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IMPLEMENTING GREEN IT

A PRACTITIONER GUIDE

Implementing Green IT

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Foreword

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1. Foundations — Understanding the Green IT Framework

This chapter establishes the conceptual and practical foundation for everything that follows in this guide. We begin by recapping the structure, components, and logic of the Green IT Framework – the blueprint on which this practitioner's guide is built. We then guide you through an initial assessment of your organization's current state across each component, and set out how to construct and communicate a compelling business case for Green IT investment. Finally, we introduce the Green IT Impact Measurement Framework – a mathematical model that will be used throughout this guide to quantify environmental impact in a rigorous, consistent, and actionable way.

* * *

1.1 The Green IT Framework: A Recap

The **Green IT Framework** was developed to address a critical gap in the sustainability landscape: while many frameworks exist to help organizations manage their environmental impact, none were designed specifically for the unique challenges and opportunities of IT operations. The result is an approach that is simultaneously comprehensive – spanning the full lifecycle of IT hardware, software, data, and organizational practice – and actionable, providing organizations with concrete guidance rather than high-level principles alone.

For practitioners using this guide, a thorough understanding of the framework's architecture is not merely useful background – it is the foundation from which all implementation decisions flow. Each chapter of this guide corresponds directly to one or more framework components, and the measurement approach introduced later in this chapter is structured around the framework's component model. Before moving to the practical work of implementation, it is worth investing time in understanding not just what the framework contains, but why it is structured the way it is, and how its components relate to one another.

Figure 1. The Green IT Framework

1.1.1 The Seven Components

The Green IT Framework is organized around seven core components. Five of these – Hardware, Software, Processes, Practices, and Data Storage – represent the primary operational domains in which organizations can take action to reduce the environmental impact of their IT. The remaining two – Measurement and Reporting, and Continual Improvement – function as enabling disciplines that make action in the other five domains purposeful, trackable, and sustainable over time.

Green IT Strategy

Green IT Strategy is the component that gives coherence and direction to all the others. A Green IT strategy articulates the organization's sustainability ambitions for its IT operations, establishes the governance structures through which those ambitions will be pursued, sets measurable goals aligned to scientific and regulatory benchmarks, allocates resources across the other components, and defines the reporting and review cadence through which progress will be monitored.

The critical insight here is that the other six components are not self-directing. Hardware teams can purchase energy-efficient devices, software

teams can optimize code, and facilities teams can explore renewable energy options – but without a strategy that coordinates these efforts, sets shared goals, and allocates resources deliberately, the result is a collection of disconnected initiatives rather than a coherent programme of improvement. Strategy is what transforms individual good intentions into organizational change at scale.

Research suggests that only 6% of organizations currently have a highly mature Green IT strategy with clear goals and timelines.[1] This is both a sobering finding and a significant opportunity: organizations that invest in building a robust strategy are positioning themselves at the leading edge of a rapidly evolving field. Chapter 2 of this guide is dedicated entirely to the practical construction of a Green IT strategy, providing a best-practice structure and detailed guidance on each of its elements.

Hardware

Hardware encompasses all of the physical devices and infrastructure that underpin IT operations: servers, workstations, laptops, monitors, networking equipment, data center infrastructure, peripherals, and mobile devices. It is the component with the most visible and tangible environmental impact, and in many organizations it is also the component where sustainability action is most advanced, precisely because the impacts are easier to see and measure.

The environmental impact of hardware spans its entire lifecycle. During manufacturing, the extraction of raw materials – metals, rare earth elements, plastics – generates significant greenhouse gas emissions, wastewater, and habitat destruction. Manufacturing processes are energy-intensive and in many cases rely heavily on fossil fuels. The global transport of components and finished devices across supply chains adds further emissions. During operation, devices consume electricity continuously – including when idle or in low-use states – contributing to ongoing energy costs and carbon output. At end of life, improperly disposed devices generate hazardous e-waste containing substances such as lead, mercury, and cadmium that can persist in ecosystems for decades.

A particularly important finding for practitioners is that the manufacturing phase of a digital device's lifecycle accounts for approximately 47% of its total

[1] DASCIN. (2025). *The Green IT Framework: A Blueprint for Sustainable Enterprise IT*. The Data Science Institute.

lifetime emissions – significantly more than the operational phase.[2] This means that procurement decisions carry an outsized environmental significance that is not always recognized by organizations focused primarily on operational energy efficiency. Sustainable hardware practice therefore requires a genuine lifecycle perspective, addressing procurement, operation, longevity, and end-of-life management with equal seriousness.

