Whitepaper

Cloud Sustainability A Double Helix of FinOps & GreenOps

by Mudit Gupta

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Introduction

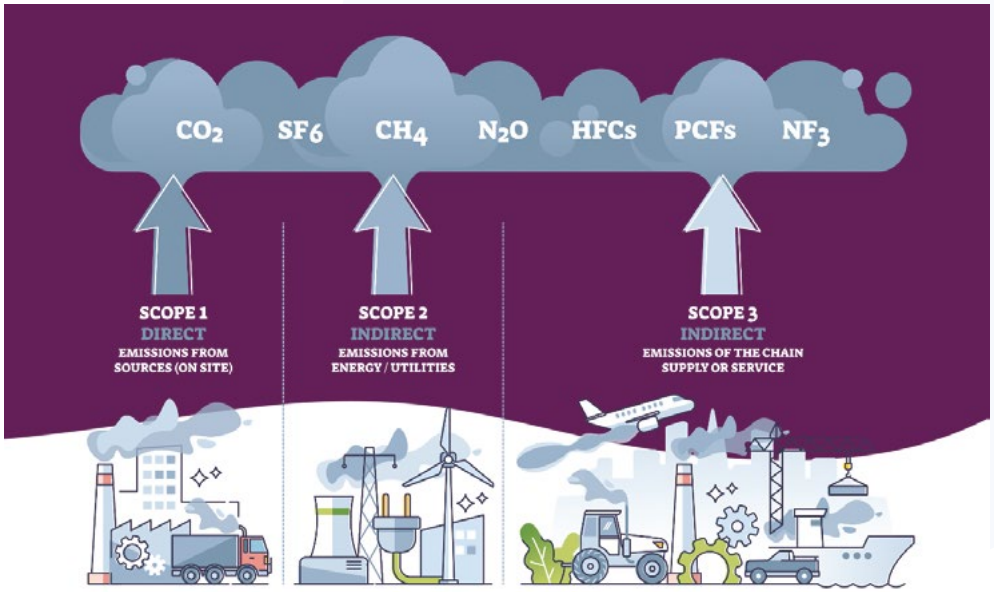
How we do business and deliver products is transforming. There is an ever growing focus to make the technologies and practices involved sustainable to create overall positive impact with key areas on Environment, Social and Governance (ESG). Governments, for example, are implementing policies and creating laws in line with the Paris agreement for climate change. The EU is going to make ESG non-financial reporting mandatory from 2024 which will mandate certain companies under Corporate Sustainability Reporting Directive (CSRD). These changes make us think and take point of how the IT contributes to the carbon footprint for the company and are concentrated at.

Over the years, cloud computing has revolutionised the IT space (Kumar, P., 2020). by bringing tools to create solutions of the future. In this whitepaper, I will share how migrating and operating on public cloud is helping companies to go green and how managers, architects, and engineers can run workloads to make a positive impact.

Cloud Carbon Emissions

On 1st March 2022, AWS released the Carbon footprint tool which gives insights into the environmental impact workloads have per AWS account. The tool is still in its early stages and is limited to give insights into total emissions and segregated EC2 and S3 emissions, along with a summary report. Nevertheless, it is a step in the right direction giving a way for the customers to view their partial Scope 3 carbon footprint (Plan A Earth, 2022). But before we can describe the significance of this tool, we present a quick overview of the three scope of carbon emissions as described by the GHG protocol.

These terms are often used in the context of corporate greenhouse gas (GHG) accounting and reporting. They refer to different categories of emissions that result from a company's activities, products, and services..



Scopes of emissions as greenhouse carbon gas calculation outline diagram. Labeled educational direct or indirect division scheme with company air pollution sectors and its examples vector

