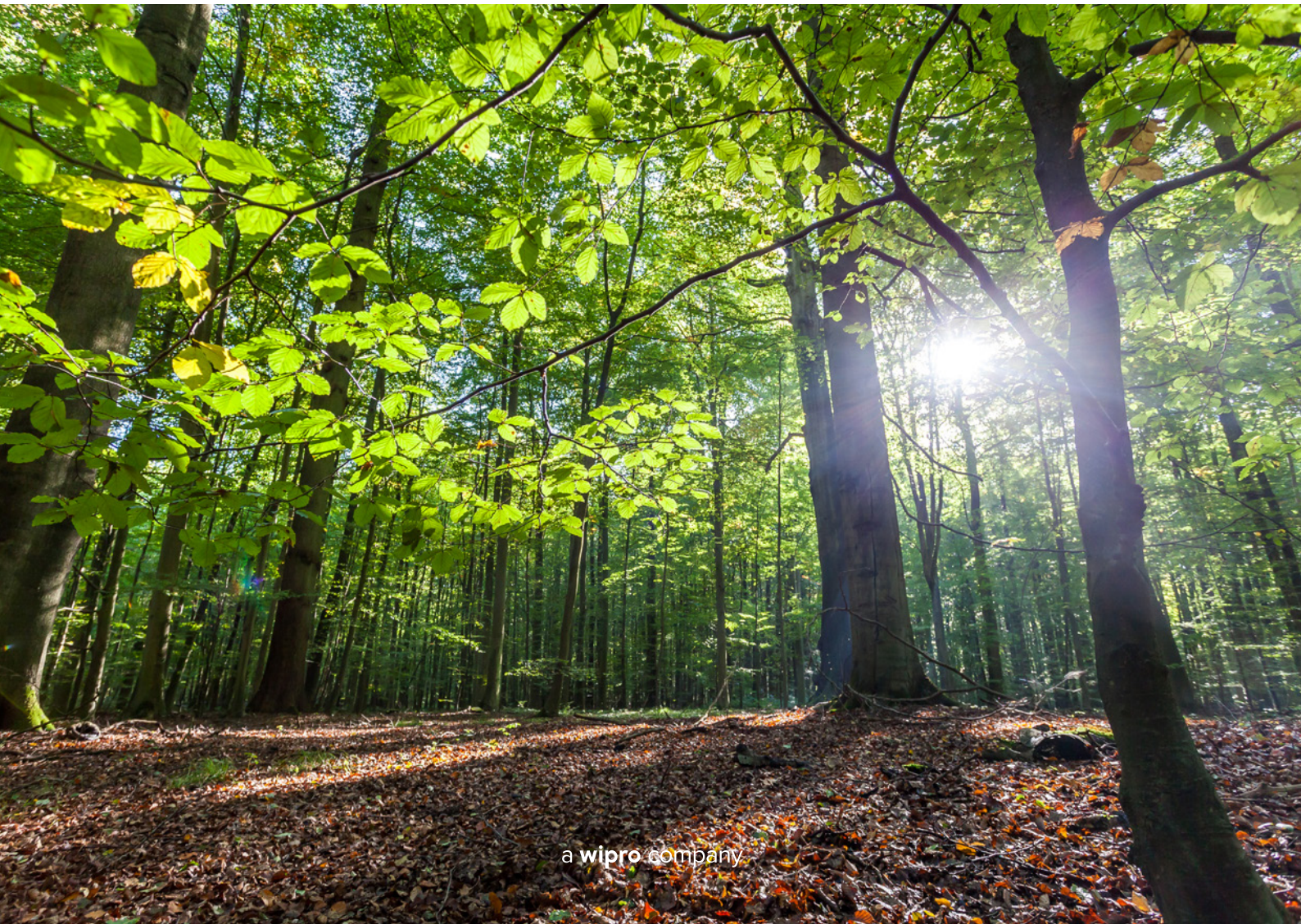
CAPCO

GREENOPS:

OPTIMISE YOUR IT ESTATE, SAVE OUR PLANET



a **wipro** company

The impacts of man-made climate change are clear to see, and net zero is now a high priority for most enterprises, including the financial services and IT industries. However, what it means for technology, cloud and software engineering to be 'green' needs demystifying.

