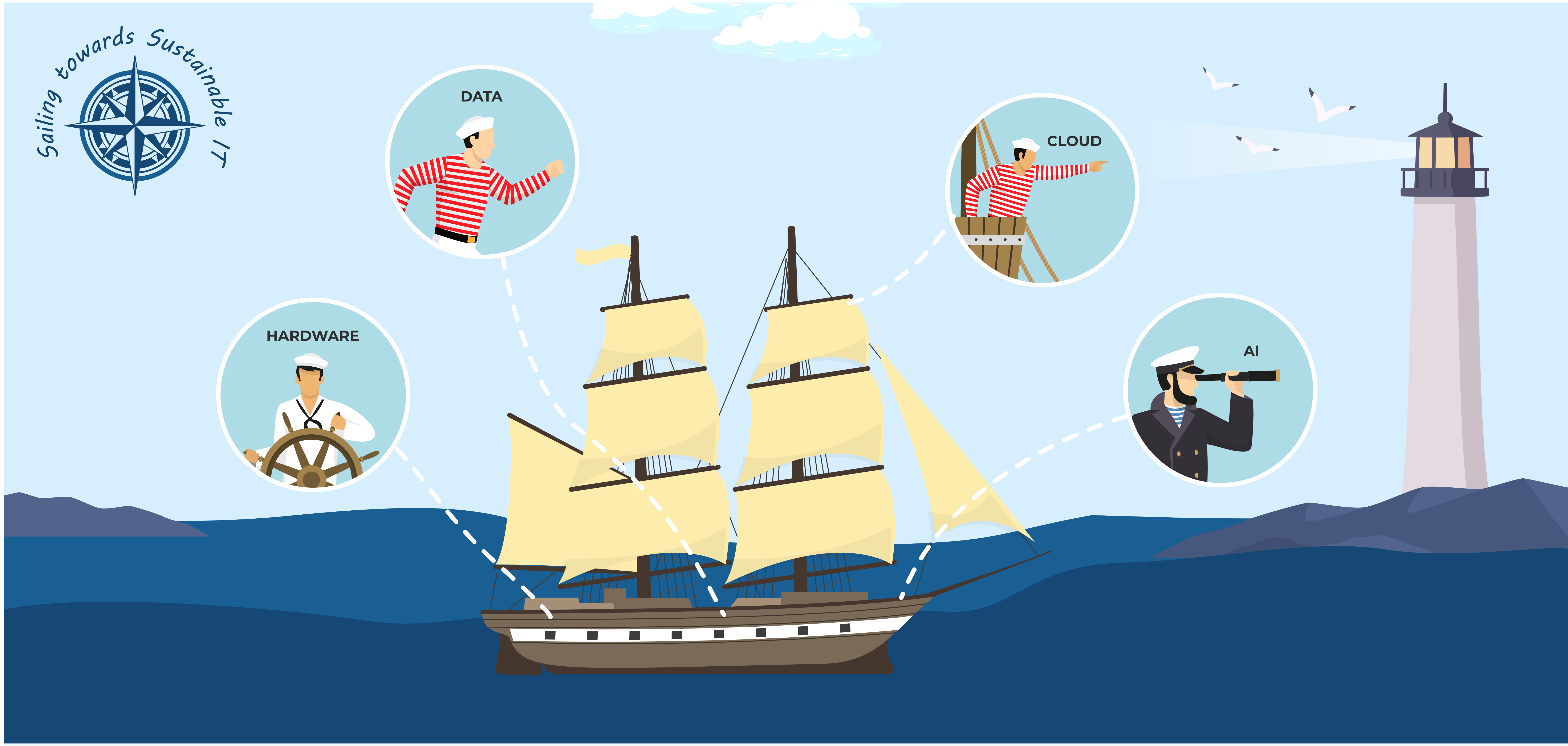
Index

Executive Summary

Most digital startups don't think about their IT footprint, until it's linked with expenses or an investor asks the inevitable "sustainability" question.

This playbook is your starter guide to building tech infrastructure that's efficient, cost-aware, and environmentally responsible. It's written for founders, CTOs, and teams where IT operations, like cloud usage and hardware, are among the top contributors to both emissions and expenses.

Sustainable IT isn't just about emissions, it's about making better decisions: optimized systems, lower bills, and avoiding waste as you grow.



Five Impact Moves You Can Start This Quarter

People: Make sustainability part of how you design and build. Begin by mapping current practices against the recommendations in this playbook. Review how your team works today, assign responsibilities, and start treating sustainability like any other non-functional requirement, alongside cost, reliability, or performance.

Hardware: Create a simple sourcing policy: choose devices that are right for the job, built to last, and energy-efficient. Track what you already own, extend usage when possible, and prefer refurbished.

Data: Define how long you keep data, where it's stored, and when it's deleted. Clean up backups, compress what you can, and keep only what you need, both for internal systems and product analytics.

Cloud: Start with what you control: rightsize virtual machines, shut down non production environments at night, and clean up unused resources. Use managed services and automated tiering to cut idle use and optimize storage.

AI: AI tools are part of daily work, but each prompt or model run has a footprint. Learn better prompting habits, reuse pre-trained models, and schedule training when grids are greener.

The Takeaway

Sustainable IT is not a "nice to have", it's a business strategy. It can cut cloud costs by up to 70% and prevents common issues: early hardware replacement, idle resources running unnoticed, or processes consuming energy unnecessarily.

Sustainable IT makes operations easier to manage, more predictable, and more cost-efficient. When your resources match actual needs, and nothing more, efficiency follows.

The best approach? Start with one area, where the impact is highest for your team: hardware, cloud, or data. Make a small change, track the impact, and build momentum. This step-by-step habit-building avoids overwhelm and helps create a sustainability culture.

This is just the beginning. Sustainability doesn't have to be perfect, it just needs to start.

Note: This is a condensed version of a broader sustainable IT framework. A full version with deeper strategies, examples and use cases will follow.

Working with this Playbook

This playbook is divided into five chapters: **Chapters 1 & 2** are an introduction to rising technology carbon emissions and an overview of emissions in startups. **Chapter 3** provides practical actions to reduce your IT carbon footprint, covering Hardware, Data, Cloud, and AI. Finally, **Chapters 4 & 5** reinforce your ongoing learning journey. You can read it from start to finish or jump directly into the chapters that are most relevant to your current focus.

At the end of some chapters and sections, you'll find **checklists** to help you put theory into action. **Key facts**, **insights**, and **reflection points** are highlighted in yellow boxes throughout the text.

You can't embed sustainable IT overnight. It's a process that requires collaboration across leadership, engineering, product, operations, finance, and procurement. That's why it's essential for your team members to become familiar with sustainable IT practices and work together on them.

Step 1: Read this playbook and assess your current practices using the checklists at the end.

Step 2: Set quarterly actions aligned with your growth stage and capacity.

Step 3: Review and iterate as you scale, launch new features, or expand your team.

Step 4: Establish policies that make sustainable IT the default.

Step 5: Invest in learning: books, tools, courses, and communities that can help your team stay sharp.

1. Introduction

Launching a startup is thrilling, and overwhelming. Founders juggle hiring, product development, and tight budgets, often leaving little time to consider how to scale **efficiently, sustainably, and cost-consciously.**

Yet every software product (whether it's an e-commerce platform, productivity tool, or AI engine) relies on data storage, transmission, and computation. These digital processes consume energy through physical machines: on your laptop, in the cloud, or at your customer's end.
Digital technologies now account for **1.4% to 4% of global greenhouse gas emissions**, rivaling the aviation industry. But unlike aviation, tech adoption is accelerating. **By 2030, data centers alone could consume nearly 3% of global electricity**.

That's why **sustainable IT practices matter from day one.** Also called **Green IT** or **GreenOps**, it means making smart choices, about hardware, software, data, and cloud use, that reduce environmental impact and operational costs.

This playbook helps you navigate those choices, so you can build tech that's lean, scalable, and future-proof from the start.