Software

Software is the component of the Green IT Framework that receives the least attention in most existing sustainability frameworks – and yet it represents one of the most significant levers for reducing environmental impact, particularly as digital operations become more complex and energy-intensive.

Software does not emit greenhouse gases directly. But it determines how hard the underlying hardware must work to deliver its functions, and therefore has a direct and substantial effect on energy consumption. An inefficiently coded application running on a data center server may consume two or three times the energy of a well-optimized equivalent performing the same function. Across the scale at which modern digital organizations operate – with hundreds or thousands of applications running continuously – the cumulative energy impact of software inefficiency is substantial.

Key software decisions with environmental significance include: the choice of programming language and framework; the architecture of cloud deployments; the management of idle processes and background tasks; the approach to virtualization and resource sharing; and the scheduling of computationally intensive tasks to align with periods of lower grid carbon intensity. Section 4.2 of this guide addresses each of these dimensions in detail.

Processes

Processes refers to the operational workflows and organizational routines that shape how technology is used – and therefore how much energy and resource it consumes – in the course of everyday business. This component is notable because many of the most impactful process improvements require policy decisions rather than capital investment, making them among the most accessible areas for early action in a Green IT programme.

[2] Luna, J. S. L. (2023). *The environmental impact of digital technologies and data.* DataCamp. https://www.datacamp.com/blog/environmental-impact-data-digital-technology

The key process domains in the Green IT Framework are: remote and hybrid work policies, which significantly affect both office energy consumption and commuting-related emissions; paperless office initiatives, which reduce the environmental impact of printing and physical document management; energy source management, including the transition to renewable energy and the practice of carbon-aware computing; and the deliberate scheduling of energy-intensive computing tasks to align with periods of greater renewable energy availability on the grid.

Research suggests that remote workers can have a carbon footprint up to 54% lower than equivalent on-site workers – a finding that underscores the potential scale of process-level environmental improvements.[3]

Practices

Practices covers the behavioral, cultural, and design dimensions of Green IT – the patterns of action, both individual and organizational, that shape environmental outcomes in ways that formal processes and policies alone cannot fully determine. It is the component most influenced by organizational culture, leadership visibility, and the effectiveness of training and engagement programmes.

Key practice areas include: employee awareness and training – equipping staff with the knowledge and motivation to make environmentally responsible choices in their day-to-day technology use; eco-friendly design standards – embedding sustainability criteria into the design of software systems, hardware configurations, and physical office environments; investment in carbon offset programmes – which, when used appropriately as a complement to emissions reduction rather than a substitute for it, can help organizations balance genuinely unavoidable impacts; and techniques such as CPU underclocking, which can reduce energy consumption in systems where maximum processing performance is not always required.

The practices component is the one most dependent on sustained leadership commitment. Training programmes that are launched once and not reinforced quickly lose impact; design standards that are not embedded into development workflows become aspirations rather than norms.

[3]Bradley, S. (2024). *Navigating the Future: 7 Key Sustainability Trends in Technology for 2024*. Rocketmakers. https://www.rocketmakers.com/blog/sustainability-trends

Data Storage

Data Storage has grown substantially as an area of environmental concern as the volume of data that organizations generate, process, and retain has increased exponentially. This growth is driven by the proliferation of connected devices, digital services, streaming media, and the expanding use of artificial intelligence and machine learning across industries.

This data growth has direct environmental consequences. Data centers – the facilities that house the servers and storage systems underpinning both cloud and on-premises data storage – currently account for approximately 2% of global energy demand, consume an estimated 980 million cubic meters of water annually for cooling, and generate substantial e-waste as hardware is regularly replaced to keep pace with growing demand.[4]

Sustainable data storage practice requires attention to four key areas: the choice between cloud and on-premises storage models, and the environmental credentials of the specific providers involved; data lifecycle management – the disciplined application of retention, archiving, and deletion policies to prevent the accumulation of redundant, obsolete, or trivial (ROT) data; data compression and deduplication techniques that reduce the volume of data requiring storage; and the selection of data center partners that can demonstrate strong environmental credentials.

Measurement and Reporting

Measurement and Reporting is the enabling discipline that transforms the other five components from good intentions into accountable, trackable, and improvable practice. Without consistent measurement, organizations cannot establish the baselines from which progress is calculated, cannot identify which initiatives are delivering genuine impact, cannot report credibly to stakeholders, and cannot meet the growing regulatory requirements for environmental disclosure.