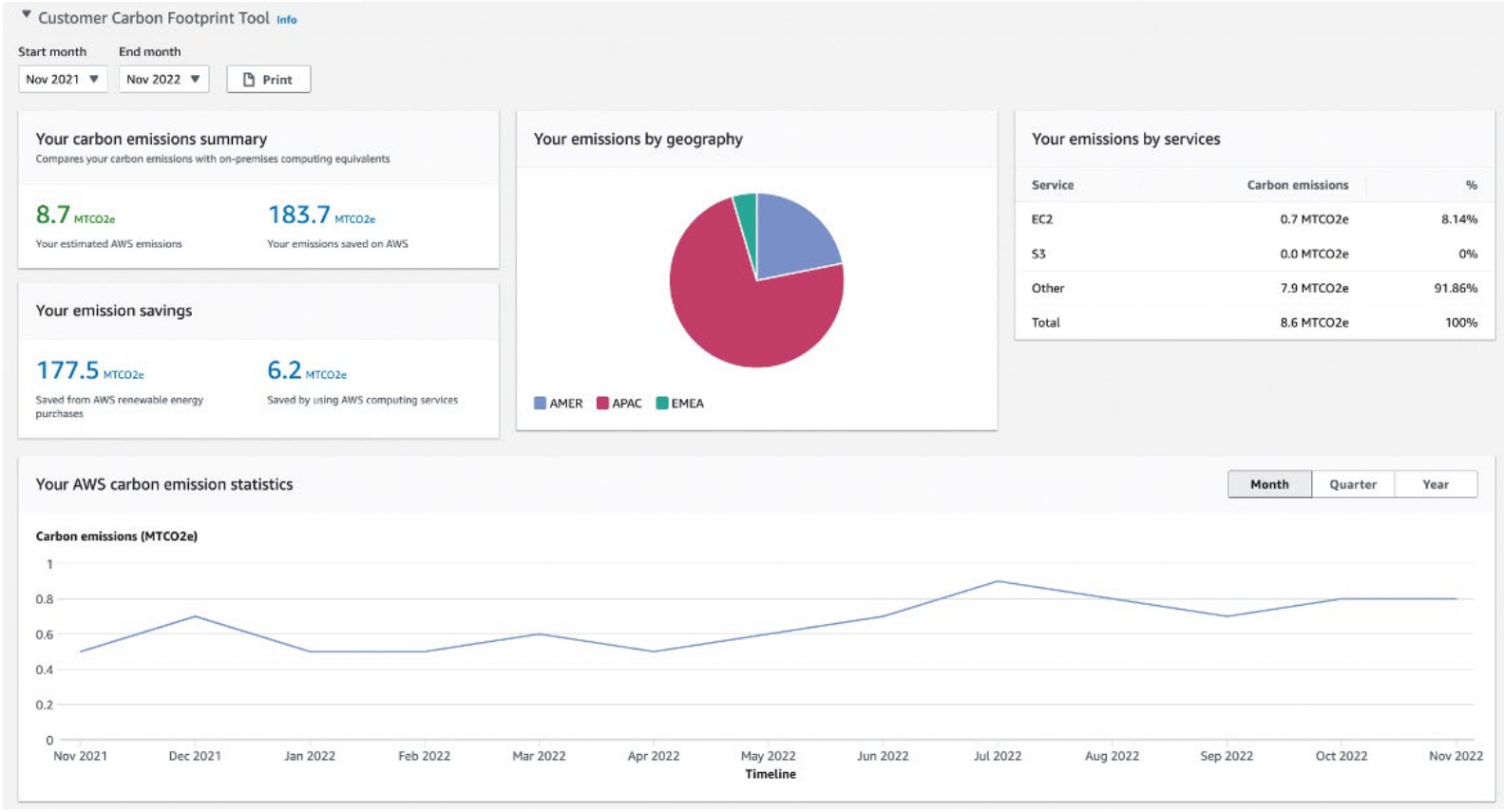
Scope 1 emissions are direct emissions from sources that are owned or controlled by the company. This includes emissions from on-site combustion of fuels, process emissions from chemical reactions, and emissions from company-owned vehicles.

Scope 2 emissions are indirect emissions from the consumption of purchased electricity, heat, or steam. These emissions are generated off-site but are associated with the company's activities and operations.

Scope 3 emissions are all other indirect emissions that result from a company's value chain, including emissions from the production of purchased goods and services, transportation of goods, and employee commuting. These emissions are often the largest portion of a company's carbon footprint, and can be difficult to measure and reduce due to their complexity and the involvement of third-party suppliers and partners.

By accounting for and reducing their Scope 1, Scope 2, and Scope 3 emissions, companies can play a key role in addressing climate change and promoting sustainable business practices. From a customer's perspective, consuming the cloud based resources, all the emissions brought into the company's value chain can be seen as Scope 3 emissions. As the customer does not have direct impact on the policies ESG set by public cloud providers but can optimise the cloud resources being utilised among other strategies.

Over the years, various steps have been taken by industries and governments to reduce Scope 1 and Scope 2 carbon emissions, though Scope 3 carbon emissions have increased many folds due to a lack of visibility and the complexity involved to gather such metrics. The introduction of the Cloud Carbon Footprint Tool by AWS is an important step for the cloud community to become carbon aware and take proactive actions to reduce the environmental impact.