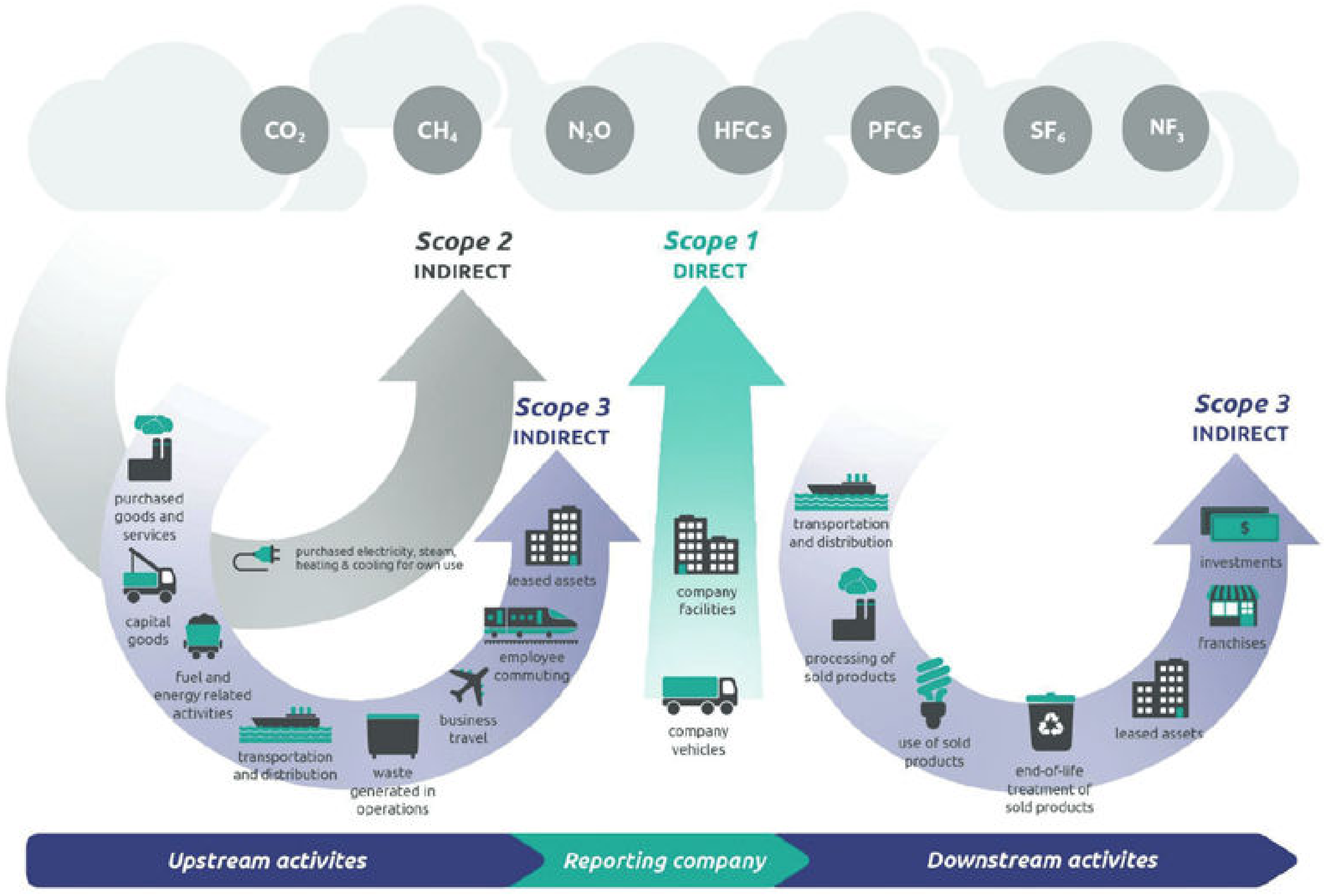
This Playbook is especially relevant for technology-intensive startups, whose primary emissions come from IT purchasing and operations.

2. Understanding Corporate Emission Scopes

Three Emission Scopes

Measuring and understanding your startup's Greenhouse Gas (GHG) emissions makes it more robust, cost-efficient, and attractive to investors and customers. But where do you begin?

The **Greenhouse Gas Protocol** provides a global framework to categorize emissions using **CO_2 equivalent (CO_2e)** unit: a metric that expresses the impact of different GHGs (like CO_2, CH_4, and NO_2) based on their **Global Warming Potential (GWP).** According to the GHG Protocol, GHG emissions fall into three scopes, as displayed in the next figure.



Source: Adapted from WRI/WBCSD *GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard*.

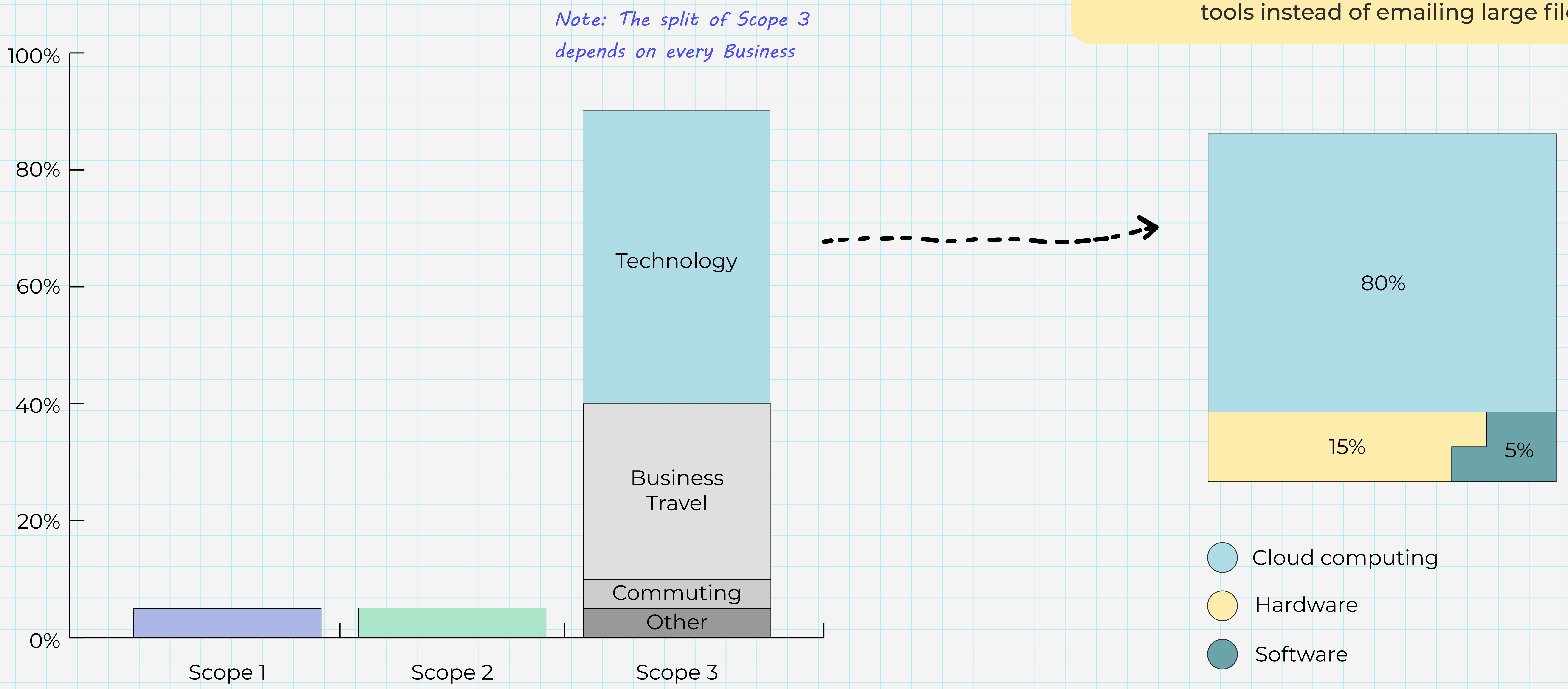
Scope 1: Direct emissions from owned assets (e.g., company vehicles).

Scope 2: Indirect emissions from purchased energy (e.g., electricity for office spaces).

Scope 3: Indirect emissions from the value chain (including technology and business travel, commuting, etc.)

The three emission scopes for a typical digital startup

Even digital communication has a footprint. While it reduces employee commuting (scope 3), our digital habits still create “digital pollution.” To reduce it, prefer chat over video calls, turn off video when not needed, and use shared tools instead of emailing large files.