The measurement and reporting component encompasses a range of tools and frameworks: Power Usage Effectiveness (PUE) for data center efficiency; the Greenhouse Gas Protocol for emissions accounting across Scopes 1, 2, and 3; the GRI Standards for sustainability reporting; Life Cycle Assessment

[4] Timchenko, A., Kucheva, I., & Silakova, L. (2024). Assessing the negative impact of the IT sector on the environment: a call for sustainable solutions. *E3S Web of Conferences*, 2024, 03026.

for evaluating the full environmental impact of IT products and systems; and the ISO/IEC 30134 series of standards for data center performance metrics. Section 1.4 of this chapter introduces the overarching Green IT Impact Measurement Framework that integrates these tools into a coherent model.

1.1.2 Continual Improvement as the Overarching Enabler

Surrounding and connecting all seven components of the Green IT Framework is the principle of Continual Improvement. This principle reflects a fundamental truth about sustainability in IT: it is not a destination to be reached but a direction of travel to be maintained. Technologies evolve, regulations change, organizational contexts shift, and new environmental challenges and opportunities emerge. A Green IT programme that treats its initial implementation as a completion – rather than a beginning – will quickly find that its practices become outdated and its impact diminishes.

Continual Improvement in the Green IT context means establishing structured review cycles for each component; building feedback mechanisms that surface insights from employees, suppliers, and measurement data; investing in the organizational capabilities needed to respond to change; and cultivating a culture in which sustainability is treated as an ongoing professional responsibility rather than a one-time project. Chapter 6 of this guide is dedicated to embedding this principle in organizational practice.

1.1.3 How the Components Interact

Understanding the Green IT Framework as an integrated system – rather than a list of independent initiatives – is essential for effective implementation. The components do not operate in isolation, and the interactions between them are often as important as the individual components themselves.

Strategy sets the direction and allocates resources across all other components. Measurement and Reporting provides the feedback that informs strategic decisions and Continual Improvement choices. Hardware and Software decisions shape the baseline energy and emissions profile that Processes and Practices then seek to optimize. Data Storage decisions influence Software architecture choices and the selection of infrastructure partnerships.

The Threat of Isolation

A common and costly failure mode in Green IT implementation is to treat one component as sufficient in isolation. Organizations that invest heavily in energy-efficient hardware while neglecting software optimization, or that launch employee awareness programmes without establishing metrics to track behavior change, typically find that their Green IT initiatives under-deliver against expectations. The framework is designed to be implemented as a system, with each component reinforcing the others. A deliberate gap in any component will limit the effectiveness of investment made in all the others.

* * *

1.2 Assessing Your Organization's Current State

Before any implementation work begins, practitioners need a clear and honest picture of where their organization currently stands across each component of the Green IT Framework. This baseline assessment serves three distinct purposes: it establishes the starting point from which future progress will be measured; it identifies the areas of greatest environmental impact and therefore the greatest potential for improvement; and it surfaces the organizational readiness factors – leadership commitment, existing policies, available data, and current capabilities – that will shape the approach and pace of implementation.

1.2.1 Conducting a Green IT Readiness Assessment

A Green IT Readiness Assessment is a structured evaluation of an organization's current state across the seven framework components. It is not primarily a technical audit, though technical data is an important input. It is fundamentally an organizational assessment – one that examines governance structures, policies, data availability, existing initiatives, and cultural readiness alongside infrastructure and technology choices.

The assessment should be conducted by a cross-functional team that includes representation from IT leadership, facilities and operations, procurement, finance, and human resources. Sustainability expertise – whether resident in the organization or brought in through an external advisor – should be involved in both the design and the interpretation of the assessment to ensure that the right questions are being asked and that findings are correctly understood. For each component of the Green IT Framework, the assessment should address the following questions:

- What policies, standards, or guidelines currently exist in this area, and how consistently are they applied?
- What data is currently collected, how reliably, and by whom?
- What Green IT initiatives are already underway, and how mature are they?
- What are the most significant environmental impacts in this area, and are they currently understood by the relevant teams?
- What is the level of awareness and capability among the staff responsible for this area?
- What are the primary barriers – technical, financial, cultural, or governance-related – to improvement?

The output of the readiness assessment should be a component-by-component maturity profile – a structured view of where the organization currently sits on a spectrum from unaware and unstructured at one end to optimizing and leading at the other. This profile provides the raw material for the Green IT strategy developed in Chapter 2, the baseline for the measurement framework described in Chapter 3, and the prioritization logic for the implementation roadmap in Chapter 4.