Example of AWS Customer Carbon Footprint Dashboard.

The Pillars Of Sustainability

To bring you up to speed regarding ESG on cloud, we will touch on three topics: Cloud Sustainability, FinOps, and GreenOps; and will relate how a task such as rightsizing compute resources impacts carbon emissions and in turn business sustainability of a company as a whole. To start, I will define business sustainability and its various aspects to bring a broader picture before diving deep.

Business Sustainability can be captured under three major pillars and any practise which has positive impact on any of these pillars, while not degrading the underlying business objectives, is a step towards sustainability:

01. **Social Pillar:** The business practise which brings positive impact on the society.

02. **Environment Pillar:** The business practice of continuous innovation to reduce the impact of its produce on the environment.

03. **Economic Pillar:** The business model that can sustain economically while achieving the set business and economic goals for the society as a whole.

Public cloud, when used and operated correctly, will play a major role in making a business sustainable. The migration of workloads from on-premises to cloud will sow seeds of the circular business model and could drastically improve sustainability credentials of the businesses. I will support my reasoning by making a case for each sustainability pillar:

Economic Pillar: Running the workloads on cloud compared to on-premises can reduce the TCO by up to 40%. Thus increasing the bottom line margin of organisations to innovate and contribute towards betterment of society (KPMG, 2015).

Environmental Pillar: Migrating workloads from on-premises to public cloud can reduce carbon footprint significantly and the % of emissions reduced will depend on migration strategy if it is lift-shift or complete refactor to make it cloud native. This can be seen from the AWS carbon footprint tool (Accenture, n.d.).

Social Pillar: Organisations running workloads on cloud have an opportunity to reduce price and carbon footprint of the unit output. This impact can in-turn be leveraged to pass on the benefits to the society (HBR, 2021).

Thus, with a little imagination, we can agree there is a strong correlation between workloads on public cloud and business sustainability. This point becomes even more clear with Gartner's press release on public cloud.

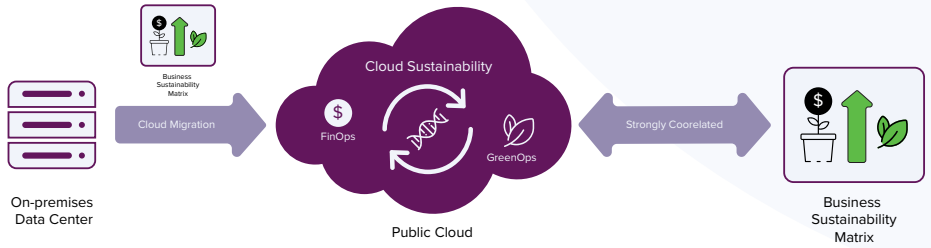
> **"Climate change mitigation will have a significant impact on the business. Cloud providers are responding to this growing focus on sustainability by instituting more aggressive carbon-neutral corporate goals"**
>
> — Gartner, 2021

Though the story does not finish just by migrating workloads to Public Cloud, it starts from here. This is the point where I would like to introduce you to **Cloud Sustainability**.

Cloud Sustainability

Cloud Sustainability is the practice to actively take actions aiming to reduce costs and the carbon footprint of the workloads running on public cloud. This becomes even more important to achieve the business goals set during the migration to cloud. Here is the interesting part: reducing the usage of cloud resources will reduce carbon footprint and vice-versa, which has a side effect of reducing the costs: the **Eureka Moment!**

With the above reasoning, we introduce **Cloud Sustainability as a double helix of FinOps and GreenOps**. Cloud sustainability can be imagined as a double helix, inter-twined and if done right will not only reduce costs to run workloads but also reduce the overall carbon footprint of the said workloads. Thus contributing towards a bigger goal of business sustainability.



Cloud Sustainability & Business Sustainability.

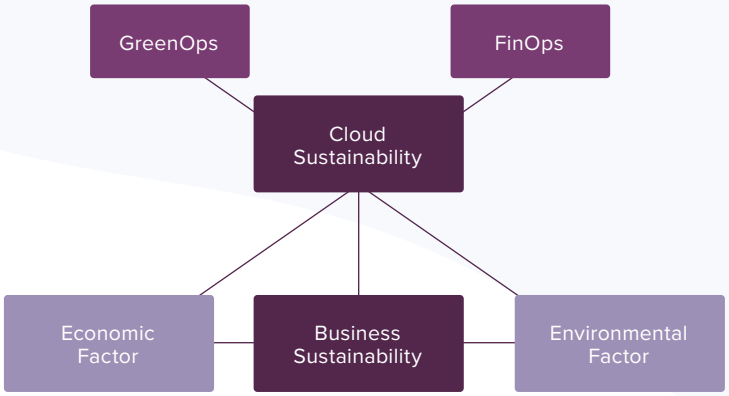
To give you some more clarity from here on out I will use two new terms frequently:

FinOps: Cloud FinOps, as an operating model, can have various facets, though in the current context, FinOps relates to cloud cost and resource optimization actions taken by the cloud user.