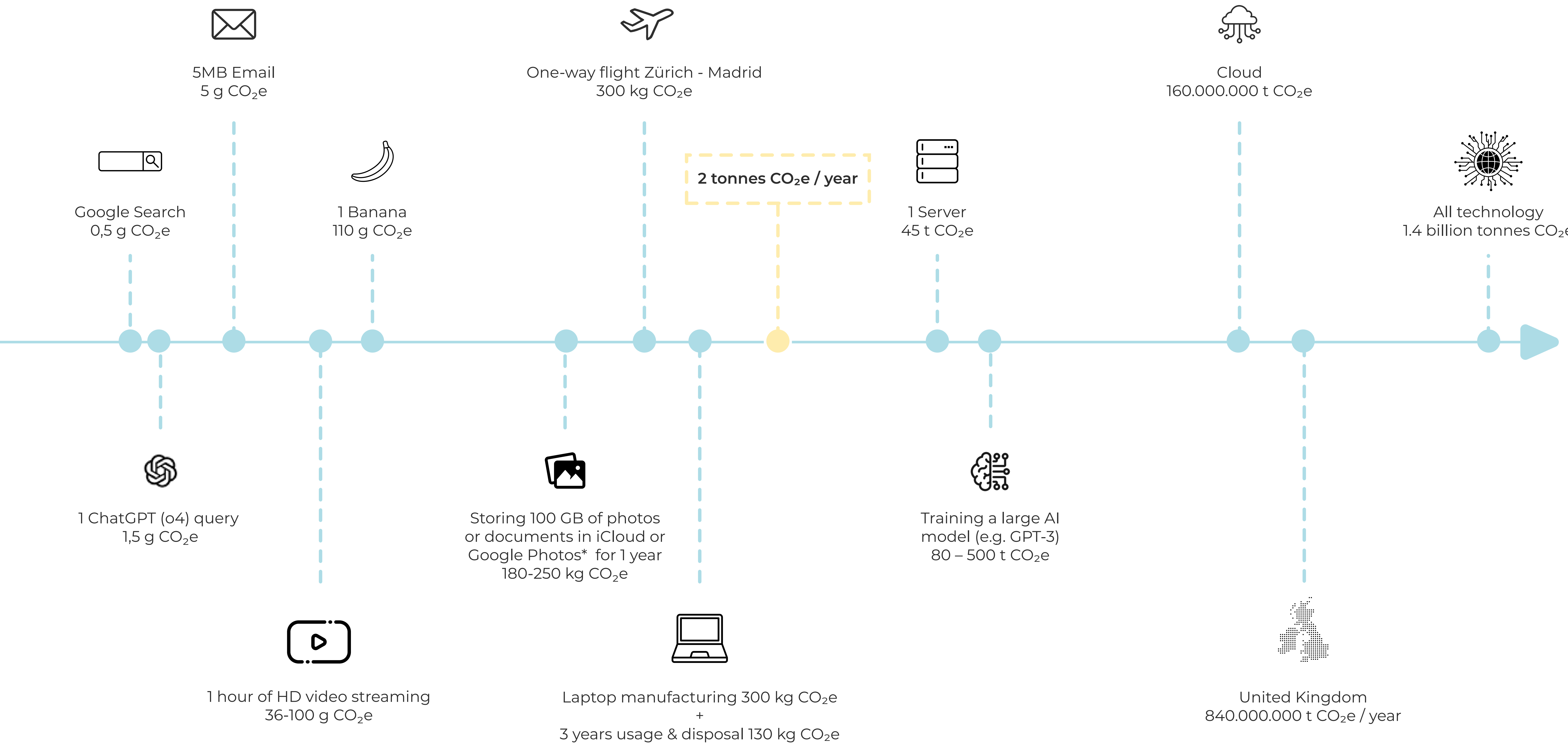


In remote-first digital startups, over __90% of emissions__ typically fall under __Scope 3__. Zooming into Scope 3, key emission categories include:

- *__Technology:__ Cloud services, SaaS tools, and devices.*
- *__Business travel & commuting__: Flights, trains, hotels and daily transport to coworking spaces, customer meetings, fairs or offsites.*

When looking into Technology GHG Emissions, an average distribution is:

- *__Cloud computing__ (50-80%): AWS, Azure, GCP or local Cloud providers.*
- *__Hardware__ (10-20%): Laptops, desktops, peripherals.*
- *__Software__ (1-5%): SaaS tools for communication, CRM, etc.*



2.1 CO_2e Emissions in Context

To limit global heating to **1.5 °C above pre-industrial levels**, the **Paris Agreement**, signed by **nearly 200 countries**, calls for emissions to fall below **2 tonnes of CO_2e per year,** per person, by 2030.

Today, the global average is ~4.7 tonnes CO_2e per person, ~7.5 tonnes in the EU, and over 14 tonnes in the U.S.

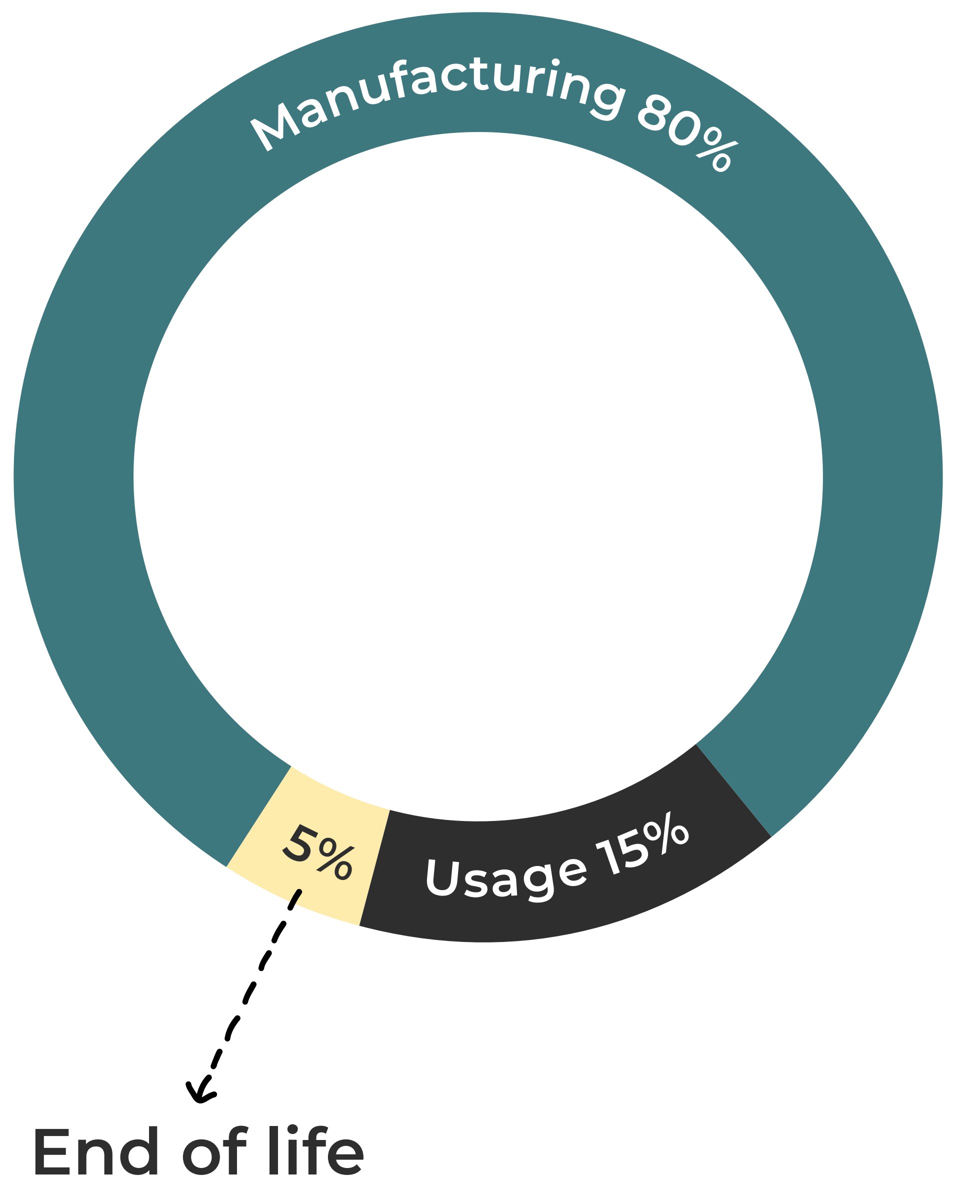
But what does **2 tonnes of CO_2e / year** actually look like? The figure on the left helps putting digital emissions in context.

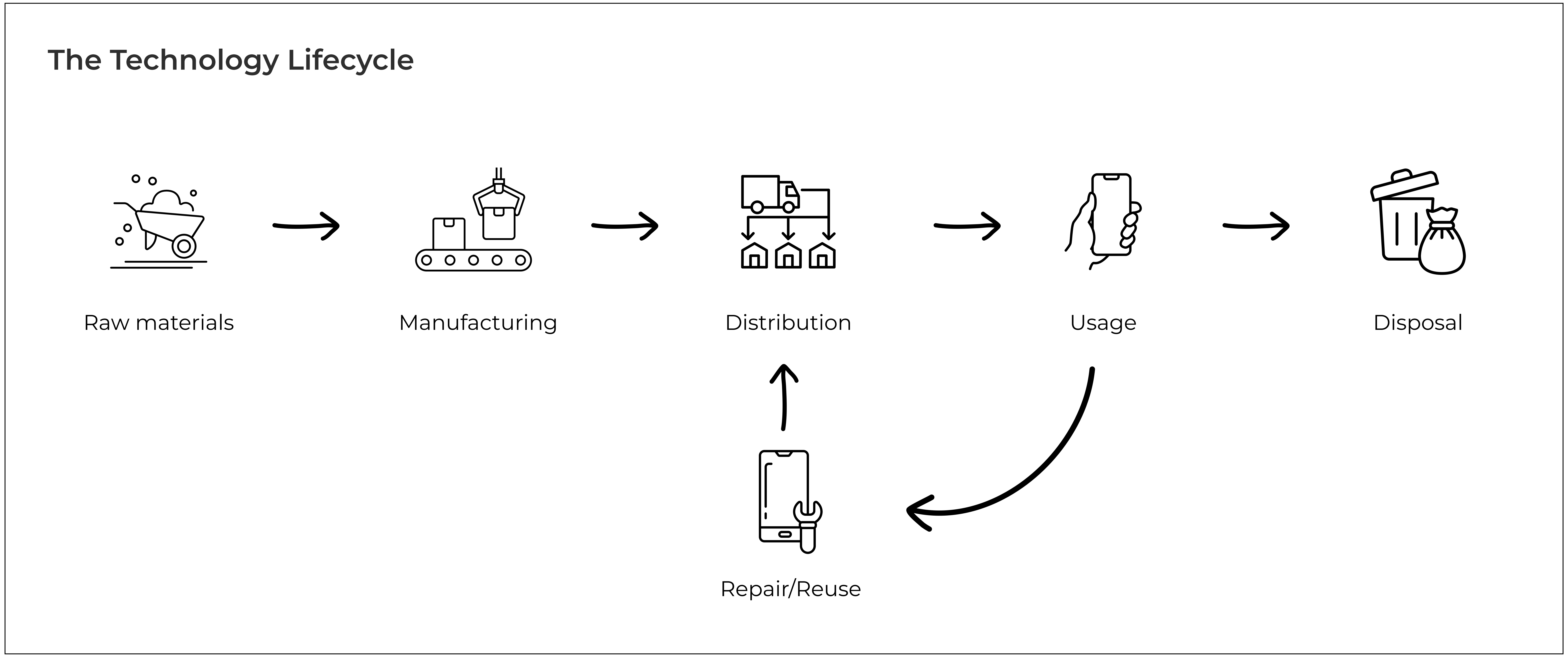
A single new laptop can consume up to 15% of your annual carbon budget. Multiply that by your team, and the impact scales fast.