Green IT Readiness Assessment

The readiness assessment is not a one-time exercise. It should be repeated on an annual basis as part of the Continual Improvement cycle described in Chapter 6, providing a consistent, comparable view of organizational progress over time. Using the same assessment instrument in each cycle is important: only like-for-like comparisons will reveal genuine improvement rather than changes in measurement approach.

1.2.2 Mapping Your IT Environmental Footprint

Alongside the readiness assessment, practitioners should develop an initial map of their organization's IT environmental footprint. This is a qualitative-to-quantitative exercise that identifies the primary sources of environmental impact across IT operations and estimates their relative scale. The footprint map does not need to be precise at this stage – its primary purpose is directional, identifying where the largest impacts lie and therefore where the greatest potential for improvement exists.

Key areas to examine include the following. First, energy consumption: how much electricity do the organization's data centers, server rooms, workstations, and networking equipment consume? Is this measured directly, or must it be estimated from billing data and device inventories? Second, carbon emissions: what is the carbon intensity of the energy sources used to power IT operations, and what are the Scope 1, 2, and 3 emissions attributable to IT? Third, e-waste: how many devices does the organization procure and retire each year, and what proportion are recycled through certified channels versus sent to landfill? Fourth, data volumes: how much data does the organization store, at what rate is that volume growing, and what proportion is ROT data that serves no operational purpose? Fifth, supply chain impacts: what is the environmental profile of the organization's primary hardware suppliers, and are sustainability criteria currently applied in procurement decisions?

Example – Green IT in Financial Services

A mid-sized financial services organization conducting its initial footprint mapping discovered that its on-premises data center – which the IT team had assumed was reasonably well managed – accounted for over 60% of the organization's total IT-related carbon emissions. The cause was an aging cooling system with a Power Usage Effectiveness ratio of 2.3, meaning that for every unit of energy used by IT equipment, a further 1.3 units were consumed by cooling overhead alone. This single finding redirected the organization's Green IT priorities significantly, moving data center modernization to the top of the implementation roadmap. Without the footprint mapping exercise, the team had planned to focus initial efforts on employee device management – an area of comparatively modest environmental impact.

1.2.3 Identifying Quick Wins and Long-Term Initiatives

One of the most valuable practical outputs of the initial assessment is a clear distinction between quick wins – changes that can be made rapidly, at low cost, and with immediate measurable impact – and long-term structural initiatives that require sustained investment, planning, and organizational effort. This distinction matters both practically and organizationally: early visible results build credibility and momentum for the harder, longer-term work that delivers the greatest environmental gains.

Quick wins in Green IT typically include: enabling power management and automatic sleep settings across the device fleet; implementing automated shutdown scheduling for workstations and non-essential servers outside working hours; establishing a basic e-waste collection and certified recycling programme; reviewing and changing default printer settings to duplex and black-and-white; and beginning to collect energy consumption data in areas where it is not currently tracked. These changes are generally policy and configuration decisions that require minimal capital investment, can be implemented within weeks, and yield immediate, measurable results.

Long-term structural initiatives typically include: transitioning to renewable energy sources; migrating workloads to sustainable cloud providers; redesigning software architectures for energy efficiency; establishing comprehensive supplier sustainability standards and audit processes; and building the measurement and reporting infrastructure needed to track progress rigorously over time. These initiatives require capital investment, cross-functional coordination, and leadership commitment measured in months or years rather than weeks.

A well-structured Green IT roadmap – developed in detail in Chapter 2 – sequences these initiatives thoughtfully, using early quick wins to build organizational credibility while laying the technical and governance groundwork for longer-term structural change.

* * *

1.3 Building the Business Case for Green IT

Securing organizational commitment to Green IT requires more than an appeal to environmental values. Decision-makers – whether boards, executive teams,

or budget holders – require a clear, credible business case that connects sustainability investment to outcomes they are already accountable for: cost efficiency, regulatory compliance, reputation, competitive positioning, and talent. This section sets out the key dimensions of that business case and provides practical guidance on how to construct and communicate it effectively.

1.3.1 Quantifying Environmental and Financial Impact

The foundation of a strong business case is quantification. Decision-makers are significantly more likely to commit resources when they can see, in concrete terms, both the scale of the organization's current environmental impact and the magnitude of the improvements that Green IT investment will deliver. Vague appeals to sustainability responsibility – however sincere – are less persuasive than specific, well-evidenced numbers.