GreenOps: Cloud GreenOps, as an operating model, includes all the efforts done to reduce the carbon footprint of the resources running on the cloud by the cloud user. This can be achieved in a few ways such as:

- By optimising the usage of cloud resources such as right-sizing, switching off resources during idle hours
- Choosing a region which utilises renewable energy
- Using/developing energy efficient architecture for the workloads
- Using intelligent and cloud native solutions such as event driven, serverless technologies
- Using compute efficient languages such as C, C++, Rust etc. to reduce usage of compute resources
- Running batch loads when the grid energy to run the hyperscalers is clean.

Following through and creating a mind map can relate how GreenOps and FinOps have an intrinsic relationship and form the DNA of Cloud sustainability.

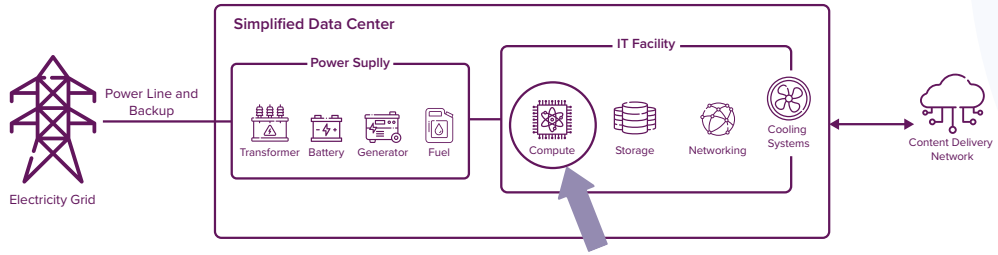


Mind-map: Relation between Business Sustainability, Cloud Sustainability, GreenOps & FinOps.

Optimising Compute Resources With AWS

Until now, we have been setting up the stage to share how we can practise Cloud Sustainability. We will not go to the extreme and suggest refactoring the code to 'Rust' language, even though Rust combines the performance and resource efficiency of systems programming languages like C with the memory safety of languages like Java*. Let us take baby steps and tackle the crux of the issue which is the energy guzzling computes which in most of the cases is the most energy taxing, carbon intensive component in a data centre, directly or in-directly.

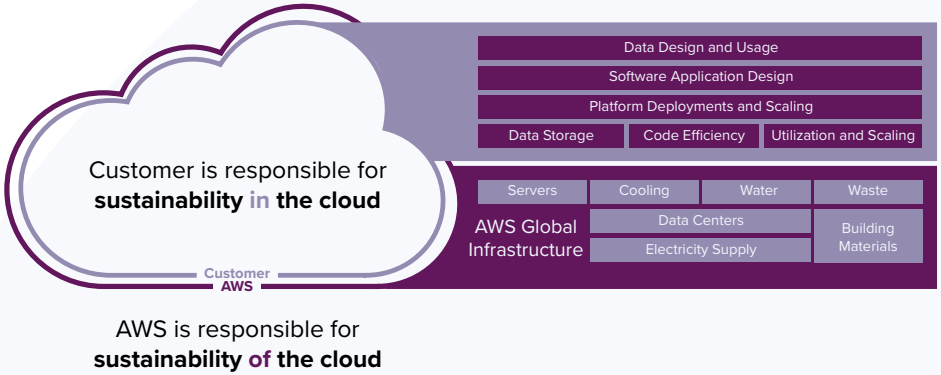
In the world of IT hardware, CPUs are the engines which process data into information and are omnipresent in every IT technology. These are silicon based chips which require electricity to run and constant cooling to perform at their peak to mitigate heat produced as the bi-product. This is done with sub-systems such as air-conditioners, cooling water pumps, fans etc. Public cloud hyperscale data centres house and run the hardware, along with sub-systems and consume huge amounts of energy to sustain.



Simplified Datacenter visualisation.

Shared Responsibility

Over the years, these hyperscale data centres are switching to renewable energy to decrease the footprint but the responsibility is shared with the cloud users who run the workloads. AWS published a Shared Responsibility Cloud Sustainability model which shows that the users have to become more conscious of their carbon footprint.