**iCloud and Google Photos both claim to be carbon neutral, but this often refers to offsetting, not zero actual emissions. So it's still valuable to understand the physical footprint.*

2.2 Where do Technology Emissions come from?

Technology emissions come from the **entire life-cycle of IT equipment: manufacturing, usage, and end-of-life.**





Manufacturing: Producing laptops, smartphones, and servers consumes large amounts of energy and water (especially for mining materials like lithium and cobalt), as well as during assembly and transportation. Manufacturing emissions are also known as "**embodied** emissions", meaning, they are intrinsic to the device, regardless of how long it is used. Embodied emissions typically account for around **80%** of a device's total carbon footprint.

Usage: Devices consume electricity during operation. Emissions vary depending on the local energy mix: **"low-carbon regions"** have a greater share of renewable energy compared to those powered mainly fossil fuels.Usage accounts for around **15% of a device's total emissions.**

End-of-life: At the end of their useful life, devices are recycled, reused, or discarded. Even at this stage, emissions arise from transport, material processing, and waste treatment, including hazardous landfilling or incineration. End-of-life typically accounts for around **5%** of a device's total emissions.

Checklist: GHG Emissions Overview

Purpose: Understand and map the emissions tied to your tech operations.

- *Do we understand the differences between Scope 1, 2, and 3 emissions?*
- *Have we mapped our main Scope 3 emissions, including transportation and technology (e.g. cloud usage, hardware, SaaS tools, travel)?*
- *Have we calculated or planned to establish a baseline of our GHG emissions in the next 6–12 months?*

3. Best practices

Implementing best practices

This chapter provides Sustainable IT **best practices across the 4 main pillars: Hardware, Data, Cloud, and AI.** However, first and foremost, every technology choice is made by **your team members,** including engineers, architects, product managers, and operations staff, who all decide which hardware to source, which algorithms to implement, and how to design the system architecture.

Therefore, it's **essential** for everyone to:

- Foster **awareness** and alignment around sustainable IT principles.
- Support your **team** with learning and development opportunities.
- Treat **sustainability as a functional product requirement,** alongside cost and performance.

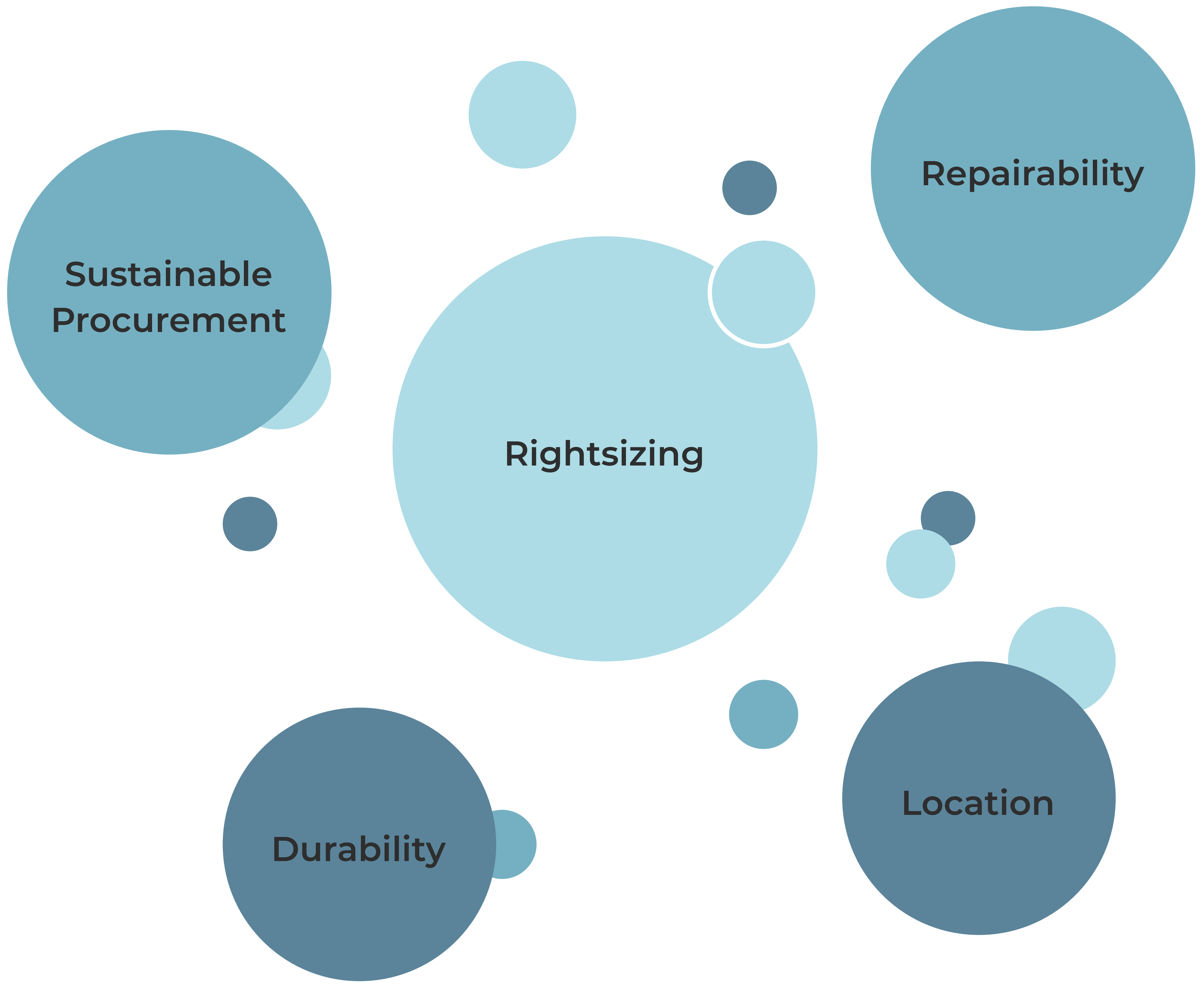
Checklist: Implementing best practices

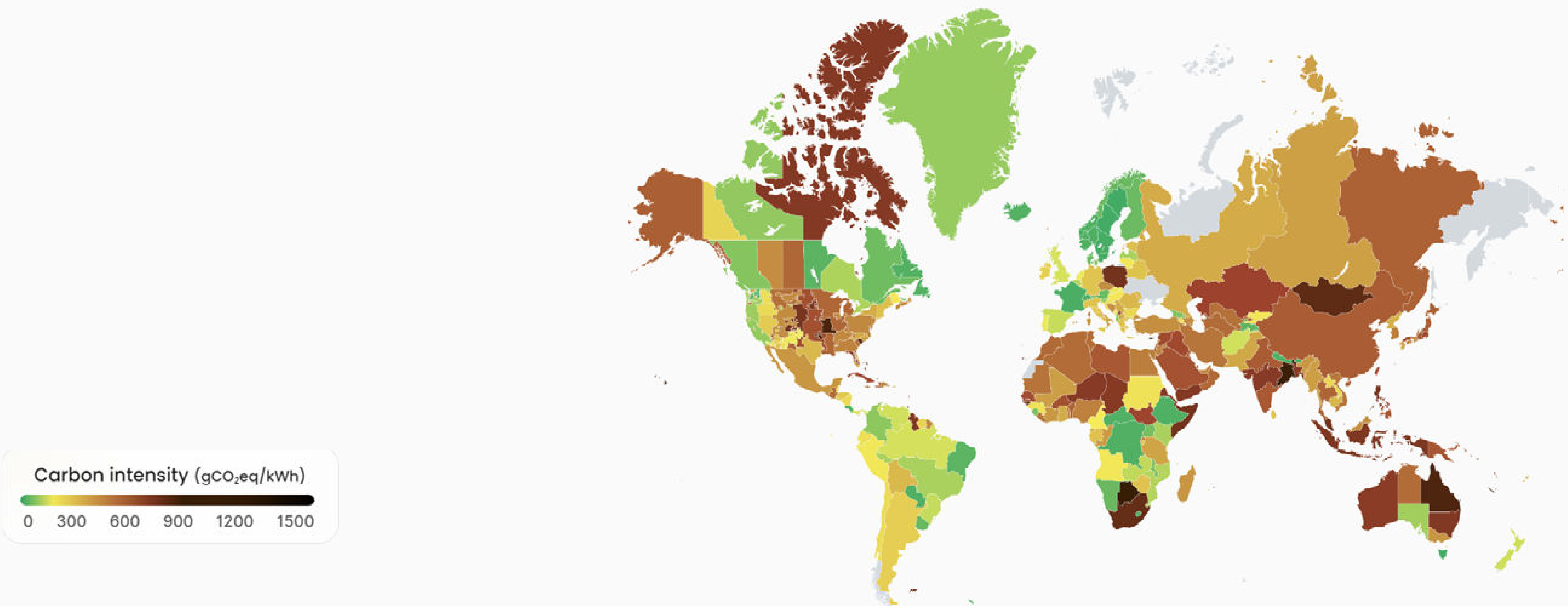
Purpose: Turn Sustainable IT from theory into action by embedding it in your team's planning, ownership, and review processes.