On the environmental side, the key metrics to quantify for the business case are: total annual energy consumption attributable to IT operations, expressed in kilowatt-hours; carbon emissions from those operations, expressed in tonnes of CO2 equivalent; annual e-waste volumes expressed in tonnes and number of devices; and water consumption associated with data center operations where relevant. These figures should be derived from the footprint mapping exercise described in Section 1.2.2, with the Green IT Impact Measurement Framework introduced in Section 1.4 providing the rigorous methodology for doing so.

On the financial side, the business case should quantify: current energy costs attributable to IT operations; projected cost savings from energy efficiency improvements, modelled against realistic assumptions about consumption reduction rates; avoided costs from extended hardware lifecycles and reduced procurement frequency; and any applicable government incentives, tax credits, or grants available for sustainability investment in the organization's jurisdiction. Many governments offer substantial financial support for energy efficiency investments and renewable energy transitions that organizations frequently fail to access simply through lack of awareness.

It is equally important to quantify the financial risks of inaction. These include: regulatory risk – the potential cost of non-compliance as environmental reporting requirements and carbon pricing mechanisms tighten in many jurisdictions; reputational risk – the potential impact on customer retention, talent attraction, and investor confidence of being perceived as a

sustainability laggard; and supply chain risk – the growing tendency of large enterprise customers to require sustainability credentials from their suppliers as a condition of procurement.

1.3.2 Securing Leadership Buy-In and Sponsorship

Green IT implementation at organizational scale requires genuine executive sponsorship. Without it, initiatives tend to stall at the pilot stage, struggle for sustained budget allocation, and fail to achieve the cross-functional coordination that effective Green IT requires. The challenge is not merely to win nominal support from senior leaders, but to secure the kind of active, accountable sponsorship that drives resource commitment and organizational change.

The key to securing this level of buy-in is to frame Green IT not as a cost centre or a compliance requirement but as a strategic investment with multiple, concurrent strands of return. Different leaders respond to different aspects of the business case, and the most effective approach is to understand the priorities and accountabilities of each key stakeholder and tailor the case accordingly.

The Chief Financial Officer will be most interested in cost savings, payback periods, and financial risk mitigation. The Chief Technology Officer or Chief Information Officer will be focused on operational efficiency, the modernization opportunities that sustainability investment creates, and the technology leadership dimensions of the case. The Chief Executive and the board will be thinking about the organization's long-term strategic positioning, regulatory compliance, and the ESG expectations of investors and major customers. The Chief People Officer will be interested in the talent attraction and employee engagement dimensions of a credible sustainability agenda.

The executive sponsor for Green IT should carry personal accountability for the organization's Green IT goals – not merely be nominally supportive of them. This accountability should be made explicit in governance structures, reflected in performance metrics, and communicated visibly to the broader organization.

Case Study – Business Language

A global logistics organization found that its initial Green IT proposals, framed primarily around environmental responsibility, gained limited traction with the executive team. When the sustainability team reframed the proposal around three concrete financial metrics – a projected annual saving of €4.2 million in energy costs, a 30% reduction in hardware procurement expenditure through lifecycle extension, and a risk mitigation value associated with anticipated EU carbon reporting requirements – the proposal was approved within a single board cycle and assigned a C-suite sponsor within the month. The environmental case was the same in both proposals. The difference was in the language used to express it.

1.3.3 Linking Green IT to Broader ESG and Business Objectives

Green IT does not exist in isolation. For most organizations, it is one component of a broader Environmental, Social, and Governance (ESG) agenda, and the business case for Green IT is substantially strengthened when it is explicitly connected to that broader agenda and to the organization's existing sustainability commitments.

Practitioners should map Green IT objectives to the organization's existing commitments – whether these are science-based targets aligned to the Paris Agreement, net zero pledges, sector-specific sustainability frameworks, or voluntary reporting commitments such as the Global Reporting Initiative Standards or the recommendations of the Task Force on Climate-related Financial Disclosures.[5] Demonstrating that Green IT investment directly advances these commitments makes it far easier to justify to boards and investors who are already committed to the broader sustainability agenda and who may be under pressure to demonstrate progress against it.