AWS Cloud Sustainability shared responsibility model.

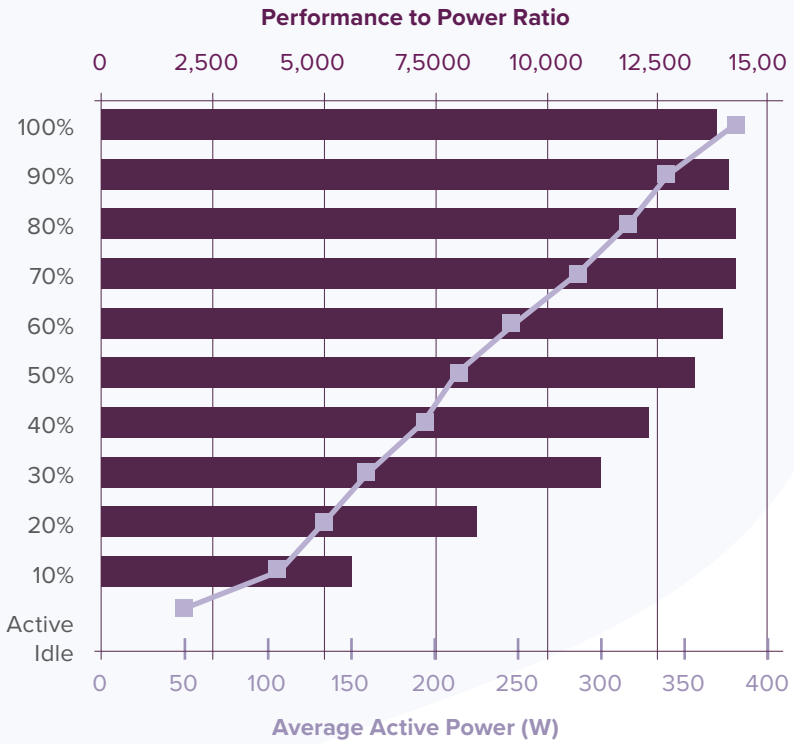
From the model we conclude that though AWS is making it their responsibility to run their facilities and processes as renewable as possible, the responsibility lies on cloud users to be aware of the emissions and how they can be reduced by optimizing their workloads.

"Sustainability with Rust" by Amazon Web Services, published on the AWS Open Source Blog, from https://aws.amazon.com/blogs/opensource/sustainability-with-rust/

Optimizing your AWS workloads

I will take advantage of David Maytton's sustainable computing blog (Mytton, n.d.) and a reference to study of AWS EC2 Power consumption (Koch et al., 2021) to summarise their findings and recommendations from a Cloud Sustainability perspective.

To optimise the compute resources and decrease the carbon footprint, it is recommended to maintain an average CPU utilisation of at least 50% at any given time. This can be seen from a snippet taken from SPECpower, an industry-standard benchmark that evaluates the power to performance characteristics of servers.



An example snippet of Performance to Power ratio published by SPECpower for servers.

If the average utilisation of compute resources is less than 50%, the performance to power ratio decreases, creating wastage. Thus practitioners should consider the resource for rightsizing or switching off during idle state. Developers, data engineers and data scientists should write effective and efficient queries as well as use efficient technologies to train and run ML/AI projects.

To root out wastage of resources such as unused storage volumes, missing lifecycle management policies, unused load balancers, etc. a mechanism should be in place to track and trace wastage and remediate such events. There are various native tools provided by the public cloud vendor to maintain hygiene of the cloud environment and cloud sustainability practitioners should effectively use them.

There are open source tools built by the cloud community to provide a more detailed report of the cloud user's carbon footprint. I welcome readers and sustainability leaders to take this opportunity to build and use open source tools such as a Cloud Carbon Footprint tool to actively provide insights and remediation recommendations to further reduce the carbon footprint.

Closing

I will close by making a request to the public cloud community and its vendors to work hand in hand in an effort to reach a goal of net zero carbon footprint. This will require a complete overhaul of the way we migrate to cloud and run our workloads, and we have to think out of the box to use the most efficient and effective sustainable technologies to make an impact on the Scope 3 emissions with an aim for a greener and better future. My hope is that this blog will inspire the community to take up the available tools and take a first step towards GreenOps.

About the Writer

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My passion is to solve data-intensive problems via automation and convert solutions into scalable, market ready products.
My hobby is cooking and working on DIY projects at home with my wife. I enjoy exploring new cities and biking in the countryside.

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