- *Establish a quarterly timeline for progress.*
- *Assign responsible people.*
- *Define metrics for success.*
- *Set a regular review schedule.*
- *Develop a training plan for your team.*

3.1 General Considerations and Concepts

There's no one-size-fits-all solution for start-ups. Each faces different constraints and trade-offs, but some key considerations apply across teams, tools, and tech stacks. Whether you're building software, sourcing equipment, or managing infrastructure, the following concepts offer a foundation for making intentional, efficient, and environmentally responsible choices.





Source: Electricity Maps

Sustainable procurement

It means shifting how purchasing decisions are made: from a cost-first mindset to a life-cycle perspective. A **sustainable procurement policy** can help teams frame decisions with this bigger picture in mind. It might include practical steps like prioritizing refurbished equipment, extending device lifespan, selecting vendors with transparent environmental standards (like EPEAT or TCO Certified), and maintaining a carbon and lifespan inventory of devices.

Durability & Repairability

A laptop that lasts five years instead of two doesn't just save money: it prevents the emissions and resource extraction tied to multiple replacements. But a **durable** device is only useful if it can be **repaired**. Teams can evaluate equipment based on repairability scores (e.g. via iFixit), choose manufacturers who offer **long-term warranties** (3 - 5 years) beyond the EU's minimum 2-year warranty, and always check how long the vendor provides security updates or component support. Cheaper or older devices may seem like a better option, but if support ends early, you're left with higher environmental and financial costs.

Rightsizing

It is about using just enough, and not more, to achieve your goals efficiently. While it's commonly applied in cloud infrastructure (e.g. avoiding underutilized VMs), the logic can be applied everywhere. A salesperson and a data scientist don't need the same laptop specs. A customer success team might not need high-powered analytics tools running in the background. Rightsizing is a mindset: understanding real needs, avoiding over-specification, and resisting the temptation to over-engineer. It helps avoid both wasted resources and inflated costs.

Location

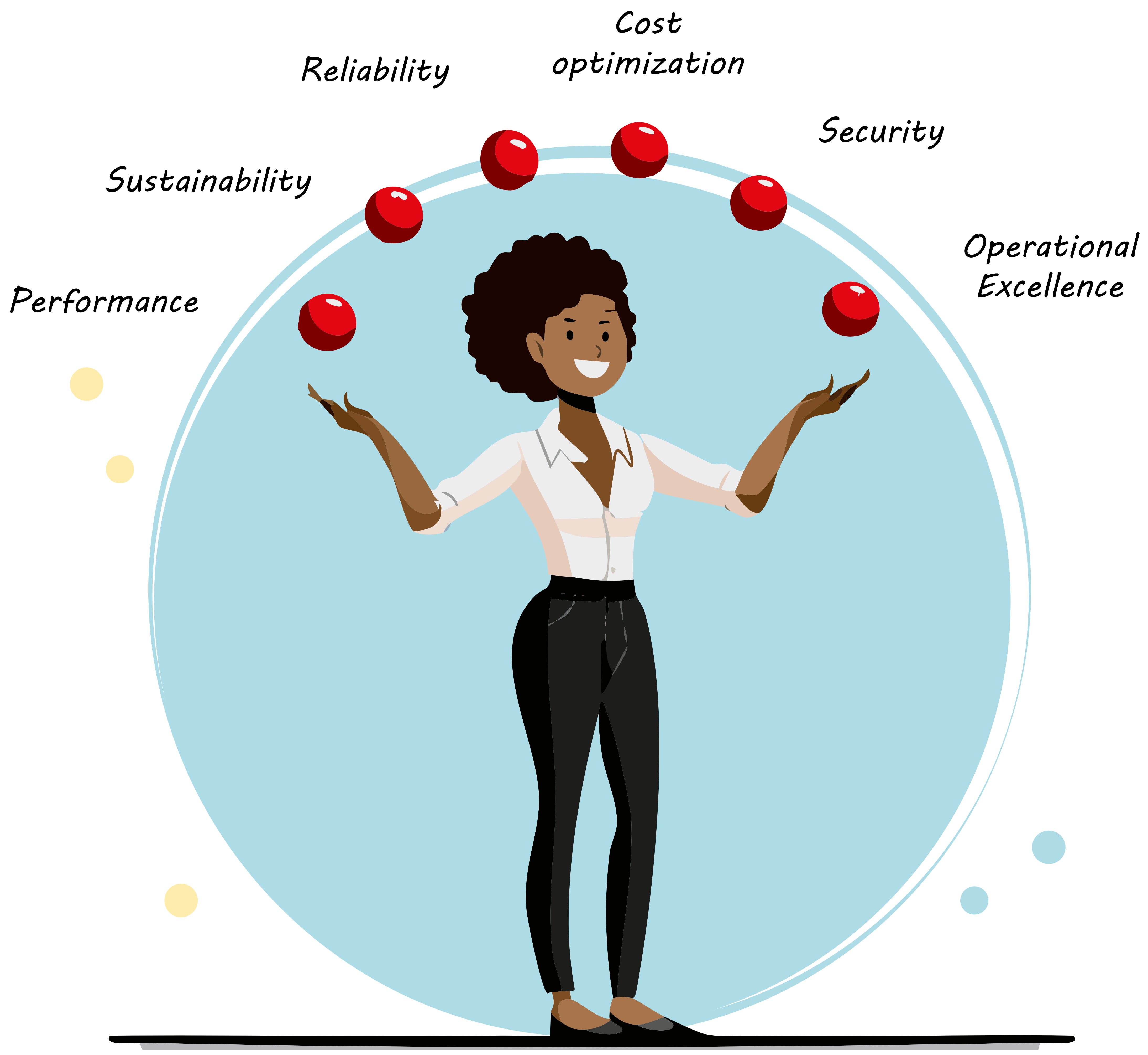
The physical location of your operations plays a major role in your environmental footprint. The electricity powering your cloud services comes from the **local energy mix**, and not all regions are equal. Running workloads in a region with high renewable energy (e.g. Norway or Quebec) produces far fewer emissions than one reliant on coal. Tools like Electricity Maps and IEA reports help you understand the energy mix by location, so you can make informed decisions about cloud regions or vendor hosting.

With these concepts in mind, you're better equipped to make conscious trade-offs across cost, performance, reliability, and usability. A solution is only truly **"Well-architected [1]"** when it includes sustainability as a core design principle.

Whether you're setting up a dev environment, planning compute capacity, or just replacing old laptops, ask: what's the right size for the job?

Extend your hardware usage. For Laptops aim for at least 6 years of usage. For Phones choose models that can last 5+ years.

Modernization, pruning, open-source software, and lightweight software also play a role in reducing digital emissions and resource usage.



[1] "Well-architected frameworks" provide guidelines for designing secure, high-performing, resilient, and efficient infrastructure. See vendor-specific examples from AWS, Google Cloud, and Microsoft Azure.

Checklist: General Concepts

Purpose: Embed sustainability into everyday IT and product decision-making.

- *Do we consider sustainability alongside cost and performance when making tech choices?*
- *Do we have a clear and shared procurement policy that prioritizes environmental impact?*
- *Are our teams familiar with key concepts like durability, repairability, and rightsizing?*
- *Do we regularly reflect on environmental impact in engineering, product, and purchasing decisions?*
- *Is someone, formally or informally, responsible for sustainability in tech operations?*

3.2 Hardware

This section helps you choose hardware, both for your team and your backend, in a way that balances emissions, cost, and practical needs.

End-user devices

When it comes to laptops, phones, and other equipment for your team, you have three main options: **buy refurbished**, let employees **bring their own devices**, or buy new. Each has trade-offs, but **refurbished** is the strongest option from both a climate and cost perspective.