Cloud computing has been fuelling the next age of innovation and agility in the IT industry – but it is also contributing to an estimated 2.5% to 3.7% of global greenhouse emissions, surpassing the commercial aviation sector (about 2.4%)[1]. It is accordingly imperative that that companies recognize that the environmental impact of the IT estate is increasingly as important as its financial accountability and reporting.

In our previous paper[2] we looked at how FinOps helps organisations establish financial accountability and operational efficiency for their cloud spend. Now we will explore how to drive your sustainability agenda in tandem with FinOps – aka GreenOps.

DRIVING FACTORS

Sustainability concerns aside, there are now regulatory and reputational reasons for a more rapid adoption of GreenOps.

Regulatory push. Currently most organisations have implemented ESG initiatives and reporting in some form. Multiple labels – carbon neutral, carbon offset, carbon credits, etc. – are used to convey the emission related efforts and outcomes. However, these mechanisms do not necessarily generate a net reduction in greenhouse gases. Governing organisations and regulators have already acknowledged this and are considering laws to challenge 'greenwashing' and bring in more transparency[3].

Evolving reporting frameworks. The International Sustainability Standards Board (ISSB) was announced at COP26 in 2021 as a step to standardise sustainability reporting. The ISSB seeks to define sustainability related disclosure standards, as exist for financial reporting, which will see a convergence of environmental impact and reporting with financial performance and reporting.

Reputational and business risk. As social awareness around sustainability increases, expectations are mounting from consumers who want to be associated with 'green' brands. Corporates likewise are considering carbon emissions as part of their purchasing decisions, including IT spend, and Gartner has predicted that by 2025 carbon emissions will start driving cloud purchase decisions[4].

MEASUREMENT AND REPORTING

The standards developed by GHG (Greenhouse Gas) protocol[5] are the most widely adopted framework for carbon accounting and reporting enabling companies to measure their sustainability. These standards cover various categories of emissions:

Table 1

Category of emission	What does it cover?
Scope 1: **Direct emissions**	Direct emissions generated by an organisation via the equipment it operates – e.g. first party data centres, end user computing devices
Scope 2: **Indirect emissions – energy generation**	Indirect emissions generated while producing any electricity, steam, heating and cooling that organisation purchases or acquires – e.g. emissions generated while producing electricity, which is consumed/ purchased by an organisation to run its first party data centres
Scope 3: **Indirect emissions – supply chain**	Indirect emissions in the corporate value chain – e.g., suppliers, vendors, manufacturers etc. – e.g. cloud service providers used by an organisation

Scope 3 emissions – challenging but important.

While Scope 1 and 2 category emissions are within an organisation's direct control, Scope 3 emissions arise from third parties up and down the value chain – and include dependencies for data points, measurement, and reporting. There is also less control on how Scope 3 emissions are addressed and optimised.

To help organisations identify and report Scope 3 emissions, GHG protocol has defined 15 categories across upstream and downstream activities with guidance for each of them[6]. Though they are tricky to measure, Scope 3 is also where the most impact occurs.

Various studies[7] indicate that the Scope 3 emissions contribution is multiple times higher than Scope 1 and 2, ranging anywhere from 50% to 90% of overall emissions depending on industry sector. For the financial sector, data suggests that Scope 3 emissions contribute more than 80% of the overall emissions of an organisation[8].

IMPLICATIONS FOR THE IT ESTATE

Table 2 below sets out the three categories of emission would be measured for the IT estate.