Green IT should also be connected explicitly to the organization's IT strategy. Energy-efficient infrastructure, cloud migration, software modernization, and data rationalization are frequently objectives that the IT function is already pursuing for operational and cost reasons. Framing them additionally as Green

[5] Task Force on Climate-related Financial Disclosures. (n.d.). *Recommendations of the Task Force on Climate-related Financial Disclosures*. https://www.fsb-tcfd.org

IT investments increases their justifiability, broadens their sponsorship base, and – critically – ensures that sustainability considerations are embedded in IT decisions from the outset rather than retrofitted after the fact. This integration is far more effective than treating Green IT as a separate programme running alongside the core IT agenda.

* * *

1.4 Introducing the Green IT Impact Measurement Framework

Measurement is the backbone of effective Green IT implementation. Without a consistent, structured approach to quantifying environmental impact, organizations cannot establish meaningful baselines, track progress against goals, prioritize initiatives by their expected impact, or report credibly to internal and external stakeholders. This section introduces the Green IT Impact Measurement Framework – a mathematical model designed to give practitioners a rigorous, component-by-component view of their organization's environmental footprint and the progress they are making in reducing it.

The full mathematical specification of the framework, including all formulae, variable definitions, data collection guidance, and worked examples, is provided in Appendix A. This section provides the conceptual overview that practitioners need to understand the framework's logic and begin applying it in their organizational context.

1.4.1 Framework Architecture

The Green IT Impact Measurement Framework is structured around the five operational components of the Green IT Framework: Hardware, Software, Processes, Practices, and Data Storage. For each component, the framework defines a set of primary metrics – the key quantities that must be measured to assess environmental impact – and a set of derived indicators that express the environmental significance of those measurements in terms of carbon emissions, energy consumption, or waste volumes.

The framework is designed to be modular: organizations can begin measuring the components for which data is most readily available and progressively extend coverage over time. This modularity is important in practice, because few organizations beginning their Green IT journey will have comprehensive, reliable data across all five components from the outset. The framework is calibrated to produce meaningful outputs even with partial data, while providing strong incentives to improve data quality progressively.

The framework also defines a composite Green IT Impact Score (GIIS) – a single, normalized index that aggregates performance across all five operational components and provides a high-level summary of the organization's overall Green IT position. The GIIS is designed to be tracked over time, enabling organizations to communicate progress in a format that is accessible to non-specialist stakeholders including boards, investors, and employees.

1.4.2 The Core Measurement Model

At its most fundamental level, the framework measures environmental impact in terms of three primary quantities: carbon emissions, expressed in tonnes of CO2 equivalent (tCO2e); energy consumption, expressed in kilowatt-hours (kWh); and e-waste, expressed in tonnes and number of devices. These three quantities serve as the common currency of the framework – all component-level metrics are ultimately expressed in terms of one or more of them.

The basic carbon calculation for any IT component follows the form:

$$C_{component} = E_{component} \times I_{grid}$$

Where $C_{component}$ is the carbon emissions attributable to that component (in tCO2e), $E_{component}$ is the energy consumed by that component (in kWh), and I_{grid} is the carbon intensity of the electricity grid supplying the organization (expressed in kgCO2e per kWh).

Grid carbon intensity varies significantly by geography, energy mix, and time of day. Organizations should use the most current published figures for their specific location and energy supplier, updated at least annually. For organizations operating across multiple geographies, a location-specific

intensity factor should be applied to each site rather than using a single blended average.

The total carbon footprint of IT operations is then calculated by summing the component-level emissions:

$$C_{total} = C_{hardware} + C_{software} + C_{processes} + C_{practices} + C_{storage}$$

This total represents an approximation of the Scope 2 and relevant Scope 3 emissions attributable to IT operations. Some emissions – such as those embedded in hardware manufacturing and supply chain logistics – are Scope 3 in nature and may require estimation rather than direct measurement, particularly in the early stages of framework adoption.

Scope of the Measurement Framework

The Green IT Impact Measurement Framework focuses on the carbon and energy dimensions of environmental impact over which organizations have the most direct ability to measure and control. It does not, in its base form, capture all possible environmental impacts – such as water consumption or biodiversity effects – though these can be incorporated as supplementary metrics for organizations with both the data and the ambition to pursue a more comprehensive assessment.

1.4.3 Connecting Measurement to Each Framework Component

Each component of the Green IT Framework maps to a distinct set of measurement inputs in the impact model. Understanding these mappings is essential for designing the data collection processes needed to feed the framework consistently.

1. **Hardware** measurements focus on three primary dimensions: the operational energy consumed by the device fleet; the embedded carbon associated with hardware procurement (the manufacturing emissions

attributed to devices purchased during the measurement period); and the e-waste generated by device retirement. Key data inputs include a complete device inventory with type categorization, average annual energy consumption by device type (available from manufacturer specifications or direct monitoring tools), the volume of devices purchased and retired during the measurement period, and the proportion of retired devices disposed of through certified recycling channels.