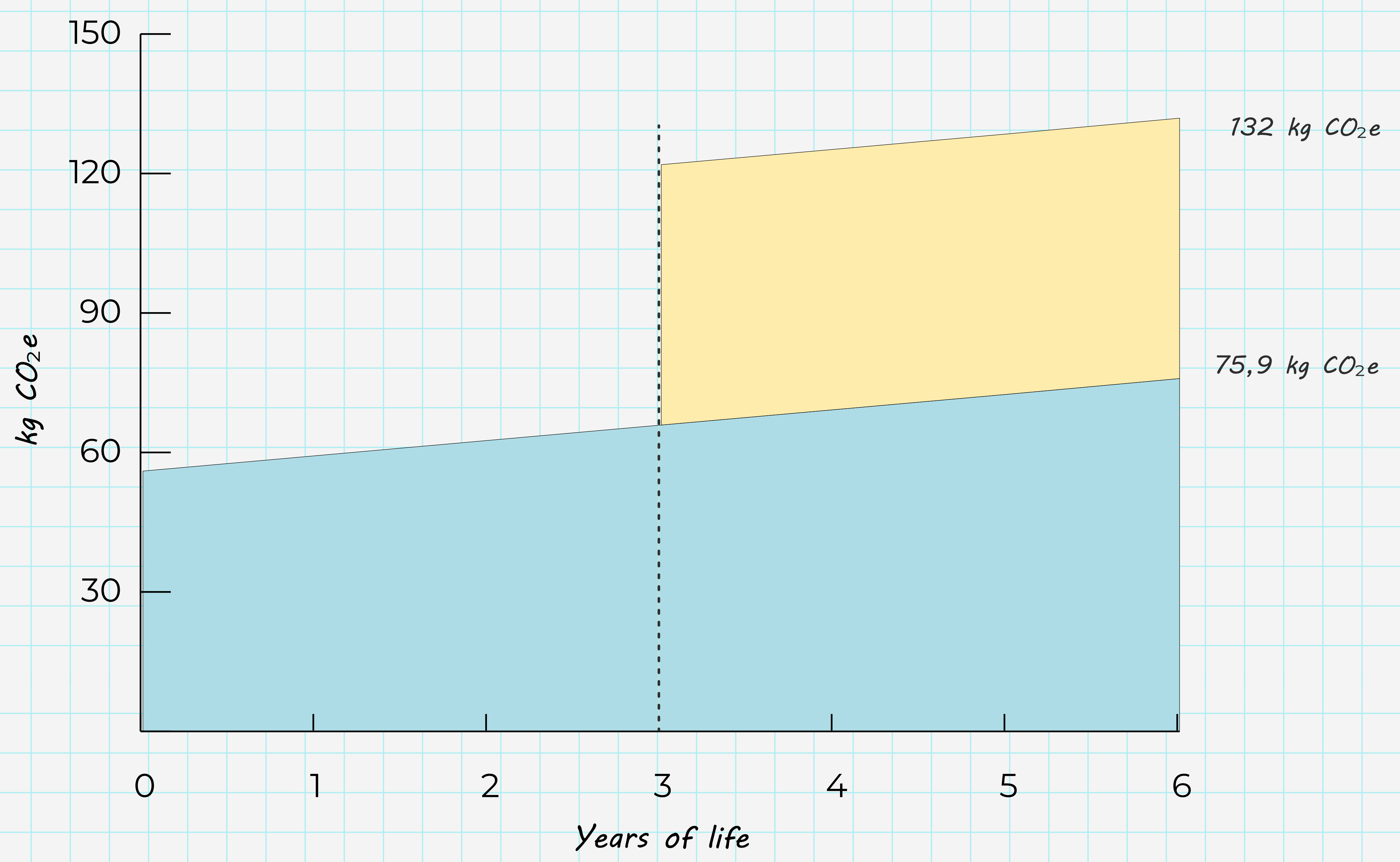
> Refurbished devices simply give a second life to an already manufactured product, avoiding the environmental cost of producing a new one.

Based on vendor carbon footprint reports, the average usage span of a smartphone is 3 years. The diagram on the right shows the options for acquiring and using smartphones for a period of 6 years, in low-carbon regions like Switzerland or Spain (3.3 kg CO_2e per year). In this example, **choosing a refurbished device reduces emissions by 43%.** And this isn't an exception: according to France's environmental agency ADEME, **refurbished smartphones emit up to 87% less CO_2e** than new ones. For laptops, the reduction can be as high as **97%**, thanks mainly to avoided manufacturing. Certified refurbishers test and replace components, offer warranties (typically 12–24 months), and comply with EU consumer protection standards. Platforms like Back Market and Refurbed are great starting points for startups in Europe.

Bring Your Own Device (BYOD) is another common practice, especially for small, distributed teams. While it reduces company costs, it shifts environmental and security responsibility to the individual. It's a valid option, but requires a clear, mutual policy on device use, security updates, and data protection.

Carbon Footprint: New vs. Refurbished Devices

If we consider a six-year usage period, there are two main options:



Option 1: Extend the life of your current device for three additional years, or get a refurbished one (only one device manufactured). Total emissions: 56 kg CO_2e (embodied) + 6 × 3.3 kg CO_2e (usage) = 75.9 kg CO_2e.

Option 2: Replace your device after three years with a new one for the next three (two devices manufactured). Total emissions: 2 × 56 kg CO_2e (embodied) + 6 × 3.3 kg CO_2e (usage) = 132 kg CO_2e.

If you're **buying new**, apply the concepts from Chapter 3.1: right-sizing, durability, and sustainable procurement, and evaluate your vendors accordingly. Several ecolabels (which can be part of your procurement policy) can help guide your choices:

TCO Certified is the most comprehensive, evaluating environmental performance, repairability, hazardous substances, and even working conditions.

EPEAT Gold/Silver is a strong second, covering materials, take-back programs, and energy use.

ENERGY STAR is easier to find and focuses on power consumption during use. When choosing between similar models, labels like the **EU Ecolabel** or **Blue Angel** can serve as tie-breakers based on repairability and emissions.

A refurbished device can cut CO_2e emissions by more than half. But if you must buy new, look for TCO Certified or EPEAT Gold options, and plan to use them for at least 5–6 years.

Backend

Beyond laptops, your infrastructure (compute, storage, and hosting) also generates emissions. Most startups rely on the cloud, but it's useful to understand the trade-offs.

Owning your servers (on-premises or colocated) gives you full control over hardware, energy use, and cooling. These emissions fall under **Scope 1 and 2**. However, this setup often leads to low average utilization: CPU usage hovers around **15%**, since you need to have more capacity available for user demand spikes.

Using third-party **Cloud services**, by contrast, run at shared infrastructure at much higher utilization: typically **50% or more**. You don't control the hardware, but you do control how efficiently you use it: right-sizing instances, reducing idle time, and choosing lower-carbon regions. These emissions fall under Scope 3. We explore optimization strategies in Chapter 3.4 on Cloud Optimization.

> Most startups are cloud-native because of low upfront costs and scalability. Just remember: the cloud is still someone else's computer: powered by real energy, in a real place.

Checklist: Hardware

Purpose: Source and manage hardware with emissions and lifecycle in mind.

- Do we have a sustainable procurement policy for hardware (e.g. TCO Certified, refurbished, and end-of-life planning)?
- Are we tracking the lifecycle and usage of our end-user devices?
- Are we extending device lifespan through repair, reuse, or refurbishment strategies?
- Have we compared the emissions and costs of new vs refurbished purchases?

3.3 Data

Whether you host on your own servers or rely entirely on the cloud, your product runs on data. And in today's zettabyte-scale world, data is growing faster than ever. Since 2022, we've generated more data than in the entire history of humanity before that. But here's the truth: **data holds no value unless it's effectively managed.** Poorly governed data becomes a cost, both financial and environmental.

Every phase of the data lifecycle offers opportunities to reduce emissions and build more efficient systems. From creation to deletion, the way we structure, store, and move data has a measurable impact.

1. Data Creation

Designing for efficiency starts at the moment of data creation. Choosing compact formats, like **Parquet over CSV** for structured data or **WebP over PNG** for images, can shrink file sizes by 25–87%, cutting both storage needs and processing time. Good **data governance** is another early lever: define what's needed, avoid duplication, and tag data by use case, sensitivity, and lifecycle.

2. Processing & Analysis

Every query, transformation, or model training operation consumes CPU, memory, and power. Using **optimized algorithms** reduces compute time and energy. For startups working with AI or ML, this becomes even more critical: training large models is energy-intensive. You can save significant emissions by using **pre-trained models**, simplifying architectures, or **pruning unused models** instead of training from scratch.

3. Storage & Retention

We tend to store everything "just in case." But unused data still consumes space, backup cycles, and energy. Set up **data retention policies** that define what gets archived, deleted, or moved to cold storage, and when. Tools like lifecycle automation in cloud storage can handle this seamlessly. Backup strategies also matter: **optimize frequency and scope**, especially for data that changes rarely.

4. Transmission & APIs

Transferring data, especially between frontend and backend, can create hidden inefficiencies. Design APIs that return **only what's needed**, avoid large payloads, and **compress** responses. Implementing **caching** (e.g., with Redis) helps avoid redundant database queries and speeds up response time, reducing both latency and energy use.

5. Disposal & End-of-Life

When data (or models) are no longer in use, they should be deleted, not just ignored. Old log files, deprecated customer records, and outdated models continue consuming storage, compute, and maintenance resources. Secure deletion policies help free up capacity and reduce emissions.

Most data emissions come from storing and processing more than we actually use. Create less, store less, process smarter, delete often.