Table 2

Category of emission	How do you measure for your IT estate?
Scope 1: Direct emissions	• Data is sourced from procurement, finance or any similar relevant function. • This is used to convert direct electricity purchases (used to power first party data centres, end user computing devices etc.) into a value in tonnes of GHGs. • DCIM (Data Centre Information Management) is an established discipline with multiple tools, platforms available in the market which can help account for the resource consumption by various IT assets.
Scope 2: Indirect emissions – energy generation	• Data is sourced from electricity (or other energy) suppliers. • The GHG protocol has guidance on measuring emissions from purchased or acquired energy[9]. • Organisations often offset impact of their Scope 1 emissions by optimising Scope 2 emissions- by purchasing renewable energy credits (showcasing that part of the electricity they consumed comes from renewable energy sources) or generating electricity from renewable sources off-site or on-site.
Scope 3: Indirect emissions – supply chain	• This has dependency on any third-party suppliers used in the IT value chain – they could be in the form of equipment/ resource vendors, SaaS providers, cloud service providers. • Cloud service providers provide carbon tracking tools so that organisations can monitor emissions of their workloads in the cloud[10,11,12]. • The way SaaS providers apportion carbon usage to their individual customer organisations varies from provider to provider – e.g. one of the major SaaS providers apportions carbon usage to their customers as a percentage of its carbon consumption, based on the percentage of customers financial contract value to their total revenue.

As can be inferred, the rise of 'cloud first' strategies and increasing cloud consumption means organisations increasingly rely on cloud service providers (CSPs) to account for their IT estate's scope 3 emissions.

DEVOLVING EMISSIONS RESPONSIBILITIES TO CSPS IS NOT AN OPTION

Cloud service providers only provide tools to track and report the carbon footprint of an organization's cloud-hosted workloads – and even these do not effectively convey the full picture. As a result, CSPs have come under scrutiny or their emissions reporting and net zero pledges[13].

From CSPs' perspective, they have their own Scope 1, 2 & 3 emissions and ideally CSPs' should account for their Scope 3 (and not just Scope 1 and 2) emissions when reporting carbon footprint for their customers workloads. The emissions dashboards from all cloud service providers does not include their scope 3 emissions.

Table 3 details how major cloud service providers cover and apportion their Scope 3 emissions for their customers.

Table 3

Cloud service provider	Coverage of their scope 3 emissions
Microsoft	Microsoft's emissions impact dashboard presents insights on their Scope 3 emissions[14]
Amazon Web Services	AWS' carbon footprint tool presents estimates for only Scope 1 & 2 emissions, with Scope 3 emissions covered as part of a separate annual report[15]
Google Cloud	Google Cloud's carbon footprint tool covers their scope 3 emissions[16]

WHAT CAN ORGANISATIONS DO TO OPTIMISE THEIR CARBON EMISSIONS IN THE CLOUD?

Optimise your cloud workloads. Resource wastage is as prevalent in the cloud as elsewhere, with overprovisioning and unoptimized workloads resulting in increased cost and carbon footprint – especially when used as Infrastructure as a Service (IaaS). Organisations have started recognising this, as reflected in Flexera's state of the cloud report[17], which highlights 'optimising existing use of cloud' as the top cloud initiative that organisations are planning to work on.

Table 4 sets out some key problem areas and associated remediation approaches for optimising cloud workloads.

Table 4

Problem areas	Remediation guidance
Idle resources	• Adopt Infrastructure as Code (IaC) to stand-up and destroy Infrastructure on demand • Consider Platform as a Service, Serverless and Software as a Service if appropriate for use cases that scale down automatically
Overprovisioned resources	• Adopt horizontal on demand scaling for both compute and storage, instead of provisioning for peak demand • Measure and optimised the capacity usage to right-size the workloads
Poorly managed storage	• Choose the right storage tier based on frequency of access • Implement archival and retention policies to optimise the storage usage

This topic is addressed in greater detail in our cloud waste management paper[18].

Green engineering. Emissions are not just a hardware problem. Cloud providers are responsible for the sustainability of the cloud services they operate, but cloud consumers themselves must start taking responsibility for the sustainability of the workloads they host in the cloud.