2. **Software** measurements focus on the energy overhead attributable to software inefficiency and poor resource management. The central metric is server and cloud resource utilization – the proportion of provisioned computing capacity that is actively and productively used. A server running at 20% average utilization is consuming 80% of its energy on idle overhead. Key data inputs include server and virtual machine utilization rates, cloud resource allocation and consumption data from provider billing APIs, and where available, application-level energy profiling data from monitoring tools.
3. **Processes** measurements capture the emissions attributable to organizational workflows – principally commuting and business travel, paper consumption and printing, and the energy used to power office buildings in support of IT operations. These are frequently the most accessible measurements to collect, as they can often be derived from existing HR, facilities management, and finance systems without requiring new monitoring infrastructure.
4. **Practices** measurements are the most behavioral in nature, capturing the impact of employee habits and organizational culture on energy and resource consumption. Key metrics include the energy waste attributable to devices left on unnecessarily, compared against a best-practice baseline, and the carbon avoided through initiatives such as the adoption of virtual meetings in place of business travel. These measurements typically involve before-and-after comparisons and may draw on a combination of quantitative monitoring data and structured survey responses.

5 **Data Storage** measurements cover the energy consumed by data center infrastructure, expressed through the Power Usage Effectiveness metric and the IT load it amplifies. The PUE-adjusted energy calculation for data storage is:

$$E_{storage} = E_{IT} \times PUE$$

Where E_{IT} is the energy consumed by IT equipment within the data center and PUE is the Power Usage Effectiveness ratio of the facility. An organization whose data center has a PUE of 1.8 is consuming 1.8 kWh of total facility energy for every 1 kWh used by IT equipment – meaning that 44% of total energy spend is overhead rather than productive computing work.

1.4.4 Establishing Your Baseline

The first practical step in applying the Green IT Impact Measurement Framework is to establish a baseline – a documented snapshot of the organization's current environmental impact across all five components, calculated for a defined measurement period, typically a calendar year. This baseline serves as the reference point against which all future progress is measured and against which the impact of specific initiatives can be evaluated.

Establishing a complete and reliable baseline requires data collection from a range of systems and organizational functions. In most organizations, this data is dispersed across multiple teams and systems: energy consumption data may sit with the facilities or finance team; device inventory data in IT asset management systems; travel and commuting data in expense management systems; cloud usage data in provider billing dashboards; and supplier environmental data in procurement records. One of the practical early tasks of Green IT implementation is therefore to identify these data sources, assess their reliability and completeness, and establish the workflows needed to bring them together into a coherent picture.

Where complete data is not available – which is typical for organizations beginning their Green IT journey – the framework provides estimation approaches that produce defensible, if approximate, baseline figures. The most important principle is to begin measurement with the best available data and to improve data quality progressively over successive measurement periods. A good baseline established with incomplete data and improved over time is far more useful than a perfect baseline deferred indefinitely.

1.4.5 Using the Framework for Decision-Making

Beyond baseline setting and progress tracking, the Green IT Impact Measurement Framework is designed to support ongoing operational decision-making throughout the implementation journey. By providing a consistent, quantified view of impact across all five components, it enables practitioners to make more informed choices in three key contexts.

1. **Prioritizing initiatives by impact.** When multiple potential Green IT initiatives are under consideration, the measurement framework enables practitioners to model the expected environmental impact of each and to allocate resources to those with the greatest return. An initiative that improves server utilization from 20% to 60% may deliver a greater carbon reduction than a full device fleet upgrade, or vice versa – the framework provides the basis for making this comparison rigorously rather than on intuition alone.
2. **Evaluating trade-offs.** Some Green IT decisions involve genuine environmental trade-offs that are not apparent without quantitative analysis. Migrating workloads from an on-premises data center to a cloud provider may reduce direct operational energy consumption while simultaneously increasing Scope 3 emissions if the provider relies on fossil fuel energy. The measurement framework provides a common currency – tCO2e – in which such trade-offs can be evaluated consistently and transparently, supporting better-informed decisions.
3. **Tracking the impact of specific interventions.** When a specific initiative is implemented, the framework enables practitioners to measure the actual environmental impact achieved and compare it against the projected impact estimated at the outset. This evidence-based feedback loop is essential for understanding what works in a given organizational context, adjusting approaches that underdeliver, and building the track record of demonstrated impact that sustains long-term leadership commitment to Green IT.