Data Creation
- Compression
- Governance

→

Processing & Analysis
- Optimized algorithms
- AI/ML model training

→

Storage & Backup
- Storage strategies
- Intelligent backups

→

Transmission & APIs
- Reducing data transfer
- Optimized APIs

→

Disposal & End-of-Life
- Deleting obsolete data and AI models

Checklist: Data

Purpose: Reduce the cost and impact of data storage, processing, and retention.

- Do we have clear lifecycle policies for data retention, deletion, and archival?
- Are we minimizing unnecessary data collection, duplication, and transfers?
- Is sustainability considered in how we design and scale our data pipelines?
- Do we regularly review and clean up unused storage, logs, or models?

3.4 Cloud

For most startups, the cloud is the default choice, thanks to low upfront costs, flexibility, and scalability. But while cloud infrastructure feels invisible, it runs on physical servers, powered by real energy. The way you use it has a direct environmental impact.

This chapter highlights Cloud provider options, the sustainability reality, as well as high-leverage strategies to reduce emissions in cloud environments. It's not exhaustive, but it's a solid starting point. If your team is already working in the cloud (or planning to), use these principles to build more consciously and efficiently.

3.4.1 Cloud Provider Choice

Choosing a cloud provider shapes your flexibility, compliance, and environmental impact. Most startups will pick between **hyperscalers** or **local providers**. Both offer advantages and trade-offs.

Local providers often stand out in areas like data privacy, regulatory compliance, and sustainability transparency. Some, like Infomaniak (Switzerland), Scaleway (France), Leafcloud (Netherlands), or Hetzner (Germany) run on renewable energy and publish detailed reports on their energy mix or cooling systems. Their flat pricing models are easier to budget around, and regional support tends to be more responsive. However, they may lack the instant scalability, global reach, and managed services that larger platforms offer, something to weigh if you expect fast growth or operate across markets.

Hyperscalers, like Amazon Web Services, Google Cloud Platform and Microsoft Azure, on the other hand, are built for massive scale. They offer elastic infrastructure, a wide ecosystem of services, and generous startup credits, making them hard to beat if you're building a high-growth, distributed product. But you'll need to be mindful of challenges like vendor lock-in, complex pricing, and less transparency around infrastructure efficiency or carbon footprint. Sensitive sectors (like health or finance) may also need to configure region-specific storage to stay compliant with regulations like GDPR or HIPAA.

3.4.2 Cloud and Sustainability

Cloud computing plays a growing role in global emissions, accounting for roughly 2.5% to 3.7% of greenhouse gases today. As demand for AI and storage surges, that number is expected to rise steeply. Most of the energy consumed in cloud infrastructure comes from **IT equipment, cooling systems,** and **support systems** like lighting and power supplies.

Despite bold marketing, the energy powering data centers isn't always clean. Many providers claim "100% renewable energy," but often rely on **renewable energy certificates (RECs)** to **offset** usage. In reality, their data centers still draw electricity from regional grids, where fossil fuels remain common. As of 2024, only about **40% of global electricity** comes from renewables, far below what's needed.

Water use adds another layer of complexity. A single data center can consume as much water as multiple hospitals, primarily for cooling. While some hyperscalers are testing alternatives, like liquid cooling or AI-based optimization, these aren't yet widely implemented.

Finally, transparency remains limited. Some providers offer sustainability dashboards, but data often lacks granularity or consistency, making it hard for users to make informed decisions or comply with regulations. Until standard reporting improves, the burden falls on startups to ask tough questions and optimize their own footprint wherever they can.

Despite bold sustainability claims and ambitious pledges from cloud providers, we are **far from achieving a "green" cloud.** The energy consumption required for cloud services remains a huge environmental challenge, and, **as users, it's our responsibility to optimize the way we use it.** Reducing unnecessary processing and resource use is key.

3.4.3 Cloud Optimization Strategies

Optimizing your cloud setup is one of the highest-leverage actions your team can take, both to reduce emissions and control costs. Once you've chosen a provider, what matters most is how you use it. This section outlines practical, high-impact strategies to operate more efficiently and responsibly in the cloud.

1. Deployment Strategy: Location and Replication

Where you deploy matters. Every cloud region draws energy from a different electricity grid, with different carbon intensity. Choosing a region with more renewables can lower your emissions **by 20–60%** without changing a line of code. Tools like Electricity Maps (see page 18 for reference) or GCP's region selector can guide you.

Equally important is **how many copies** of your data you keep. Multi-zone replication (e.g., Multi-AZ) improves resilience, but triples your storage footprint. Reserve it for mission-critical services. For logs, backups, or analytics, single-zone is often enough.

Remember to review your default configuration. Are you using multi-zone replication or single-zone?

2. Compute Efficiency: VMs, Containers, Serverless

Every task your software performs consumes compute resources. This is where most cloud emissions come from. Use these levers to reduce waste:

- **Right-size your compute**: Avoid overprovisioned machines. Target 70–80% average CPU utilization.
- **Auto-scaling**: Use auto-scaling instances which scale up automatically when traffic spikes, and down when it drops, reducing idle servers and energy waste.
- **Schedule downtime**: Shut down non-production environments outside work hours. Switching from 24/7 to 9/5 can cut energy use by 73%.
- **Use managed services**: Shared infrastructure is more efficient and easier to maintain.
- **Go serverless**: For event-driven tasks, serverless architectures eliminate idle compute.
- **Try spot instances**: Use discounted spare capacity for flexible jobs like testing or batch processing.
- **Clean up regularly**: Tag resources and automate monthly audits to catch forgotten VMs, IPs, or test environments.

3. Storage: Match the Class to the Need

Not all data is equal, and storing everything the same way leads to wasted energy and unnecessary cost. Cloud providers offer different storage tiers based on how often data is accessed, how fast it needs to be retrieved, and how resilient it must be. Each tier comes with different emissions and pricing. Take a moment to review what you're storing and how.

Frequently accessed files, customer data, or application resources, that need to be ready instantly, belong in **standard (or "hot") storage.** But other data, like monthly reports, archived logs, or compliance backups, can be stored in lower-energy, slower-access tiers like **"cold"** or **"archive" (e.g. Glacier)**. These tiers can cut emissions and costs **by up to 80%**, with no change to the data itself.

Use **automated lifecycle policies** to move files to colder storage as they age, and clean up old backups or snapshots that accumulate unnoticed.

Review your defaults: are you keeping everything in "hot" storage just in case? Switching to smarter tiering can lower both your cloud bill and your emissions, automatically.

4. Automation & Deployment Practices

Sustainable cloud setups are lean and intentional. Automation helps enforce this:

- **Infrastructure as Code (IaC)** lets you define your cloud setup with appropriate defaults, like deploying in low-carbon regions or tagging resources with owners and expiry dates. These rules are locked in with role-based access, so only authorized users can make changes. Everyone else must submit a request. This way, your sustainability policy is enforced by code.

- **Automate cleanups:** Over time, unused volumes, old snapshots, and inactive network components build up silently. Automating regular cleanups with scripts or tools helps you catch and remove this digital clutter before it becomes costly. It's one of the simplest ways to reduce cloud waste without touching your architecture.

5. Monitoring and Continuous Improvement

Sustainability isn't a one-off project: it's a habit. Build awareness and processes to keep it going:

- **Raise team awareness:** Engineers should understand the emissions impact of their infrastructure decisions. Share resources, training, and include sustainability as a non-functional requirement.

- **Use joint monitoring:** Tools like Cloud Carbon Footprint or your provider's sustainability dashboards can help you link usage, emissions, and cost.

- **Review regularly:** Schedule quarterly infra reviews with sustainability in mind, not just performance and cost.

Checklist:
Cloud Optimization

Purpose: Optimize cloud infrastructure to be efficient, low-emission, and cost-effective.

- Do we select cloud regions or providers based on sustainability and emissions data?
- Are we using automation or tagging to manage idle or unnecessary resources?
- Have we adopted policies for cloud rightsizing and clean-up?
- Are we applying lifecycle policies for data storage tiers (hot/cold/archive)?
- Are sustainability and cost both part of our infrastructure reviews?

3.5 Artificial Intelligence

Beyond building Artificial Intelligence (AI) products or supporting your product with this technology, AI is everywhere in our daily working habits: in search engines, productivity platforms, design tools, and even internal workflows. Startups increasingly rely on AI to accelerate product development, automate support, analyze data, or experiment with new interfaces. Tools like ChatGPT, Notion AI, and RunwayML are part of the daily stack. But while AI improves speed and productivity, it doesn't come for free: each interaction or model run has a real environmental cost.

Even if your startup is not building an AI product, chances are your team uses AI tools daily. A single ChatGPT prompt emits approximately 1.3 grams of CO_2e. This may sound negligible, but it adds up quickly. A team of 20 using AI tools one day could generate over 2 kg of CO_2e, that's similar to running a laptop continuously for a week.

The way to reduce this? Learn how to prompt better. "**Prompt engineering**" is the practice of crafting efficient, purposeful queries to get high-quality results in fewer attempts. It's not just about saving time, it reduces energy consumption too:

- Draft your request before hitting enter. Don't prompt piece by piece.
- Be specific: more detail will require fewer retries.
- Group related questions: bundling saves compute.
- Avoid chat-like habits: AI isn't a person. Get to the point.