This requires giving consideration to the way the organisation architects and engineers such workloads. The objective is to embed sustainability considerations into your Agile delivery lifecycle while not impacting time to market and quality.

We have identified six areas where organizations can start tackling the software aspects of the emissions problem:

1. **Learning and experimentation**
   Green/ sustainable software engineering is an emerging area. There are multiple projects exploring and contributing to the development of this area. For example Microsoft has published learning resources[19] and multiple blog posts covering the various techniques[20].

   The Green Software Foundation[21] is working on number of standards and projects, including Software Carbon Intensity (SCI) specification which defines a methodology for calculating the rate of carbon emissions for a software systems. They have also published a training course[22] and launched certification in this area.

   Encourage your engineering teams to learn, explore and adopt green software engineering practices like other more established practices such as secure coding. Consider sponsoring hackathons around this topic to facilitate experimentation and ideation.

2. **Measurement and tracking**
   Any optimisation and improvement effort is futile without a robust measurement and tracking mechanism to baseline the AS-IS state and measure the outcome of any future changes.

   The Green Software Foundation is working on a project[23] to cover approaches and methodologies for calculating core components of their Software Carbon Intensity (SCI) specification. GoCodeGreen[24] has developed a platform which produces carbon calculations for the build and run cost of software products based on 400-plus variables, including SCI calculation scores.

3. **Architect cloud native applications**
   While 'lift and shift' transformations using the IaaS capabilities of cloud service providers could optimise emissions as compared to on-premise data centres, further optimizations can be achieved by transforming applications to be cloud native.

   This will allow them to reap the benefits of cloud native paradigms such as Platform as a Service (PaaS), Software as a Service (SaaS) and Serverless, which are more elastic in their application when compared to IaaS. CSPs have also started addressing sustainability as part of their architecture frameworks – e.g. AWS has added sixth-pillar sustainability to the AWS Well Architected Framework[25].

4. **Consider optimising apps running on end user computing devices like mobile phones**
   Emissions optimization is not just applicable for cloud workloads. Consider energy usage on the end user devices such as mobile phones. For example, Android Studio has an energy profiler[26] which can help inspect usage of CPU, network radios, sensors etc. during app development. Consider adopting such tools to develop energy conscious apps.

5. **Consider your AI/ ML training use cases**
   As per MIT research, training a single AI model can emit as much carbon as five cars in their lifetime[27], which is further exacerbated by the emergence of LLM (Large Language Models) like ChatGPT[28]. The MIT study also shows that any incremental improvements to coverage and accuracy of these models come at the cost of exponential increase in the carbon footprint.

   As AI/ ML adoption increases in the industry, organisations should consider buying and adopting pre-trained models rather than starting from scratch, especially for their operational, non-business differentiating use cases. All major cloud providers offer a number of pre-trained AI/ ML models covering common use cases such as text, image, video analysis, natural language processing etc.

6. **Cultural change**
   As is the case with any successful transformation journey, it is not just about process and technology change. People change management is also a key consideration to facilitate the mindset shift required to successfully achieve sustainability goals.

   This can be affected through training and awareness sessions, and by enabling and empowering the entire business value chain to consider sustainability as a required outcome for their respective areas of focus – be it vendor procurement, programme/ project KPIs, architecture, design and software development lifecycle KPIs.

CONCLUSION

Sustainability and operational efficiency are not mutually exclusive. Effort to tackle carbon emissions can complement operational efficiency, resulting in cost optimisation. Considering factors such as current regulatory imperatives, evolving frameworks, and reputational and business risk, now is the right time for organisations to start practicing GreenOps by embedding considerations discussed in this paper, in the architecture, design, engineering and delivery lifecycle of their technology solutions.

Capco is an award winning ESG data and technology consultancy. We have helped multiple organisations on their cloud adoption and cost optimisation journeys, contributing to their FinOps and GreenOps agenda. We offer an end-to-end green technology approach, covering AS-IS assessment, strategy definition, roadmap identification, strategic implementation, and tailored training to enable clients to take charge of their sustainability implementation and scale it across business areas.