The complete technical specification of the framework – including all formulae, variable definitions, worked numerical examples across each component, and data collection templates – is provided in Appendix A. Practitioners should read that appendix in conjunction with Chapter 3, which provides

detailed, component-by-component guidance on measurement methodology, data sources, and tooling.

* * *

Exercise 1 — Green IT Readiness Asessment

Objective

Apply the concepts introduced in this chapter to your own organization by conducting a preliminary Green IT Readiness Assessment and developing an initial environmental footprint map. This exercise will form the basis of the strategy work in Chapter 2 and the measurement baseline work in Chapter 3.

Instructions

1. Assemble a small cross-functional team to complete this assessment. Aim to include representatives from IT, facilities or operations, procurement, and finance. If possible, include someone with sustainability knowledge.
2. For each of the seven Green IT Framework components – Strategy, Hardware, Software, Processes, Practices, Data Storage, and Measurement and Reporting – rate your organization's current maturity on the following scale:

    - **1 – Unaware**: No awareness or action in this area.
    - **2 – Initiating**: Some awareness but ad hoc and uncoordinated activity.
    - **3 – Developing**: Defined initiatives in place but inconsistently applied.
    - **4 – Established**: Consistent, governed practice with basic measurement.
    - **5 – Optimizing**: Mature practice with continuous improvement built in.

3. For each component, note the one or two most significant environmental impacts you believe exist in your organization in that area. Do not worry if you cannot quantify them precisely – qualitative estimates are a valid starting point.
4. Based on your readiness assessment ratings and impact notes, identify:

- Three quick wins that could be implemented within the next 30 to 60 days.
- Three longer-term structural initiatives that would require more sustained investment.

5. Identify the primary barrier to Green IT improvement in your organization – whether cultural, financial, technical, or governance-related – and consider what would be needed to address it.

Reflection Questions

- Which component shows the greatest gap between your organization's current maturity and what you believe best practice looks like?
- Were there areas of environmental impact you discovered through this exercise that had not previously been on your organization's radar?
- Who in your organization would need to be engaged to make progress on the quick wins you identified? What is the most effective way to approach them?
- How does your organization's current approach to Green IT connect – or fail to connect – to its broader ESG and sustainability commitments?

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7.5 Integrated Case Examples

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7.5.1 Case Example: The Public Sector Organization

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Context

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Challenges encountered.

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How the challenges were addressed.

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Outcomes after two years.

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7.5.2 Case Example: The Rapid-Growth Technology Company

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Context.

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Challenges encountered.

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How the challenges were addressed.

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Outcomes after two years.

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7.5.3 Case Example: The Global Manufacturing Organization

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Context.

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Challenges encountered.

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How the challenges were addressed.

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Outcomes after two years.

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Appendices

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Appendix A: Mathematical Measurement Model

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A.3.2 Embodied (manufacturing) hardware carbon

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A.3.3 E-waste volume

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A.4 Software Component Formulae

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A.4.3 Carbon from under-utilized infrastructure

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A.5 Processes Component Formulae

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A.5.1 Business travel carbon

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A.5.3 Carbon from idle device energy waste

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A.6 Data Storage Component Formulae

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A.6.1 Power Usage Effectiveness

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A.6.3 Data center carbon

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A.6.4 Water Usage Effectiveness

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A.7 Total IT Carbon and Scope Classification

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A.7.1 Total operational IT carbon

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A.7.2 Scope classification summary

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Appendix B: Readiness Assessment Template

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B.7 Measurement and Reporting

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B.8 Overall Score and Interpretation

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Appendix C: KPI Reference by Component

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C.1 Green IT Strategy KPIs

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C.2 Hardware KPIs

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C.3 Software KPIs

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C.4 Processes KPIs

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C.6 Data Storage KPIs

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C.7 Measurement and Reporting KPIs

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Appendix D: Green IT Strategy Template

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Reporting period covered by this strategy:

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Scope of the strategy

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Key drivers for this strategy

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Current Green IT maturity

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Vision:

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Section 4: Governance Structure

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Green IT steering committee members:

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Programme manager:

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Practices policy:

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Year 3+ Initiatives (pipeline)

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Section 8: Stakeholder Engagement Plan

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Section 9: Reporting Cadence

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E.2 Hardware Sustainability Certifications

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E.5 Software Sustainability Tools and Frameworks

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E.7 Carbon Offset Programs and Standards

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