AI Reduction Strategies

Many of the strategies in Chapter 3.4 on Cloud Optimization also apply to AI workloads. But AI introduces unique challenges, particularly during training and inference. These steps are compute-heavy, and startups can take action to reduce their impact from the start.

1. Choose Smarter Models

Use pre-trained models from platforms like Hugging Face or TensorFlow Hub instead of training from scratch. For most use cases, lightweight models (like DistilBERT or MobileBERT) are more than enough, and use far less compute. If you're fine-tuning, apply transfer learning rather than full retraining. Also, consider techniques like model pruning or quantization to keep things lean.

2. Deploy Efficiently

Run inference close to where data is generated, on edge devices when feasible. This reduces data movement, lowers latency, and eases pressure on backend infrastructure. Use hardware designed for AI tasks (like TPUs or FPGAs) which can be orders of magnitude more efficient than general CPUs.

3. Clean Up and Monitor

AI experiments generate artifacts (models, logs, checkpoints) that pile up over time. Use MLOps tools like MLflow or Weights & Biases to track what matters and retire what doesn't. Define retention policies and lifecycle rules to clean up unused models, and avoid unnecessary retraining unless results justify it.

4. Be Thoughtful with Data

Don't collect more data than you need. Every gigabyte has a footprint, through storage, processing, and transmission. Re-use open datasets when possible, and apply data augmentation techniques if you need variety. Reducing data volume also makes training faster and less resource-intensive.

5. Time Your Workloads

Train models when the electricity grid is cleanest, like during daytime solar peaks or overnight wind production. Most training jobs can be scheduled using standard CI/CD or job orchestration tools.

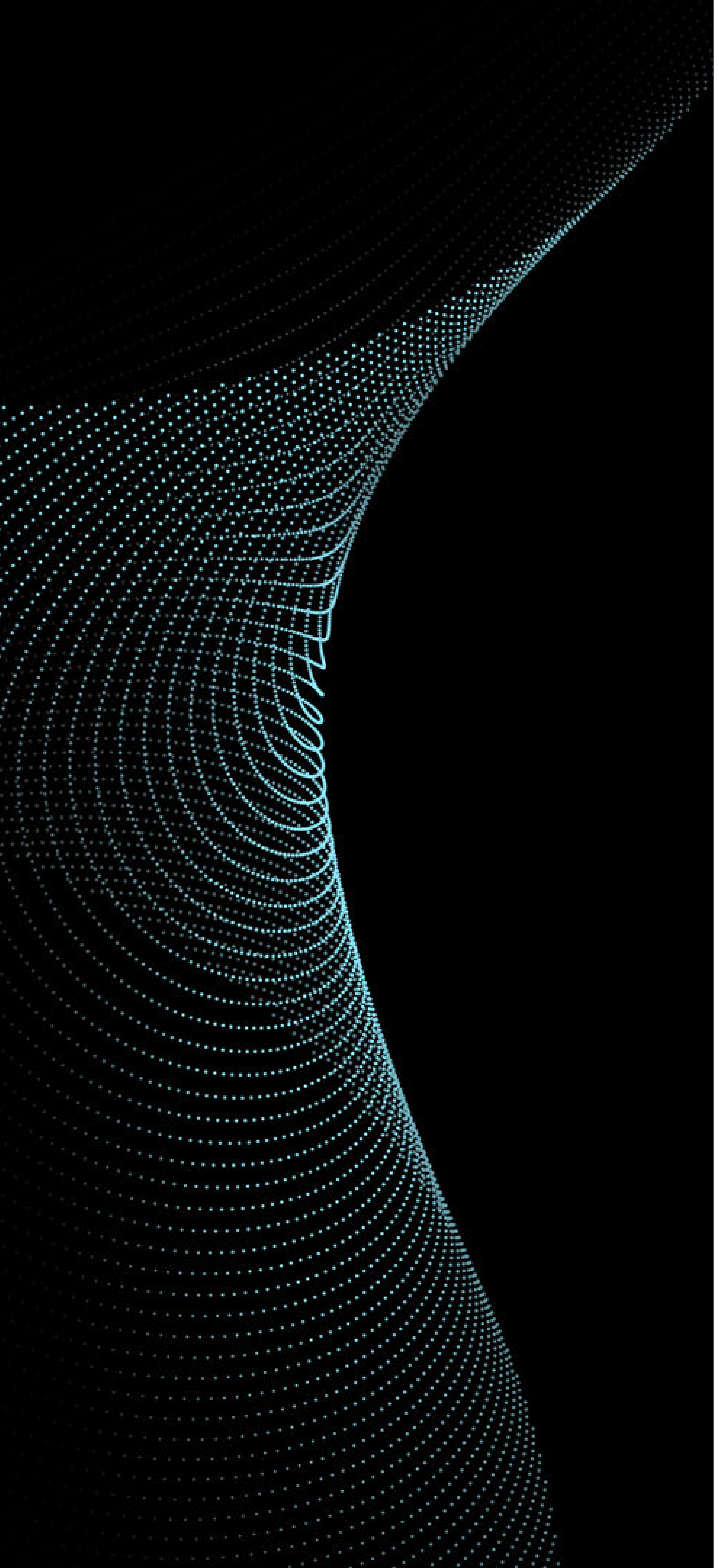
Treat AI like any product feature: design with purpose. Choose the right model, run it at the right time, and don't keep what you won't use.

Checklist: Artificial Intelligence

Purpose: Make AI development and deployment more sustainable.

- Are we matching model size and complexity to the actual use case?
- Do we reuse or fine-tune pre-trained models instead of training from scratch?
- Are we considering sustainability when choosing where and when to train models?
- Do we have policies to avoid unnecessary re-training or over-collecting data?
- Are MLOps practices aligned with efficiency (e.g. scheduled runs, model lifecycle tracking)?

4. Conclusion: Sustainable IT is a Business Strategy



Sustainable IT is a Business Strategy

For early-stage startups, efficiency isn't just desirable, it's existential. Every euro, every watt, every line of code has to work harder. That's what makes **Sustainable IT not a moral imperative, but a strategic one.**

The practices outlined in this playbook aren't about going green for green's sake. They're about building a more efficient and resilient company from day one. Done well, they shrink your cloud bills, extend the life of your devices, and reduce technical debt. They help you scale more deliberately and make sharper infrastructure decisions.

But theory won't change anything without action. **To turn this strategy into reality**, it needs to live in your team's daily decisions: how you source devices, structure data, manage compute, and write code. It means giving engineers, product leads, and ops teams a voice early on. And it means **leadership must prioritize it visibly, turning sustainability from a side note into a shared mindset.**

What's Next?

Start small and start now. Engage your team and:

- **Step 1:** Review the checklists and assess your current practices across cloud, data, devices, and AI.
- **Step 2:** Define quarterly actions that match your stage and capacity.
- **Step 3:** Revisit regularly, as you grow, ship new features, or expand your team.
- **Step 4:** Review your defaults, from device sourcing to VM configurations, storage tiers and backup settings.
- **Step 5:** Invest in learning: books, tools, courses, and communities that can help your team stay sharp and stay aligned.

This is a process, not a one-time task. Change will come through small, persistent iterations, backed by clear policies and cultural norms.

And remember: Sustainable IT is a business strategy.

5. Useful Resources

These curated tools and references complement the actions outlined in this playbook. Most are free and beginner-friendly.

Recommended Reading

- Efficient Cloud FinOps by San Miguel Sánchez & Obando García: Practical guide to cost-aware, sustainable cloud operations.
- Building Green Software by Anne Currie et al. (O'Reilly): Covers strategies, tooling, and organizational practices.
- Sustainable IT Playbook for Technology Leaders by Niklas Sundberg: High-level strategy with actionable steps.
- The Carbon Footprint of Everything by Mike Berners-Lee: A relatable overview of the emissions behind daily choices—from laptops to cloud use.

Learning & Awareness

- Green Software Foundation (GSF): Drives education and standards for sustainable software. Offers the Green Software Practitioner course and a curated list of tools via Awesome Green Software.
- PromptingGuide.ai and Prompt Engineering for Developers (DeepLearning.AI + OpenAI): Improve the efficiency of AI use by learning to write better prompts—saving both compute and emissions.

Impact Estimation Tools

- Cloud Carbon Footprint: Open-source tool that estimates CO_2 emissions from AWS, GCP, and Azure usage. Ideal for GreenOps and FinOps alignment.
- CodeCarbon: A Python library from Hugging Face that estimates CO_2 emissions from code execution.
- Electricity Maps: Shows real-time carbon intensity of electricity grids worldwide. Useful for timing compute jobs when energy is cleaner.
- ResilioDB: Free tool to compare the full environmental impact of digital devices. Ideal for sustainable hardware sourcing.

Useful Tools

- FreeConvert.com: Free online tool for converting images (e.g. to WebP), videos, and documents to reduce file size and energy use.
- SwissTransfer: Privacy-first file transfer service hosted in Switzerland, running on 100% renewable energy.

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