We work together with GoCodeGreen who offer the first and most complete carbon diagnosis and decisioning platform for software and technology to baseline the current carbon footprint of a product, business area or organisation. This allows us to generate a concrete strategic plan which we help our clients implement end to end through a combination of setting up Green Technology CoE's, deploying experienced green technology implementation teams and delivering capability uplift programmes to leave long lasting change in our clients' organisation.

Our aim is to drive transformative change, enabling your organization to lead the way towards a sustainable and prosperous future. If you would like to know more about our green technology offering and how we can help you on your sustainability journey, please get in touch with us.

REFERENCES

1. https://www.climatiq.io/blog/measure-greenhouse-gas-emissions-carbon-data-centres-cloud-computing
2. https://www.capco.com/Intelligence/Capco-Intelligence/Managing-cloud-costs-through-the-FinOps-Framework
3. https://ec.europa.eu/environment/eussd/smgp/initiative_on_green_claims.htm
4. https://www.gartner.com/en/newsroom/press-releases/2022-01-24-gartner-predicts-hyperscalers-carbon-emissions-will-drive-cloud-purchase-decsions-by-2025
5. https://ghgprotocol.org/standards
6. https://ghgprotocol.org/scope-3-technical-calculation-guidance
7. https://cdn.cdp.net/cdp-production/cms/guidance_docs/pdfs/000/003/504/original/CDP-technical-note-scope-3-relevance-by-sector.pdf
8. https://www.gbm.hsbc.com/en-gb/feed/sustainability/scope-3-emissions
9. https://ghgprotocol.org/scope-2-guidance
10. https://www.microsoft.com/en-us/sustainability/emissions-impact-dashboard
11. https://aws.amazon.com/aws-cost-management/aws-customer-carbon-footprint-tool/
12. https://cloud.google.com/carbon-footprint
13. https://www.datacenterknowledge.com/sustainability/cop27-hidden-emissions-cloud-computing-pose-net-zero-threat
14. https://download.microsoft.com/download/7/2/8/72830831-5d64-4f5c-9f51-e6e38ab1dd55/Microsoft_Scope_3_Emissions.pdf
15. https://docs.aws.amazon.com/awsaccountbilling/latest/aboutv2/ccft-estimation.html
16. https://cloud.google.com/carbon-footprint/docs/methodology
17. https://info.flexera.com/CM-REPORT-State-of-the-Cloud-2023-Thanks?revisit
18. https://www.capco.com/Intelligence/Capco-Intelligence/Uncovering-the-Optimization-Potential-of-Cloud
19. https://learn.microsoft.com/en-gb/training/modules/sustainable-software-engineering-overview/
20. https://devblogs.microsoft.com/sustainable-software/
21. https://greensoftware.foundation/
22. https://learn.greensoftware.foundation/

REFERENCES

23. https://sci-guide.greensoftware.foundation/
24. https://gocode.green/
25. https://docs.aws.amazon.com/wellarchitected/latest/sustainability-pillar/sustainability-pillar.html
26. https://developer.android.com/studio/profile/energy-profiler
27. https://www.technologyreview.com/2019/06/06/239031/training-a-single-ai-model-can-emit-as-much-carbon-as-five-cars-in-their-lifetimes/
28. https://arstechnica.com/gadgets/2023/04/generative-ai-is-cool-but-lets-not-forget-its-human-and-environmental-costs/

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ABOUT CAPCO

Capco, a Wipro company, is a global technology and management consultancy focused in the financial services industry. Capco operates at the intersection of business and technology by combining innovative thinking with unrivalled industry knowledge to fast-track digital initiatives for banking and payments, capital markets, wealth and asset management, insurance, and the energy sector. Capco's cutting-edge ingenuity is brought to life through its award-winning Be Yourself At Work culture and diverse talent.

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